SCIENCE ZONE
SCIENCE AUGMENTED REALITY APPLICATION FOR O/L STUDENTS

2020 – 160

RESEARCH PROBLEM

A(8.25%)
B(7.33%)
C(21.91%)
S(32.35%)
W(30.17%)
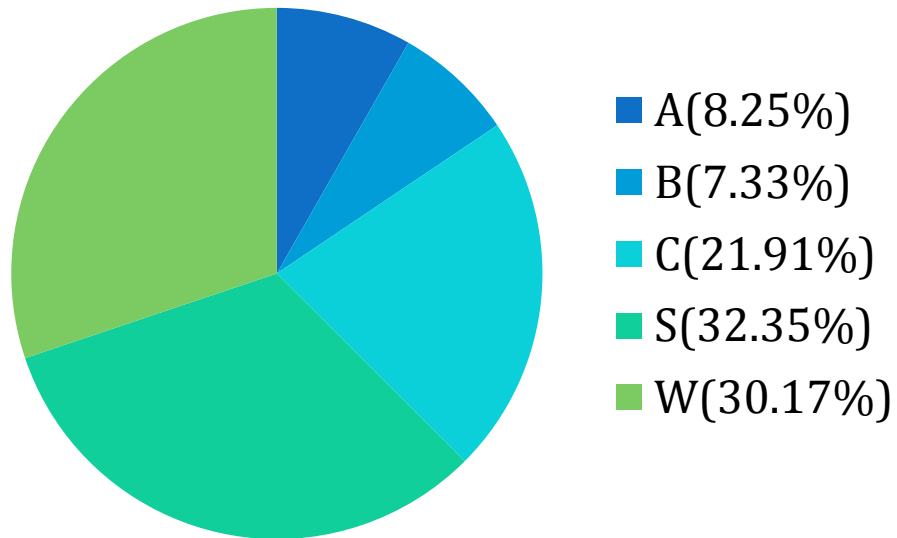
O/L Science Results in 2018
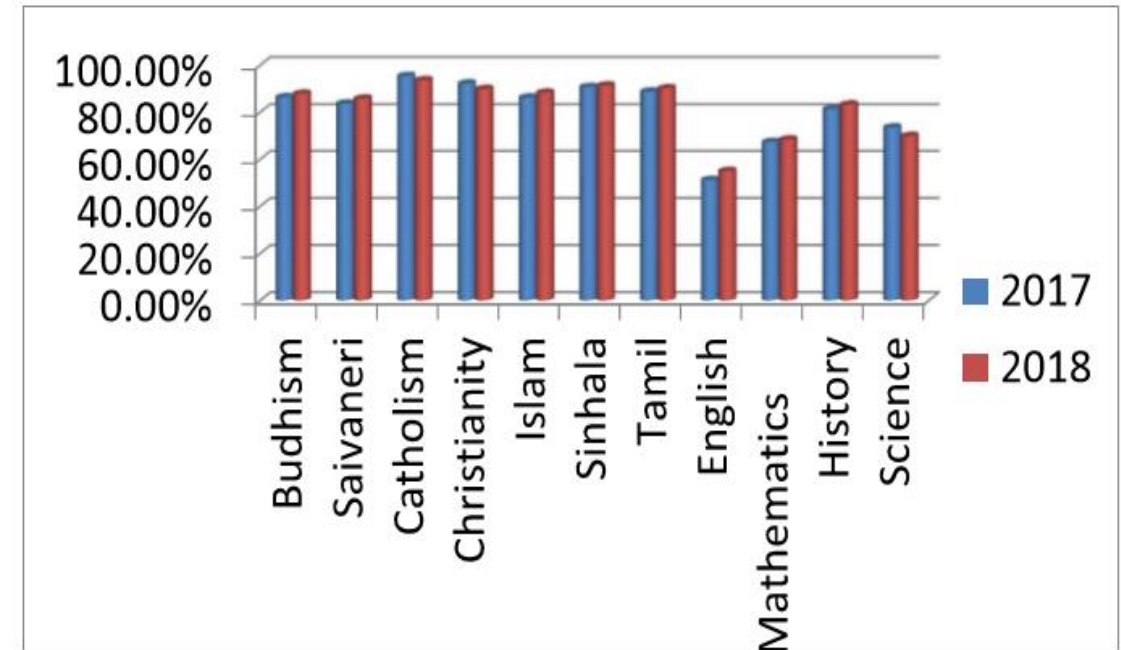
Passed rate of compulsory subjects during previous two years

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RESEARCH PROBLEM

- Most of the students are having low grades for Science at the O/L exam.
- This is because of the complexity of the concepts in the Science syllabus.
- Most of the students are having low interest in studying Science

# RESEARCH OBJECTIVES

MAIN OBJECTIVE

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

SPECIFIC OBJECTIVE

- Language support on both Sinhala and English
- AR support on Plant bodies
- AR support on Human anatomy
- AR support on acids
- AR support on Biosphere cycles

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SYSTEM DIAGRAM
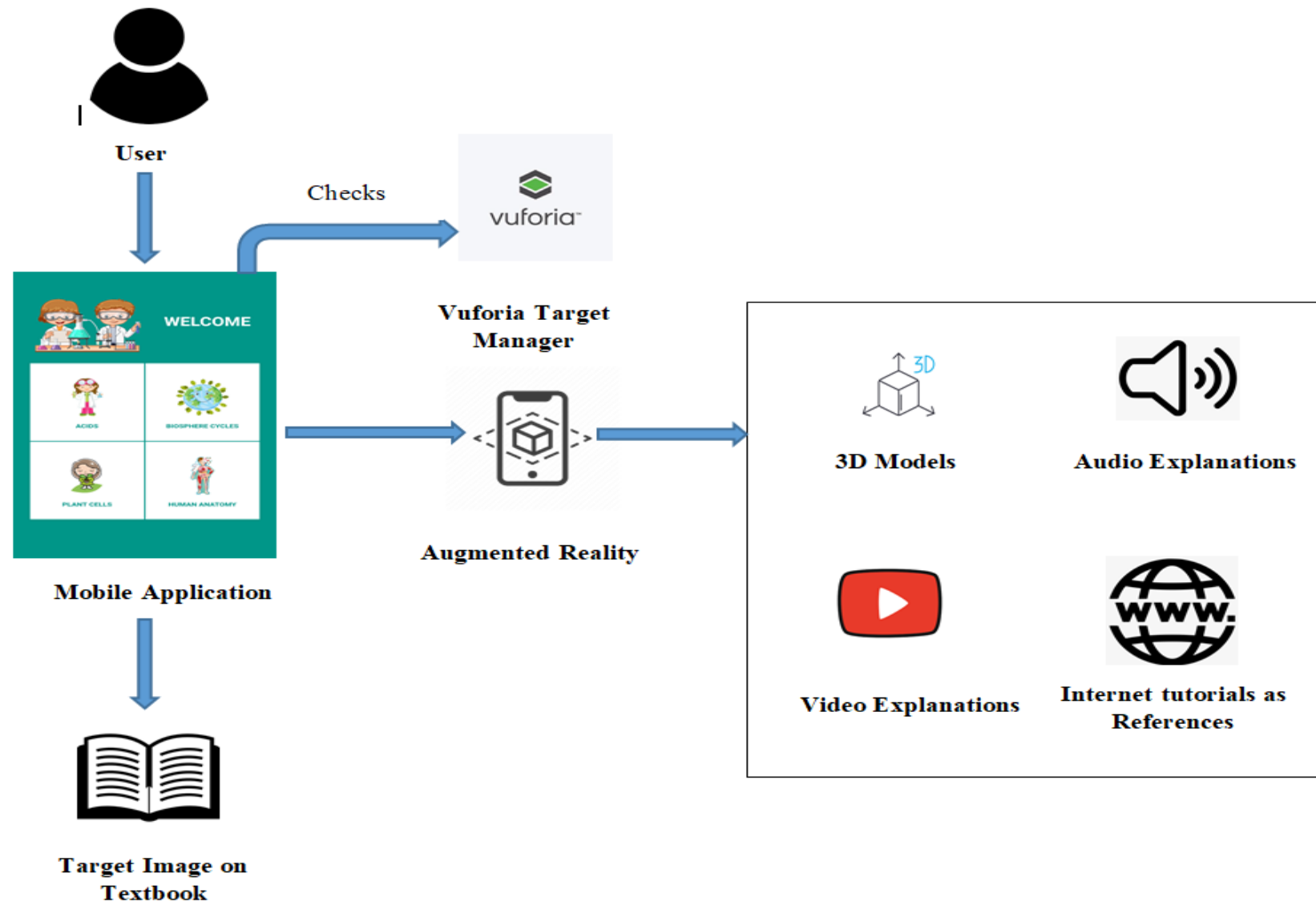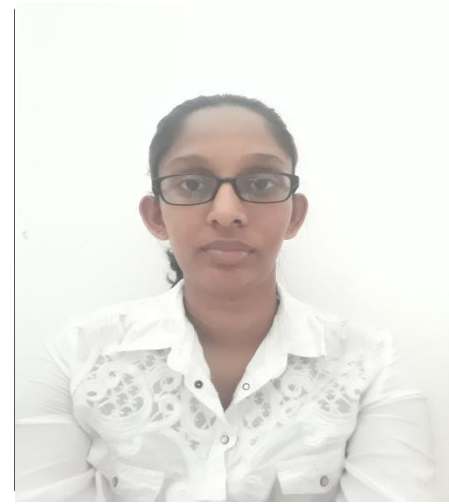
IT17107624 | DE SILVA K.V.P.W

Software Engineering

BACKGROUND

- The content relevant to acids is complex.

- Having an interactive method of learning will help students to understand the concepts properly.

- Augmented reality is having the ability to present the concepts using 3D visualisations.

- To understand the concepts need proper practical exposure

- Augmented reality can demonstrate experiments without the need of any lab equipment

RESEARCH GAP

- There are some applications based on acids developed using augmented reality

- Most of them are in English

- None of them are specific to the O/L syllabus in Sri Lanka

- No applications are built to provide AR support for experiments based on acids.

RESEARCH PROBLEM

- Some schools are not having the ability to provide practical experience for their students.

- Reading only notes will not be effective because the concepts of the lessons based on acids are hard to memorise.

- Some students are not interested in studying the lessons based on acids

OBJECTIVES

SPECIFIC OBJECTIVE

- Improving the science results of O/L students by providing support for the lessons based on Acids in the grade 11 Science syllabus.

SUB OBJECTIVE

- Providing the ability to select either Sinhala or English as the language in using the application.

- Displaying 3D models of molecular structures of acids.

- Demonstrating experiments using augmented reality.

SYSTEM DIAGRAM
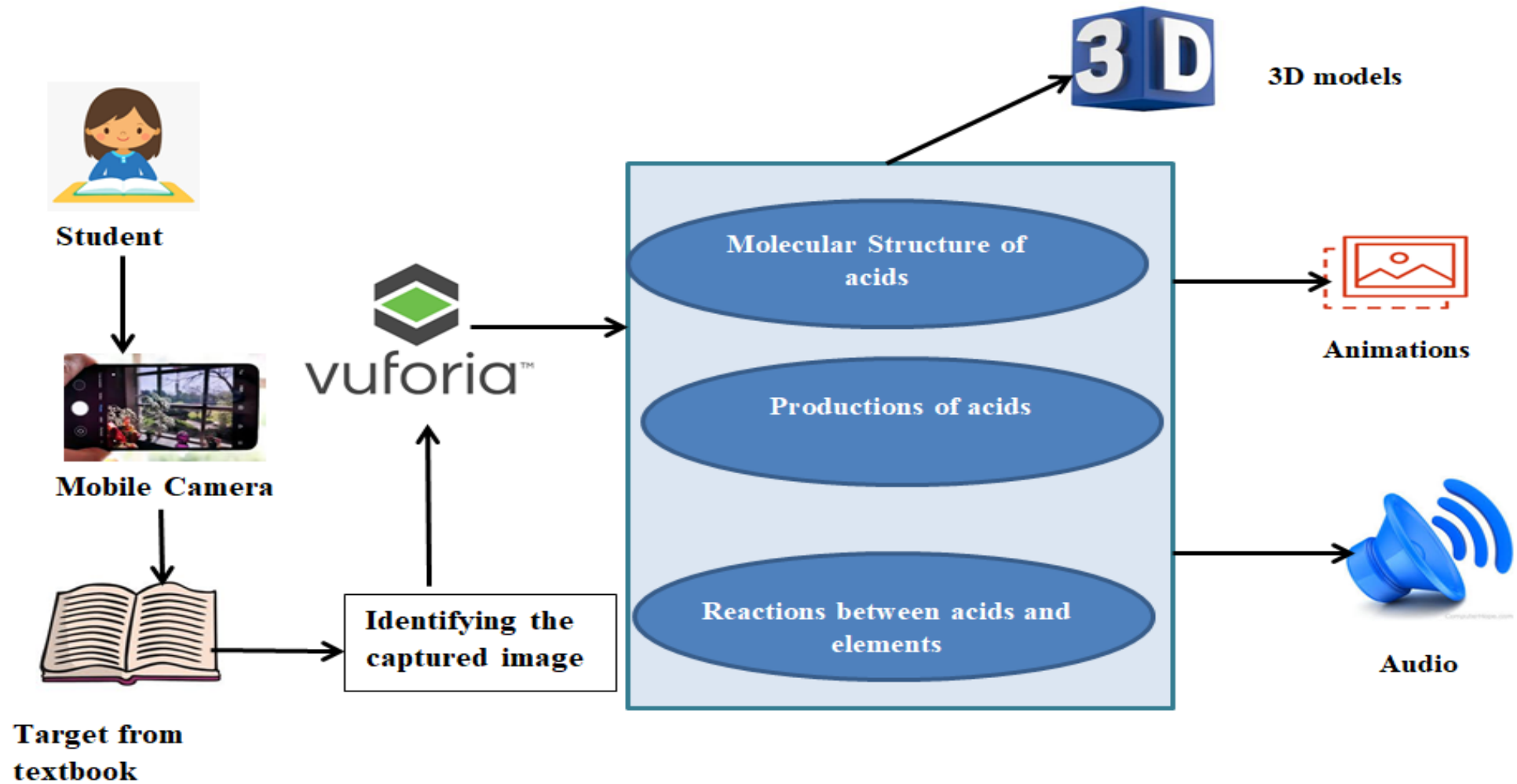
METHODOLOGY

- The application was developed using Unity 3D and Vuforia was used as the image store to store image targets.

- C# scripts were written to perform various AR features.

- The application was developed to convert captured images of formulas, equations and detailed descriptions into 3D models, videos and image slideshows using augmented reality.

ACHIEVEMENTS

- The application is having the ability to convert captured images of formulas of acids into 3D models of the molecular structure.

- Ability to demonstrate experiments of reactions between acids and elements using augmented reality.

- Audios are played in either Sinhala or English according to the selection of the user.

IT17098588 | N.M.W.K.P.C.NARANPANAWA

Software Engineering

BACKGROUND

- Technology has become highly important today since it has brought numerous opportunities for everyone.

- When considering the field of education, technology has a huge impact on its growth and development.

- Augmented Reality is among these newest technologies which have unveiled major possibilities for various fields including education.

- Applying AR for education could immensely support to improve the learning process because AR has the potential to change the traditional classroom-based learning to distance learning.

RESEARCH GAP

- For Sri Lanka AR is a new concept, especially for the field of education.

- There are very few attempts have been made on AR based e-learning in Sri Lanka, and none of these studies are focused on learning Science with AR.

- While considering the educational system in Sri Lanka, O/L Examination takes an important place in a student's life since it can decide his or her future path.

- Therefore, it would be a major support if they have a better and an effective way to learn difficult subjects in the O/L syllabus, such as Science.

RESEARCH GAP

Existing Research and Applications	Ability to visualize the textbook objects using 3D models	Audio Support	Provides both Sinhala and English Audios	Relevant to the O/L Syllabus
Augmented Reality Mobile Application to Enhance Sinhala Learning Experience for Children [8]	✓	✓	Sinhala Only	✗
Anatomiar [2]	✓	✗	✗	✗
GeoAR [7]	✓	✗	✗	✗
Digital Anatomy [1]	✓	✗	✗	✗
Spellbound [4]	✓	✗	✗	✗
ARBio [7]	✓	✓	English Only	✗
New Product	✓	✓	✓	✓

RESEARCH QUESTION

- Science is a subject with many complex topics which has made it difficult to understand without proper explanations.

- Under the topic "**Biosphere**" in the Science syllabus, there are two main biochemical cycles: Carbon cycle and Nitrogen cycle.

- In order to gain a better understanding about these cycles, reading the textbook will not be enough.

- Therefore, as an effort of making it easy for O/L students to learn about these two biochemical cycles, an Augmented Reality mobile application has been developed.

SPECIFIC AND SUB OBJECTIVES

Main Objective

- Implementing a mobile application using Augmented Reality to provide necessary knowledge about the biosphere cycles in the O/L Science textbook.
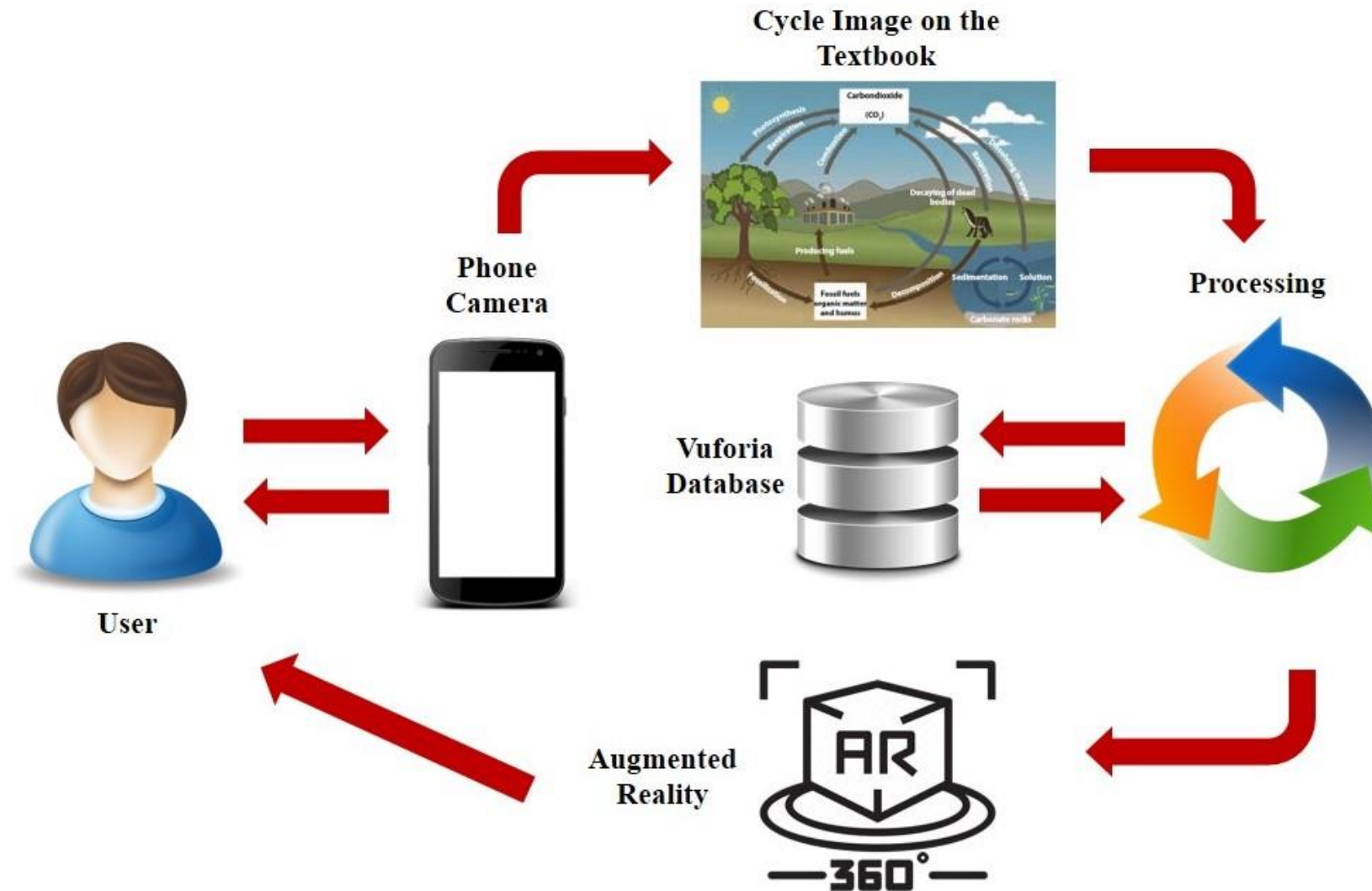
Sub Objectives

- Displaying 3D models for the Carbon and Nitrogen cycles in the textbook.

- Playing a background audio explanation along with the 3D model.

- Providing audio support in both Sinhala and English languages.

METHODOLOGY

- To develop the application Unity Editor and Vuforia were used.

- 3D models were created using Sketch Up software.

- Marker-based approach is used to display the relevant 3D model for each cycle.

- C# scripts were written to navigate through interfaces using buttons.

METHODOLOGY

Cycle Image on the Textbook

Phone Camera

Processing

User

Vuforia Database

Augmented Reality

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25 / 09 / 2020

ACHIEVEMENTS

- Application successfully identifying the 2D cycle images in the textbook.

- Displaying 3D models for the Carbon and Nitrogen cycles.

- Playing a background audio explanation in both Sinhala and English languages.

- Attractive and simple user interfaces.

- Easy navigations between the interfaces.
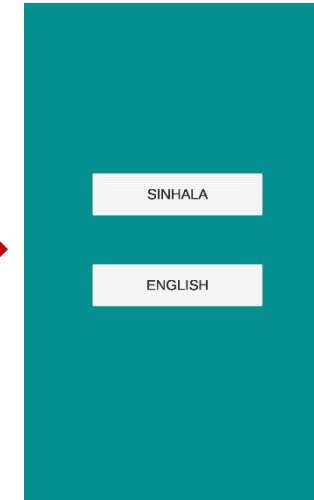
ACHIEVEMENTS
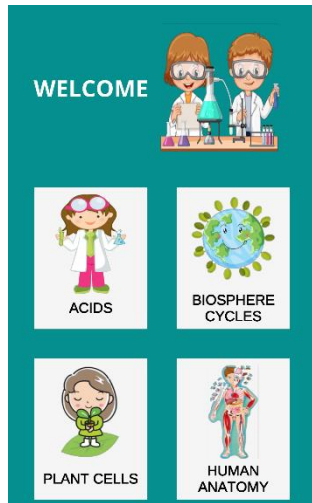
Click on the
Biosphere Cycles
tab
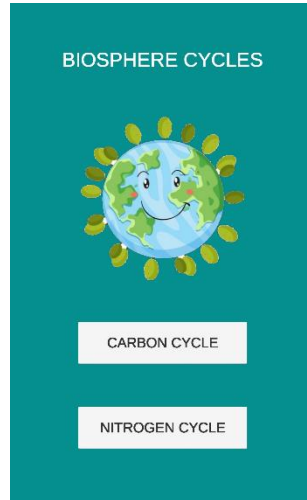
Click Carbon
Cycle button

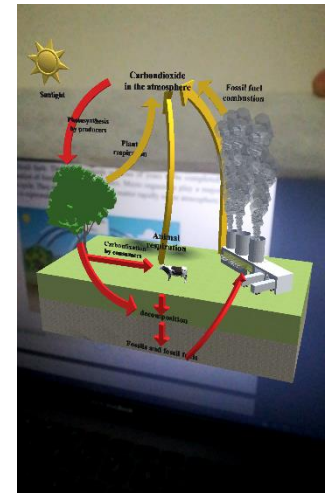Click Learn
button

Click on Sinhala
or English

3D model of the
Carbon Cycle

IT17106252 | U.S HETTIHEWA

Software Engineering

BACKGROUND

- The content related to Plant organization is complex.

- Since Science subject mostly goes with practical sessions, applying AR in an educational context is an advantage.

- Augmented reality visualizes deeper concepts attractive and interactive way.

RESEARCH GAP

	3D animations on plant cell structure	Videos on Photosynthesis	Lecture delivery in native language(Sinhala)	Specific to local syllabus
Cell World[4]	✓	x	Only English	x
Plant Tissue Plus[5]	x	✓	Only English	x
Biology Photosynthesis L[6]	x	✓	Only English	x
"Science Zone" mobile application	✓	✓	✓	✓

- The figure shows a brief comparison of existing augmented reality applications with our application

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RESEARCH GAP

- Concepts included does not specific to the local syllabus.

- Language inconsistency.

- Comprehensive learning environment.

- No available apps for demonstrating plant structure using augmented reality

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RESEARCH QUESTION

- According to the figure, only few have scored good grades for science.

- Most of the students have scored average or lower grades.

- because the science content has become more advance with the introduction of the new syllabus.

- Interactive and attractive learning approach

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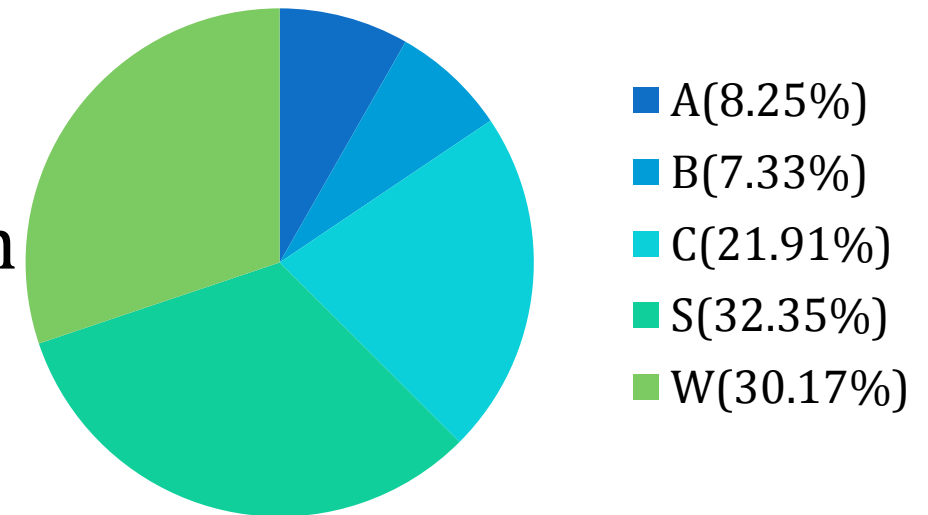
RESEARCH OBJECTIVE

Main Objective

- improve G.C.E ordinary level science results by providing interest in the Plant Organization section using augmented reality.

Sub Objective

- Language support on a preferred language either Sinhala or English
- 3D demonstration of virtual objects related to plant cell organization using augmented reality.
- Video demonstration on the process of Photosynthesis and experiments related to production of Oxygen during Photosynthesis.

METHODOLOGY

- "Science Zone" is an augmented reality-based application mobile application
- Developed using Unity 3D and Vuforia Engine to store image targets.
- It supports both Sinhala and English languages.
- C# scripts were written to perform various AR features.
- The application was developed to convert captured images into 3D models, videos using augmented reality.

SYSTEM DIAGRAM
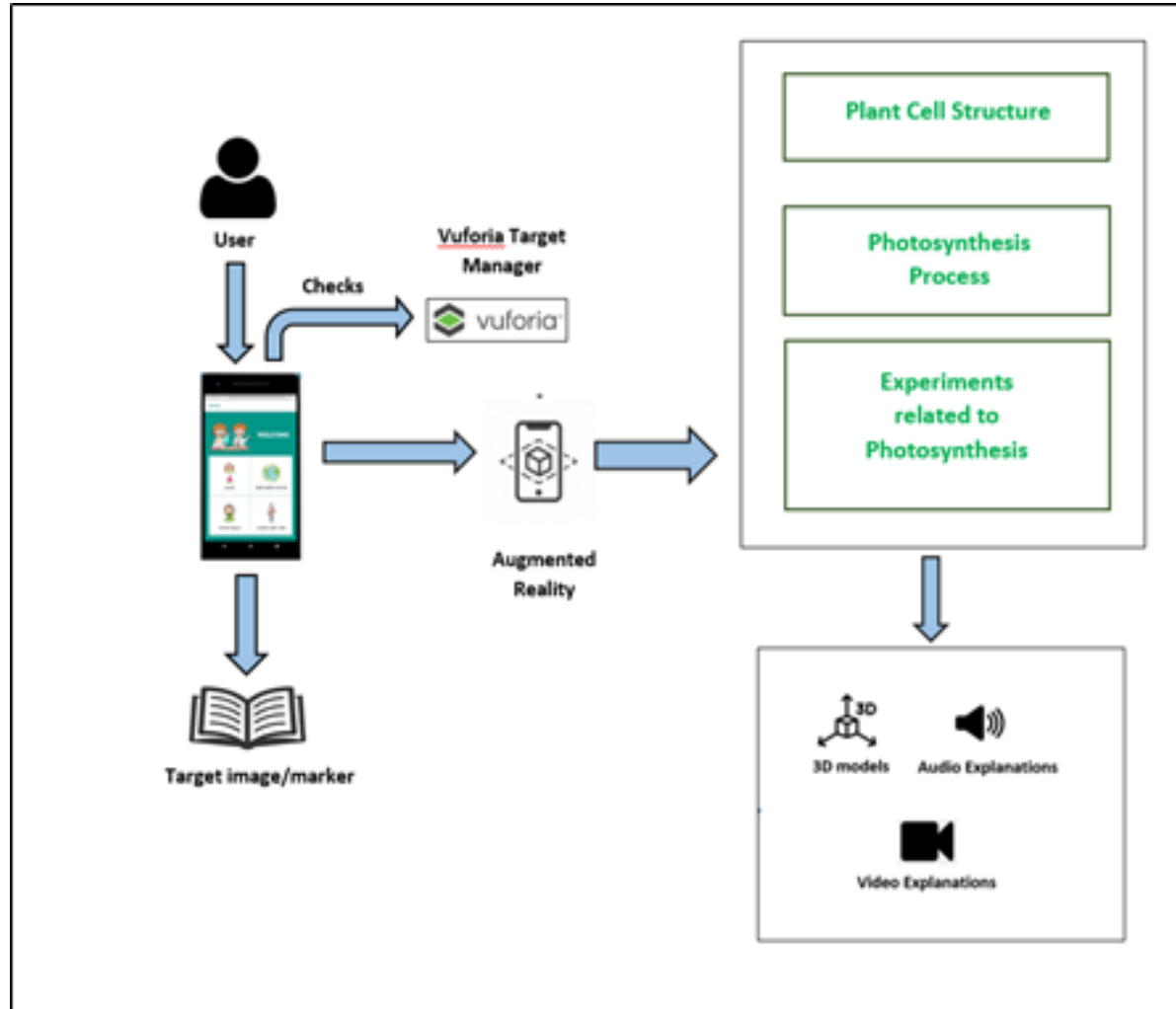
ACHIEVEMENTS

- The application can convert captured image of plant cell into 3D model

- Ability to demonstrate videos on Photosynthesis process using augmented reality

- Ability to demonstrate videos on experiments related to production of oxygen during photosynthesis.

- User is able to learn either in Sinhala or English according to their preference

IT17157988 | LIYANAGE P.M

Software Engineering

BACKGROUND

- Nowadays education sector gets beneficial from the technological advancement through combine the theoretical and practical learning methods within the modern technologies.

- Augmented Reality is a modern technology which has an ability making virtual learning environments, so it supports learning in attractively, make students more interesting in learning and enhance teaching skills of teachers.

- It improves student's enthusiasm for learning and helps enhance student's performance than the traditional classroom methodologies.

RESEARCH GAP

- There are existing researches and mobile applications developed based on human anatomy.

- All these applications support English language only.

- Also they are focused on structure of the body systems and some of them have explained only about internal organs.

- There are no any application which describes structure, functions and diseases regarding to human body systems together in one application.

Existing Researches and applications	3D view of Animal Cell	3D Demonstration of human body systems	3D demonstration of functions	3D demonstration of Diseases	Sinhala and English language support
Web based Augmented Reality Application for Human Body Anatomy Learning [3]	✘	✓	✘	✘	Only English
Internal Organs in 3D (Anatomy) [5]	✘	✓	✘	✘	Only English
Human body(male) educational VR 3D[4]	✘	✓	✘	✘	Only English
Augmented Reality to Teach Human Heart Anatomy and Blood Flow	✘	✓	[only animations]	✘	Only English
"ARESS" Augmented Reality for the human respiratory system	✘	✘	✓	✘	Only English
Human anatomy Augmented Reality Mobile application	✓	✓	✓	✓	✓

RESEARCH PROBLEM

- Human Anatomy is an advanced concept, and it is difficult to learn it only using notes and mannequins in laboratory.

- Therefore, it is highly effective and useful if students can learn these concepts in an interactive approach.

RESEARCH OBJECTIVES

Main Objective

- To improve G.C.E Ordinary level science results by introducing augmented reality based mobile application.

- Provide an attractive approach to enhance knowledge regarding to human anatomy.

RESEARCH OBJECTIVES

Specific Objective

- Learn animal cell overviews and human body systems through generating 3D models within audio explanations digestive system and urinary system

- Digestion and Urine Formation through augmented videos.

- Generate important notes regarding to animal cell, digestive and urinary systems.

- Generate Notes and Online tutorial access to recommended videos about diseases.

SYSTEM DIAGRAM
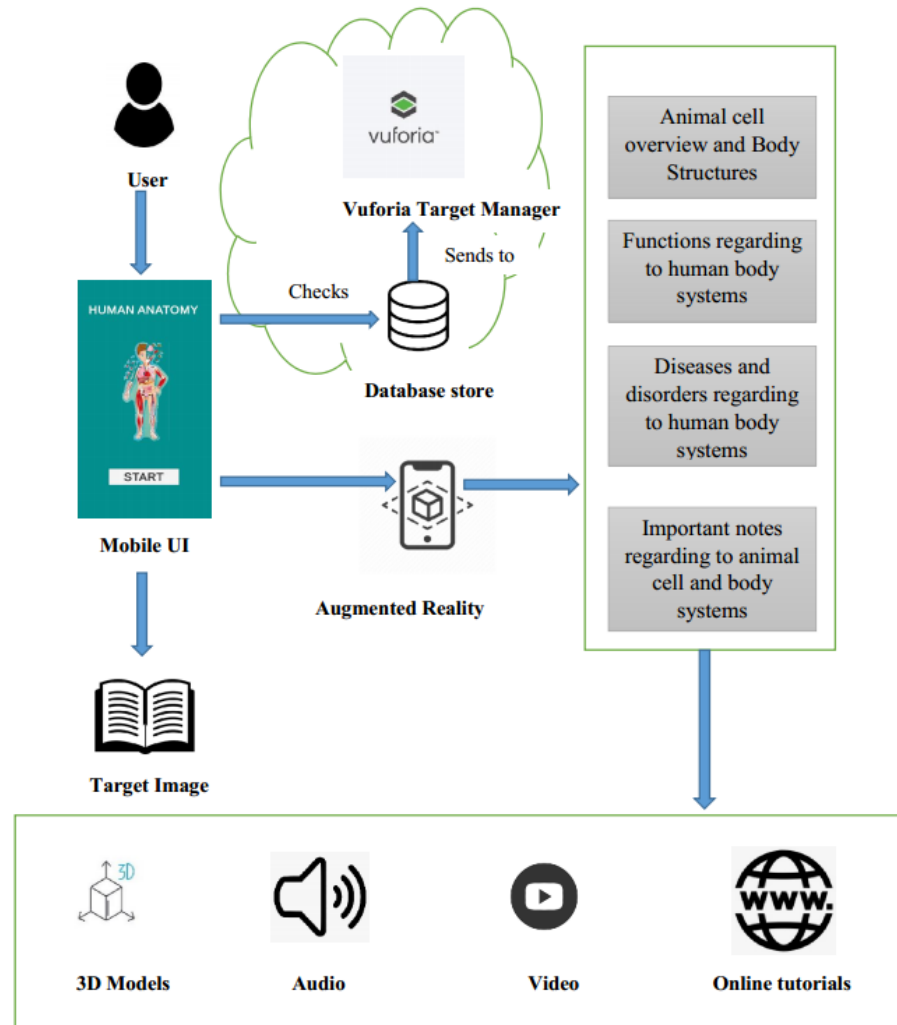
METHODOLOGY

- Human anatomy displays 3d models , audios , videos , images , text-based descriptions and give access to online tutorials using augmented reality to refer about animal cell organization, structures, functions and diseases regarding to digestive system and urinary system.

- This Mobile application developed using Unity 3D and Vuforia engine.

- C# was the programming language used in this component

ACHIEVEMENTS

- Ability to see 3d model of animal cell while audio playing in the background.

- Ability to see 3d model of digestive system and urinary system while audio playing in the background.

- Digestion and Urine Formation demonstrate as augmented videos.

- Diseases regarding to each systems describe within images, text-based descriptions and provides ability to refer online tutorial as further references.

- This application supports both Sinhala and English languages.

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