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DEPARTMENT OF COMPUTER ENGG

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A PROJECT REPORT ON

“E-LEARNING USING AUGMENTED REALITY”

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UNDER THE GUIDENCE OF

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CERTIFICATE

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of class Third Year (2020-21) have successfully completed project on **‘E-Learning Using Augmented Reality’** under the guidance of **Mrs. Archana Paike** in parallel fulfillment of requirement for the award of Diploma in Computer Engineering from Government Polytechnic, Pune.

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ACKNOWLEDGEMENT

We are thankful for providing such an exciting way of developing our knowledge regarding the project development. We take a great pleasure in presenting the report for our project “**E-Learning using Augmented Reality**”. We came to know project development and its overall aspects through this project.

First and foremost ,we would like to express our deepest sense of gratitude and sincere thanks to our Project guide **MRS. A.S.PAIKE** for their timely co-operation, eminent guidance and lots of encouragement. In a particular, we wish to offer our gratitude to honorable Head of Computer Engineering Department **MR. U.V. KOKATE**.

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ABSTRACT

Augmented Reality mixes virtual and actual reality, making available to the user new tools to ensure efficiency in the transfer of knowledge for several processes and in several environments. Various solutions based on Augmented Reality have been proposed by the research community: particularly in maintenance operations Augmented Reality tools have offered new perspectives and have promised dramatic improvements.

On the other side Augmented Reality is an extremely demanding technology and, at the present day, it is still affected by serious flaws that undermine its implementations in the industrial context.

At the same time the principal flaws of Augmented Reality are commented and possible lines of investigation are suggested .

ELAR is An Augmented Reality based software which can be used by students with their traditional textbooks. This software will help students to visualize the three dimensional representation of the entity they are learning about.

This Software will allow students to great extend to understand the concepts easily and way better than just seeing the 2d pictorial format of the subject. Basic requirement of the software will be a Android phone or table on which our software will run and if user wants to enhance the experience then a VR glasses can also be used.

1. INTRODUCTION

Augmented reality has been a hot topic in software development circles for a number of years, but it's 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 your 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 your field of view and can take you 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.

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 your camera screen.

Technology has advanced to the point where realism in virtual reality is very achievable. However, in our obsession to reproduce the world and human experience in virtual space, we overlook the most important aspects of what makes us who we are—our reality. Yet, it isn't enough just to trick the eye or fool the body and mind. One must capture the imagination in order to create truly compelling experiences. On the spectrum between virtual reality, which creates immersible, 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.

Augmented Reality (AR) is often mistaken with Virtual Reality (VR). The main difference between the two is that while Virtual Reality replaces the entire real

environment with an artificial one, Augmented Reality is applied in a direct view of an existing real environment and adds elements like sounds, videos, or graphics onto it.

The term Augmented Reality was coined back in 1990 by Boeing researcher Tom Codell and one of the first commercial uses of this technology was in television and the military. As the world shifted towards becoming more technology-driven, AR became increasingly prominent in multiple fields, rolling out its second wave and drawing its connection towards the interactive concept. As the technology develops there emerge several new trends in Augmented Reality.

When we use a device or application enabled with the AR technology the hardware of the device or application captures the object's picture, sharing it with the computer vision program which then processes the image to gather all relevant details like the measurements of the object, any other objects which are present on the same surface, while also calculating how far these other objects are from the main object in focus.

By applying these insights the AR-enabled device will then develop and create virtual information that will serve as an overlay over the real object, giving a unique customer experience.

Augmented Reality (AR) is a new technology that involves the overlay of computer graphics on the real world . One of the best overviews of the technology is , that defined the field, described many problems, and summarized the developments up to that point. That paper provides a starting point for anyone interested in researching or using Augmented Reality.

AR is within a more general context termed Mixed Reality (MR) , which refers to a multi-axis spectrum of areas that cover Virtual Reality (VR), AR, telepresence, and other related technologies.

Virtual Reality is a term used for computergenerated 3D environments that allow the user to enter and interact with synthetic environments . The users are able to “immerse” themselves to varying degrees in the computers artificial world which may either be a simulation of some form of reality or the simulation of a complex phenomenon .

2. PROJECT TIMELINE AND TARGET

A target schedule is a project management tool that is used as a supplement to the approved baseline schedule. It takes into account the fact that variations in resource availability and other circumstances may sometimes affect the completion timeline of various activities. The baseline specifies the planned start and finish dates and the duration of each activity based on information gleaned from initial schedule network analysis. Target dates typically focus on the completion of individual tasks and may deviate from the baseline dates as needed to provide additional flexibility in project management. However, the original baseline data is still retained for historical reference regardless of any changes that occur during the lifecycle of the project.

A project timeline is a visual list of tasks or activities placed in chronological order, which lets project managers view the entirety of the project in one place. A project timeline typically takes the form of a horizontal bar chart, where each task is given a name and a corresponding start and end date.

A project timeline provides an in-depth overview of the entire project from start to finish. You can see when a task starts and when it's due—and importantly, whether or not it's dependent on another task.

A project timeline can be priceless for a project team, but they can be challenging to make by hand or even in Excel. Fortunately, project timeline software can create an interactive timeline in just a few clicks. With ProjectManager.com, all you have to do is add your tasks and due dates. Want more detail? Add subtasks, milestones, dependencies, cost estimations and more. As your team executes their tasks, your timeline updates instantly, turning it into a powerful tracking device.

Project Target Dates are specific dates on a project schedule which the project performers should be focused on while executing a project. These dates are usually associated with readiness of certain project deliveries, achievement of certain milestones, etc. They contrast against the deadlines (each project stage or deliverable may have its deadline) which are certain time limits that a project must never go beyond, so if some deadline is violated it makes no more sense to continue working at this project (its competitive advantages are lost irrevocably), while the target dates are not so critical – if some of them are missed, then work should be continued and completed anyway.

In other words a deadline is a strict project constraint, while the target date is a desired objective which should be met according to project plan, but if it is violated, then a project gets into a state of schedule slippage (it risks to miss its completion deadline), and should be put back on track as soon as possible (probably by adding some additional resources, reviewing its scope, etc).

Timelines are one of the few concepts in project management that are common in all projects irrespective of the project's characteristics, industry, or project management methodology. A timeline keeps the project together and gives you insights into the progress. It gives you a clear idea of what you are trying to achieve and where you are with that.

Here are a few examples of how a project timeline can help you track the project progress:

- Having a project timeline improves communication because everyone will know what to expect and the current standing of the project. It not only allows everyone involved to be in the loop but also makes it easier for new members to know what's happening.
- Project timelines will be of great help during the controlling and monitoring phase. You can immediately know where you stand with the progress of your project and react immediately according to the situation.
- A project management timeline showing that everything is according to the plan can be a great motivator for your team. With everything going smoothly, your team will approach its tasks with the correct attitude and things will automatically start to go smoothly.
- Project timelines are also a great visibility tool that can tell you a lot of data in a glance. You can get a clear idea about the dependencies in project management and how tasks are prioritized. Since dependencies are automatically ingrained in your project timeline, you'll be able to see how a delay in one specific task affects your entire project.
- Project timelines also tell you how much workload a specific team member will have in a certain period. You can use that information to ensure equal distribution of tasks and prevent overburdening the team, which is one of the biggest causes of project burnout.

Project Targets refer to a set of fixed goals or objectives that determine how a given project is expected to be done and what result or effect is supposed to be produced by the project. They identify project purpose while ensuring that there is no conflict between project goals and project deliverables. Project targets are established for a certain piece of project work. They cannot be changed or modified once established.

Project targets describe a project in terms of goals or objectives to be reached by the project with a predefined set of rules and requirements, including fixed deliver period, product specification, team size and composition, resource pool, others. Any target is always fixed and attached to the respective piece of project work. A floating or changeable target exists only if there is a project that has no definite or preset product/effect to be developed/reached.

Project targets help structure projects into smaller pieces of work and thereby simplify project management activities. Complex goals and high-level objectives can be structured by a range of targets that project teams are required to complete under a fixed amount of resources (time, technology, funds etc.).

PROJECT DEVELOPMENT PLAN

9th April 2021 : Finalized Project Problem Statement.

1st Week : Requirement Gathering , Scope Analysing And Project Plan

2nd Week : Software and Other Project Requirement Installation And Project Design Finalization And Module Divisions

3rd Week : Design Module 1 i.e GUI for Application.

4th to 6th Week : Testing The GUI And Making The AR Module And 3d Models.

7th Week : Integration Of Various modules into Single Application

8th Week : Testing And Other Documentational Work .

9th Week : Presentation Of The Product

3. PROJECT PLANS

3.1 BACKGROUND AND PURPOSE :

A background of a project is just a simple and short statement of the project, meaning why we need to initiate it and what problems and needs will be addressed once it's been implemented successfully. We do not say anything about objectives, resources to be allocated, methods to be used, and any other, more accurate information. The purpose of the background is to give an overview of the project for deciding on the need to do the project and for initiating the planning process. When you write a background for your project your primary focus should be placed on giving a general idea and explaining the key prerequisites. This will let your potential investors (sponsors) get the "initial impression" about the project.

Traditionally , in today's education system , the students are provided with 2-D diagrams in text books which need to be engrossed . Students feel it boring seeing the same pictures again and again and don't gain that much of the interest .

Students need to imagine how the particular object would look in real life . It also becomes difficult for teachers to make students understand the proper structure of the object .

To overcome this problem we have come forward with a new thought to change the images in our regular textbooks with 3D objects . These would give the real life experience of visualizing the object to the students and make it easier for them to understand . Once the image is scanned a 3D view of the image as well as all the necessary details about it will be displayed .

Thus, this will ease the task of teachers as well as give a proper view to the students imagination.

3.2 GOAL OF STUDY :

This study is aimed at developing an E-Learning application which would work using Augmented Reality which would provide the 3-D view and details about the scanned image. The application should scan the Image create its 3-D view and display it to end users .

3.3 ENVIRONMENT OF IMPLEMENTATION

Environment refers to the collection of hardware and software tools a system developer uses to build software systems. As technology improves and user expectations grow, an environment's functionality tends to change.

Over the last 20 years the set of software tools available to developers has expanded considerably. We can illustrate this change by observing some distinctions in the terminology. Programming environment and software development environment are often used synonymously, but here we will make a distinction between the two. By "programming environment" we mean an environment that supports only the coding phase of the software development cycle—that is, programming-in-the-small tasks such as editing and compiling. By software development environment we mean an environment that augments or automates the activities comprising the software development cycle, including programming-in-the-large tasks such as configuration management and programming-in-the-many tasks such as project and team management. We also mean an environment that supports largescale, long-term maintenance of software.

In this chapter, we shall be explaining the technologies and tools, programming languages and methodology used in this project.

TECHNOLOGIES AND TOOLS :

UNITY

- Unity3D is a powerful cross-platform 3D engine and a user friendly development environment.
- Easy enough for the beginner and powerful enough for the expert.

- Unity attracts anybody who wants to easily create 3D games and applications for mobile, desktop, the web, and consoles.
- It has imposed in it the C# scripting API and built-in Visual Studio integration which the programmers love the most about it.
- Unity also offers JavaScript as a scripting language and MonoDevelop as an IDE to those who want an alternative to Visual Studio.
- It allows for multiple projects to be built for multiple platforms.
- One of the helpful features of developing a game in Unity 3D is access to online tutorials and learning materials. It really helps an amateur game developer, who is starting out his/her journey in the game development sector to be able to access the tutorials in which he/she is making the game.
- Unity 3D allows you to use multiple coding languages. The hands-on experience of C#, Javascript and BOO often referred to as Unity Script is straight-forward for any game developer. These can be programmed by developers also fairly easy.
- It is effective, reliable and preferred by multiple gamers across the world.

BLENDER

- It is 3D open software free to install and get support and add-ons based on our project requirements
- Blender is freeware in the market, whereas the rest of the software is costly for the same workflow requirements.

- Easy and user-friendly interface to understand for beginners and experience to work fast and effectively with shortcuts.
- Work can be done in less time, presets and templates help in creating a model quickly and easy to unwrap for texturing.
- Stimulation and keying as per the animation movement for the time frame can be done in less time.
- Blender has support for a variety of geometric primitives, including polygon meshes, fast subdivision surface modeling, Bezier curves, NURBS surfaces, metaballs, icospheres, text, and an n-gon modeling system called B-mesh.
- Blender has multi-res digital sculpting, which includes dynamic topology, maps baking, remeshing, re-symmetrize, and decimation.
- Blender can be used to simulate smoke, rain, dust, cloth, fluids, hair and rigid bodies.

C#

- C# is pronounced "C-Sharp".
- It is an object-oriented programming language created by Microsoft that runs on the .NET Framework.
- C# has roots from the C family, and the language is close to other popular languages like C++ and Java.
- C# programming is based upon the current trend and it is very powerful and simple for building scalable, interoperable and robust applications.

- C# type safe code can only access the memory location that it has permission to execute. Therefore it improves a security of the program.
- Interoperability process enables the C# programs to do almost anything that a native C++ application can do.
- It is one of the most popular programming language in the world
- It is easy to learn and simple to use
- It has a huge community support
- C# executes faster and it has some language features which provide significant advantages over UnityScript which you probably won't understand at the beginning but are extremely helpful.
- Developing with C# has advantage of Visual Studio. It provides better code completion feature than Mono develop.

ADOBE FUSE

- It is often-underused system that allows a 3D model to be part of a normal '2D' Photoshop file.
- Adobe Fuse files can be exported as OBJ models with their associated textures for rigging in 3D applications.
- Creating new characters can be a tricky task for any 3D artist, and it's even harder when the artist is new to CGI creation.
- Adobe Fuse enables artists to create bespoke humanoid models, and clothe them using the array of clothing presets that come with the software.
- Adobe Fuse is primarily designed to work with Adobe Photoshop's 3D system.

VUFORIA ENGINE

- Designed to provide the best possible AR experience on a wide range of devices.
- It offers robust and accurate tracking by using the Positional Device Tracker that includes tracking a Vuforia target even when the object or content is no longer in the camera view.
- It recognize a large set of images and frequently update the database with new images.
- It can record and replay your AR session to test, experience, and improve your AR development workflow with the Session Recorder.
- Allows developers to provide and consume data from external systems through Vuforia Engine.
- It helps to Access video data from a camera outside of the one in a phone or tablet when creating AR experiences.
- 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 and 3D objects 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 objects when they are viewed through the camera of a mobile device.

4. PROJECT REQUIREMENTS

Requirement Analysis is the first phase of software development process. This phase focuses to understand the problem. Requirement Analysis is on identifying what is need from these systems, not how the system will achieve its goals. In this phase often at least two parties are involved in Software Development-a client and a developer. The developer has to develop the system to satisfy the clients' needs. The developer and client arrange a meeting and discuss his/her own views. The developer asks the clients for his/her needs. After a meeting the developer understands what the requirements of the client are. Before starting of the development process, the developer analyse , test the requirements which are given by the clients. According to those requirements the developer starts development process. Hence the developer needs a user's problem.

Requirement Analysis, also known as Requirement Engineering, is the process of defining user expectations for a new software being built or modified. In software engineering, it is sometimes referred to loosely by names such as requirements gathering or requirements capturing. Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project, taking account of the possibly conflicting requirements of the various stakeholders, analyzing, documenting, validating and managing software or system requirements.

In the software requirement we are dealing with the requirements of the proposed system, that's the capabilities of that system, which is yet to be developed, should have. The software requirement specification (SRS) is a document that completely describes what the proposed software should do without describing how the software will do it. So the basic goal of Requirement Phase is to produce the SRS, which describes the complete external behavior of the proposed software.

The basic aim of problem analysis is to obtain the clear understanding of the needs of the clients and the user, what exactly described from the software, and what the constraints on the solution are? This involves a meeting of user and developers.

The developer may ask the following questions to users-:

- **Who will use the developed software?**

The developed software will be used by the students for increasing the understandability level and even by teachers and other professionals to demonstrate their perspective in an efficient way.

- **What types of characteristics may have the software?**

The characteristics of the software are :

- Advanced E-Learning Platform
- Combination of real and virtual
- Interactive in Run time
- 3D object visualization
- Combines real and virtual objects in real environment;
- Performs real-time interactivity;
- Aligns real and virtual objects together;
- Applies to all senses, including hearing, touch, smell and strength.

4.1 FUNCTIONAL REQUIREMENTS :

In the development process, we have ensured that the software will work under the condition that every user gets the proper interface to interact with the system in an ease. The software achieves the capability that the users interacting with this system is completely satisfied.

USER REQUIREMENTS :

The main requirement of the user is that the system should be used by the Users and administrator for proper maintaining. The developer can face a number of requirements given by the user. So, the software should have a number of facilities. According to the User Requirements the system is built in the way that it provides the number of facilities to the users and administrators. The user may require the followings:

(I) CORRECTNESS :

Correctness is the degree to which the software performs its required function. The extent to which the software satisfies its specifications and fulfils the customer's mission objectives. This system adapts the degree of Correctness by achieving the facilities and the User requirements. The software is correct in all the manner because the testing is done in each unit of the system. Thus we can say that our system to be Correct system as it meets all the requirements of the users.

II) PERFORMANCE :

The main motto of the degree of performance is that the developed system should perform all the tasks the user has specified. The performance of our software is measured on the basis of response time taken to display the record of the particular student. All the requirements of our software directly relates to its performance. The software response is measured on the basis of execution of the program constraints. In the Performance, the software “process all the operations quickly”. So the performance of our system is measured by throughput, efficiency, response time and the processing speed.

III) USER FRIENDLY :

The developed software is user friendly by which the user can understand the software easily. It provides a good interface thus it is said to be user friendly. Our software is developed in rather than CUI, therefore the developed software is friendlier. The Base of our system is developed by using the Unity as a user interface . The software provides integrated and consistent information. The information is completely reliable .

IV) MAINTENANCE :

The user wants that the software must be maintained properly before accepting the software. Thus the software provides the maintenance to the users. Software needs to be maintained not because some of its components wear out and need to be replaced, but because there are often same residual errors remaining in the system that must be removed as they are discovered. The Maintenance of the software is given to the user by using the maintainability. The maintainability is ease with which a program can be corrected, if an error is encountered. The maintenance depends on the user's requirement because there are many kind of maintenance. Thus, the user requires maintenance because, maintenance involves understanding the software (code and related modules), understanding the effects of change, making new changes. Because often during development some needs are not kept in mind. Thus by considering all the above points we can say that our system adapts the degree of maintainability.

4.2 PERFORMANCE REQUIREMENTS

Performance requirements typically comprise a set of criteria which stipulate how things should perform or the standards that they must achieve in a specific set of circumstances. This is as opposed to prescriptive specifications which set out in precise detail how something should be done.

- **PORTABILITY**

The system portability should be taken care of without any interventions. Portability means the capability of the software to be transferred from one environment to another. Thus our system provides the portability that it can run on any machine with backward compatibility.

Portability is the ability of an application to run properly in a different platform to the one it was designed for, with little or no modification. Where modification is needed, the task of modifying the software to allow it to run in the new environment is known as porting.

- **SECURITY**

The system should be secure from unknown interventions and the modification of the internal code should not be permissible to unknown users.

System security encompasses all facets of accessing information assets. From authentication, to software updates, anti-virus protection, and modifications - security is a key component to a device operating at its optimum. These best practices help to mitigate various security concerns.

- **EFFICIENCY**

The system should be capable of providing the required performance related to the amount of resources of the organization.

Efficiency measures the amount of each engineer's "productive" code, or code that provides business value. An engineer creating a whole new solution or implementing sweeping code changes will likely deal with lots of trial and error with a low efficiency rate.

- **RELIABILITY**

Our system should be capable enough to maintain the level of performance. Application reliability is the probability of a piece of software operating without failure while in a specified environment over a set duration of time. In a perfect world, a reliable piece of software is completely defect free, does not create downtime, and performs correctly in every scenario.

5.DESIGN STRATEGY

5.1 FEASIBILITY STUDY

A feasibility study is an evaluation of a proposal designed to determine the difficulty in carrying out a designated task. Generally, a feasibility study precedes technical development and project implementation.

The feasibility study identifies various aspects of the project, which includes mapping out potential roadblocks, offering alternative solutions, identifying project objectives, human resources requirements, budgets, timeframe, etc. A feasibility study usually assesses areas such as:

Legality – What are the legal requirements of the project? Is it possible to meet these legal requirements?

Budget – Is there adequate financial resources to start and complete the project? What is the cost/benefit analysis of the project? Is it sufficient to warrant starting the project?

Time – What is the likelihood that the project will be completed in the stipulated timeframe?

Risk – Are there risks associated with undergoing this project? What is the risk-to-reward ratio of the project?

Technical capability – Does the organization have both technical resources to accomplish the project?

In carrying out a feasibility study, this can be divided into various studies. For instance, you can have a technical feasibility study, economic feasibility study, and operational feasibility. These studies have different requirements that must be fulfilled before starting the project. Today, our focus will be on the operational feasibility study and how you can get it done accurately.

➤ TECHNOLOGY AND SYSTEM FEASIBILITY :

Augmented reality has application in various segments, such as in surgical procedures, engineering, entertainment and education. The AR is already used in some segments and the challenge is that telecommunications operator, specifically the mobile, able to deploy this technology in order to provide its customers with new forms of fun and entertainment, generating positive results for the company. One of the challenges faced by mobile carrier to deploy the AR is that the mobiles need to be quite sophisticated, requiring an open operating system and allows downloading applications.

This assessment focuses on the technical resources available to the organization. It helps organizations determine whether the technical resources

meet capacity and whether the technical team is capable of converting the ideas into working systems. Technical feasibility also involves the evaluation of the hardware, software, and other technical requirements of the proposed system. As an exaggerated example, an organization wouldn't want to try to put Star Trek's transporters in their building—currently, this project is not technically feasible.

➤ **ECONOMIC FEASIBILITY :**

Economic analysis is the most frequently used method for evaluating the effectiveness of a new system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

This assessment typically involves a cost/ benefits analysis of the project, helping organizations determine the viability, cost, and benefits associated with a project before financial resources are allocated. It also serves as an independent project assessment and enhances project credibility—helping decision-makers determine the positive economic benefits to the organization that the proposed project will provide.

➤ **COST BASED STUDY :**

The framework consists in estimating the cost and benefit resulting from the use of the AR system in the targeted context. At the time of writing, as mentioned, the AR solution is still being developed, which prevents the possibility of providing a quantitative evaluation of the cost and benefit resulting from its application in the real scenario. Nonetheless, some indications about the potential cost and saving resulting from the use of an AR solution to support the task examined can be provided.

It is important to identify cost and benefit factors. Cost and benefits can be categorized into the following categories. Basically it is an analysis of the costs to be incurred in the system and benefits derivable out of the system. In a broad sense the costs can be divided into two types:

1. Development costs
2. Operating costs.

➤ **TIME BASED STUDY :**

Contrast to the traditional system management it can generate any information of data just by single scan and it saves user time .No extra time is being provided to deliver application.

➤ OPERATIONAL FEASIBILITY :

It is a measure of how well a proposed system solves the problems, and takes advantages of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.

Operational feasibility is based on issues such as manager support, required training, workforce reduction, and adverse effects to users and customers.

This assessment involves undertaking a study to analyze and determine whether—and how well—the organization's needs can be met by completing the project. Operational feasibility studies also examine how a project plan satisfies the requirements identified in the requirements analysis phase of system development.

5.2 USE CASE DIAGRAM FOR ELAR

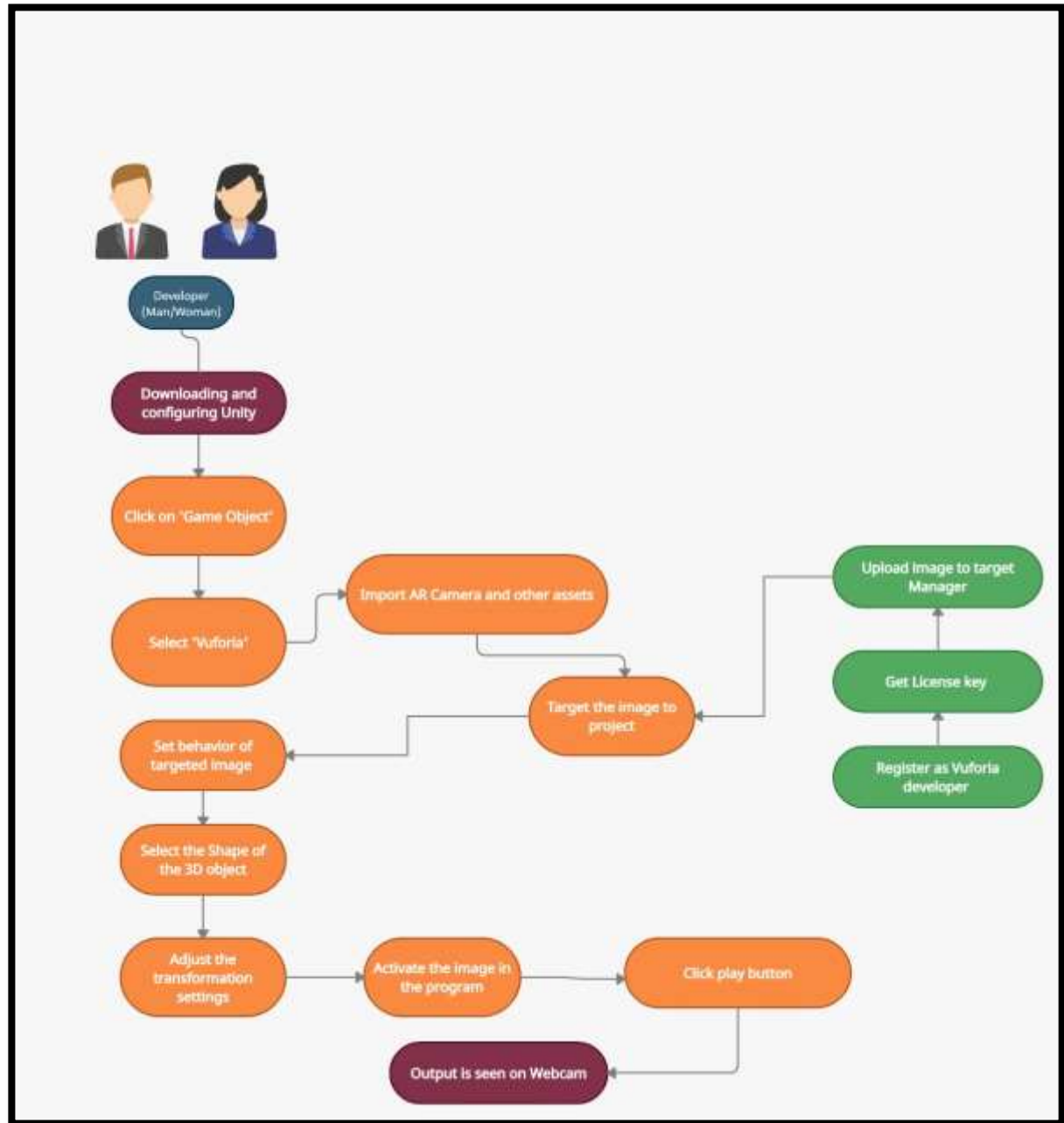
“Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases”.

A UML use case diagram is the primary form of system/software requirements for a new software program underdeveloped. Use cases specify the expected behavior (what), and not the exact method of making it happen (how). Use cases once specified can be denoted both textual and visual representation (i.e. use case diagram). A key concept of use case modeling is that it helps us design a system from the end user's perspective. It is an effective technique for communicating system behavior in the user's terms by specifying all externally visible system behavior.

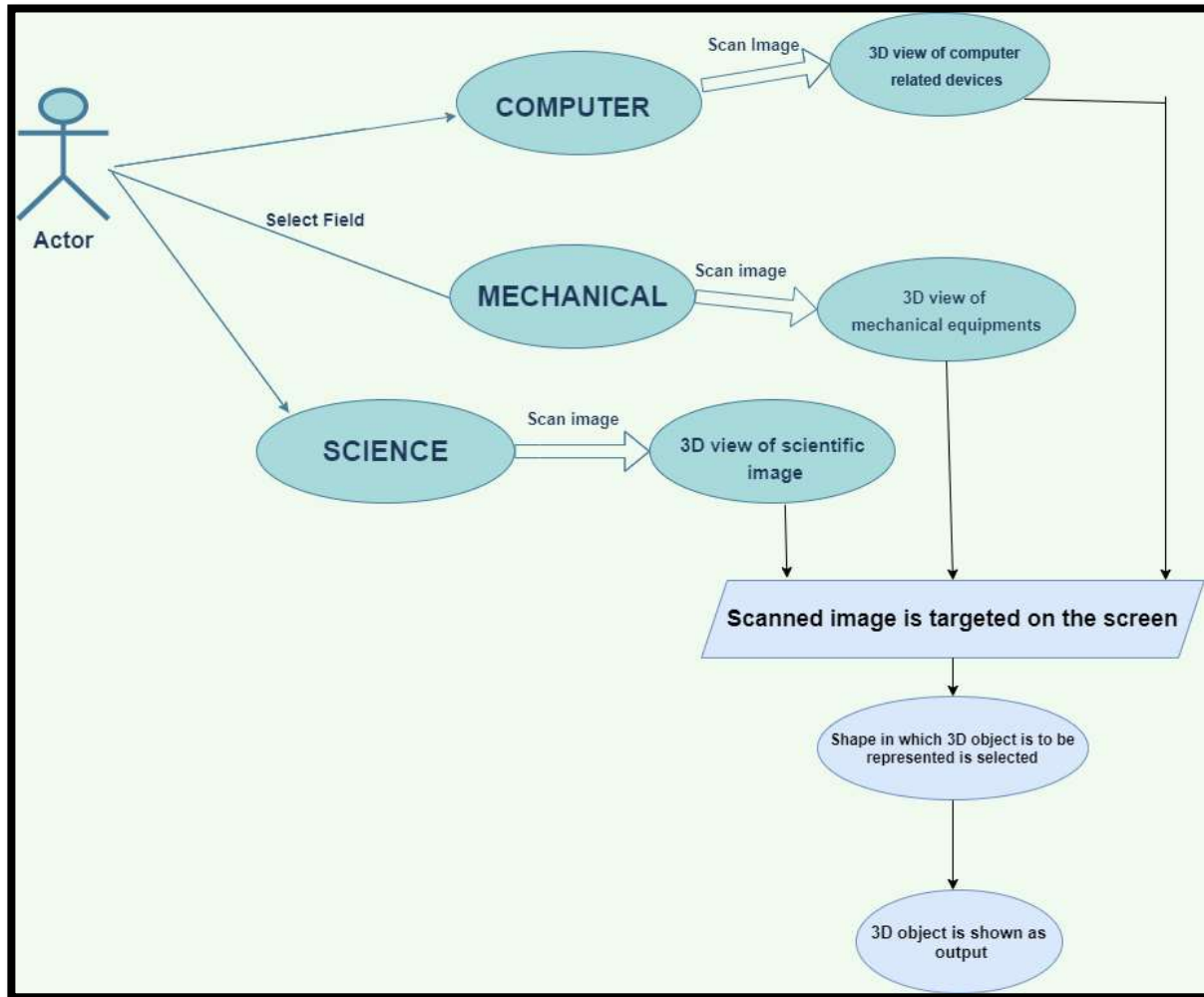
A use case diagram is usually simple. It does not show the detail of the use cases:

- It only summarizes some of the relationships between use cases, actors, and systems.
- It does not show the order in which steps are performed to achieve the goals of each use case.

USE CASE DIAGRAM FOR DEVELOPER:



USE CASE DIAGRAM FOR THE END USER :



5.3 AR APPLICATIONS

From education to remote work, here are ten of the best uses cases for AR technology that are set to emerge in the near future -

1. Medical Training

From operating MRI equipment to performing complex surgeries, AR tech holds the potential to boost the depth and effectiveness of medical training in many areas. Students at the Cleveland Clinic at Case Western Reserve University, for example, will now learn anatomy utilizing an AR headset allowing them to delve into the human body in an interactive 3D format.

2. Retail

In today's physical retail environment, shoppers are using their smartphones more than ever to compare prices or look up additional information on products they're browsing. World famous motorcycle brand Harley Davidson is one great instance of a brand making the most of this trend, by developing an AR app that shoppers can use in-store. Users can view a motorcycle they might be interested in buying in the showroom, and customize it using the app to see which colors and features they might like.

3. Repair & Maintenance

One of the biggest industrial use cases of AR is for repair and maintenance of complex equipment. Whether it's a car motor or an MRI machine, repair and maintenance staff are beginning to use AR headsets and glasses while they perform their jobs to provide them with useful information on the spot, suggest potential fixes, and point out potential trouble areas. This use case will only continue to get stronger as machine-to-machine IoT technology grows and can feed information directly to AR headsets.

4. Design & Modeling

From interior design to architecture and construction, AR is helping professionals visualize their final products during the creative process. Use of headsets enables architects, engineers, and design professionals step directly into their buildings and spaces to see how their designs might look, and even make virtual on the spot changes. Urban planners can even model how entire city layouts might look using AR headset visualization. Any design or modeling jobs that involve spatial relationships are a perfect use case for AR tech.

5. Business Logistics

AR presents a variety of opportunities to increase efficiency and cost savings across many areas of business logistics. This includes transportation, warehousing, and route-optimization. Shipping company DHL has already implemented smart AR glasses in some of its warehouses, where lenses display to workers the shortest route within a warehouse to locate and pick a certain item that needs to be shipping. Providing workers with more efficient ways to go about their job is one of the best ROI use cases in today's business environment.

6. Tourism Industry

Technology has gone a long way towards advancing the tourism industry in recent years, from review sites like TripAdvisor to informative website like Lonely Planet. But AR presents a huge opportunity for travel brands and agents to give potential tourists an even more immersive experience before they travel. Imagine taking a virtual "Walkabout" Australia before on AR glasses before booking a ticket to Sydney, or a leisurely stroll around Paris to see what museums or cafes

you might like to visit. AR promises to make selling trips, travel, and vacations a whole lot easier in the future.

7. Classroom Education

While technology like tablets have become widespread in many schools and classrooms, teachers and educators are now ramping up student's learning experience with AR. The Aurasma app, for example, is already being used in classrooms so that students can view their classes via a smartphone or tablet for a more rich learning environment. Students learning about astronomy might see a full map of the solar system, or those in a music class might be able to see musical notes in real time as they learn to play an instrument.

8. Field Service

Whether it's something as small as an air conditioner, or as large as a wind turbine, every day field service technicians get dispatched to repair a piece of mission critical equipment that needs to get up and running as soon as possible. Today, these technicians can arrive on-site with AR glasses or headsets and view whatever they're repairing to more quickly diagnose - and fix - the problem. And instead of having to thumb through a repair manual, technicians can go about their business hands-free to get in and out faster than ever.

9. Entertainment Properties

In the entertainment industry, it's all about building a strong relationship with your branded characters and the audience. Properties like Harry Potter are immensely successful because readers of the books and watchers of the movies feel like they know the characters, and are hungry for additional content. Entertainment brands are now seeing AR as a great marketing opportunity to build deeper bonds between their characters and audience. As a matter of fact, the makers of AR sensation Pokemon Go are soon planning to release a Harry Potter-themed AR game that fans can interact with day in and day out.

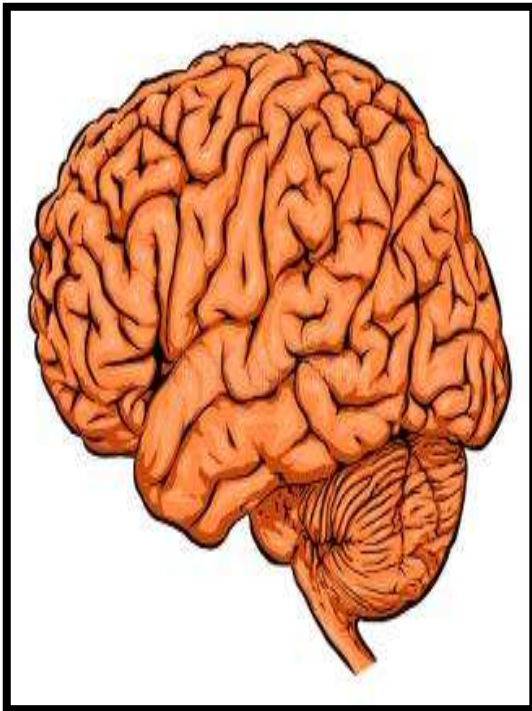
10. Public Safety

In the event of an emergency today, people will immediately reach for their smartphone to find out what's going on, where to go, and whether their loved ones are safe. Moreover, first responders arrive on the scene of a fire or earthquake trying to figure out who needs help, and the best way to get them to safety. AR is showing promise in solving both pieces of the public safety puzzle. First responders wearing AR glasses can be alerted to danger areas, and show in real-time individuals that need assistance while enabling to still be aware of their surroundings. For those in need, geolocation enabled AR can show them directions, and the best route to, safe zones and areas with firefighters or medics.

6.APPLICATION OUPUTS

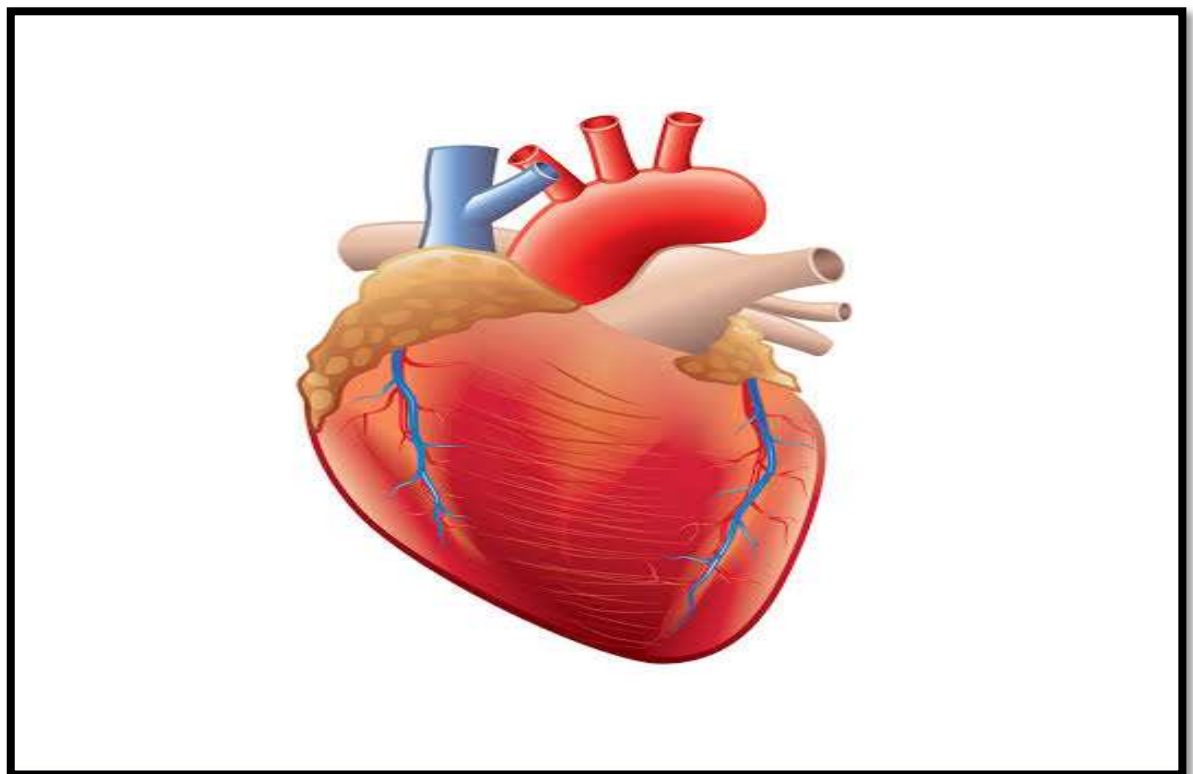
Here , the objects that are developed using various tools are displayed an then scanned for 3D view.

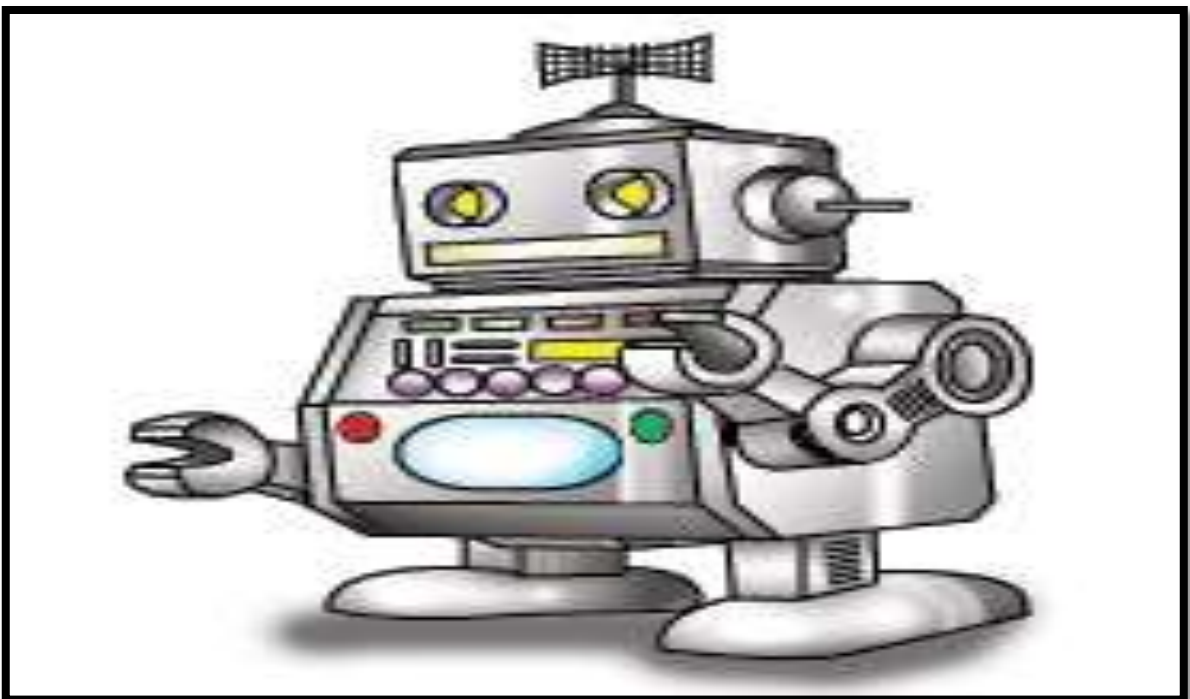
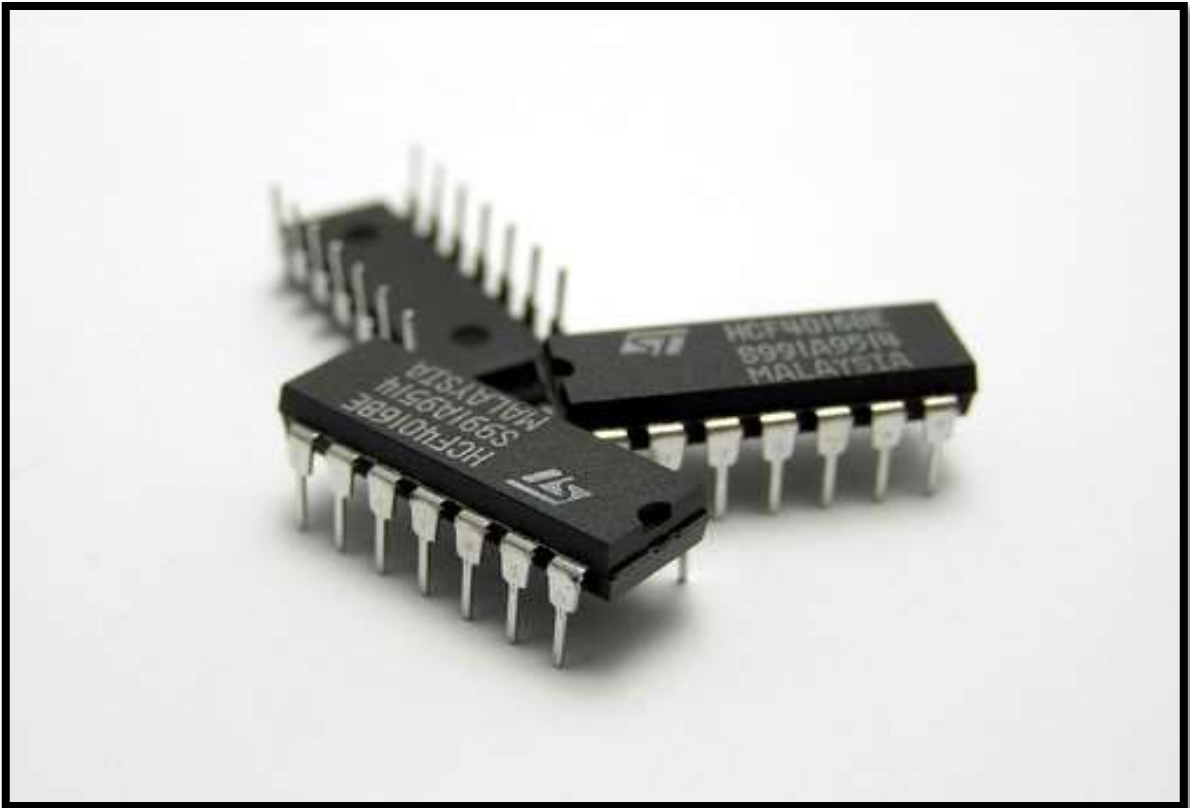
OBJECTS :







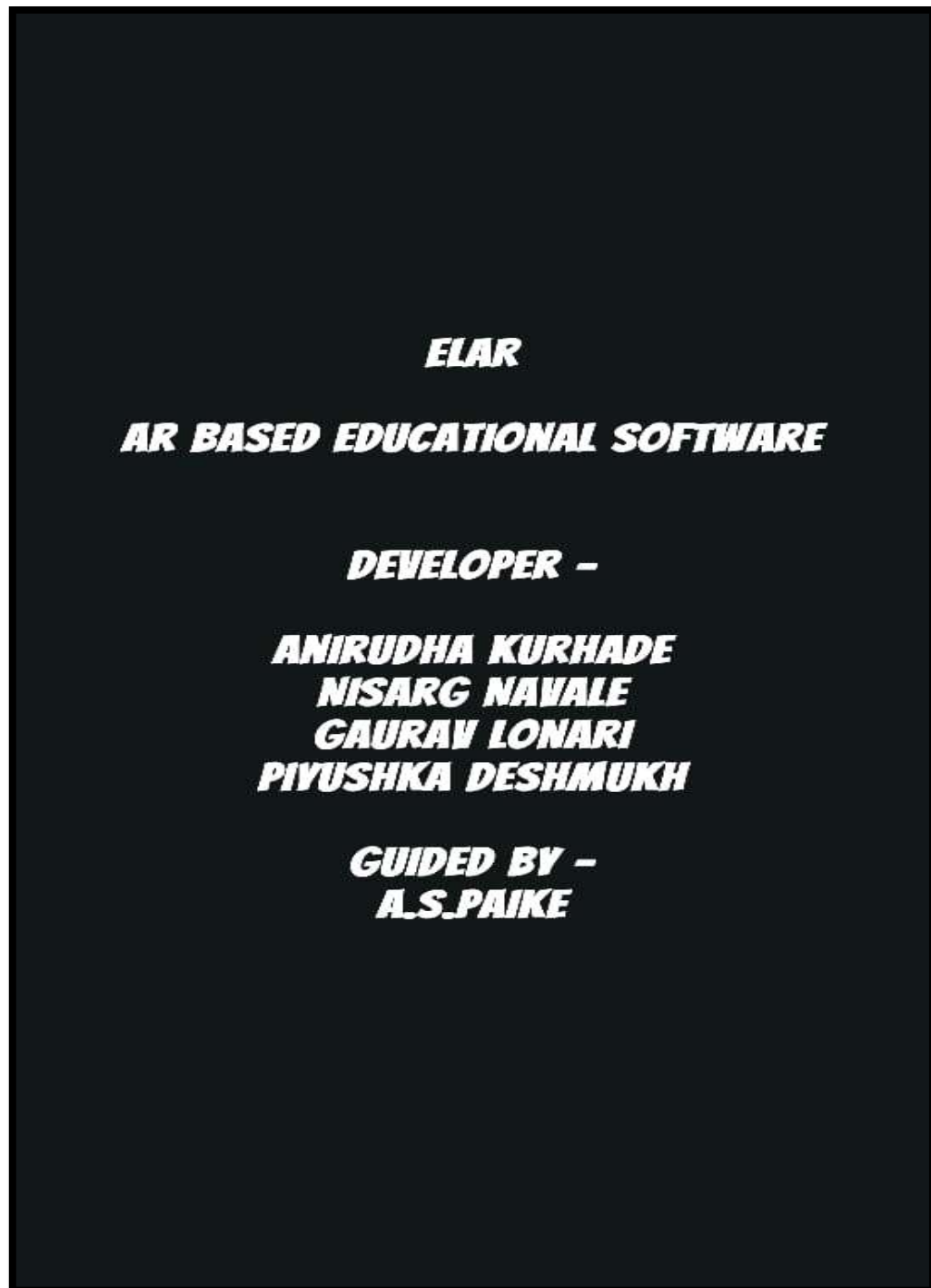








Application Layout :



Select the branch

[Quit](#)

Computer Engineering

Mechanical Engineering

Civil Engineering

Electronics Engineering

Medical And Health

Fun Area

7. PROJECT TESTING

Testing is the process of executing a program with the aim of finding errors. To make our software perform well it should be error-free. If testing is done successfully it will remove all the errors from the software.

Principles of Testing:-

- (i) All the test should meet the customer requirements
- (ii) To make our software testing should be performed by a third party
- (iii) Exhaustive testing is not possible. As we need the optimal amount of testing based on the risk assessment of the application.
- (iv) All the test to be conducted should be planned before implementing it
- (v) It follows the Pareto rule(80/20 rule) which states that 80% of errors come from 20% of program components.
- (vi) Start testing with small parts and extend it to large parts.

FUNCTIONAL TESTING :

In software testing, functional testing is a practice that delivers huge benefits to the development process. When done properly, it increases communication between analysts, developers, and testers. The progress of the entire project is objectively visible at any point in time to management by examining the passing (and failing) functional tests. Eventually, the speed of development increases because well-communicated requirements result in less re-work. The tests also drive a more modular architecture with subsystems that have clear responsibilities.

Types of Functional testing are :

1. UNIT TESTING

Unit Testing is a type of software testing where individual units or components of a software are tested. The purpose is to validate that each unit of the software code performs as expected. Unit Testing is done during the development (coding phase) of an application by the developers. Unit Tests isolate a section of code and verify its correctness. A unit may be an individual function, method, procedure, module, or object.

- It's hard to diagnose failed tests
- Test fixtures work around known issues rather than diagnosing and fixing them

Unit Testing is a software testing technique by means of which individual units of software i.e. group of computer program modules, usage procedures and operating procedures are tested to determine whether they are suitable for use or not. It is a testing method using which every independent modules are tested to determine if there are any issue by the developer himself. It is correlated with functional correctness of the independent modules.

Unit Testing is defined as a type of software testing where individual components of a software are tested.

Unit Testing of software product is carried out during the development of an application. An individual component may be either an individual function or a procedure. Unit Testing is typically performed by the developer.

In SDLC or V Model, Unit testing is first level of testing done before integration testing. Unit testing is such type of testing technique that is usually performed by the developers. Although due to reluctance of developers to tests, quality assurance engineers also do unit testing.

Objective of Unit Testing:

- To isolate a section of code.
- To verify the correctness of code.
- To test every function and procedure.
- To fix bug early in development cycle and to save costs.
- To help the developers to understand the code base and enable them to make changes quickly.
- To help for code reuse.

2. SMOKE TESTING

Smoke testing is performed on the 'new' build given by developers to QA team to verify if the basic functionalities are working or not. It is one of the important functional testing types. This should be the first test to be done on any new build. In smoke testing, the test cases chosen cover the most important functionality or component of the system. The objective is not to perform exhaustive testing, but to verify that the critical functionality of the system is working fine.

Smoke Testing is a software testing process that determines whether the deployed software build is stable or not. Smoke testing is a confirmation for QA team to proceed with further software testing. It consists of a minimal set of tests run on each build to test software functionalities. Smoke testing is also known as "Build Verification Testing" or

“Confidence Testing.”

In simple terms, we are verifying whether the important features are working and there are no showstoppers in the build that is under testing.

It is a mini and rapid regression test of major functionality. It is a simple test that shows the product is ready for testing. This helps determine if the build is flawed as to make any further testing a waste of time and resources.

3. INTEGRATION TESTING

Integration testing is performed to test individual components to check how they function together. In other words, it is performed to test the modules which are working fine individually and do not show bugs when integrated. It is the most common functional testing type and performed as automated testing.

Generally, developers build different modules of the system/software simultaneously and don't focus on others. They perform extensive black and white box functional verification, commonly known as unit tests, on the individual modules. Integration tests cause data and operational commands to flow between modules which means that they have to act as parts of a whole system rather than individual components. This typically uncovers issues with UI operations, data formats, operation timing, API calls, and database access and user interface operation.

Integration Testing is defined as a type of testing where software modules are integrated logically and tested as a group. A typical software project consists of multiple software modules, coded by different programmers. The purpose of this level of testing is to expose defects in the interaction between these software modules when they are integrated

Integration Testing focuses on checking data communication amongst these modules. Hence it is also termed as 'I & T' (Integration and Testing), 'String Testing' and sometimes.

4. REGRESSION TESTING

Regression Testing is defined as a type of software testing to confirm that a recent program or code change has not adversely affected existing features.

Regression Testing is nothing but a full or partial selection of already executed test cases which are re-executed to ensure existing functionalities work fine.

This testing is done to make sure that new code changes should not have side effects on the existing functionalities. It ensures that the old code still works once the latest code changes are done.

Whenever developers change or modify the functionality/feature, there's a huge possibility that these updates may cause unexpected behaviors. Regression testing is performed to make sure that a change or addition hasn't broken any of the existing functionality. Its purpose is to find bugs that may have been accidentally introduced into the existing build and to ensure that previously removed bugs continue to stay dead. There are many functional testing tools available which support regression testing.

Regression testing can become a challenge for the testers as well. Here are some of the reasons:

- The Number of test cases in the regression suite increases with each new feature.
- Sometimes, the execution of the entire regression test suite becomes difficult due to time and budget constraints.
- Minimizing the test suite while achieving maximum test coverage is not a cake walk.
- Determination of frequency of Regression Tests after every modification or every build update or after a bunch of bug fixes is always a challenge

5. SYSTEM TESTING

This software is tested such that it works fine for the different operating systems. It is covered under the black box testing technique. In this, we just focus on the required input and output without focusing on internal working.

System Testing is a type of software testing that is performed on a complete integrated system to evaluate the compliance of the system with the corresponding requirements.

In system testing, integration testing passed components are taken as input. The goal of integration testing is to detect any irregularity between the units that are integrated together. System testing detects defects within both the integrated units and the whole system. The result of system testing is the observed behavior of a component or a system when it is tested.

System Testing is carried out on the whole system in the context of either system requirement specifications or functional requirement specifications or in the context of both. System testing tests the design and behavior of the system and also the expectations of the customer. It is performed to test the system beyond the bounds mentioned in the software requirements specification (SRS).

In this, we have security testing, recovery testing, stress testing, and performance testing

Test Case for ELAR Application :

Test Step	Test Case	Test Data	Expected Result	Actual Result	Status
01	Check whether the Elar application downloaded.	-	The application should be downloaded.	The application is downloaded.	Pass
02	Verify whether the Team members name is visible.	-	The team members name should be displayed.	The team members name is displayed.	Pass
03	Check whether all the field options are available.	-	5 field options should be available.	5 field options are available.	Pass
04	Verify whether all the field options are accessible.	Computer/ Mechanical/ Medical/ Other	All the fields should be accessible.	All the fields are accessible.	Pass

05	Check whether message pops about the field selection.	-	The selected field entitled should be popped out.	The selected field entitled does not pop out.	Fail
06	Check whether the camera is on.	-	The camera should be visible.	The camera is visible.	Pass
07	Check whether the 3D object is ready.	-	The 3D object should be ready.	The 3D object is ready.	Pass
08	Verify whether the 3D object visible on another device	-	The object should be visible.	The object is visible.	Pass
09	Is the 3D view available.	3D object	The 3D view should be available.	The 3D view is displayed.	Pass
10	Does the view of image change on rotation of camera angle.	-	The view of image change should be on rotation of camera angle.	The view of image changes on rotation of camera angle.	Pass

8. FUTURE SCOPE

ADVANTAGES

- The AR system is highly interactive in nature and operates simultaneously with real time environment.
- It reduces line between real world and virtual world.
- It enhances perceptions and interactions with the real world.
- It can be applied to part of practical's as it makes things memorable and eye catching.

DISADVANTAGES

- A need of extra wearable device :
Since users may want to feel more authenticity in AR, wearable devices such as Google Glass and Mac's iWatch may be provided for users in order to offer authentic experiences in more convenient yet expansive way.
- Technical Failure :
Technical failures like camera not working, damaged screen or Low battery of mobile phone may cause trouble while using the application.
- Larger application size
- Only the created object's 3D view can be displayed :
The objects need to be first created and then implemented i.e. scanned . Random objects cannot be eligible for providing us the 3D view.
- Only developer can modify the application :
Developer can be the only source for modifying the application such as

adding more objects.

FUTURE DEVELOPMENT

- Improvement can be done for authorizing the modification properties to other users as well.
- The detailed internal structures of the objects can be added for efficient studying.
- The application size can be reduced.
- Tracking can be included as a part of the application – which object was viewed previously can be notified.
- The various parts of the object can be efficiently labeled.
- Instead of rotating the camera in different angles , animation videos can be preferred .

9. CONCLUSION

Thus , we have successfully created an application for the ease of today's individuals where the imagination is brought into reality.

From different ways of researching and analysing, most of the data and information convince that AR technology is applicable not only on architecture industry, but also sectors that relating to architecture and design such as construction and visualisation. With AR being rather new and innovative in every aspect, I have done a general research on AR technology. This has allowed me to collect more information about AR before I focusing down my aims and objectives. Simultaneously, these researches also help supporting my studio projects as I get to know what can AR achieve in every aspects.

Hence , the project that has been developed would help the individuals to visualize the hardware devices through our project just by scanning the image and getting its real world demonstration.

10 . REFERENCES

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