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An IT Model to engage elderly people to the community.

by Tuan Vinh Ha

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the degree of

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Certificate of Original Authorship

I, Tuan Vinh Ha, declare that this thesis is submitted in fulfillment of the requirements for the award of Master of Science (Research) in Computing Sciences, in the Faculty of Engineering and Information Technology at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in this thesis.

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Tuan Vinh Ha

Date: 17/06/2021

Dedication

To my parents, aunty, and siblings

To my primary supervisor

Thank you all for your great support.

Acknowledgment

During the length of my candidature, I have received many valuable lessons, support, and encouragement. I want to express my deepest appreciation to my principal supervisor, Professor Doan B. Hoang, for his tireless guidance. From him, I have learned many invaluable lessons that cannot be read in books, learnt from documents, or even experienced from the industry. Problem-solving, research skills, critical thinking are among the few to be named. His understanding and enthusiasm encouraged me to reach further than I expected. Without his insightful feedback, comments, and motivation, I would not be able to bring my work up to this standard.

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Sydney, 2021

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Abstract

Many countries around the world are experiencing an aging population issue. It is predicted to have a negative impact on the economy, health and social security system. As a result, it requires a solution that reduces the economic burden and the impact on the health care system by increasing productivity and promoting mental and physical health. Many solutions utilise the benefits of social networks or service networks. However, those solutions typically fail on the following measures: 1) they are ineffective in allowing elderly people to act as value contributors, 2) they do not provide enough benefits to older users. The goals of this thesis are to overcome these challenges by demonstrating the feasibility of how social network and service network can be integrated to provide benefits for elderly people. It also reveals the design and implementation of the engaging factors for online platforms to engage their users. Finally, it validates and evaluates the performance of the platform by collecting and analysing data after trial.

To achieve the above goals, this study investigates the possibilities and designs the necessary features of social network and service network to engage elderly people in the community. It also investigates and designs the engaging factors that can be adopted to engage users on an online platform.

The result of the collected data indicates that the platform has a positive effect on its users' financial and social well-being. The respondents indicated that it has the potential to improve their social relationships, increase their productivity and income. However, privacy and security remain the main concerns for some users.

The contribution of this thesis includes the integration of social network and service network with the novelty of the architecture where the integration of the two platforms can cover the shortfalls and assist each other to bring the maximum benefits. Another contribution is the methods to engage users on the platform with the novelty of interpreting and converting the factors that engage users in volunteering activity to technical implementation. It shows the possibilities of using these factors for future development on different online platforms.

Ultimately, the findings will have an impact on future directions for addressing the aging population. It opens the potential of using elderly people as a resource to provide benefit for

both elderly people, the society, and the community using a platform that utilises the social network, service network with the engaging factors.

Chapter 1 Introduction

1.1 Introduction

An aging population is an emerging concern that many countries around the globe are confronting. It has been predicted that by 2050, there will be 2 billion people over 60 years of age around the world [1]. Two major factors contribute to this process: people have a longer life expectancy, and the birth rate is declining. For instance, in Australia, the baby boomers are gradually approaching their retirement age. Currently, there are about 15% of the Australian population over 65, and this is expected to reach 20% in the next 30 years. Also, in the next 30 years, China will see more than 300 million people in its population over 60 years of age [2]. As a result, there will be more and more elderly people while fewer and fewer people in their working age. Around the world, this phenomenon is leaving a pessimistic view in many countries. It is often referred to as the 'Demographic time bomb'. Recently, the United Kingdom government suggested that they are under-prepared and that its aging population may create a series of crises [3]. As a matter of fact, the aging population pose many challenges for society, which subsequently will affect individuals.

As longer life expectancy increases, the pressure to extend the working life also increases. This pressure is the result of governments who see the importance to retain older people in the workforce longer and to avoid the challenges that the aging population brings along. One of the challenges that emerges from the aging population is a sluggish economy as a large proportion of the population will have ceased to contribute. While the economy is growing slowly, there is also increasing pressure for governments to invest more in age-related services such as health and senior benefits. More and more efforts are required to spend on improving health, mental well-being as well as to maintain independence. As a result, a quick solution is to increase the retirement age, which many countries are implementing. However, this measure is not a sound solution because many industries which involve physical work may not be suitable for elderly people. Therefore, we need a solution that does not have a focus on the age factor, and the longer we keep people active, the more we can benefit society.

Besides the challenges, an aging population also brings along many opportunities. These opportunities refer to the fact that many seniors still possess valuable experience, knowledge and wealth that they accumulated throughout their working lives. With the advancement in

technology and health science nowadays, many elderly people can still contribute to the community either as a professional or as businesspeople. These valuable resources are believed to help assure a wealthier healthier successive generation [4, 5]. As a result, many organisations are trying to utilise these resources, such as building corporate alumni network, encouraging people to volunteer. These measures aim to extract the valuable resources from an aging population to benefit the society rather than treating them as an issue to be resolved.

While many elderly people can enjoy their retirement lives, the same experience does not apply to all of them. Many of them are taking their own life as a result of prolonged suffering of depression and social isolation [6]. These issues happen because they have lost their social connections as they move to a retirement life. Another compounding factor is that Western culture tends to encourage children to live away from their parents when they are mature enough. Subsequently, this practice and culture can further promote social isolation and depression, especially for those who have lost their spouse. Another factor that contributes to this issue is the self-esteem of elderly people. As they have withdrawn from productive activities, a sense of worthlessness may accumulate in their mind [6]. Therefore, social connection and community engagement is arguably one of the best methods to handle these issues and promote active aging.

To overcome the above challenges and issues, social connection, and active engagement in the community of the aging population is arguable the most effective way. In fact, there are many studies [7, 8] suggesting that communication and socialisation are some critical factors as they allow elderly people to express and ease their negative feeling. There are many existing solutions with the purpose to reduce social isolation and to improve mental well-being. With the advancement in information technology, many of these solutions are online platforms. Typically, these platforms have many necessary functions to facilitate interaction and collaboration, such as viewing profiles and viewing activities. Social networks, one of these types of platforms, operate on the idea to help people connect with each other. Most people on this type of platform tend to know each other in their everyday life, such as friends and colleagues. It is not common, although it is possible, for its users to connect with people they are not familiar with. Another example is service networks such as Freelancer and Airtasker, which also allow their users to interact with each other during the course of exchanging products or services. The nature of this operation demonstrates the ability to connect people sharing the same interests. However, their users do not often maintain ongoing relationship such as becoming online friends or sharing other activities. That

limitation persists because the goal of service networks is to exchange services, not to maintain a social connection.

However, even to receive those limited benefits, elderly people must participate in those types of platforms to maintain or expand their social relationships or even to maintain productivity. Nevertheless, elderly people do not seem to be among the active participants because either the benefits are not appealing to them [9] or the platforms do not address their needs [10]. While each of these types of platforms has its own benefits, social networks or service networks themselves may not appear attractive enough to them. To overcome these shortfalls, a new model is required to address the desire to participate in productive work and the need to improve mental well-being and reduce social isolation.

This research addresses the above challenges by proposing a solution to engage elderly people actively and collaboratively through an assistive platform that integrates a social network with a service network. The IT model proposed in this study integrates the features of a social network and service network in such a way that users can receive benefits of both platforms while only using our one. The new architecture that this model proposes allows the social network to cover the limitation of the service network while the service network acts as a component to make users productive whilst also covering the limitations of the social network at the same time. Apart from that, it is also strengthened with enhanced user experience developed from proven factors that engage people in certain activities which is effective in engaging them on the platform as a result. Therefore, the solution provides them with opportunities to make contributions to the society in a way that is attractive to them and their capability in a voluntarily way and may benefit themselves socially, intellectually, and financially but also it may: 1) reduce the burden on the government welfare system and 2) create a new business model that is workable for the society, especially for the aging population. It utilises the benefits of each platform to provide the best possible benefits and opportunities to engage with the community, which will eventually keep them active and healthy. The social component not only allows users to connect and promote social interaction but also acts as a means to create more opportunities to engage with the community. The service component allows the exchanging of resources for users. Additionally, it also creates a trigger for them to meet in real life and thus enhance the social relationship. The proposed design can be adopted as a means to engage elderly people to the community, utilise the resources they have to offer, improve their mental well-being, promote

active aging and subsequently reduce the burden of the aging population to the society while opening up a new economy.

The significance of this research is its ability to not only address the issues of the aging population by promoting active aging with the above approach but it also suggests a new direction for creating a platform that utilises the advantages of social network and service network with the aim to serve their social and service needs which will eventually benefit themselves, other generations and the economy. Apart from that, it also suggests a new direction for platforms that are utilising social network or service network to engage their users better and benefit financially from this valuable resource.
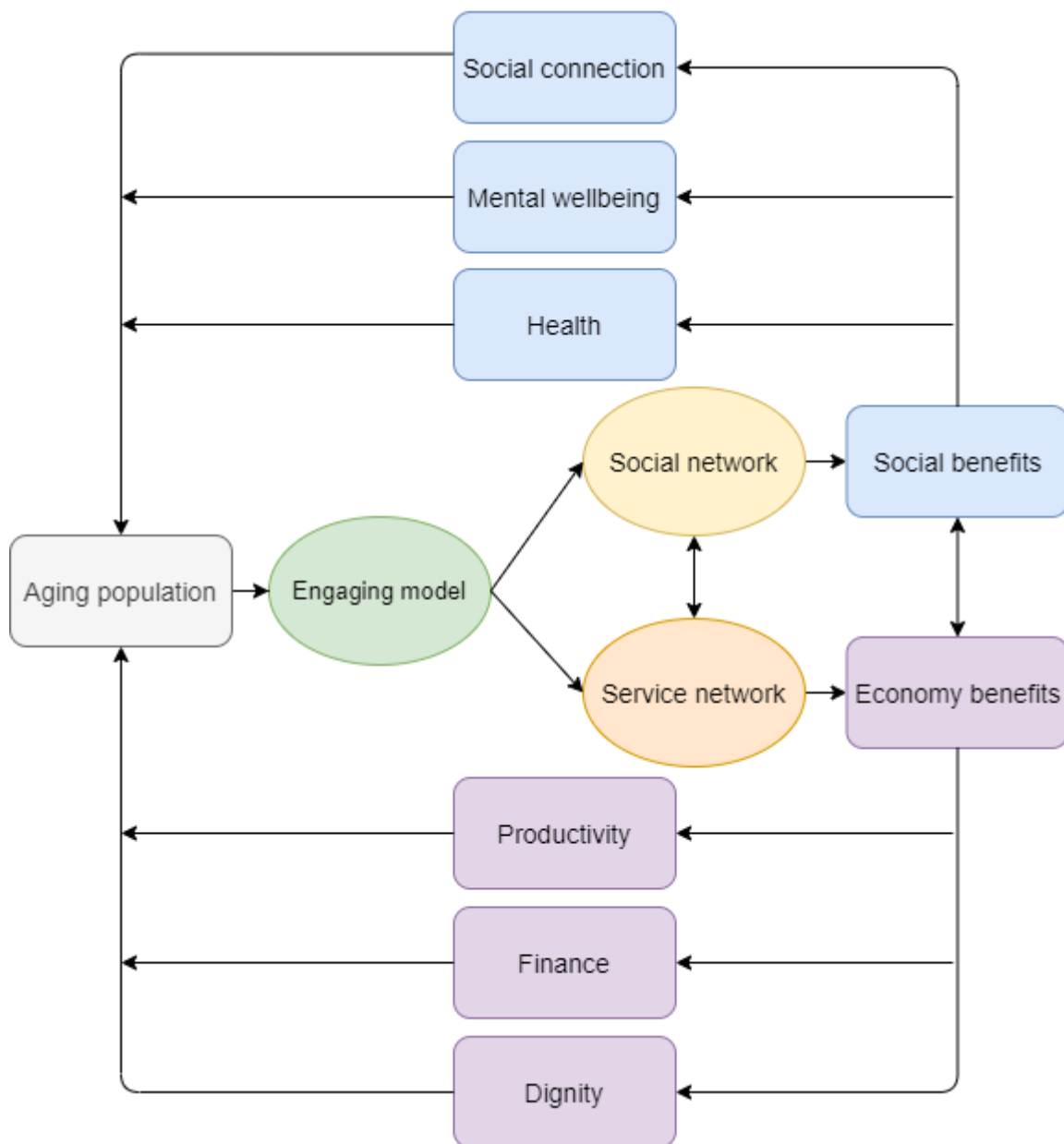
Figure 1.0: Overall goal and mechanism of the model

This chapter is organised as follows Section 1.2 indicates the research problems addressed by this dissertation. Section 1.3 states the research aim and objectives. Section 1.4 summarises the key contributions of this research. Section 1.5 describes the research model and methodology. Section 1.6 presents the structure of this thesis.

1.2 Research questions

The reduction of involvement in intellectual stimulation, which is the result of withdrawal from active life, can promote ill-health and lead to other health problem. Elderly people, therefore, do not necessarily need to withdraw entirely from work or involvement in the community, especially when many elderly people are still quite capable of contributing to the community either as professionals or volunteers. There are two major challenges to tackle the above issue. Firstly, we need to find a method to promote active aging in a way that it will not only benefit elderly people but can also provide value to society and the economy. Secondly, it is critical to encourage people to keep using that method to provide maximum value.

To sum up the research question addressed in this study is as follows:

How to promote active aging so that the elderly can maintain productivity, improve well-being and at the same time generate benefit for themselves, the society and the economy?

The main research question is broken down into the following questions:

1. What type of methods is effective in improving elderly peoples' mental health and well-being?

   Social network is effective in allowing people to maintain and form new social connection and therefore can improve their mental health and well-being.

2. What type of methods is effective in allowing elderly people to maintain productivity while aging?

   Service network is a type of platform where people can provide assistance for others. Therefore, it is effective in allowing elderly people to use knowledge, skills and experience to provide value for other people.

3. How to engage elderly people on the platform to the community using social network and service network?

To maximize the benefit and achieve the best result, there is a need to engage users on the platform. This can be achieved by reviewing past studies on the psychological aspects of how people are engaged in a certain activity. After that we need to transform those aspects into the requirements when designing the platform. As a result, an IT model which integrates a social network and a service network with a set of motivational factors is effective in engaging elderly people in the community.

4. How can the proposed method be validated and evaluated?

To validate the proposed method, we need to develop an online platform and incorporate the above models and features. Then we can invite users to provide feedback on the effectiveness of the method. The evaluation focuses on 2 main parts: the engaging aspects and the actual platform with its features.

1.3 Research Aim and Objectives

This research aims to provide a solution to reduce the impact of the aging population on the economy by promoting their quality of life and engaging them actively and collaboratively as contributors of services or receivers of social benefits. In particular, the solution facilitates the interaction and harvest of skills and experience to provide value for the aging population themselves as well as other people which will eventually provide greater benefit for the economy and reduce the burden of the aging population on the society.

To achieve this aim, we define the following objectives and investigate a feasible solution.

- Exploring the issues and investigate solutions associated with the aging population.
- Identify the benefits and limitations of the social network and service network regarding the aging population.
- Identify the motivational factors that encourage the ongoing participation of elderly people and propose the design that addresses those factors.
- Proposing and implementing a model which integrates the social network, service network together with the motivational factors.
- Evaluate the feasibility of the solution.

1.4 Research Contributions and Significance

This research focuses on a new direction to address the aging population issue by utilising them as a resource rather than treating them as an issue to be resolved. Expected outcomes in relation to the above objectives are as follows:

- This research investigates the integration of social network and service network, the necessary features to accommodate each type of network and how they should be designed to work together to utilise the strength of each network. As a result, it proposes a new type of model that not only addresses the needs of elderly people and improves their quality of life but also allows them to create mutual benefits for the economy, the community and for themselves through the use of both social and service networks.

- This research investigates and delivers the methods to engage users on online platforms by studying the factors that engage people in volunteering activities. After that, it suggests the required technical features to comply with the factors identified. As a result, it helps deliver a new method to engage users on the platform at the technical and user experience level which can be implemented and adopted by different online platforms.

- This research explores the use of an IT model as a mean to address the issues with the aging population. As a result, together with the above contributions, it suggests a new direction to address the aging population issue by considering and utilising their resources to provide benefit and minimise the negative impact for the community and the society.

- The findings in the proposed model can be utilised as a new business model and can be applied to different types of platforms that use social network and/or service network.

The contributions are very significant to not only the aging population but also to the society in general as they have an impact on the socio-economy.

For the aging population aspect, the proposed model offers a new direction to promote active aging and improve the quality of life for the elderly. Unlike other solutions where they only focus on taking care of elderly people and often lack measures to allow them to maintain active aging, this new model can improve productivity and well-being, reduce the burden on the government welfare system which will ultimately minimise the impact on the economy.

For the non-aging population aspect, the proposed model reveals a potential business model for utilising the social network, service network model and engaging model as the benefits are much more than the traditional model. As the users are engaged on the platform, there are many opportunities to benefit financially from this valuable resource. Moreover, it can be applied to any other platforms not, only on those for seniors.

1.5 Research Methodology

This study adopts the research process and methodology by [17]. This research is divided into 5 main phases:
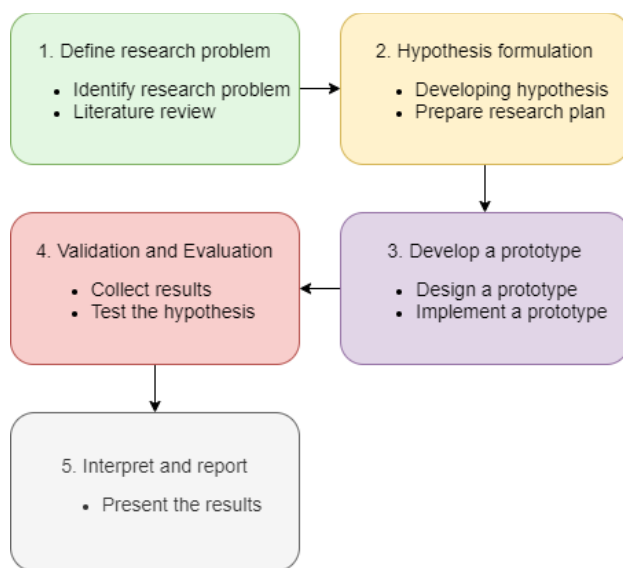
Figure 2.0: Different phases in the research methodology

1. Define the research problem: this step involves identifying the research problem and reviewing the concept and theories. To achieve that, we review current and past studies on projects that promote active aging. Then we find that even though there is a considerable number of studies in this field, most of them are not quite successful. The reason for this drawback is that most solution only focus on the communication needs of elderly people without taking into account that they are still healthy, active and still want to participate in productive activities.

2. Hypothesis formulation: this step involves developing the hypothesis and preparing the research plan. To achieve that, following the literature review, we propose an idea that helps engage elderly people into the community by integrating a social network with a service network. The social network component will serve communication

needs and allow them to maintain or form a new social connection. The service
network component allows them to offer assistance to other people by utilising their
skills and knowledge. Moreover, we identify the factors that help promote quality of
life from the perspective of elderly people. These factors form the basis to develop the
functional requirements. Following the literature review, we identify the common
factors that are important to the elderly to promote their quality of life. These factors
are translated into functional requirements of the platform.

Additionally, we identify the motivational factors that help encourage elderly people
to remain active on the platform through a literature review. The reviews focuses on
the motivational factors that encourage elderly people to participate in volunteering
activities. These factors are then compiled into the functional requirements of the
platform and act as the driving force to encourage ongoing participation or active
involvement in the solution.

3. Develop a prototype: this step requires us to develop a prototype and implement a
   prototype. To achieve that, we design a platform with the necessary features identified
   in step 2. After that, the platform is implemented and deployed as an online web
   platform.

4. Validation and evaluation: this step require us to conduct the implementation, collect
   results and test the hypothesis. To achieve that, we invite seniors to try out the
   platform/prototype developed in step 3 and obtain feedback from them. The feedback
   will form the basis to determine the level of effectiveness of the solution proposed in
   this study.

5. Interpret and report: This step requires us to present the results. The results in this
   study are presented in the form of the thesis for this research as well as a contribution
   to be submitted to a journal.

1.6 Limitation of this study

There are some limitations which are listed below that are not fully addressed as part of the
research because they are not within the scope of this study. However, even though they are
not the primary focuses, there has been an effort spent to ensure the model is safe and secure.

- Security: while it is crucial to online platforms, this is not the focus of this research.

However, minimum security measures are in place to prevent common attacks such as cross-site scripting, brute-force attacks. These measures are provided as part of the architecture that utilises some of the security features provided by Microsoft.

- Privacy: protecting users' privacy is also another critical factor that should be invested in. However, similar to the security aspect, it is not heavily focused on during this study. The effort is spent mainly on the areas to protect the data of users.

- Trust: establishing and enhancing trust between parties often requires long term commitment and interaction. As a result, due to the time constraints, this aspect cannot be thoroughly studied and addressed.

- Ethical conduct: ethical conduct of the users is also not an area of focus. In this area, the effort is spent to ensure that there is no scam and abusive language used.

The above limitations are some of the potential areas that can be addressed in future studies.

1.7 Thesis Structures

Chapter 1: Introduction

This chapter presents an overview of this research. It first provides an overall picture of the aging population around the world, the issues as well as the challenges that are associated with the aging population. It then states the research problem, aim, objectives, contributions, methodology and presents the thesis structure.

Chapter 2: Background and Related Work

This chapter reviews the solutions that have been developed to benefit the aging population. It also outlines the advantages as well as the limitations of each solution.

Chapter 3: Consideration

This chapter describes different aspects considered when designing the platform. It provides an overview of how the needs of the aging population are required to be balanced with the needs of society. Apart from that, it also covers technical considerations when designing the platform for elderly people. It also outlines why the social network and service network can be combined and how an online platform can serve those needs.

Chapter 4: Design

This chapter presents the design of the platform. It describes the features as well as their design rationale. It also covers different technical aspects, such as functional and non-functional requirements.

Chapter 5: Implementation

This chapter presents the technical implementation of the platform. It presents different architectures of the platform, from a high level to a detailed one. It also includes some sample user interfaces and the typical workflow.

Chapter 6: Result and Evaluation

This chapter reveals the prototype result of the platform. Users from different age groups are invited to try out the prototype, and their feedback is obtained and analysed. It also provides an evaluation of the models and the entire platform.

Chapter 7: Conclusion and future work

This chapter summarises the contribution, significance, strengths as well as the limitations of this research and proposes the direction for future research work.

Chapter 2 Background and related work

2.1 Introduction

This chapter provides an introduction to social network and service network, the theory as well as the technology used. It also covers some of the security issues that many online platforms commonly face. Some aspects of the User Experience are also covered. Moreover, it also explores different attempts to address the aging population ranging from academic studies to industry projects. Each project has its own strengths and weaknesses. Therefore, we review their purpose, implementation, as well as their strengths and limitations. In this study, we utilise two main models, the social network and the service network. Thus, we provide background about how these models are used and applied, their effect on users and how users perceived these models. Furthermore, it is necessary to review different attempts to overcome the challenges as well as to identify benefits.

The rest of this chapter is organised as follows. Section 2.2 provides some background information. Section 2.3 gives a review of past projects. Section 2.4 concludes this chapter.

2.2 Background

Online social networks are a type of online platform that operates as its name suggest, a place for people to socialize with the purpose of staying connected with family, friends and clients. In recent years, it also works as a place for many businesses to market their products to different types of users. As a result, the necessary features of a social network should focus on the ability to enable users to communicate with each other and expand social connection. Most online social networks address this requirement by offering users the features to create, view, or share a user's profile or post. The profile page typically contains some basic details such as name, age, gender and potentially some additional information such as hobbies and tastes in movies. The most important feature is to allow users to find and make friends with each other. To accommodate for that, there are many features such as friend suggestion, timeline to attract people. For many elderly people, who have withdrawn from work, social networks are an important mode to maintain social connections.

On the other hand, service networks are a type of platform that allows users to act as service providers or consumers. The service can be as simple as buying and selling, or it can be

something more sophisticated, such as professional service (e.g. taxation service). Therefore, the mandatory features of a service network should allow the service provider to offer the service by describing, posting, and managing the service which they provide. In summary, the typical users in the platform are:

- Service consumers: people who need assistance. Can be both elderly people and the younger generation.
- Service providers: People who are offering assistance. Similar to the service consumers, it can be both elderly people and the younger generation.

The service network will require the following functionalities for its normal workflows.

- Service posts: To allow users to make service requests, the platform allows users to make service posts. Users can create a post about the type of service that they are requesting or offering. This function can also help users form a service.
- Communication: One of the ways to help users deliver the service is to communicate with the service consumer in a service post. The platform allows its users to exchange messages which will help them request more information.
- Buying the service: after all the communication has been made, users can decide whether they wish to buy the service or not.
- Delivering the service: after the users have purchased, it is the responsibility of the service provider to fulfil the requirement. The service can be delivered online or offline, depending on its nature.

However, as mentioned earlier, service networks do not have many features to encourage ongoing social interaction after the service has been delivered. The reason being is that it is not the main purpose of this type of platform. For many people, a service network is a platform or an opportunity for them to earn extra income besides their daily activities.

Typically, social network and service network do not require any special technology stack to develop. That is, it can be developed with something as simple as a WordPress site or with something more sophisticated, such as using a modern framework with .NET and Angular or React. The reason is that the technology used should not matter; it is the content and the features it has to offer. However, due to a large amount of data and demand for optimisation, many social networks have opted for a modern framework. WordPress and other older technologies may only suit some small-scale networks. Generally, the architecture would be a 3-tier architecture with the server, client, and data access. Although in recent years, the

concept of serverless is gaining more popularity, however, at a high level, it is still a cloud server.

As a result, instead of the technology stack, more focus should be emphasised on the user experience in dealing with users. Nowadays, mobile devices are getting more popular and powerful. Therefore, there is always a demand for most applications to be able to run on a mobile device. Many online web applications must be designed in a responsive way.

However, as with many applications, online applications are also subject to many security issues. The commonly seen issues are:

SQL Injection: it occurs when unfiltered data is passed to the SQL server (SQL injection), so the attacker can temporarily execute dangerous SQL statements in the database. Traditionally, the older web application would use SQL statements to handle requests from users, like DELETE FROM TABLE. As a result, the input must be sanitised. It is best to use the technology already available if possible, rather than inventing a new one. For instance, the Entity Framework from .NET backend eliminates the need for most of the data-access code that usually needs to be written. That means the application can communicate with the database without having to write a single SQL statement. This behaviour can minimise the risk of SQL injection.

Cross-site scripting (XSS): it is a type of attack that attackers use to inject client-side scripts into web pages which are then served to other users on the client-side. The result is that the end-users may see or click on the harmful content of the attackers, believing it is coming from the original application. Therefore, user requests must be validated. If there are dangerous elements like the script tag, the request must be stopped, and some messages should appear.
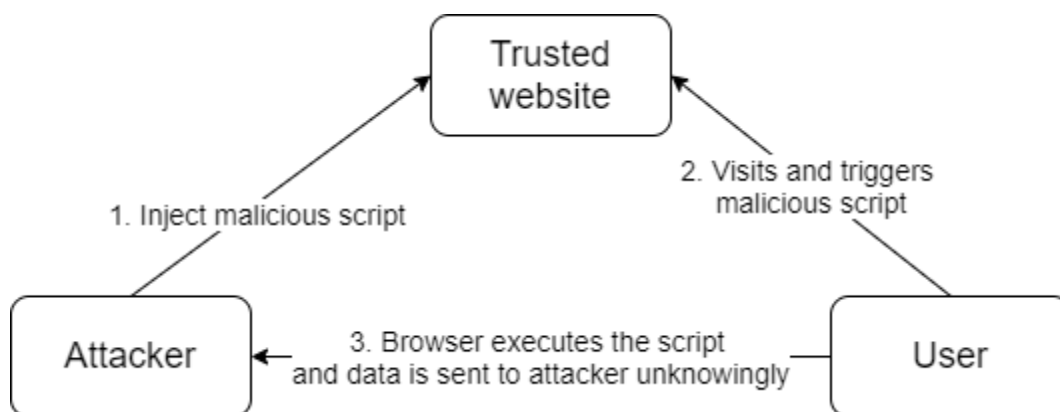

Figure 3.0: Typical XSS attack scenario

Brute-force attack: this type of attack aims to gain access to user accounts by repeatedly trying to input the password of a user by guessing it. If the online application does not employ any protections to safeguard this type of attack, it is possible for attackers to use many automated tools, which are readily available on the Internet, to submit hundreds of password attempts in a short time frame, typically within seconds, making it easy for an attacker to defeat any password-based authentication as it is just a matter of time. A simple method to tackle this issue is to lock the account after a certain number of attempts. Many highly sensitive applications also employ this method. For instance, the ATM will lock the card by taking it after the PIN is entered wrongly too many times.

Cross-site forgery attack: many online applications use the browser as the primary way to access the platform. Unfortunately, it can be tricked by another party to change its behaviour. A 3rd party site can make the user's browser to use its authority to do something for the attacker. In the case of CSRF, a 3rd party site typically issues requests to the target site using the browser with the application cookies or session. A quick and relatively simple solution is to use the anti-forgery token. This token is stored in 2 places: in the form (form token) and cookie (cookie token). If the two does not match, then an error should be returned.

Apparently, apart from the above issues, there are many security threats out there, and each of them is getting more and more sophisticated. Therefore, developers must keep themselves up to date with the latest threats and apply any security update if they need to.

With the increase in security issues and identity theft nowadays, it is understandable the users are afraid that the information they put online is not safe. That means someone could hack the system and steal the information. Even though the web application is safe and secure, it is hard to convince users to believe this as they are not able to see or understand the technical bit behind the scenes. To increase the level of trust, an online platform can consider purchasing an SSL certificate; for instance, an SSL certificate saying that a particular vendor protects this site. This certificate can also act as an extra layer of protection. Developers can always implement some security measure at the server and letting the users see that their information is secured, providing them with peace of mind.

Apart from that, privacy is also an emerging concern where many users may not be certain how their information is collected and used. Therefore, there should always be a clear and concise privacy policy that the designers must adhere to.

Age-related changes often include declining eyesight, reduction of attention and impaired memory. As a matter of fact, to cope with these changes, online platforms require special attention when designing their UI. One possible approach is to create a simple UI, increase the usability and reduce the level of complexity. However, online platforms such as social network or service network may require complex functionalities, and therefore, this approach may not be suitable in these situations. Additionally, lack of technical knowledge also limits elderly people to fully utilise the platform. There are various aspects that need to be considered when designing for elderly people. These include typography, navigation and colour design. All these aspects are related to individual technological experience and vision.

Generally, there are some aspects that are worth paying attention to when designing for elderly people. Firstly, the interface should be constructed in a way that is graphic organised. Due to the declining eyesight and decline in perception, elderly people cannot read small font. Thus, while designing the graphic design, images should be more dominant while text can be a supplement. To increase their interest in reading and visual sensory experience, the text should be able to be adjusted to a reasonable size to suit their personal needs. To create a clear visual impression, relevant graphics should be grouped together and distinguished with a blank space. Secondly, colour use should be very carefully selected to maintain a neat and clean layout. As their visual acuity declines, colours with little comparison can make it extremely hard for them to discriminate. Therefore, common principles of unity in the colour design should be followed, for example, triadic colour scheme, try not to use too many different colours, use of bright colours and avoid visual fatigue colours combination for example, blue and green. Finally, maintaining a simple, clean, and unique layout can speed up their operation and improve the overall experience. More technical design consideration will be discussed in Chapter 3, titled 'Consideration'.

2.3 Literature review

Haritou et al. have also consolidated research [11] in developing an online social network for the retiree. The project is named "Go-mylife" and is aiming to improve the quality of life of elderly people by encouraging them to participate in an online social network. This objective is particularly effective as it reinforces the idea that social network is found to have a positive impact on psychological well-being [12]. Through the project, seniors are expected to be able to interact with different people who also use the network and even view the information of their friends on other social networks. It also acts as a platform where it allows them to

contribute their ideas to the community. Apart from that, it also simplifies the process of getting support from different people, especially from family members.

The project also demonstrates many technical aspects that are useful to a social platform. From these factors, we can see how the platform is designed in a way that it can connect with many communities. These technical factors are worth considering before implementing a new model as they are suggesting a new way to bring people from different platforms together.

Nevertheless, there are a few limitations in this study. Firstly, the platform could not differentiate itself from other traditional social network sites such as. Facebook and Twitter in terms of design apart from using many external APIs to connect to different platforms. Therefore, there is a high chance that it will be considered as an ordinary social network and thus raise an issue of whether it can attract elderly people to use it, as it generates no incentives to participate. Secondly, one of the aims of the project is to provide information to seniors while they are out and about. However, it faces many obstacles in terms of technical limitations, which were internet coverage and the ability of elderly people to use location-based service. From these constraints, we can see the weaknesses in terms of technical knowledge of elderly people and therefore, in the future, we should consider this factor in our design.

The primary factor that leads to the above limitations of this study is that the project was carried out in 2013. At this point, the smartphone was still a new concept to elderly people, and therefore, they may not have enough knowledge to receive the benefits it offers. Furthermore, the technology that utilises location-based service at this time was not available, and therefore, the platform could not overcome the above issues. With the advancement in today's mobile devices, the above challenges have been reduced somewhat and created many opportunities to implement location-based service in a new design.

The above studies and projects support the idea that the use of a social network site can assist in creating a positive effect on one's life satisfaction and increase feelings of well-being. Therefore, they create many possibilities to use social network platforms as a benefit for seniors. However, different studies have revealed different perspectives of the retiree on social networks. Some studies do not see the benefit or the purpose of using social networks [13]. Other studies suggested that the existing social networks do not meet the daily communication needs of the elderly user [9].

Lehtinen et al. conducted a study [9] to identify the points of view of elderly people on social networks. They deem it to be useless for elderly people to use social networks as a means of communication. The research outlines many important factors that have a critical impact on the future development of a platform or any form of an online community for future studies. It has revealed the challenges that elderly people face when they use social network sites, their motivations, their concerns, and interest. The findings from this study can contribute a substantial amount of knowledge to assist future research on how to develop and implement social network sites that cater to the needs of elderly people. Firstly, from this study, we can see that many elderly people do not see the need for using a social network site. Their preferred method of communication is to use the traditional channels which involve mobile, SMS and email as they lack technology skill. Secondly, it identifies another concern which refers to the privacy issue. This factor suggests that extra attention should be made when managing users' privacy. Moreover, it also reveals the influential effects of other people such as friend, colleague, and family on the decision of using social network sites. Most of the findings in this article are backed up and confirmed by another study [13]. These results suggest that the current social networks are not implemented in a way that can attract seniors.

There are a few limitations in the above study. Firstly, the number of participants in this research is relatively small. With only eight participants, it was not easy to draw a solid conclusion on their perspectives. The low sample of the study may not be able to represent the majority of elderly people. Secondly, the duration of the research is relatively short when the participants were only given four weeks to try out the new system. Consider that these participants are elderly people; understandably, they may require more time to become familiar with the system before they can make use of it. Therefore, it could affect their perspectives on the system and lead to misunderstanding on social network sites as a whole.

Another thing to consider is that the study was carried out in 2009. At this point of time, social networks were not popular, and technology was not highly developed. Therefore, it is understandable that elderly people were not equipped with the skills and knowledge to make use of social network sites. With the advancement of technology nowadays and the popularity of social networks, they have opened many opportunities to implement a better platform that caters to the needs of this age group.

Apart from studies in social networks, Koene et al. [10] propose a platform that implements the idea of using a service network to connect elderly people. Unlike social network, the

primary purpose of a service network is to deliver services online or even offline and do not aim to connect their users in a social way. However, online service like Freelancer and Airtasker also allow their users to interact with each other during the course of selling or retrieving product or service. In this way, service networks prove the possibilities to connect people with similar interests. The platform is called Bring Dich Ein (translated from Germany as "Get involved") and is aiming at creating an environment where elderly people can request and offer services to other users on the platform. Through the platform, seniors are provided with a means to engage with their local community.

The project explores many critical aspects that elderly people expect from a service network such as privacy setting, and user interface design. These elements help contribute to a positive pilot result of the platform. Therefore, they are worth considering and taking into account when implementing a new platform.

However, the result of this platform also suggests many limitations. Firstly, the platform mostly focuses on the local community. While this is one of the features of the platform, it poses a potential to hinder service trading itself. Most people in a local community tend to know each other and therefore, may not see the platform as an effective mean to communicate their service needs. This constraint is reflected in the pilot operation result of the platform. Secondly, while it is necessary to protect the privacy and security of its user, however, the use of novel technologies (for example biometric ID) can create a privacy issue for elderly people and therefore, limited the number of active uses on the platform. Another factor that is worth considering for a service platform in this study is that it lacks a way to promote its services to the users. When a user posts a service request, that request may not reach the desired user due to several factors such as keyword search, and visibility of the post itself. Therefore, it can limit the service trading of the platform, making it becomes less active.

Furthermore, this study only consists of elderly users aged from 48 to 64. While they are the main target of this study, however, to achieve the purpose of engaging elderly people in the community, the platform should have involved users across different age groups. This inclusion will open opportunities for elderly people to provide assistance to their younger generation and vice versa.

As mentioned above, one of the ways to keep older adults healthy is through volunteering activities. In order to help them find a volunteering opportunity in which they are interested,

Fang et al. [14] develop a platform to engage elderly people to the community in Taiwan. The platform is called 'iDianNao' and is aiming at recommending volunteering opportunity to elderly people so that they can be kept active and therefore, reduce social isolation. This behaviour is effective as it reinforces the idea that participation in volunteer activities has a positive impact on mental health [15, 16]. Through the platform, participants are presented with many opportunities based on a set of matching criteria. While there are a few platforms that operate based on the idea of matching volunteer, this platform is designed exclusively for seniors. The project also establishes many technical aspects that are worth considering when implementing an algorithm that recommends volunteer opportunity to users. These factors include location and time. The matching algorithm retrieves data from different service organisations. This method suggests that the platform is aiming at matching the volunteer with a volunteer organisation.

However, there is a possible issue with the approach. The study did not address one of the main concerns identified in the above projects, which is the privacy issue. As the project is still in its early stage, therefore it is difficult to predict whether or not it will address this concern in the future release.

To promote active aging, Cornejo et al. [17] develop a paper-based social network application. The application is called TLATOSKETCH and acts as a Facebook client where it allows the user to interact with Facebook through a digital pen and paper. This approach is effective in bridging the gap of IT for elderly people. The project produces many suggestions for improving social interaction and keeping seniors active while aging. However, there are many limitations which exist in this study. The project requires many modules to be fully operational. Moreover, extra training is required for elderly people to become familiar with the use of a digital pen, particularly for those who experience difficulties in motor control.

To help improve elderly peoples' quality of life and health, Pensas et al. [18] develop a platform called AMCOSOP. The platform allows its users to maintain connections with their friends and relatives. through a social network platform. The project is effective in addressing the communication needs of elderly people. However, it is not effective in allowing them to act as a value contributor to the society considering that many elderly people are still healthy and possess many valuable skills.

To help elderly people strengthen communication and improve their health condition, Marcelino et al. [19] propose a senior social network (SSN) with the aim to digitally include

all seniors regardless of their educational level or technical skills. The project establishes many valuable considerations regarding the technical difficulty that elderly people face. However, this project also fails to recognise elderly people as active service contributor where they can still contribute more to the community using their skills and expertise.

In addition to the literature attempt to keep elderly people active while aging, there are many ongoing projects in the industry that are aiming to promote active aging in society. Recently, LinkedIn launched a new feature called Career Advice, a feature that allows its users to act as a mentor for other users. While the feature is not designed specifically for elderly people, it provides a great opportunity for them to engage with people from different generations in the community. Moreover, there are many platforms such as Udemy and Lynda; while these platforms are not aiming at elderly people, they provide a platform for them to use their skills and knowledge to host their classes and generate value for themselves and other people. However, the interactions between students and instructors are limited and therefore are not effective in reducing social isolation. Moreover, elderly people who would like to become an instructor will need to have good technical skills to be able to use video editing software. As a result, these online platforms are not effective for elderly people to reduce social isolation and act as a value creator for the society.

2.4 Summary

In this chapter, we provide an overview of social and service networks, the typical architecture, the challenge of an online platform in term of security and user experience and the past attempts from academics and industry to address the needs of the aging population. These projects include different types of platforms such as social network, service network, and volunteering platform. The strengths and limitations in each of the above studies help contribute to the foundation of this research.

Chapter 3
Consideration

3.1 Introduction

When working with technology, it is normal to assume that users are technically savvy. Many IT professionals are young, and this is the reason that most applications or technology tend to be designed for young people. Even though there is an age difference, there are many fundamental things that are common between elderly people and younger ones. Ageing, however, also makes many things become more difficult, and one of those is the use of technology. As a result, when designing technology for older users, there are various aspects to be considered such as colours design, font type, and font size. All these elements are deeply affected by factors such as physical, psychological for example. Apart from technology, there are also many other factors such as economic and social.

This chapter describes the considerations when designing the platform. These factors are ranging from broader social-economic to a more personal aspect, such as technology consideration. It also outlines how the aging population will affect other factors if we do not provide a new direction and what are the elements to be considered when designing this platform. Moreover, this chapter also gives the justification on why the combination of social network and service network is feasible.

The remainder of this chapter is organised as follows. Section 3.2 describes the considerations for the solution. Section 3.3 explains the IT technologies for engagement. Section 3.4 concludes this chapter.

3.2 Areas of considerations for design

There are many challenging factors related to designing a platform for older people. The technological challenges when designing a platform for older adults are that many of them are not familiar with the technology. As a result, the platform must be user-friendly to attract users and at the same time, needs to generate enough value to maintain ongoing participation and, in order to provide a more effective solution, the platform needs to consider the following factors:

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It needs to consider the factors which relate to the usability factors that cater for different impairments that seniors often experience. These factors revolve around enhancing the user experience, such as font and text size. When designing the user experience, it is normal for the designer to assume the behaviour of certain elements. Nevertheless, people who are not familiar with technology might have never come across some elements of the interface that we the designer may take for granted. To overcome these obstacles, it is necessary when designing user interfaces for seniors to keep the interface simple, maintain consistency across UI elements and page layout, using appropriate colour, typography that emphasises clarity and hierarchy, ensure that the system communicates smoothly across different workflows. While many platforms allow its users to change font sizes, changing the colour theme is not often seen.

Many elderly people have some eye conditions that can affect the use of computers such as Presbyopia, Glaucoma and Cataract. Presbyopia is an optical defect that affects the focusing power of the eye on close up objects. To allow users to compensate for Presbyopia, most internet browsers such as Chrome and Safari allow users to change the font size and screen magnification. However, these types of adjustments often require users to take extra steps in locating them and can pose difficulty if the user is not familiar with the technology. In order to provide a better experience for elderly people with the above condition, font size should be easily adjustable. Ideally, the feature should be placed in an area where it can be accessed easily. To avoid complication in workflows, there should be some predefined levels. For instance, the default of the setting is normal, which can be adjusted larger to suit their needs. However, if the font size is too large, it can create a privacy issue as the content is exposed.

Glaucoma is a medical condition that affects the peripheral vision. This condition can affect the reading ability. As we read, our eyes move from one group of words to another. When the peripheral vision is affected, the ability to scan a paragraph is also limited. As a result, the reading process is also slowed down. To minimise the effort in reading the content for elderly people, especially for people with Glaucoma, more attention is required when choosing the correct typography and line spacing.

Good reading experiences can be very engaging and supportive. With an exemplary user interface, all designs will benefit when the concern on readability is addressed correctly. For instance, websites that are heavy in text use, e.g. magazines, newspapers, need to place the highest priority in reading. However, others such as e-commerce, events, may need to adjust

their font design accordingly. Therefore, designers need to continue refining the platform to achieve an effortless reading experience. That is, the platform should ensure that its users have no difficulty in reading and understanding the site content.

Reading should be enhanced by using easy to read font style. In general, fancy font type such as script-type or handwritten font should be avoided. Script-type is harder to read due to the curvy lines of the characters, which make it difficult to see clearly. These font types are suitable for other occasions such as weddings, celebration, where the context is established. However, it may not be suitable for web users, particularly with older people who may have visual impairments. Alternatively, Sans-serif enhances readability, as every character is clearly distinguished.

Fonts also have an effect on the readability of the platform. In general, fancy font type such as script-type or handwritten font, etc. should be avoided

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Figure 4.0: 'Script MT' (left) and 'Sans-serif' (right)

As shown in Figure 4.0 above, Script-type is more challenging to read due to the curvy lines of the characters, which make it difficult to see clearly. These font types are suitable for other occasions such as weddings, celebration, where the context is established. However, it may not be suitable for web users, particularly with elderly people who may have visual impairment. Alternatively, Sans-serif enhances readability, as every character is clearly distinguished.

Another factor that affects the readability of the content is the vertical space between text lines which is also known as leading. If the leading is too small, not only elderly people but also users from the younger generation may find it hard to read. As elderly people often have vision impairment, especially Glaucoma, it is critical to ensure that the text lines are not sitting too close to each other. Ideally, it should be around one-and-a-half times the size of the text.
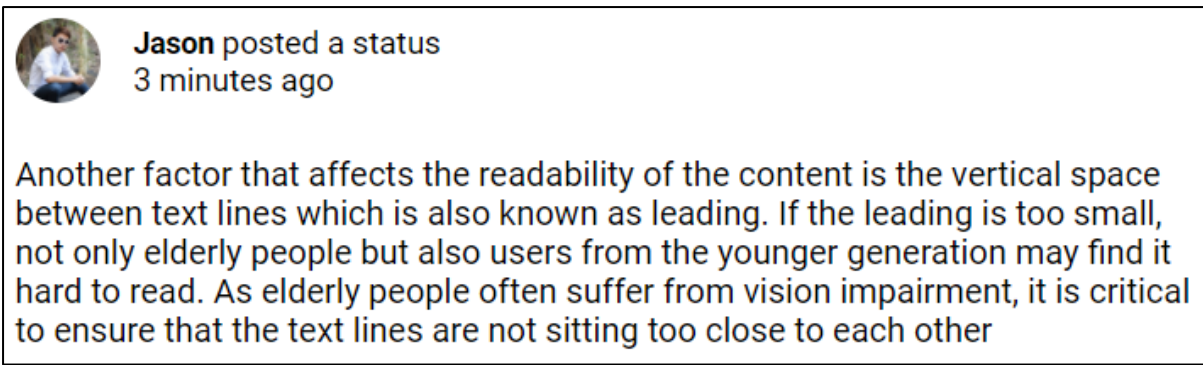
> **Jason** posted a status
> 3 minutes ago
>
> Another factor that affects the readability of the content is the vertical space between text lines which is also known as leading. If the leading is too small, not only elderly people but also users from the younger generation may find it hard to read. As elderly people often suffer from vision impairment, it is critical to ensure that the text lines are not sitting too close to each other

Figure 5.0: Text with the default line-height is harder to read.

> **Jason** posted a status
> 5 minutes ago
>
> Another factor that affects the readability of the content is the vertical space between text lines which is also known as leading. If the leading is too small, not only elderly people but also users from the younger generation may find it hard to read. As elderly people often suffer from vision impairment, it is critical to ensure that the text lines are not sitting too close to each other
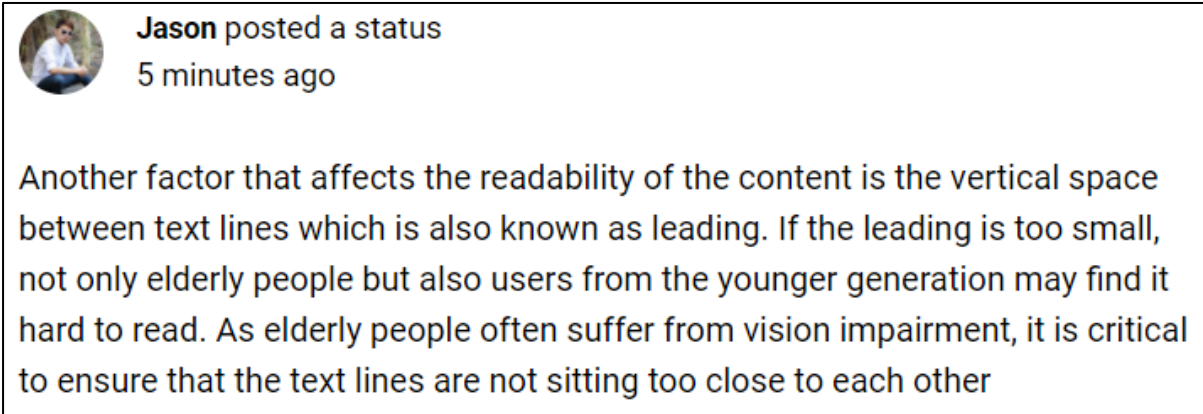
Figure 6.0: Text with 1.5 line-height on our platform is easier to read.

Another condition that affects the vision is Cataract. Users who have this condition may become sensitive to glare and light. As a result, display contrast can be considered too high for some users. This is one of the reasons why older adults would prefer soft pastel colours. Unfortunately, the colour design on most of the online platforms is fixed, and there is no way to change the colour through the browser setting as it is with font size. It creates a challenge for elderly people who want to use the platform. To overcome this issue, users should be allowed to change the colour scheme of the platform.

The information on the page should be structured. The more content is organized, the more easily people can read it. This design approach helps users find relevant information quicker as users do not read every word. Therefore, the information should be broken into sections and subsections with a clear heading. As a result, readability can be improved for users, especially for those with visual impairment.
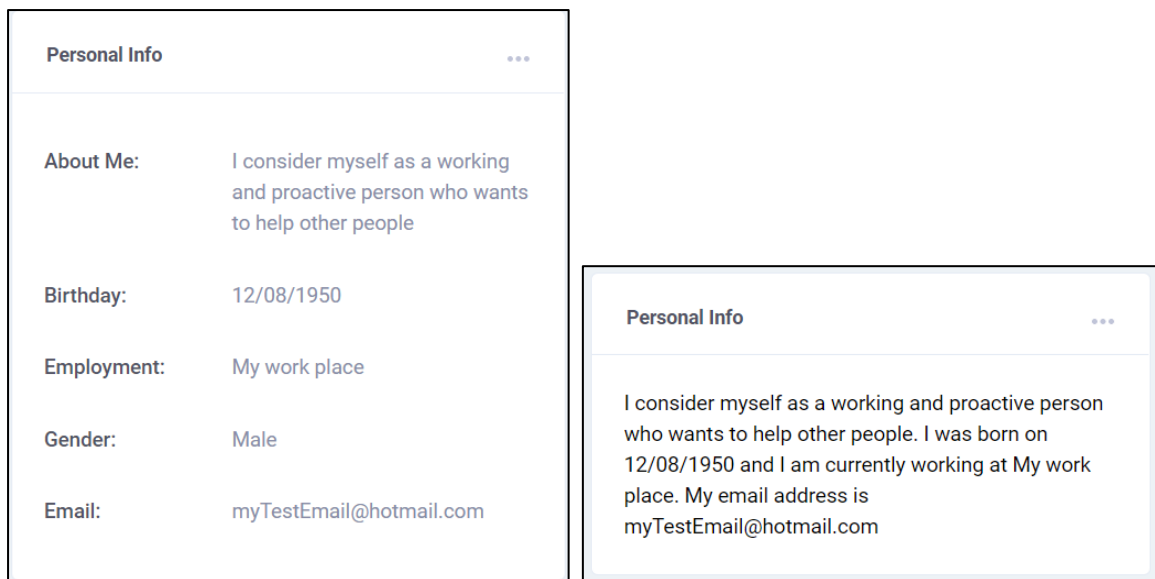
Figure 7.0: Structured information (left) and unstructured information (right). Structured information allows users to obtain information quickly.

As people get older, the precision of the hand and finger movement starts to decrease slowly. This decline indicates that manipulating a small object can become difficult. These include moving the mouse pointer to a specific location, clicking on a small object. If a person cannot move their hand reliably, they are more likely to make an unintended gesture. The risk becomes greater when the objects are small or close to each other.
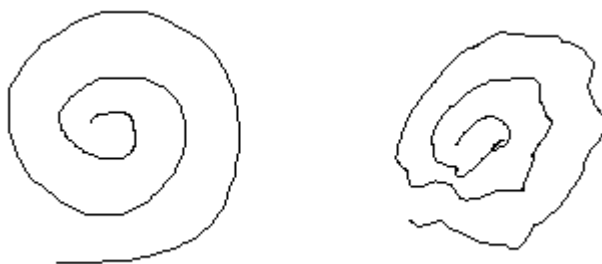

Figure 8.0: Steady hand versus un-steady hand drawing

Since 1950, pointing at objects on a screen follows Fitts' law. That is the larger our target on the screen, we can point to it faster if it is closer. Based on this idea, the clickable area of the target object should be maximized. This approach can be designed using Bootstrap, each block can span between 3 to 6 large columns. This method will ensure the target is not only big enough but also maintain responsiveness if used on a mobile device.

Since users with reduced motor control often have difficulties in moving a mouse and pointing of the objects, another method to assist them is to ensure the path of the menu item is wide enough while moving to a submenu. This approach will ensure they can move the pointer down and select the item easier.
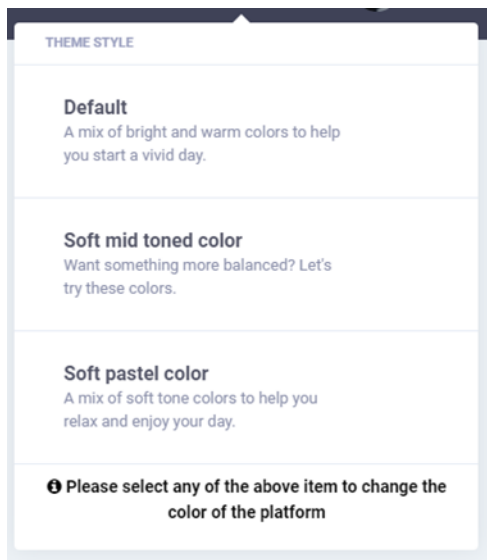

Figure 9.0: Big menu item

Many elderly people can remain healthy and alert even when they reach the age of 70 and above. However, not everyone can share the same experience as many also suffer from a decline in knowledge. Because of these differences, there are many areas to focus on when working on the user interface. Some of these areas include memory, attention and decision making. There are many types of memory, such as long term and short term, and these are affected by the process of aging more or less. For instance, older people tend to forget things, but their ability to learn and reproduce what they have learnt may not be affected over time.

As mentioned above, older users often suffer from some memory issues, one of them is short-term memory. They may encounter difficulties in trying to understand how the new concept works if it is too complicated in the interface. However, a good design has the potential to minimise such confusion and complication by reminding users of the actions they have taken. To accommodate that, designers should ensure the product features are introduced gradually to avoid cognitive overload. They also should not consider splitting tasks across screens if the information depends on the previous screen. Finally, alerts and reminders should also be considered for actions that are repetitive.

Elderly people often have dementia, a form of cognitive impairment that affects their short-term memory capacity and the ability to focus on tasks. As their short-term memory is reduced, they often require detailed steps to follow in completing a complex task. Therefore, a lengthy process must be simplified or broken into smaller steps, so they can easily keep track of their progress. For instance, most platforms require their users to fill out a long registration form when they try to register for the platform. This process can be overwhelming, which can result in elderly people giving up or having to start over again. To avoid burdening users' memory, complex tasks must be broken into smaller steps. For instance, the registration process can be divided into different smaller interactive questions and present them to the users. The new question will be shown only when they have answered the previous question. Furthermore, their answer can be validated straight away after it is provided, so they do not need to come back if there is an error.

It is impossible to appreciate a platform when the user is not able to access the required information due to the complication in navigation. Therefore, complication in navigation is an important aspect to be considered. Typically, there are two fundamental rules for navigation. Firstly, the user must be able to identify where they are currently, that means they should know their place within the platform. This rule is critical as it allows them to feel comfortable when navigating around the site. Secondly, the method of navigation should be consistent. As such, menu, headers, navigation bars should not be moved around. To successfully design a user interface, there are also many other factors that should be considered. These include menus, filter and links. Filters will be a great support for sites with heavy content, and links can help users understand the relationship between content.

Another technological factor that might not be critical but is worth considering is accessibility. With the advancement in today's technology, many platforms provide multiple access methods such as a web application or as a mobile application; the former is arguably one of the most traditional methods that are more familiar to older users, while the latter position is a more up-to-date method that can attract younger users. While each method has its benefits, the focus should be on the level of familiarity to older users. As a result, a web application might seem appropriate when designing an online platform for older users.

Another area of consideration is the economy issue, as people withdraw from employment activities, their financial situation also suffers. As a result, some of them may need to rely on the welfare system as a mean to support their daily expenses. When a significant proportion

of the population relies on this welfare system, it can create a burden for the government, which in turn will be passed on to the younger generation. An increase in income tax or other taxation is arguably one of the most common methods. However, if people decide to remain longer in the workforce, it may hinder the career progression of the younger generation. For instance, a business may not need to maintain two team leaders in the same team. Therefore, when designing a solution for seniors, it must provide a means for them to earn extra income, either to cover their expenses on the platform or as a means for them to support their financial situation.

Another aspect of the economy for consideration is to utilise the wealth of the retired population. Undoubtedly many people are financially secure enough to retire without the need to rely on government welfare. However, it also indicates that while they have a lot of money to spend they may have other needs such as a desire to learn a new thing, or just simply want to team up with someone to start a business. As a result, we can utilise this monetary resource to provide mutual benefit. Whether they are old or young, the platform can be a medium for this supply and demand to meet. Additionally, apart from the economic issues, social connection is also affected. Loss of social connections that they established through employment activities is a common one. As a result, they need to find a way to establish a new social relationship or face depression and isolation. Therefore, the platform needs to employ features that address the issues that elderly people commonly face, such as social isolation, or depression. It should not only cater for the above issue but can also address the factors that promote quality of life. A social network is a good example and use-case where users can expand the social relationship and reduce depression. Besides social network, the service network also needs to be designed in such a way that it enhances the quality of life by allowing users to carry out or participate in activities that suit their needs. In addition to the above consideration, the platform should employ a range of methods to maintain and encourage ongoing participation of users. While it is not difficult to produce an online platform, it is not easy to actively engage its users. As outlined in many of the past studies, users often experience technical difficulties, or the platform does not generate enough benefit to attract them. These factors are reducing the interest and hinder the ongoing participation. To overcome these shortages, a solution can be developed by studying the motivational factors that encourage elderly people to participate in a certain activity. Those factors are then transformed into technical and non-technical requirements and should act as a driver for most if not all activities that are carried out on the platform.

3.3 IT technologies for engagement

Many of the younger generations have a thirst for knowledge and experience and are required to learn new skills every day. In contrast to that, many elderly people, who possess those valuable resources, are withdrawing from productive activities and those skills and knowledge are not particularly useful for them anymore. As a result, to minimise the gap, there is a need for seniors to engage with the younger generation, so there is a means to allow knowledge to be passed on to them. As a result, the service network is an ideal medium to accommodate this behaviour. However, as mentioned above, a service network alone does not provide enough benefit; that is the reason why service network and social network can be integrated.

When comparing this type of platform with the current social networks such as Twitter and Facebook, the advantage that this type of platform can provide are that it creates a specific environment to address a specific need. For instance, in a typical use case, a user is unlikely to go on to Facebook to create a random post to ask for a particular service. This method is not effective as it is challenging for the service consumer to connect with the service provider as the service provider may not see the post. Moreover, the credibility of the service provider is also another question. On the other hand, for this type of platform, that user can easily connect with the person with the right skill through the integration of a service network. The credibility of the service provider is also reflected through different methods such as users' reviews, recognition (e.g. account age, number of achievements). As a result, the benefit is applied to both parties, both the service consumer and the service provider.

Another advantage of this type of platform is that it encourages users to provide the best possible service as they can easily get more customers through the promotion of the social network. Traditionally, for a standalone service network, it relies heavily on the reviews that the previous buyers left; however, not everyone is willing to leave a review. As a result, even for a good service provider, they miss out a lot of chances to gain more businesses. However, this situation can be improved when using our new type of platform, as a word-of-mouth recommendation through the integrated social network can be a great benefit.

Only the core functions of existing social networks such as Facebook, Twitter and of service networks such as eBay, Freelancer are retained and refined to better serve our engaging model, for example: 'friend' feature to enhance social connection. As a result, those features

serve as the foundation which allow us to develop novel features that enable and sustain the engagement of the aging population.
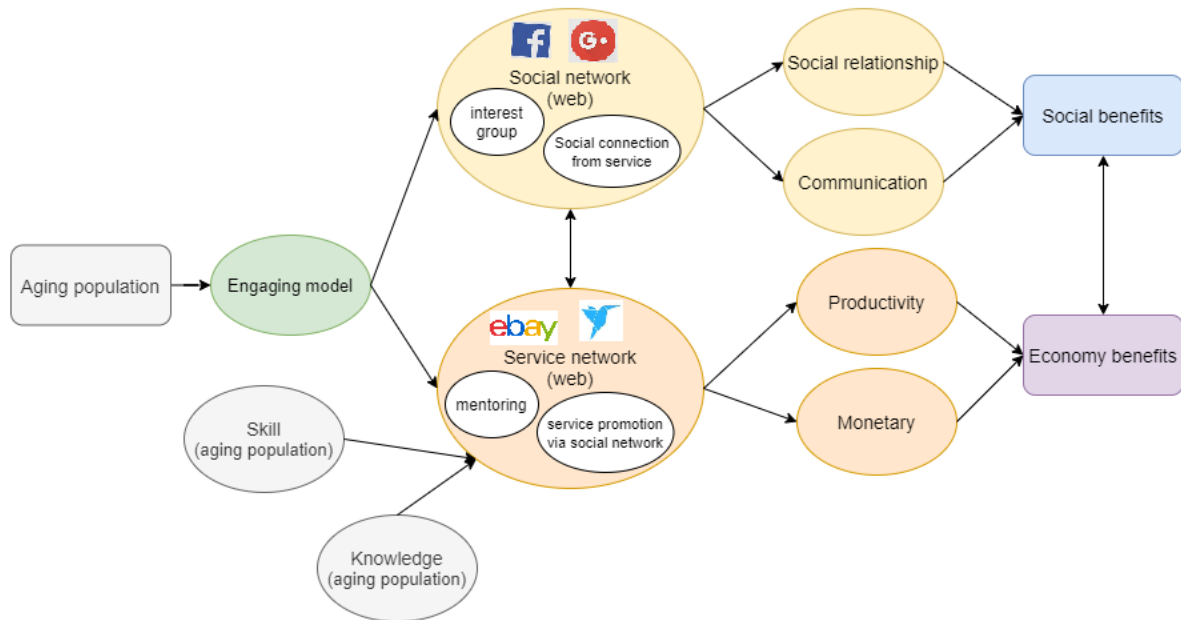

Figure 10.0 Overview of benefits

3.4 Summary

This chapter presents the factors for consideration of this platform. We considered the technical elements with the focus on the user experience and some of the practices that we should consider when designing user interfaces for the elderly. These include keeping the interface simple, creating consistent UI elements, being purposeful in page navigation and layout, using the correct colour and typography that emphasizes clarity. Apart from that, other factors such as financial elements, economic, and other social-related factors are also covered. Most importantly, while it is not possible to cover every aspect of the aging population, this chapter presents some of the main foundations that are considered when designing this platform. Furthermore, we also provide the justification and a typical use case as to why the integration of social network and service network is considered.

Chapter 4 Design

4.1 Introduction

There are three models that contribute to the design of the solution. Each has its features and benefits which are inter-related. In many existing solutions, often only one model exists at a time which is not effective in promoting active aging or addressing the issues of elderly people. As a result, utilising, specialising, and providing additional features that benefit each of the models in one combined platform may produce a suitable solution. The main challenge is maintaining participation; without this factor, the effectiveness of other models could be limited.

The remainder of this chapter is organised as follows: Section 4.2 outlines the overall design. Section 4.2.1 describes the design of the engaging model. Section 4.2.2 discusses the design of the service network model. Section 4.2.3 provides the design of the social network model. Section 4.3 summarises this chapter.

4.2 Design

Based on the considerations in chapter 3, the design of our platform is broken into three main models: the engaging model, the social network model, and the service network model. The overall links between the three models of the platform are illustrated below.
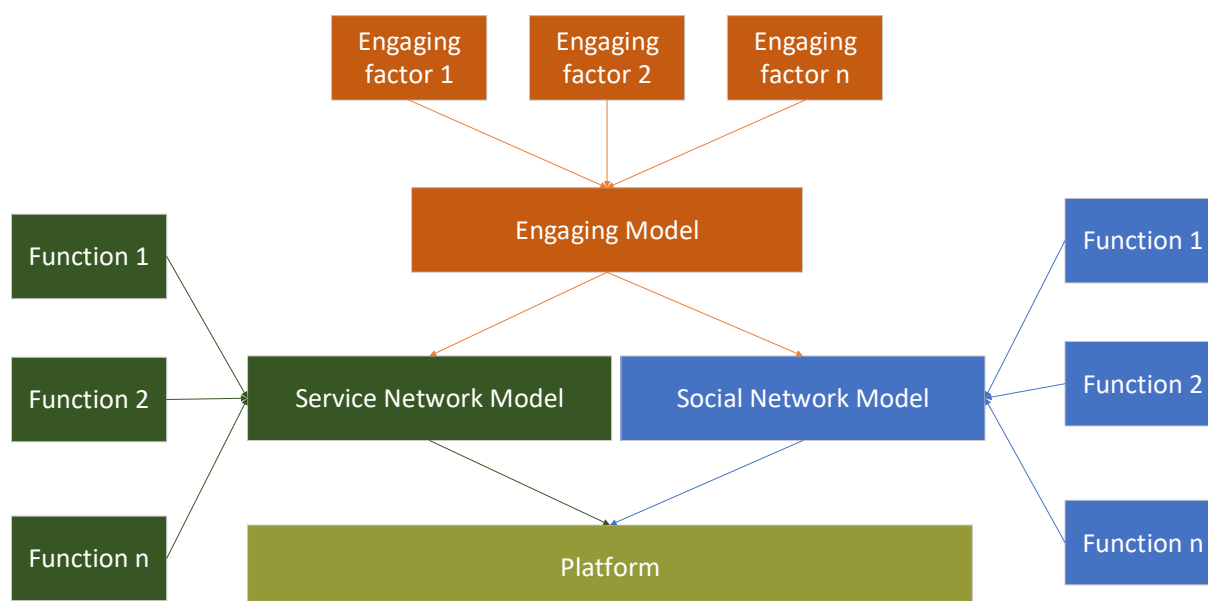
Figure 11.0: The links between models in the platform

The engaging model is a base model with the factors that help engage users on the platforms. The social network and service network model extends these factors and works together to form the platform. The requirements for those models are identified below.

4.2.1 Designing the engaging model.

There are many studies that focus on engaging people in volunteering activities as it helps strengthen the community relationship and have a positive impact on physical and mental well-being. Volunteering activities are perhaps worthwhile to consider as they often attract elderly people. In 2004, Michael conducted a study [20] on the volunteering motives among retirees. The study identified many motivational elements that encourage elderly people to participate in voluntary activities. Some people volunteer because it helps increase their self-satisfaction, and they enjoy their emotional reward of being acknowledged by other people. It also suggested that the need for socialisation is not only a critical element but also a source of satisfaction. Many of the participants mentioned that they enjoyed the interaction with people during their duration of doing volunteer activities. Other people volunteer because they would like to seek activities to maintain their productivity level. This factor reinforces the idea that even when they have withdrawn from work, they still want to participate in productive activities [21]. Another motivational factor refers to the monetary reward, which is in the form of stipends. All the participants in this study indicated that they are happy to accept it as it indicates the level of importance of the tasks they performed. The final factor refers to the value of time where participants indicated that they are more likely to give up their role if they face too many obstacles along the way. The above research describes many critical factors that attract and encourage ongoing participation in voluntary activities of elderly people.

Additionally, Alicia conducted research on the factors that contribute to the recruitment and retention of older adults in volunteer programs [22]. The research is an extensive literature review which focuses on the articles published between 2006 and 2014 to identify the common motivational factors. Many of the studies suggest that providing the opportunity for elderly people to conduct activities that are meaningful to them helps encourage them to engage in volunteer activities. Several of the studies suggest that social interaction is an important reason for many older adults to do volunteering. Social interaction occurring as part of the volunteer experience is essential for maintaining ongoing participation. Another critical factor refers to flexibility in terms of task and work schedule. It is important to allow

participants to have control over the task and time to provide a comfortable work environment that can enhance their experience. Monetary reward, as both a supplement and reimbursement, has a vital role in encouraging them to maintain ongoing participation, especially for those who have low income. It is also a way to reduce financial and transportation barriers. People who receive adequate training and support can increase their perception of the benefits of volunteering, especially for those who are learning a new skill. Recognition or appreciation for the contribution or service is also critical in retaining a volunteer.

Based on the above studies, the workable motivational factors can be summed up as follows:

- Maintain productivity: even though they have withdrawn from employment activities, they still want to participate in productive work. It is also a means to inform other people that they are still capable of contributing to society.

- Reward: People are likely to participate in certain activities if they are provided with reimbursement. For many people, a reward is not simply money; it also means a symbolic gesture of appreciation for their effort and output.

- Recognition: people often feel valued if the effort they spent is well recognised. The emotional reward from being recognised and acknowledged serves as a driving force that encourages ongoing involvement in many activities.

- The value of time: the amount of time spent on an activity, in some instances, can be seen as a cost to the participants. Depending on the cost, it may make the participants wonder if it is worthwhile for them to do so. Therefore, any unnecessary process should be removed.

- Social interaction: an essential factor to retain users in online platforms and is one of the drivers to motivate people to participate in certain activities. For elderly people, social connection is often a means to overcome the solitude feeling that builds up when they withdraw from work.

- Role flexibility: being able to choose activities of interest and schedule the work to suit their needs is an important step in providing a flexible work environment for them. For many people, this factor has a high potential to increase their level of engagement in an activity.

- Support: to increase the level of engagement, providing enough support is an important consideration, especially for the people who are still new to the environment. For many people, this is a critical factor to determine whether they will continue performing a particular activity.

The above factors have an important role in retaining and encouraging ongoing participation. As more and more people move into retirement age, it is important to note that not only are they still capable of maintaining their contribution to the society but also to use their activities to grow as individuals.

To motivate users to provide services, the design of the engaging model on the platform shall focus on a range of features that facilitates the motivational factors as outlined in the above considerations. It also acts as a driver for the other two models where their features also need to take into account these considerations. The features of the engaging model include:

Reward: Users are more likely to provide services if they are provided with reimbursement to cover their expenses. For many people, a reward is not simply money; it also means a symbolic gesture of appreciation for their effort and output. To address this factor, users can decide whether to charge for a service when they produce it.

Recognition: people often feel valued if the effort they spent is well recognised. To accommodate this element, the platform will award different badge and title to the users depending on their contribution and activities. The recognition can indicate that their service is of high quality, and the platform will promote the service to other users. As a result, the users will have more chance to obtain reward through the service they provide and at the same time, gain more recognition. Apart from that, services that have high review indicate that the service provider has input a considerable amount of time and effort. To help recognise this effort, these services are given a boost in popularity by being promoted throughout the platform.

The platform rates the user from level 1 to 10 with a description to describe the level of experience. It uses the basis of their contribution to determine the level. The more activities they perform, the higher the level. A higher-level can the increase credibility and popularity of their service.

Services are promoted based on the level of users, interest and the rating of the service. The method used to calculate the promotion is as follows.

WR = (v ÷ (v+m)) × R + (m ÷ (v+m)) × C + L

where:

WR = Weighted Rating of the service (WR)

R = average review for the service

v = number of votes for the service

m = minimum votes required to be considered

C = the mean vote across the service category

L = Level of the user

The above formula is developed based on the Bayesian rating technique where it smooths out and balances the ratings. The parameters have an emphasis on the votes of the service being rated, which sees the better rating the service has, the higher the Weighted Rating. As a result, this factor encourages users to provide good quality services by giving them some unique advantages. The above feature ensures that their contribution to the community is recognised.

The value of time: the amount of time spent on a task, in some instances, can be seen as a cost to the user. Depending on the cost, it may make the participants wonder if it is worthwhile for them to do the task. The main goal of this principle is to ensure that users can quickly achieve the tasks they want to do.

Social interaction: this is an important factor to retain users in online platforms and is one of the drivers to motivate people to participate in certain activities. For elderly people, social connection is often a means to overcome the solitude feeling that builds up when they have withdrawn from employment activities. This element is addressed by the social network component and other socialising methods integrated into the platform.

Support: to increase the level of engagement, providing enough support is an important consideration, especially for the people who are still new to the concept of the platform. For many people, this is a critical factor to determine whether they will continue using the platform. This factor is accommodated by providing guidance and explanation where possible, and these are often located on the same page for convenience.

Usability:

As mentioned earlier, users feel encouraged to spend more time on the platform if they do not need to use too much effort. Elderly people are often affected by various visual impairments, such as Presbyopia and Cataract. Most browsers allow users to adjust the font size and screen magnification as a means to compensate for Cataract. However, for users who do not have much experience with browser technology, it can pose a certain difficulty. To overcome those disadvantages, the platform offers three levels of adjustment (standard, large, extra-large) and is located at the fixed header bar to enhance its visibility and adjust the font-size with only one simple click.

Variety in glare and light may bother users who experience Cataract. This discomfort might come from the way a platform uses its colour or contrast. Unfortunately, these settings are typically not adjustable as font size. To minimise the impact of this factor on users, our platform allows user to change the colour scheme with different colour tone and contrast. Similar to the font size adjustment, this feature is located at the fix header bar.

As people get older, it is difficult for them to maintain the precision of the hand and finger movement. As a result, manipulating or aiming for small objects can become difficult, particularly moving or aiming the mouse pointer to a location, and clicking on small objects. As a rule, pointing at objects on a screen should follow Fitts' Law so that the object must be large enough to allow quick interaction. To accommodate for this shortage, our platform uses Bootstrap to increase the clickable area of the objects where each block spans between 3 to 6 columns. This approach will also ensure the objects are large enough for display on a mobile device and maintain responsiveness at the same time.

Elderly people also experience dementia, a form of cognitive impairment which affects their ability to focus on tasks and affects their short-term memory. When their short-term memory is decreased, they might experience difficulty in completing complex tasks. Therefore, a lengthy process must be broken down into smaller steps so the users can maintain their pace and progress. Unfortunately, this approach has not been widely adopted yet. This process can become overwhelming, which may see people give up on a task or lose track of their progress. To reduce the burden on users' memory, complex tasks on our platform are often broken down into smaller steps. For instance, during the registration process, our platform divides the steps into smaller interactive questions. The new question is shown once the previous question is answered and validated.

4.2.2 Designing the service network model.

There are not many platforms where elderly people can use to contribute to the society as our society tends to perceive that they often need support for their daily activities and that they might not be as productive as they used to be [23]. However, with current trends in the health system, it is realistic for people to be healthy and productive even at a later stage in life. Therefore, elderly people who are still healthy can prolong their contribution through a range of activities. In fact, it can lead to many issues mentioned above which eventually impact on their quality of life. Apart from that, being actively and continuously generating value can contribute to the development of the economy, improve their financial situation and reduce the likelihood of relying on government welfare. As a result, society and different generations will benefit as a whole.

Quality of life is discussed below as a perception of an individual regarding the value system in the context of their goals, expectation, standards and concerns. It is critical that the elements that affect the quality of life of elderly people are taken into account when designing the platform. The following studies below help identify the factors that affect the quality of life of elderly people.

Julie et al. conducted research [24] on 500 participants to identify the factors that give them a high quality of life. These factors include Control, Self-care, Independence, Safety, Social relationships, Dignity, Mental Health, Physical Mobility, Pain, Sleep, Vision, Hearing. Based on this study, Control has 14%, Self-care has 4%, Independence has 35.6%, Safety has 2.2%, Dignity has 2.4%, Mental Health has 7.8%, Physical mobility has 14.4%, Pain has 7.4%, Sleep has 2%, Vision has 6.8%, Hearing has 1.2%. This study identifies the most important factor, which is Independence with 36%, followed by physical mobility (14%) and Control (14%). Independence refers to the ability to spend time as they want, doing the things they value and enjoy.

Katarina et al. conducted another study [25] with 141 participants to reveal the factors that promote quality of life. The factors in this study include Social relations, Health, Activities, Functional ability, Well-being, Living in one's own home, Personal finances, Personal beliefs and attitudes. Based on this study, Social relations has 57%, Health has 44%, Activities has 34%, Functional ability has 32%, Well-being has 19%, Living in one's own home has 11%, Personal finances have 7%, Personal beliefs and attitudes has 11%. This study reveals the most important factor, which is social relations (57%), followed by Health (44%) and

activities (34%). Social relations refer to the interaction with other people such as family and friends.

Zahava and Ann conducted another study [26] with 80 participants to reveal the elements that help elderly people improve their quality of life. The factors in their study include Social relationships, Home and neighborhood, Psychological well-being, Other activities done alone, Health, Social roles and activities, Financial circumstances, Independence, Politics. According to this study, Social relationships has 96%, home and neighborhood has 96%, Psychological well-being has 96%, Other activities done alone has 93%, Health has 85%, Social roles and activities has 80%, Financial circumstances has 73%, Independence has 69%, Politics has 1%. This study demonstrates that social relationship with other people and psychological well-being are the most important elements.

Based on the above studies, we identify the common factors and extract the social and mental factors. These factors include: Activities, Social relationship, Dignity and Mental Health. Activities refers to being kept busy and doing things that they value and enjoy; Social relationship refers to having good social resource and regular contact with friends and families. Dignity refers to the psychological well-being such as feeling good or better about oneself. Mental Health refers to the mental well-being such as not feeling stressed, depressed.

Table below shows the common factors that are extracted from the above studies (percentage)

Factor	Study 1 (Julie et al. 2017)	Study 2 (Katarina et al. 2005)	Study 3 (Zahava and Ann 2004)	Average
Activities	35.6	34	80	50
Social relationship	2.3	57	96	51
Dignity	2.4	19	96	40
Mental Health	7.8	40	85	45

Table 1.0: common factors that are extracted from the above studies.

The factors from the above studies indicate that elderly people still want to participate in different activities or prolong their contribution as it helps improve their mental well-being. It forms the basis for designing the service network model on the platform; it needs to provide a range of features that allow elderly people to participate or provide activities to other users. To achieve that goal, the service network model consists of the following features:

• Forming a service: service is formed in a self-organised manner where the user creates a service and provides the necessary details that may attract other users. After that, users can deliver the service by organising an offline meeting based on the date and time of the service. This action can help facilitate real-life interaction and better service management.

• Delivering service: Users who decide to participate in the service based on the information provided can create a booking for the service. After that, they are automatically added to the group created for the service. Users in the group can start socialising with each other before the offline meeting is held. Face to face meeting can enhance social relationship and create many opportunities for future partnership.

• Post service delivery: After the service is delivered, users can maintain an ongoing relationship and continue the discussion in the group created for the service earlier. Each group also has a section that describes the last group event, which allows the service provider to upload any photos to it. Users in the group can also comment in the section as well as the group itself, which can further strengthen the relationship or continue the discussion if they have any unfinished business. New users who just joined the group can also pick up the situation as they can go through the last group event section.

• Location-based: location is an important factor for many users that may experience mobility issues. To overcome this obstacle, users can view different services or activities that are available in their local community and act upon those details. As a result, a service can be conveniently delivered.

4.2.3 Designing the social network model.

A recent report [7] suggests that communication is a critical factor for seniors as it satisfies their desire to socialise with other people. With the advancement of communication technology, especially the development of social networks, the process is becoming easier than ever. Socializing is also reported to minimise the negative emotion or feeling of elderly

people. The benefits are further strengthened by another study [8] where social network or other forms of online communication can minimise loneliness and social isolation. These studies indicate that social network is an effective means of addressing the social isolation issue that elderly people commonly face and establish strong social bonds which can reduce depression and increase life satisfaction.

As a result, more and more elderly people are using social networks. According to Statista [27], more than 3 million Australians who are 55 years and above are active on Facebook. The reasons for increasing online presence are studied in many researches as outlined above. Moreover, it is reported that they have a positive effect in promoting aspects of quality of life identified above and improve the communication needs of elderly people.

According to one study [28], one of the driving forces for this behaviour is the need for social engagement. The most common types of social engagement include keeping in touch with friends, family, and the community. In many nonhuman species, physical grooming can help strengthen group stability and social bond [29]. In humans, Dunbar suggested that activities like gossip and small talk can also serve as a type of social grooming. As a result, users of an online social network engage in activities that can be classified as social grooming. Other reasons are related to the need to minimise loneliness and the needs of users who actively participate in online activities, who reported lower feelings of loneliness and stress.

Another way that a social network helps promote quality of life is through enhancing the dignity of its users. It is a tool to serve the need to belong and the need for self-presentation. Self-esteem is related to the need to belong. It has been proposed that self-esteem can be represented by the acceptability of one person to the group. A reduction in self-esteem indicates the potential of social exclusion and encourages the individual to take action to avoid being excluded [30]. Internet use has been associated with the psychological effect of well-being, such as self-esteem and life satisfaction [31]. Considering this factor, Gonzales and colleagues [32] conducted research to study the relationship between social network exposure and self-esteem. Results showed that exposure to information presented on a person's social network profile enhances self-esteem, especially when a person edit his/her information.

Additionally, social networks help enhance mental health and promote greater psychological well-being. It has been reported that an increase in the number of friends on social network can lead to greater social support which in turn can lead to greater psychological well-being.

Also, the number of friends on a social network has a direct relationship with life satisfaction [33]. Moreover, social networks use has an effect on inducing a positive emotional experience [34]

Based on the above factors, it is evident that social networks are effective in addressing the factors that affect the quality of life for many people. However, they often lack the ability to allow elderly people to participate in productive activities and more importantly, to continue contributing to society. Yet, the activities on social networks often focus on promoting social relationship, dignity and mental health. However, one of the main factors that affect the quality of life is the ability to be able to participate in different activities and do things that they enjoy. In social networks, the ability to conduct productive activities is quite limited as they often lack functionalities to enable this feature.

The benefit of social networks, as outlined in the above studies, form the basis of this model. Those studies indicate that a social network allows elderly people to maintain connection and interact with other people. Therefore, it is effective in addressing common issues related to socialising that older adults normally face. Apart from that, the increasing social connection tends to minimise depression and enhance life satisfaction. As a result, the social network model consists of the features used to facilitate communication and provide maximum opportunity for users to expand their social engagement.

• Friends: To help users to expand their social relationship, it is essential that they can make friend with other users on the platform. This feature allows them to create a connection with other users and allows them to receive updates or activities involving their friends. When users create an activity or service, their friends can easily see it show up on their main page. As a result, this behaviour significantly increases the visibility of the activity and indirectly promotes it.

• Profiles: In order to use the platform, the user needs to create an online presence represented by their personal profile. The registration process is simplified and broken down into smaller tasks. The user only needs to provide basic information such as name and password. Other information such as interests, and hobbies can be recorded at a later stage if they choose to update their profile when they have gained confidence in the platform. The additional information will be used by the platform to enhance their overall experience. Moreover, users can also adjust their privacy setting to decide how their activities will be shared with just one simple click.

• Interest group: when users create a service, a group will be automatically created for that service and users who booked for that service are automatically added to that group. This approach allows users with the same interest to be grouped into the same group. As a result, it helps promote the interactivity between users who booked for the service. Apart from that, users in the group are also able to view their relationship between every member and create another group based on those relationships.

• Timeline: This feature allows users to post any interesting information or share their story with their friends in their social relationship. The activities of the user, such as reviewing a service, booking for a service, will also be reflected on the timeline. As a result, it also helps other users maintain their social connection and attract other users to participate in a particular activity.

• Messaging system: the messaging system is built using Google Firebase Cloud messaging, which allows messages to be sent and received instantly.

How the three models promote quality of life and encourage productivity
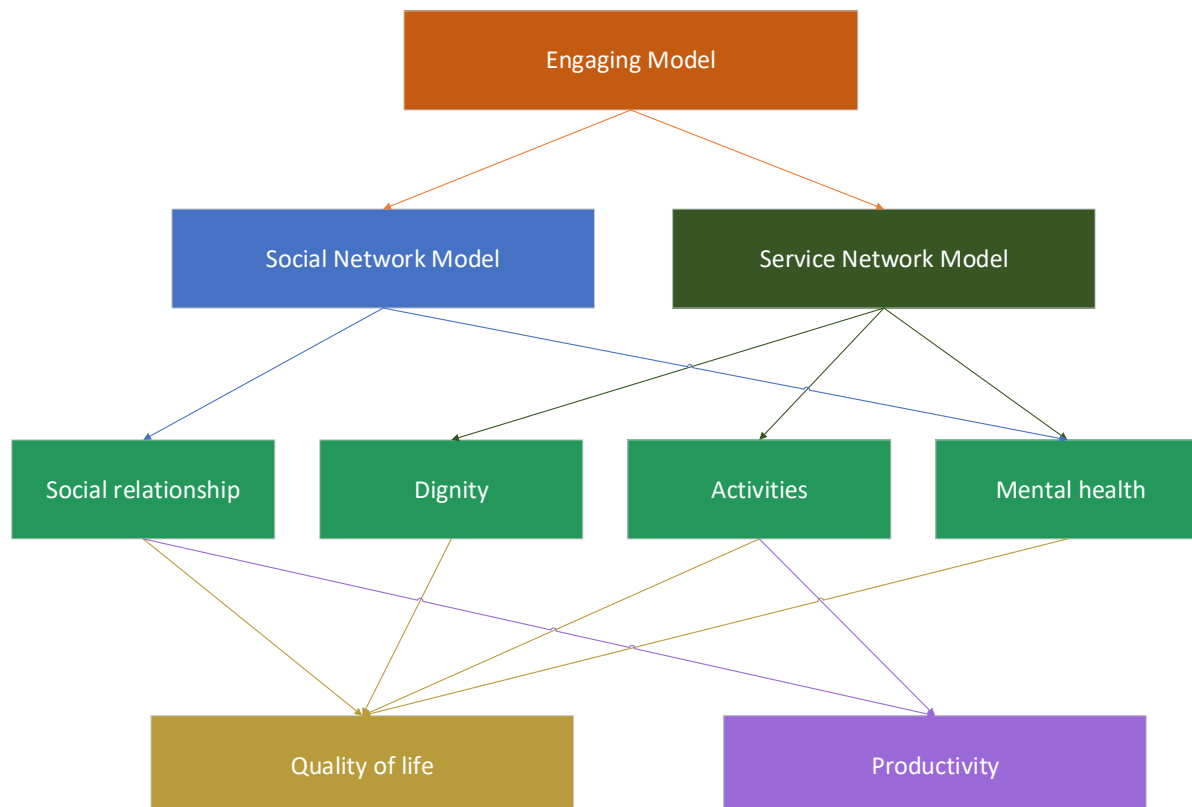
Figure 12.0: How the 3 models promote quality of life and productivity

The engaging model acts as a base and provides the necessary functions to engage users on the platform, such as reward, recognition. The functionalities of the social network model address the needs that are related to social relationship and mental health, such as helping users to expand their social connection, minimise social isolation. The service network model allows users to become more engaged by involving them in different types of activities with many other users (social relationship)

4.3 Summary

This chapter presented the design for the solution and the necessary features of each model. The main features of the social network are to help users expand their social relationship. The main features of the service network are to promote productivity. Each model and its features are interrelated and is driven by the engaging model, which is responsible for encouraging users to maintain participation with the ultimate goals are to enhance their quality of life and productivity. In chapter 5, we will describe the implementation of this design, and its effectiveness is discussed in chapter 6 where we validate and evaluate the model.

Chapter 5
Implementation

5.1 Introduction

This chapter describes the implementation of the platform and provides some sample images as proof of concept. The design elements covered in this chapter includes the architecture, the technical aspects such as the programming language used for the front-end and back-end. It also provides an overview of a typical workflow on the platform. The platform has been developed with the necessary features to facilitate the operation of the platform. For each of the implementations of the individual model, some sample images are provided as proof of concept.

The remainder of this chapter is organised as follows. Section 5.2 describes the overall implementation, architecture, and general workflow. Section 5.3 concludes this chapter.

5.2 Implementation

High level architecture:

At a high level, the architecture represents a typical 3 tier with client, application, and database layer. The client side is the web browser with access to different third-party services while the application handles all the requests from the client and retrieves data from the database where necessary.

The 3 tiers of the architecture consists of the following technologies:

1. Client layer: the front end, represented by the browser, is developed with mainly HTML and .NET razor where suitable. The responsive aspect is catered for by Bootstrap and CSS takes care of the styling.
2. Application layer: implemented with.NET as the main technology stack for backend.
3. Database layer: using Microsoft T-SQL to provide data access.

The entire platform is hosted on a VPS to provide better access in terms of speed and connectivity. The connection is secured with a 128-bit SSL.
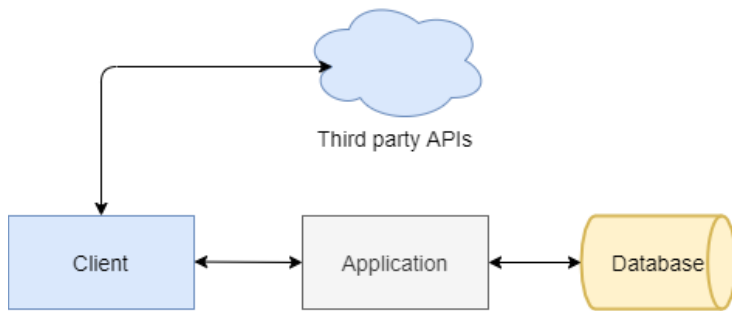
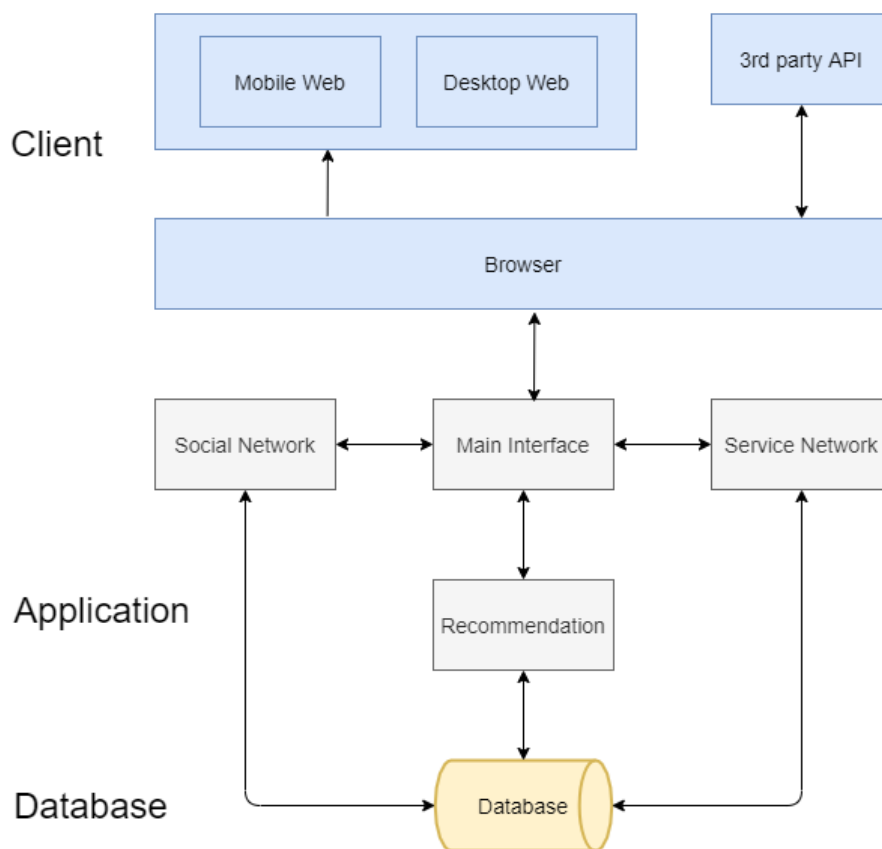Figure 13.0: High level architecture

Overall architecture

Figure 14.0: Overall architecture

The client side consist of:

- Browser: the component that users use to access the platform

- The Mobile Web and Desktop: it refers to the content that is served which depends on the device that users use to access the platform. The platform is implemented using Bootstrap to ensure a mobile-friendly experience.

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- 3rd party API refers to Google Map API and Google Geocoding Service API to provide the location of activities where required.

The application side consist of:

- Main interface: an interface where social and service activities interact with each other. It uses ASP.NET, jQuery, and JavaScript to deliver content to users.

- Social Network: allows users to perform operations related to the social network such as viewing profiles, posting stories.

- Service Network: contains operations related to the service network such as creating services, booking.

- Recommendation: a component that analyses different service activities using the above calculation and suggests them to the users.

The database layer consists of

- Database: refers to the MS-SQL database which provides many built-in security and recovery features.

Detail architecture:
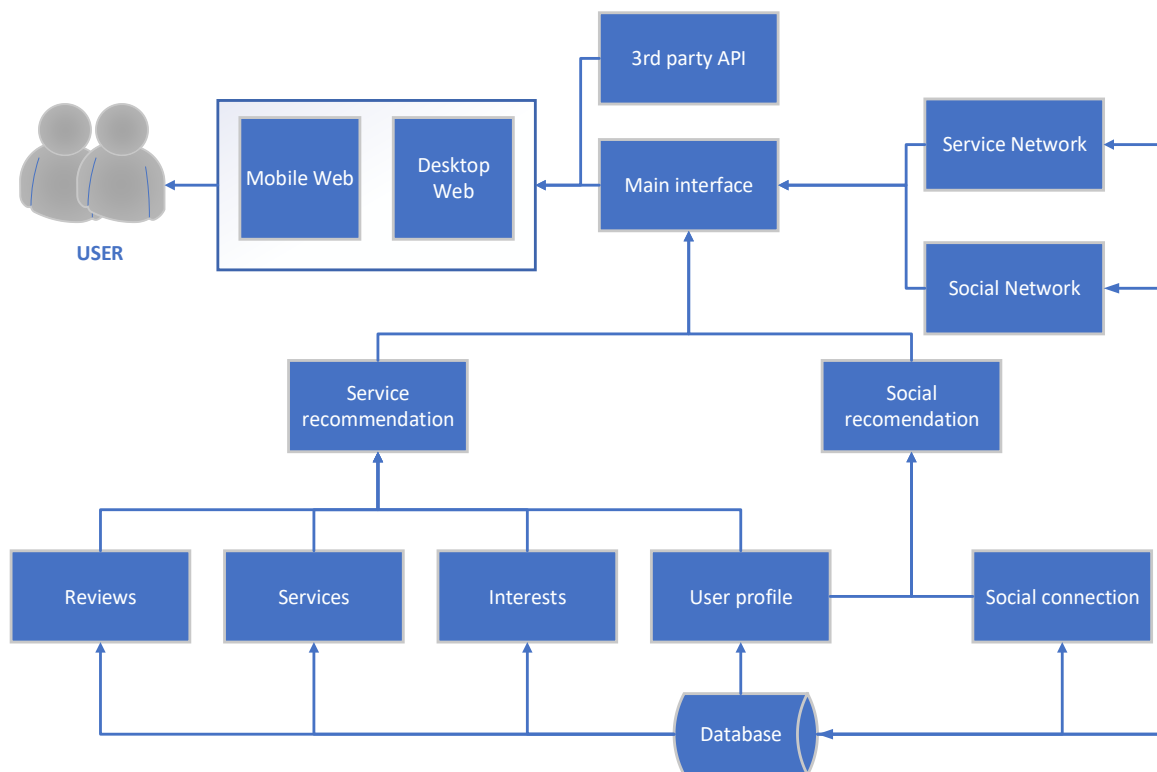
Figure 15.0: Detail architecture

The components as well as their roles are described below:

- Review: a component that collects the users' reviews on different posts; its roles are to provide data for analysis in other processes and to allow other users to view the performance of the services.

- Services: a component that handles the operation of creating, managing and other service-related operations. It also collects the details of the services in the platform and provides input for other processes.

- Interests: a component that collects and allows users to update their interests. The role of this component is also to provide input for analysis in other processes and allows other users to find someone who has the same interests.

- User profile: a component that collects and handle the necessary information of the user such as name, profile picture, gender. It also acts as an input for other processes where these data are analysed.

- Database: the main component to store and retrieve data from. It is placed on the server and uses Microsoft T-SQL.

- Social connection: this component analyses the social connection of users such as common friends, timeline, the link between users. The data is used as an input for other processes.

- Service recommendation: analyses data and input collected from different factors and processes to suggest services to users; these factors include reviews of the service, the category of the service, the interest of the user and some details of the user profile and ultimately determine the suitability of the service to a particular user.

- Social recommendation: it analyses data from different sources of input such as friends of friends, timeline posts, and the user profile to find the common link, and interests.

- Social network: a component that handles and manages social activities. These social activities include timelines, comments, sharing.

- Service network: a component that handles and manages services activities. The service network is an environment where users interact with different services created by the Service component.

- Main interface: The main interaction is facilitated through the main interface, which is serviced by the corresponding social or service network. Apart from that, it also presents the data provided by the two recommendation engines.

- 3rd party API: API can be used to assist both social and service network through the main interface. Its purposes are to retrieve and display on the map the location of different services and handle real-time messaging between users. These APIs are provided by Google.

- Desktop web and Mobile web: typically, this component is represented by the user's browser. As the platform is designed to be mobile-friendly, it can display correctly on both desktop and mobile browser.

The novelty of this architecture lies in the integration of the two platforms where social network and service network can cover the shortages and assist each other. Specifically, the interaction of the two networks in the main interface can not only reduce duplicated content but also helps diversify it, promote each other's features and improve the overall user experience. Apart from that, the two recommendation engines analyse a wide range of factors from different aspects ranging from the normal user profile to the activities they perform on the platform which can significantly promote relevant content and activities to users and hence engage them onto the platform.
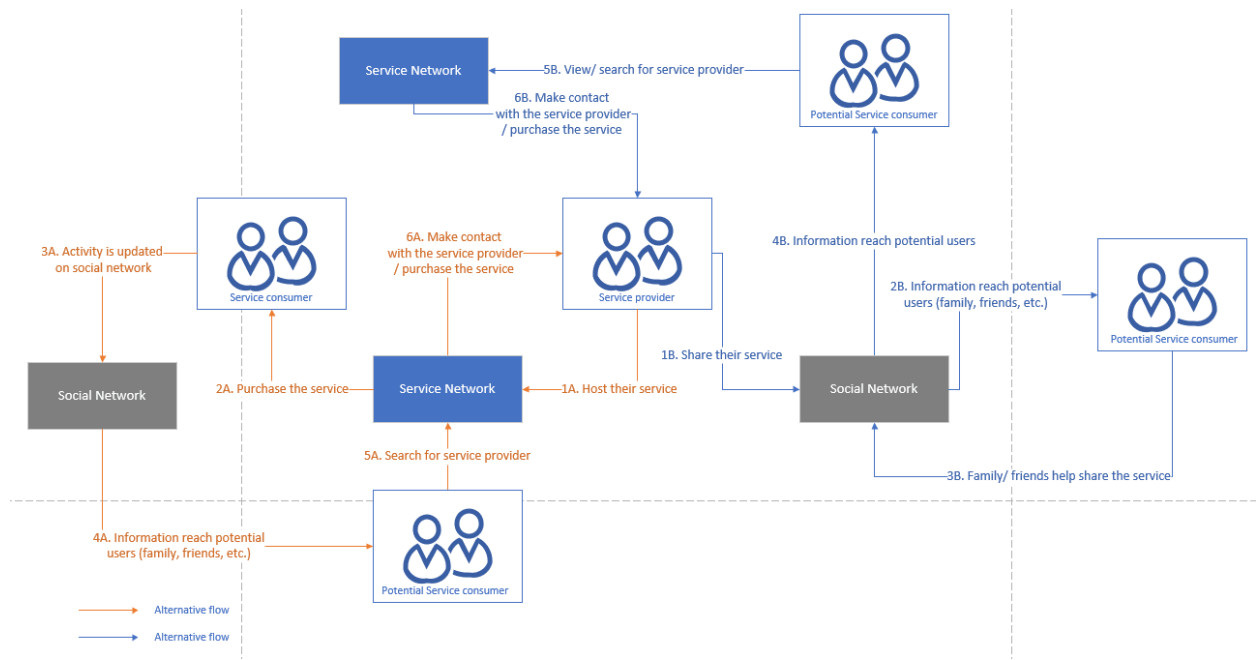
Overall workflow

Figure 16.0: Overall workflow of the platform

Figure 16.0 above illustrates the overall operation of the platform. The activities of the users on their service network will be shared on their social network. Friends and family in their social connections can help share the service they created and make the service become more popular. As a result, users who would like to maximize the benefit of the service network have a motivation to make more friends. Moreover, when users purchase a service, it creates a notification on the social network and allows the service to gain popularity.

Figure 17.0 below illustrates the ER diagram that serves the main operation.
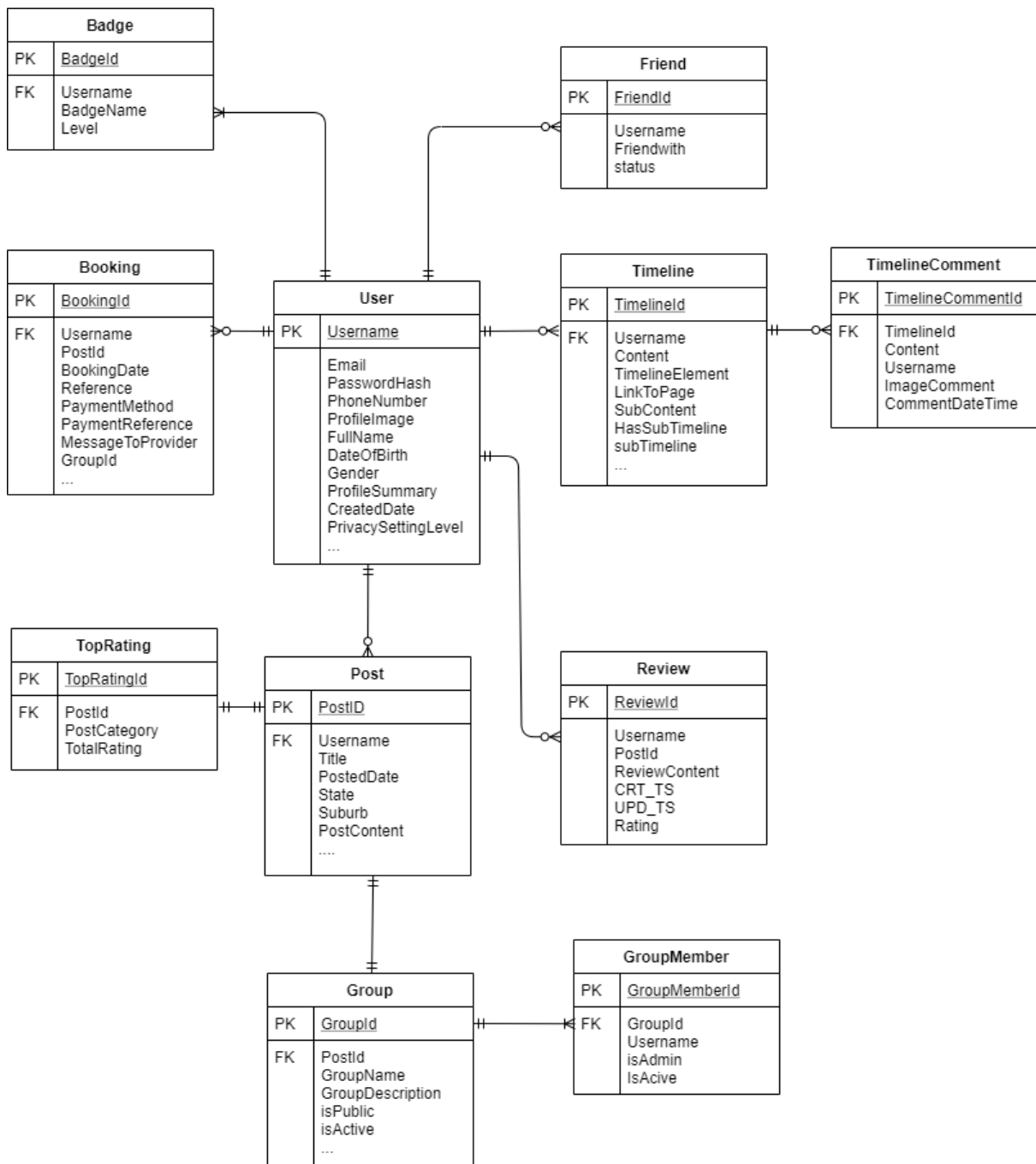
Figure 17.0: ER diagram

5.3 Implementation of the engaging model

Figure 18.0 below displays different levels of colour adjustment. The options range from a colour scheme for those who want a mix of bright and high contrast colour to a colour scheme dominated by light and soft colours. Apart from that, the menus on the platform are designed with a path that is wide enough while moving to the submenu. This measure ensures users can easily select the option that they want.
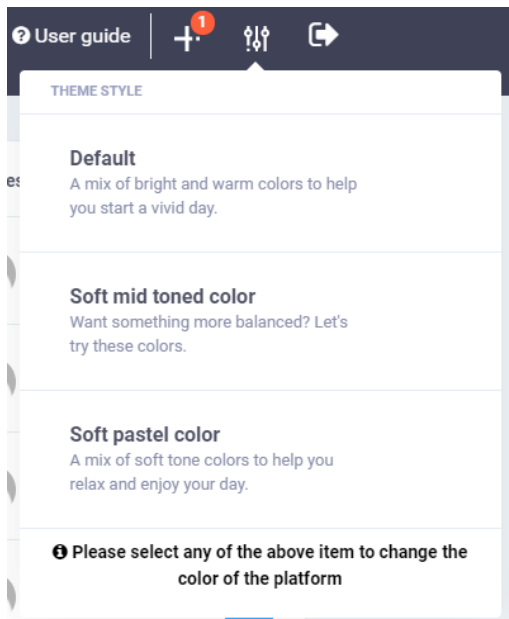
Figure 18.0: Colour adjustment options window

Figure 19.0 below shows the level and achievements of a user. Based on those indications, other users can have an overview of the activities of this user and determine the credibility of this user before deciding to purchase a service. Typically, a high-level user who has many achievements might have their service purchased more often as it indicates a higher level of credibility.
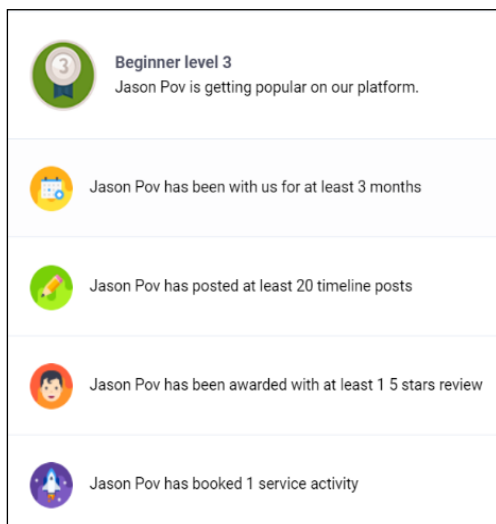

Figure 19.0 Example of a user level

Figure 20.0 below provides an example of on-screen instruction to help users completing tasks. With this guidance, users can have an understanding on what the expected data is and how should they provide it.

Figure 20.0 Example of on-screen instruction

5.4 Implementation of the service network model

Figure 21.0 below depicts a review of a service on a mobile browser. Users who purchased the service can provide a review for it. They can provide feedback and opinion regarding their experience with the service. Eventually, these feedbacks are taken in different processes to determine whether this service will be promoted to other users.
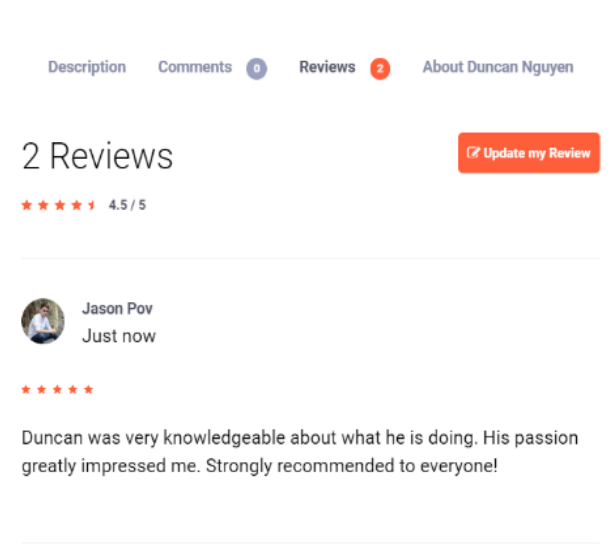

Figure 21.0 Example of a review for a service

Figure 22.0 below displays the booking screen appearing on a mobile browser; the upper section consists of the details of the service such as provider name, date, location of the activity. The lower section is where users can enter their billing details such as contact details, additional note to the service provider.

How to take care of your succulent

How to take care of your valuable succulent

Location: New South Wales Penrith

Provided by: Jason Pov

Date of activity: 30/03/2020

From: 9:00 AM

To: 1:00 PM

Billing Details

The following details will be shared with the activity provider(s) so they know you booked this activity.
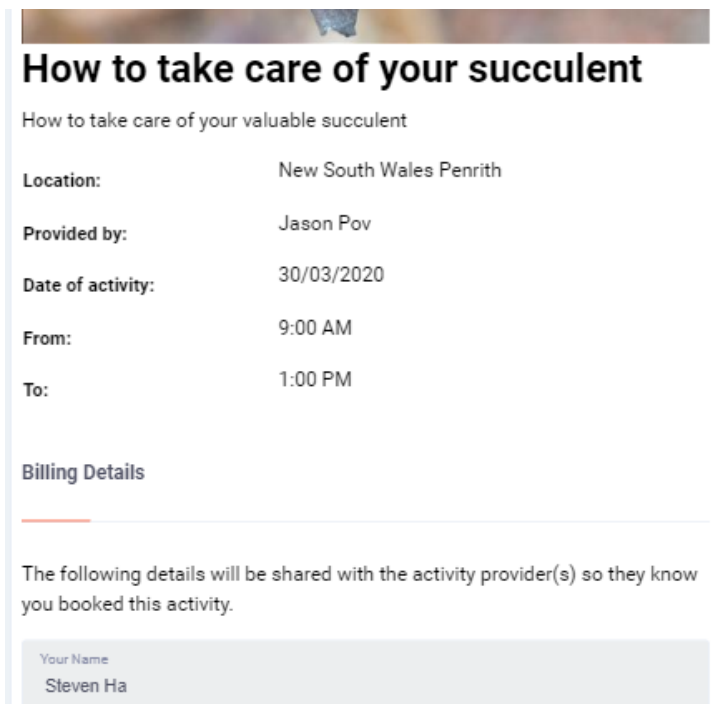
Your Name
Steven Ha

Figure 22.0: example of a booking screen on mobile browser

Figure 23.0 below shows the action of the service network by suggesting activities that it finds based on the information of the user and suggests those.

Suggested Activities

Dessert making
Who wants some cake???

2 participant(s)
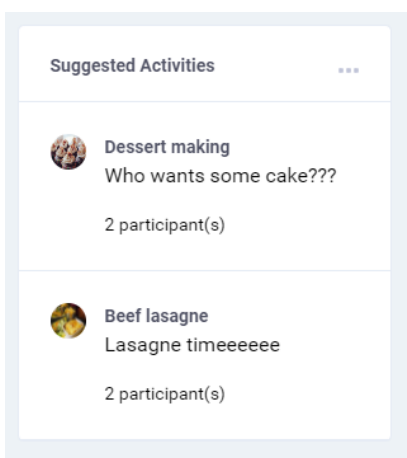
Beef lasagne
Lasagne timeeeeee

2 participant(s)

Figure 23.0 Service suggestion

Figure 24.0 below depicts the services based on their location. By providing visual clue, users can easily see which activities or service is happening in their local or surrounding areas. As a result, it can generate more interaction between the service provider and consumer.
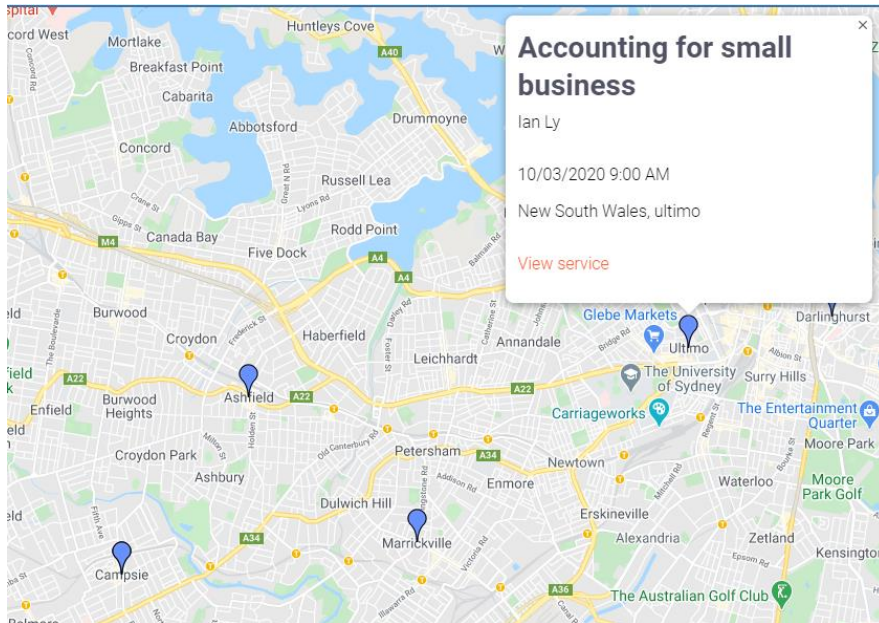
Figure 24.0 Location-based services

5.5 Implementation of the social network model

Figure 25.0 below shows a typical user profile where it indicates some information to increase the credibility of the user such as the Level of that user and their achievements. Other optional information such as hobbies, interests are also displayed if the user provides that. As a result, a user who provides full information might get more connection as it provides some common topic for other users to connect with.

Figure 25.0 A typical user profile

Figure 26.0 below displays the messaging window between users. This feature is implemented on the browser side using Google Firebase messaging to support real-time messaging.

Figure 26.0: Messaging window

Figure 27.0 below shows a typical timeline post; it has the features that can normally be found on other social network such as 'Share with friends', 'Comments', 'Images'. These features help users easily connect and engage with other users by sharing their favourite posts and/or comments. Moreover, it also provides a sense of familiarity for users who have already participated in other social networks.
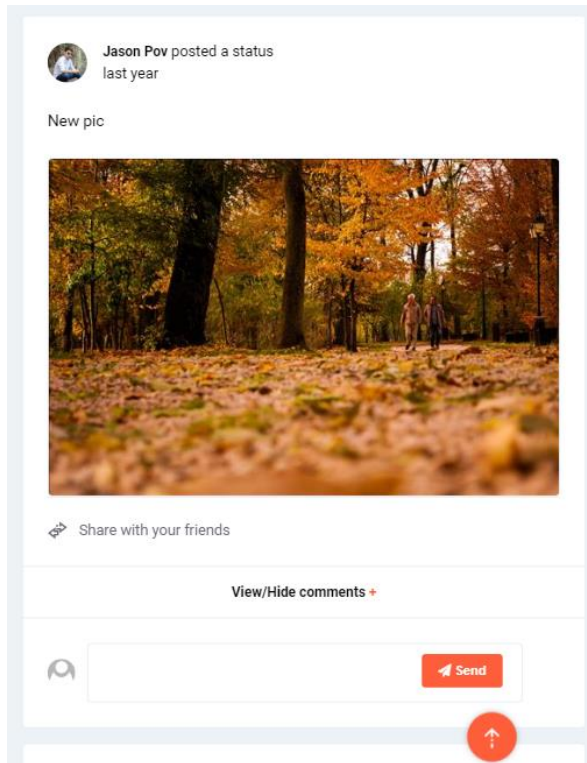
Figure 27.0 Typical timeline post

5.6 Summaries

This chapter presented the overall design, the detailed architecture, and the implementation of the platform. The architecture, in its simplest form, can be easily re-created. An important factor is a responsive web application that can ensure the accessibility of the platform on different devices. The two modules integrate and collaboratively operate with each other. For instance, users with a similar interest can form an interest group. From that group, they can use the service network module to offer services. This way, the platform is eliminating the risk of social isolation and allowing its users to be more productive. Alternatively, users who like the services that they received can also add the service provider to their friend list. This way, the platform is bridging the gaps (such as awkwardness, shyness) to help its users expand their social contacts. It can also create many chances for future cooperation and suggests a possibility that they can be friends with each other in real life.

Chapter 6 Results and Evaluation

6.1 Introduction

This chapter presents the results and evaluation of this study. The research is conducted with a diversified age group ranging from 18 to over 65 years of age. Users are invited to try out the platform for a short duration, and their feedback is recorded through a set of questionnaires that cover different aspects of this study such as social relationship, productivity, quality of life. Generally, the platform is perceived as effective in addressing the issues identified above and promoting quality of life.

The remainder of this chapter is organized as follows. Section 6.2 presents the results. Section 6.3 focuses on evaluation, with 6.3.1 focusing on the social network model, 6.3.2 focuses on the service network model, 6.3.3 focuses on the engaging model. 6.3.4 provides an overall evaluation of the entire platform, and 6.3.5 describes the limitations of this study. Section 6.4 concludes this chapter.

6.2 Result

The results from our pilot phase indicate that the platform has a positive impact on the financial and social well-being of its users. The data is collected from 33 people with different age group ranging from 18 to over 65. We invited users to try out the platform for a duration of 3 to 4 days. The majority (52%) of the respondents are 55 years and above, 42% are between 18-34 years, and the rest (6%) are between 35-39. This diversification enables us to see how the platform may perform in production. Users are from different backgrounds, ranging from professionals to students. With a majority of elderly people, this combination allows us to create an environment with a mix of service providers and service consumers and creates a realistic representation of the community.

Age	Frequency	Percentage
18-34	14	43%
35-39	2	6%
55-59	9	27%
60-64	7	21%
65+	1	3%
Total	**33**	**100%**

Table 2.0: Age distribution

As the number of respondents is greater than 30 (n = 33), we can assume that the sample is normally distributed.

The analysis focuses on analysing the effect of the platform on its users. The platform was developed with the aim to improve productivity, financial situation, social relationship, and mental well-being of its users. The analysis aims to provide an answer to the following areas:

1. Effectiveness of the platform in engaging its users (for example, are people likely to spend more time, make money)

2. Effectiveness of the platform in allowing its users to expand their social relationships and/or become more productive (e.g. the main purpose of using the platform, users can become more productive and expand their social connection)

3. Difficulties and concerns that users face and potential improvements that can be made. Examples such as user experience, security, privacy.

To conduct the analysis, we first construct a data visualisation of the data set using a column chart. It can provide a better comparison of value between categories. After that, we use 'mode' to reveal the value that appears most in the data set. It represents the answer that most users selected. Based on the above methods, we will be able to see the behaviour of most users and the effect of the platform. However, it does not allow us to determine if there is any relationship between categories, the age group and the answer provided. Being able to determine the relationship can help us understand whether the platform only provides benefits for a particular age group.

The chi-square test, which is used to determine the independence of the variables, is employed in this study to help us determine whether there is a relationship between age group and the answer provided. Although the platform is designed to target elderly people, however, to successfully engage them with the community, there must be a wide range of users from different age groups. As a result, the design should cater not only for elderly users but also it has to consider those users from different age groups. Thus, there should be no link between age group and the answer provided (H0). Furthermore, the chi-square test is also one of the recommended methods of analysis for Likert-type data [35].

To start with the chi-square test, we give each answer a value (i.e. 'strongly agree' is 5, 'agree' is 4 and so on) and we group strongly agree (5) and agree (4) into 1 group, strongly disagree (1) and disagree (2) into 1 group, and Neutral (3) into its own category. Other

questions already have their own category. Then we convert those into a table and then execute the test on the table. The example below illustrates how the chi-square test is run in R Studio to determine the relationship between age group and the 'easy to use' aspect of the platform.

```
> easyToUse <- read.csv("EasyToUse.csv", header =  FALSE)
> easyToUse <- table(easyToUse)
> chisq.test(easyToUse)

        Pearson's Chi-squared test

data:  easyToUse
X-squared = 4.5451, df = 4, p-value = 0.3372
```

Figure 28.0: Example of Chi-square test

P-value method of analysis is suitable as it allows us to determine whether the null hypothesis is true. There are two hypotheses formed when conducting the chi-square test; one is a relationship exists between categories, and another one is no relationship exists between categories. By using a suitable p-value (e.g. 0.05), we will be able to determine if there is a relationship between age group and the answer provided.

Typically, the p-value is 0.05 to indicate the statically significance. If p-value is greater than 0.05, it indicates strong evidence for the null hypothesis (H_0), and typically that means the variables are independent which is in-line with the null hypothesis (H_0) that we are trying to test above.

As mentioned earlier, the effectiveness of the platform is assessed by the 3 main aspects: the level of engagement, the positive effect of the platform and the difficulties that people face.

The effectiveness of the platform in engaging its users is measured using the following questions/variables:

1. The platform gives me more activities I would like to do.

The data reveals that most of the participants (52% agree and 12% strongly agree) agree that the platform gives them activities that they want to participate in, while 12% disagree and the rest are neutral.
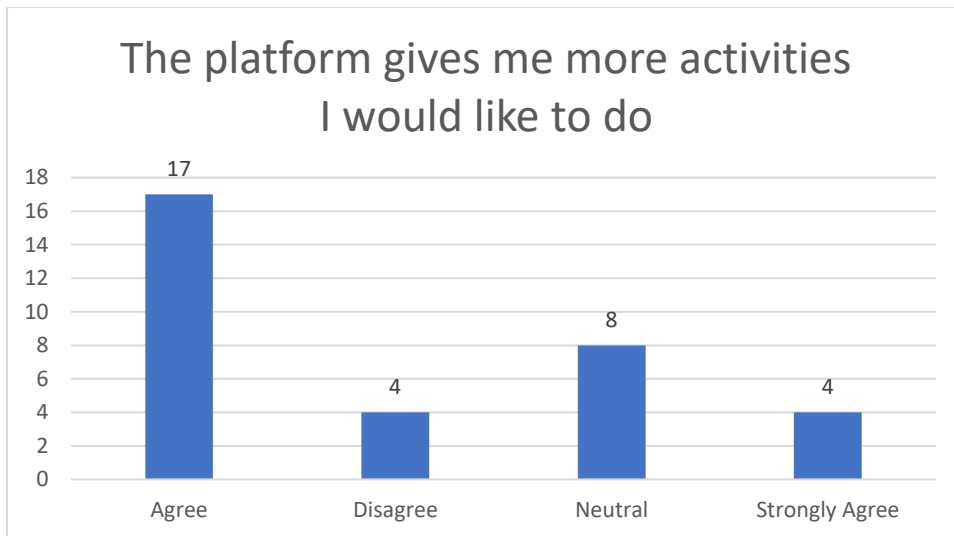
Figure 29.0: Responses of the question

The frequency distribution for this question is as follow.

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total answers
18-34	0	1	3	8	2	14
35-39	0	0	1	0	1	2
55-59	0	1	1	6	1	9
60-64	0	2	2	3	0	7
65+	0	0	1	0	0	1
Total	**0**	**4**	**8**	**17**	**4**	**33**

Table 3.0: Frequency distribution

The mode is response 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided.

H_1: there is a relationship between age group and the answer provided.

Although the platform mainly targets elderly people, however, it should provide benefit for all age groups.

With the p-value = 0.4878 (> 0.05), we do not reject H_0, therefore, it indicates that there is no relationship between age group and the answer provided.

2. The platform is easy to use.

Most of the respondents agree that the platform is easy to use though 39% give a neutral response.

Figure 30.0: Responses of the question

The frequency distribution for this question is as follow.

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total answers
18-34	0	0	4	8	2	14
35-39	0	0	0	1	1	2
55-59	0	0	4	5	0	9
60-64	0	0	4	3	0	7
65+	0	0	1	0	0	1
Total	**0**	**0**	**13**	**17**	**3**	**33**

Table 4.0 Frequency Distribution

The mode is 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates the platform is easy to use for all users.

H_1: there is a relationship between age group and the answer provided. That indicates the platform is easy to use for a certain age group(s).

Although the platform mainly targets elderly people, however, it should be easy to use for all age groups.

With the p-value = 0.3372 (> 0.05), we do not reject H_0, therefore it indicates that the platform is easy to use for all its users

3. I enjoy spending time on the platform.

More than 80% of the participants indicate that they enjoy spending time on the platform. While there is about 20% giving a neutral response, none disagree with this statement.
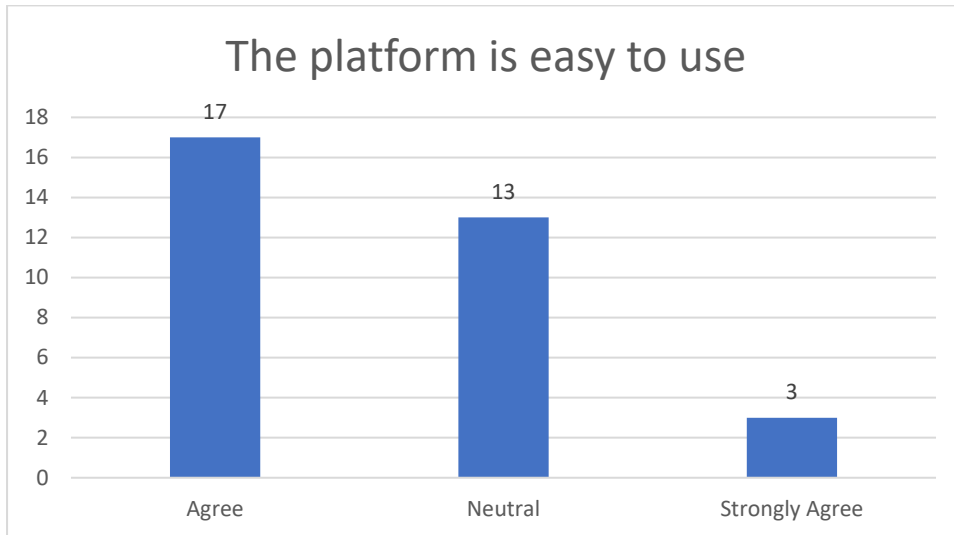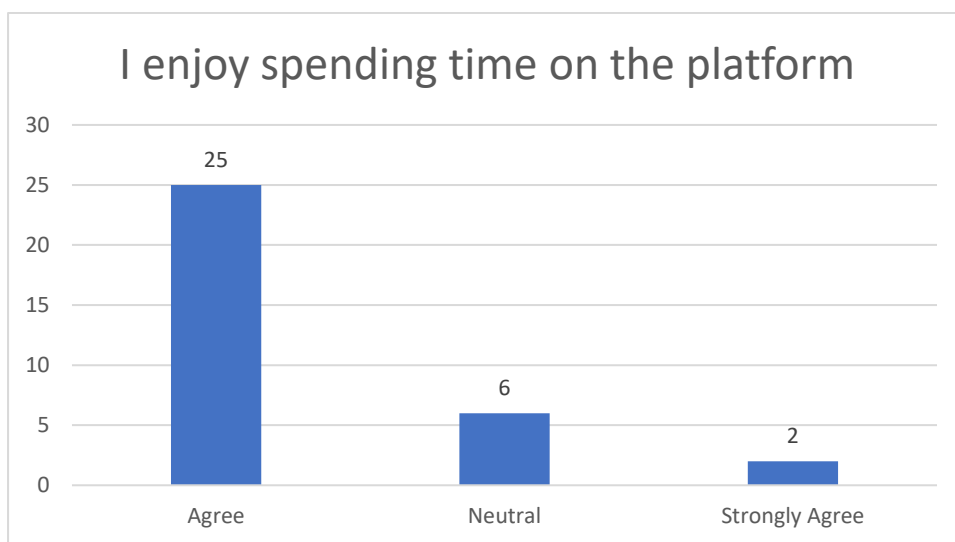

Figure 31.0: Responses of the question

The frequency distribution for this question is as follow:

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	**Total answer**
18-34	0	0	2	10	2	**14**
35-39	0	0	0	2	0	**2**
55-59	0	0	2	7	0	**9**
60-64	0	0	1	6	0	**7**
65+	0	0	1	0	0	**1**
Total	**0**	**0**	**6**	**25**	**2**	**33**

Table 5.0 Frequency Distribution

The mode is 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates all users enjoy spending time on the platform.

H_1: there is a relationship between age group and the answer provided. That indicates only certain age group(s) enjoy spending time on the platform.

Ideally, the platform should be appealing to all users and all of them should enjoy spending time on it.

With the p-value = 0.2619 (> 0.05), we do not reject H_0, therefore it indicates that all users enjoy spending time on the platform.

4. How often do you think you will be using our platform?

The data reveals that while most of the respondents are not willing to use the platform daily, they will be using the platform on a weekly basis.
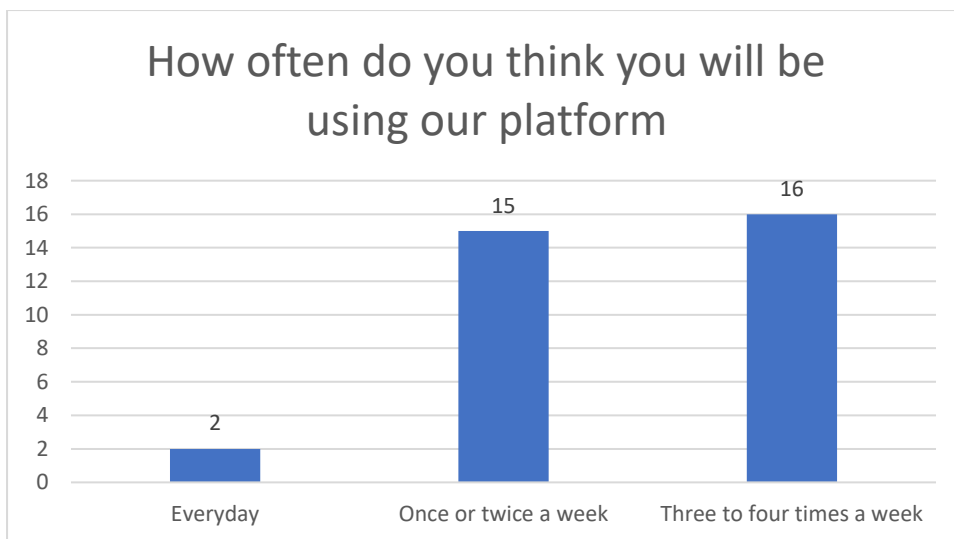
Figure 32.0: Responses of the question

The frequency distribution for this question is as follows.

	Everyday	3 to 4 times a week	Once or twice a week	Once a month	I will not be using	**Total answers**
18-34	2	7	5	0	0	**14**
35-39	0	2	0	0	0	**2**
55-59	0	5	4	0	0	**9**

60-64	0	2	5	0	0	7
65+	0	0	1	0	0	1
Total	**2**	**16**	**15**	**0**	**0**	**33**

Table 6.0 Frequency Distribution

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates all users have different usage frequency.

H_1: there is a relationship between age group and the answer provided. That indicates certain age group(s) have different usage frequency.

The usage frequency should not be favourable towards one group.

With the p-value = 0.447 (> 0.05), we do not reject H_0, therefore it indicates that all users have different usage frequency.

The effectiveness of the platform in allowing its users to expand their social relationships and/or become more productive is measured by the following questions/variables:

1. What would be your main purpose in using this platform?

The focus for this question will be placed on respondents that are 55 years and above. The data reveals that most of the respondents aged 55 and above use the platform for social and financial purpose.
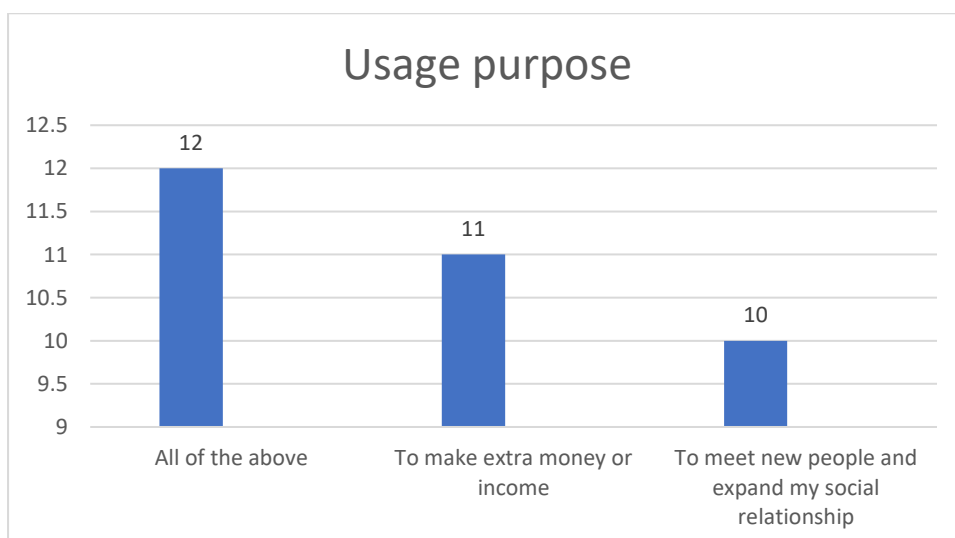
Figure 33.0: Responses of the question

The frequency distribution for this question is as follows:

	To make extra money or income	To meet new people and expand my social relationship	All of the above	None of the above	Total answer
18-34	7	2	5	0	14
35-39	0	2	0	0	2
55-59	3	2	4	0	9
60-64	1	4	2	0	7
65+	0	0	1	0	1
Total	11	10	12	0	33

Table 7.0 Frequency Distribution

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates the purpose of using the platform should not be affected by the age group.

H_1: there is a relationship between age group and the answer provided. That indicates certain age group(s) have different purpose.

The purpose of using the platform should not be affected by the age group.

With the p-value = 0.1699 (> 0.05), we do not reject H_0. Therefore, it indicates that the purpose of using the platform should not be affected by the age group.

2. The platform will help me become more productive.

The analysis reveals the majority (45% agree, 27% strongly agree) that the platform will assist them in becoming more productive. 15% are neutral, and only 12% disagree with this assessment.

Figure 34.0: Responses of the question

The frequency distribution for this question is as follow.

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	**Total answer**
18-34	0	1	0	9	4	**14**
35-39	0	0	1	0	1	**2**
55-59	0	1	1	4	3	**9**
60-64	0	2	2	2	1	**7**
65+	0	0	1	0	0	**1**
Total	**0**	**4**	**5**	**15**	**9**	**33**

Table 8.0 Frequency Distribution

The mode is 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates the platform allows all users to become more productive.

H_1: there is a relationship between age group and the answer provided. That indicates only certain age group(s) feel become more productive.

The platform should allow all users to become more productive.

With the p-value = 0.07757 (> 0.05), we do not reject H_0, that indicates the platform allows all users to become more productive regardless of the age group.

3. The platform will help me expand my social connection.

All participants except 3 highlighted that they believe the platform can help them improve their social relationship.
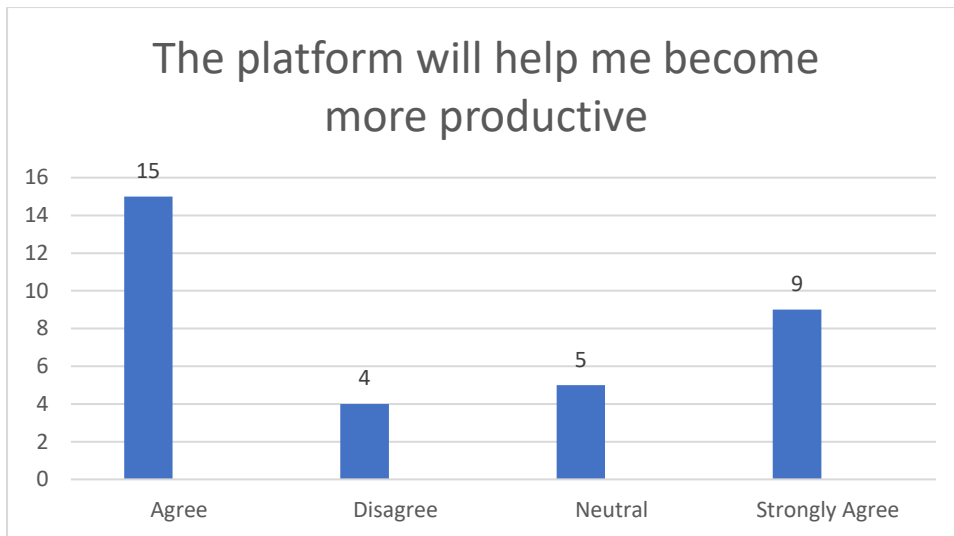

Figure 35.0: Responses of the question

The frequency distribution for this question is as follow.

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total answer
18-34	0	0	2	8	4	14
35-39	0	0	0	2	0	2
55-59	0	0	1	6	2	9
60-64	0	0	0	7	0	7
65+	0	0	0	1	0	1
Total	**0**	**0**	**3**	**24**	**6**	**33**

Table 9.0 Frequency Distribution

The mode is 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates the platform allows all users to expand their social connection.

H_1: there is a relationship between age group and the answer provided. That indicates only certain age group(s) feel like they can expand their social connection.

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The platform should allow all users to expand their social connection.

With the p-value = 0.8264 (> 0.05), we do not reject H_0, that indicates the platform allows all users to expand their social connection regardless of the age group.

    4.   There are plenty of opportunities to meet new people.

Most respondents except 5 (15%) indicate that the platform provides them with plenty of opportunities to meet new people.
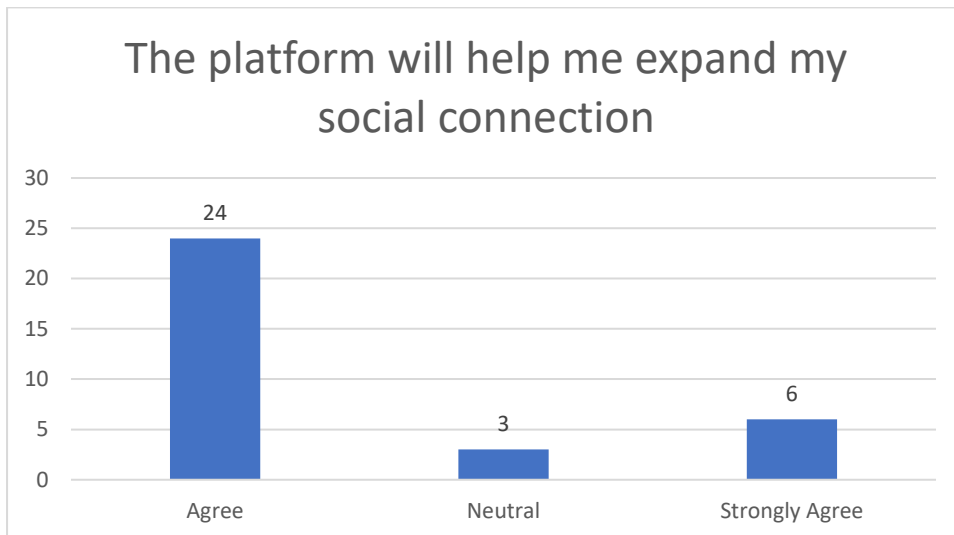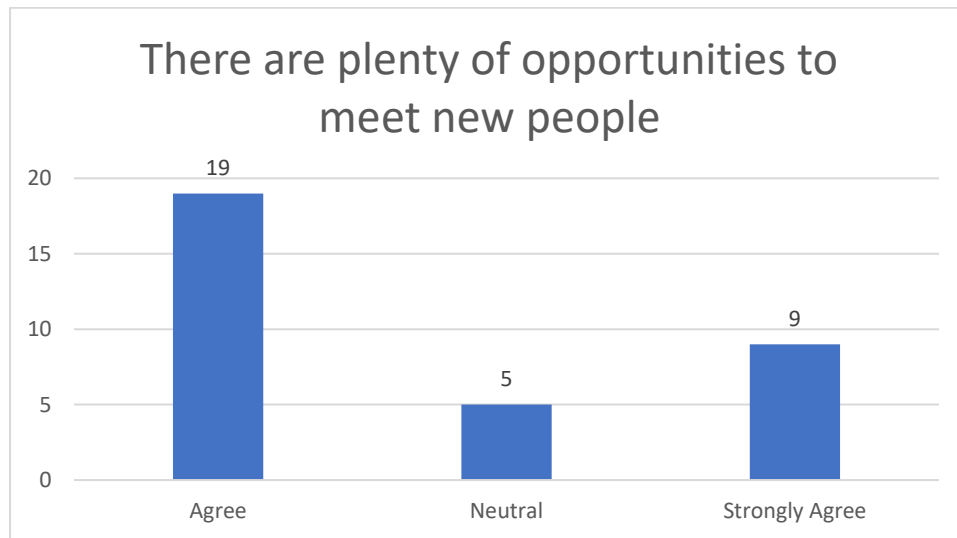

Figure 36.0: Responses of the question

The frequency distribution for this question is as follows:

	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	**Total answer**
18-34	0	0	3	5	6	**14**
35-39	0	0	0	1	1	**2**
55-59	0	0	1	6	2	**9**
60-64	0	0	1	6	0	**7**
65+	0	0	0	1	0	**1**
Total	**0**	**0**	**5**	**19**	**9**	**33**

Table 10.0 Frequency Distribution

The mode is response 4 (agree)

The following hypotheses are tested.

H_0: there is no relationship between age group and the answer provided. That indicates the platform provides opportunities for its users to meet new people regardless of the age group.

H_1: there is a relationship between age group and the answer provided. That indicates only certain age group(s) feel like they are given more chances to meet new people.

The platform should provide opportunities for its users to meet new people regardless of the age group.

With the p-value = 0.8969 (> 0.05), we do not reject H_0, that indicates the platform provides opportunities for its users to meet new people regardless of the age group.

The questionnaire also reveals the concerns and difficulties that people face. The difficulties revolve around the interaction on the platform; some users outline that the suggestions made by the platform are a bit limited. This limitation is currently inevitable as the platform is still in prototype mode. Some other users suggest for some sort of ice breaker activities to be implemented so that people can overcome the awkwardness when they first meet or just simply to get the conversation going. Others have indicated some technical issues related to user experience such as pages take too long to load, or some UI screens seem to flicker when loading content. The respondents also call for an improvement in user experience design; they want the platform to be more intuitive and want a better description of functionalities. Apart from that, privacy and security are the main concerns. In our case, some users mention it is hard to trust someone on the platform while others want to protect their privacy. As a result, more effort is required to cater for these areas.

6.3 Evaluation

In summary, the analysis of the data reveals that users are generally optimistic about its effects on their financial and social well-being. There are substantial numbers of users who indicate that the platform can considerably improve their productivity, social relationship and potentially increase their income. With the above result, the platform poses the potential to address the social issue, improve the quality of life of its users and eventually make positive contributions to the economy. To evaluate this platform, we focus on the following area: the willingness of users to participate. This demonstrates the feasibility of the engaging model and the effectiveness of each model in performing its main functions as well as the effectiveness when integrating the two models.

6.3.1 Evaluation of social network model

The main goal of the social network model is to allow users to expand their social relationship. To evaluate this model, we investigate two main areas: the willingness of users to use it and whether it enables users to improve their social relationship by creating an environment for them to meet new people. The effectiveness is reflected in Figure 33, where we see most users (over 65%) would use the platform to expand their social relationships. Figure 35 helps confirm this finding by indicating that the platform will help them expand their social connections. Finally, Figure 36 indicates that most users believe there are many opportunities to help improve social connectedness. Based on the above data, it is obvious that the social network is an environment where it would allow users to expand their social relationship and more importantly, users would be willing to participate. When users are engaged in the social network, it can improve their quality of life in term of social relationship and mental health as outlined in Figure 12.

6.3.2 Evaluation on service network model

The main goal of the service network model is to allow users to become more productive. To evaluate this model, we investigate the willingness of users to use it and whether it enables them to become more productive. The effectiveness is revealed in Figure 33, where most users (almost 70%) indicate that they would use the platform to earn extra money. This behaviour is in-line with the findings in Figure 34, where it reveals that the platform will assist them in becoming more productive. Based on the above findings, it can be concluded that the service network is effective in allowing them to become more productive. As a result, it can improve their quality of life by providing activities for them to contribute so that they can increase a sense of self-worth which can also improve their dignity and mental health.

6.3.3 Evaluation on engaging model

The main goal of the engaging model is to encourage users to participate more on the platform. The effectiveness is indicated in the following aspects: easy to use, users enjoy spending time on the platform, users are given more activities to do and the frequency of using the platform. With most users stating that the platform is easy to use in Figure 30, it is not difficult to see that users are enjoying the platform in Figure 31 and willing to get online multiple times a week (Figure 32) to participate in different activities (Figure 29). Based on the data in the above results, it is revealed that those factors have indirectly supported the above model and users are willing to participate in those activities. As a result, the engaging model has successfully acted as a driver.

6.3.4 Evaluation of the platform

Overall, the 2 main goals set in the design phase (Figure 12): improving the quality of life and productivity, are achieved. It is clearly revealed in the evaluation of each of the 2 models that they have demonstrated that the essential elements: social relationship, mental health, dignity and activities achieved positive results. By engaging users on the platform and with the assistance of the other 2 models, social network and service network, social relationship and mental health are improved by the social network while the service network improves dignity, activities and mental health.

6.3.5 Limitations

There are certain limitations that still exist in this study, together with the areas outlined in Chapter 1, section 1.5, above. As with many of the previous studies and projects, there is a certain concern regarding privacy. In addition to that, security is also a potential hindering factor. Unfortunately, these areas are not within the scope of this study, but admittedly these factors need to be addressed to provide a safe and secure environment for users. Moreover, the social interaction element in the engaging model can be further strengthened to eliminate the awkwardness as users also express a desire for a method to enhance social interaction. Apart from that, certain technical issues also need to be addressed, such as performance and some user interface elements to provide users with a better experience. However, as technology evolves, these factors can be easily altered as they strongly depend on the technology used to develop the platform.

6.4 Conclusion

In conclusion, the three models are effective in demonstrating their own benefits and achieving the purposes they are designed for. The other two models, with assistance from the engaging model, have increased the willingness of users to participate in the platform. With a result from diversification of age group, it allows us to obtain an overview of the effect of the design on not only elderly people but also the younger generation. As a matter of fact, the overall model can improve social relationships, allow users to become more productive, which can improve them financially. Therefore, the use of the platform can reduce the likelihood of relying on social welfare which can ultimately reduce the burden on the government and improve the economy. Apart from that, it can also promote the quality of life of its users. However, as with many online platforms, privacy and security remain the source of concern for some users. Some actions could be taken such as an identity check on sign up

though it could be a big concern for many users which may make them hesitate to join the platform.

Chapter 7 Conclusion and future work

7.1 Research remarks

The aging population is a contemporary concern for many countries nowadays. Without carefully addressing this issue, it is set to have many negative impacts in term of social and economic outcomes. However, there are not many solutions that focus on utilising the elderly as a resource rather than as an issue to be resolved. Most people or solutions tend to see the aging population as a matter to be taken care of, which will further reduce the resources of the society and weaken the economy. As a result, the new direction is to aim to reuse the resources and the ability of the aging population, provided that many elderly people are still capable of making contributions.

In this study, we describe many existing issues and limitation with the current and past approaches. The first issue is that social network itself has many limitations in allowing its users to become productive. The second issue is that service networks are not effective in allowing their users to expand their social relationships. The third issue is that many of the existing solutions do not consider how to engage users or encourage them to maintain ongoing participation on the platform. Without that factor, the benefits of those solutions will be limited.

In order to address the above issues and challenges, we propose a new model that utilises the strengths of both social network with a service network to maximise their benefits in such a way that it not only allows users to extend their social relationships but also enables them to become more productive which ultimately enhancing their quality of life. More importantly, to maximise the benefit, it employs the novel engaging model which consists of a set of motivational factors to engage users on the platform, encouraging them to spend more time and perform more activities. Eventually, there is a model that can address the issue of the aging population and make positive contributions to the economy as it can reduce their dependency on government welfare.

The contributions of this research can be summarised as follows:

We proposed a platform that utilises the strengths of social network and service network to utilise the advantages of each platform. Through this proposal, we reveal the possibilities as well as the feasibilities for such a model to address different aspects of the aging population, such as social relationship and quality of life.

We introduced an additional model that utilises various factors and converts them into relevant technical features to engage users on the platform. This model can be adopted as a driving force for many platforms, even though they may not be designed to address the needs of the aging population.

Finally, we designed and implemented the proposed model to examine its capabilities and feasibilities. We include diversification of age group with most users over 55 years of age to demonstrate the performance as well as to identify different improvement aspects of the solution if adopted in production.

In summary, we believe that this thesis provides a firm answer to the question "How to promote active aging so that elderly people can maintain productivity, improve well-being and at the same time generate benefit for themselves, the society and the economy?". Our model and platform have laid the foundation which can be used to further develop into a full solution to help promote active aging.

The novelty of this study lies in the development of a platform that uses and adapts a set of motivational factors into an engaging model and incorporate it together with the integration of social network and service network. Unlike many previous projects where the focus is only on one specific platform which often lacks the capability to engage users, this research proposes, reveals, and confirms the possibility and the potential benefits when these platforms and models are integrating together.

The significance of this work is that it opens the possibilities of utilising the resources of elderly people. It demonstrates the potential for a solution that 1) reduces the burden of the aging population on the government and the society 2) allows them to act as active contributors which eventually generate benefits and value for them and for the society 3) demonstrate a new model that can be adopted to maintain users' participation.

7.2 Future work

In this study, we investigate the feasibility of one of the possible methods to address the aging population. The proposed model can be a crucial study for developing new methods to

enhance or promote active aging. As the world population is aging, more and more effort will be required to serve the needs of this aging population, not only for those who are in need of care but also for those who are still healthy and capable.

The proposed model still has many limitations that need to be improved and developed before it can be adopted as a production version. More features of the social network may need to be studied to encourage interaction and eliminate awkwardness, such as providing ice breaker activities and mini-games. The engaging model can be further researched to identify more factors that encourage more commitment and participation on the platform. Ideally, we can integrate machine learning or artificial intelligence that is able to study and extract the behaviour of the users and make adjustments to the platform to suit their needs.

Moreover, more efforts are required to be spent on privacy, as it is one of the concerns identified in this study. For future work, we would study the type of information or data that users perceive as unimportant and are willing to share. Another aspect is the impact of having minimum information such as name, age, gender, on privacy perception. The focus of these factors needs to be diversified across users from different age groups.

Additionally, security also plays an important role in many platforms. Therefore, for future study, we would revise the security aspects of the platform. These aspects include some measures to enhance users' credibility, such as requiring users to take additional verification steps such as phone number verification.

Bibliography

[1] Adult Learning Australia. (2017). *The-aging-population-report-final* [Online]. Available at: https://ala.asn.au/wp-content/uploads/2011/02/The-ageing-population-report-FINAL-WEB.pdf

[2] World Health Organization. (2017). *Global health and ageing* [Online] Available at: http://www.who.int/ageing/publications/global_health/en/

[3] Publications.parliament.uk. (2017). *House of Lords - Ready for Ageing?* [Online] Available at: https://publications.parliament.uk/pa/ld201213/ldselect/ldpublic/140/14002.htm

[4] Fries, J. "Compression of morbidity in the elderly," *Vaccine*, vol. 18, pp. 1584-1589, 2000.

[5] Fries, J. "Measuring and monitoring success in compressing morbidity," *Ann. of Internal Medicine*, vol. 139, pp. 455–459, 2003.

[6] ABC (2015), *Why are elderly Australians taking their own lives?* [Online]. Available at: <http://www.abc.net.au/news/2015-10-08/mental-health-depression-elderly-suicide/6808998>.

[7] Machado, L.R., Jantsch, A., de Lima, J.V., Behar, P.A., *Cyberseniors and quality of life: a focus on social networking*, in European Conference on e-Learning, Kidmore End, 2014, pp. 313-320.

[8] Harley, D., Howland, K., Harris, E. and Redlich, C., *Online communities for older users: what can we learn from local community interactions to create social sites that work for older people*, in Proc. 28th International BCS Human Computer Interaction Conference on HCI 2014 - Sand, Sea and Sky - Holiday HCI, Southport, 2014, pp. 42-51.

[9] Lehtinen, V., Näsänen, J., Sarvas, R. "*A little silly and empty-headed": older adults' understandings of social networking sites*, in Proc. 23rd British HCI Group Annual Conference on People and Computers: Celebrating People and Technology, Cambridge, 2009, pp. 45-54.

[10] Koene, P., Köbler, F., Esch, S., Leimeister, J.M. and Krcmar H., *Design and evaluation of a service-oriented collaborative consumption platform for the elderly*, in CHI '12 Extended Abstracts on Human Factors in Computing Systems, Texas, USA, 2012, pp. 2537-2542.

[11] Haritou, M., Anastasiou, A., Kouris, I., Villalonga, S.G., Gancedo, I.O. and Koutsouris, D.: *Go-myLife, "A context-aware social networking platform adapted to the needs of elderly users*," in Proc. 6th International Conference on PErvasive Technologies Related to Assistive Environments, Rhodes, Greece, 2013.

[12] Steinfeld, C., Ellison, N. B., Lampe, C. 2008, *Social capital, self-esteem, and use of online social network sites: A longitudinal analysis*, Journal of Applied Developmental Psychology, vol. 29, no.6, pp. 434-445.

[13] Sundar, S.S., Oeldorf-Hirsch, A., Nussbaum, J. & Behr, R. 2011., *Retirees on Facebook: can online social networking enhance their health and wellness?*, CHI '11 Extended Abstracts on Human Factors in Computing Systems (CHI EA '11), ACM, New York, USA, pp. 2287-2292.

[14] Fang, W.C., Hsieh, M.C., Yang, P.C., Li, W.G., Chiu, C.J. and Chiang J.H., *iDianNao: an orange technology that recommends volunteer opportunities to older adults*, in 2015

International Conference on Orange Technologies (ICOT), Hong Kong, 2015, pp. 38-41.

[15] Greenfield E.A. & Marks N.F., *Formal volunteering as a protective factor for older adults' psychological well-being*, The Journals of Gerontology: Psychological sciences and social sciences, Series B., vol. 59B, no. 5, pp. S258-264, 2004.

[16] Morrow-Howell N., Hinterlong J., Rozario P.A., Tang F., *Effects of volunteering on the well-being of older adults*, The Journals of Gerontology: Psychological sciences and social sciences, Series B., vol. 58B, no. 3, pp. S137-145.

[17] Cornejo, R., Weibel, N., Tentori, M. and Favela, J., *Promoting active aging with a paper-based SNS application*, in CHI '11 Extended Abstracts on Human Factors in Computing Systems, Vancouver, BC, 2011, pp. 2287-2292.

[18] Pensas, H., Kivimäki, T., Vainio, A., Konakas, S., Costicoglou, S., Kölndorfer, P., Summanen, K., Moisio, H. and Vanhala, J., *Building a Client-Server Social Network Application for Elders and Safety Net*, in AcademicMindTrek '13 Proceedings of International Conference on Making Sense of Converging Media, Tampere, Finland, 2013, pp. 310-312.

[19] Marcelino, I., Laza, R. and Pereira, A., *SSN: Senior Social Network for Improving Quality of Life*, International Journal of Distributed Sensor Networks, vol. 12, 2016.

[20] Callow, M. *Identifying promotional appeals for targeting potential volunteers: an exploratory study on volunteering motives among retirees*, International Journal of Nonprofit and Voluntary Sector Marketing, vol. 9, pp. 261-274, 2004.

[21] Freedman, M. *Prime time: how baby boomers will revolutionize retirement and transform America*. New York: Public Affairs, 2002.

[22] Sellon, A.M., *Recruiting and Retaining Older Adults in Volunteer Programs: Best Practices and Next Steps*, Ageing International, vol. 39, 2014, pp. 421-437.

[23] Sperry, L., Prosen, H., *Aging in the twenty-first century: a developmental perspective*. New York: Routledge, 1996.

[24] Ratcliffe, J., Lancsar, E., Flint, T., et al., *Does one size fit all? Assessing the preferences of older and younger people for attributes of quality of life*, Quality of Life Research, vol. 26, 2017, pp. 299-309.

[25] WilHelmson, K., Andersson, C., Waern, M. and Allebeck, P., *Elderly people's perspectives on quality of life*, Aging & Society, vol. 25, 2005, pp. 585-600.

[26] Gabriel, Z. and Bowling, A., *Quality of life from the perspectives of older people*, Aging & Society, vol. 24, pp. 675-691.

[27] Statista. (2018). *Australia social media usage by age* [Online]. Available at: https://www.statista.com/statistics/729928/australia-social-media-usage-by-age/

[28] Wilson, R.E., Gosling, S.D. and Graham, L.T., *A Review of Facebook Research in the Social Sciences*, Perspectives on Psychological Science, vol. 7, pp. 203-220.

[29] Dunbar, R., *Grooming, gossip, and the evolution of language*. Cambridge, MA: Harvard University Press, 1998.

[30] Leary, M. R. *Motivational and emotional aspects of the self*. Annual Review of Psychology, vol. 58, 2007, pp. 317–344.

[31] Huang, C., *Internet use and psychological well-being: A meta-analysis.*, Cyberpsychology, Behavior and Social Networking, vol. 13, 2010, pp. 241–249.

[32] Gonzales, A.L. and Hancock, J.T., *Mirror, Mirror on my Facebook wall: Effects of exposure to Facebook on self-esteem*, Cyberpsychology Behavior and Social Networking, vol. 14, 2010, pp. 79–83.

[33] Nabi, R.L., Prestin, A., So, J., *Facebook Friends with (Health) Benefits? Exploring Social Network Site Use and Perceptions of Social Support, Stress, and Well-Being*, Cyberpsychology, Behavior, And Social Networking, vol. 16, 2013, pp. 721-726.

[34] Mauri M., Cipresso, P., Balgera, A. et al. *Why is Facebook so successful? Psychophysiological measures describe a core flow state while using Facebook*, Cyberpsychology, Behavior, and Social Networking; vol. 14, 2011, pp. 723–731.

[35] Journal of Extension (2012). *Analyzing likert data* [Online]. Available at: https://www.joe.org/joe/2012april/tt2.php