PROJECT REPORT ON

E-LEARNING WEBSITE SOLUTION

Submitted in partial fulfillment of the
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In

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Abstract

This report describes the implementation of hybrid tracking software that is capable of operating indoors. The position and orientation of pattern is measured in physical world coordinates at all times, and tracking of the pattern is performed relative to the paper. The respective model that is chosen by the user will then appear in 3D view, providing a clearer view of the model. Accompanying the model is a sound clip that describes and elaborates on the selected model thus allowing the user to view a three dimensional rendering and listen to the explanation at the same time, thus enhancing the learning experience. It is made more interesting and interactive.

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1. Introduction

1.1 Introduction and Motivation

Augmented Reality (AR) is a growing area in virtual reality research. The world environment around us provides a wealth of information that is difficult to duplicate in a computer. This is evidenced by the worlds used in virtual environments. Either these worlds are very simplistic such as the environments created for immersive entertainment and games, or the system that can create a more realistic environment has a million dollar price tag such as flight simulators. An augmented reality system generates a composite view for the user. It is a combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information. Augmented reality presented to the user enhances that person's performance in and perception of the world. The ultimate goal is to create a system such that the user cannot tell the difference between the real world and the virtual augmentation of it. To the user of this ultimate system it would appear that he is looking at a single real scene.

An Augmented Reality system supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world. While many researchers broaden the definition of AR beyond this vision, we can generally find Augmented
Reality system to have the following properties:

- Combines real and virtual objects in a real environment;
- Runs interactively, and in real time;
- Aligns real and virtual objects with each other.

Augment Reality can be thought of as a middle ground between Virtual Environment (completely synthetic) & Tele-presence (completely real). On the spectrum between virtual reality, which creates computer-generated environments, and the real world, augmented reality is closer to the real world. Augmented reality adds graphics, sounds, haptics and smell to the natural world as it exists. You can expect video games to drive the development of augmented reality, but this technology will have countless applications.

Everyone from tourists to military troops will benefit from the ability to place computer-generated graphics in their field of vision.

Augmented reality will truly change the way we view the world. Picture yourself walking or driving down the street. With augmented-reality displays, which will eventually look much like a normal pair of glasses, informative graphics will appear in your field of view and audio will coincide with whatever you see. These enhancements will be refreshed continually to reflect the movements of your head. In this article, we will take a look at this future technology, its components and how it will be used.

With the introduction of Augmented Reality (AR) as being coined the term in the early nineties, we were able to apply virtual objects within physical reality. Combining techniques of Sutherland/Sproull's first optical see-through Head Mounted Display (HMD) from the early 1960's with complex, real-time computer-generated wiring diagrams and manuals. Both were registered with each other and manuals were embedded within the actual aircraft for intensely detailed procedures.

1.2 Problem Definition

Learning in classrooms is well refined and traditional. However the main problem with this approach is that it does not keep up with the times very well. We live in a technological age. But, unfortunately technology is not sufficiently used. In order to take full advantage of this technology, we need to introduce students and teachers alike to new concepts and inventions. One of the many biggest advantages of e-learning is interactivity of the student with the supposed learning activity. No longer will a student have to look at only a 2D view of an image s/he wants to see. With 3D modeling, a student can twist and turn the model to look at all sides, hear a tutorial about the model and thereby remember it better. Our project seeks to ingrain such knowledge into the minds of students by using Augmented Reality. It provides an opportunity to play and interact while at the same time gain knowledge from an unconventional source or method.

We hope to build a platform that encourages and provides interaction and engagement between the user and source of information. By allowing the user to have full control on the data or information, the user can grasp at his or her comfort level. Also due to the interactive nature of the platform the user will not get bored and we hope at increasing the user’s concentration span while studying or learning from this E-Learning Website.

1.3 Aims and Objectives

E-Learning represents an innovative shift in the field of learning, providing rapid access to specific knowledge and information. It offers online instruction that can be delivered anytime and anywhere through a wide range of electronic learning solutions such as Web-based courseware, online discussion groups, live virtual classes, video and audio streaming, Web chat, online simulations, and virtual mentoring.

The main aim of this project is to provide an interactive learning experience, complete with voice tutorials and 3D models to help the student absorb and understand the material better than an ordinary learning experience.

Other goals and objectives include the following:

- To reduce learning costs.
- To change the current teaching and learning experience.
- To reduce the need for classroom training.
- To track student progress.
- To track learning effectiveness (or absorption).
- To provide a more realistic and 360 degree scope of understanding a concept.
- To let a user interact with a source of knowledge and experiment.
- Interaction in Real-Time environment.

1.4 Scope

This projects aims at developing an E-Learning platform that will currently facilitate subjects like history, universe and learning to play instruments. The can be further developed to support other topics and subjects on similar lines. This platform can be used to build an interactive environment opportunity for students to learn some old and new topics. It can help them get a better perspective and understanding of how these objects and entities exist in the real world.

In the near future, the website can incorporate live class rooms with 24x7 learning and engagement activities. We have an extended student – teacher interaction that is online via this medium. Students will be able to build interactive notes with the help of Augmented Reality with the click of a simple button. Thus not only do they gain but can also start contributing to the platform. The level of interaction and engagement can reach a great scale in the future. If students can adapt to the new way of learning, it can help a lot of students.

Similarly using this we can setup virtual classrooms where availability of teacher and guides is a problem. Students can now learn in an online environment provided they have the minimum technology for interaction and operation.

2. Review Of Literature

In order to conceptualize and build the project framework, we surveyed different sources of information. We started off, by looking into various E-Learning platforms and the services they offer. Also what kind of technology and level of interaction they involve.
After understanding how exactly the current E-Learning services work, we looked at the various options in order to add interactivity to the web.

2.1 Current E-Learning Services

The current E-Learning services that are offered by several of sites have a very low level of interactivity. They enhance the user experience either by audio, video or images. However, very few sites really encourage user activity. Most of the platforms adapt a common method of providing download links for reference material and notes, which falls into the category of reading again. None of them offered a solution, where and individual could engage and constantly control the kind of learning environment he or she is in. These E-learning sites don’t facilitate any insight tools or progress tracking backend. They don’t facilitate interaction between the educators and the students. The students cannot seek immediate aid or guidance online.
The current E-learning site provide 60% offline resources and only 40% online resources with minimum user engagement and interaction. However these sites have less of study material and more of resources like Question papers and solutions to them that an individual would require only after studying. These site focus less on the learning and more on the exam preparation aspect without enough detail towards understanding and basics.

Currently most of these systems offer on:

• 70% Offline content & resources.

• 10% Online interactive services.

• 10% Actual understanding.

• 10% Online guidance

2.2 Augmented Reality Technology

Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are *augmented* by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one's current perception of reality. By contrast, virtual reality replaces the real world with a simulated one. Augmentation is conventionally in real-time and in semantic context with environmental elements, such as sports scores on TV during a match. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable. Artificial information about the environment and its objects can be overlaid on the real world.

Currently, Augmented Reality (AR) is not being used for educational purposes. Most of its applications are in the field of advanced virtual graphics, games, or advertisements. We surveyed various sites that showcased products and projects that were powered by AR. There were certain websites that offered a first-hand guide to beginning with AR. We looked most of the projects that were based on AR and had web interaction associated with it. Currently a lot of AR projects are designed for mobile applications and offline usage.

Current Technology that uses Augmented Reality is:

Hardware

Hardware components for augmented reality are: processor, display, sensors and input devices. Modern mobile computing devices like smartphones and tablet computers contain these elements which often include a camera and MEMS sensors such as accelerometer, GPS, and solid state compass, making them suitable AR platforms.

Display

Various technologies are used in Augmented Reality rendering including optical projection systems, monitors, hand held devices, and display systems worn on one's person.

Head-mounted

A head-mounted display (HMD) is a display device paired to a headset such as a harness or helmet. HMDs place images of both the physical world and virtual objects over the user's field of view. Modern HMDs often employ sensors for six degrees of freedom monitoring that allow the system to align virtual information to the physical world and adjust accordingly with the user's head movements.

Eyeglasses

AR displays can be rendered on devices resembling eyeglasses. Versions include eye wear that employ cameras to intercept the real world view and re-display its augmented view through the eye pieces and devices in which the AR imagery is projected through or reflected off the surfaces of the eye wear lens pieces.

Contact lenses

Contact lenses that display AR imaging are in development. These bionic contact lenses might contain the elements for display embedded into the lens including integrated circuitry, LEDs and an antenna for wireless communication. Another version of contact lenses, in development for the U.S. Military, is designed to function with AR spectacles, allowing soldiers to focus on close-to-the-eye AR images on the spectacles and distant real world objects at the same time.

Virtual retinal display

A virtual retinal display (VRD) is a personal display device under development at the University of Washington's Human Interface Technology Laboratory. With this technology, a display is scanned directly onto the retina of a viewer's eye. The viewer sees what appears to be a conventional display floating in space in front of them.

EyeTap

The EyeTap (also known as Generation-2 Glass) captures rays of light that would otherwise pass through the centre of a lens of an eye of the wearer, and substituted each ray of light for synthetic computer-controlled light. The Generation-4 Glass (Laser EyeTap) is similar to the VRD (i.e. it uses a computer controlled laser light source) except that it also has infinite depth of focus and causes the eye itself to, in effect, function as both a camera and a display, by way of exact alignment with the eye, and resynthesis (in laser light) of rays of light entering the eye.

Handheld

Handheld displays employ a small display that fits in a user's hand. All handheld AR solutions to date opt for video see-through. Initially handheld AR employed fiduciary markers, and later GPS units and MEMS sensors such as digital compasses and six degrees of freedom accelerometer–gyroscope. Today SLAM markerless trackers such as PTAM are starting to come into use. Handheld display AR promises to be the first commercial success for AR technologies. The two main advantages of handheld AR is the portable nature of handheld devices and ubiquitous nature of camera phones. The disadvantages are the physical constraints of the user having to hold the handheld device out in front of them at all times as well as distorting effect of classically wide-angled mobile phone cameras when compared to the real world as viewed through the eye.

Spatial

Spatial Augmented Reality (SAR) augments real world objects and scenes without the use of special displays such as monitors, head mounted displays or hand-held devices. SAR makes use of digital projectors to display graphical information onto physical objects. The key difference in SAR is that the display is separated from the users of the system. Because the displays are not associated with each user, SAR scales naturally up to groups of users, thus allowing for collocated collaboration between users. SAR has several advantages over traditional head-mounted displays and handheld devices. The user is not required to carry equipment or wear the display over their eyes. This makes spatial AR a good candidate for collaborative work, as the users can see each other's Examples include shader lamps, mobile projectors, virtual tables, and smart projectors. Shader lamps mimic and augment reality by projecting imagery onto neutral objects, providing the opportunity to enhance the object's appearance with materials of a simple unit- a projector, camera, and sensor. Handheld projectors further this goal by enabling cluster configurations of environment sensing, reducing the need for additional peripheral sensing. Other tangible applications include table and wall projections. One such innovation, the Extended Virtual Table, separates the virtual from the real by including beam-splitter mirrors attached to the ceiling at an adjustable angle. Virtual showcases, which employ beam-splitter mirrors together with multiple graphics displays, provide an interactive means of simultaneously engaging with the virtual and the real. Altogether, current augmented reality display technology can be applied to improve design and visualization, or function as scientific simulations and tools for education or entertainment. Many more implementations and configurations make spatial augmented reality display an increasingly attractive interactive alternative.

Spatial AR does not suffer from the limited display resolution of current head-mounted displays and portable devices. A projector based display system can simply incorporate more projectors to expand the display area. Where portable devices have a small window into the world for drawing, a SAR system can display on any number of surfaces of an indoor setting at once. The drawbacks, however, are that SAR systems of projectors do not work so well in sunlight and also require a surface on which to project the computer generated graphics. Augmentations cannot simply hang in the air as they do with handheld and HMD-based AR. The tangible nature of SAR, though, makes this an ideal technology to support design, as SAR supports both a graphical visualisation and passive haptic sensation for the end users. People are able to touch physical objects, and it is this process that provides the passive haptic sensation.

3. Analysis and Design

3.1 Analysis

3.1.1 Functional and Non-Functional requirements

3.1.1.1 Functional Requirements:

Interface requirements:

• User account form accepts data in validated format.

• Disable navigation and additional features if user is not logged in.

Business requirements:

• User data must be displayed only if user has logged into his account.

• Test data should be entered only if user takes a test online.

• Check if every login is valid and new accounts are validated.

Security requirements:

• User should not be able to create account with the same name.

• Should not be able to access additional features if not logged in.

3.1.1.2 Non-Functional Requirements:

• Sufficient network bandwidth.

• Accessibility.

• Effectiveness.

• Concentration span.

• Clarity of camera.

3.1.2 Use Case Diagram

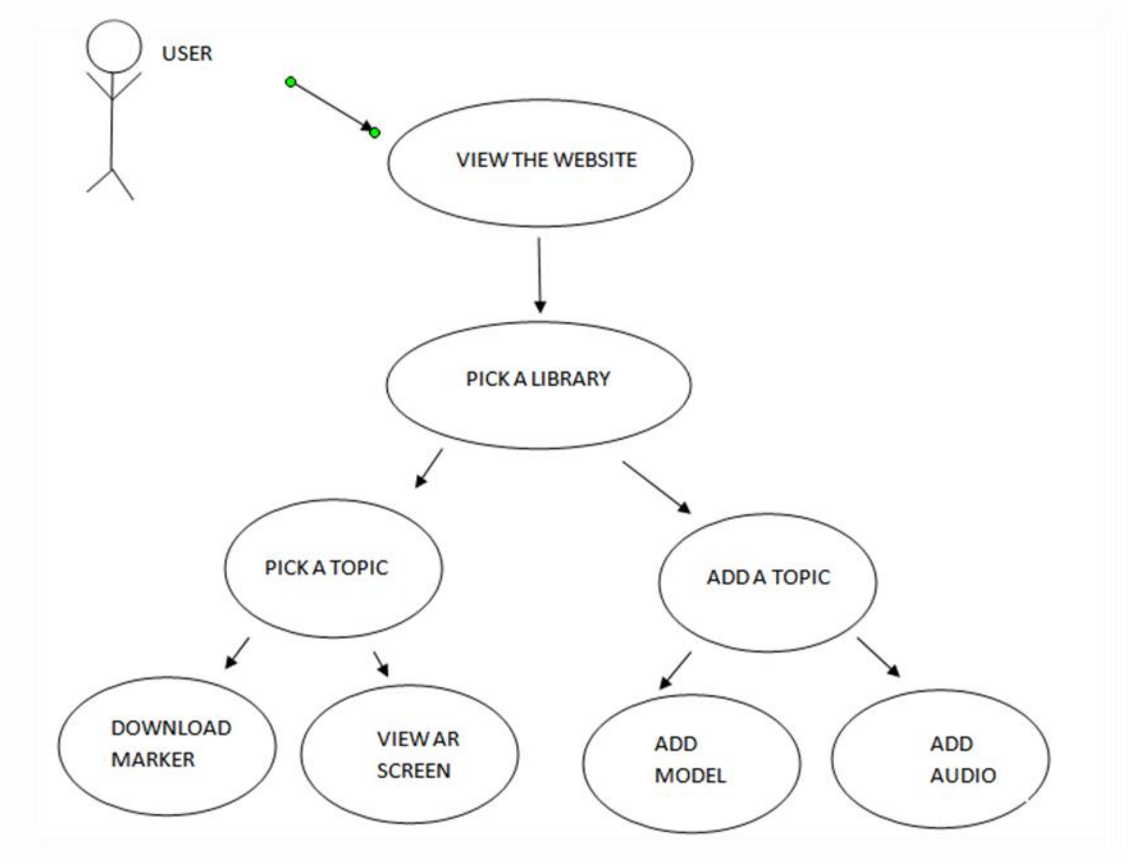

Figure 3.1: Use Case Diagram of the System

3.1.3 State Chart Diagram

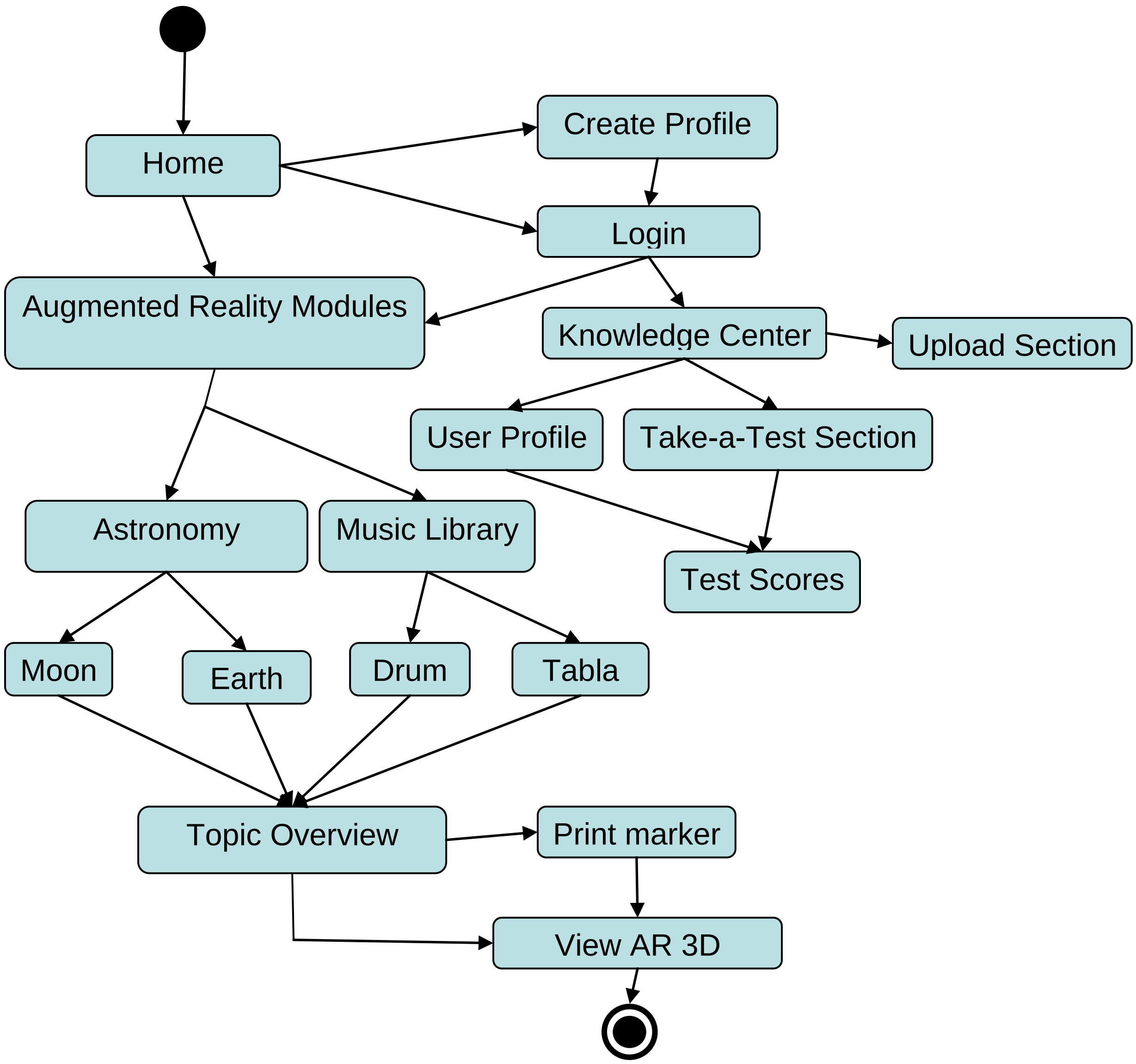

Figure 3.2: State Chart Diagram of the System

3.2 Design

3.2.1. Augmented Reality Model

3.2.1.1. Block Diagram of Augmented Reality Model

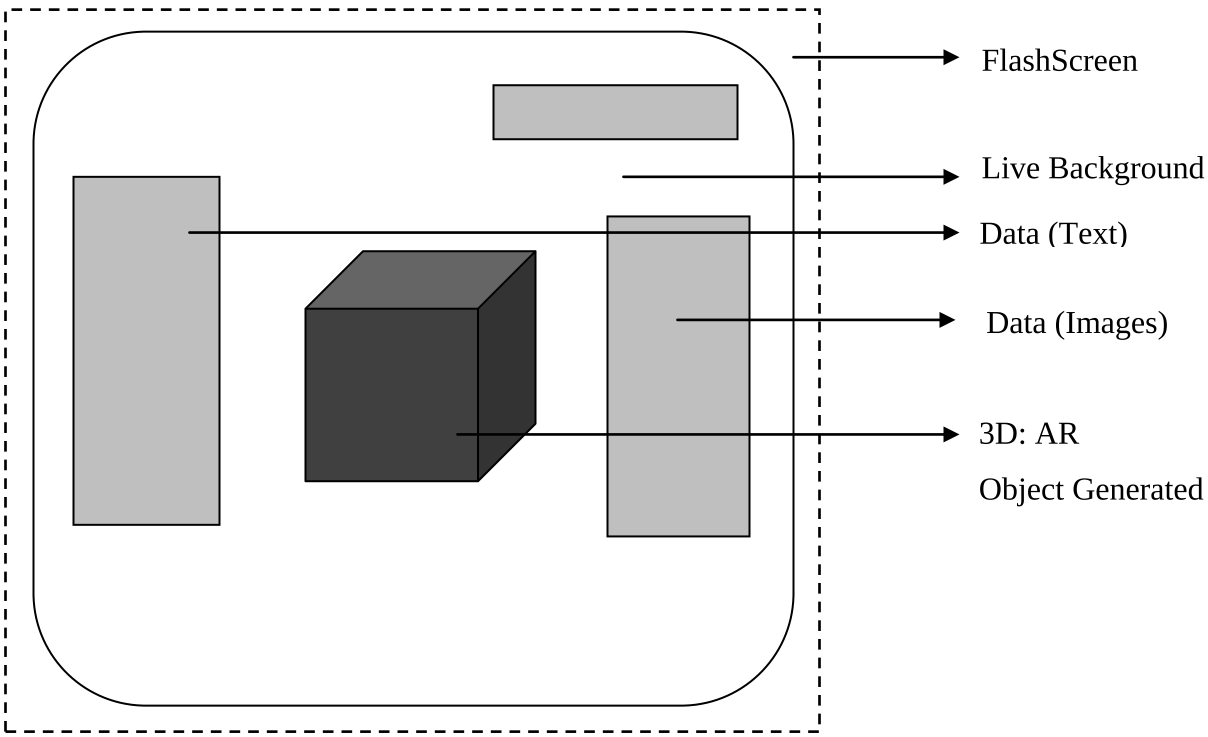

Figure 3.3: Block Diagram of the Augmented Reality Model

3.2.1.2 Preview of Augmented Reality Model

Figure 3.4: Preview of the Augmented Reality Model

3.2.2 E-Learning Website

3.2.2.1. Block diagram of E-Learning Website - Library

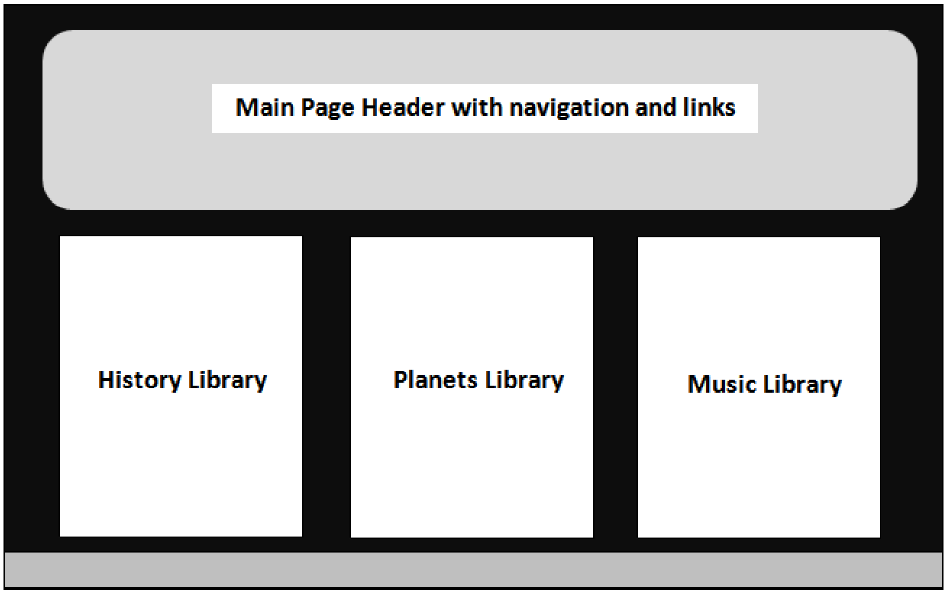

Figure 3.5: Block Diagram of Library

3.2.2.2. Block diagram of E-Learning Website – Sub Library

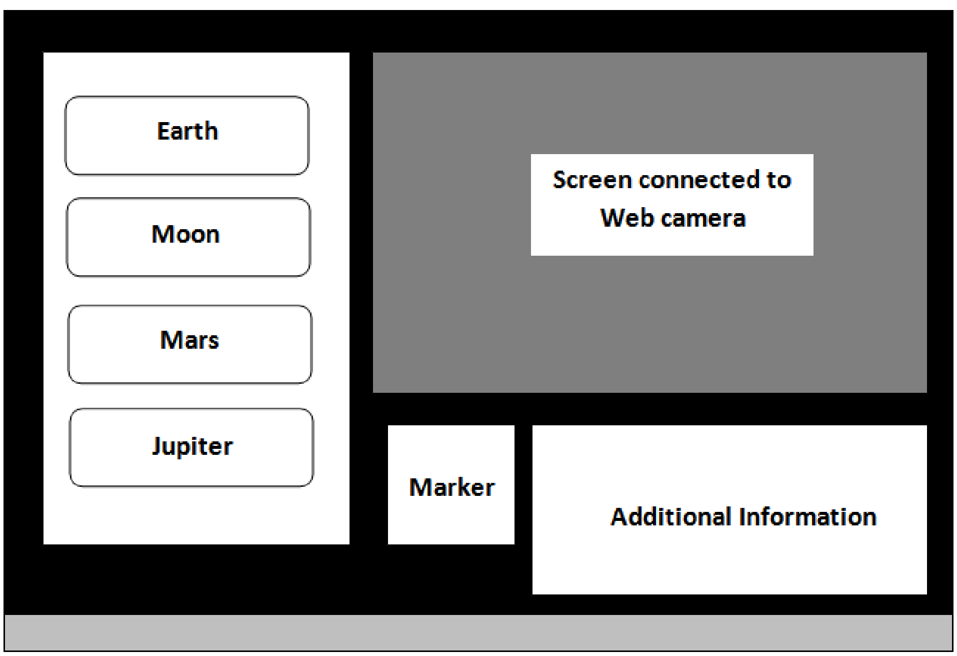

Figure 3.6: Block Diagram of Sub Library

3.2.2.3. Preview of E-Learning Website - Library

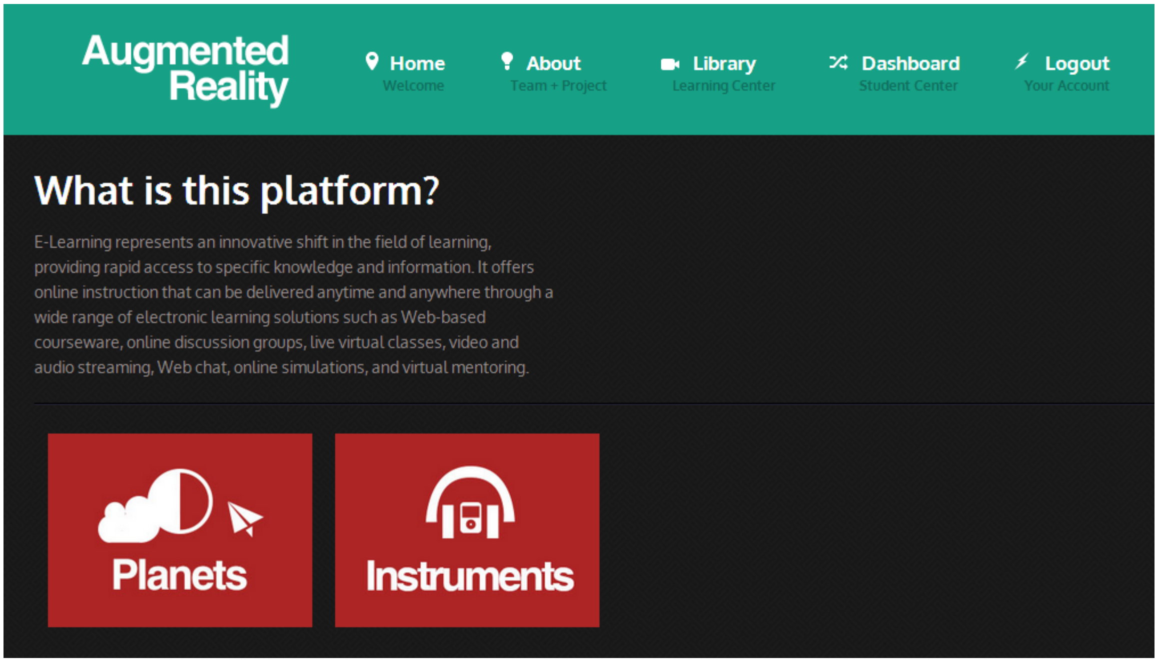

Figure 3.7: Preview of Library

3.2.2.4. Preview of E-Learning Website – Sub Library

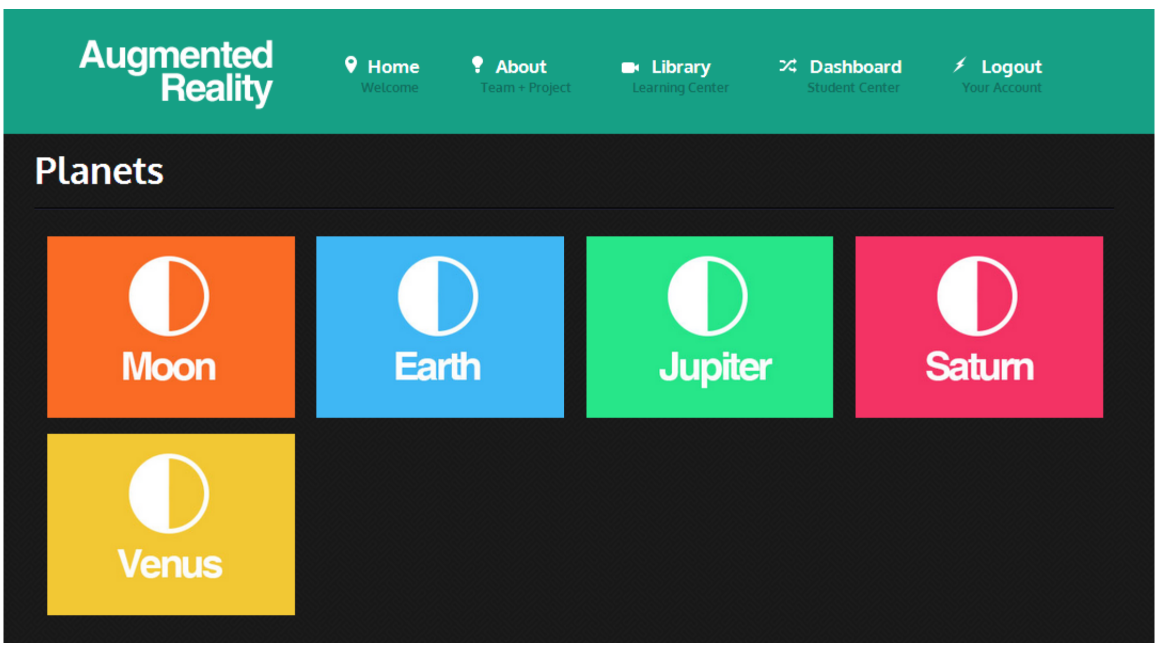

Figure 3.8: Preview of Sub Library

3.2.3 User Interface

3.2.3.1 UI – Home Page

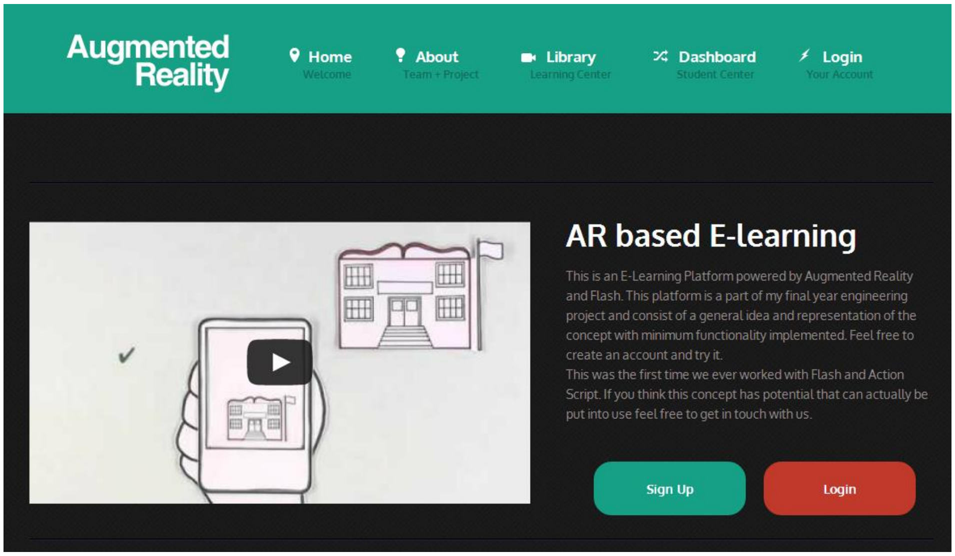

Figure 3.9: UI – Home Page

User can now choose to either create a new profile or login in using an existing profile account.

3.2.3.2 UI – Create Account

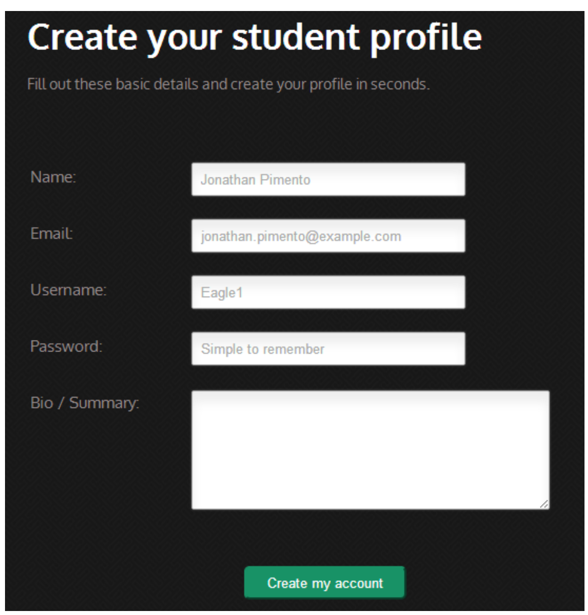

Figure 3.10: UI – Create Account

3.2.3.3 UI – Login Page

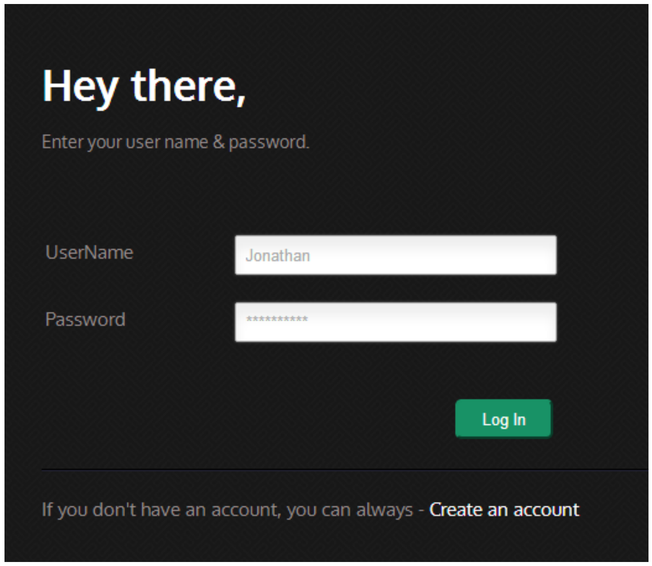

Figure 3.11: UI – Login Page

The User can simply login with his or her details or create a new account quickly.

3.2.3.4 UI – Library Page

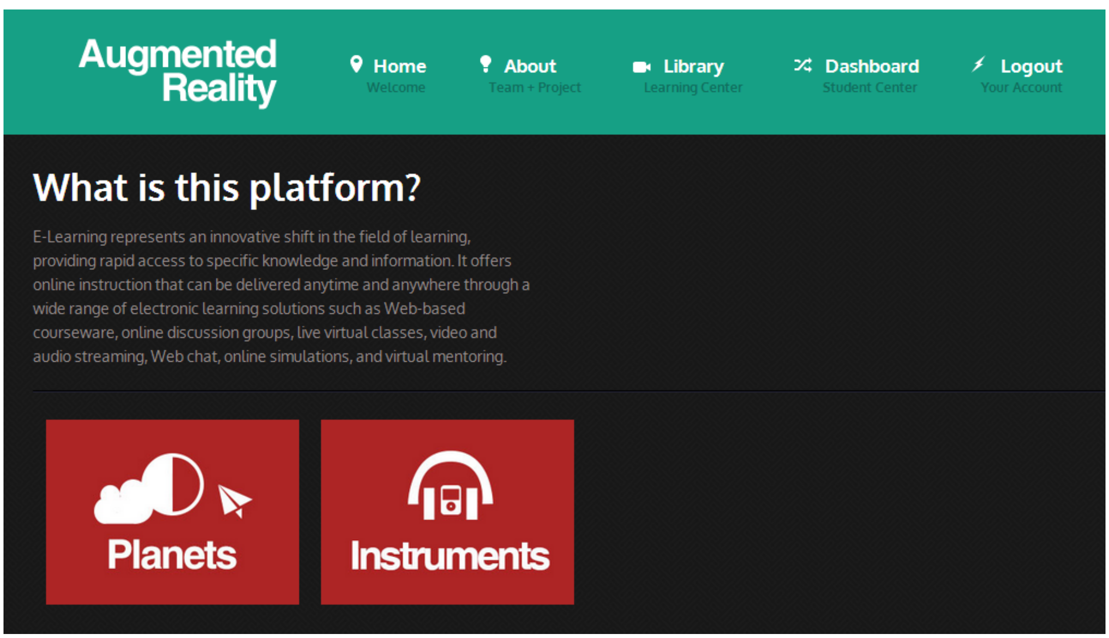

Figure 3.12: UI – Library Page

User can navigate to the library to pick a subject of interest. In this case Planets or instruments.

3.2.3.5 UI – Sub Library Page

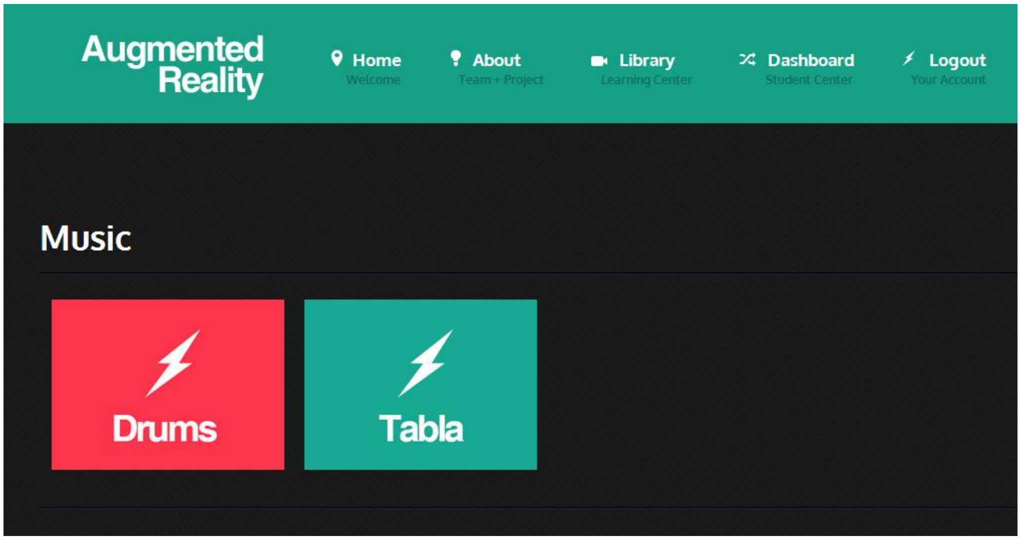

Figure 3.13: UI – Topic Page

Here the user chooses a topic from a specific library. For example inside instruments he could choose drums or table.

3.2.3.6 UI – Topic Page (Information)

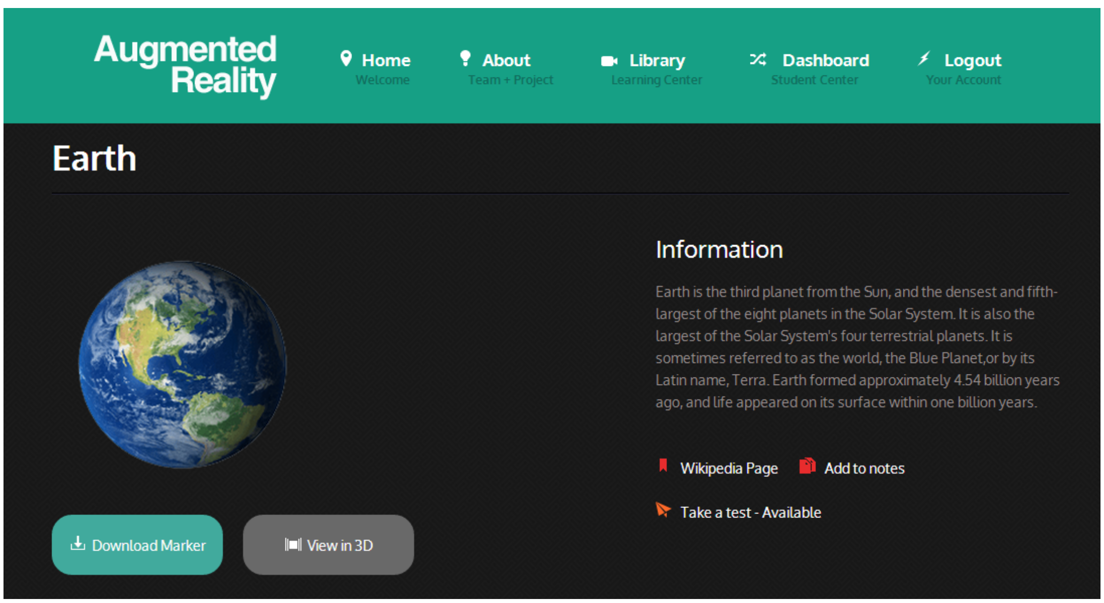

Figure 3.14: UI – Topic Page (Information)

After the user selects a topic from the sub-library, he reaches the actual content of the topic page

3.2.3.7 UI – Topic Page (Augmented Reality Screen)

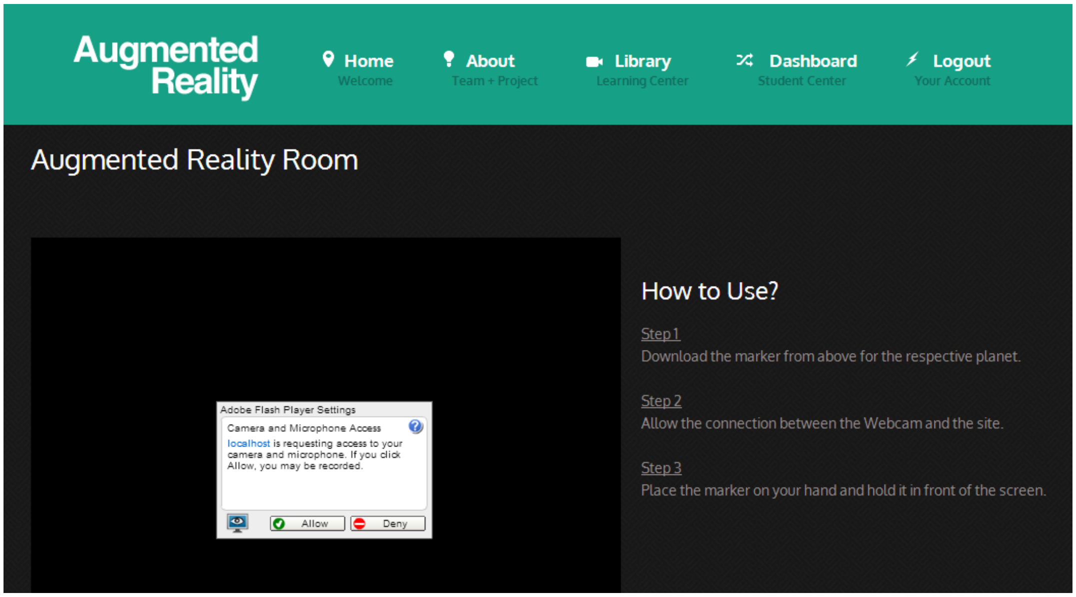

Figure 3.15: UI – Topic Page (Augmented Reality Screen)

The part of the topic page where the user uses his webcam to connect and view the AR Model.

3.2.3.8 UI – Augmented Reality Screen in action

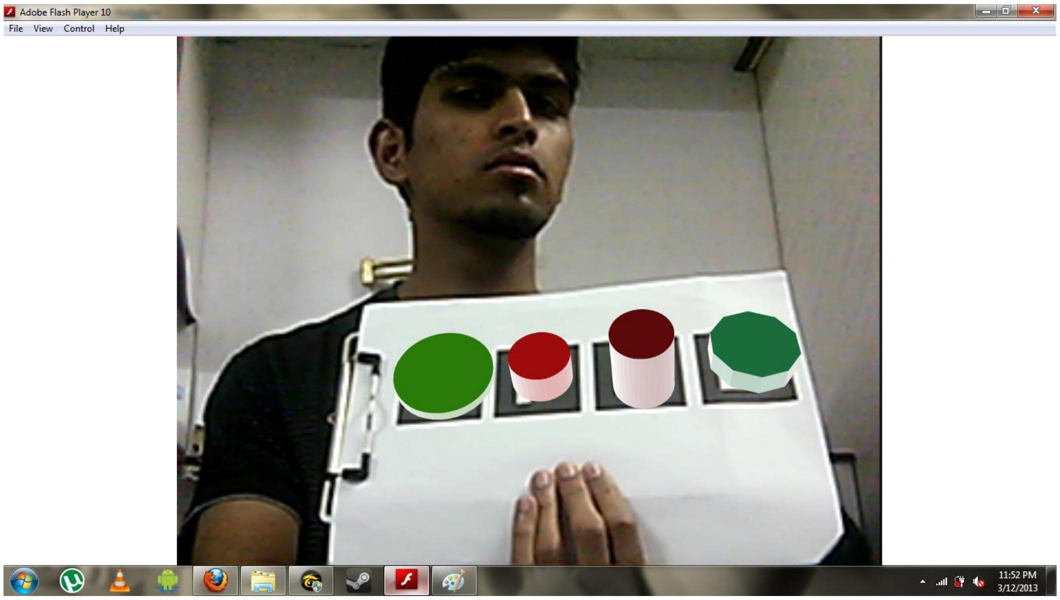

Figure 3.16: UI – Augmented Reality Screen in action

This is how the screen appears after he connects via his webcam to the page.

3.2.3.9 UI – Additional Features

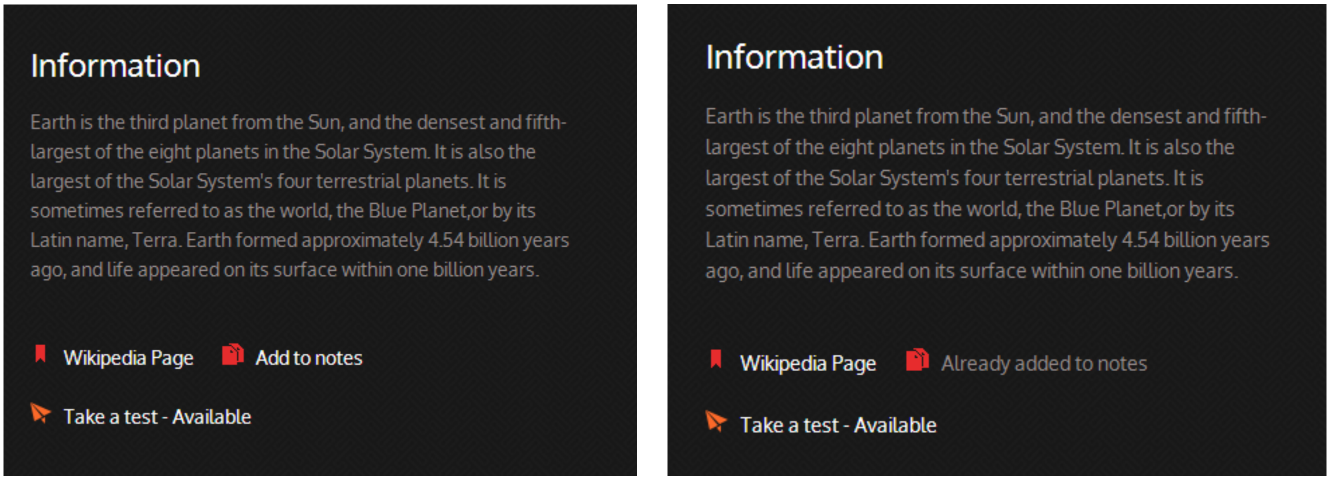

Figure 3.17: UI – Additional Features

On each topic page there are a couple of external links and resources to help aid the learning process. The test option records the student's progress in the database.

3.2.3.10 UI – Knowledge Center

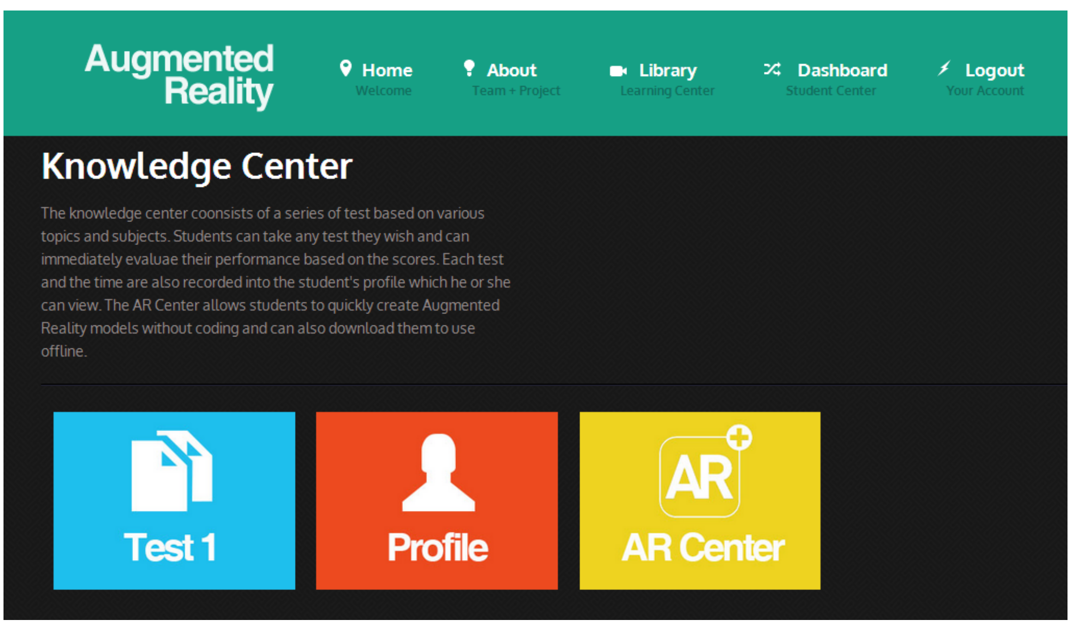

Figure 3.18: UI – Knowledge Center

The Knowledge center allows the user to view his profile, take a test and create his own AR models without coding in just a few simple steps.

3.2.3.11 UI – Test

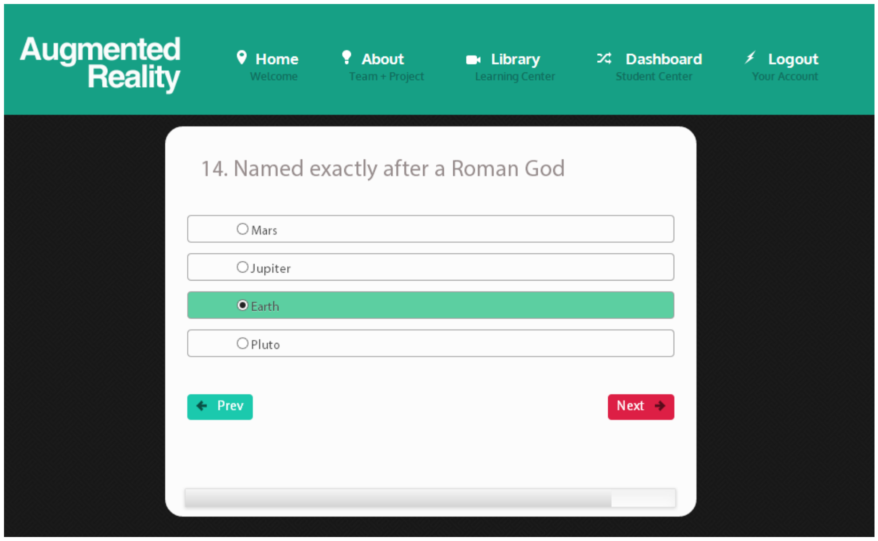

Figure 3.19: UI – Test

This is the test the student takes based on a multiple choice question set.

3.2.3.12 UI – Test Results

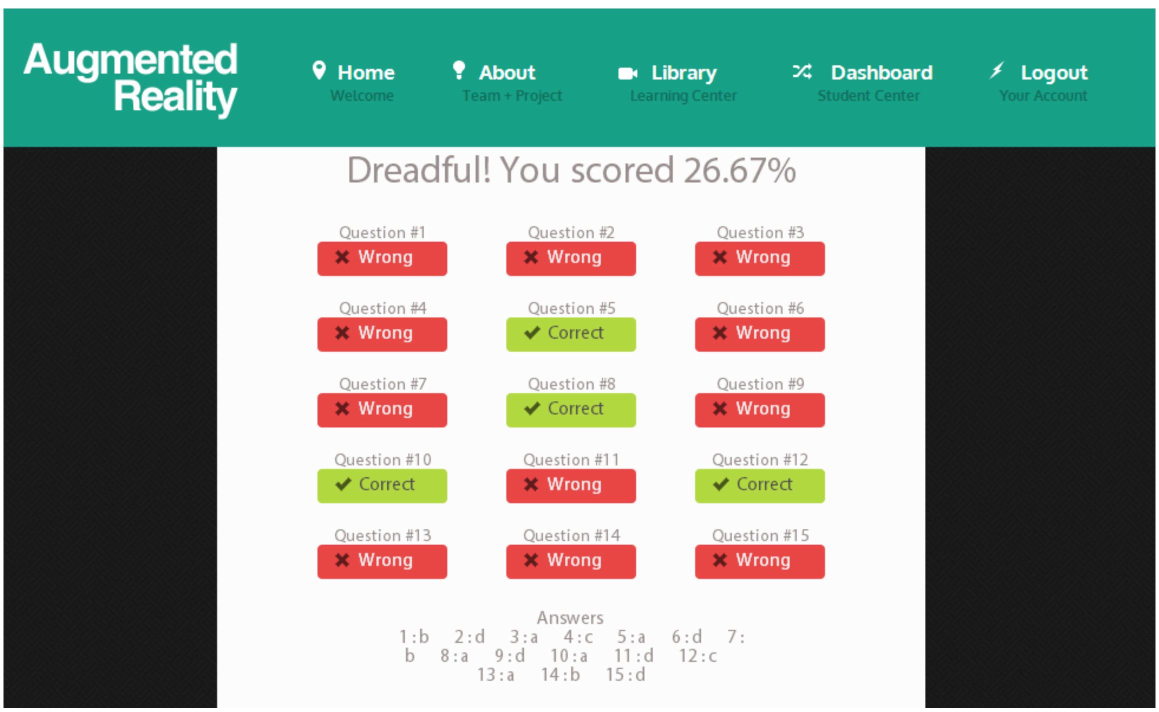

Figure 3.20: UI – Test Results

At the end of each test the student can see his marks and evaluation immediately.

3.2.3.13 UI – User Profile

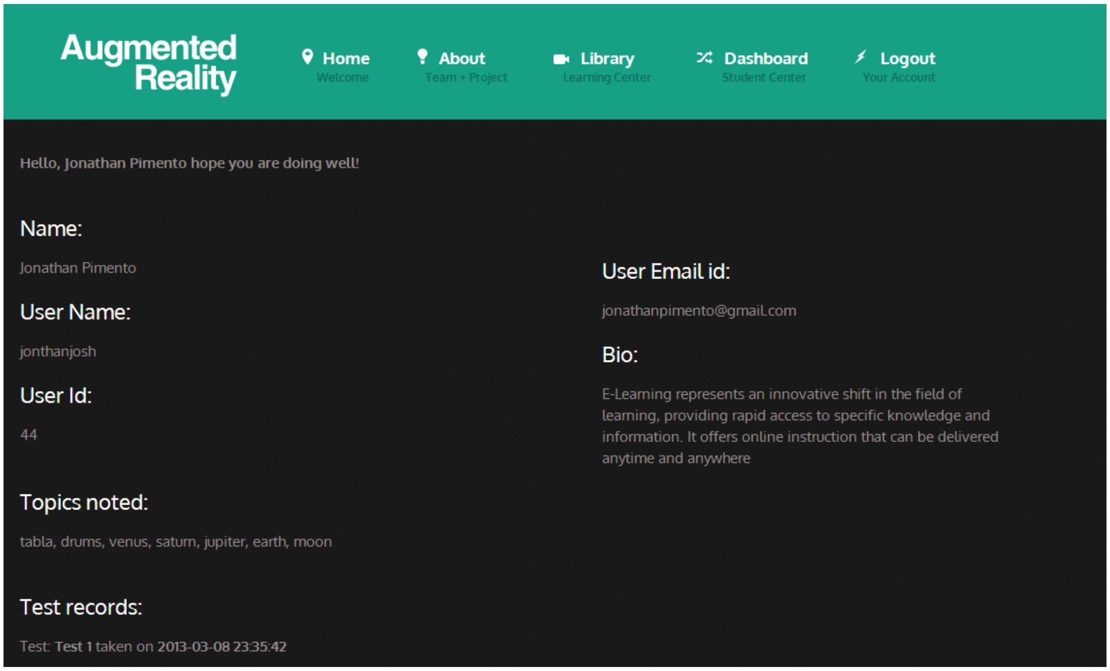

Figure 3.21: UI – User Profile

This how the student's profile appears in the knowledge center.

3.2.3.14 UI – User Created AR Modules

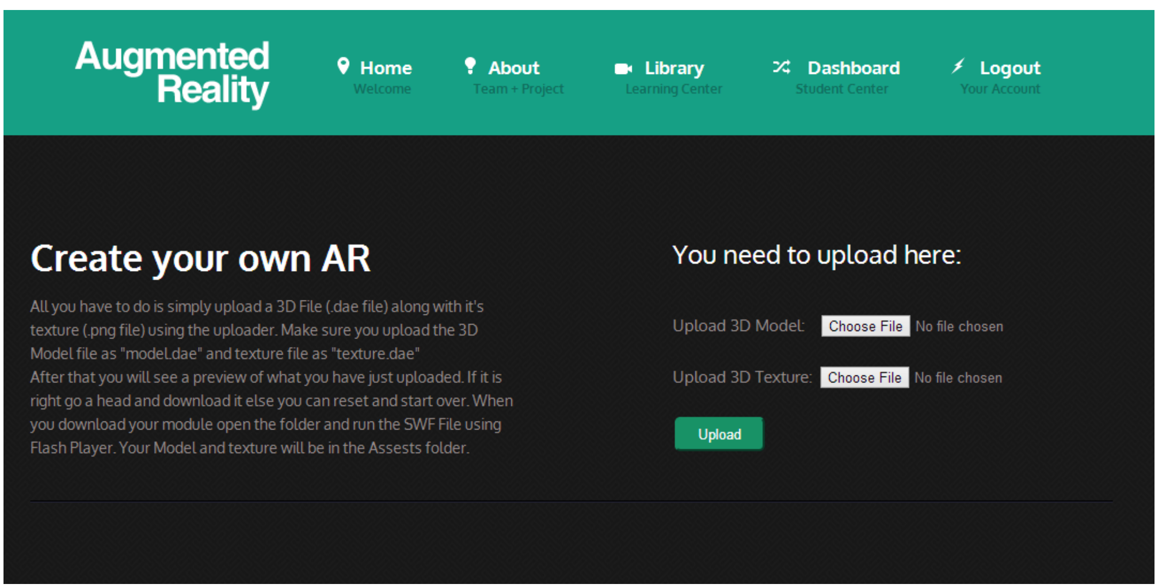

Figure 3.22: UI – User Created AR Modules

This page allows the user to upload 2 files to create his AR models in seconds.

3.2.3.15 UI – User downloads AR Modules

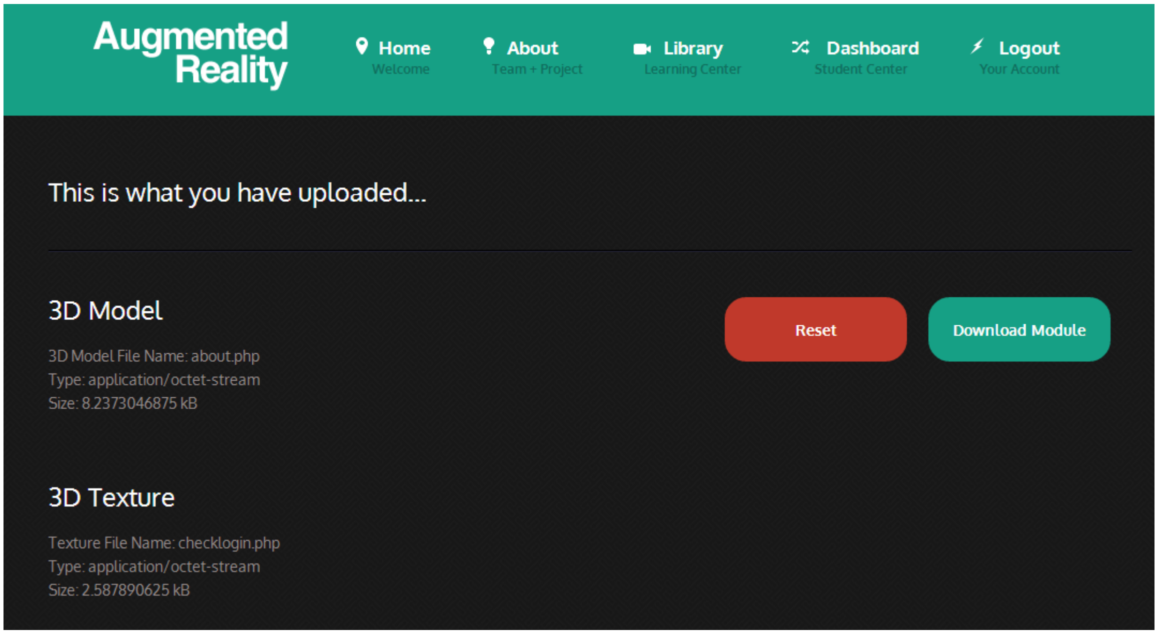

Figure 3.23: UI – User downloads AR Modules

After the user uploads the files he is redirected to a page where a brief summary of the upload is provided along with two options:

a.) Reset: Upload a new set of files

b.) Download: Download your AR Module based on the 2 files uploaded by you.

The download option saves a compressed zip folder on the user's machine containing the AR Module in the form of a SWF file that works offline with Adobe Flash Player.

4. Implementation Details

4.1 Technologies used

We are using a combination of different programming languages for this project. Along with that we need certain softwares and hardware requirements.

4.1.1. Hardware

The brilliance of our Augmented Reality e-learning system lies in its simplicity. All that is needed is a webcam connected to a computer, be it a desktop or a laptop. The webcam is used to track the pattern on the piece of paper. The monitor displays the respective model, whether it's a model of a planet or of an animal.

- **Desktop / Laptop PC**
- **Web camera**

4.1.2 Software

The software we use to build the Augmented Reality modules is Adobe Flash Professional CS6. We use Flash programming as well as Action Script 3.0 to build the Flash screens that display the Augmented Reality models. Besides that we also use a text editor Notepad ++ for the entire web programming, that involves HTML, CSS, PHP, and JavaScript.

- **Adobe Flash Professional CS6**
- **Notepad ++**
- **Maya (3D Modelling)**
- **Sublime Text Editor**
- **Photoshop CS6**
- **Dreamweaver CS6**
- **Browsers: Google Chrome, Mozilla Firefox, Internet Explorer, Apple Safari**

4.2 Methodology

The system we have built is in two main parts. The first part in the Augmented Reality Modules for each library / topic. The second part is building the website where these modules will be uploaded and made available to the user in the form of an E-Learning Website.

To build the various modules in Augmented Reality we make use of Action Script. However to enrich the application with interactivity we make use of Flash. Similarly we also integrate HTML and CSS to present data more visually and meaningfully with the flash screen. We will then use basic PHP for framework and build a website using HTML5 and CSS3. This website will host all the markers and their respective flash screens. The user can download and print the marker and also use it on the website by going to the respective flash screen of the topic.

The website will have a basic user interface where the user can simply login and do any of the following. The user can:

- Create an account
- Login to his / her account
- Browse through any of the libraries.
- Select a sub-library of interest
- Pick a topic of interest.
- Proceed to the respective subject page.
- Download the marker.
- Hold it in front of the screen for AR module
- Click and view additional online and offline resources and links
- Add and create his AR based notes.
- View profile
- Logout of the system

4.2.1 Building the AR Modules

We first developed the individual AR Modules for the planets and drums usinf Action Script 3.0 and Adobe Flash. We imported different libraries in Action Script to add animation, effects, 3D Models and textures. Similarly more packages for adding text, HTML and event triggers in Action Script.

```
package {
    //import stuff
    import flash.events.Event;
    import com.greensock.*;
    import org.papervision3d.lights.PointLight3D;
    import org.papervision3d.materials.shadematerials.FlatShadeMaterial;
    import org.papervision3d.materials.utils.MaterialsList;
    import org.papervision3d.objects.DisplayObject3D;
    import org.papervision3d.objects.primitives.Cube;
    import org.papervision3d.materials.BitmapFileMaterial;
    import org.papervision3d.objects.primitives.*;
    import org.papervision3d.materials.ColorMaterial;
    import flash.geom.ColorTransform;
    import flash.filters.*;
    import flash.media.SoundMixer;
    import flash.media.SoundChannel;
    import org.papervision3d.objects.parsers.Collada;

    import com.squidder.flar.FLARMarkerObj;
    import com.squidder.flar.PVFLARBaseApplication;
    import com.squidder.flar.events.FLARDetectorEvent;

    import flash.display.*;
    import flash.text.TextField;
    import flash.text.TextFormat;
    import flash.display.Stage;
```

This code was used to detect the marker via the webcam.

```
public function MultiFLARExample() {

    _cubes = new Array();

// import the marker pattern
    _markers = new Array();
    _markers.push( new FLARMarkerObj( "assets/flar/kmarker.pat" , 16 , 50 , 80 ) );
    _markers.push( new FLARMarkerObj( "assets/flar/kickdrum.pat" , 16 , 50 , 80 ) );
    _markers.push( new FLARMarkerObj( "assets/flar/ride.pat" , 16 , 50 , 80 ) );
    _markers.push( new FLARMarkerObj( "assets/flar/snare.pat" , 16 , 50 , 80 ) );

    super( );
}

override protected function _init( event : Event ) : void {

    super._init( event );

    _lightPoint = new PointLight3D( );
    _lightPoint.y = 1000;
    _lightPoint.z = -1000;
```

We created the planets by using various classes and inbuilt library functions like sphere and cubes.

```
//create the earth
            var Earth:Sphere = new Sphere(earth, 1);
            Earth.z=-20;
            TweenMax.to(Earth, 4,{scaleX:40, scaleY:40, scaleZ:40, z:"90", delay:1});
            dispObj.addChild(Earth);
```

Similarly we embedded HTML into Action Script in the following manner.We can easily import fonts into the library and define text to display on the flash screen. Similarly basic adjustments like borders, font size, height, width, color and opacity could be added and modified.

```

//text drop out
var myFont = new Font1();
var myFormat:TextFormat = new TextFormat();
myFormat.size = 15;
myFormat.font = myFont.fontName;

var myTextFormat:TextFormat = new TextFormat();
myTextFormat.size = 25;
myTextFormat.font = myFont.fontName;

var myText:TextField = new TextField();
myText.defaultTextFormat = myFormat;
myText.embedFonts = true;
myText.text = "The Moon is the only natural satellite
addChild(myText);

myText.wordWrap = true;
myText.width = 150;
myText.height = 250;
myText.x = 40;
myText.y = 100;

myText.textColor = 0xCCFFFF;
```

4.2.2 Building the Database

In order for the student's progress and data to be recorded and stored we make use of 2 different tables in the database. We create a Test table to record test related data and a user table to record the user or student's data.

4.2.2.1 User Table:

The user table consisted of basic details that were saved when the student creates an account for the first time on the site. Apart from that it also records the notes he keeps adding from the various libraries on the website.

	Field	Type	Collation	Attributes	Null	Default	Extra
☐	Uid	int(11)			No	*None*	AUTO_INCREMENT
☐	UserName	varchar(25)	latin1_swedish_ci		Yes	*NULL*	
☐	Name	varchar(25)	latin1_swedish_ci		Yes	*NULL*	
☐	Bio	varchar(255)	latin1_swedish_ci		No	*None*	
☐	email	varchar(140)	latin1_swedish_ci		Yes	*NULL*	
☐	password	varchar(40)	latin1_swedish_ci		Yes	*NULL*	
☐	notes	varchar(400)	latin1_swedish_ci		No	*None*	

4.2.2.2 Test Table:

The test table records the test name and the also the details regarding the time and date of the test taken by the student. This is used to display test details on the user's user profile page. Also the score the is updated and stored here in this table for insights and profile display.

	Field	Type	Collation	Attributes	Null	Default	Extra
☐	id	int(11)			No	*None*	AUTO_INCREMENT
☐	username	varchar(30)	latin1_swedish_ci		No	*None*	
☐	test_name	varchar(225)	latin1_swedish_ci		No	*None*	
☐	datetime	datetime			No	*None*	
☐	score	int(11)			No	*None*	

5. Testing

5.1 Component testing

We tested each of the individual augmented reality modules offline by running their SWF files. After that we embedded them into an HTML page and ran them. Tested them on different systems that had Adobe Flash preinstalled and systems that need Adobe Flash to be installed. Systems or browsers that had Adobe Flash installed successfully executed the code. Browsers and systems that didn't have Flash installed provided an error message along with a download link to install the latest Adobe Flash Player.

5.2 Cross-browser / platform testing

We tested the E-Learning website on 4 different browsers:

- Google Chrome (Win 8)
- Internet Explorer (Win Vista, Win 7)
- Mozilla Firefox (Ubuntu)
- Apple Safari (iOS 6)

We tested them to check if they supported the latest HTML5 and CSS3 tags that we used. Out of all the browsers Chrome and Firefox supported all the tags we used. There were minor issues with Safari and Internet Explorer nt supporting certain CSS3 tags and features.

5.3 Database Testing and connectivity

We also tested the individual pages that were connected to the main database to check if records were successfully entered and saved. We also checked and tested pages that retrieved and displayed values from the database.

5.4 Responsive device testing

We viewed and tested the entire website on different screen resolutions, tablets and smart phones. 60% of the entire website successfully adapts to the screen size and hardware restriction. However we haven't been able to design a completely responsive layout for all devices.

6. Result

We successfully implemented augmented reality e-learning as an effective solution to a simplified teaching and learning experience. We successfully created two libraries, astrology and musical instruments which allows the students to view 3D models of planets and play different instruments.

We created a database that records the students profile and tracks his progress as he takes different tests while adding notes. We also created a section that allows a user to upload 3D models and their textures to create his own offline AR Module which is available for public download.

7. Conclusion and Future Work

7.1 Conclusion

We successfully implemented an E-Learning website that allows the users to create a profile and browse through libraries that contain various AR Modules of different topics. The students can view the 3D models in real-time along with an audio guide and external reference material and links together on the same page. Apart from that the user can also take various test that get recorded into his profile and can also view his profile to track his progress.

7.2 Future work

In the near future we plan to expand the number of libraries and topics provided through the website. Apart from that also improve the 3D models with better animation and textures. We plan on balancing the orientation of the website by providing some key insight features and tools for teachers and educators to keep track of class and individual progress.

List of future implementations:

- New libraries and topics.
- Better 3D Models and animation.
- Insight tools and features for teachers and educators.
- Convert the current design to make it more responsive and device friendly.
- Include convenient offline and online assistance and resources.

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