

Augmented Reality Modelling based Learning and Investigation of Electronic Components and Its Operation

**Sree Lakshmi Vineetha Bitragunta¹, Muthukumar Paramasivan²,
Gunnam Kushwanth³**

(¹bitraguntavineetha, ²muthukumarvlsi, ³g.kushwanth0147)@gmail.com

Abstract

Electronic components can be complex to understand, for any engineering student, but it can be made simple by visualizing them. The purpose of this project is to develop a mobile application that helps people, recognize and learn about electronic components easily. Knowledge on the fundamentals and theory of electronic components is vital for any engineering student. There are still many people who do not know about electronic components due to lack of knowledge and the lack of means to provide visual access to learn about electronic components. In this study our aim is to develop a augmented reality mobile application for college students to learn about electronic components by gathering the requirements and designing a curriculum for course structure, developing layout and circuit diagram for individual as well as complete systems, simulation of these circuits for a range of inputs and outputs, animating the circuits and their working by implementing augmented reality modelling, to develop the application and test its functionality for correctness. The existing work focuses solely on image recognition to recognize the components and uses augmented reality to superimpose virtual objects upon it. This project uses QR codes to recognize components and location-based AR to build virtual objects on real objects by tapping on the image on the screen.

Keywords: Augmented Reality, Mobile applications, virtual

I. INTRODUCTION

Augmented reality (AR) technology can be used to create interactive 3D models of electronic components, which can be overlaid onto the user's real-world environment, allowing them to interact with the component as if it were physically present in front of them[1].The first step in using AR modelling to teach electronic components would be to identify the component to be modelled. This could include resistors, capacitors, transistors, diodes, and other electronic components. The component should be selected based on its importance in electronics and its relevance to the learners' level of knowledge and experience.Once the electronic component has been identified, the next step would be to create a 3D model of the component using computer-aided design (CAD) software. The 3D model should be as accurate as possible and include all the relevant details, such as pins, leads, and markings.After the 3D model has been created, the next step would be to integrate it into an AR environment. This would involve creating a mobile application that can be downloaded on smartphones

or tablets. The application should use AR technology to overlay the 3D model onto the user's real-world environment. This would allow the user to interact with the electronic component as if it were physically present in front of them.

II. PROJECT DESCRIPTION

An augmented reality base application for differentiating musical instruments in Indonesia. For finding and recognizing the traditional musical instrument and modern musical instruments[2]. An augmented reality-based artificial intelligence education application for non-engineering majors. A conceptual model for studying the immersive mobile augmented reality application-enhanced experience[3]. Adjusts their size, and places them at the specified hole locations on the 3D breadboard. Once the breadboard is localized, its 3D geometry can be recovered based on the intrinsic parameters of the camera. Mounted spatial view, which enables spatial AR, and smart device display, where virtual objects only appear the screen. However, advancements in technology have led to the development of state-of-the-art AR targeting lightweight handheld displays that seek to amalgamate

A. *Disadvantages of Existing System*

Many AR devices have a limited field of view, which can make it difficult to create a fully immersive experience. The accuracy of the tool's performance may depend on the quality of the camera and the lighting conditions of the environment in which the tool is used[4]. The camera is low-quality or the lighting is poor and the tool may have difficulty accurately identifying the components some potential drawbacks of AR technology include the potential for distraction and decreased situational awareness, especially when used while operating heavy machinery or driving. Additionally, some users may experience motion sickness or other discomfort when using AR technology[5]. AR systems may not always be reliable and may have technical issues or errors that could affect the user's experience.

B. *Proposed System*

An application is developed to learn and experience the components and overcome the problem which was faced by the student community via augmented reality. Augmented reality makes the virtual object into a real scene. So the students can able to understand the concept practically by visualizing the objects. Here we are trying to develop a learning tool for electronics and communication laboratory using augmented reality

Augmented training and education: An AR system could provide an immersive and interactive training or educational experience by overlaying digital content onto real-world objects or scenarios,

Industrial or medical applications: AR systems could be used to provide real-time guidance and support for workers in industrial or medical settings, providing them with visual cues or information to aid in their work.

Gaming and entertainment: AR systems could create new and exciting gaming and entertainment experiences by overlaying digital content onto the real world

Advertising and marketing: AR systems could be used to create interactive and engaging advertising and marketing campaigns, such as overlaying product information or promotional content onto real-world objects.

C. *Advantages Of Proposed System*

Enhanced user experience: AR systems can provide a more immersive and interactive user experience by overlaying digital content in the real world, creating a more engaging and dynamic environment.

Improved training and education: AR systems can provide a more effective training and education experience by simulating real-world scenarios and providing interactive and visual feedback to learners.

Increased efficiency: AR systems can improve efficiency in industrial and medical settings by providing real-time guidance and support to workers, reducing errors, and improving productivity.

New opportunities for gaming and entertainment: AR systems can create new and exciting gaming and entertainment experiences by overlaying digital content in the real world, creating unique and immersive gameplay experiences.

Innovative marketing and advertising: AR systems can create more engaging and interactive marketing and advertising campaigns by overlaying promotional content onto real-world objects, capturing users' attention and increasing brand awareness.

D. Description of Proposed System

Immersive and interactive learning: The use of AR technology can create an immersive and interactive learning experience for students, which can increase engagement and retention of information.

Real-world simulation: AR systems can simulate real-world scenarios, allowing learners to practice skills in a safe and controlled environment. This can reduce the risk of accidents and errors in high-risk training scenarios.

Customizable content: AR systems can provide customized content tailored to the specific needs of each student, allowing for personalized learning and better learning outcomes.

Instant feedback: AR systems can provide instant feedback to learners, allowing them to identify and correct mistakes in real time.

Cost-effective: AR systems can be cost-effective compared to traditional training methods, as they eliminate the need for expensive physical equipment and can be used to train large groups of people simultaneously.

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III. AR DEVELOPMENT TOOLS

A.Unity Real Time Development Tools

Unity is a popular real-time development platform used for creating 2D, 3D, AR, and VR applications across various industries such as gaming, architecture, film, and automotive.

With Unity, developers can easily create immersive, interactive experiences with its intuitive drag-and-drop interface, extensive scripting API, and a vast library of assets, plugins, and tools. Unity supports multiple platforms, including Windows, Mac, iOS, Android, and many others.

The platform's real-time rendering engine enables developers to see changes in their projects instantly, which greatly speeds up the development process. Unity also offers a range of collaboration tools that allow developers to work together seamlessly, regardless of their location.

In addition, Unity has a large and active community of developers who create and share plugins, assets, and tutorials, making it easy for developers of all skill levels to get started and improve their skills.



Fig.1.Unity real-time development.

B. Unity Hub Work

Unity Hub is a tool provided by Unity Technologies that serves as a central hub for managing multiple Unity projects and versions. Here's how it works:

Install Unity Hub: First, you need to download and install Unity Hub on your computer. Once installed, you can open it and log in with your Unity ID.

Manage Projects: Unity Hub allows you to manage your Unity projects from a central location. You can create new projects, open existing ones, and delete projects that you no longer need.

Manage Unity Versions: Unity Hub also allows you to manage different versions of the Unity Editor. You can install multiple versions of Unity on your computer and switch between them as needed. This is useful for ensuring compatibility with different projects or testing new features.

Add Modules: Unity Hub also provides access to additional modules that you can add to your Unity Editor installation, such as the Android SDK or iOS support.

Collaborate with Teams: Unity Hub provides tools for collaborating with teams on Unity projects, including the ability to create and join Unity Teams projects.

Unity Hub simplifies the process of managing Unity projects and versions, making it easier for developers to focus on their work.

C.Unity Asset Store

Asset Store is an online marketplace for game developers to buy, sell, and share assets, tools, and resources for use in the Unity game engine. The Unity Asset Store has a vast library of assets, including 2D and 3D models, audio and music tracks, scripts and plugins, textures, shaders, and more. Here are some of the key features of the Unity Asset Store:

Easy to Use: The Unity Asset Store is built into the Unity game engine, making it easy for developers to access and use assets within their projects.

High-Quality Assets: The Unity Asset Store has a large selection of high-quality assets, including free and paid content, created by Unity developers and third-party creators.

Community: The Unity Asset Store has a community of creators who share their assets and knowledge with others, fostering collaboration and innovation.

Regular Updates: The Unity Asset Store is regularly updated with new assets and features, ensuring that developers have access to the latest and greatest tools and resources.

Licensing: The Unity Asset Store provides developers with clear and easy-to-understand licensing terms, ensuring that assets can be used legally in their projects.

Asset Preview: The Unity Asset Store provides previews of assets, allowing developers to see how they will look and work in their projects before making a purchase.

The Unity Asset Store is a valuable resource for game developers, providing access to a wide range of high-quality assets and tools that can help them save time and improve the quality of their games.

D. Unity Hub Application

Unity Hub is a desktop application that provides a central location for managing and launching multiple versions of Unity game engine, as well as additional tools and resources. Here are some of the key applications that can be managed and launched through Unity Hub:

Unity Editor: Unity Hub allows you to install and manage multiple versions of the Unity Editor, which is the main tool used for creating and building Unity projects. You can easily switch between different versions of the editor based on the needs of your project.

Add-Ons: Unity Hub also provides access to various add-ons and extensions, such as Unity Pro, Unity Analytics, and Unity Ads. You can install and manage these add-ons directly from the Unity Hub interface.

Modules: Unity Hub also allows you to manage the installation and updates of different Unity modules, such as Android, iOS, WebGL, and more. This helps you to keep your development environment up-to-date with the latest features and fixes.

Templates: Unity Hub provides access to various project templates, including 2D and 3D templates, which help you to get started with a new project quickly and easily.

Tutorials: Unity Hub also provides access to various tutorials and learning resources, which help you to learn the basics of Unity, as well as more advanced features and techniques.

Unity Hub is a valuable tool for game developers, providing a central location for managing and launching multiple versions of Unity Editor, add-ons, modules, templates, and learning resources.

E. VUFORIA

Vuforia is an Augmented Reality (AR) platform developed by PTC, a global technology company. Vuforia enables developers to create AR applications that can recognize and track real-world objects, such as images, 3D models, and environmental features, in real time. Here are some key features of Vuforia:

Image Recognition: Vuforia can recognize and track images in real-time, allowing developers to create AR experiences that overlay digital content onto physical objects.

Model Target Recognition: Vuforia can recognize and track 3D models, allowing developers to create AR experiences that overlay digital content onto physical objects that may not have a printed image target.

Ground Plane Detection: Vuforia can detect the ground plane in a real-world environment, allowing developers to place digital content onto a surface in the real world.

Cloud Recognition: Vuforia offers cloud-based recognition services, allowing developers to recognize and track a large number of images and models without requiring the app to store them locally.

Cross-platform Compatibility: Vuforia supports a wide range of platforms, including Android, iOS, Unity, and other popular game engines.

Vuforia is used in a wide range of applications, including gaming, education



Fig.2.Vuforia

F. Image recognition

OpenCV for Unity: OpenCV is a popular computer vision library, and the OpenCV for Unity plugin allows you to use it in your Unity project. You can use this plugin to perform image recognition tasks such as object detection, face detection, and optical character recognition (OCR).

AR Foundation: AR Foundation is a cross-platform framework for building augmented reality (AR) applications in Unity. You can use AR Foundation to recognize images and objects in the real world and overlay virtual content on top of them.

Vuforia: Vuforia is a popular AR platform that provides image recognition capabilities. You can use the Vuforia Unity extension to recognize images and objects in the real world and trigger AR experiences

G. Ground plane detection

Ground plane detection in Unity can be achieved using the AR Foundation package. AR Foundation is a cross-platform framework for building augmented reality (AR) applications in Unity. It includes features like plane detection, image recognition, and object tracking.

Import the AR Foundation package: Open the Package Manager in Unity and search for "AR Foundation". Install it along with the AR Kit XR Plugin and/or AR Core XR Plugin depending on the platform you want to develop for.

Enable plane detection: In the AR Session Origin component, enable "Plane Detection" and set the "Plane Detection Mode" to "Horizontal". This will enable the detection of horizontal surfaces like the ground.

Add a visualizer: Add a Plane Prefab or a custom visualizer to the AR Session Origin. This will display the detected planes in the scene.

Run the application: Once you run the application on a supported device, it will start detecting the ground plane and display it in the scene.

H. VUFORIA Developer Portal

Vuforia Developer Portal is a website provided by PTC, the company behind Vuforia, that serves as a central hub for developers who want to create Augmented Reality (AR) applications using Vuforia. Here are some of the key features of the Vuforia Developer Portal:

Access to Vuforia SDK: The Vuforia Developer Portal provides access to the Vuforia software development kit (SDK), which includes all the tools and resources developers need to create AR applications.

Documentation: The Vuforia Developer Portal provides extensive documentation, including tutorials, guides, and reference materials, to help developers get started with Vuforia quickly and easily.

Cloud Services: The Vuforia Developer Portal provides access to Vuforia's cloud recognition services, which enable developers to recognize and track a large number of images and models without requiring the app to store them locally.

License Management: The Vuforia Developer Portal allows developers to manage their Vuforia licenses, including purchasing, renewing, and upgrading licenses.

IV. RESULTS AND DISCUSSION

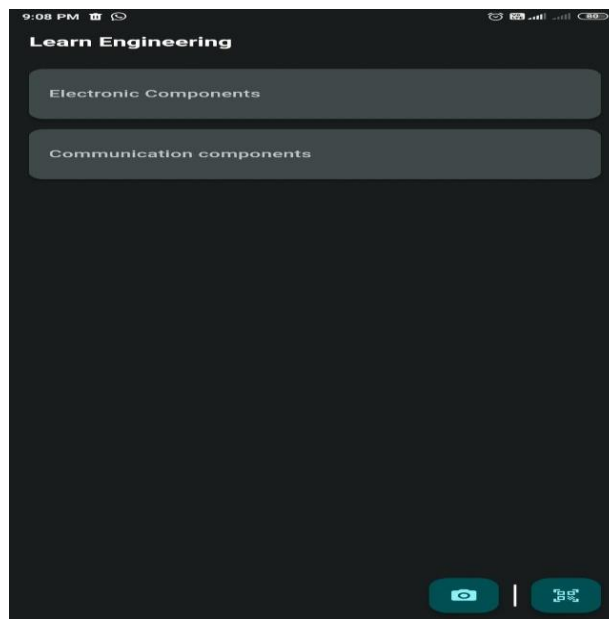


Fig.3.Application Homepage

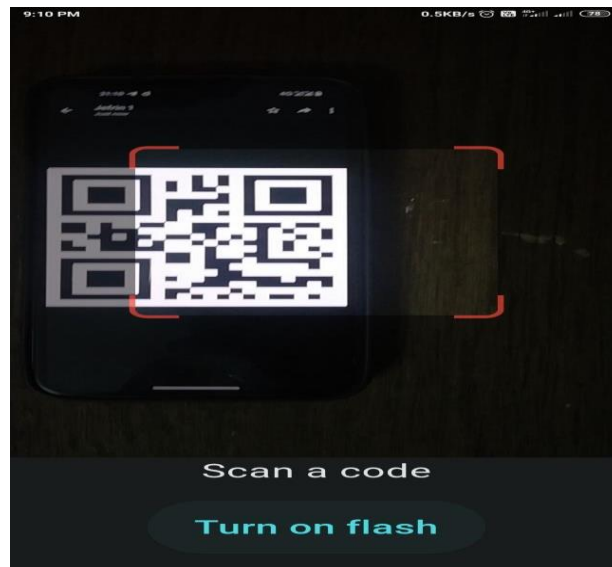


Fig.4. QR code scanner

The output of the project is a mobile application. Figure 3 depicts the home page of the application, the user can navigate to the video content using UI or by scanning the QR code. Figure 4 shows the built in QR scanner, the user can scan given QR codes which takes them directly to the content.

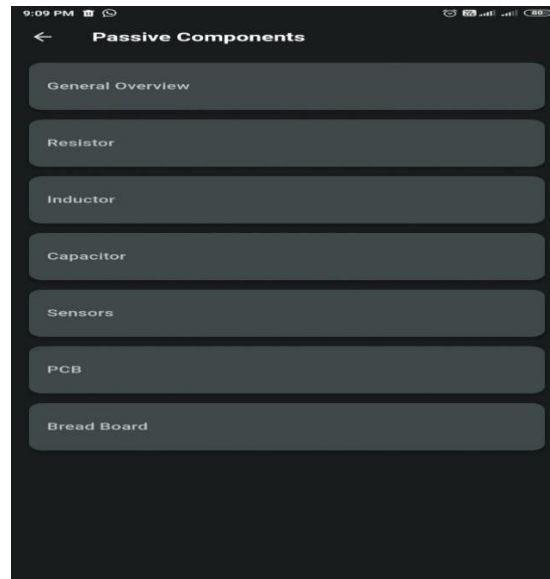


Fig.5.Components Page

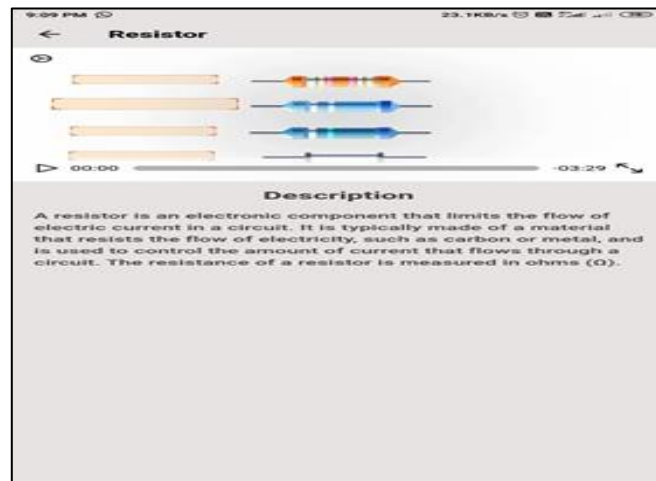


Fig.6.Video Player Page

The augmented reality application superimposes the video contents upon real-time image targets. Figure 7 shows the augmentation of the video contents within the Unity AR development platform.

V. CONCLUSION

The learning tool for electronic components is developed using augmented reality modeling and streaming of video content from cloud storage. The features of the application are tested properly. The whole video content is stored in cloud which reduces the overall application size.

VI. REFERENCES

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