

Smart Home Automation Using AR and IoT

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Abstract: The modern home automation system gives security and blissful life at residence. That is why the popularity of using home automation technology is increasing day by day. Controlling home appliances with our smart phones, smart glasses and smart watches without the actual usage of conventional switches is home automation. Our paper proposed the design and implementation of home automation, monitoring, and home security through the internet of things (IoT) and Augmented Reality (AR). Our system can control and monitor the house temperature, humidity, lights, air conditioner and all home devices virtually by simply seeing towards that application through AR app. we are making smart home AR application using unity software with Vuforia engine. Our proposed system gives more real time experiences as we are imposing virtual environment in real world by using AR. Our proposed system is more secure because to get specific output it required to have targeted image along with AR app which we have developed.

Keywords: Internet of Things, Augmented Reality, Vuforia Engine, Unity Software, Home Automation.

I. INTRODUCTION

The modern age is the age of technology and technology is never finishing process. Technology is advancing continuously and making our life easier, safer and comfortable. From higher living standards we mean usage of smart phones, smart watch, smart glasses, smart TVs highly upgraded laptops etc. that ease human life. Controlling home appliances with our smart phones, smart glasses and smart watches without the actual usage of conventional switches is home automation. Most of the IOT based home automation system are present already but we are trying to connect that IOT based system with Augmented reality to make it more interactive and user friendly. We are trying to give virtual view of controlling object in real environment. Our system is more interactive efficient, less cost effective and user-friendly home automation system which can be easily used by any age group of people. There is no barrier of language no specific technical knowledge is required. From kids to elder everyone can use our AR application to make their home smart. Because we just have to open our AR app point towards target image, we will get to see virtual buttons floating in air. We just have to click on that button to control appliances.

1.1 Internet of Things



Figure 1: IOT Based Home Automation System.

IOT means Internet of Things. It is very tough to define IoT. The topic IoT has been used by Kevin Ashton. IoT is a network of internet-linked action capable of gather of data or information. Many computing devices are embedded with our necessary appliances to the internet through IoT. IoT term has two major parts:

- Internet is the backbone of connectivity.
- Things meaning object.

The term internet of things is a concept but it is not specific hardware or software or electronics. With the introduction of IoT, the home automation systems are becoming more famous at present days research. Through the internet of things, it is possible to control and monitor home appliances.

1.2 Augmented Reality

Augmented reality (AR) is one of the recent technologies used for automation of the electrical appliances. This system uses Augmented Reality (AR) technique for automation which is getting increasingly popular for controlling of home appliances.

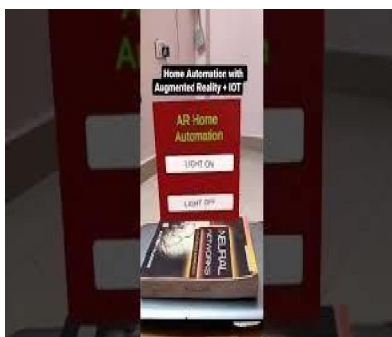


Figure 2: AR Based Home Automation

The principle of, AR can be implemented on any computer and handheld device that use video-see through technology that allows to “see through” the display to view both the real world and super- imposed computer-generated objects.

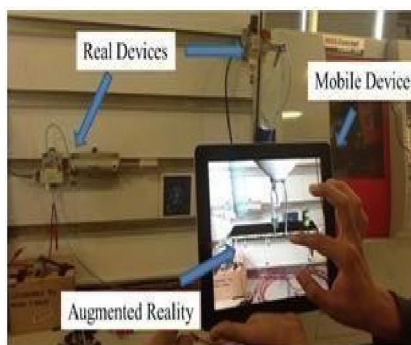


Figure 3: Augmented Reality Example

Augmented Reality gives a virtual view of the de- vices generating a real environment. Augmented Reality brings virtual objects into the real world where we live. Augmented Reality used in many areas such as education, entertainment, commerce, information visualization, translation and so on. Augmented reality usage in the field of home auto- mation is a relatively new idea and there has been a growing interest regarding its implementation. The use of AR gives us significant advantage over other models since it can help us to control devices or ma- chines in a real time environment and helps anyone to understand how to operate them. Using Aug- mented reality, the users are able to control the appliances more effectively and easily.

II. LITERATURE SURVEY

IOT based smart home automation using Sensor node.

Author: H. Singh, V. Pallagani, V. Khandelwal and U. Venkanna.

Methodology and Principle Proposed: The Arduino is connected to the Bluetooth module and the appli- ances can be controlled using the Arduino but it needs to be within a small distance for it to connect to the Bluetooth.

Outcome: The Bluetooth module is used so, the range at which the home appliances can be con- trolled is reduced.

A low-cost Automation System

Author: N. Vikram, K. S. Harish, M. S. Nihal, R. Umesh, A. Shetty, and A. Kumar

Methodology and Principle Proposed: The system can be controlled from the Wi-Fi module which avoids the need of using an Arduino board, the command can directly be provided by the user

Outcome: The competent that is used is low cost so, there can be numerous occasions when you are encountered errors or technical difficulties

IoT-based smart security and home automation system

Authors: Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose, and Lakshmi Boppana

Methodology and Principle Proposed: This IoT system focuses on a wireless home security system that sends alerts to the user by using the Internet through a Microcontroller.

Outcome: System can be used in two ways: As a smart security system and as a smart home automation system.

Voice Controlled home automation system.

Author: P.J. Rani, Jason Baktha Kumar

Methodology and Principle Proposed: The devices connected to the Arduino board can be controlled by voice commands.

Outcome: A user-defined NLP algorithm is used so, there can be many times when the assistant is not able to recognize your commands properly.

IV. PROPOSED METHODOLOGY-

The proposed block diagram of the system consists of step-by-step flow of our project

4.1 Block Diagram

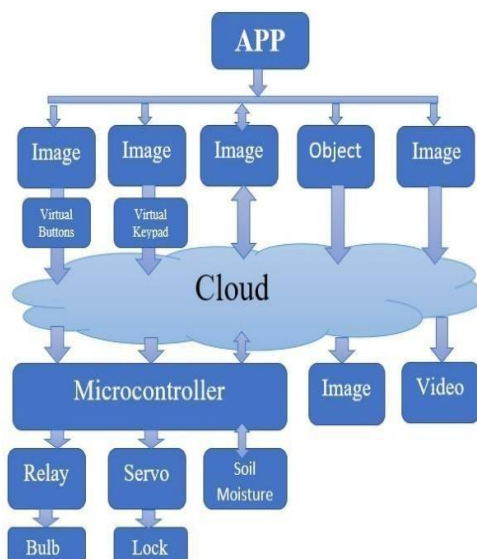


Figure 4: Proposed Block Diagram

The block diagram starts with app which we have develop with the help of unity software and Vuforia engine. In the next blocks we can see image or object. The flow of block diagram is we have to open the AR app and point towards targeted image or object then we can see virtual buttons/keypad. We have to send input through that button to cloud then cloud sends signal to microcontroller over internet.

Microcontroller perform particular task like opening door by moving servo motor or switch on lights by sending signal to relay.

4.2 Working Principal

In this project, we have designed a simple home automation system using simple components in which different electrical appliances can be switched on or off virtually through AR App. This project presents an idea or a concept for home automation using Arduino with Blynk for Internet of Things and unity for Augmented Reality. We have developed 5 different applications to make our home smart are as follows:

1. Smart door lock
2. Light on/off through virtual buttons
3. Video through image
4. Virtual photo album
5. Emotional plant

A. Smart Door Lock

- This smart door lock will open by entering correct password through virtual keypad. But how to get virtual keypad?
- For that open AR based smart home application and point towards targeted image assign for smart door lock which we have store in database of Vuforia's cloud. App will recognize image and perform assign task with that image.
- Now we can see one 3D model welcoming us in front of door through the AR app. There is one button present near 3D model. When we click on that button then virtual keypad popup.
- Then by using this keypad we have to enter correct password after that click on open button.
- Then through the API's request is send to Blynk cloud which we have used for IOT part then Blynk cloud sends request to the microcontroller over the internet.
- Then Microcontroller will send signal to servo motor to turn shaft with particular angle to open the door.

B. Lights ON/OFF

- When we point our same AR application towards bulb or any particular image.
- We are able to see two virtual buttons floating in air.
- Virtual button will trigger the event only when the particular area on targeted image gets block from the camera view of App. To recognize that particular area we have used RED and GREEN symbol.
- When we keep our hand below GREEN symbol in air it will block the camera view and sends API request to Blynk cloud to switch ON light.
- Then cloud will send request to microcontroller then microcontroller sends signal to relay to switch ON light.
- Similarly, RED symbol is used for switch OFF light.

C. Video through Image-

- When we point AR application towards particular image then video related to that image starts playing. For example, if marriage photo is present on wall and if we see that photo through AR app then video of that marriage will start playing.
- For this application we have store particular video on cloud and while making AR application we have write code like when that particular image gets pointed through AR app that particular video will starts playing.

D. Virtual Photo Album

- When we point AR app towards particular object or image then memories regarding that Image or object starts displaying virtually.
- For example, if there is one trophy presents on table and when we see trophy through AR application then we are able to see all memories regarding that image like video or photos of prize distribution ceremony or the celebration moments displaying virtually.

E. Emotional Plant

- Here plant can express emotions about water requirement by displaying related image.
- When we point AR app towards targeted image present on pot, we can see image of How are you will display and one button below that also displays.
- When we click on that button, API request will send to cloud to take the soil moisture information from microcontroller to which soil moisture sensor is connected.
- If the moisture level is above the threshold value soil is dry and plant requires water. Hence it will display thirsty image other- wise happy image.

V. HARDWARE IMPLEMENTATION

The major components of hardware parts are Arduino Uno, Relay Module, ESP 8266, Servo motor, Soil moisture sensor.

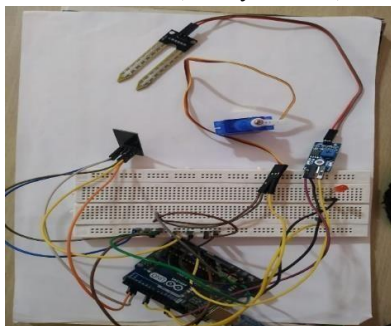


Figure 5: IOT System

Arduino Uno is Arduino is an open-source electronics Platform based on easy-to-use hardware and software. Arduino boards are able to read inputs Sig- nals of a sensor and turn it into an output. It is based on ATmega328P Microcontroller. Here we are using Arduino uno as main controller of system.

ESP 8266 is Wi-Fi enable system on chip module. It is low-cost standalone wireless transceiver that can be used for end point IOT development. We are using ESP 8266 Wi-Fi module to communicate with AR APP over internet.

Relay Module It is an electrically operated switch that can be turned on or off deciding to let current flow through or not. Here we are using relay module to control the lights through microcontroller using virtual buttons.

Servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. In this project we are using servo motor for movement of Lock. Soil Moisture Sensor measures or estimate the amount of water in soil. Here we are using soil measure sensor to measure moisture in soil of plant and display virtual smiley and thirsty image accordingly

VI. SOFTWARE IMPLEMENTATION

A mobile application (android/ios) is used for con- trolling the electrical appliances. This application will use the camera of the mobile to point to the different virtual switches of the appliances. We use Arduino IDE, Unity Software and Blynk Software in this project.

Arduino IDE is open-source Arduino Software makes it easy to write code and upload it to board. Software can be used with any Arduino board. It supports the languages C and C++ using special rules of code structuring. User Written code only re- quires two basic functions, for starting sketch and main program loop.

Unity software is powerful, extremely easy to use, and free. With Vuforia engine Unity software is used to create AR application. Blynk Software is mainly used for Internet of Things. It can control hardware remotely; it can store data. It also provides APIs which we can used in unity software to control appliances with AR application.



Figure 6: AR App

VII. TESTING AND RESULT

1. Smart Door Lock:

- Open AR App.
- Point towards targeted image.
- See the 3D model.
- Press one button.
- Virtual interface popup.
- Press required keys
- Door will open.



Figure 7: Smart Door Lock

2. Lights ON/OFF

- Open AR App.
- Point towards targeted image.
- Red and green virtual button popup.
- Move hand below green button to on light and red button to off.

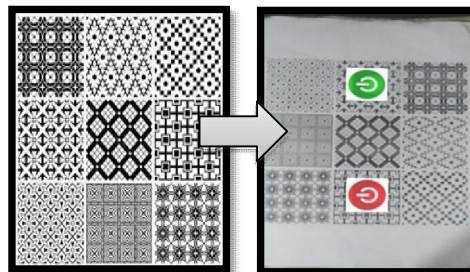


Figure 8: Light On/Off

3. Virtual Photo Album

- Open AR App.
- Point towards targeted object.
- See the memories related to that object virtual.



Figure 9: Virtual photo album

4. Video through Image

- Open AR App.
- Point towards targeted image.
- Watch video related to that image virtually.



Figure 10: Video through image

5. Emotional Plant

- Open AR App.
- Point towards particular plant.
- Move hand below send button
- See thirsty image if plant is thirsty, if not see happy image displaying virtually.

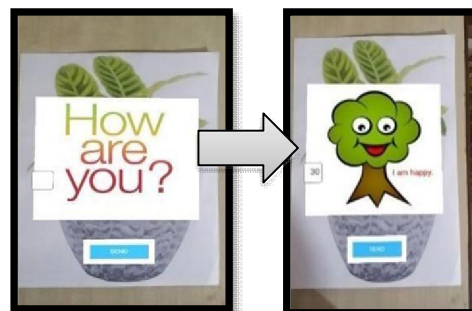


Figure 11: Emotional plant

VIII. CONCLUSION

Through this work we came to know that augmented reality and IOT used for the automation of our day- to-day electrical appliances like fan, tube lights, door lock, Video through the image, virtual photo album, etc. Augmented reality and IOT as suggested by the survey results proved to be the most user-friendly method for automation. The technique can be used in our day-to-day life to control and monitor our electric power consumption as well also avoid any hazardous situation.

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