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MiStory- Digital Life Story

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of the requirements for the degree of
B.A.I. (Computer Engineering)

Student's Declaration

I hereby declare that this project is entirely my own work except for quotations and summaries which have been duly acknowledged. It has not been submitted as an exercise for a degree at this or any other university.

I have read, and I understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at http://www.tcd.ie/calendar.

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Name of the Supervisor: Dr. Gerard Lacey
Date:12/04/19

Acknowledgement:

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Abstract:

The body of the work presents, research, development and evaluations of a mobile application, My Story, which will allow dementia patients to record, save and edit their life stories in the form of photographs or videos. This application can be used diversely as its usage will not be limited to only patients but also their families as well as stakeholders in medical field to support them.

To gain the full understanding of the problem and get insights about the requirement of this application, stakeholders from the healthcare field were consulted as well as references were taken from the various existing systems of the similar kind. The project involves building on existing work in a project called Digital Life Story. The app is developed in Unity to allow for cross platform portability and the easy incorporation of some gamification and game like features. It offers a unique opportunity for people living with dementia to store, access and generate memories, capture them in writing and audio and the ability to continue adding to the original stories.

The first phase of the project details related state of the art work that is ongoing or is already implemented in this healthcare field involving dementia patients that is applications and systems which are in used currently. The second phase of the project details the design and implementation of the application. The final phase of the project evaluates the performance and discuss the user feedback as well as future works on this project.

Analyzing the performance evaluation and user feedback, it can be said that considering the first draft of the application it performed fairly good as it has all the basic features that were required for this application, but still there are some minor changes are needed and some features can be added to make this application even better.

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1) INTRODUCTION

1.a) Motivation

1.b) Background

1.c) Aims and Objectives

1.4) Dissertation overview

1.a) MOTIVATION

Dementia is a neurodegenerative chronic condition characterized by a progressive decline in a person's memory, thinking, learning skills and ability to perform activities of daily life[2]. According to the latest stats around 50 million people are currently suffering from dementia and more alarming fact is that it is increasing at the rate of around 10 million per year[15]. Smart technologies are being developed to not only support people suffering with dementia but also to help caregivers (healthcare staff, family) support them. These will also reduce the burden on caregivers.

As the dementia patients progress to advance stages, there is a decline in a person's memory, thinking, learning skills and ability to perform activities of daily life. Taking this as a primary consideration there is a need for a software that can help capture the memories of these people which will not only support them and act as a medium for them to stay connected to the world and preserve their identity as an individual they are but also it will help their family and other medical professionals involved with them to support them. Creating a digital personalized story with people who have mild to moderate dementia can contribute a lot to stimulate and share long term memories.

1.b) BACKGROUND

Smart technologies are being developed to not only support people suffering with dementia but also to help caregivers (healthcare staff, family) support them. These will also reduce the burden on caregivers. However, while these technologies have the potential to facilitate this approach, there are many challenges and barriers to successful implementation. Currently, most of the technology for people with dementia are being developed in the conventional way but what we need to realize is that we are dealing with a specific set of users here which have limitations, so it is very important to include caregivers and patients as well while developing technologies for them because only then will you be able to identify their requirement, which is not the case right now and

hence this results in greater difficulty in understanding how to effectively use such technologies, or incorporate them into their everyday lives, which in many cases is not successful, with the consequence of abandoning the device for not being found useful or not fitting its purpose. Therefore, there is a need to include People with Dementia and their caregivers in technology design, to better understand their needs, and to use this knowledge to address any potential deficits.

To understand how to effectively use such technologies, and incorporate them into their everyday lives, this project is worked with stakeholders in the School of Nursing and Midwifery to better understand the needs and perceptions, and to use this knowledge to address any potential deficits. A mobile application is developed on unity platform which provides a medium for people with dementia to capture their life stories. As dementia develops the application will remind people who they are and support their sense of self. The app will also be used by careers, professional and family, to support conversation and positive interaction with patients. Patients will be able to build multi-platform story that will facilitate engagement and keeps attention.

1.c) AIMS AND OBJECTIVES

People with dementia start with just being forgetful about small things but as dementia progress to more advanced stages it chronically disables a person as they don't even can carry out their daily tasks, which in turn is an added responsibility for the family or other caregivers to take care of them.

There are various smart technologies that are being developed or are already developed to support patients and the caregivers, who support these people with dementia from initial stages of dementia to final stages of dementia when people with dementia are totally dependent on the caregivers even for the smallest of things. However, research has found that many current systems are ineffective in real life situations due to their low acceptance rates.

Although technology can facilitate the delivery of care, but there are many barriers and challenges to its actual implementation. People suffering with dementia suffer a decline in their memory retention, thinking skills, learning skills and ability it performs daily tasks hence it would be very difficult for them to open themselves for a new technology and hence there are high chances that they will reject these new technologies. These usage limitations and adoption problems are compounded when we consider the cognitive and behavioral problems associated with dementia, creating further barriers for adoption [2]. There is not a need to develop a very fancy and modern technology rather there is a need to develop a technology which is well accessible so that people with dementia can see its benefit and are open to accepting them.

Our story is one such application developed by Open University aimed at providing support to people with dementia as well as their caregivers. But there are some shortcomings in that application which needs to be rectified. The problems with our story application are:

a) The delete button is too accessible

b) Chapter Sequence cannot be formatted either to run as a storyline or to have most used chapters easier to access

c) Music cannot be added

d) Application crashes and stories are lost

e) The application needs to be simplified

f) Application is not cross platform

In this project we will work on the shortcomings of the our story application and add add some features to make it better.

Hence, the aim and objectives of this project are:

1) To review existing literature to explore the difficulties that PwD and their

2) caregivers have to overcome when using smart technologies for their home care, as a way of understanding their reasons behind the adoption or non-adoption.

3) Based on these findings, design and develop a Digital Life Story application in Unity to allow for cross platform portability and the easy incorporation of some gamification and game like features. The Unity app will incorporate many features of the Our Story app for iPad developed by the Open University. It will offer a unique opportunity for people living with dementia to store, access and generate memories, capture them in writing and audio and the ability to continue adding to the original stories.

1.4) DISSERTATION OVERVIEW

This thesis aims to give a detailed description and documentation of the design and implementation MY STORY unity mobile application for dementia patients.

Chapter 2 gives a review about existing literature for instance Reminiscence systems, UI design and implementation, etc., based on the findings of which this project is designed and implemented, Chapter 3 gives an overview of theory and design of the software developed, Chapter 4 gives an overview of implementation of the software, Chapter 5 evaluates the achievement of the project and identifies some future work, and Chapter 6 discusses the conclusion of this project.

2) LITERATURE REVIEW

2.a) Introduction

2.b) Reminiscence Systems

2.c) Accessible Computing

2.d) Ubiquitous technology

2.e) User Interface Design

2.a) INTRODUCTION

Smart technologies are being developed to help patients and their informal caregivers at home, which may also have a role in supporting the PwD in their ADLs, and also, to provide support to their caregivers in reducing levels of burden, stress, and symptoms of depression or anxiety, which are often associated with informal caregiving. However, research has found that many current systems are ineffective in real life situations due to their low acceptance rates.

In this section of the report, existing literature has been reviewed to explore the difficulties that People with Dementia and their caregivers must overcome when using smart technologies for their home care, as a way of understanding their reasons behind the adoption or non-adoption.

2.b) Reminiscence systems

A story or memory told about a past event remembered by narrator is reminiscence and similarly the systems which helps people remember their life stories and memories are knowns as reminiscence systems. Dementia is a health priority internationally, reminiscence systems are the intervention which prompts memories ard are currently be developed and used as therapeutic approach widely[4].

Technology-based reminiscence increases opportunities to participate in conversations and enhances the social interactions of people living with dementia and their careers [5], furthermore, it enables remote reminiscence to be delivered at home [6]. Traditional systems were more reliant on the collection of resources which could stimulate a range of sensory feeling for instance touch, smell or taste whereas the modern technology based systems are oriented towards utilizing visual and auditory senses to prompt memory, to support people with dementia. It makes more sense if we think about it logically because studies have proved that retention of visual memory and auditory memory is

longer as compared to smell, taste or feel of something.

Reminiscence therapy is the evolving field, its effects on people with dementia was studied, four trails with a total of 144 patients were considered and the results were quite significant. Cognition and mood or people with dementia improved 4 to 6 weeks after the therapy, not only this but the caregivers who were a part of this trial also felt reduced stress and burden which in turn will help them work more efficiently and provide better support to people with dementia. People with dementia were reported to show some indications of improved functional ability. No harmful effects were identified on the outcome measures reported.[7]

Although the results of the trails were significantly good but Ifelt as it was only conducted on a limited group of people, which is one of its limitations as of now. In future these trails should be conducted on a large scale to get more accurate results. As highlighted in the review as well there is an urgent need for more and better designed trials so that more robust conclusions may be drawn[7].

Increasingly, computerized systems are being designed for therapeutic treatment of Dementia patients. Most of these systems address the cognitive decline of the patients by trying to compensate for the loss of memory or to offer a cognitive training, by trying to record the memories of people with dementia.[8]

Reminiscence systems have the potential to facilitate this approach of using technology to provide cognitive support to the people with dementia as well as help reduce the burden on their caregivers, over the recent years this system has show significantly good results and lots of these systems are currently been developed and tested however there is a lot to done in this new field of development to make it even better and more beneficial for people with dementia and the caregivers associated with them.

2.c) Accessible computing

This is the new age of technology. For those who belong to this current generation it's a big boon as the new technologies are making lives of a lot easier. But if we talk about people of previous generation, are they getting the benefit of the current technologies? Is technology being developed beneficial to all or in simple terms is it be accessible by all?

Access to technology is has been hampered by the short sightedness on the part of designers and although the this is changing as more and more research is being done on the user centered design but the situation is still the same up to considerable extent [10]. Older people they not only suffer from visual impairments but also intellectual impairments and since they have a reduced capacity of learning, they are often not willing to spend time on new technologies and hence the are not very open to accept new technologies. There is a divide between those who can actually access and benefit from technologies and those who do not or cannot access it[11].

Design should be more focused on the needs and requirements of the users, it not necessary to develop a fancy technology with lots of feature rather it is important to develop a technology which is well designed and accessible to the set of users it is being developed for.

There is still a lot to be done to make technologies accessible to all sets of users. This should include more emphasis on supporting cognitive dysfunction, providing computer systems which are accessible to those with mild cognitive dysfunction as well as developing systems to support people with major cognitive dysfunction. Researchers should not only consider what older users are perceived to need, but also what they want. Further, they should provide accessible computing in a way which is aesthetically pleasing as well as effective. [10]

2.d) Ubiquitous technology

New technologies are being developed all over the world for benefit of people. But one of the important aspects to talk about it that is the technology being develop reaching all.

While there have been advances and more effective solutions are available, ensuring that those who would benefit have access to these solutions is a problem that has yet to be solved[12]. However there several reason due to which the technology is not reaching all such as prohibitive cost due to which assistive technologies are out of reach of many. Though in many countries free access to internet is provided at public locations yet the ground in not truly even because disabled people don't have effective access to these locations and even if they have the access it is very difficult to install assistive technology at each public work station.

To address access in this ubiquitous world, we will need to begin thinking about ubiquitous accessibility and, for some, pluggable user interfaces. The ability to invoke any assistive technologies or specific features that are needed directly from the Net to use on whatever displays are nearby, may be the most effective means of access.[12]

The ubiquity of assistive technologies are very important if the assistive technologies are to reach their full potential, because only then will it be able to fulfil the purpose for which it is being developed and give a better quality of life of life to people with dementia and other impairments. If only such technologies won't be accessible by all, then it will just defeat the purpose for their development. One of the most effective ways to solve this problem is to develop a networked reminiscence therapy system that combines IP videophones with a photo- and video-sharing mechanism based on Web technology, so the anyone can get therapy anytime and anywhere[9].

2.e) User-Interface design

Until not recently, the user interface design was only the responsibility of the developer. But with time people realized that user interface design is not just a responsibility of the developer rather it is a collective responsibility of a team because it needs to be user centered. Different sets of users have different requirements. It is very important to anticipate and understand those needs before developing any application.

Designers must be educated on how to operate when the user base may contain older or disabled people because they have a very specific set of requirements [1].In order to ensure the development of genuinely usable technology for a wide range of users, a change of culture is required[1].

People with dementia have specific requirements. While designing applications for healthcare it is very important that the application is designed by a team not only consisting of developers but also various healthcare staff related to that field of work and if possible people suffering as well, as only this would ensure that the application is designed keeping in mind the actual requirements or needs of the user, user centered design should be given utmost priority while developing such applications. Developers need to know understand the problems fully and think from the point of view of end users and only then will the requirements of the application can be anticipated and worked upon.

Ideally, this should be an iterative design process, where the final users contribute with their knowledge and experience to develop a product that can be adapted to meet their own needs in a user-friendly manner. However, while these technologies have the potential to facilitate this approach, there are many challenges and barriers to successful implementation.

As caregivers and other health care staff are not kept in loop while designing these technologies this results in greater difficulty in understanding how to effectively use such technologies, or incorporate them into their everyday lives, which in many cases is not successful, with the consequence of abandoning the device for not being found useful or not fitting its purpose[2].

Some of the recommendation for designing an application for people with dementia are [13] [14]

a) To facilitate the processing of complex information, colour and contrast will be efficient in guiding the patient through the website. The pages should be 'clean', including noticeable objects, without any overlapping or complex setting of shapes, which may confuse the patients.
b) To support the memory function, it is recommended to use recognizable visual cues such as pictures or icons. In addition, navigation will be easier by keeping consistent structure for different pages. Also, changes in semantic memory can be supported by using a non-complex language and avoiding abstract or metaphorical terms.
c) To prevent attention disruption, it is extremely important to reduce cognitive load when presenting information to people with dementia. The number of items in a page requiring attention should be decreased, the number of options available on a page should be minimized, and page size should be limited to fit the screen.

3) Theory and Design

3.a) Introduction

3.b) Definition of Problems and solutions

3.b.1) Addressing the task
3.b.2) Initial Ideas and possibilities
3.b.3) Realistic aims and design of the project

3.c) Resources

3.c.1) Hardware
3.c.2) Software
3.c.3) Assistance and help

3.a) Introduction

This subsection examines the definition of the problem that is identifying the tasks at hand, then considering those coming up with initial ideas and possibilities to solve those problems. It moves on to discuss the realistic objectives and aims of the project. Finally, it goes on to discuss the resources required for this project.

3.b) Definition of Problems and Solution

3.b.1) Addressing the tasks

The project brief stated that the application is to be made for dementia patients, this meant that this is not just day today life application rather it is for a very specific set of users. Hence while addressing the tasks in hand there was a need to keep in mind the requirements of this specific set of users.

i) Cognitive load

As the age of a person increases his ability to see and hear declines. This is amplified even more in a person suffering from dementia because as dementia their ability to think, learn and perform daily tasks decline, therefore they might not be open to learn and accept new technologies hence it is very necessary that the application made reduces the cognitive load.

Cognitive load basically refers to the amount of brain power is used by a human to operate and understand an application. People suffering with dementia has a limited processing power and it is on a constant decline hence it is necessary that the application is made in such a way that it does not provide them too much information which can be overwhelming for them and make them reject the application. It was very essential to keep the application simple and just provide enough information that can be easily processed by the people suffering from dementia.

ii) Look and feel of the application

Usually as a person ages his or her eyesight deteriorates. Not only this but also their colour vision declines, they are unable to distinguish between various colours, therefore it is very necessary that application does not has noisy colours and yet it is interactive, and language is easily readable.

The application should not look too noisy as in the colour combination of the application should not be very bright rather it should be simple. Also the the font size used in the application should not be small, it should be large enough for the people with weak eyesight to read.

iii) Decluttering

When a person is suffering from dementia, there is a decline in their memory retention thinking skills, learning skills and ability to perform tasks. They tend to forget things and as the they progress to advance stages of dementia their ability to retain memory declines even further, hence it is very important for the application to be made in such a way that it's easy to navigate and there are not a lot of layers and buttons involved.

As the memory retention and learning skills of the dementia patients is reduced hence it should be kept in mind that there should be as less number of layers in the application as possible as well as it should provide the user with such an environment that after using the application a couple of times the user already knows the functioning of the application, they do not even need to read the label on the button rather just by seeing the button they know what is its function. If the number of layers will be less it will be very easy for the patients to navigate through the application without forgetting what the next step is or any functionality of the application.

iv) Offload Tasks

It a proven track record that majority cause of errors that occur irrespective of the field, are humans. People suffering from dementia lose the ability to perform simple tasks hence it is very important that the application does not overwork them and reduces the tasks as much possible.
In a application we can say that we can reduce the tasks but reducing the user input required to operate the application, as there will less user inputs there will be less chance of error.

v) Device

It is safe to assume that the modern technology is fairly new for elderly people and although we are used to using such complicated technologies but they are not. Many elderly people even describe it as fiddly and annoying. But one thing we can say for sure is that they are open to new technologies if they see a clear benefit.

Hence it is very important to select a device on which is easy to use for elderly and on which application can be easily implemented. Keeping that in consideration the device best suited for the implementation of this application are tablets, which have bigger screens and hence larger fonts can be used, which make them perfect device for the use by people suffering from dementia and to implement our application.

vi) Anticipating user needs

In the end one of the most important task in hand is to think from the users point of view and anticipating their needs to design and implement an application which will reflect their requirements. Due to the limitations of dementia, the users are not able to interact with the application in a conventional way in which a normal person would hence it is very important to identify their needs and requirements and avoid including that in the application.

3.b.2) Initial ideas and possibilities

Initially the focus of this project was to review existing literature to explore the difficulties that Patients with Dementia and their caregivers have to overcome when using smart technologies for their home care, as a way of understanding their reasons behind the adoption or non-adoption.

Based on these findings, design and develop a Digital Life Story application which will offer a unique opportunity for people living with dementia to store, access and generate memories, capture them in writing and audio and the ability to continue adding to the original stories and incorporation of some gamification and game like features. The application should allow users to click photograph, video or add audio and music which will allow them to build multi platform story that facilitates engagement and keeps attention. The application should allow the user to share their stories with others. The application should be developed keeping in mind that it is being developed for patients suffering with dementia and it should reflect upon all their requirements. The application would allow them to capture their life stories.

It was planned that the application should be developed for iPad although it should be developed on a multi platform software

3.b.3) Realistic aims and design of the project

After researching and getting familiar with the requirements of the application I thought that some of the features were too ambitious for now and were more of a extra feature rather than a basic one such as adding custom music. So after leaving some such feature for future work Idecided to move forward with the aim of review existing literature to explore the difficulties that Patients with Dementia and their caregivers have to overcome when using smart technologies for their home care, as a way of understanding their reasons behind the adoption or non-adoption.

Based on these findings, design and develop a Digital Life Story application in Unity to allow for cross platform portability and the easy incorporation of some gamification and game like features. The Unity app will incorporate many features of the Our Story app for iPad developed by the Open University. It will offer a unique opportunity for people living with dementia to store, access and generate memories, capture them in writing and audio and the ability to continue adding to the original stories.

The application should allow users to click photograph, video which will allow them to build multi platform story that facilitates engagement and keeps attention. The application should be developed keeping in mind that it is being developed for patients suffering with dementia and it should reflect upon all their requirements. The application would allow them to capture their life stories. The application is developed for android tablet.

3.c) Resources

In this section I will briefly talk about the all the resources that I used while implementing the project. I will talk about the hardware I used, software I used, documentation and help and assistance got.

i) Hardware

A computer workstation is the most important part of the development of this application, the specifications of the computer work station I used are

Cpu- intel i5
Ram- 4 Gb
Graphic memory- Nvidia 820M
Os version - windows10

The device on which I implemented the application is Android tablet, specifications are

Cpu - quad core

Ram- 2 Gb
Android version - 4.4 kitkat

Although it was a fairly basic application yet it is better to have a system with good graphic memory so that the rendering and processing can be faster.

ii) Software

The software I used to develop the application is Unity which allows for cross platform portability and the easy incorporation of some gamification and game like features. More about unity is discussed in the implementation section.

iii) Help and assistance

The science of cognition is a huge topic, to develop an application for that would target such a specific set of users is a difficult task for someone without any prior experience.
Initially senior registered nurse, Pamela Dunne, clinical nurse at St. Joseph's center who specializes in dealing with dementia patients guided me and made me familiar with the requirements of the dementia patients as well as their caregivers. My supervisor for this project, Dr. Gerry Lacey provided continuous feedback of my work as well as guided me whenever I was stuck at some technical problem. I had access to various literature available online which helped me further in understand the requirements of the dementia patients and what factors should be kept in mind while designing the user interface.

4) Implementation

4.a) Introduction

4.b) The Task in Hand

4.c) Using Unity Engine

4.d) Problems Encountered

4.a) Introduction

The subsections describe the implementation of this project. It will start with discussion on the task in hand that is the requirements of the application then further discussion will focus what software was used for implementation and why that software was used. And in the end the problems faced while implementation will be discussed.

4.b) The task in hand

Develop an application :

1) That allows users to click photographs and videos and build multi story platform that facilitates engagement and keeps attention.

2) That allows user to share their story.

3) That allows user to create personalized stories/chapters.

4) Which is easy to use for people suffering with dementia.

5) Which is easy to use for the caregivers associated with the patient.

6) In which delete button should not be accessible by patients.

7) Which facilitates automatic save.

8) Which will work on multiple platforms

To summaries all the points mentioned above I can say that, I need to develop an application which is easy to use for dementia patients and would allow them to capture their life stories, which will be used to prolong their memories as well as used by the caregivers to support them in the advance stages of their

dementia.

4.c) Using Unity Engine

i) Why unity was chosen to develop the application?

Unity is a cross platform game engine with its own built in IDE which allows for development of either 2D or 3D applications. Unity is a cross platform software that is compatible with about 25 different platforms and is used to develop software applications majorly games.

Unity is the primary tool that was used to create this project. It was chosen because majorly because it is cross platform, but also it has a free version available for students and it provides support to the developer by making tasks easier as it has inbuilt libraries which saves time as well as is cost effective. Unity features a main scene view which displays the visual elements of the project such as buttons, etc. Any object that is used in Unity, whether it's a button, a shape, a model, is referred to as a GameObject. Game objects can be customised as per the requirement using inspector view, which allows a developer to perform various functions such as transform, rotation and scale information of the selected GameObject. You can also attach scripts and the components to it. Unity offers support for assets that are created in a wide variety of file formats. Assets created in other programs can simply be added to a game project in Unity by choosing them from the saved location on your computer and importing to your project folder. Unity makes adding imported art assets to different scenes possible by simply dragging and dropping in the desired location.

Unity's scripting is based on Unity visual studio by Microsoft. In unity you can only code using C# which is already integrated in the visual studio.

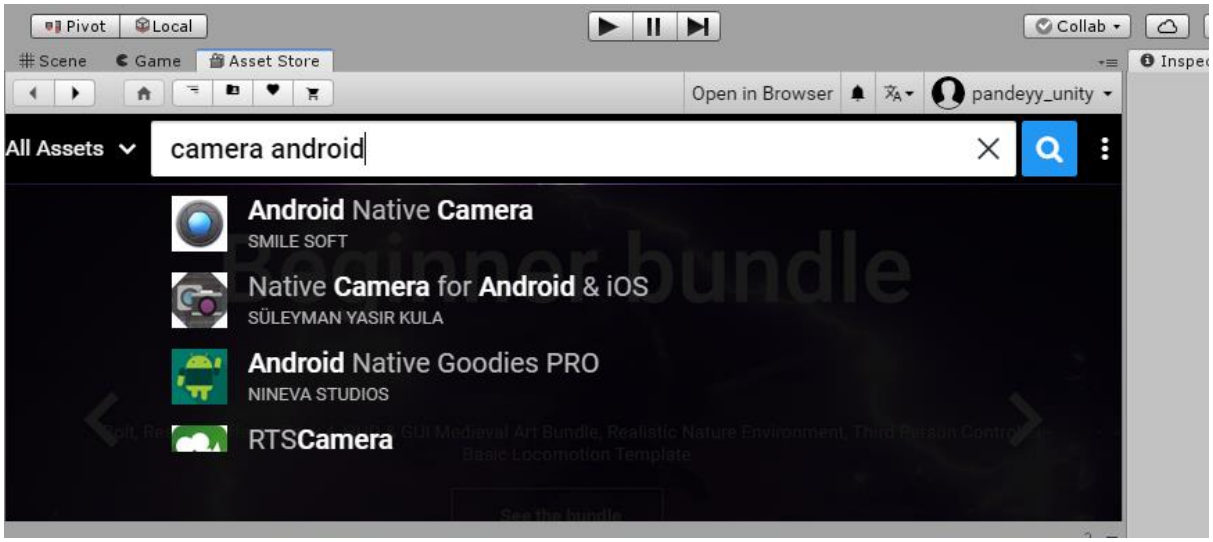
After a project is finished, developers can choose which platform they would like their project to run on for instance android, mac, windows,etc. This makes cross platform portability very easy. To develop My story application I used Unity 2018.3.3 student version(free) of unity.

Unity decreases the necessary complexity of the code and increases developers comfort and capability. Unity gives a developer just about everything they need to build an application in one package.

4.1) My story application in unity

ii) Unity asset store

The asset store is a resource that is located within the Unity editor and is also available online. The store currently consists of thousands of packages which are divided into sections and you can search them as per your need. Developer can download and use assets in their projects. They can be free or paid. Without the asset store, all the assets such as device camera would have to be created manually in android developer which in not only a difficult task and is also extremely time consuming. The asset store was used for importing the device camera plugin that allows the application to access the device camera.[17]



4.2) Asset store in unity

iii) Unity visual studio

Unity visual studio is an IDE which is installed with Unity 3D. It allows you to create and edit C# files used in the application. It is better than other IDEs because it already has many inbuilt functions and auto completion feature of code. Unity visual studio is able to interact with the Game Objects used in Unity. It can access everything attached to them such as coordinates, scripts attached to them, their tags, etc. These are very useful in creating, debugging and editing scripts. It also allows variables to be edited from Unity so changes do not need to be made in the scripts every time. Errors that appear within the IDE are also shown in the Unity Debugging Window which compiles regularly. Double clicking the error will bring you to the line of code in the script that is causing the problem.[18]

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.Video;

public class CamFn: MonoBehaviour {

    public CameraCapture CamCap;

    public Text pathText;

    public RawImage pickPreiveimage;

    private int mode = 1;

    private void Start()
    {
        if (CamCap == null) {
            CamCap = GameObject.FindObjectOfType<CameraCapture> ();
        }

    private void Update()
    {

    }

    public void takePhoto()
    {
        this.mode = 1;
        this.CamCap.takePhoto();
```

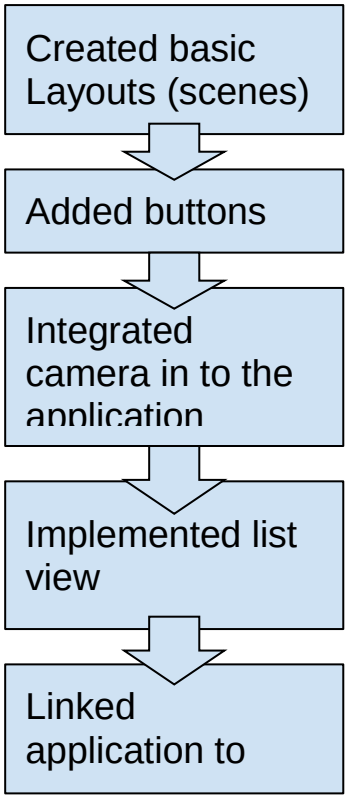
4.3) creating script to capture photo in visual studio

iv) C#

C# is a object oriented programming language which allows developers to create applications which will then run on the .NET . C# is very easy to learn as it is works in a similar way as to most other object oriented languages and since i was familiar with C++ it was just about getting familiar with the syntax of c# and different libraries and functions.

```
Assembly-CSharp                                   ListView.ListViewItem
1   using UnityEngine;
2   using System.Collections.Generic;
3
4   namespace ListView
5   {
6       public class ListViewItem : ListViewItem<ListViewItemInspectorData>
7       {
8       }
9
10      [RequireComponent(typeof (Collider))]
11      public class ListViewItemBase : MonoBehaviour
12      {
13      }
14
15      public class ListViewItem<DataType> : ListViewItemBase where DataType : ListViewItemData
16      {
17          public DataType data;
18
19          public virtual void Setup(DataType data)
20          {
21              this.data = data;
22              data.item = this;
23          }
24      }
25
26      public class ListViewItemData
27      {
28          public string template;
29          public MonoBehaviour item;
```

4.4) list view in C#



4.5) work diagram

4.d) Problems encountered

i) New software

I have had a prior experience in developing a mobile application for android but the software that I used was android studio, so developing a mobile application on unity was a new challenge for me as I had no experience with Unity before. Further Unity uses C# for scripting which I never used before for any projects. In all it was a big challenge for me to develop an application using unity from scratch without having any prior experience. But not only unity is designed in a very user friendly way but also loads of documentation is available online which helped me to get familiar with unity. C# is one of the many object oriented programming languages available and as I already have good experience of languages such as C++ and java, it was not very difficult for me to get used to C#.

ii) Technical problems

As unity is a game engine, most of the documentation for unity and other resources available online in the form of YouTube videos, etc., are mostly game oriented as unity is majorly used to develop games rather than applications. It proved very challenging for me when it came to the requirement specification of this project as I had to devout a large amount of time to find resources which were of actual help.

Unity at the time I started working on this project had no official support of the databases like sql, and having a database was one of the basic necessity of our application, so integrating sql database with unity was a major challenge I faced, but after doing some research and read forums that discuss unity problems I was able to find a SQLite plugin which i imported and used for my application.

Initially I was trying to integrate camera into my myself and I was successful up to some extent as I managed to access the device camera but I realized that to actually capture the photograph I actually needed to write a xml file in android studio which was not possible for me due to time constraints. I discussed this with my supervisor and after his guidance I was able to find a plugin for capturing images in unity asset store at a minimal cost of Euro 13, which I imported into my project.

Also as i was using a workstation with 4gb ram, and 4th generation i5 processor, the time taken by unity to process and build and the run the code was substantially high, as compared to the time it takes in latest systems.

iii) Non - technical problems

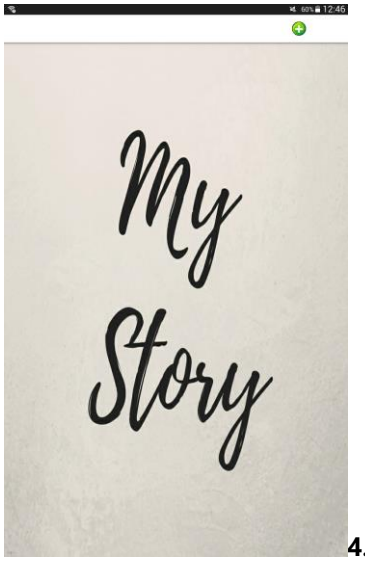
While designing applications for healthcare it is very important that the application is designed by a team not only consisting of developers but also various healthcare staff related to that field of work and if possible people suffering as well, as only this would ensure that the application is designed keeping in mind the actual requirements or needs of the user, user centered
design should be given utmost priority while developing such applications.

Ideally, this should be an iterative design process, where the final users contribute with their knowledge and experience to develop a product that can be adapted to meet their own needs in a user-friendly manner. While development of this

application, the only input from a healthcare professional I had was the initial meeting with senior registered nurse, Pamela Dunne (Nurse at St. Joseph's Center), in which she explained the requirements of dementia patients and what exactly I should keep in mind while working on this project. Although I had all the technical help I needed from my supervisor but I felt if I had frequent interaction with health care experts as well it would have helped me work on the small details of this application which in turn would have made the application even better.

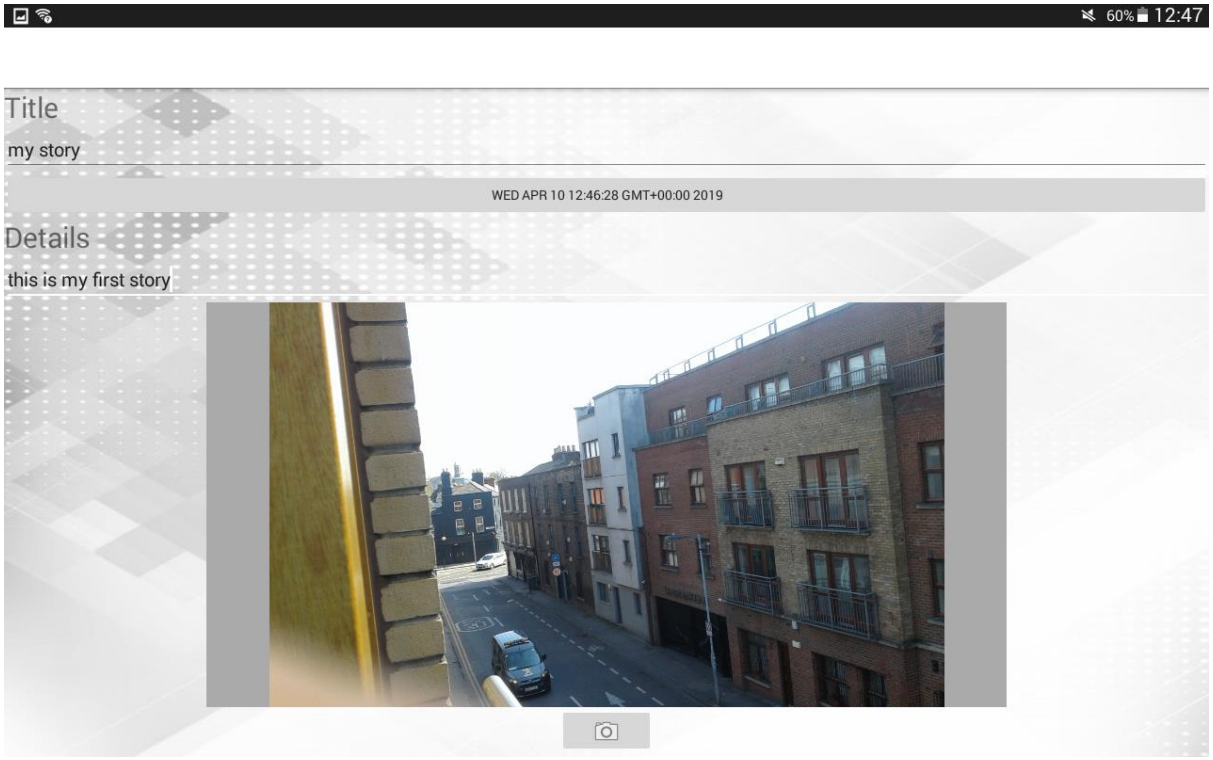
Due to the incompatibility of my cell phone with unity, the application was not working as per expected, there was a bug in the layouts but as I switched to Tablet this issue was sorted.

4.6) Landscape view of my story app



4.7) portrait view of my story app

4.8) Story creation layer



4.9) After story is created

4.10) List view showing several created stories

5) Evaluation

5.a) Introduction

5.b) Evaluation of performance

5.c) Feedback from users

5.d) Key findings

5.a) Introduction

In this section I will talk about the evaluation and testing of this application. I will start with discussing the performance of the application on various aspects and then I will discuss the user feedback and suggestion and further I will give my final thoughts on it. In the end i will discuss my future work on this application.

5.b) Evaluation of performance

The best way to evaluate the performance of the application is survey and let the end users test the application and evaluate it. There are some basic parameters on which an application can be evaluated so to know the true reaction of end users towards this application I made a survey keeping in mind those parameters, which allowed the user to rate the application from 1 to 5 on various aspects with 1 being the least rating or strongly disagree and 5 being the maximum rating or strongly agree.

I managed to get the reviews of Senior registered nurse, Pamela Dunne, clinical nurse at St. Joseph's center, who works very closely with dementia patients and also she played a very fundamental role in this project. Apart for her I got the reviews of 9 student nurses, studying in Trinity College Dublin.

The questions asked were

1) I found this app easy to use
2) I can use it without any tutorial
3) I found it easy to navigate through the app
4) The language used in the app is easy
5) The app has clearly marked buttons

6) The app is designed for all level of users

7) I would recommend this app to others

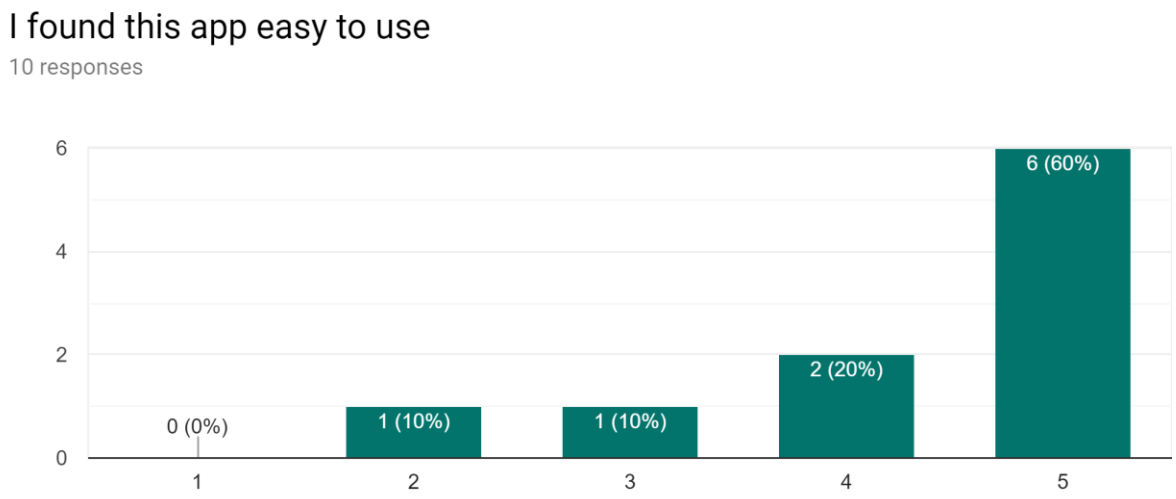
8) The app has a good look and feel

9) The app has all the features I need

10) I would give this app overall rating of

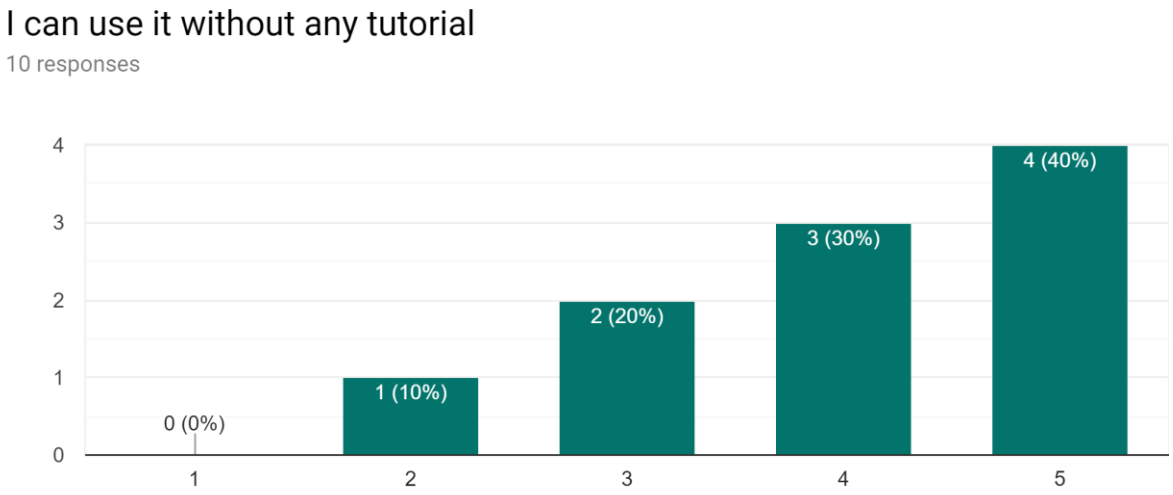
In the end I also asked users to give their feedback and suggestions if any, which is further discussed in next section.

Now let have a glance of the results and discuss this survey.



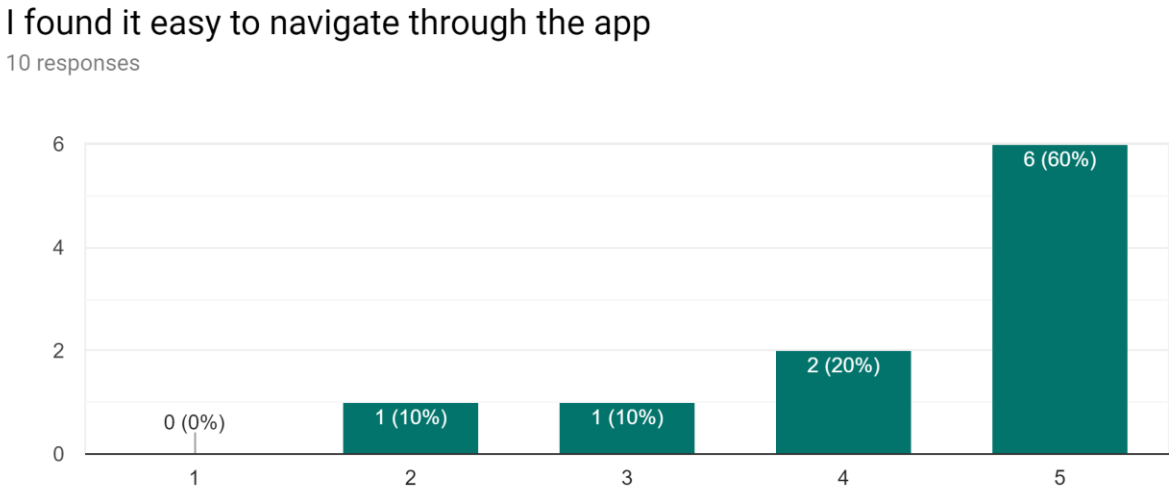
1- strongly disagree/least rating, 5- strongly agree/highest rating

It can be noted from the above graph that majority of the users found this application easy to use. Average rating was 4.3 out of 5.



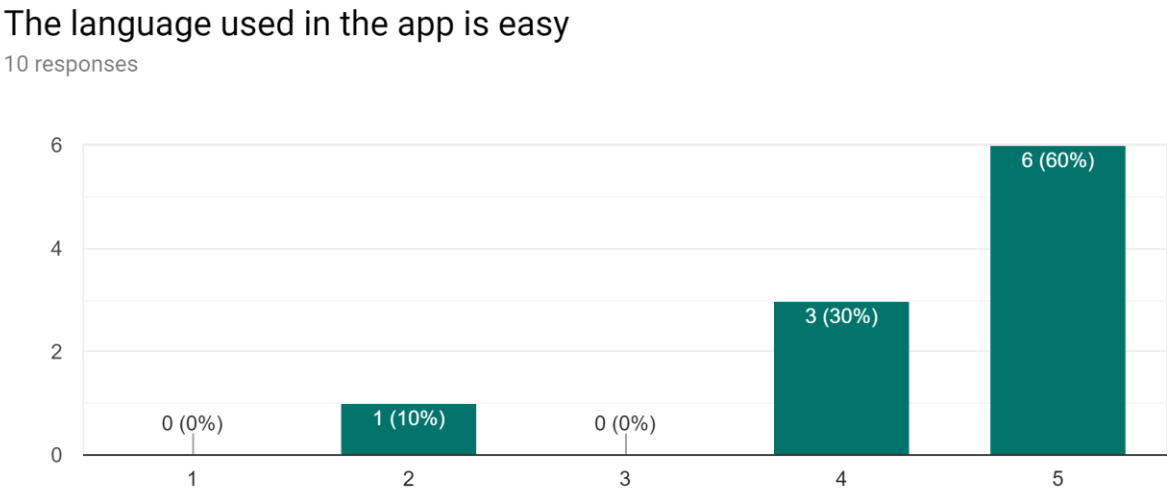
1- strongly disagree/least rating, 5- strongly agree/highest rating

Matching the previous graph, this graph also shows that majority of the users can use this application without any tutorial which again compliments the fact the application is easy to use. Average rating was 4 out of 5.



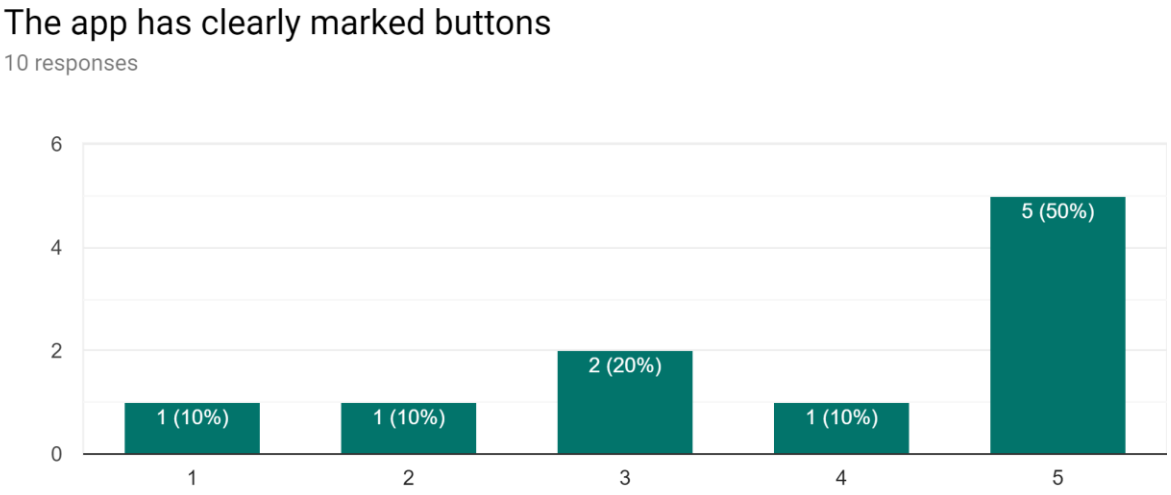
1- strongly disagree/least rating, 5- strongly agree/highest rating

Majority of the users feel that it was easy to navigate through the application from which it can be inferred that application is not cluttered that it it doesn't have many layers, it has just two layers which makes it very suitable for our end users. Average rating was 4.3 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

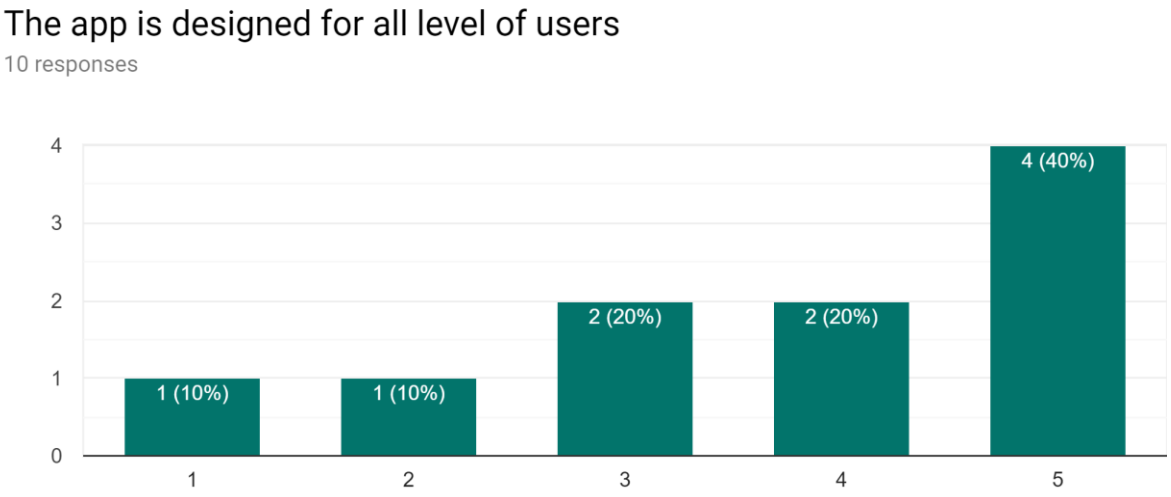
Majority of the users felt that the language used in the application is easy to understand. This again points to the fact that users will find application easy to operate. Average rating was 4.4 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

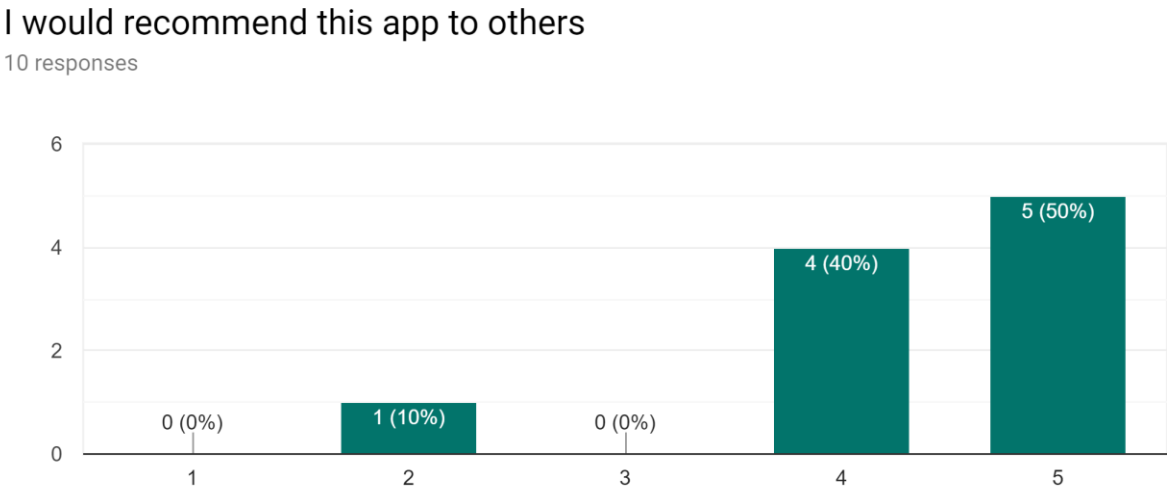
We can see divided views of the user from the above graph while half of the users thought buttons are clearly marked, the others felts that the buttons were not clearly marked, this might be because of the fact the android tabs already

have inbuilt back button, so the users of iPhone might not be familiar with this and they might be looking for back button in the application itself. Average rating was 3.8 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

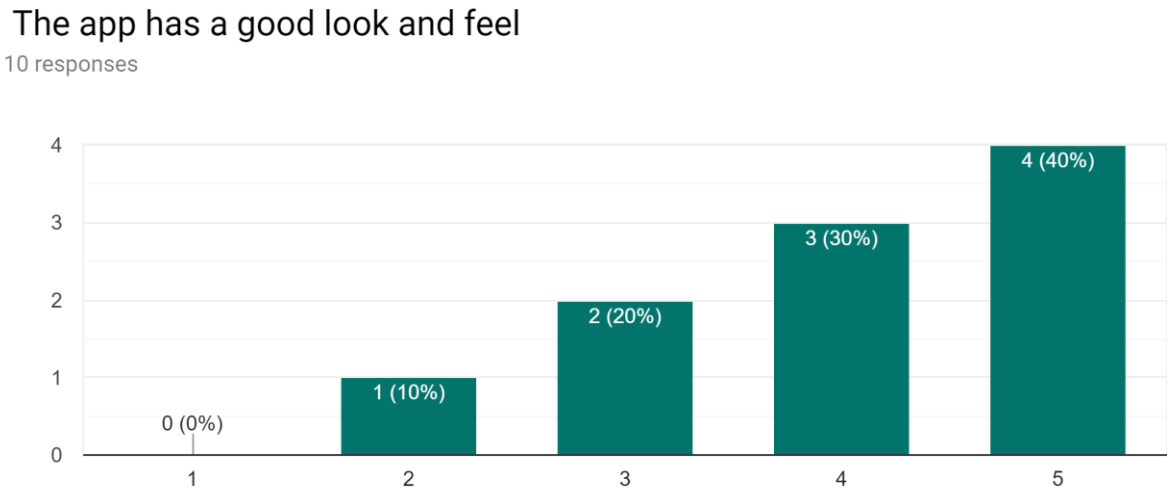
This question again received divided views of the users but still it can be said that majority of the users felt that this application can be used for all level of users. Average rating was 3.7 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

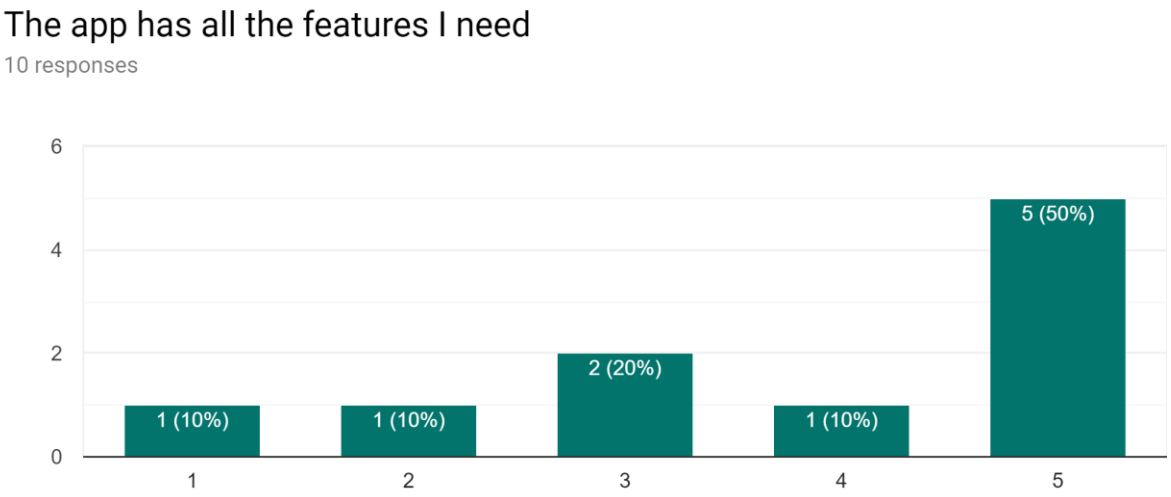
Again, majority of the people were happy with the application and felt that they

could recommend this application to others. Average rating was 4.3 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

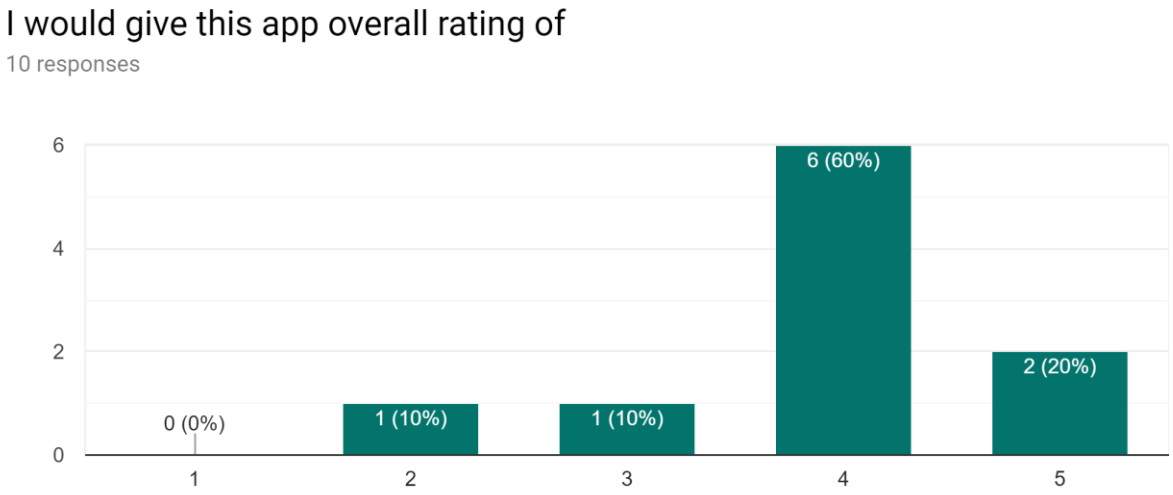
Majority of the users felt that the application has a good look and feel, the interface is not very noisy, it's simple and peaceful. Average rating was 4.0 out of 5.



1- strongly disagree/least rating, 5- strongly agree/highest rating

The views of users about the features of the application varied, while half the users thought that this application has all the basic features that they need while others thought that there are features which can be added into this application to make it better and more increase its benefit for people with dementia.

Average rating was 3.8 out of 5.



Majority of the users were happy with the application and gave it a good overall rating. Average rating was 3.9 out of 5.

5.c) Feedback from users

Apart from the survey questions, i also added a feedback and suggestions column at the end of the form so that users can voice out their opinion about the application and suggest the changes that can be made to improve the application.

Getting senior registered nurse, Pamela Dunne's (at St. Joseph's center) opinion about the application was very essential as she was one of the fundamental persons who was the lead in this project. Although she was quite happy with the first draft or first prototype of this application as it had all the basic functionalities more or less but she suggested there is still work to done before the application is actually ready for clinical use. She suggested that there should be a facility for users to group the stories they create in albums, for instance they want to create a album about families they can put all the stories featuring their families and view it whenever they want. She also suggested that there should be a feature to capture video and audio as well, which can act as a key part of storytelling. She felt that it would be even better if there is use of

thumbnails to show chapters/story because there are people who for who it is very difficult. She was quite impressed with the time stamp feature that was added in the application as this would enhance the story even more.

Majority of the student nurses who used the application was fairly happy with it, they felt that it a really good concept for Dementia patients and their families, and will help them to remember and communicate with others. While some felt that it is better to steer away from technology with older people because they are not as familiar with it but since this application is very simple to use, it could be successful in nursing homes and stuff If staff took time to sit down with dementia patients and use it. They suggested that the fonts should be larger as people with dementia has poor eyesight. Some of them even thought that application should have brighter colours this might make it more interactive. One of the nurses also suggested that application can have a face detection feature which would automatically detect faces and users can save it with their names which would help them in remembering those people whose faces are saved in the application. They were very impressed by the simple nature of the application and how it would help people with dementia capture their life stories.

5.d) Key findings

Analyzing the discussion in the previous two sections that is performance evaluation and user feedback, it can be said that considering the first draft of the application it performed good as it has all the basic features that were required for this application, but still there are some minor changes are needed and some features can be added to make this application even better. Ideally the application developed for such specific set of users and purpose needs to be designed iteratively, so this was just the first iteration and in future if worked upon this application will be fit for clinical use in very short time.

The one of the major gap in the project was the exclusion of video feature which was mainly due to the fact that I was trying to use a feature, movies texture which was till recent a part of unity but recently it got deprecated from unity and

a new feature called video players was added instead. Senior registered nurse, Pamela Dunne also suggested that album feature could also have been included

because it would have allowed users to group similar stories at one place and view them together rather than going through all the stories. While some of the users also felt that font size should be bigger, although the font size was 32 points but due to the large screen size of the device it was a bit small and hence people with visual impairment would find it difficult to read so it can be increased to around 40 points. It was also suggested that thumbnails could be added to the side of the story, people with dementia have worse eyesight so it will be more convenient for them to identify a story with a picture rather than reading title. While some users also suggested the colours should be brighter although while making this application i tried to keep it simple keeping in mind there are also people with colorblindness but the colours I used were slightly dull and were not in contrast therefore making it slightly difficult to read. While there were some shortcomings, there were also features which were new and major improvement upon our story application developed by open. Delete button was very easily accessible in the our story application but in the new my story application the users won't be able to delete stories, only the administrator can. The new my story application has just two layers and hence very simple to use as compared to our story application, and hence the ui pattern is very memorable in the my story application. Another feature lacking in the our story application developed by open university was autosave feature, which is a part of new my story application due to which users will not have to worry about saving the story after capturing as it will be auto saved and not lost, this also reduces the user input and makes application easier to use.

6) Conclusions and future works

To conclude, we can say that this project is a good first prototype but in the current state it would not fulfil every requirement that it was initially aimed to fulfilled so there are few changes that are needed and some more features will need to be added before this application is ready for clinical use.

There are few features that the application lacked currently such as video and audio features but also there are features which are new and better such as timestamp. The application autosaves stories and delete button is not accessible to user, where as in old application this was lacking. I have made a table for comparison of the old app and the new my story application.

Features	Our story (open uni)	My story
Picture story	Yes	Yes
Audio and video	Yes	No
Albums	Yes	Singular stories
Ease of use	Multilayers	Single layers
Easy access of delete	Yes	No
Time stamp	No	Yes
Auto save	No	Yes
Cross platform	No	Yes

6.1) Table showing comparison between our story and my story applications

While the new application improved upon what old application lacked yet it had some shortcomings but of which can be resolved in future and make this app ready to use clinically.

Overall I enjoyed a lot working on this project, it was a very nice experience for me. Not only I gained professional skills but also Non-professional skills. I will use. I plan

to continue working on this project in future. I am very certain that I will be able to apply the skills and experiences i gained in various circumstances of my life in future.

Future work

There is still a lot to be done on this is application to make is ready for clinical use. If I talk about short term future changes, I would like to make the fonts and the buttons bigger so that it becomes people with poor eyesight easy to use the application. I would like to add a thumbnail which shows with every story, this would make application more interactive as well as it would be more convenient for the users to identify their stories visually without even reading the story title. I would also like to add a feature using which users will be able to create customizable albums in which they will be able to group several stories together and rather than searching and scrolling through different stories they can view all the stories in that album.

For the long term future changes I would like to include video and audio capturing feature, which will allow users to capture video stories as well and allow users to add their voice to a story, this would be a key part of the whole story capturing and storytelling. I would also like to like this application to an online database such as firebase, which will ensure that users stories are safe and backed up if any mishap happens with the device and are not lost.

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