ARG THERAPY FOR CHIDREN WITH ASD

PROJECT REPORT

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ABSTRACT

This project presents progress on treating children with Autism Spectrum Disorder (ASD) using Augmented Reality based games. The aim of these games is to enhance social interaction and hand-eye coordination in children with ASD thus easing them into becoming more comfortable around unfamiliar people. Colour detection, tracking and motion tracking concepts in augmented reality have been used to develop games for young children with ASD. The idea is that these games will encourage concentration and imagination from children through repetitive movement and visual feedback.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Augmented reality has been a hot topic in software development circles for a number of years, but it is getting renewed focus and attention with the release of products like Google Glass. Augmented reality is a technology that works on computer vision based recognition algorithms to augment sound, video, graphics and other sensor based inputs on real world objects using the camera of our device. It is a good way to render real world information and present it in an interactive way so that virtual elements become part of the real world.

Augmented reality displays superimpose information in our field of view and can take us into a new world where the real and virtual worlds are tightly coupled. It is not just limited to desktop or mobile devices. As mentioned, Google Glass, a wearable computer with optical head-mounted display, is a perfect example, but our project is implemented in android devices because Microsoft hololens is very expensive. A simple augmented reality use case is: a user captures the image of a real-world object, and the underlying platform detects a marker, which triggers it to add a virtual object on top of the real-world image and displays on our camera screen.

AR applications can become the backbone of the education industry. Apps are being developed which embed text, images, and videos, as well as real–world curriculums. Printing and advertising industries are developing apps to display digital content on top of real world magazines. With help of AR, travelers can access real-time information of historical places just by pointing their camera viewfinder to subjects. AR is helpful in development of translation apps that can interpret text in other languages for us. Location based AR apps are major forms of AR apps. Users can access information about nearest places relative to current location. They can get information about places and choose based on user reviews. With the help of Unity 3d Engine, AR is being used to develop real-time 3D Games. It is estimated that 2.5 billion AR apps will be downloaded annually and will generate revenue of more than $1.5 billion by 2015. This is because AR apps will not be limited to conventional mobile apps. There will be new markets like Google Glass, which will open more forms of development and use.

A marker-based AR works on concept of target recognition. The target can be 3D object, text, image, QR Code or human-face called markers. After detection of the target by AR engine, we can embed the virtual object on it and display it on our camera screen. Qualcomm Vuforia SDK is our present framework to develop native apps.

1.2 OBJECTIVE OF THE PROJECT

This project presents progress on treating children with Autism Spectrum Disorder (ASD) using Augmented Reality based games. The aim of these games is to enhance social interaction and hand-eye coordination in children with ASD thus easing them into becoming more comfortable around unfamiliar people. Color detection, tracking, and motion tracking concepts in augmented reality have been used to develop games for young children with ASD. The idea is that these games will encourage concentration and imagination from children through repetitive movement and visual feedback. Current research in therapeutic technology for autism is aimed toward improving maintaining eye contact, determining facial expressions and other behaviors that influence social interactivity. Today technology can be a safe and motivating way of engaging autistic children in social interaction activities. The Economic and Social Research Council (ESRC) and the Engineering and Physical Science Research Council (EPSRC) in the UK developed a joint research project called ECHOES, a Technology Enhanced Learning (TEL) program. The aim of this research project was to help teachers, parents, practitioners and researchers to understand the unique strengths and weaknesses in their children. The project was brought into the classrooms of students with autism, which allowed children to play with virtual and interactive characters through interacting with echoes on a large multi-touch screen. The screen allows children to handle objects, explore the virtual environment and interact with Andy, the semi-autonomous agent. Andy facilitates engaging activities with children acting as their social partner through the program. Teachers have reported on the success of the program and how it has improved communication and social skills in their students. Socially Assistive Robotics (SAR) is a new field of robotics being explored to treat autism. SAR focuses on social interaction where robots are designed to enhance user engagement, emotional Expressions and physical appearance for the child. SARs are developed to assist a child with social interaction through coaching and motivating changes in their behavior. These systems need to be able to adapt to the varying moods of children with ASD. Researchers are aiming to control drastic mood changes in children by exposing them to autonomous robots with consistent reactions.

However, this is not entirely effective for long periods and there is a lot of room for improvement towards creating robots that can handle more dynamic, complex situation handling and unpredictable moments in an autistic child's behavior. Socially assistive robots can be designed to suit a child's height and weight, can be silicone-based with highly expressive facial features or made up of simple features with basic expressiveness. These robots can also resemble animals or toy-like imaginative characters that are simple and easy to use. The robots are often used as mediators between an adult and the child, working to create a Comfortable environment for the child around other people rather than socially engaging with the child directly in a solo situation. The biggest challenge researchers face with socially assistive robots used in autism therapy sessions is creating non-threatening and simple robots for a child.

1.3 SCOPE OF THE PROJECT

Few years ago, we all very familiar with "Edu comp" which become a huge revolution in education field but our system is something better than that. In this app, we can study anything with a real world field. Finlay, scope of this project is to create an Augmented Reality mobile application for autism children to get better education than 3D animations displayed on screen. Augmented Reality has the ability to grow and nurture imagination in a child where he or she may struggle with spontaneous pretend play. AR allows children to see a representation of imaginary content overlaid on the real world environment thus imagination and pretend play makes sense. Evidence-based research shows that AR attracts the attention of children with ASD. However, few studies have combined AR with VM to train children with ASD to mimic facial expressions and emotions to improve their social skills. In addition, we made a book by compiling all target platforms so this makes children to get most attracted towards education; they may get new idea about this technology.

1.4 AUGMENTED REALITY APPS

Augmented reality apps are written in special 3D programs that allow the developer to tie animation or contextual digital information in the computer program to an augmented reality "marker" in the real world. When a computing device's AR app or browser plug-in receives digital information from a known marker, it begins to execute the marker's code and layer the correct image or images.

AR applications for Smartphone's typically include global positioning system (GPS) to pinpoint the user's location and its compass to detect device orientation.

Sophisticated AR programs used by the military for training may include machine vision, object recognition and gesture recognition technologies

1.5 AR COMPONENTS

Augmented reality is a live, copy, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data. Hardware components for augmented reality are processor, display, sensors and input devices like smartphones and tablet.

1.5.1 SCENE GENERATOR

The scene generator is the device or software responsible for rendering the scene. Rendering is not currently one of the major problems in AR, because a few virtual objects need to be drawn, and they often do not necessarily have to be realistically rendered in order to serve the purposes of the application.

1.5.2 TRACKING SYSTEM

The tracking system is one of the most important problems on AR systems mostly because of the registration problem]. The objects in the real and virtual worlds must be properly aligned with respect to each other, or the illusion that the two worlds coexist will be compromised. For the industry, many applications demand accurate registration, especially on medical systems.

1.5.3 DISPLAY

The technology for AR is still in development and solutions depend on design decisions. Most of the Displays devices for AR are HMD (Head Mounted Display), but other solutions can be found. When combining the real and virtual world two basic choices are available: optical and video technology. Each of them has some trades depending on factors like resolution, flexibility, field-of-view, registration strategies, among other. Display technology continues to be a limiting factor in the development of AR systems. Still no see-through displays have sufficient brightness, resolution, field of view, and contrast to seamlessly blend a wide range of real and virtual imagery.

1.6 AR DEVICES

Their display type can distinguish four major classes of AR: Optical See-through, Virtual Retinal Systems, Video See-Through, Monitor Based AR and Projector Based AR. The following sections show the corresponding devices and present their main features:

1.6.1 OPTICAL SEE-THROUGH HMD

Optical See-Through AR uses a transparent Head Mounted Display to show the virtual environment directly over the real world. It works by placing optical combiners in front of the user’s eyes.

These combiners are partially trans missive, so that the user can look directly through them to see the real world. The combiners are also partially reflective, so that the user sees virtual images bounced on the combiners from head-mounted monitors.

1.6.2 VIRTUAL RETINAL SYSTEMS

The VRD (Virtual Retinal Display) was invented at the University of Washington in the Human Interface Technology Lab (HIT) in 1991. The aim was to produce a full color, wide field-of-view, high resolution, high brightness, low cost virtual display. Micro vision Inc. has the exclusive license to commercialize the VRD technology. This technology has many potential applications, from head-mounted displays (HMDs) for military/aerospace applications to medical purposes. The VRD projects a modulated beam of light (from an electronic source) directly onto the retina of the eye producing a rasterized image. The viewer has the illusion of seeing the source image as if he/she stands two feet away in front of a 14-inch monitor. In reality, the image is on the retina of its eye and not on a screen. The quality of the image he/she sees is excellent with stereo view, full color, wide field of view and no flickering characteristics.

1.6.3 VIDEO SEE-THROUGH HMD

Video See-Through AR uses an opaque HMD to display merged video of the VE and view from cameras on the HMD. This approach is a bit more complex than optical see-through AR, requiring proper location of the cameras. However, video composition of the real and virtual World’s is much easier. There is a variety of solutions available including Chroma-key and depth mapping. Mixed Reality Systems Lab (MRSL) of Japan presented a stereo video see-through HMD at ISAR 2000. This device addresses some of the parallax related to location of the cameras vs. eyes.

1.6.4 MONITOR BASED

Monitor Based AR also uses merged video streams but the display is a more conventional desktop monitor or a hand held display. It is perhaps the least difficult AR setup, as it eliminates HMD issues. Princeton Video Image, Inc. has developed a technique for merging graphics into real time video streams. Their work is regularly seen as the first down line in American football games. It is also used for placing advertising logos into various broadcasts.

1.6.5 PROJECTION DISPLAYS

Projector Based AR uses real world objects as the projection surface for the virtual environment. It has applications in industrial assembly, product visualization, etc. Projector based AR is also well suited to multiple user situations. Alignment of projectors and the projection surfaces is critical for successful applications.

CHAPTER 2

LITERATURE SURVEY

2.1 METHODOLOGY

For designing educational therapeutic and affordable games for children with Autism Spectrum Disorder, two augmented reality games are prepared in this project. The aim of these games is to assist children with ASD with social interaction and communication skills. Both games are tackling the developing social skills in an atypical child. The games are:

a. Happy Minion Game

To be successful, the games required a child-like design that would appeal children between the ages of 8 to 15. This meant the games needed to be designed with bright colours, sounds and known characters. To be able to create an attractive Graphical User Interface (GUI) and animated graphics as well as incorporate computer vision features into the games, Adobe Flash Professional CS6 was used. Adobe Flash Professional CS6 contains a broad range of multimedia development abilities. It allows development of web applications, games, movies and mobile phone applications. Adobe Flash Professional CS6 is also an Integrated Development Environment (IDE) for ActionScript 3.0. The object-oriented (OO) programming language ActionScript 3.0 was used to develop both games. ActionScript 3.0 is also an Adobe Systems product, which is quite similar to the Object Oriented programming languages, Java and C#. As it is an object-oriented language, the code is readable, more modular and scalable. The language comes with a wide range of Application Programming Interfaces (API). The Happy Minion Game that uses motion tracking was developed using the GreenSock Tweening Platform. This library contains a number of tweening classes that enable Flash to automatically create frames in between two key frames thus the developer is able to move an object from point A to point B over a given period of time. In order to capture real time video feed in the games, a web camera was used. An in-built laptop web camera was used in this project however; an external web camera connected to a computer may also be used. The video feed was used to establish the augmented reality feature in both games by overlaying virtual objects in the real world captured through the camera. The live video feed aims to also act as immediate feedback on the reaction of the child playing it and whether there is improvement or not. Finally, both games can be played with any objects in the player's surroundings.

The aim of this project is to make them cost effective for those families already paying for expensive therapy sessions or simply cannot afford clinical sessions. In addition, children with ASD may not find it comfortable being told to use a foreign object to play the games.

This allows the child to choose and control the games with the most comfortable object around them. The constraint with using any object has to be small enough to fit in the game window; this can explain to the child. For the purpose of this paper, a standard blue pen lid was used to control the Emotions Game and any object the size of a human hand and it is similar for the Happy Minion Game. However, the Happy Minion Game can be controlled without an inanimate object and through the player's hand himself or herself. The flexibility of essentially game controllers means that there is minimal fuss for children that may not like change or using foreign devices. The sole focus of the games is to improve their ability to identify and understand human emotions as well as improve their hand-eye coordination. Children with ASD struggle with pretend play skills and often prefer playing with common objects such as rocks, ballpoint pens and sticks. The fact these games allow them to play in solitude creates comfort and hopefully full concentration on developing their ability to recognise emotional features on a face or common situational based reactions. Both games have been designed keeping in mind the environment a child with ASD is most comfortable in. The purpose is to develop social interaction and hand-eye coordination through simple instructions and concentration.

b. Emotions Game

The game so far, is a simple game that allows a child to drag and drop features onto a blank face to create a facial expression. The facial expressions are created depending on the situation presented in the instructions of the game. For example, the child is told that the character or owner of the blank face is happy today because it is a sunny day and then prompts the child to create a happy face. This design allows a child with ASD to recognise the cause for happiness and what it looks like on a human face following simple instructions. The game can be played on any laptop with either an external web camera or an inbuilt camera. The player is presented with a blank face on the left hand side of the screen and individual facial features on the right. These virtual objects are overplayed on a live video feed where the player can see himself or herself in the background. The instructions at the top left hand corner of the screen prompt the user to create a happy, sad or angry face by dragging and dropping face features such as a smiling mouth, eyes and nose. The player clicks on a self-chosen marker from their surroundings. The game detects the colour of the object and registers it as a tracker. Using the tracker, the player will be able to pick up an individual face feature, for example, eyes and drag it onto the face where they think the appropriate position for a pair of eyes is.

A child is able to explore their imagination and methods of pretend play through this game. The game also acts as feedback to their guardian on the level of understanding the child may have on facial expressions and emotions hence demonstrates if there is any need for improvement in their social interaction development.

The figures below display the emotion game screen where the user can see him/herself interacting with the objects. They also illustrate a red box around the colour tracker displaying that a colour has been detected and will be tracked and the player can drag objects onto the face. It provides the player with option to mirror the face in the background, once completed.

2.1.1 An Augmented Reality Question Answering System Based on Ensemble Neural Networks. Author: Chi-Hua Chen Chunghwa Telecom Co., Ltd., Taoyuan, Taiwan, in 2013.

Paper proposes a classification algorithm based on ensemble neural networks. In the training phase, the proposed algorithm uses a random number of training data to develop multiple random artificial neural network (ANN) models until those ANN models converge. Those models with lower accuracy than the threshold are filtered out. The remaining highly accurate models will be used to predict the output in the testing phase. Meanwhile, the accuracy of ANN models is presented as a weighting value in the testing phase. In the testing phase, the testing data are loaded into the selected ANN models to predict the output class. The output values are multiplied by the corresponding weighting values of ANN models. Then the weighted average of the outputs can be obtained. Finally, the predicted output is converted into the predicted class. User design an augmented reality question answering system (AR-QAS) applying and implementing the proposed algorithm on mobile devices. AR-QAS offers an interactive user interface and automatically replies according to user's queries. By comparing with the logistic regression method and the ANN method, the experiment results demonstrate that the proposed algorithm offers the highest accuracy. [1]

2.1.2 W-FYD: a Wearable Fabric-based Display for Haptic Multi-Cue Delivery and Tactile Augmented Reality. Author: Simone Fani, in 2007, "E. Piaggio", University of Pisa, Pisa, Pisa Italy.

Despite the importance of softness, there is no evidence of wearable haptic systems able to deliver controllable softness cues. Here, User present the Wearable Fabric Yielding Display (W-FYD), a fabric-based display for multi-cue delivery that can be worn on user's finger and enables, for the first time, both active and passive softness exploration. A given stiffness profile can be obtained by modulating the stretching state of the fabric through two motors. Furthermore, a lifting mechanism allows putting the fabric in contact with the user's finger-pad, to enable passive softness rendering. In paper, User describe the architecture of W-FYD, and a thorough characterization of its stiffness workspace, frequency response and softness rendering capabilities. User also computed device Just Noticeable Difference in both active and passive exploratory conditions, for linear and non-linear stiffness rendering as well as for sliding direction perception.

The effect of device weight was also considered. Furthermore, performance of participants and their subjective quantitative evaluation in detecting sliding direction and softness discrimination tasks are reported. Finally, applications of W-FYD in tactile augmented reality for open palpation are discussed, opening interesting perspectives in many fields of human-machine interaction. [2]

2.1.3 Augmented Reality Smart Glasses in the Smart Factory: Product Evaluation Guidelines and Review of Available Products. Author: Anna Syberfeldt, Oscar Danielsson, Patrik Gustavsson, May 2017.

Augmented reality smart glasses (ARSG) are increasingly popular and have been identified as a vital technology supporting shop-floor operators in the smart factories of the future. By improving our knowledge of how to efficiently evaluate and select the ARSG for the shop-floor context, paper aims to facilitate and accelerate the adoption of the ARSG by the manufacturing industry. The market for ARSG has exploded in recent years, and the large variety of products to select from makes it not only difficult but also time consuming to identify the best alternative. Using the suggested evaluation process, manufacturing companies can quickly make optimal decisions about what products to implement on their shop floors. Paper demonstrates the evaluation process in practice, presenting a comprehensive review of currently available products along with a recommended best buy. [3]

2.2 EXISTING SYSTEM

Patrik Gustavsson: Augmented reality game for autism children is proposed. It included three modules, first is science module, it about simple kinder garden science chapters like human body, solar system etc. Second is about mathematical numbers that is about numerical values and symbols. Third part is about English, alphabetical assets are introduced.

Simone Fani: Merging all the modules and combining in to a android app using android SDK and binding those base images (target area) into a book for complete AR book. Next step is use-recognizing algorithm to calculate virtual object’s coordinates and scale it, after virtual object, Scaled user should analysis the environment information, such as illumination and grey scale histogram to get background environment parameter’s value.

When environment information calculation is done virtual objects should be created but not output, through the virtual object’s scale information to create an output device based object projection mask, the region of mask is the render layer’s target zone, use environment information as render parameter to rendering virtual objects, and output final composited graphic to output devices.

Bai, Blackwell: University of Cambridge, uses marker-based tracking and lets the player pretend that a simple block is a car which can be pushed over a bridge, a train pushed through a tunnel or an airplane that releases cotton balls acting as bombs that hit an animated target. The system received positive feedback in its early stages of release as it was tested out with two neurotypical children between the ages of 4-5 that showed potential for pretend play in a simple situational environment.

2.2.1 DRAWBACKS - EXISTING SYSTEM

Gustafson's AR app is similar to our AR 360° it also contains same modules like English, Maths and Science. But we mostly included animated modules in all fields and having static asset is not a major drawback for Gustafson's AR app but it has a serious disadvantage that this app has no content management and it lacks some reality that is if we show A for Apple, Apple can be shown easily but in our AR 360° we use A for Aeroplane. Same as Apple in maths module they used some shapes like circle, rectangle those shapes are 2D shapes they can be easily explained with a single chalk and a board no need of creating an AR app but in our AR 360 °, we use Rubik's cube, Pyramid, Cylinders for shapes.

Beyond Reality, which was the first to introduce a marker less magazine, presents two board games, PIT Strategy and Augmented Reality Memory. In PIT Strategy, the player is the "pit boss" in a NASCAR race and must act according to given weather condition, forecast and road condition. In Augmented Reality Memory, the player turns a card and sees a 3D object, turns a second card and sees another 3D object. If they match, a celebration animation will appear; otherwise, the player can keep looking for matches. These two games are still under development. Here again, augmented reality has not fully reached its potential to enter the industrial market. Once again, this is mostly due to technological advances such as tracking system. For example, we saw that the few museum guidance systems developed were only applicable to the museum or exhibition they were developed for and could not be utilized for other museums. This is because both these systems relied on the organization of the museum or the exhibition to recognize the artifacts as opposed to detecting the artifacts solely using computer vision. So why hasn't computer vision been used to recognize the objects instead of relying on knowing the user's position in the museum.

As was seen in the Computer Vision Methods in AR section, some objects have irregular forms and although it might seem easy for us to recognize them, it is very hard for a computer to detect what these objects are, and this is the case of most artifacts. More over the issue of object detection have been overcome by enabling the autofocus script, which enhances the field of object detection faster, and crispier enhancing the user interaction.

2.3 PROPOSED SYSTEM

Evidence-based research shows that AR attracts the attention of children with ASD. However, few studies have combined AR with VM to train children with ASD to mimic facial expressions and emotions to improve their social skills. In addition, we used marker less natural tracking to teach the children to recognize patterns as they focused on the stable visual image printed in the kinds book (Learn via AR) and then extended their attention to an animation of each Alphabet. After the three-phase (baseline, intervention, and maintenance) test data had been collected, the results showed that AR360° intervention provided an augmented visual indicator which had effectively attracted and maintained the attention of children with ASD to nonverbal social cues and helped them better understand the main purpose of alphabetical characters and labeling of science assets. AR360° increased virtual visual hints overlaid on the kid's book for children with ASD to learn. AR360° increased focus on specific nonverbal cues to prompt social-emotional reciprocity judgments.

CHAPTER 3

REQUIREMENT GATHERING AND ANALYSIS

3.1 REQUIREMENT GATHERING

To develop any Augmented Reality app we need a AR tools like (ARToolKit, Kudan AR, Vuforia, Wikitude, LayAR), and we need a code developer IDE like Monodeveloper or visual studio, and Unity 3D is a best gaming software for creating an AR app, unity is most recommended by Vuforia. Tracking methods in AR depend mostly on the type of environment the AR device will be introduced to as well as the type of AR system. The environment might be indoor, outdoor or a combination of both. In the same way, the system might be mobile or static (have a fixed-position). For example, if the AR device is a fixed-position device for an outdoor real environment, such as Huang et al.'s device AR-View, the developers can use mechanical tracking since the movements to be tracked will all be mechanical, as the position of the device is known. This type of environment and system makes tracking of the environment for augmenting the surroundings easier. On the other hand, if the AR device is mobile and designed for an outdoor environment, tracking becomes much harder and different techniques offer some advantages and disadvantages. Their system is mobile and outdoor. For a camera moving in an unknown environment, the problem for computer vision is to reconstruct both the motion of the camera and the structure of the scene using the image and additional sensor data sequences**.** In this case, since no assumption about the 3D geometry of the scene can be made, SfM method is used for reconstructing the scene. Developers also have the choice to make use of existing AR libraries, such as the ARToolKit. Once the real camera position is known, a virtual camera can be placed at the same exact position and 3D computer graphics model can be drawn to overlay the markers.

3.2 REQUIREMENT ANALYSIS

The combined use of mobile Augmented Reality (AR) and various visualizations has a potential to support geography fieldwork. Central to the development of a usable mobile tool is adopting the principle of User-Centered Design (UCD), the first phase of which is identifying user requirements. This research first establishes the current situation of using (mobile) AR in education based on a literature review. At the same time, in a real educational human geography fieldwork executed in China, through a survey, observation and interviews, we have investigated how teachers and students currently conduct the fieldwork, what difficulties they experience and their expectations and suggestions for a future mobile tool.

It was found out that it would be practical to make use of a new mobile AR tool in geography fieldwork. In the fieldwork in China, students used their mobile phones to mainly collect data and browse digital maps of the fieldwork area, with the purposes of completing the fieldwork tasks and assisting them to geographically understand the fieldwork area, respectively. They also had trouble, e.g., the time required for and troubles in switching between different mobile applications and the data collected in the field lacking locational details. Both teachers and students, as users, expressed their expectations of a future mobile tool and indicated some basic key requirements, e.g., labeling geo-locations of all field collected data, making notes, recording voice data and field walking routes and optionally viewing various materials (maps, satellite images, etc.) of the fieldwork area.

3.3 HARDWARE REQUIREMENTS

Processor	:	AMD 87410 APU With AMD Radeon R5 Graphics
RAM	:	4 GB
Hard Drive	:	500 GB
Web Camera	:	Logitech C310 720p HD

3.4 SOFTWARE REQUIREMENTS

OS	:	Windows 10
Tools	:	Vuforia
IDE	:	Maya, Unity, Visual Studio
Android SDK	:	Version 3.0.0.18
AR Interface	:	Vuforia Developer Kit

3.5 FEASIBILITY STUDY

This project is feasible for developing animated graphical designs but to implement in all platform is little big difficult. We performed a usability study on our in-progress AR games for children with ASD with four typically developing children ranging from ages 10 to 15 and were right-handed. Each child was given 15 minutes of playtime. Using a questionnaire that been developed as can be noticed in the appendix, the children provided us with feedback immediately after playing the games.

The questionnaire was influenced through other research papers and focused on gauging whether the games sparked interest from children between the ages of 10-15 and if there was scope for further development. No standard tools were referred to when designing the questionnaire. The children were instructed on how the games are played and were allowed to play on their own with just our supervision.

3.5.1 TECHNICAL FEASIBILITY

Technical feasibility determines whether the organization has the technology and skills necessary to carry out the project. The existing resources are capable and can hold all the necessary data. The software is too flexible, its operations are simple, easy to use, and it can be expanded further. Even though our team is beginner in this field, we learnt properly in communities and tutorials from YouTube. After upgrading technically, we started to work with relevant softwares. While starting this project we calculated only 60 % of feasibility but after getting a sample, output we concluded that this project could be get completed cent percent.

3.5.2 ECONOMICAL FEASIBILITY

To create this project we not met any big capital problems because we mostly use free softwares and student id in big softwares. Blender and vuforia provides free services and addons. Unity and maya gives student Id for practicing in software as a student. Mostly for examining our AR view in unity, we use web camera. For our project, we purchased Logitech HD web camera. Privacy policy, Developer account payment, domain names and hosting services brought nearly to ₹ 3000. Nothing more than that we expensed for this application. Therefore, after all these activities we bind all those target platforms to a single book with a cost of ₹ 360. However, before completing this project we calculated same budget, only little miscellaneous expenses where encountered. Comparing Virtual Reality Augmented Reality is less expensive because VR applications only exported in VR Glass but our AR applications are exported in any device, which must have a camera and Operating System

CHAPTER 4

DESIGN AND IMPLEMENTATION

4.1 SYSTEM STUDY

The Architecture of the System is designed in such a way to enable a User Friendly User Interface. The Simplicity in Design enables all kinds of Users to work with the Design. The Architecture is re-engineered to support augmented reality. This application must help autism children's education. When autism AR app is opened, it requests mobile permission to access camera then it starts to search target platform after reaching perfect target platform it displays the 3D module inside our mobile. AR Camera included in unity is the camera what is used for visualizing assets. It works as a view for asset in target platform. If user use animated asset in Augmented reality shadows plays important role. A directional light typically simulates sunlight and a single light can illuminate the whole of a scene. This means that the shadow map will often cover a large portion of the scene at once and this makes the shadows susceptible to a problem called perspective aliasing.

Fig 4.1 Characters included in AR 360°

There are three Apk associated with this project:

1. AR_360°
2. Solar 360
3. AR maths

Fig 4.2 Logo for three Android Applications

4.2 SYSTEM DESIGN DEVELOPMENT

The below pictures are AR 360° models its includes English and science model explains about the chapter Muscular body, human heart, skeleton system, solar system, microscope, and DNA. In addition, Alphabets from A to Z are included with some animated examples. By using this model user can explain the purpose of human body, human heart, lab equipment and alphabets in easy way of teaching for autism children. This module helps those autism children to learn human science with an interactive module like robotic interaction. The purpose why user use Augmented Reality can be openly said here that augmented reality modules are always cost efficient. If user use any robot for teaching students it is more complicated and cost effective so user use AR app to reduce these problems and it is also a simple way to educate those autism children on their own way as children always like to see animated things.

4.2.1 AR 360°

In this application, we included twenty-six alphabetical characters for each special characters example words are displayed in 3D text for spelling reference. Those twenty-six characters have some animated features for better understanding. It also consist of four science chapters they are DNA, Muscular and Skelton system (With human skull), Human Heart with labeling and microscope. All those features are included on the markers, which we use as book to view the animated assets. Exporting often makes errors but using vuforia 6.2 and Unity 5.6 errors can be minimized.

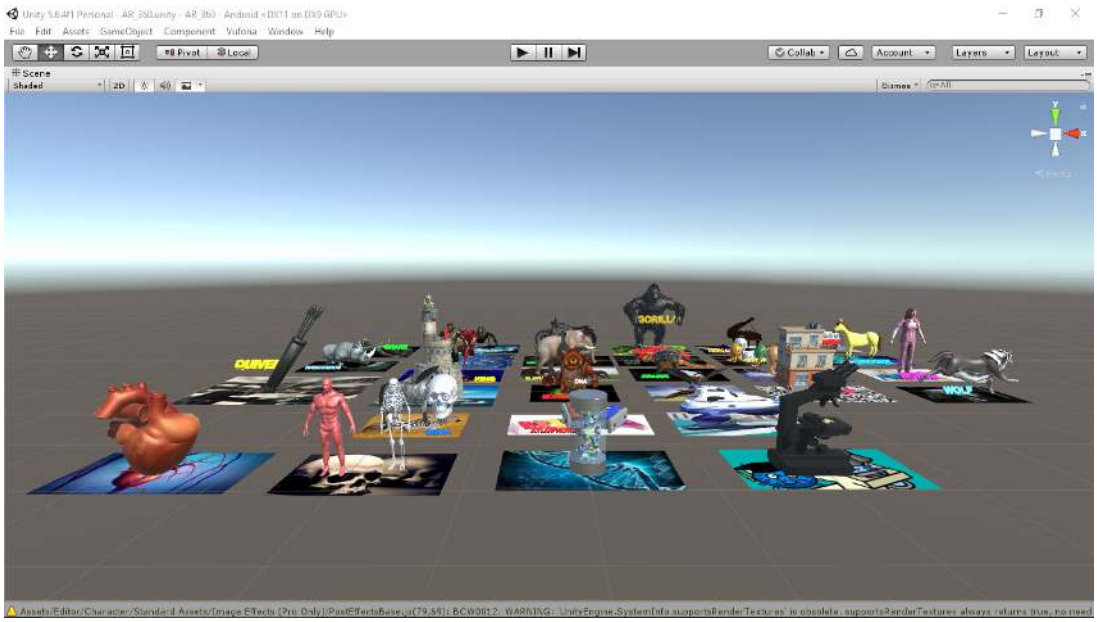

Fig 4.3 AR 360° Module

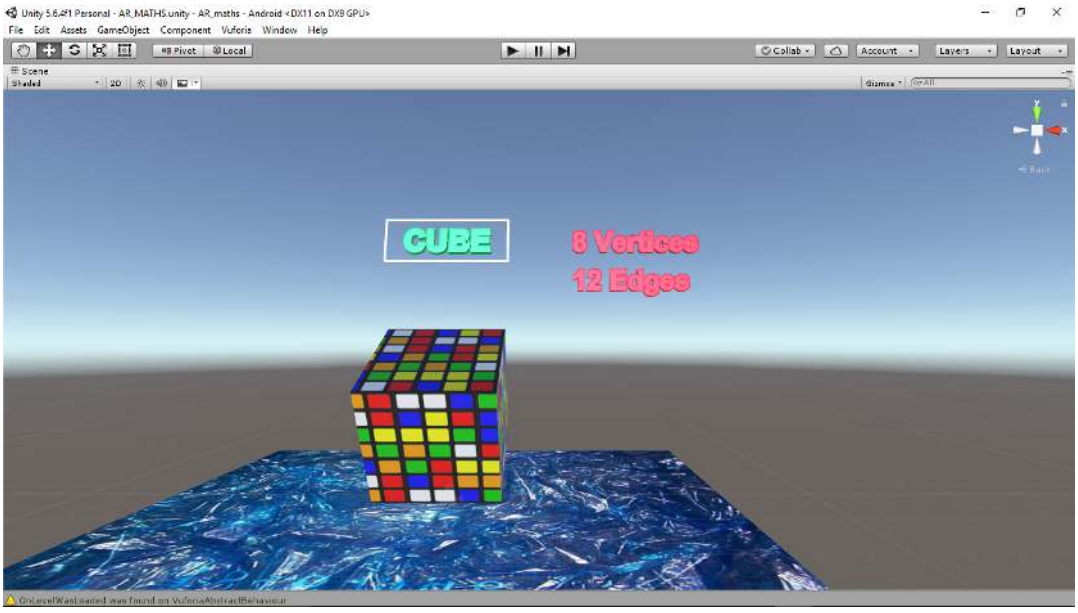

Fig 4.4 AR maths Module

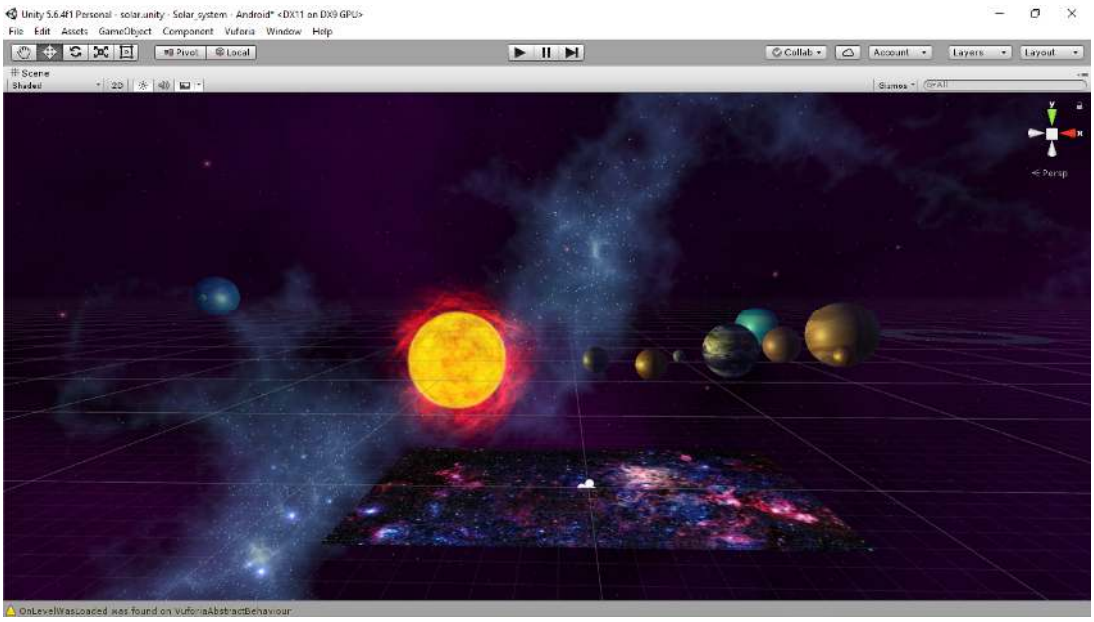

Fig 4.5 SOLAR 360 Module

This AR 360° module explains about English Alphabets with some examples and science chapters like muscular and skeleton system, human heart, DNA and microscope for autism children as preplanned target platform assigned for AR 360° in vuforia packages this can be shown in front of camera to access Chan asset. This module can run from one place to another until the target platform associates with camera view.

4.3 OUTPUT

Fig 4.6 Muscular and Skeleton system

Fig 4.7 R for Rhinoceros

Fig 4.8 S for Snake

Fig 4.9 T for Tiger

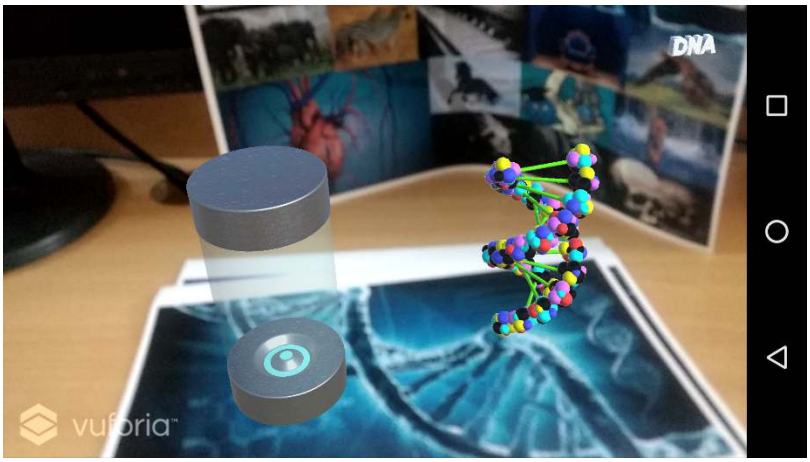

Fig 4.10 DNA

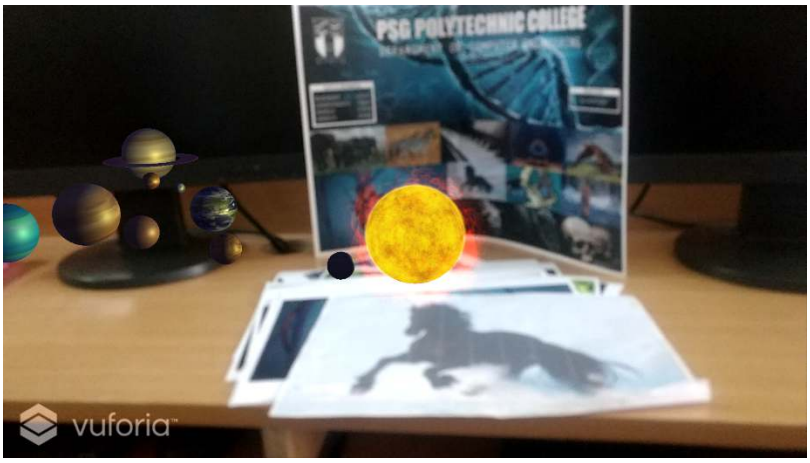

Fig 4.11 Solar System

First, we created this solar 360 app with normal target platform and for next update; we included QR code instead of target platform. Anybody can download that QR code from link given below in playstore. Same as target platform QR code size determines the size of object build above. This solar 360 app is exported separately because of its size. Total size of app is 82.7 MB where graphical 3D assets is major part.

4.4 USE CASE DIAGRAM

Use case diagram for all three AR apps. The user executes these steps repeatedly. Capturing Screen of Result is not compulsory that is optional.

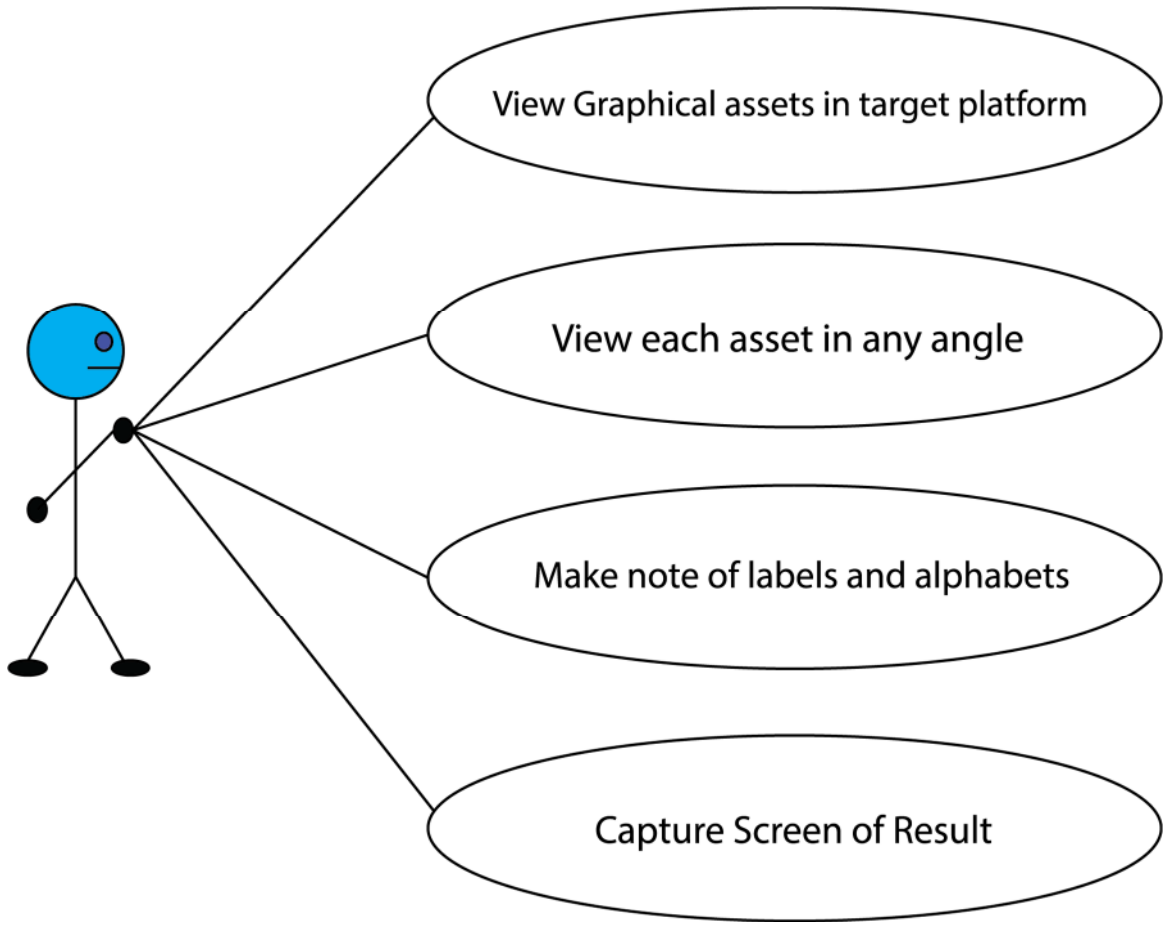

Fig 4.12 Use case for AR app

Open our Augmented Reality app and start focusing AR book or Provided Target platforms that will show us those Graphical assets. We can view each asset at any angle and each movement of those assets are encountered clearly. We must make note of those labels and alphabets in English module. In maths, module formulae must be noted. Capturing is not compulsory for reference purpose we can capture all those features. Screen recording is best because we mostly included animated assets.

4.5 WORK FLOW DIAGRAM

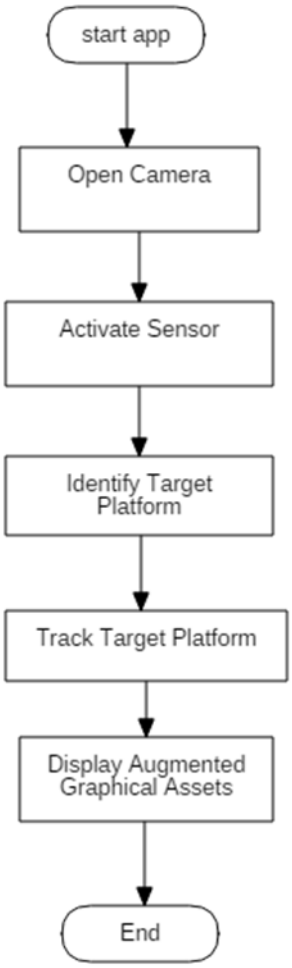

Fig 4.13 Workflow for AR app

After installing AR 360 or any AR app from playstore, we need to start our app. It automatically open our camera and activates the sensor for Identifying Target Platform. After finely sensing those target images it start to display Augmented Graphical assets above the platforms. Until our camera lost its sensing on that Target platform, it will be continue to display those graphic animated or non-animated assets.

CHAPTER 5

STUDY ON TOOLS

5.1 STUDY ON TOOLS - BLENDER

Blender is the free and open source 3D creation suite. It supports the entirety of the 3D pipeline modelling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation. Advanced users employ Blender's API for Python scripting to customize the application and write specialized tools; often these are included in Blender's future releases. Blender is well suited to individuals and small studios who benefit from its unified pipeline and responsive development process. Examples from many Blender-based projects are available in the showcase.

Blender is cross-platform and runs equally well on Linux, Windows, and Macintosh computers. Its interface uses OpenGL to provide a consistent experience. To confirm specific compatibility, the list of supported platforms indicates those regularly tested by the development team. As a community-driven project under the GNU General Public License (GPL), the public is empowered to make small and large changes to the code base, which leads to new features, responsive bug fixes, and better usability. Blender has no price tag, but you can invest, participate, and help to advance a powerful collaborative tool: Blender is your own 3D software.

Hundreds of people from all around the world are actively developing blender. These include animators, artists, VFX experts, hobbyists, scientists, and much more. All of them are united by an interest to further a completely free and open source 3D creation pipeline. The Blender Foundation supports and facilitates these goals—and employs a small staff for that but depends fully on the global online community.

Many of them may ask why we use Blender instead of Maya and the answer is simple Blender is an Open Source Software and easy to work while we compare to Maya. Moreover, Blender gives simple and smooth workspace for sculpturing. Maya also provides some smoothness but still it treats all developers as the expert one so to learn more about Maya is little complicated. Blender also have some little bit problems like texturing an object needs more steps but in unity it has only one-step that too a drag and drop job. In addition, Blender has some new type of control compared to unity and maya that is to get simpler to work with 3d designing. We feel easy to design in Blender because of those edit mode, Object mode controls and for creating shaders and materials.

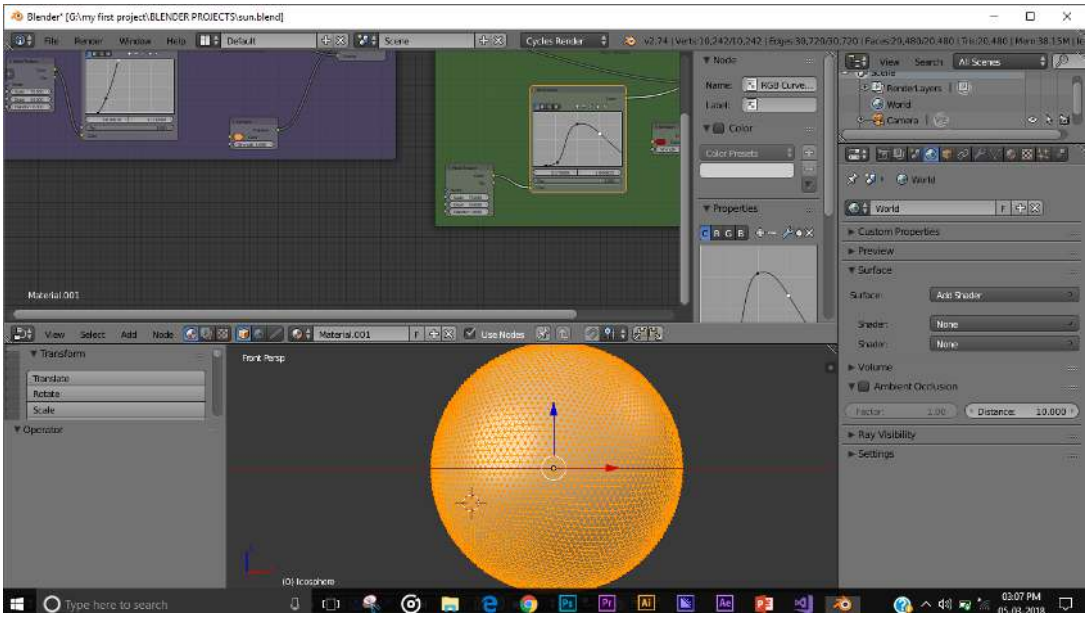

Fig 5.1 Blender

5.2 STUDY ON TOOLS – UNITY 3D

Unity is a multipurpose game engine that supports 2D and 3D graphics, drag-and-drop functionality and scripting using C#. Two other programming languages were supported, which was deprecated with the release of Unity 5 and JavaScript, which started its deprecation process in August 2017 after the release of Unity 2017.1. The engine targets the following graphics APIs: Direct3D on Windows and Xbox One; OpenGL on Linux, macOS, and Windows; OpenGL ES on Android and iOS; WebGL on the web; and proprietary APIs on the video game consoles. Additionally, Unity supports the low-level APIs Metal on iOS and macOS and Vulkan on Android, Linux, and Windows, as well as Direct3D 12 on Windows and Xbox One. Within 2D games, Unity allows importation of sprites and an advanced 2D world renderer. For 3D games, Unity allows specification of texture compression, mipmaps, and resolution settings for each platform that the game engine supports, and provides support for bump mapping, reflection mapping, parallax mapping, screen space ambient occlusion (SSAO), dynamic shadows using shadow maps, render-to-texture and full-screen post-processing effects. Unity also offers services to developers; these are Unity Ads, Unity Analytics, Unity Certification, Unity Cloud Build, Unity Every play, Unity IAP, Unity Multiplayer, Unity Performance Reporting and Unity Collaborate. Unity supports the creation of custom vertex, fragment (or pixel), tessellation, compute shaders and Unity's own surface shaders using Cg, a modified version of Microsoft's High-Level Shading Language.

Fig 5.2 Unity 3D

5.3 STUDY ON TOOLS – VUFORIA

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time. This image registration capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world images when these are viewed through the camera of a mobile device. The virtual object then tracks the position and orientation of the image in real-time so that the viewer's perspective on the object corresponds with their perspective on the Image Target, so that it appears that the virtual object is a part of the real world scene.

The Vuforia SDK supports a variety of 2D and 3D target types including 'markerless' Image Targets, 3D Multi-Target configurations, and a form of addressable Fiducial Marker known as a VuMark. Additional features of the SDK include localized Occlusion Detection using 'Virtual Buttons', runtime image target selection, and the ability to create and reconfigure target sets programmatically at runtime.

Vuforia provides Application Programming Interfaces (API) in C++, Java, Objective-C++ (a language utilizing a combination of C++ and Objective-C syntax), and the .NET languages through an extension to the Unity game engine. In this way, the SDK supports both native development for iOS and Android while also enabling the development of AR applications in Unity that are easily portable to both platforms.

AR applications developed using Vuforia are therefore compatible with a broad range of mobile devices including the iPhone, iPad, and Android phones and tablets running Android OS version 2.2 or greater and an ARMv6 or 7 processor with FPU (Floating Point Unit) processing capabilities

The Vuforia mobile vision platform allows apps to deliver reliable vision-based experiences across a range of conditions - ensuring that users have great user experiences the first time and many more. Vuforia enables Unity developers to create engaging AR experiences and reach the broadest possible audience. Deploy your AR project across a wide selection of handheld and headworn devices for iOS and Android and unlock new categories of apps by overlaying digital content on physical 3d objects.

Ground Plane: Ground Plane allows digital content to be placed on a horizontal surface, such as a floor or table. Ground Plane supports Android and iOS devices, taking advantage of underlying OS enablers, such as AR Kit when available. See the complete list of supported devices here.

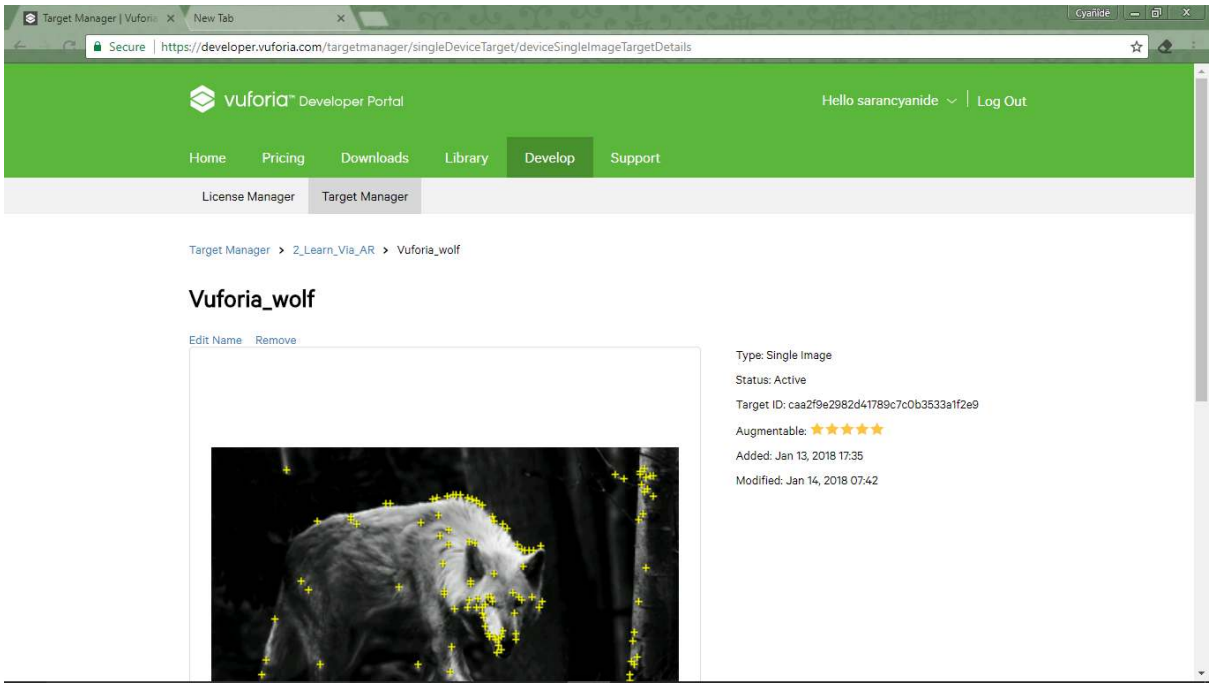

Fig 5.3 Vuforia

5.3.1 Device Tracking:

The Device Tracker class tracks the rotational pose of a device within a world coordinate system using data from the device's inertial sensors.

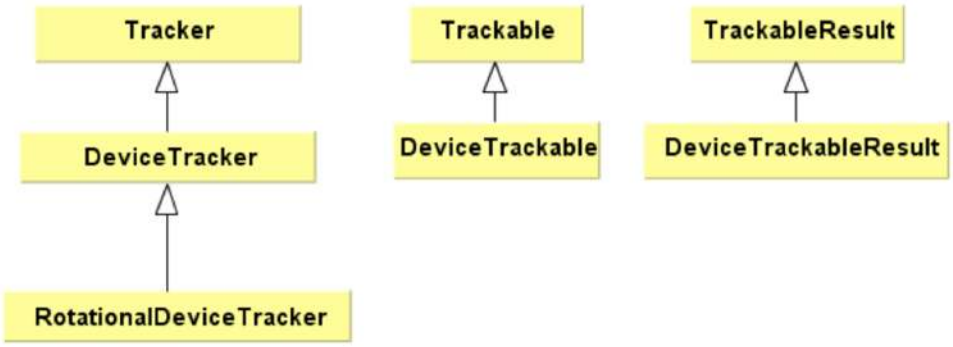

Fig 5.4 The RotationalDeviceTracker, DeviceTrackable, and DeviceTrackableResult

CHAPTER 6

WORK PROCESS AND ERROR HANDLING

6.1 OVERVIEW OF THIS APP CREATION

All over the world Augmented Reality is a direct or indirect live view of a physical, real-world environment whose elements are "augmented" by computer-generated perceptual information. This is according to Wikipedia but in our project Autism, children consider this as a real world features. The term Augmented Reality is “augebatur rem” in Latin.

To create any android app we need an API with SDK and JDK. Same as here we need Android SDK and JDK for unity to export our project as well as our scenes in android device. After adding those tool kits in Unity, using preferences our next step is to create an account in vuforia and need to purchase a license key for AR app development. Mostly for creating application in mobile devices, Vuforia License is free. We need to download Vuforia package from Vuforia downloads which consists of AR Camera, Image Target, and Scripts etc. Beyond that, what we do is all in our hands after that we need to export our project with usb connected to our device. Exporting gives us many errors like android version error, bundle identifier error, assembly reference error, namespace error etc. After facing all error we need to export in android for testing our app we can use google console it needs only a developer account for 25 USD.

Steps to Create an Augmented Reality app is easy for everyone who know basic but to handle error we need an expert person’s knowledge. Only these errors drag us long for exporting our app. In addition, there are some simple errors in unity, which can be overcome by simple steps. For example, we may forget to add a 3d model inside a target platform that will not be shown as an error but it will make some bad alignments in our game play.

6.2 WORK DONE IN UNITY

Comparing to all three software (Unity, Blender, Maya) Unity handles more work. Because it does integrating all target platform in one open scene, Compiling script with help of visual studio, displaying console errors and warnings by monitoring our actions, hand shaking with Vuforia for AR development, Deals with all platform like Android, IOS, Windows etc even for old Operating Systems still in use to get their tool kit versions for exporting.

A big advantage in unity is Asset store, which reduces our time for concentration towards modeling there many friends who work for unity, will be providing us many 3D models, which we can download free or else we can purchase paid models, which is better than free models. Downloading within asset store needs your account permissions and it is like a cloud download so we can access from anywhere else.

Importing those assets is not a big deal it is just a click process. Then if we need some our own models, we need to model our own 3D models in Blender or in Maya. We use to create 3D text in Blender and some simple animated models in Blenders. Unity accepts all .obj and .fbx formats of models. We created a stream of Target Images displayed in Unity Scene for AR 360 to get easy capturing of markers shown in Fig 5.2 Unity 3D.

Unity gives us support for publishing and even they helps us to promote our application what we made. Even if we interested we can also sell our 3D models in asset store as a merchant or for free.

6.3 VUFORIA'S USAGE

After Purchasing Vuforia license, we need to enter those encrypted license key in Vuforia configuration to get interconnection between unity and our Vuforia Account. Main Purpose of Our Vuforia is to store our target images it plays a role of database. It also used for checking our target image's field for Augmentation. After completing license key process next step is to download that package which contains compressed scripts and images and checking ".unity" format is important. Open that compressed file after downloading that will automatically extract the stuff into Unity workspace. Login into Vuforia account from Vuforiadeveloper.com and go to download tab for downloading vuforia package, which includes all scripts, prefabs, assets, Editor, Plugins etc. Extract that package into Unity workspace and start working with unity. An important feature in Vuforia is AR Camera that acts as main camera in Augmented Reality Gaming. Vuforia is the best toolkit for Augmented Reality that linked with Unity.

6.4 ERRORS HANDLED IN UNITY

Mostly we get exporting errors in unity. After Completing AR project, we need to Build and Run that application on any unity-supporting platform. First, we need to set our platform and next we need to open player settings, which deals with App logo, Resolution, XR-settings and other settings. An Important setting we need to fix is Bundle Identifier, company name and app name is necessary to export, other packs will be previously present inside android support package.

6.4.1 BUNDLE IDENTIFIER ERROR

This error occurs while exporting our package to android phone. If we forget to set bundle identifier settings in Player settings, this error will occur. We must fill our app name and company name in bundle identifier. These details must be filled with this format com.saransakthivel.AR360 here saransakthivel is company name and AR360 is app name.
To solve this error we need to fill correct app name and company name.

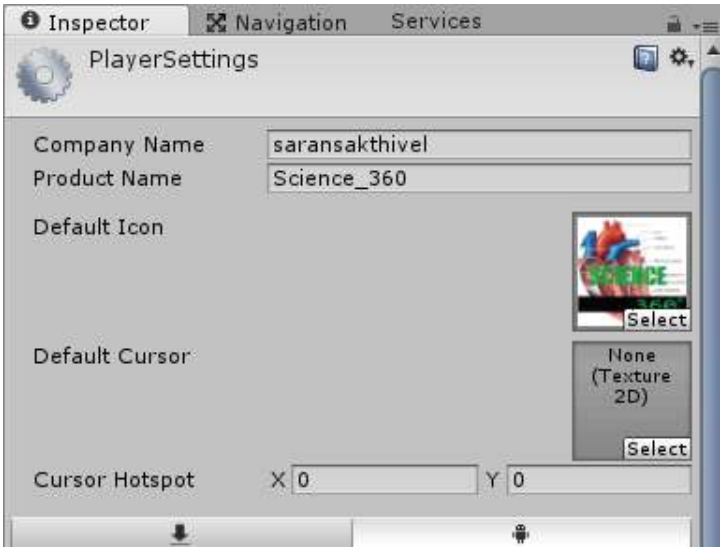

Fig 6.1 Player settings

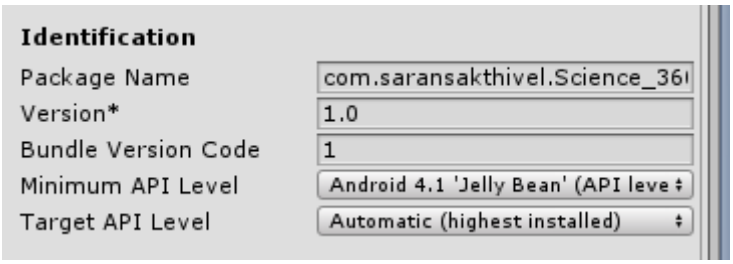

Fig 6.2 Bundle Identifier settings

6.4.2 ANDROID SDK BUILD ERROR

This error occurs when we not added our sdk path to unity engine preferences. To solve this error we must have android sdk in our system. This error will not pop out while we working with unity engine this only pop out while we try to export our application. This error is simple to solve adding sdk path and jdk path is the only work we need to do to solve. Unity needs sdk and jdk to build an android app from its workspace to mobile using usb cable.

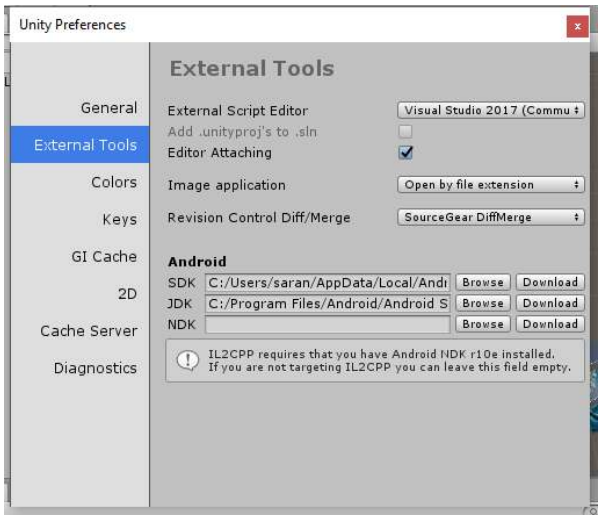

Fig 6.3 External Tools

6.4.3 ERROR BUILDING PLAYER

Error building player because scripts have compiler errors in the editor. If any compiler error left without solving in console, we will get this error. Therefore, before exporting we need to solve all compiler errors in the console. Leaving a warning in console may not make any problem for exporting but an unsolved error will make building player error. It may also stop all process before clearing compiler errors for example if we need to add any script first we need to fix all compiler errors.

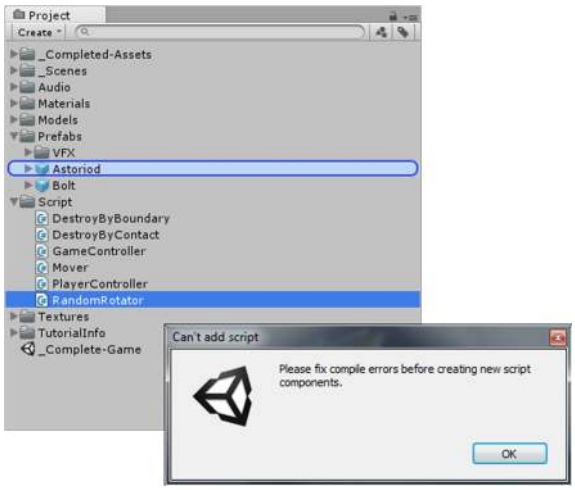

Fig 6.4 Compiler error

6.4.4 ERROR HALF3 TO STRUCT UNITYGI

This error occurs for shaders for example we may get some console error like this, Shader error in 'Transparent/Cutout/Soft Edge Lit Double Sided': 'LightingLambert': cannot implicitly convert from 'half3' to 'struct UnityGI' at line 98(on d3d11). To solve this error we must fix Shader properties from our c sharp code or else we need to create a new shader for our 3D model.

6.5 ERRORS HANDLED IN VUFORIA

In vuforia we almost get errors are attached to unity and these errors can be solved with help of vuforia community. However, we cannot say community solves our all problems. Because still some problems have no solution in community, it must be solved only with our own risks. Here some errors are listed with solutions these errors are often occurs while we try to build an AR app.

6.5.1 TYPE OR NAMESPACE COULD NOT BE FOUND

Namespace error is similar to our C sharp error where we need to rename correct namespace. Vuforia consists of many scripts so while working with Monodeveloper or visual studio we may get some name space errors. Those errors will be suddenly displayed while exporting. Error may be look like "error type or namespace could not be found". To rectify this error we need to give correct namespace for all scripts.

6.5.2 CAMERA NOT WORKING WHEN APP INSTALLED ERROR

This error made our project to halt for 4 weeks because we got no clear solution from unity community at last with help of vuforia developers community we got a solution. That is using unity 5.6 version and android tool kit version r25.2.5 will not give any black screen error. Until that, we will get only black screen when u open your exported app.

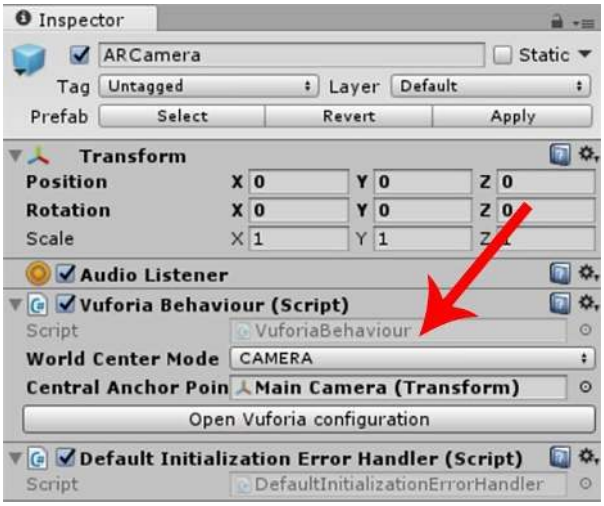

Fig 6.5 AR Camera Inspector

6.5.3 IMAGE TARGET NOT VISIBLE ERROR

This type of error is not so much complicated to solve. For this error, we have simple solution. While working with unity to add target platform we need to add imageTarget prefab from vuforia package. Next, we need to add an image on that imageTarget prefab. After adding that image, we may not get that image on that prefab only white plane is displayed on our scene so we need do some fixing. Now we need to search for our image from downloaded package and if that image looks like sphere from inspector tab, we need to reset it. Then we will get that image on imageTarget plane. Moreover, we need to activate our database to get output.

6.5.4 VUFORIA INITIALIZATION ERROR

After exporting app to an android mobile without applying vuforia license, we will get this error displayed on app screen. To avoid this we need to add license key from vuforia developer account where we can get free license. After adding our license key in AR camera we need to re-export our app after that our app will work perfectly. An Important point we need to add our license key inside AR camera open vuforia configuration and paste license key copied from vuforia developer account. Select database and check activate box to activate that database or else our asset will not be displayed in AR app.

6.6 WORK DONE IS OTHER SOFTWARE

Ultimate aim of this software is to spread among kids especially for autism children. For spreading, we need promotion so we created Poster, Advertising video, app logo, app background and finally we printed a book called Learn via AR. This book is made of target platforms bind together with app link on playstore. To create all those stuffs we used seven software they are Adobe After effects, Adobe Premier Pro, Adobe Media Encoder, Adobe Illustrator, Adobe Photoshop, Unity animations, Google Play console. Here, google play console is the only android software other softwares are system softwares.

Each activity made for this four app is to upload on play store, even we created a website to collect target images as jpeg file from us and web address for that website is www.cyanideedits.cf and we will update our domain so it can be checked from playstore admin details. We also made privacy policy for 14 USD and purchased google play console developer account for 25 USD.

CHAPTER 7

UPLOADING ON PLAYSTORE

7.1 PURCHASING DEVELOPER ACCOUNT

To upload the android application to play store, we need to purchase a Play Console Developer Account. It is one of the essential features needed for an android developer. The purchase is made via the Google Console. The applications uploaded to the Play store can be monitored utilizing the Play Console. To setup an account, personal details and credit card details of the developer along with a charge of 25 USD is required. The amount of 25 USD provides the developer with life-long license to upload applications to the playstore.

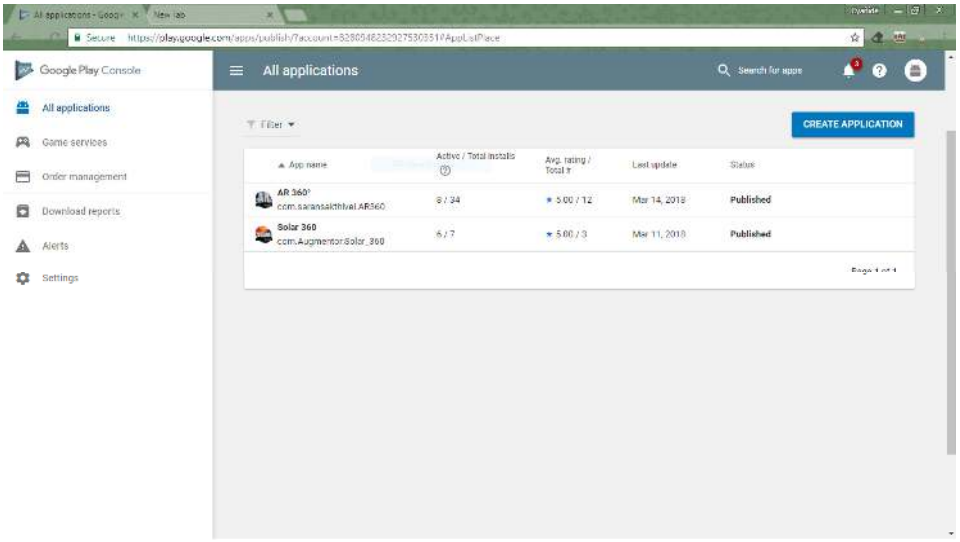

Fig 7.1 Google Play Console

There are more services provided by play console for uploading android app.

7.2 STORE LISTING

We need to prepare some background posters for android app and app logo, app advertising promo video. Play console provides specially generated png images for advertising which get rid from copyright problems.

Fig 7.2 Google play tag

Store listing area needs more promotion details for our app. Where we provide some screen shots of this app, posters and logo with the size of 512 x 512 pixels. Poster must be in the size of 1024 x 500 pixel.

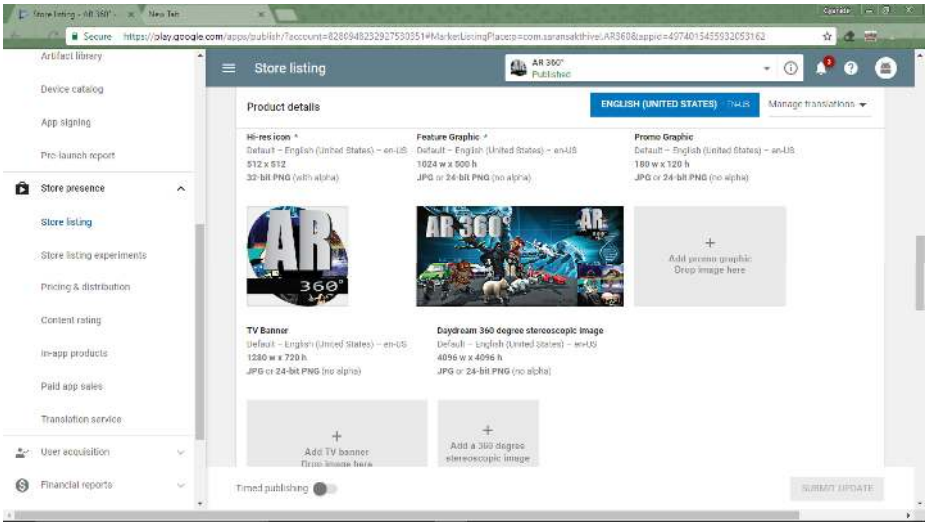

Fig 7.3 Store listing

We can create our own advertising video (promo video) for our app. To establish that we need to upload that video in YouTube and further it must be linked with play console. This 30-second promo video gives more understanding to users. In store listing, we can add our own graphic assets, screenshots in category wise. Some categorization details must be given for identifying category of our app we provided educational category with gaming application type.

Content rating is very important for every app uploaded in playstore, which deals with some certifications. After uploading our app in console, we must choose content rating tab below store listing to get IARC certificate ID. Our app AR360's ID is given below. Some of the boards gave us good rating their names are Australia Classification Board (ACB), Classind Brazil, Entertainment Software Rating Board (ESRB) North America, Pan-European Game Information (PEGI) Europe, Unterhaltungs software Selbstkontrolle (USK) Germany, IARC Generic Rest of world, Google Play Russia, Google Play South Korea.

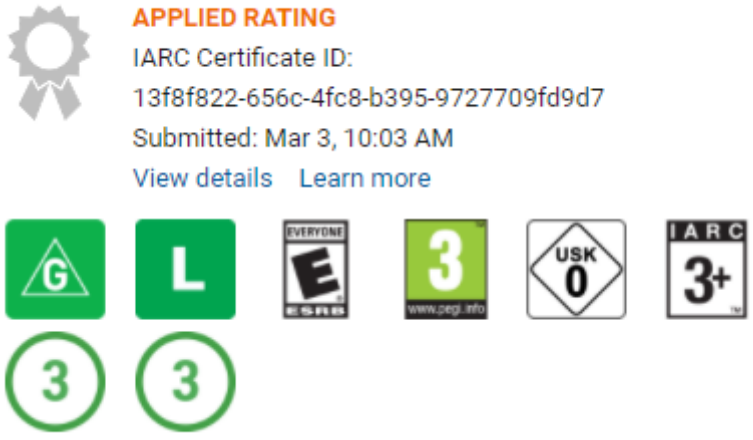

Fig 7.4 Content Rating

User must provide their contact details and privacy policy. Contact details consist only three attributes like name, email and website address but for privacy, policy is not needed for some applications, which has no accessing permissions. In our app, we have two permissions, camera permission and internet permission. Therefore, we need to purchase privacy policy for our app from online.

7.3 RELEASE MANAGEMENT – APP RELEASES

Here we can manage our production here and we can edit our release. To upload Apk first time we need to click on create release button from here. Before uploading, we can create Alpha testing, Beta testing and Internal testing in app releases. We need to upload our Apk from create release form and we need to fill some app details. At last, apk must be uploaded but only condition is its size must be below 100mb. After uploading, just we need to click roll out button within few hours our app will be rolled out in google play store.

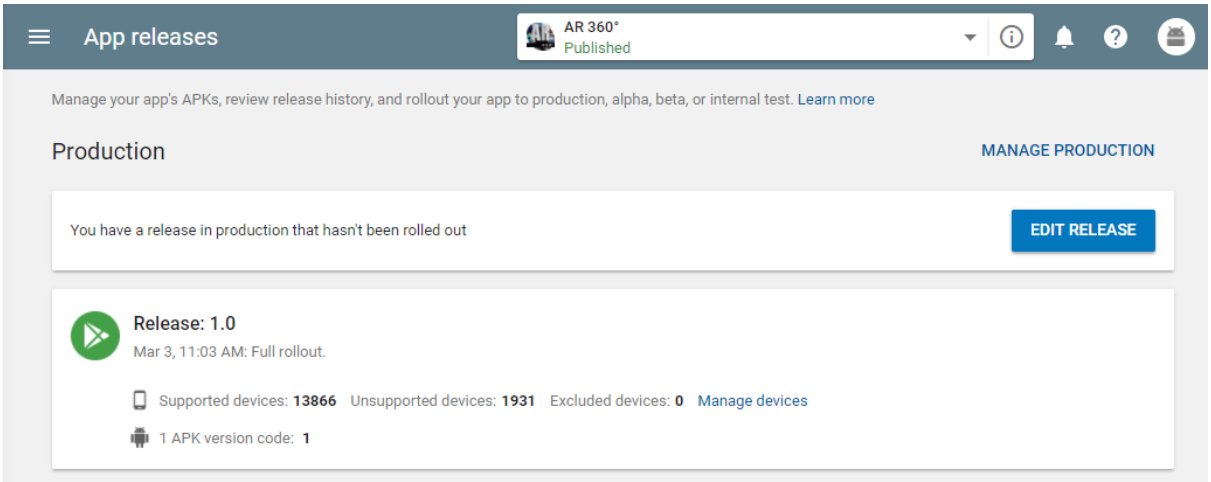

Fig 7.5 Production

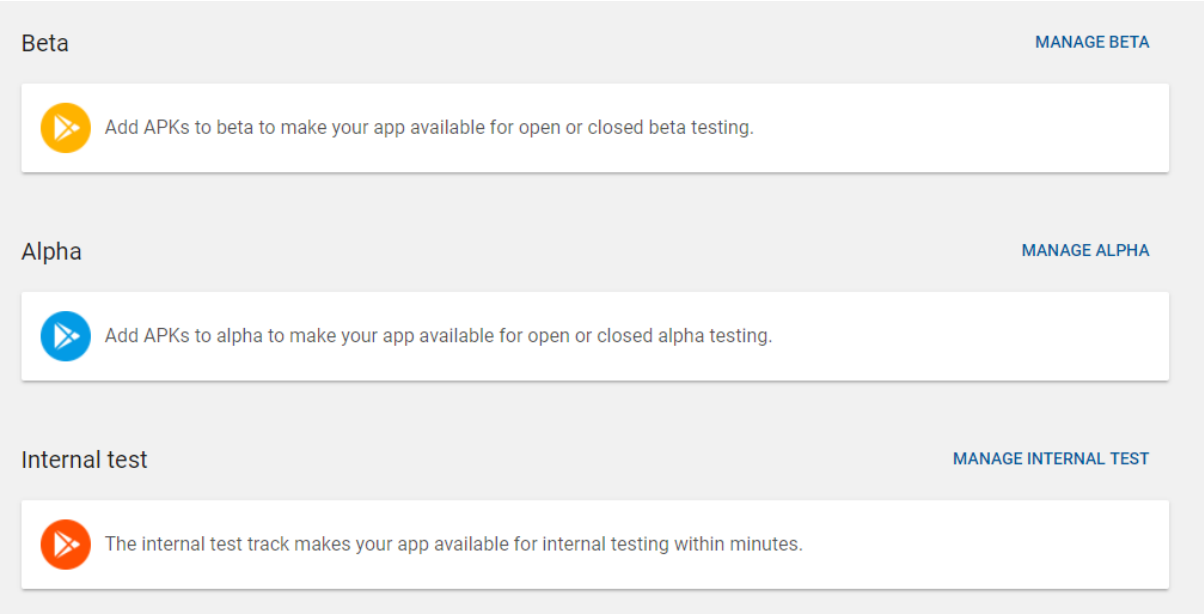

Fig 7.6 Testing tracks

7.4 PLAY CONSOLE

Google play console is used to monitor our app that is uploaded in play store. We can download this app from google play but to use this app we need to have a developer account. Google play console's developer account can be purchased for 25 USD. This play console is only used for monitoring and editing release but play console website is best for both monitoring and accessing. They show published apps and their daily, weekly, monthly and yearly progress. Number of Installs, uninstalls, Devices using this apps and crashes are updated within short time intervals. In addition, Ratings are updated with three categories and they are count, average, cumulative. Active Releases option is used to update our changes in what's new column of play store. App version, rollout details can be viewed and we can manage those releases often it will be updated within two hours.

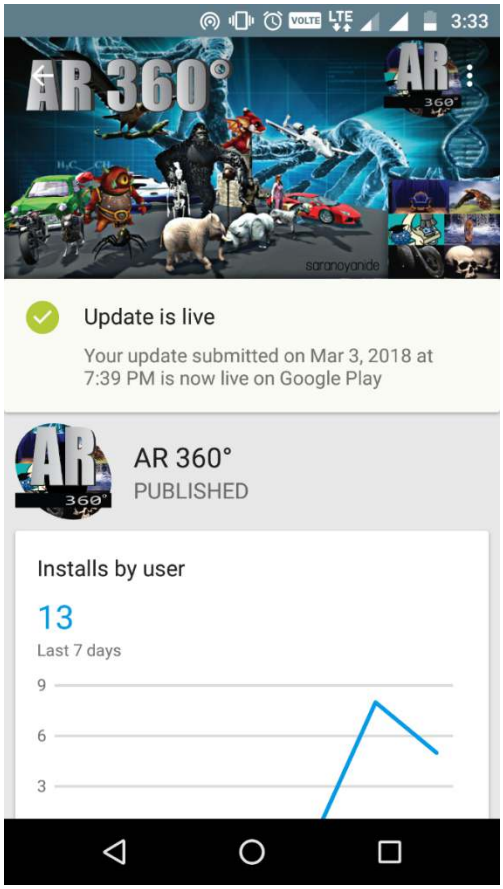

Fig 7.7 AR 360 Dashboard

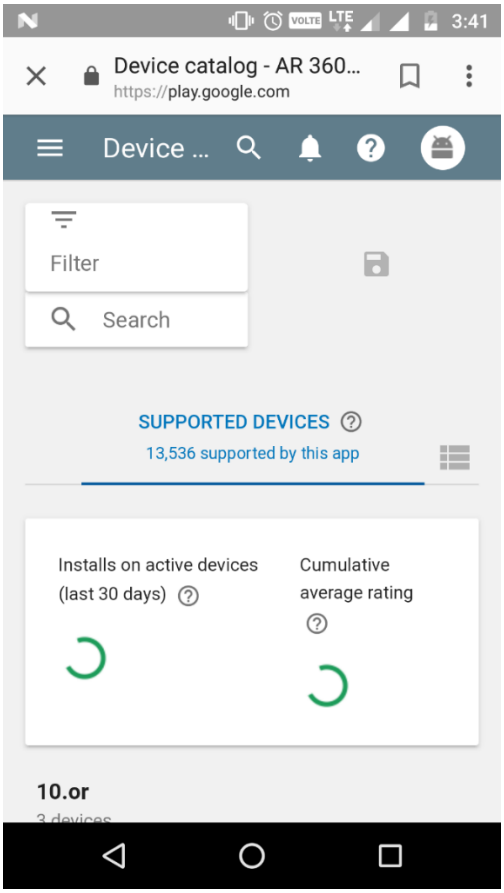

Fig 7.8 AR 360 Supporting devices

From above fig 7.8, we can see number of supporting devices for this application. Our AR360 is now available at 141 countries and it supports 13,536 devices.

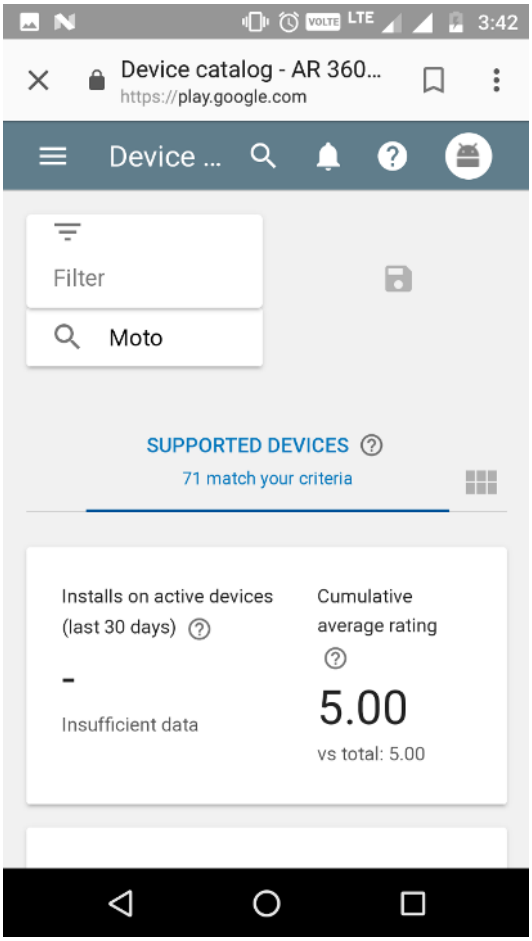

Fig 7.9 AR 360 Moto devices

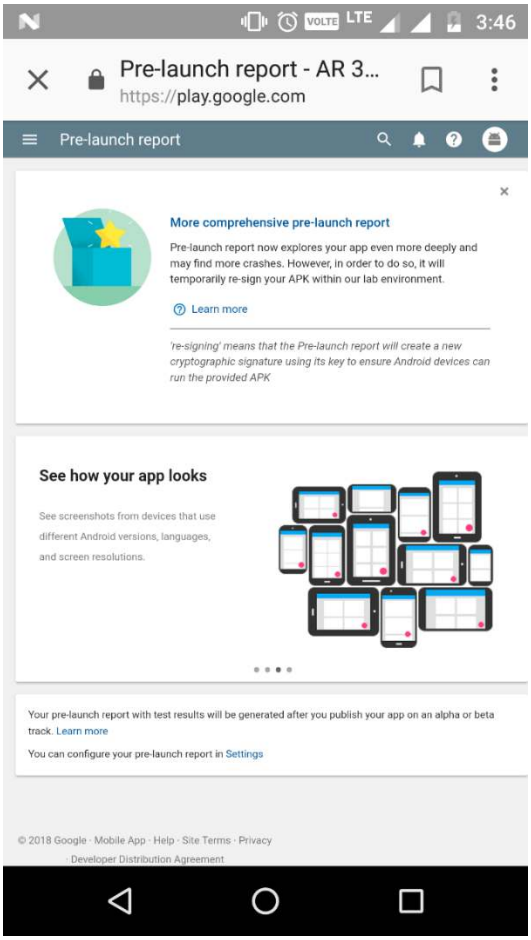

Fig 7.10 AR 360 Pre launch report

APPENDICES

CameraFocusController.cs

```
using UnityEngine;
using System.Collections;
using Vuforia;
public class CameraFocusController : MonoBehaviour {
    private bool mVuforiaStarted = false;
    void Start ()
    {
        VuforiaARController vuforia = VuforiaARController.Instance;
        if (vuforia != null)
            vuforia.RegisterVuforiaStartedCallback(StartAfterVuforia);
    }
    private void StartAfterVuforia()
    {
        mVuforiaStarted = true;
        SetAutofocus();
    }
    void OnApplicationPause(bool pause)
    {
        if (!pause)
        {
            // App resumed
            if (mVuforiaStarted)
            {
                // App resumed and vuforia already started
                // but lets start it again...
                SetAutofocus(); // This is done because some android devices lose the auto focus
after resume
                // this was a bug in vuforia 4 and 5. I haven't checked 6, but the code is harmless
anyway
            }
```

```
        }
    }
    private void SetAutofocus()
    {
        if
(CameraDevice.Instance.SetFocusMode(CameraDevice.FocusMode.FOCUS_MODE_CON
TINUOUSAUTO))
        {
            Debug.Log("Autofocus set");
        }
        else
        {
            // never actually seen a device that doesn't support this, but just in case
            Debug.Log("this device doesn't support auto focus");
        }
    }
}
```

ImageTargetBehaviour.cs

```
/*==============================================================================
Copyright (c) 2010-2014 Qualcomm Connected Experiences, Inc.
All Rights Reserved.
Confidential and Proprietary - Protected under copyright and other laws.
==============================================================================*/
using System.Collections.Generic;
using UnityEngine;
namespace Vuforia
{
    /// <summary>
    /// This class serves both as an augmentation definition for an ImageTarget in the editor
    /// as well as a tracked image target result at runtime
    /// </summary>
```

```
    public class ImageTargetBehaviour : ImageTargetAbstractBehaviour
    {
    }
}
```

VuforiaConfiguration.cs

```
/*==============================================================================
==========
Copyright (c) 2016 PTC Inc. All Rights Reserved.

Confidential and Proprietary - Protected under copyright and other laws.
Vuforia is a trademark of PTC Inc., registered in the United States and other
countries.
==============================================================================
=========*/

namespace Vuforia
{
    public class VuforiaConfiguration : VuforiaAbstractConfiguration
    {
    }
}
```

CONCLUSION

As for the conclusion, the objective of the project has been achieved which is to model Advance Graphic Integrated Model to enhance the teaching and understanding abilities of the Exported topics. This module is aimed in helping children affected with Autism and enhance their capabilities by making them understand the Concepts of education. This game enhances with autism children education and it gives them real world interaction. Bridging the gap between the virtual and physical worlds, Augment changes the way we see, imagine, and learn about the world around us. Physically impossible activities can be done in Augment Reality even in this project solar System is in science module it shows solar system in our hand with a single target platform. Augmented reality (AR) app and platform enables students and teachers to visualize 3D models in the real environment, in real time, and at scale.

Future enhancement of this project is to implement this same application in iOS and at that time both iOS and android may have spatial mapping technology so it is easy to export assets in spatial mapping application, which needs no target platform it, coordinates with real platform. In future Augmented Reality is the best way for reducing E-waste, Augmented Reality mobiles and Tabs will be introduced in market no need of solid mobiles and tabs, more resources is saved, Thefts may reduce, soon Augment Reality Gadgets may be introduced in market.

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