Deliverable 1: Final Year Dissertation

Personal Safety Applications

Jamie McCulloch

Heriot Watt University

H00189648

jm7@hw.ac.uk

MEng Software Engineering

Supervisor: Mike Just

I, Jamie McCulloch, confirm that this work submitted for assessment is my own and is expressed in my own words. Any uses made within it of the works of other authors in any form (e.g., ideas, equations, figures, text, tables, programs) are properly acknowledged at any point of their use. A list of references employed is included.

Signed:

Date:

Abstract

As smartphone ownership continues to rise, they have become an integral part of society. Their capabilities and services are used daily, and continue to grow. The ability to track locations, contact relatives and emergency services within seconds, and instantly record video and audio has ensured that the general public can use their smartphones to improve their personal safety. However, this avenue has not been well explored, and question mark resides over this - are smartphones able to improve personal safety?

Contents

1 Introduction

1.1 Overview

Smartphone ownership is at an all time high, and it is imperitive that they are used to their full potential. With this in mind, one area in which there is not a lot of research or evaluation into is personal safety. Smartphones are able to do many things, such as:

- track GPS location
- store thousands of contacts
- record video and audio instantly
- access the internet through broadband cellular networks

It is now possible for people's location to be tracked, for others to be immediately contacted, and instant proof of crime through video/audio recording. The rise of social networking has allowed people to spread news, and their own personal experiences of certain areas within their local community, allowing people to gauge what surrounding areas are safe to walk or not.

1.2 Aims and Objectives

The aim of this project is to develop a smartphone application that improves the personal safety of its user while they are walking outside alone. This will be done through location updates and tracking, an emergency panic button, alternate route planner, among others. The objectives for this project are listed below:

- **Designing the application**

  Designing a personal safety application with an intuitive user interface, that users can easily follow and complete tasks with, and with features that people want. I have carried out an online survey, with 74 participants, asking their opinion of personal safety applications and if they would find them useful. The survey comprised of 9 questions, and a copy of the survey questions is available in Appendix A. I kept the survey online for 5 days, then closed it and

sorted through the responses. I also used the survey to gather requirements for the application laid out in section 3.2 of this document. I intend to create use cases during the design stage of the project, as well as designing the user interface, and the prototype.

- **Building the application**

  I will implement my own personal safety application, using the research I've found. I will implement features from other applications (panic button, alarm button, location tracker) but also some of my own ideas (a proximity based message board for people to consult, time filters, etc.). Then carry out multiple experiments and tests to determine if it was a success, and if it genuinely improves peoples safety.

- **Evaluating the application**

  After I have created a prototype application, I will then recruit a small group of participants and conduct an interview with them to get their feedback in terms of the application. I will ask them to complete tasks on the application, and ask if they have any improvements they would make.

1.3 Challenges and Possible Solutions

The challenge with personal safety applications is how people determine somewhere being unsafe. For example, social media can be used to alert to unsafe locations, or unusual activity, but with the sheer scale of information on social media, and the privacy surrounding individual profiles, this information can easily get hidden or missed. The proximity based social media platform I hope to integrate into my application will potentially solve this, as anyone will be able to post to it and only those in a certain area will be able to see posts.

There are many factors that determine if somewhere is unsafe - noise level, past crime rate, time of day, the people residing there, etc., [1] and these all have to be considered individually and refined. People may not want to be able be tracked, or want to know when they are entering an unsafe location, essentially, due to privacy concerns

My personal safety application would prevent these problems. It would extract information from local council/authority Facebook/Twitter feeds, and also rely on users contributing directly to the application, anonymously, their experiences. The application would run only when the user selects it, and all features are able to be turned off and on as the user pleases.

1.4 Layout of Dissertation

Section 2: In this section I will conduct a literature review into the topic of personal safety, including differences in gender and age, problems with personal safety applications, and the need for a personal safety application, among others.

Section 3: Using my survey, I will derive requirements, both functional and non functional, and conduct analysis on these.

Section 4: I will outline the evaluation strategy and testing protocols I am going to implement for my prototype, including a one-to-one interview containing a usability study.

Section 5: This section will include the project management side of this project, including a Gantt chart, risk analysis, and considerations of legal, ethical, professional, and social matters regarding this project.

2 Background

This section will investigate and evaluate existing research into the use of smartphones for safety applications.

2.1 Gender Difference

Males and Females have different habits when it comes to their smartphones. A study by the team behind 'uSafe' found that 72% of females (in their study) reported feeling unsafe while walking at night. This is compared to 62% in males [2]. Although only 10% of a difference this still shows that on the highest level, men either have lower levels of fear, or they're embarrassed to admit to feeling unsafe.

Men also rarely use their phone to increase their safety [3], with 75% in this study claiming to have never used their phone for safety. On the contrary, 65% of women in this study claimed to use their phone all the time to increase their personal safety.

According to the Bureau of Justice in 2009, females are more likely to be sexaully assaulted than males [4], however more surprisingly, men are more likely to be assaulted or robbed than females. With this in mind, a personal safety application would be beneficial for both genders, contrary to popular belief, not just females.

2.2 Age Difference

Age is another factor that determines whether people would want/use a personal safety application on their phones. For example, in a group of 50-68 year olds, 81.7% sent less than 10 texts a day [5], compared to 22.5% of 18-24 year olds sending less than 10. This could be a range of factors, one of which being the fact that they may not feel as comfortable sending multiple texts to the same person in a day. This could be an issue in terms of the application, would they feel awkward sending their location to contacts if they thought they were in trouble for fear of being annoying? However people would rather text than phone in every social situation other than driving (which is illegal in most districts) [5] which highlights that any application should favour a text based system rather than a phone based one, which I will look into for my own application.

The younger generation, between 18-34 showed high signs of anxiousness if they were to lose their

phone, displaying a high emotional attachment to it [5]. This goes to show that people tend to have their phones on them at all times, and rarely go without, meaning the application would be highly accessible, and available.

Younger women are more likely to contact their parents more, in general, than males, this also hints to the fact that women are more likely to want someone to know where they are and use a personal safety application [5]. Charlton *et al* found that 38% of children aged 10-11 had used their phone in a crisis situation [6]. The younger generation who are growing up in the smartphone generation are using them effectively to enhance their personal safety. There is no description as to what these situations where but with the percentage being so high, its clear that the phones have been advantageous for these children.

2.3 Need for Personal Safety Applications

Smartphones are becoming increasingly popular, and accessible, with smartphone penetration rising by 33% in the last 5 years [7] in the UK, it is clear that most people have them. These can be incredibly useful when confronted with a crime, or when trying to avoid an unsafe or uncomfortable situation. The same can be said around the world, smartphones are on the rise, and show no signs of stopping. With features like GPS tracking and the improvement in carrier coverage, people can be found and contacted easier than ever before. With this in mind, generally the amount of crimes being committed is lowering [4], whether or not this is due to the rise of smartphones is unknown, however it still happens thousands of times a day, and may sometimes be avoidable.

There was a large incident in Dehli, India in 2012 which involved two women being brutally attacked [8] and raped on a public bus. Police recorded more than 550 cases of rape in Dehli in 2011 [9], leading to Dehli being called the "rape capital of India". To counter this, the Indian government have mandated that all mobile phones must have a panic button installed in 2017, and all phones must have GPS by 2018 [10]. Considering the popularity of smartphones, and the constant threat of these sorts of crimes happening, it seems only logical to combine these and prevent crimes of this nature happening as much as they have been.

Crime can sometimes be avoidable. In some cases it definitely cannot be, but there are some methods to avoid it. For example, avoiding a certain area that you know is prone to criminal activity or is poorly lit. You can also (pretend to) be on the phone, which may deter some criminals

as there is someone who would instantly know that you are in danger. Most of these are common sense and easy to do, but can be incredibly useful when someone is feeling unsafe. A personal safety application can combine all of these ideas into one place.

2.4 Problems with Personal Safety Applications

In this current society, privacy concerns are an all time high. The thought of being constantly tracked and easily located is scary to most. Snapchat recently implemented a location tracking feature, which instantly raised fears of stalking and bullying [11]. Although it is intended to be a way of inspiring adventure and spontaneity, a large percentage saw it as a negative feature. It is essential to a personal safety application however, and arguably people would it expect it to be there when using the application. It will, as well as all other features on my application, be optional.

The uSafe study found that 94% of its participants said that it was important for their privacy to be respected while using the application, and 90% would prefer to stay anonymous when using the application [2]. A problem that arises from this would be that once something is anonymous, it can be difficult to track what information is correct and what is not. As there is no way to tell who is contributing information, it becomes unreliable. Anyone can potentially add data to the application, without filter and without trace, skewing results. To combat this, there could be local moderators, to regulate the information being posted, while on the implementation side, it may be possible to introduce a filter, to regulate swearing and insults, for example.

It was found that a quarter of people in the uSafe study claimed to not appreciate using a personal safety application [2], and 45% would not want to be informed when entering an unsafe area. Furthermore, 22% strongly disagreed to being informed [2]. There may be a lot of reasons attributed to this. For example, the user may follow an *ignorance is bliss* motto to life, and if the application was to tell them that they were entering an unsafe area they may become paranoid and feel uncomfortable for no reason other than someone has previously reported that it is a dangerous area. It may also be due to the user thinking that they are being constantly tracked, and that every step they take is monitored. This would not be the case with my application, as it would need to be opened by the user and exits as soon as the home button is pressed. However it is still a rational

fear, especially in current society where everything is monitored.

The user may also not want any unneccesary notifications on their phone, as they can be annoying and overbearing if going off consistently.

Alerts from a personal safety application may only inform the user of a dangerous event or unsafe place once it has happened or once the user is in the unsafe area [12]. This would need to be overcome as it essentially renders the application pointless.

2.5 Perception of Smartphones

While features of smartphones are designed to improve the daily lives of its user, making everything as simple and accessible as possible, with that comes the risk of people using them inappropriately. A study into primary school children by Chartlon *et al* [6] found that 14% of primary school children had admitted to sending an inappropriate/threatening message to someone else, and 17% had admitted to receiving one. Cyberbullying is becoming increasingly more common among school children, both primary and secondary. A study found that 34% of students admitted to being cyberbullied [13], with 40.6% of females being cyberbullied compared to 28.2% in males. This is in part due to the increase in social media, in 2015 it was found 92% of teenagers aged 13-17 were online everyday and 24% were online *constantly*. With smartphones enabling internet access anywhere with 4G it is increasingly easy to get online. Due to this a lot of the older generation view smartphones negatively, as a way of interfering with children's lives and causing them undue stress, anxiety, and depression.

On the other side, it was found that improving personal safety was one of the main reasons for teenagers getting a phone [14]. It allowed young people to be in contact with their parents/guardians if they need them and gave the parents/guardians a sense of comfort knowing that their child was only a phone call away. Despite the cyberbullying aspect, smartphones are an incredibly useful tool for the younger generation. If they get lost, or need help it is easy for them to phone for help, or to load up a map-based application and find a way to wherever they are going.

Owning a smartphone can be a double-edged sword. It may help prevent a crime, i.e. being on the phone may deter a criminal, or the phone may be used if someone is lost, instead of asking strangers or walking around aimlessly in an unknown part of a city. However if someone is walking around

the streets with an expensive smartphone, a criminal may attempt to steal the phone. Theft of smartphones makes up for a third of all personal robberies in the UK [3], meaning it is a common occurrence. This was highlighted in a study by Downes and Aoki when participants were asked if a smartphone helps or hinders their personal safety [14].

2.6 Characteristics of Feeling Unsafe

Although somewhat obvious, it is helpful, and useful, to be able to characterise factors which determine whether someone is feeling unsafe. For example, poor lighting is a significant factor in determining someone's safety levels. It was found that more lighting would improve personal safety [1], along with CCTV cameras when it is dark.

Another common characteristic to feeling unsafe is the visibility of people around you. If it is dark, and another person (or group of people) is visible, it can improve the feeling of safety. If anything happens there will be witnesses and help [1]. However, there is also the possibility that it is detrimental to feeling safe. It may be that some feel safer thinking they are alone, if there is no one around, then there is no one to attack them. This is subjective, it differs from person to person and there is no pattern to determine this.

People feel significantly more unsafe if they are walking in an unfamiliar place, or in an area that is notorious for having criminal activity. While this seems obvious, it is important as there may be occasions in which these circumstances are unavoidable. It may be that the shortest route home travels through an unfamiliar place, or an unsafe place. Nasar found that females are more likely to take the shortest route home, with 71.6% preferring it to 46.0% of males [15]. Any personal safety application would have to bare this in mind when planning any route to a destination.

2.7 Mobile Phone Safety

Mobile phones have long been used for personal safety, even before smartphones were the phenomenon they are today. Police advise the public to phone friends when walking alone, as it makes them look less vulnerable. It also deters criminals, as they are aware that someone would be instantly alerted if they were attacked [1].

Mobile phones could also be used to improve safety as the user knows that they can contact the emergency services, or a friend or relative if they are in trouble. Knowing this, even if it is not

being used, can take a weight of one's mind and make them feel safer [16].
Just having a phone in their possession can improve someone's sense of safety, it was found that the majority of undergraduate students feel safer when walking alone if they have a mobile phone on their person. As mentioned above, just the feeling of knowing you can contact someone in an emergency and that you have a way of being contacted [17].

2.8 Related tools

2.8.1 Social Media

As mentioned in Section 2.1, smartphones are everywhere. A large percentage of people have one, and use it frequently. Smartphones can be used for many things, but one of the most common aspects is social media. With phone contracts becoming more common, and each offering high amounts of 4G data, the ability to check in and share your day with friends is easier than ever. Social media refers to "websites and applications that enable users to create and share content or to participate in social networking." according to the dictionary definiton. Although these were predominantly used by younger age groups, more recently older age groups have started using it as a way of finding old friends and keeping up with family. Social media has existed for years, from sites like MySpace, Friends Reunited, and Bebo all the way to current sites like Facebook, LinkedIn and Twitter. There is a plethora of information on social media, some useful and some not, and this is one of its biggest downfalls - it is difficult to find information once its more than a few hours old. Posting about crimes and unsafe situations has become more popular in recent months. It is a way for people to share their experience with their local friends, warning them of dangers and of areas that they've felt unsafe, as well as if a crime has been committed - i.e. car broken into. Trying to find this sort of information within the labyrinth of social media is difficult. With a personal safety application, this would be the only informaation featured, and so would be easy to find and relate to.

Each local district, at least within Scotland, has a local police division page on Twitter and Facebmodiook, which they use to alert people of crimes or dangerous areas around the local community. This is an essential tool when personal safety is involved, and it would be useful to integrate these together in the application. Not all the information on these pages is pertinent to crimes however,

there tends to be fundraising activities, or updates to the local police force as well.

Each social media account can have a lot of personal information on it, and a lot of people have concerns over this data. Regulating a profile to only show posts to 'friends' is simple, and is commonplace. This means that a lot of information is hidden, only to be viewed if you are already connected to someone. A lot of people locally may not be friends with each other, or follow each other, meaning their warnings go unread by people that would find it most useful.

2.8.2 Existing Applications

A number of personal safety applications exist for both Android and iOS, including StaySafe [18], bSafe [19], and SafetiPin [20]. All of these have their own special features and unique selling points. For example bSafe has a "Follow Me" feature which allows contacts to watch your journey on a map, tracking your movements to ensure you don't stray from your path. This feature is incredibly useful, it instantly allows your trusted contacts to see where you are, and if you deviate from a path or stop walking then it is clear that something is wrong. Although features like this may sometimes cause undue panic (if the user stops to talk to someone they know, or goes another way home) however this is easily remidied, just by texting them or phoning the user.
There is very little research being done into the effectiveness of these applications, and if they are a solution to the larger problem of personal safety.
Google has developed applications that allow proximity-based alarms based on the user's location. Google Keep [21] is a reminder based application that alerts the user to alerts that they have previously set. The interesting thing is that while it can be a time-based reminder which is commonplace in reminder applications, it can also be location-based, allowing you to set a reminder of a shopping list, for example, and it would remind you once it detected your location as being at a supermarket. While this is not directly related to personal safety, the same technology can be applied to a personal safety application. For example, if an area has been flagged as unsafe by multiple reports and a user goes into this area, then the application may alert them and inform them they are in an unsafe area. As mentioned in Section 2.4, it was found that 45% of participants in the uSafe study would not like to be informed if they enter an unsafe area [2], although this also signifies that 55% would appreciate this feature, or at least are neutral towards the idea of it.

3 Requirements Analysis

3.1 Survey Results

For my initial survey, I used SurveyPlanet to create and share. The survey consisted of 9 questions, mostly multiple choice, and was geared towards gathering requirements for the application as well as gauging the attitude towards personal safety applications in society. 74 participants responded to the survey, ranging from 18 years old to 70 years old, and 26 male respondants (35%)compared to 48 female (65%). This gave a significant variation in results and allowed me to see the trends among age groups and gender difference, and see if they match with the studies already discussed in sections 2.1 and 2.2. Below are the results of the most important features:

Feature	Count
Location Tracker/Updates	61
Panic Button	55
Alarm Sound	39
Fake Incoming Call	30
Alternate Route Planner	15
None	3
Selfie Mode	0

3.2 Functional Requirements

Functional requirements of the application are listed below:

RequirementsID	Requirement	MoSCoW
RF1	The system shall have a location tracker	M
RF2	The system shall allow user to call emergency contacts	M
RF3	The system shall implement a fake call feature	M
RF4	The system shall send location updates through text to trusted contacts	M
RF5	The system shall record audio/video for a short period of time if panic button is pressed	M
RF6	The system shall integrate Google Maps API	S
RF7	The system shall implement a proximity based social media platform	S
RF8	The system shall have a journey countdown alert	S
RF9	The system shall have an alarm feature to make a loud noise to deter criminals	S
RF10	The system shall have a panic button, to quickly contact emergency contacts	S
RF11	The system shall implement an alternate route planner to avoid unsafe locations	S
RF12	The system shall take a photo from front facing camera if phone is stolen	C
RF13	The system shall display help hotlines and should link to important info	C

These requirements were compiled by taking into account answers to the survey I carried out, available as Appendix A. Full results are available as Appendix B. It was found that out of 74 participants, 61 of them thought a location tracker to be one of the most important features within the application. Thus, location tracking is a 'Must' in the requirements, as it is what most participants expect to be in. Another important feature, with 55 out of 76 votes, was the panic button, so this also became a 'Must'. Other features included in the requirements became 'Should' and 'Could' in terms of MoSCoW.

3.3 Non-functional Requirements

From using my survey results, I also derived non functional requirements. These are listed below:

RequirementsID	Requirement	MoSCoW
NRF1	The system shall be reliable and robust.	M
NRF2	The system shall work with recent versions of Android OS.	M
NRF3	The system shall be intuitive and easy to use.	M
NRF4	The system shall not invade users privacy and make clear when it is tracking location.	M
NRF5	The systems features shall be fully customisable for the user.	S
NRF6	The system shall make clear what permissions it is using to the user.	S
NRF7	The system shall use as little battery power as possible while running.	S

4 Evaluation Strategy

In terms of evaluating my application, I intend on conducting a one-to-one interview with 6-10 participants. The main purpose of this interview is to carry out a usability study on a prototype of my application. The participant will be asked to complete a series of tasks on the application. The intention here is to see if the application is intuitive, and well laid out. I will ask for feedback after each task on how the participant felt, and record all answers. I will also time them for certain tasks, for example activating the panic button, or the alarm buzzer, as these are very time sensitive features, and need to be able to activate quickly. As well as testing the user interface, I also intend to test the functionality of the application, ensuring that the main features work well and consistently.

Using this study, I will try to gauge whether or not my application was successful in improving personal safety, but also ensuring it is well designed and there are no obvious bugs with it. I will also use this study to fix any problems with the application, and create an improved prototype.

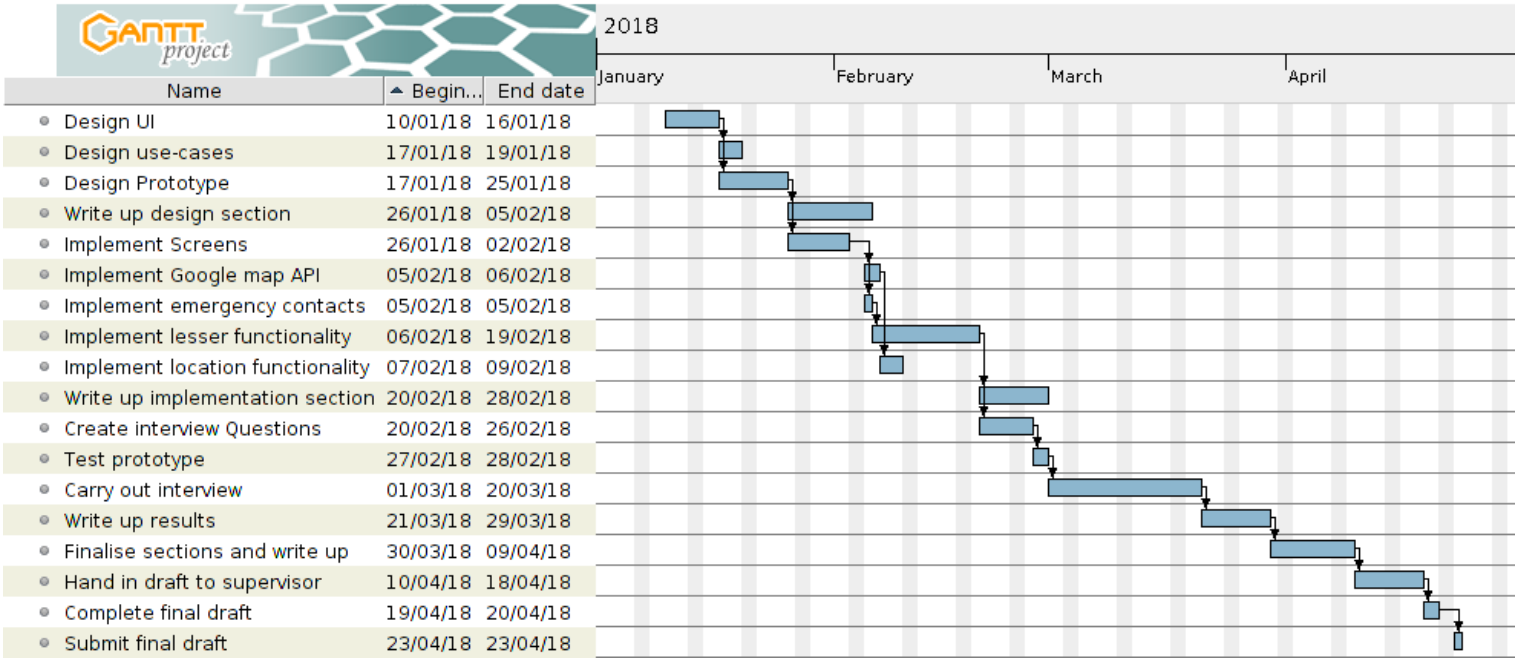
5 Project Management

5.1 Risk Analysis

Type	Risk	Likelihood	Impact	Mitigation Plan
Project	Not sticking to original schedule.	H	M	Have regular meetings with supervisor and constantly update project plan.
Project	Experiencing difficulties in development.	H	H	Not fixate on a single aspect for too long, ask for help from other people and if still too difficult, consider omitting it from project.
Project	Supervisor leaving.	L	H	Discuss with supervisor what will happen and get his recommendation on a new supervisor or keep in touch with him until project is finished.
Project	Other courseworks due.	H	M	Start all courseworks when first given out and work on all equally, so as to not ignore certain ones until the last minute.
Project	Running out of time to implement features.	M	M	Work on all important and necessary features first, so that main functionality is there.

Project	Not receiving ethical approval.	M	L	Submit ethical approval form early in the semester to ensure sufficient time to amend and gain approval.
Project	Low survey response rate.	M	M	Plan and conduct the survey over multiple weeks to get maximum response.
Technical	Laptop crashes/data loss.	M	H	Back everything up to external harddive and cloud storage.
Technical	New version of Android is released.	M	L	Only being run on personal phone, no intention to make public.
Technical	A certain feature may require rooting phone.	M	L	Only being run on personal phone, and most important features should not need rooted phone.
Human	Working at my part time job may result in falling behind	H	M	Manage my time well so that I have enough time to do both
Political	New privacy laws may be implemented	M	M	Ensure all features are toggleable, and keep up to date with privacy laws to ensure application stays within these laws

5.2 Project Plan



Name	Begin...	End date
Design UI	10/01/18	16/01/18
Design use-cases	17/01/18	19/01/18
Design Prototype	17/01/18	25/01/18
Write up design section	26/01/18	05/02/18
Implement Screens	26/01/18	02/02/18
Implement Google map API	05/02/18	06/02/18
Implement emergency contacts	05/02/18	05/02/18
Implement lesser functionality	06/02/18	19/02/18
Implement location functionality	07/02/18	09/02/18
Write up implementation section	20/02/18	28/02/18
Create interview Questions	20/02/18	26/02/18
Test prototype	27/02/18	28/02/18
Carry out interview	01/03/18	20/03/18
Write up results	21/03/18	29/03/18
Finalise sections and write up	30/03/18	09/04/18
Hand in draft to supervisor	10/04/18	18/04/18
Complete final draft	19/04/18	20/04/18
Submit final draft	23/04/18	23/04/18

5.3 Project Plan Writeup

Task	Start Date	End Date	Description
Design user interface	10/01/2018	16/01/2018	To design the user interface of the application, which is integral to the project. The UI needs to be clear and all functionality should be easily activated.
Design use cases	17/01/2018	19/01/2018	To design use cases to make clear how actors interact with the system and how basic functionality is achieved.
Design prototype	17/01/2018	25/01/2018	Designing the application, combining the UI design with functionality, ensuring everything is laid out well and is as easy as possible for the user to follow.
Write up design section	26/01/18	05/02/2018	Write the design section of my dissertation once all of the design elements are finished, ensuring that it is still fresh and I am not rushing to do it later.
Implement screens	26/01/18	02/02/2017	Implement the screens that were designed for the UI.
Implement Google Map API	05/02/2018	06/02/2018	Integrate the Google Maps API to make the location/map aspect of the application easier to implement.

Implement emergency contacts	05/02/2018	05/02/2018	Integrate/allow users to add their emergency contacts either manually or through accessing the users contacts on their phone.
Implement lesser functionality	06/02/2018	19/02/2018	Implementing other functionality, such as panic button, fake call button, and alarm button.
Implement location functionality	07/02/2018	09/02/2018	Perhaps the most important part of the application, implementing the location parts of the application, such as sending updates to contacts of location, or displaying messages within a certain area through the social media platform.
Write up implementation section	20/02/2018	28/02/2018	Write the implementation part of dissertation after implementing a complete prototype.
Create interview questions	20/02/2018	26/02/2018	Create multiple questions to ask users during the interview, including a usability study, asking the user to complete tasks, and asking their opinion of the application.

Test prototype	27/02/2018	28/02/2018	Doing the interview questions myself and ensuring the interview is acceptable. I will make sure the functionality works and then conduct a pilot study on one participant to ensure any unbiased interview questions are removed.
Carry out interview	01/03/2018	20/03/2018	Carry out the interview with participants over a two week period, to ensure maximum participants.
Write up results	21/03/2018	29/03/2018	Gather all answers to interview, correlate the results, and write them up.
Finalise sections and write them up	30/03/2018	09/04/2018	Add all the sections already written up to one document and make sure they relate to each other.
Hand in draft to supervisor	10/04/2014	18/04/2018	Hand in first draft of dissertation to supervisor and wait for feedback.
Complete final draft	19/04/2018	20/04/2018	Using supervisors feedback, refine dissertation and fix all mistakes.
Submit final draft	23/04/2018	23/04/2018	Submit dissertation.

6 Professional, Ethical, Social, and Legal Issues

For this project, we must consider how this application will fit into the following categories:

- **Professional:** I am not anticipating any professional issues with this project.
- **Ethical:** While designing the study carried out in semester 1, ethical approval was difficult to obtain, due to the implications of personal safety. It was difficult to create a survey about personal safety without causing discomfort to those who may have been attacked or had an experience while walking around alone. It is also difficult to test whether or not an application would improve personal safety, as it would involve putting participants into unsafe and dangerous situations and seeing if the application is effective. However, as this is incredibly unethical, I am planning on just using hypothetical vague situations that do not reference anything explicitly. During the survey, all participants agreed to take part and were informed they had the right to exit the study whenever they liked.
- **Social:** In terms of social considerations, and based on the information in section 2 of this dissertation, females are more likely to be using a personal safety application, and so this is a focus for the application.
- **Legal:** There are legal implications to this application also. For example, if the application is wrong and causes the user to panic, and phone the police, then it raises the matter of wasting police time. It would be recommended to the user to only contact emergency services when something has actually happened (followed by someone, etc.) and to contact family/friends if they are feeling unsafe. There would also be a disclaimer detailing this on the application.

References

[1] Orla Thérèse McCarthy, Brian Caulfield, and Margaret O'Mahony. How transport users perceive personal safety apps. *Transportation research part F: traffic psychology and behaviour*, 43:166–182, 2016.

[2] Delphine Christin, Christian Roßkopf, and Matthias Hollick. usafe: A privacy-aware and participative mobile application for citizen safety in urban environments. *Pervasive and Mobile Computing*, 9(5):695–707, 2013.

[3] KL Uthpala Senarathne Tennakoon and Daphne G Taras. The relationship between cell phone use and sense of security: A two-nation study. *Security Journal*, 25(4):291–308, 2012.

[4] Jennifer L. Truman and Michael R. Rand. Criminal victimization, 2009, 2009. Available from `https://www.bjs.gov/content/pub/pdf/cv09.pdf`. Accessed 29/09/2017.

[5] Deborah Kirby Forgays, Ira Hyman, and Jessie Schreiber. Texting everywhere for everything: Gender and age differences in cell phone etiquette and use. *Computers in Human Behavior*, 31:314–321, 2014.

[6] Tony Charlton, Charlotte Panting, and Andrew Hannan. Mobile telephone ownership and usage among 10-and 11-year-olds: Participation and exclusion. *Emotional and Behavioural Difficulties*, 7(3):152–163, 2002.

[7] Deloitte Global Mobile Consumer Survey. Device penetration among uk adults 2012-2017. 2017. Available from `DeloitteGlobalMobileConsumerSurvey`. Accessed 25/09/2017.

[8] Huizhong Wu. Indian supreme court upholds death sentences in delhi gang rape, 2017. Available from `http://edition.cnn.com/2017/05/05/asia/india-gang-rape-death-penalty/index.html`. Accessed on 30/10/2017.

[9] BBC News. India 'gang-rape': Student, friend attacked on delhi bus, 2012. Available from `http://www.bbc.co.uk/news/world-asia-india-20753075`. Accessed on 30/10/2017.

[10] Huizhong Wu. India says every phone must have a 'panic button' by 2017, 2016. Available from http://money.cnn.com/2016/04/27/technology/india-smartphone-panic-button-rape/index.html Accessed 30/10/2017.

[11] Olivia Solon. Snapchat's new map feature raises fears of stalking and bullying, 2017. Available at https://www.theguardian.com/technology/2017/jun/23/snapchat-maps-privacy-safety-concerns. Accessed 29/09/2017.

[12] Nishi Tiku, Neha Menon, Dhanashri Phatak, and Venkatesh Vaasudhevan. On the spot: An android application for personal safety, location based alarms and location based reminders. *International Journal of Computer Applications*, 171(8):41–45, Aug 2017.

[13] Justin W. Patchin. 2015 cyberbullying data. Statistics available at https://cyberbullying.org/2015-data, accessed 18/10/2017.

[14] Kumiko Aoki and Edward J Downes. An analysis of young people's use of and attitudes toward cell phones. *Telematics and Informatics*, 20(4):349–364, 2003.

[15] Jack L. Nasar, Bonnie Fisher, and Margaret Grannis. Proximate physical cues to fear of crime. *Landscape and Urban Planning*, 26(1):161 – 178, 1993. Special Issue Urban Design Research.

[16] Filippo Dal Fiore, Patricia L. Mokhtarian, Ilan Salomon, and Matan E. Singer. "nomads at last"? a set of perspectives on how mobile technology may affect travel. *Journal of Transport Geography*, 41(Supplement C):97 – 106, 2014.

[17] JACK NASAR, PETER HECHT, and RICHARD WENER. 'call if you have trouble': Mobile phones and safety among college students. *International Journal of Urban and Regional Research*, 31(4):863–873, 2007.

[18] StaySafe. Personal safety app. Available at https://www.staysafeapp.com/, accessed 18/10/2017.

[19] bSafe. "Never Walk Alone" personal safety app. Available at https://getbsafe.com/, accessed 18/10/2017.

[20] SafetiPin. "Supporting Safer Cities" Personal Safety app. Available at http://safetipin.com/, accessed 18/10/2017.

[21] Google. Google keep. Available at https://www.google.com/keep/, accessed 18/10/2017.

A Survey Questions

1. What is your age, in years?

2. What gender do you identify with?

- Male

- Female

- Rather not say

3. Have you ever felt unsafe while walking alone outside?

- Yes

- No

4. Is there a particular time of day that you might feel less safe while walking alone outside?

- 12am-6am

- 6am-12pm

- 12pm-6pm

- 6pm-12am

- None, I don't think I feel unsafe at any particular time

5. Which of the following situations would make you feel unsafe while walking alone outside?

- Walking through a busy shopping centre

- Walking past a pub at midnight

- Walking through an unlit residential area - Hearing loud shouting behind you

- Walking to the supermarket during the day

- Walking without your phone

- None, I don't think I feel unsafe in any particular situation

- Other

6. Have you ever used a mobile phone to make you feel safer while walking alone outside?

- Yes

- No

7. Have you ever used a 'personal safety application' to make you feel safer while walking outside

alone?

-No

-Yes (please specify what app below)

8. In your opinion, what is the 3 most important features for a personal safety app?

(If you wouldn't find a personal safety application useful, you only need to select the one choice.)

- Location tracker

- Alarm sound (plays loud alarm when activated)

- Panic button (calls emergency contacts instantly)

- Alternate route planner to avoid unsafe areas

- Selfie mode

- Fake incoming call button

- None, I don't think I would find a 'personal safety app' useful

- Other

9. Would you be comfortable with your location being tracked as part of a 'personal safety application'?

- Yes, all the time

- Yes, as long as I could turn it off

- Not at all

B Survey Results

‘ 1.

Age Range	Count
16-25	35
26-36	5
36-45	5
46-55	11
56+	18

2.

Gender	Count
Male	26
Female	48

3.

Felt Unsafe?	Count
Yes	61
No	13

4.

Unsafe Time?	Count
12am-6am	27
6am-12pm	3
12pm-6pm	5
6pm-12am	30
None, I don’t think I feel unsafe at any particular time	9

5.

Unsafe Situation?	Count
Walking through a busy shopping centre	1
Walking past a pub at midnight	29
Walking through an unlit residential area	52
Hearing loud shouting behind you	50
Walking to the supermarket during the day	0
Walking without your phone	20
None, I don't think I feel unsafe in any particular situation	4
Other	3

6.

Mobile phone to make you feel safer?	Count
Yes	52
No	22

7.

Mobile app to make you feel safer?	Count
Yes	2*
No	72

Both answers are disregarded as misunderstood question and answer does not apply.

8.

Most important feature (pick 3)	Count
Location Tracker/Updates	61
Panic Button	55
Alarm Sound	39
Fake Incoming Call	30
Alternate Route Planner	15
None	3
Selfie Mode	0

9.

Comfortable with location tracking?	Count
Yes, all the time	15
Yes, if I could turn it off	55
Not at all	4