

**SCIENCE APP FOR O/L STUDENTS USING
AUGMENTED REALITY**

Project Id: 2020-160

Project Proposal Report

Liyanage P.M – IT17157988

Bachelor of Science Special (Hons) Degree in Information Technology
Specializing in Software Engineering

Department of Software Engineering

Sri Lanka Institute of Information Technology

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DECLARATION

I declare that this is my 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 my 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
Liyanage P.M	IT17157988	

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

Signature of the supervisor:

.....

Ms Uthpala Samarakoon

.....

Date

ABSTRACT

Science is main and important subject in Sri Lankan G.C.E Ordinary Level Examination. Because Pass science in good grade is needed to follow G.C.E Advanced Level in science and math sections. But we were able to see there is a decrement on results of science compared to the other subjects after analysing the results of G.C.E ordinary level science subject of past two three years. Students have to refer the text book provided by the government to learn the subject but most of students have problems in conceptualizing while reading the text book. And most of learning materials in form of books and some materials can only use in laboratory. Therefore we assumed that results can improved by moving students to learn in interesting way because it is a way to influence student motivation in self-learning. Human Biology section becomes important topic in Biology in science syllabus. Nowadays Technology is everywhere and most of people tend to use mobile phones. Considering above mentioned matters we decided to develop 3D mobile application with Augmented Reality using Unity IDE and Vuforia engine. Augmented Reality is modern technology which have capability of converting to 2D images into its 3D version. This system is mainly focus on Digestive system and Urinary system. System overview, functions of each systems and diseases and disorders going to describe with this system according results of the survey we did. Systems are going to demonstrate using Animations, audios videos texts which effects students in different ways there are vision, listening. This system is which motivate student in self-learning and helps to increase results.

Keywords: Augmented Reality, 3D Mobile application, G.C.E ordinary level

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1 INTRODUCTION

1.1 Background

Science is most important and compulsory subject in G.C.E Ordinary Level examination. As well as the pass in science in good grade is essential to follow the Biological stream in G.C.E Advanced Level examination. But there is a decrement on results of science subject compared to the other compulsory subjects and most of passing students passed by getting average marks according to statistics of national examinations department [1]. With the introduction of new syllabus its content has become more advanced than the previous syllabus. Science is a practical subject and lack of proper practical experience will make it hard to understand the subject.

This research done to improve student interesting on Human Biology. Human Biology is important section in science syllabus. Human Biology section and animal cell in the O/L science Subject are going to describe within this research. Human Biology is about tissues, shape of the body anatomy, the position of the organs, relationship between organs, tissues, functions, diseases and disorders of the each body systems etc.

This is a 3D mobile application using Augmented Reality develop within Unity IDE and Vuforia engine. When students click the start button they switch to the home page and when they select human biology option they can focus their device camera to the image in textbook related to the Urinary or Digestive systems, its provide system overview, functions, diseases and disorders options as they preference. Systems overviews are present using 3D animations audios and important notes using texts. Functions, diseases and disorders are demonstrate using 3D animations audios videos and important notes are provided using texts using marker base Augmented Reality.

Main Purpose of this research is to develop effective and interactive self–learning augmented reality based mobile application to support the science subject of O/L students.

1.2 Literature Survey

Nowadays technology has become part of our life and its everywhere. And Mobile phones have become an essential part of everyone. So mobile application is an attractive way of e-leaning systems. Mobile applications which developed based on Augmented Reality has ability to deliver a blended learning experience created from mixing of virtual and real world objects[5].

Augmented Reality (AR) is modern technology which have capability of convert two dimensional images in to its three dimensional version in real time. AR technologies used in everywhere in everyday life. Many of fields tend to use AR technology such as medicine, transportation, gaming, Architecture, construction, Business fields [5].

Students have problems in conceptualize the while reading the text book. And most of learning materials available inform of books and some of resources can only use in laboratory. They can refer the internet to further reading but some tutorials contain other than the syllabus [5].

We held a Questionnaire to grade 11 students to have the clear idea about subject in their mind. And 65% students state that Urinary system and the digestive system as the hard to study and imagine. And 85% students prefer get support to study science in more interactively using 3D mobile application.

Students have textbooks provided by the government to refer the subject which contains the subjects matter within text based descriptions and two dimensional images. Therefore students tend to understand the content by memorization of images and text based descriptions. But new Science syllabus content has become more advance than the previous syllabus [3]. Memorizing all the subject manners is not a practical way to learn the subject. But the appropriate form of instructional media can be a good way for effectively enhancing student's perception of learning [12].

Especially it is most important and effective way to educational sector because students can learn in interactive way. Listening and vision is a best ways influence

student's attention in studying science. Students will find it easier to understand the shape of the human body anatomy. This is a way to gain more knowledge and understanding and ultimately increase their interesting in the subject. Most of learning materials available in form of book and some kind of materials can use only within the laboratory [5]. F. K. Algarawi, W. A. Alslamah, A. A. Alhabib, A. S. Alfehaid and D. M. Ibrahim states that the use of modern learning tools in education assists students to their study, Quality of learning and improve the educational experience of students [9]. Augmented Reality has an ability to effects people to delivery of educational materials in effective and interesting way. Maria Fuchsova, Lilla Korenova states that the use of mobile AR technology applications allows the work of educators to be made more effective and in addition, it enables pupils to become actively involved in the educational process. Visualization can help students to improve their understanding of the subject.

1.3 Research Gap

Web Based Augmented Reality Application for Human Body Anatomy Learning is only describe about Lungs, Nose, Faring, Larynx, Trachea, Bronchus, Bronchioles, and Alveolus Using Marker Based Augmented Reality only within 3D animations. But there is only 3D interaction no other sounds, videos or audios. The research not describe about the any Human Body anatomy as well as diseases and disorders occurs in the Human Body.

Internal Organs in 3D (anatomy) only describe about internal organs in the Human body within Texts and 3D animations. But not describe any Human Body anatomy as well as diseases and disorders occurs in the Human Body.

Human body (male) educational VR 3D describes about selected Human Body systems using 3D animations and Texts. But there is no description about diseases and disorders occurs in the Circulatory system.

“Augmented Reality to Teach Human Heart Anatomy and Blood Flow” describe about Human Heart and Blood circulation in using 3D animations, texts and sounds. But there is no description about diseases and disorders occurs in the Circulatory system.

““ARESS” Augmented Reality for the human respiratory system” is only describe about the Process of Respiration using 3D animations. There is no description about System Overview as well as diseases and disorders occurs in the System.

But in the current research going to represent the Animal cell overview, Human Body anatomy with its Overview, functions and diseases and disorders occurs in the each systems.

Existing Researches and applications	3D view of Animal Cell	3D Demonstration of System Overviews	3D Demonstration of Functions	3D Demonstration of Diseases and disorders
Web based Augmented Reality Application for Human Body Anatomy Learning	✗	✓	✗	✗
Internal Organs in 3D (Anatomy)	✗	✓	✗	✗
Human body(male) educational VR 3D	✗	✓	✗	✗
Augmented Reality to Teach Human Heart Anatomy and Blood Flow	✗	✓	[Only Animations]	✗
“ARESS” Augmented Reality for the human respiratory system	✗	✗	✓	✗
Current Research	✓	✓	✓	✓

Table 1: Current research comparison within existing researches

1.4 Research Problem

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).

There are several reasons for the inability of most of the students to score higher grades in science.

- The concepts of science are complicated and hard to understand.
- Some students are not much interested in studying science.
- Lack of proper practical experience as some schools are not having proper lab facilities.

The proposed augmented reality based mobile app will solve all of these issues.

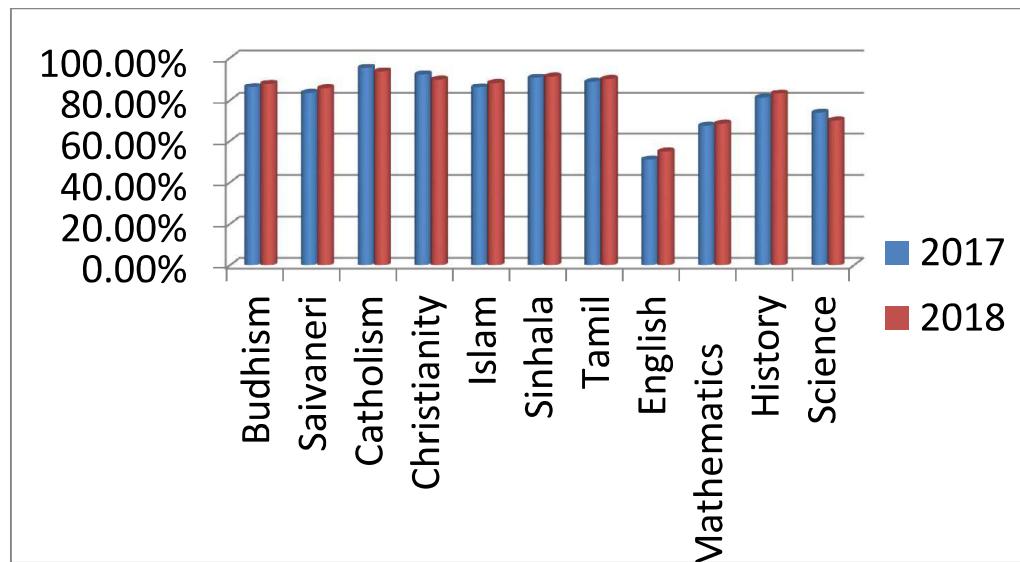


Figure 1.1: Passed percentage of compulsory subjects during previous two years [1].

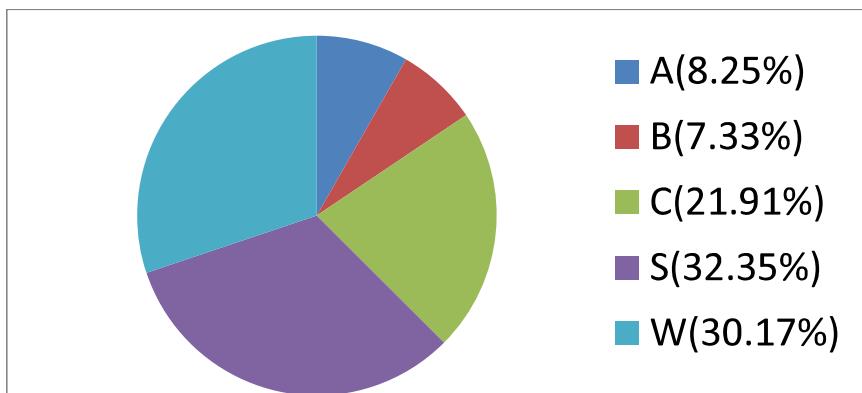


Figure 1.2: Science results of 2018 by grades [1].

1.4.1 Problems Specific to the Component

As the result of survey we conducted among O/L students we were able to find out that most of the students prefer to have an interesting way to learn about Digestive system and Urinary System in Human Biology Section in the Biology. According to the Figure 1.3 depicts that 40% students have problem in conceptualizing of Urinary system and 25% students have problems in conceptualizing of Digestive systems.

They have to memorize the contents which are provided using text based manner and two dimensional images. The Functions, diseases and disorders regarding to Urinary System and Digestive systems study within text based manner is very hard. And they would like to have an interactive and effective way to study these subject manners. According to the figure 1.4 depicts that 80% students likes to have 3D mobile application to get help for their studies.

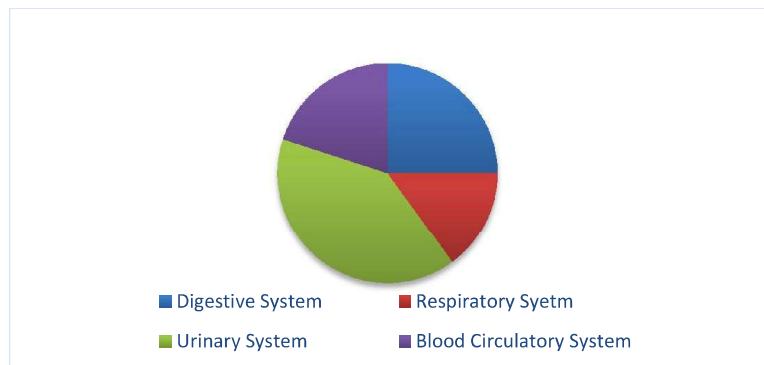


Figure 1.3: Human Body anatomies hard to study

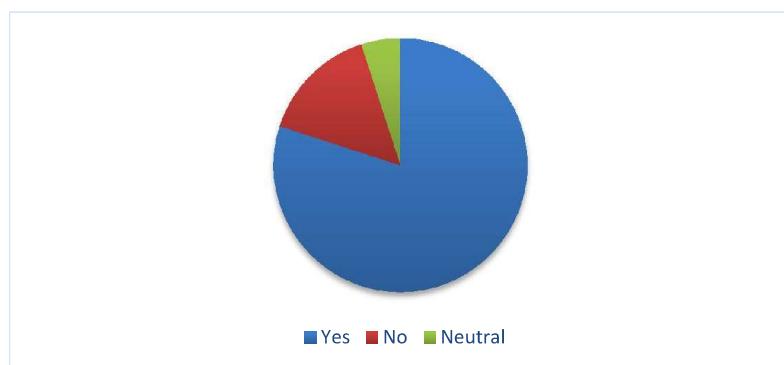


Figure 1.4: Preference to have a 3D Mobile Application

2 OBJECTIVES

2.1 Main Objective

Main Objective of this research is to improve G.C.E ordinary level science results by introducing an augmented reality based self-learning mobile application. This 3D mobile application contains all of the text based subject matters regarding to human biology as its 3D presentations.

The use of modern learning tool in education assists students to their study, quality of learning and improve educational experience of the students. This system which appear to be interesting, enhancing and beneficial in the context of Human Biology.

2.2 Specific Objectives

- This research is to provide and alternative methods of human body anatomy learning while reading the textbooks.

Students can use the mobile application and focus camera the 2D image on the text book and they can see all of the text based descriptions with real world objects with 3D interaction in real time while reading the textbook. This method influence student's motivation in learning human biology.

- To help student in learning the human body anatomy more easily and interesting.

Listening and vision is a best ways influence student's attention in studying science. Students will find it easier to understand the shape of the human body anatomy. This is a way to gain more knowledge and understanding and ultimately increase their interesting in the subject.

- Provide support to students who have problems in conceptualize the body anatomy in the 2D images provided in the text book within solution of 3D versions of them.

3 METHODOLOGY

According to the survey we did we were able to find out they have lots of problems in Human Biology on conceptualizing digestive system and urinary system and students prefer to have a 3D application.

Therefore we decided to develop a 3D mobile application with Augmented Reality. Students can install the “Science mobile Application for O/L students” Mobile application from Google play store easily. And when open the app they can move to the home page and they can move to the Human Biology section when they click on the Human Biology Button. There are two options as

- Animal cell organization
- Human Body anatomy

There are other three subsections in Human Body Anatomy Sections. There are

- System Overview
 - Functions
 - Diseases and disorders
1. 3D presentation of Animal cell Organization.

This section demonstrate about full detailed 3D demonstrate of animal cell overview using 3D animations, audios and texts. Overall cell demonstration including plasma membrane, cytoplasm, Golgi complex, nucleus, smooth and rough endoplasmic Reticulum and mitochondrion demonstrate using 3D animations, audios. Application displays the 3D view of Animal cell using animations and each cell organelle indicate using texts. And animal cell describe using audios while displaying animations. And important notes about each of those organelles display while demonstrating the Animal cell.

1. 3D demonstrate of Human Body Anatomy

Human body anatomy section mainly focuses about Digestive system and urinary system.

1.1 3D demonstrate of Human Digestive System

Digestive System demonstrate using animations with indicating each internal organelle with text. Each internal organelle there are Buccal cavity, salivary glands, oesophagus, Liver, stomach, gall bladder, pancreas, large intestine, small intestine, caecum, appendix and Rectum and anus display using 3d animations and audios and important notes about each internal organelle display while demonstrating the digestive system.

1.2 3D demonstration of Human Urinary system

Urinary System demonstrate using animations with indicating each internal organelle with text. Each internal organelle there are Renal artery, kidneys, renal vein, systemic artery, inferior vena cava, ureters, bladder, urethra display using 3d animations and audios and important notes about each internal organelle display while demonstrating the urinary system.

1.3 3D demonstration of process of Excretion / process of urine formation

Process of urine formation in kidney follows 3 main processes. There are ultra-filtration, selecting reabsorption, secretion.

1.4 3D demonstration of process of Digestion

Digestion in buccal cavity, stomach, small intestine, large intestine will demonstrate using animations, videos and audios and important notes will display using texts.

1.5 3D presentation of diseases and disorders occurs in Urinary and Digestive systems

System describe about the Gastritis, Renal failures using 3D animations
Audios videos.

3D Models create within Unity Hub and each 3D model is going to save in the Vuforia Engine database. This system id developed within Marker less Augmented Reality because 3D models animations generate regarding to the picture that captured by the camera.

3.1 System Diagram

According to the Figure 3.1 Once a student captures a 2D image of one of these systems using his mobile camera our application will identify the image and it will be matched with images stored in a vuforia database. If a similar image is stored in the database it will be matched with the identified image and a 3D model of the system along with the animations of the functions will be displayed on the captured image.

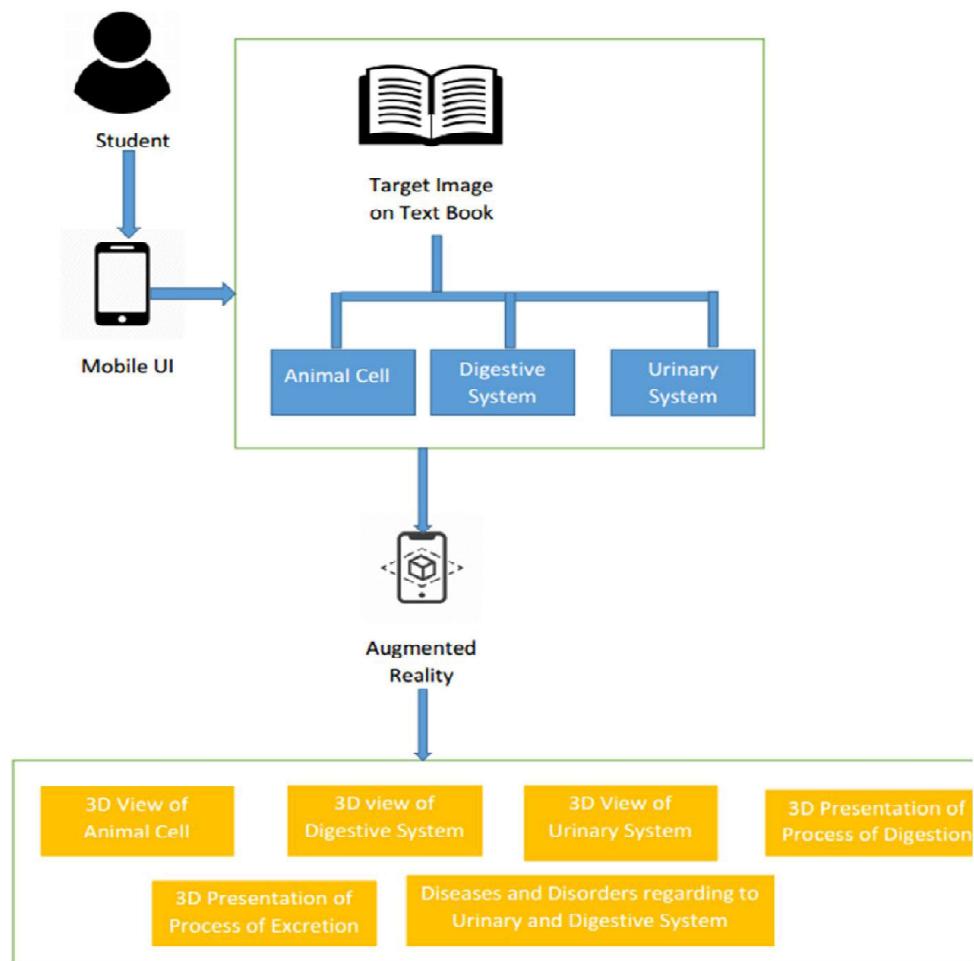


Figure 3.1: System Diagram

3.2 Work Breakdown Structure

I have categorized the tasks in my project into four sub parts. There are Initial task, documentation, developing and testing. Initial tasks are the steps which we took as group to come up with a suitable research. Documentation is going to be carried out different stages in the project. Developments are the main tasks which are done in order to come up with a proper solution. Testing is also main Stage in the projects because it helps to deliver the best error free Product.

Figure 3.2 depicts how my projects tasks will be carried out under the stages mentioned above. At the end of the developing each and every unit will be tested using unit testing to verify whether each unit works properly as expected or not. At the end of the developing of my component will be tested before integrating to the other components. After integrating the whole system it will be tested as well. And User Acceptance Testing done at the end of developing to ensure that the system has reached the customer requirements.

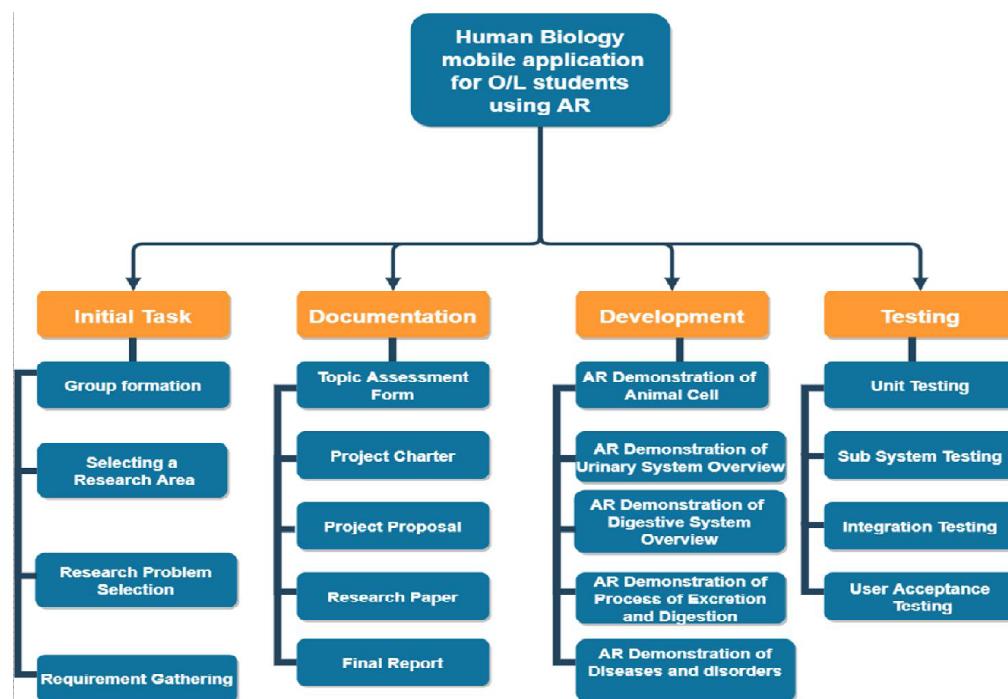


Figure 3.2: Work Breakdown Structure

3.3 Gantt Chart

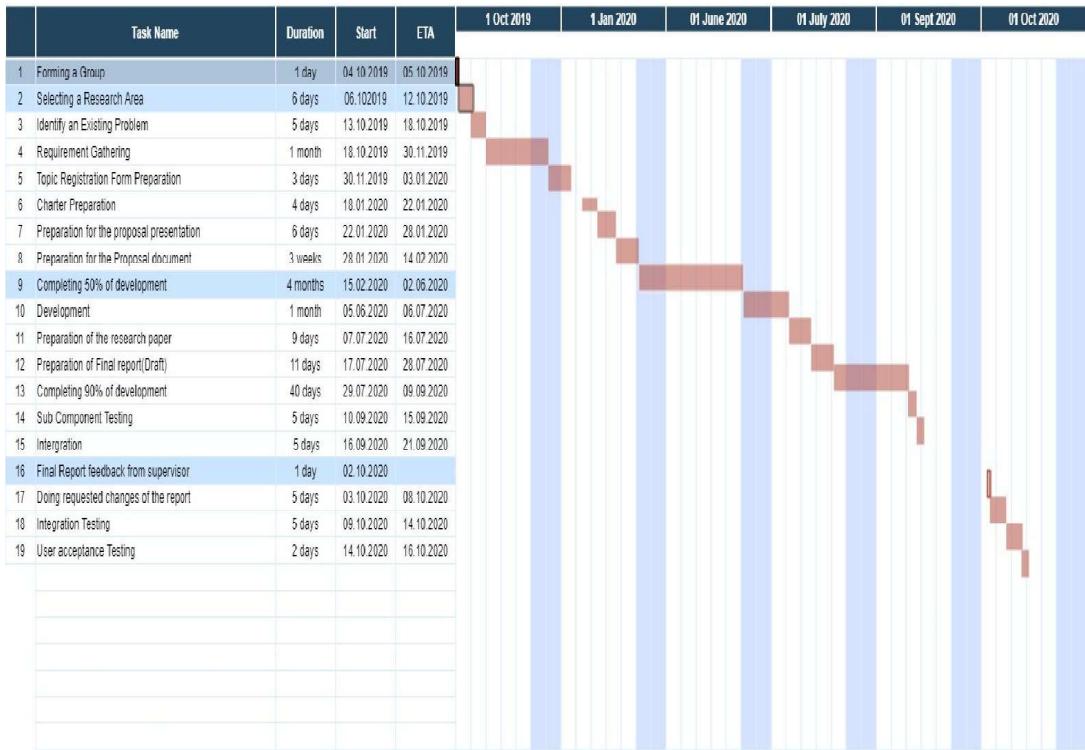


Figure 3.3 : Gantt chart

4 PROJECT REQUIREMENTS

4.1 Functional Requirements

- Ability of convert 2D images of Urinary system into its 3D version
- Ability of convert 2D images of Digestive system into its 3D version
- Ability of viewing Process of digestion as a 3D presentation
- Ability of viewing Process of excretion as a 3D presentation
- Ability of viewing how occur Diseases and disorders in urinary and digestive systems as 3D presentations

4.2 User Requirements

- The ability to learn science in an interactive manner.
- An easy way to learn advanced concepts.
- Ability to study science without reading detailed notes

4.3 Non-functional Requirements

- Accuracy: This is most important requirement because we have to ensure users about the content we provided because we have to limit the content into syllabus. And we have to ensure about the correctness content we provided.
- Effectiveness: 3D application which developed using aid of multimedia contents such as animations sounds texts audios videos influences students in motivate in learning and its impacts student learning in an effective and interesting way.
- Reliability:- There are may be students who have less knowledge on technology and use the mobile applications. So we must concern about the functionalities before adding them into our tool.
- Availability: - ensure that systems are running and available most of time.
- Accessibility: - This mobile application access without internet.

DESCRIPTION OF PERSONAL AND FACILITIES

Member	Component	Task
IT17157988 Liyanage P.M	AR support on the study of the human body	<ul style="list-style-type: none">• Demonstration of the animal cell• Urinary System Overview using AR• .Digestive System Overview using AR• Demonstrate Process of Digestion• Demonstrate Process of Excretion• Demonstrate how occurs Diseases and Disorders in each systems

Table 2: Description of Personal and Facilities

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engineering education of future Primary School Teachers in Human Biology
Education Using Augmented Reality” *European Journal of Contemporary
Education*, 2019, 8(1)

AUGMENTED REALITY SCIENCE APP FOR O/L STUDENTS

We are a final year project group at Sri Lanka Institute of Information Technology (IT17107624 – De Silva K.V.P.W, IT17106252 – U.S Hettihewa, IT17157988 – Liyanage P.M, IT17098588 – N.M.W.K.P.C Naranpanawa). The purpose of this questionnaire is to gather requirements for our final year research project. Please spare few minutes from your busy schedules and be kind enough to respond to this survey. Further, we will assure that all correspondence, including completed survey forms will be kept confidential and secure.

1. What is your expected grade for science at the O/L examination?
 - i. A
 - ii. B
 - iii. C
 - iv. S
 - v. F
2. Are you facing any difficulties in studying science?
 - i. Yes
 - ii. No
3. How familiar are you in using mobile phones?
 - i. Very familiar
 - ii. Somewhat familiar
 - iii. Not familiar
4. Do you think that a mobile app with 3D technology will support you to study science more effectively?
 - i. Yes
 - ii. No
 - iii. Neutral
5. Which way will be more convenient for you to study science?
 - i. Reading notes
 - ii. Using a mobile app with 3D technology
6. Number the following according to the order you think that 3D technology will be benefited most study (1- most benefited, 4 – least benefited)?
 - i. Acids
 - ii. Bases
 - iii. Salts

iv. Hydrocarbons

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

- i. Digestive System
- ii. Respiratory system
- iii. Urinary System
- iv. Blood Circulatory System
- v. Reproductive System

8. 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)

- i. Photosynthesis
- ii. Plant respiration
- iii. Reproduction

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

- i. Plant cell structure
- ii. Plant tissue organization

10. Which of the following experiments do you feel difficult from your science syllabus?

(1-most, 5-least)

- i. Starch production during photosynthesis
- ii. Need of light energy for photosynthesis
- iii. Need of CO₂ for photosynthesis
- iv. Need of chlorophyll for photosynthesis
- v. O₂ production during photosynthesis

11. Number the following cycles according to the order which is complicated for you to understand? (1 – most, 4- least)

- i. Water Cycle
- ii. Hydrogen cycle
- iii. Nitrogen cycle
- iv. Carbon cycle

12. According to you, what kind of benefits you can gain by using a mobile app with 3D technologies to study your O/L science syllabus?

Thank You!