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AR and IoT Assisted Electronic Device Control System

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Abstract: ***The document proposes an efficient implementation for IoT (Internet of Things) and AR (Augmented Reality) used for monitoring and controlling the electronic appliance via a mobile application . A large amount of energy and time is consumed in powering up appliances, mainly due to the location and confusing assembly of switch board. The proposed system works on a combination of AR and IoT, where the controlling device will be a smartphone with an application to scan for the available Wi-Fi connections in the room. Application should identify the device and a control panel would be available to the user for further actions. The signals from the phone will be received at the IoT module attached to the switch board which will control the powering of each device. Also there will be a troubleshooting mechanism which is to be used in case of any malfunctioning***
Keywords: Internet of Things, Augmented Reality, Smartphone, Device, unique Wi-Fi.

I. INTRODUCTION

The document proposes an efficient implementation for IoT (Internet of Things) and AR (Augmented Reality) used for monitoring and controlling the electronic appliance via a mobile application.

A large amount of energy and time is consumed in powering up appliances, mainly due to the location and confusing assembly of switch board. The proposed system works on a combination of AR and IoT, where the controlling device will be a smartphone with an application to scan available devices in the space. Application should identify the device and a control panel would be available to the user for further actions. The signals from the phone will be received at the IoT module attached to the switch board which will control the powering of each device. Also, there will be a troubleshooting mechanism which is to be used in case of any malfunctioning.

Existing system follows the conventional manual operation, which is more time consuming when switch boards are at uneasy locations. In case of situations with a large number of devices, switchboard layout will be confusing for users, making undesired outcomes, which in turn increases the power consumption.

The proposed system is designed to deal with shortcomings of the existing system. The unique Wi-Fi connection on the IoT module helps us to reduce the manual effort, as the user will be provided with a graphical control panel which will reduce the effort and time spent. Also, as connection is unique and the signal passed are processed accordingly only the desired device would be accessed, so unnecessary power consumption is avoided.

In this era of automation and revolutionary technologies, our project aims at using technology for reducing human effort, time and power consumption. By associating AR and IoT, we focus on feasible automation structures, which is scalable to any extent and applicable to a wide variety of devices.

We also aim at minimal make over transitions at areas where we use conventional methods. A single IoT module will be the only thing that is to be installed other than the identification stickers on the device. Considering it as a feasible automation technology, we could extend the applications towards other area.

II. DESCRIPTION

A. Product features

The project proposes an efficient implementation for IoT (Internet of Things) and AR (Augmented Reality) used for monitoring and controlling the electronic appliance via a mobile application. The proposed system works on a combination of AR and IoT, where the controlling device will be a smartphone with an application to scan the available unique Wi-Fi modules in a room. Application should identify the device and a control panel would be available to the user for further actions. The signals from the phone will be received at the IoT module attached to the switch board which will control the powering of each device.

B. Architecture

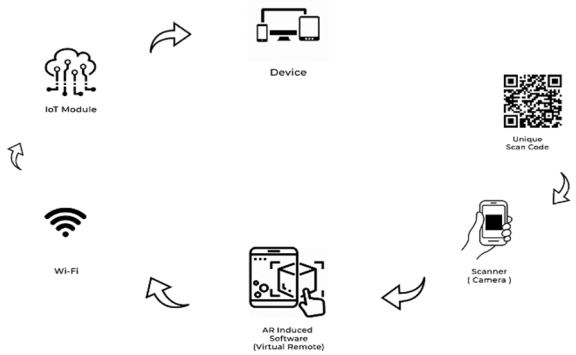

Fig 1. Architecture

C. Modules

1) Image scanning & processing

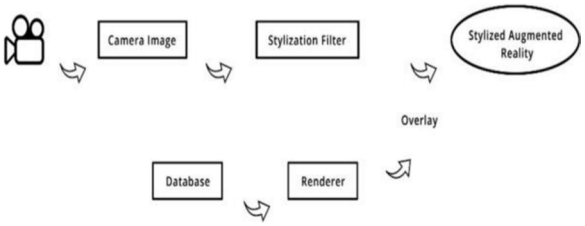

Fig 2. Modules

Device cameras are provided with AR overlay to capture the image. Image is rendered with the data provided in the database and a stylized augmented reality is generated, which would be the general layout of the room.

2) Virtual Remote: It is the second phase of the system. Access to the device Wi-Fi, sends signals to the IoT Module. It is designed to perform the required operation and is developed using Flutter.

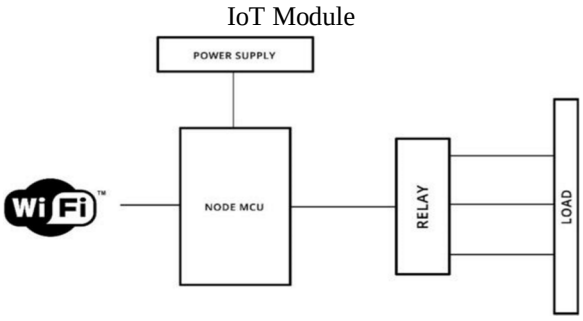

Fig 3. IoT Module

It is capable of receiving Wi-Fi signals. Node MCU is used as IoT module.

III. HARDWARE IMPLEMENTATION

A. Hardware Requirements

1) Node MCU: NodeMCU is a low-cost open source IoT platform. It is used to implement the IoT part.

2) Relays: A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

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B. Hardware Implementation

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

A *thing* in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.

IV. SOFTWARE IMPLEMENTATION

A. Front End

1) Flutter: Flutter is an open-source UI software development kit created by Google. It is used to develop applications for Android, iOS, Windows, Mac, Linux, Google Fuchsia and the web. Augmented Reality - A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view. ARCore Plugin by Flutter, provides the platform for featuring Augmented Images in the application.

B. Back End

1) Firebase: Firebase is a mobile and web application development platform developed by Firebase. Which provides a real-time database and back-end as a service. The service provided are application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. It provides client libraries that enable integration with Android, iOS, JavaScript, Java, Objective-C, Swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as AngularJS, React, and Ember.js etc. The REST API uses Server-Sent Events protocol, which is an API for creating HTTP connections for receiving push notifications from a server. Developers using the real time database can secure their data by using the server-side-enforced security rules.

C. Software Implementation

1) Use case

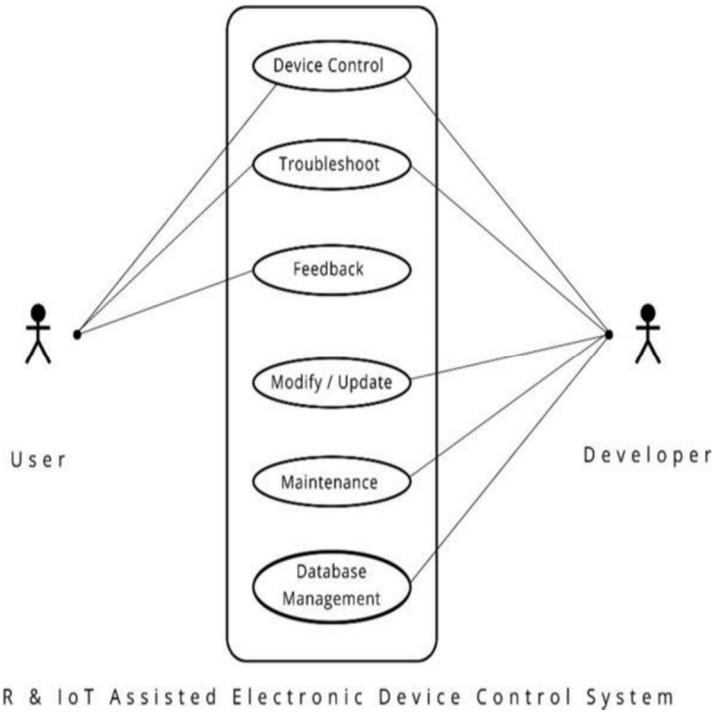

Fig 4. Use Case Diagram

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2) ER Diagram

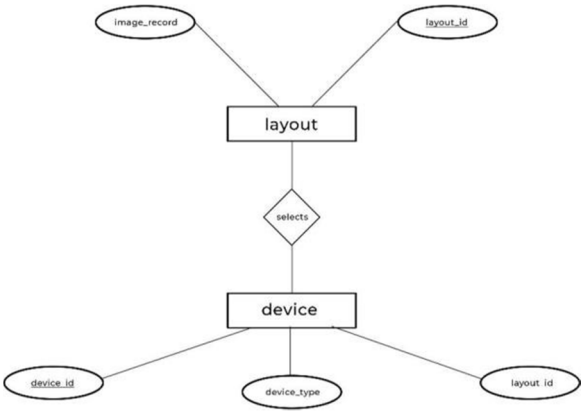

Fig 5. ER Diagram

2) Database Design

TABLE I
Database Design

ROOM_ID	DEVICE_ID	DEVICE_TYPE	STATUS

V. IMPLEMENTATION

AR & IoT ASSISTED ELECTRONIC DEVICE CONTROL SYSTEM consists of two modules User Module and Developer Module.

A. User Module

This module deals with the all the functionalities of the user. After installing application, the user can access the services we provide. Mainly adding and deleting of devices and modification. The user can access the electronic devices using this application whenever needed.

The main functionalities include:

1) The user can enter the device details by adding the details into the database through android mobiles.
2) Can give feedback regarding the application.
3) Whenever a problem is occurred, the user can troubleshoot the problem.
a) *Device Control:* Any user who wish to access services, are requested to install our application on an android phone. After installation he/she can add device details into it and can access it. Also, we can delete the details from the application.
b) *Troubleshoot:* Whenever there is a problem regarding the connection or application, we can troubleshoot the problem and fix it.
c) *Feedback:* The user can give feedback about the application which helps the developer to improve the product.

B. Developer Module

This module deals with the all the functionalities of our application. The admin controls and coordinates every function done inside the system.

The main functionalities include:

1) Add and delete device details to test and verify the product.
2) Uses troubleshooting to verify the problems regarding the application.
3) Uses feedback to improve the working of application

a) *Device control:* Admin can add and delete devices details to the application. This information is used to test and verify the device function.
b) *Troubleshoot:* Admin can troubleshoot the application to check whether if there is any problem related to hardware or regarding the software. Those information helps to improve the product.
c) *Feedback:* Admin can access the feedback given by the user to improve the product.
d) *Modify & Update:* Admin verifies the feedback and does the necessities.
e) *Maintenance:* The application is maintained according to the changing technologies.
f) *Database Management:* Admin can manage the database which contains the details regarding the devices.

VI. RESULTS

On the basis of tests conducted, the application found to be working smoothly with expected outcomes. IoT module was able to receive the signals from cloud server and controlled the devices.

A. *Checklists: Application*

1) Connection to Network: Success
2) Augmented Reality output: Working perfectly
3) AR gesture detection: Gestures detected
4) HTTP call: Connected and Signals passed

B. *Checklists: IoT Module*

1) Connection to Wi-Fi: Connected
2) Receiving signals from cloud server: Received
3) Powering of Devices: Working perfectly

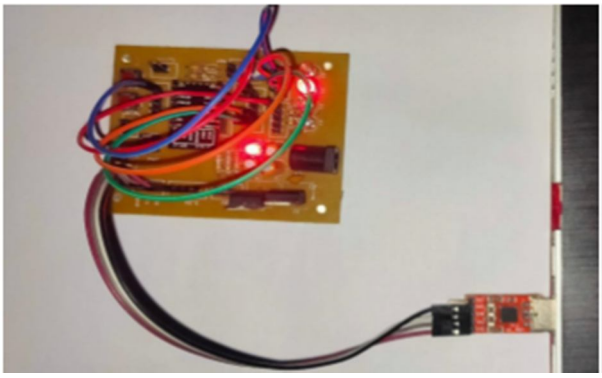

Fig 6. Device 1 powered ON

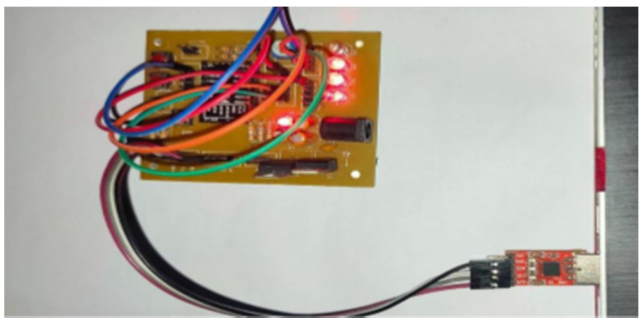

Fig 7. All devices powered ON

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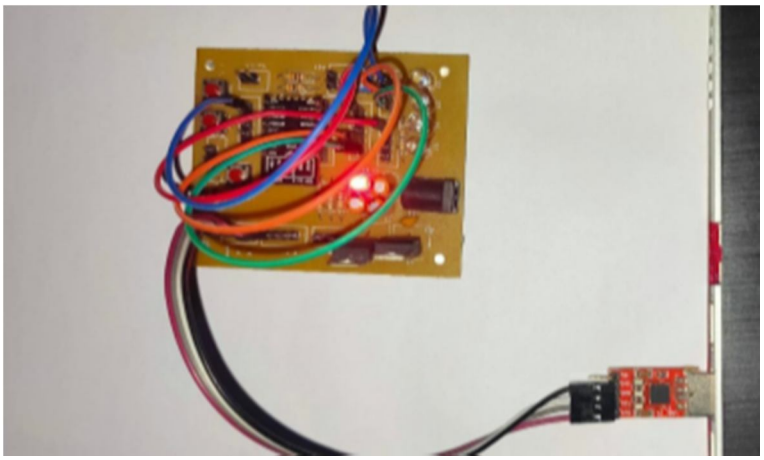

Fig 8. All devices powered OFF

VII. APPLICATION

This project replaces the conventional switch boards with automated IoT system. This helps people, especially who are blind or with difficulties in moving, to find the particular switch of an electronic device. This can be used in home, commercial places, halls etc. so as to reduce power consumption and human effort. This project has many scopes for future expansion. It reduces the manual effort and the time spent. It also reduces unnecessary power consumption. A single IoT module will replace the switch board, therefore no extra accessories are needed for the device. Control signals are passed using the Wi-Fi, so no IR remotes are required. It has a higher demand for automation and thus saves time and avoids confusion. It helps to replace switch boards.

VIII. RELEVANCE

It reduces the manual effort and the time spent. It also reduces unnecessary power consumption. A single IoT module will replace the switch board, therefore no extra accessories are needed for the device. Control signals are passed using the Wi-Fi, so no IR remotes are required. It has a higher demand for automation and thus saves time and avoids confusion. It helps to replace switch boards. Also, it is cost effective.

IX. CONCLUSION

In this era of automation and revolutionary technologies, our project aims at using technology for reducing human effort, time and power consumption. By associating AR and IoT, we focus on feasible automation structures, which is scalable to any extent and applicable to a wide variety of devices. We also aim at minimal make over transitions at areas where we use conventional methods. A single IoT module will be the only thing, that is to be installed other than the identification stickers on the device. Considering it as a feasible automation technology, we could extend the applications towards other areas.

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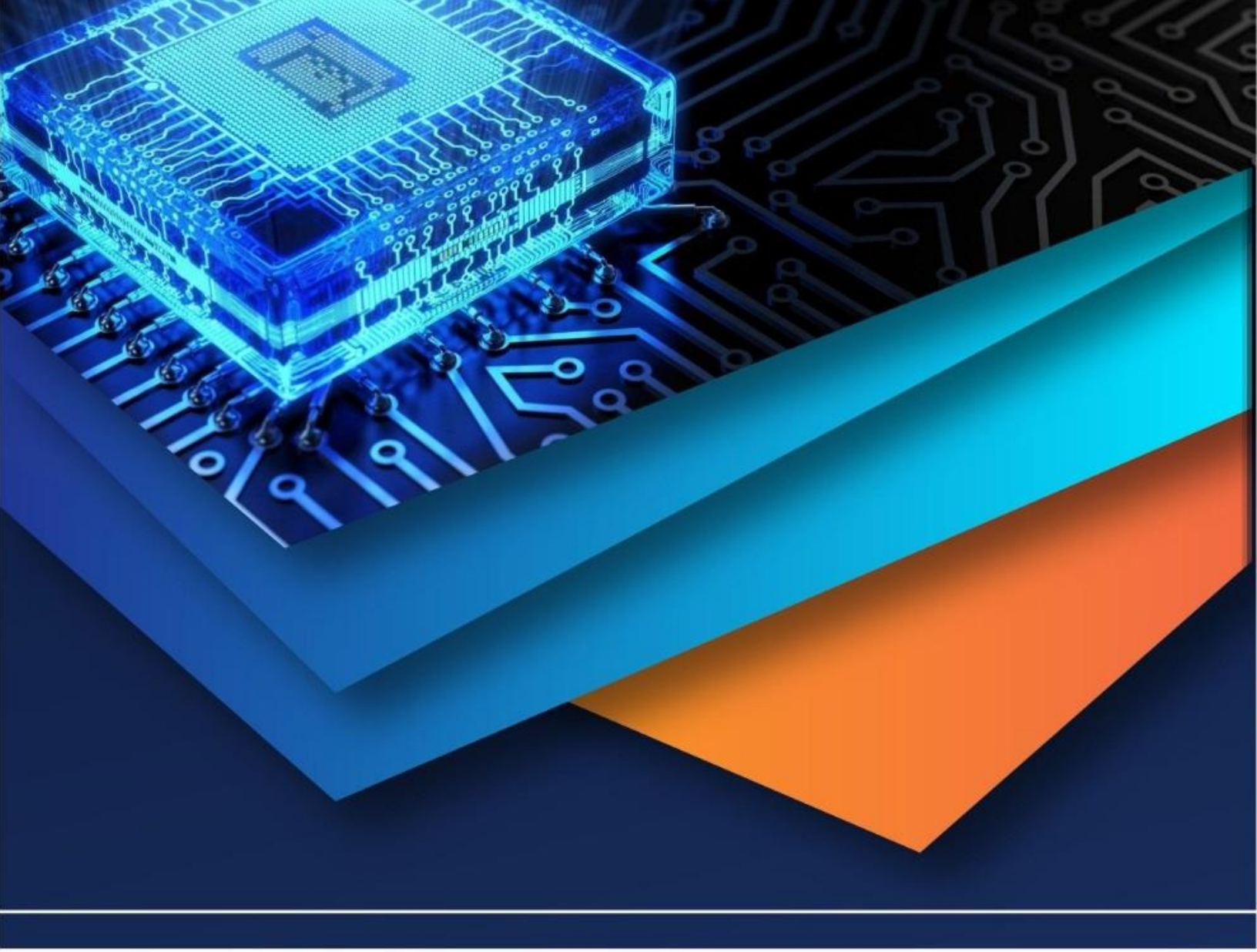

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