SCIENCE APP FOR O/L STUDENTS USING AUGMENTED REALITY

Project Id: 2020-160

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology

Department of Software Engineering

Sri Lanka Institute of Information Technology
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DECLARATION

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
U.S Hettihewa	IT17106252	

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor:

…… ……..

Ms Uthpala Samarakoon Date

ABSTRACT

In recent years, many information technologies have been applied to learning environments in an attempt to overcome limitations in traditional teaching environments. With the advancement of wireless communications, lot of technologies have been applied to improve learning motivations. Advancement in wireless technology have raised interest on researches in the development of E-learning environments to enhance learner motivation and learning performance. Augmented Reality is one of the latest technologies that offer virtual learning environment. This study reports the use of augmented reality (AR) technology to generate virtual objects for use in mobile devices to create AR enabled application as a support for Ordinary Level students to study about plant bodies in an efficient and interactive way. The goal is to provide learners a friendly, interactive engaging media to enhance learning performance. The main functionalities of proposed function includes the following, 1) Stimulate learning intention through outdoor learning. 2) 3D demonstration of virtual objects related to organization of Plant Cell and tissue structure. 3) Video demonstration on the process of Photosynthesis. 4) Video demonstration to understand the production of Oxygen during Photosynthesis. 5) Aims to improve communication and collaboration skills to ease Science learning. The motivation behind the proposed function is to enhance learner friendly, interactive learning environment to learn on plant organization.

Keywords – Augmented Reality, Science, Ordinary Level

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1.INTRODUCTION

1.1 Background

Basically traditional classroom was carried out through face-to-face instructions where the learning activities were conducted by the teacher. Rapid advancement in Information Technology have created organized learning environment, going beyond the traditional classroom. According to the statistics of national examinations department [1] the science passed rate at the G.C.E ordinary level examination is comparatively lower than other compulsory subjects. The science content has become more advance than the previous syllabus with new concepts to learn [3]. The deep concepts of science have become the reason for getting lower grades. Nowadays Augmented reality has become growing field of Information Technology. Augmented reality based mobile apps are an effective mode in E-learning as it is having the ability to demonstrate even deeper concepts in an attractive and interactive way. Once the student points her device's camera on some content of her text book, the app can recognize and display 3D models, animations, videos or further clarified descriptions. Since Science subject mostly goes with practical sessions, it will be easy to build an attractive learning environment. The main objective of this function is to develop an augmented reality based mobile application to support on the study of plant bodies for Ordinary Level students.

1.2 Literature Survey

Today, technology has become an important part in everyone's life, making it nearly difficult in survival in any field. Education is one of those fields which use technology for its development and enhancement to obtain the desired outcome. Combination of technology and education has opened new opportunities for an attractive learning environments, and it has brought education to a level which makes it more beneficial and effective for the students. Among different kinds of technologies which are been used for the educational advancements, Augmented Reality (AR) has become one of the most popular technologies these days. Moreover, it has its own characteristics and benefits that are beneficial to support learning and make students more interested in learning. Since AR brings lots of benefits to the field of education, many researches have been carried out to emphasize its true usage in this field.

Athanasios S. Drigas and Pantelis Angelidakis together have carried out a research on the effects of usage of electronic devices in the field of education. As discussed in the research they have used selected mobile applications measure how effective is to use mobile devices in learning environment. A predefined measurements have been used to measure user satisfaction on using electronic devices in education. Whole research discussion is based on a questionnaire,

1) Can technology assist student learning?

2) How can an app be of use within education? [7]

At the end of the report it is concluded that E- learning encourages an anywhere – anytime learning habit and easy access to critical data which will take hours of search to find resources.

Apart from the above mentioned researches, the research carried out by Kamalika Dutta, the benefits and the detriments of AR with regard to e-learning has been emphasized. Furthermore, this research has explained some relevant aspects which is need to be considered in order to identify the true benefits of the AR technology in order to improve the learning processes[8]. Similarly, V. Camilleri and M. Montebello have emphasized in their research that the industrial-age approach have been added barriers between the "classroom" setting and the real world, and AR is one of those powerful technologies which can break these barriers. The following advantages of AR have been mentioned in the research.

- Experimentation in encouraging learners to try and learn in the process.
- Experiment on which is more engaging than other digitally mediated technologies.
- Motivation stimulated by the people's own active part.[9]

"Cell world", which is an available app on play store gives the user a 3D view of an interior structure of a plant cell and helps to discover the details of each cell part by navigating in game-like fashion to the Nucleus, Mitochondria, Ribosomes and more. [4]

"Plant Tissue Plus", which is an available app on play store, utilizes your device's camera allowing you to capture photos to include with analysis results making grower discussions easier. [5]

"Biology Photosynthesis L", which is an available app on play store, describes the user on Photosynthesis process and a plant performs these functions. [6]

According to the above mentioned facts, it is clear that AR is one of the most powerful technologies which can be used to enhance the field of education. Even if it is true, in Sri Lanka, this technology is rarely being used for the purpose of enhancing the education of our children. Therefore, implementing an AR application can be highly important in Sri Lanka, and it can surely be useful to obtain the educational advancements, and encouragement to the students in their academics.

1.3 Research Problem

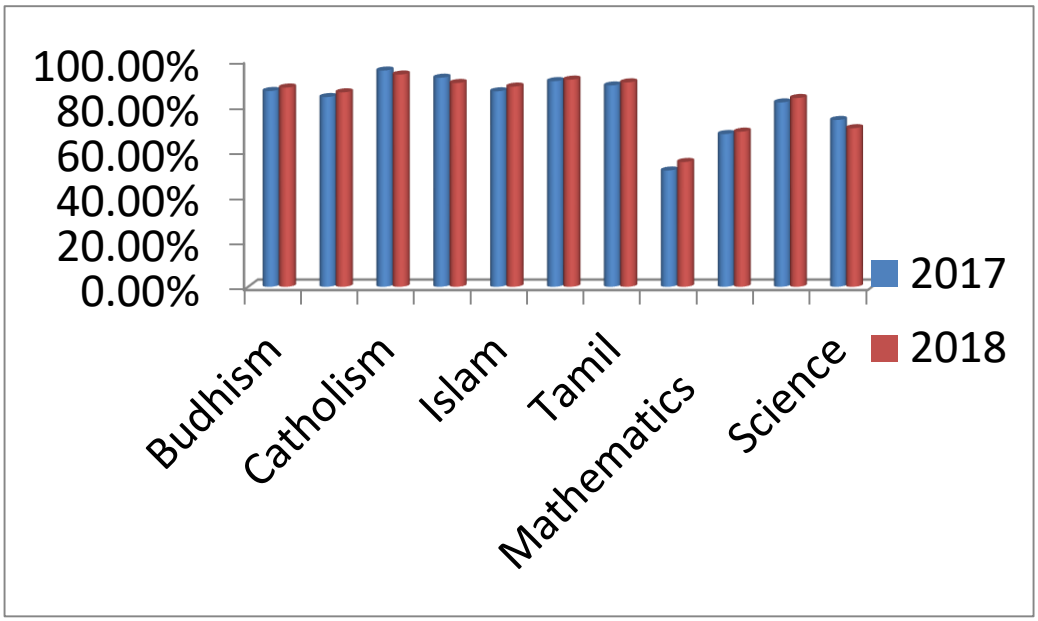

Figure 1.1: Passed percentage of compulsory subjects during previous two years [1].

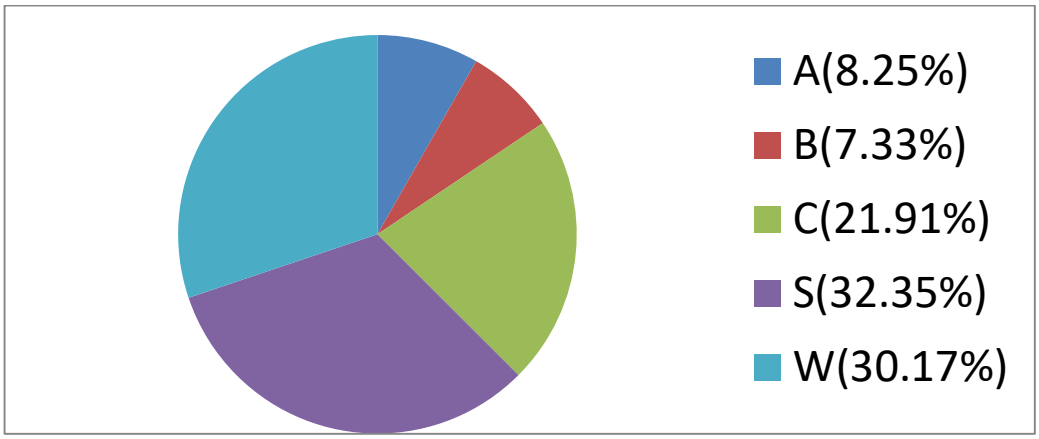

Figure 1.2: Science results of 2018 by grades [1].

Figure 1.1 depicts that the amount of students who have passed science is somewhat low than other major subjects and Figure 1.2 depicts that the amount of students who have scored higher grades at the ordinary level examination is low. Most of the students have scored average grades (c and s).

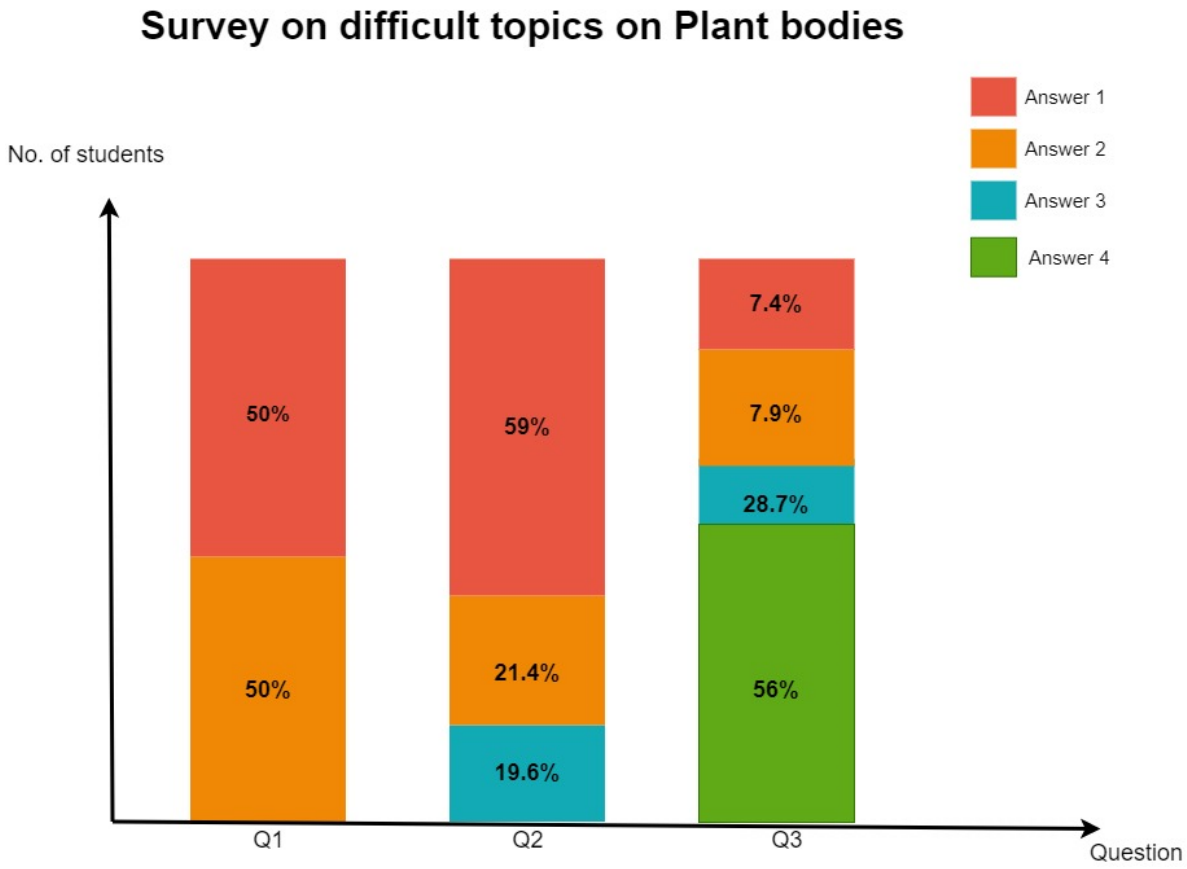

Figure 1.3: Survey on ordinary level students on weak topics about Plant structure.

Figure 1.3 depicts the opinion of ordinary level students on the difficult topics about plant structure out of 40 students. The survey proved that students are interested to learn on Structure of plant bodies, process of photosynthesis and production of Oxygen during photosynthesis. So this function implemented to cover up those weaker topics.

1.4 Research Gap

The below table is a comparison of the proposed app with the existing apps. According to the comparison the proposed function will be an assistance to the learner to go for a higher grade.

Table 1.1: Comparison with existing systems

	3D Animations on Plant cell structure	3D Animations on Plant tissue structure	Videos on Photosynthesis	Specific to Local Syllabus
Cell World [4]	No animations	✗	✗	✗
Plant Tissue Plus [5]	✗	No animations	✗	✗
Biology Photosynthesis L [6]	✗	✗	✗	✗
Proposed App	✓	✓	✓	✓

2 OBJECTIVES

2.1 Main Objective

To improve G.C.E ordinary level science results by introducing an augmented reality based self-learning mobile application.

2.2 Specific Objective

- Generating 3d models on 2d images to make studying more effective.
- Focus on practical approach rather than just only learning theory.
- Instead of reading theory about processes of human body systems, plant bodies and other scientific procedures students can see those with their own eyes in action.

3 METHODOLOGY

The proposed system is a mobile application to support ordinary level students of Sri Lanka in their science subject. Augmented reality is used as the technology, though it can demonstrate hard concepts of science syllabus in an attractive and interactive way. As a result of the survey we were able to find out the area which most students need support and the proposed application mainly focuses on those difficult areas. The proposed mobile application is implemented as a combination of four major components, and this study refers to the component for students to learn about plants using augmented reality. The performed survey depicts that among the content to study under this topic most of the students would like to have 3D support on the tissue structure. This component will be helpful for students to learn about plants using augmented reality. Once a student captures a given image of a plant tissue or cell, the application will extract its details and those details will involve in searching for 3D demonstrations of the internal structures of the cell and tissue from the vuforia database and a suitable 3D demonstration will be done on the captured image. If a student captures a description on the photosynthesis process it will be converted to a meaningful augmented video.

3.1 High Level Architecture

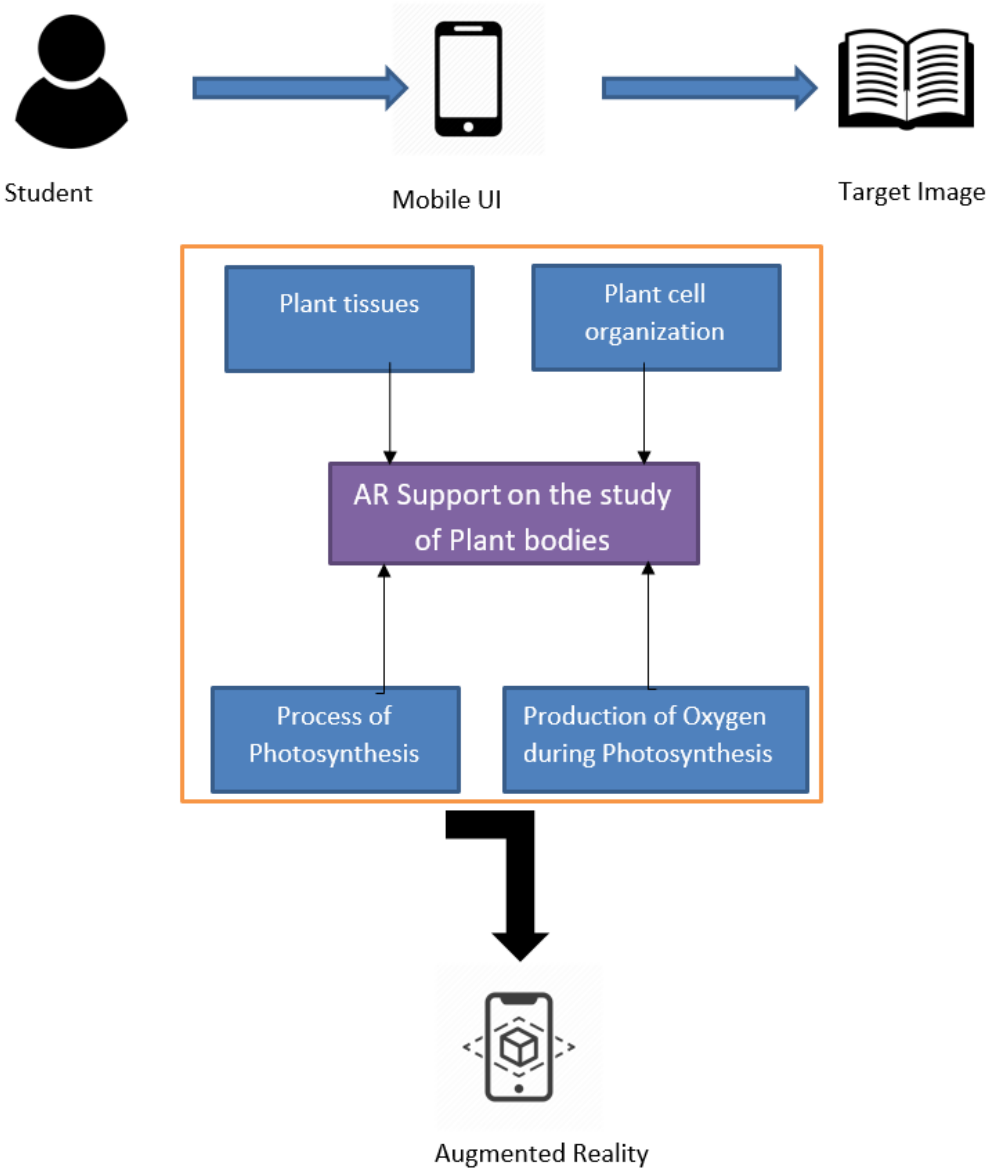

Figure 3.1

3.2 Work Break Down Structure

The below diagram gives a detailed view of the breakdown of the work to be done in the research. Formation of a group, Selection of a research area and the problem was the initial steps taken as the initial step. Then the documentation is needed to be done including Topic Assessment Form, Project charter, Project proposal, Research paper and finally the report. The development phase is based on three sub components AR demonstration on plant structure, Experiments related to production of Oxygen during Photosynthesis, AR demonstration on Photosynthesis. The final phase is on testing which is based on Unit testing, Sub system testing, integration testing and user acceptance testing. The development of each component will be done by the group members. At the end of the development phase, each unit will be tested individually, to ensure that it is error free.

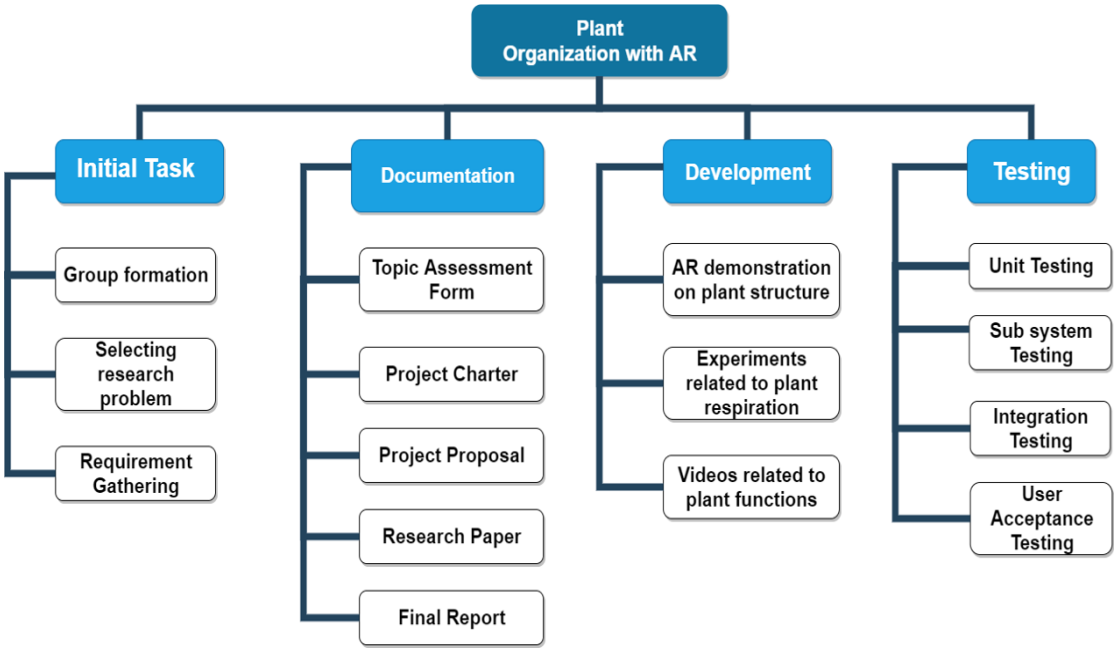

Figure 3.2

3.3 Gantt Chart

The chart describes the time management schedule of the tasks that is supposed to do during the given time period.

	Task Name	Duration	Start	ETA
1	Forming a Group	1 day	04.10.2019	05.10.2019
2	Selecting a Research Area	6 days	06.102019	12.10.2019
3	Identify an Existing Problem	5 days	13.10.2019	18.10.2019
4	Requirement Gathering	1 month	18.10.2019	30.11.2019
5	Topic Registration Form Preparation	3 days	30.11.2019	03.01.2020
6	Charter Preparation	4 days	18.01.2020	22.01.2020
7	Preparation for the proposal presentation	6 days	22.01.2020	28.01.2020
8	Preparation for the Proposal document	3 weeks	28.01.2020	14.02.2020
9	Completing 50% of development	4 months	15.02.2020	02.06.2020
10	Development	1 month	05.06.2020	06.07.2020
11	Preparation of the research paper	9 days	07.07.2020	16.07.2020
12	Preparation of Final report(Draft)	11 days	17.07.2020	28.07.2020
13	Completing 90% of development	40 days	29.07.2020	09.09.2020
14	Sub Component Testing	5 days	10.09.2020	15.09.2020
15	Intergration	5 days	16.09.2020	21.09.2020
16	Final Report feedback from supervisor	1 day	02.10.2020	
17	Doing requested changes of the report	5 days	03.10.2020	08.10.2020
18	Integration Testing	5 days	09.10.2020	14.10.2020
19	User acceptance Testing	2 days	14.10.2020	16.10.2020

Figure 3.3

4 PROJECT REQUIREMENTS

4.1 Functional Requirements

- The ability to demonstrate processes related to plant bodies.
- The ability to convert 2D images into 3D models by just only capturing by the phone.
- Ability to convert detailed descriptions into interactive augmented videos.

4.2 Non-functional Requirements

- Availability.
- Usability.

4.3 User Requirements

- Attractive and interactive manner to learn science.
- An easy way to learn advanced concepts of science.
- Ability to study science without referring to PowerPoint presentations and hand outs.

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[9] M. Montebello and V. Camilleri, "Augmented Reality in interactive e-Learning," 2008.

Appendix A

Sample Questionnaire

Q1) Which of the below topics on plant processes, you feel difficult in your studies? Number according to your preference. (1-most difficult, 3-least difficult)

Answer 1) Photosynthesis
Answer 2) Plant respiration
Answer 3) Reproduction

Q2) Number the following according to the order which is hard for you to study (1- most , 4 - least)?

Answer 1) Plant cell structure
Answer 2) Plant tissue organization

Q3) Which of the following experiments do you feel difficult from your science syllabus? (1-most, 5-least)

Answer 1) Identify Starch is produced during Photosynthesis.

Answer 2) Carbon dioxide is required for Photosynthesis.

Answer 3) Chlorophyll is required for Photosynthesis.

Answer 4) Oxygen is produced during Photosynthesis.