



GRIFFITH COLLEGE LIMERICK

Bachelor Degree in Computing Science (Honours)

E-reader for the Mobility Impaired Android Mobile Application

Project Proposal Form

The form, fully completed, must be returned to:

Sonia Zheleva
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Griffith College Limerick
O'Connell Avenue
Limerick

Final Year Research & Development Project Proposal

PROJECT TITLE:	<i>E-reader for the Mobility Impaired Android Mobile Application</i>
STUDENT NAME & ID:	
NAME OF DEPARTMENT:	Engineering, IT & Computing
PROGRAMME	Bachelor (Honours) Degree in Computing Science
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PROJECT SUMMARY:

The proposed in this document Project will undertake research and development of a mobile application that will integrate speech recognition for voice commands to allow for independent books reading by mobility impaired persons on a tablet or smart phone without touching the screen. The developed application will benefit the mobility impaired in navigating easily through a book of their interest and the overall application, just by giving voice-commands, without assistance of a caregiver, thus contributing to their independence, mental health stimulation, and broadening their learning skills in comprehension and understanding different subjects.

OTHER INSTITUTIONS / DEPARTMENTS / PERSONNEL ASSOCIATED WITH THE PROJECT:

FULL DESCRIPTION OF THE PROJECT:

Problem Statement & Project Background:

For the last decade, more and more people in Ireland consume entertainment through use of smart phones. As of June 2019, 84% of Irish households own a smartphone (Communications Regulation, 2019). This means majority of the households today have access to entertainment directly from their phones, like movies, television shows, music and books. Nearly all of these categories make their entertainment available to disabled consumers as well.

One common disability is the mobility impairment. Three people a week in Ireland sustain a spinal cord injury that affects their arms and legs. This includes non-traumatic (meaning degenerative) diseases, spinal cord injuries, which is 26.7 per million population as of 2017. Having a spinal cord injury forces the victim to remain at home most of the time, which becomes mentally and emotionally draining (Shanahan, 2019). This is why it is important for people with housebound disabilities to access entertainment easily.

The mobility impaired are using Assistive Technology to get information online and to interface with the tools needed to consume various media. The way people get over the hurdle of using their hands to touch screens or type on keyboards is to use the sensory inputs that still function above the neck. Inputs, like the GT3D eye tracker, use already existing off-the-shelf items, like two cameras from a video game console attached to a pair of eyeglasses,

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barely outside the user's field of vision. The cameras photograph the pupils of the wearer's eyes and coordinate the place of the pupil with the place they are looking at on the screen (Ruger, 2020). An input device that is more tailor-made would be the commonly named "sip and puff" which is a mouth-controlled joystick that interprets sipping and puffing on a straw-like device to mouse movements on a computer (Axistive, 2007).

Ireland has the lowest employment rate for people with disabilities in Europe, 20% lower than EU's average of 50.8%. And as regard to poverty, the disabled in Ireland suffer 10% higher than the EU average. There are ongoing discussions to grant funding for an Assistive Technology Passport which will allow the disabled to receive proper education, employment, and independent living (Disability Federation of Ireland, 2020). Funding for the disabled to have access to learning materials without the added cost of Assistive input devices should be possible nowadays.

The advent of voice assistants has enabled the mobility impaired to use a new approach in accessing different media. As of 2018, Amazon's Echo Dot was mostly used for listening to music, audiobooks, and looking up information on the Internet. The voice assistant helped quadriplegics by giving them a little bit of independence throughout the house (Pradhan, *et al.*, 2018). With voice assistants, users can now access movies and television programmes by using applications that interface with the assistant's API. For example, Netflix interfaces with the *Amazon Echo* and *Google Home* IoT devices by allowing the user to wake up their assistant and to navigate through the menu to play any media available (Netflix, 2020).

Using a voice assistant to read books should be available in the same manner. Voice assistants make audiobooks available as background noise. Audiobooks benefit from non-interaction, but they are limited to the attention span of the listener. Reading the text is an active task that takes the reader's mind off every other distraction to focus on interpreting the text in their head. Audiobooks may also manipulate the reader's own interpretation of the book by using a different tone of voice in certain passages (Kommers, 2018).

The decision to choose an Android development environment has been made since as of 2019, nearly 40% of the smartphone users in Ireland use Android phones whereas 32% are using iPhones (Communications Regulation, 2019). This means the android application will reach a broader market. Android phones and tablets are also easier to obtain and develop for,

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compared to Apple phones, due to not being tied down to the restrictive proprietary software environment. With the majority mobile share being Android, the interfacing IoT device should be compatible to the Android, therefore the *Google Home* assistant would be suitable to use for the proposed application development. It not only can interface the proposed Android application with its own API but can also be integrated with the mobile device itself.

The decision to add a voice assistant integration into the proposed mobile application was made because a peaceful book reading process is important for the mental health of a person. It was found that living in a quiet area has a very positive impact on health (European Commission, 2015). Therefore, for a mobility impaired individual, trapped for most of the time in their home, it is very important to keep their mental health at a good level. With an added voice assistant integration in the proposed book reading application, it would be easier for them to navigate through the book utilising the application's interface, instead of passively listening to an e-book reader.

Project Goal:

The Goal of the proposed in this document Project is through research in the needs for more independent life, good mental health, and wellbeing of mobility impaired persons with various arm impairments or spinal cord injuries, to develop a suitable Android mobile application which could integrate voice recognition and assistance in an independent book reading process for the mobility impaired. Utilising the Google's voice assistant and interfacing Google Mini IoT device, the application will provide the needed independence level of the users without a caregiver's support to read a book on their Android smart phone/mobile device. With the aid of voice commands, impaired users will be able to select book titles, turn book pages, add bookmarks, and receive other book recommendations in the field of their interest, based on their reading speed. This will help readers with developing their own reading and comprehension skills, while they are actively engaging in the material, rather than passively listening to a book in an audio format.

The application will accommodate multiple book formats that are not tied down to a proprietary software environment (like Amazon, etc.) and does not limit the user's choice.

Project Scope: The project is delimited to disabled people with arm mobility impairments in the Limerick area.

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Project Objectives:

The objectives of the Project are as follows:

- Brainstorm ideas to identify suitable topic in the field of mobile development
- Perform initial research, limiting the scope of the Literature review on the chosen topic to:
 - Technology used nowadays by the mobility impaired individuals to assist in the process of independent reading of books and ways to be simplified.
 - The use of Google's voice assistant and Google Home IoT device and how to integrate it with Android mobile application.
- Prepare the Project Proposal
- Perform Primary Research on topic:
 - Apply *Quantitative* Research method to design a Survey questionnaire for the target audience to gather information and their opinion and experienced difficulties in the process of independent book reading.
 - Critically analyse the results to evaluate the feasibility of the proposed project and complete Thesis Ch.1.
- Carry out a comprehensive Literature review on the topic with historical and current perspectives, and Case studies on similar, already existing applications; complete Thesis Ch.2.
- Structure the functional and business requirements for the application to be developed into a Conceptual model. Complete Thesis Ch. 3
- Design and Code the GUI and data structures of the application
- Integrate the application with *Google Home* IoT device to make it available for *smart home* users. Complete Thesis Ch. 4.
- Test of the application integrated with the IoT device (*Google Home*) and complete Thesis Ch. 5.
- User-evaluate the developed application, critically analyse the results, provide meaningful conclusions and scope for future work; Complete Thesis Ch. 6
- Prepare Project presentation slides
- Compile and submit the Thesis and present the Project

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Project Methodology & Evaluation Criteria:

The project will follow a *Quantitative* Research method to gather insights into the target audience's opinion on feasibility and viability of the proposed mobile application development.

The *Quantitative* method involves designing and distributing a Survey questionnaire to a sample of mobility impaired people, gathering of quantitative (statistical) data, which will then be analysed to determine the necessary features of the application and compare with already existing similar applications. The Survey will be undertaken in Limerick area, using Google Forms.

During the Analysis phase of the application development, Use Case, Sequence, and Object Class diagrams will be constructed and used to present the functional requirements specification for the proposed application, according to the results of the Survey. Following this, the prototype of the mobile application will be designed and developed.

Evaluation Criteria:

Once developed the application prototype will be available on Google Play Store for users to undertake evaluation. An online Evaluation Survey will be conducted to obtain feedback from the target users. This feedback will aid enhancement of the application (if needed) in making it more robust and according to the users' needs. The Evaluation Survey will address the following key factors from user feedback and comments:

- **Accessibility:** Evaluation of the availability of the application to users, including cross compatibility between Android devices and future compatibility and ability to access the application.
- **Navigation:** Evaluation of the simplicity and intuitiveness of navigating through the application, with a clear indication of navigation menus defined where the user can easily anchor to different topics.
- **Design:** Evaluation of the overall aesthetic value of the application's graphical user interface, including use of appropriate colour scheme, fonts, size, and placement of interface elements.
- **Content:** Evaluation of the presented information's value for the purpose of the application. Appropriate styling and formatting for ease of readability.
- **Security:** Evaluation of the security measures put in place to avoid sensitive user information of getting hacked. Provision of strict measures against security flaws.

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Project Milestones, Deliverables, Risks:

The Project Milestones are as follows:

- Initial research to identify suitable project topic.
- Perform preliminary Literature Review on the topic, including Case studies of already available similar e-reader mobile applications for mobility impaired persons
- Submit First draft of the Project Proposal for review
- Complete the Project Proposal
- Design and distribute Survey questionnaire to sample of mobility impaired individuals and their caregivers to gather their opinions on assistive technologies for reading used today and features they would like to see in the proposed for development application
- Critically analyse the results obtained from the Survey to evaluate feasibility of the proposed Project and complete Thesis Ch.1.
- Perform comprehensive Literature review on the Project topic and complete Thesis Ch.2
- Undertake Application Analysis and structure the system's functional requirements in a Conceptual model; Complete Chapter 3 of the Thesis
- Submit Thesis First draft for review
- Undertake Design and Coding of the e-reader application to be integrated with Google voice assistant and Google Home IoT device; Complete Thesis Chapter 4
- Choose appropriate Testing method to test the application and complete Thesis Chapter 5
- Perform User Evaluation, critically analyse the results, reflect on project achievements, provide conclusion and scope for future work on the project and complete Thesis Chapter 6
- Submit a Thesis Second draft for review
- Prepare a PowerPoint presentation for the Project
- Collate and submit the Thesis and present the Project.

Project Deliverables:

- Project Proposal draft
- Completed Project Proposal
- Thesis First draft
- Thesis Second draft
- Completed Thesis

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- Application Source Code
 - Project Presentation slides

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Project Timeframe & Gantt Chart:

Include key timeframe, milestones, grant chart, identify risk and an RMMM matrix (Risk, Measurement, Monitor, Mitigation)

#	Milestones	Deliverables	Duration
1	Perform initial research to identify suitable project topic	Appropriate project topic & Research method identified	2 weeks
2	Perform preliminary Literature Review on the chosen topic to prepare the Project Proposal	Project Proposal draft	3 weeks
3	Amend the Proposal according to Supervisor's feedback	Completed Project Proposal	1 week
4	Design and distribute Survey questionnaire to sample of target audiences	Statistical data from the target users gathered and analysed; Thesis Ch.1 completed	3 weeks
5	Perform a comprehensive Literature review and write Ch. 2 of the Thesis	Completed Thesis Ch. 2	2 weeks
6	Perform System Analysis and structure the application's functionality in a Conceptual model; write Thesis Ch.3	Completed Thesis Chapter 3	3 weeks
7	Submit First draft of the Thesis for review	Completed Thesis Chapters 1, 2 and 3 submitted	1 day
8	Learn required new languages	Coding skills in Android Studio and Google Firebase gained	2 weeks
9	Undertake Design and Coding of the e-reader application to be integrated with Google assistant and Google Home	Developed application Prototype, integrated with <i>Google Home</i> IoT device; completed Thesis Chapter 4	8 weeks
10	Select appropriate Testing method and perform application Testing	Fully tested application; Thesis Ch.5 completed	2 weeks
11	Perform User Evaluation, analyse results, reflect on project achievements, conclude, and provide scope for future work in Ch.6	Completed Thesis Chapter 6	3 weeks
12	Submit the second draft of the thesis	Thesis chapters 4, 5 and 6 completed and submitted	2 weeks
13	Prepare a PowerPoint presentation	Project presentation completed	2 weeks
14	Submit collated and completed Thesis and present the Project	Thesis submitted and project presented	1 day

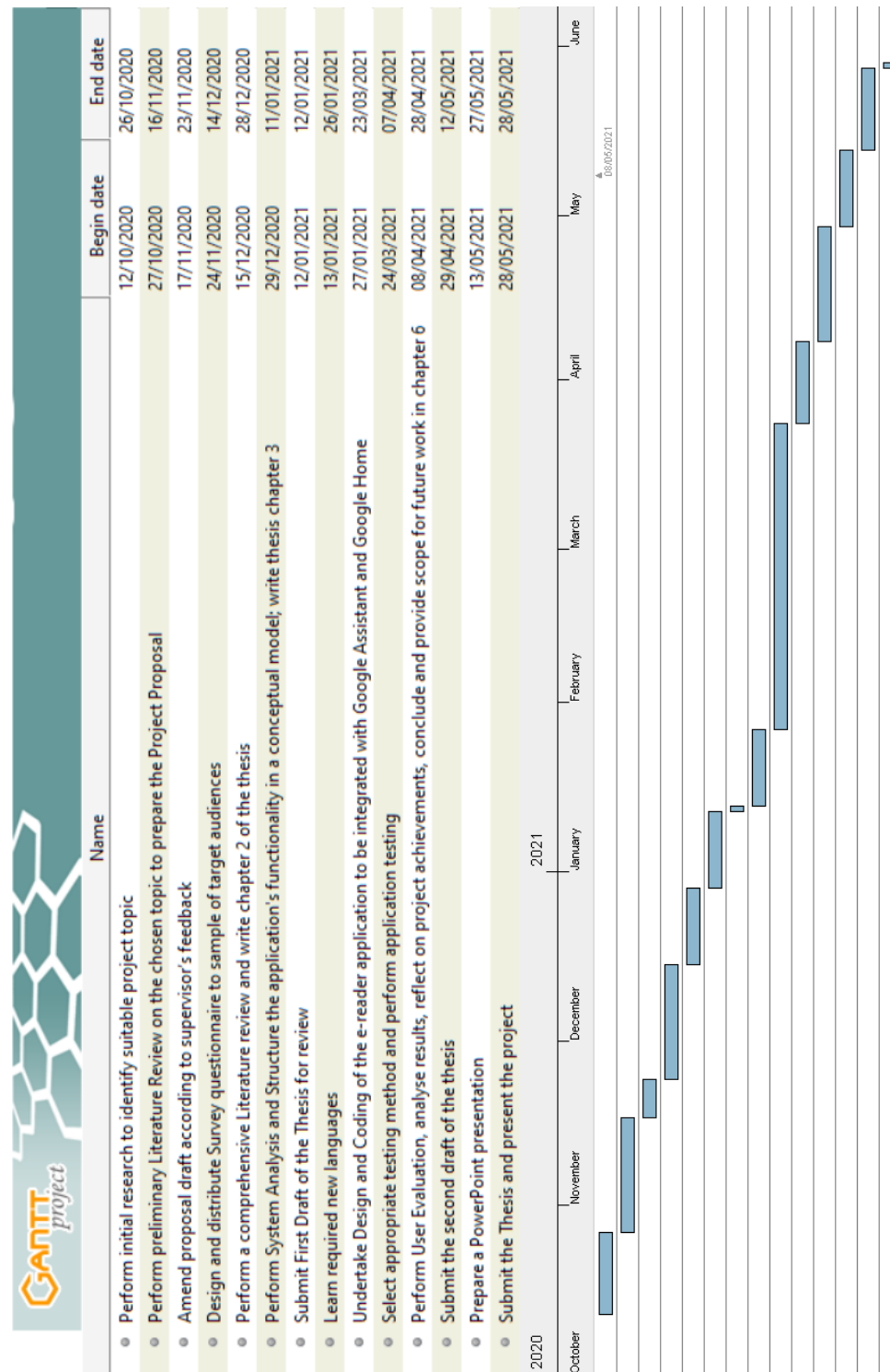
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Project Risks:

No.	Risk Description	Impact	Action
1	Time to learn new application programming languages	Critical	Dedicate time to learn programming languages early on with online tutorials
2	Proper Project Time Management	Critical	Apply good time organisation to all Project tasks to complete the Project on time & schedule
3	Data Loss	Critical	Backup data frequently on the Cloud and on separate disk storage devices
4	Google Home API authorisation for interfacing	Critical	Research Google Home beforehand to find the appropriate steps to undertake integration with the application

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Project Gantt Chart:



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Student Signature:

Date:

Supervisor Signature:

Date: