AI Cum AR Based Smart Home Automation System

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Abstract - *According to the World Health Organization (WHO) Survey 27% of the virus (covid-19) spread between people through direct and indirect physical contact, to overcome the situations people should reduce use of manual switches in public places for controlling electrical appliances like light, fans, etc., In the current technology appliance are controlled by using IR remote or mobile phones, while mobile phones work only by an authorized person because of a private network and in case of IR remote it can be operated through only physical touches, to overcome the problem, the proposed technique includes of AI cum AR based automation system for controlling all electrical equipment. The system equipped with microcontrollers and relay along with the power supply unit, the outcome of the product is to reduce the transmission of virus between people through physical touches and it additionally help the people with bodily disabilities.*

*Key Words***:** Home Automation; AI; AR; IoT

1. INTRODUCTION

Today technological changes make the probability of more complex things made into simple tasks with more accuracy in major areas and mostly in Automation Industry. In this paper, we developed an Automation Using AR & AI with the help of an IoT the proposed system consists of web camera, Processing unit, Relay, Microcontrollers, Mobile Phone and Target image. This aims to reduce virus spread and to assist people, especially the physically challenged people and elderly who cannot do their own work and need help from others for doing simple tasks such as controlling the electrical appliances in the home. They are dependent on others which causes a lot of inconvenience too many people. With the rise of smart home devices and easy use of mobile phones people can easily control the home appliances. But in many cases the GUI (Graphical User Interface) of the mobile is difficult to use for the physically challenged people. This system uses Augmented Reality (AR) & Artificial intelligence technique for automation which is getting increasingly popular for controlling of home appliances.

Using this technology, it will greatly help the physically challenged and elderly people to control the appliances easily. A mobile application along with Vuforia Server will help the users to control a switch by simply pointing their mobile camera to it from a distance. Separate virtual switches will appear on and off when the camera is pointed to image target, thus allow the user to control different appliances easily and conveniently. Instead of normal switches, 2D buttons will appear on the screen which gives a familiar interface to the user. When the user touches the button information will be transfer to the Blynk server and instruction is forwarded to the microcontroller and the controller turns the device on or off according to the user operation.
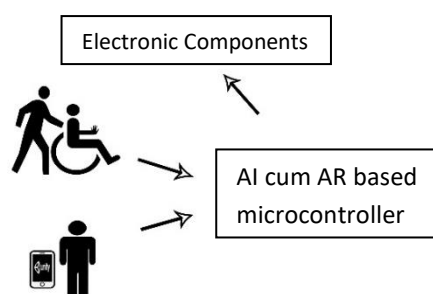

Fig -1: Working Procedure

This system also contains AI based gesture capture, so the user can control the appliance by showing their fingers. There are three ways to control the appliance first one by Blynk Application and the second one using ARIOT (AR based) Application and third one is using AI based gesture control.

The section II of the paper is the literature survey. Section III is the hardware of the paper section IV of the paper is about working and section V is software description. The section VI is about implementation of this paper and section VII is the conclusion.

2. LITERATURE SURVEY

H. K. Singh, S. Verma, S. Pal and K. Pandey, [1] "A step towards Home Automation using IOT" They develop home automation system based on IOT using Wi-Fi based microcontroller.

H. Durani, M. Sheth, M. Vaghasia and S. Kotech, [2] "Smart Automated Home Application using IoT with Blynk App" The author proposed the functionality of node esp8266 are connected with home appliances with help of coding and hosting online with web server. All the functionality is handled by Mobile App.

A. Sugiura, M. Toyoura and X. Mao, [3] "Clickable Virtual Button in Real Space" A new natural click interface for AR systems. The acceleration of fingertips provides cues for detecting click gesture and succeeded in use it for recognizing natural click gestures with a single camera.

S. Sureshkumar, C. P. Agash, S. Ramya, R. Kaviyaraj and S. Elanchezhiyan, [4] "Augmented Reality with Internet of Things" AR can be integrated with industry (AR-IoT) 4.0 and how the sensors are used to monitoring objects/things contiguously round the clock, and make the process of converting real-time physical objects into smart things for the upcoming new era with AR-IoT.

C. Wu and C. H. Lin, [5] "Depth-based hand gesture recognition for home appliance control" hand gesture recognition system for home appliance control using only the depth camera.

Minchev, Dimitar & Dimitrov, Atanas, [6] "Home automation system based on ESP8266" it shows implementation of an Internet of Things Home Automation System with energy measurement capabilities, hardware components are the ESP8266 micro-controller and energy meter chip HLW8012 by HLW Technology, Software works over the TCP/IP stack and uses the MQTT protocol to communicate between the devices.

3. HARDWARE

The hardware components and materials that we used in the system are NodeMCU esp8266 Wi-Fi development board, Arduino UNO, Relay Unit.

3.1 NodeMCU

NodeMCU is based on the Espressif ESP8266-12E Wi-Fi System-On-Chip, loaded with an open-source, Lua-based firmware. The NodeMCU is the Wi-Fi enabled microcontroller where it is been widely used in the IoT areas it gets the input from the sensor and it will upload to the internet.

3.2 Arduino UNO

The boards are equipped with sets of digital and analog input/output pins that may be interfaced to various expansion board shields or breadboards for prototyping and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus USB on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the "Arduino language".

3.3 Relay Unit

The four-channel relay module contains four 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections.
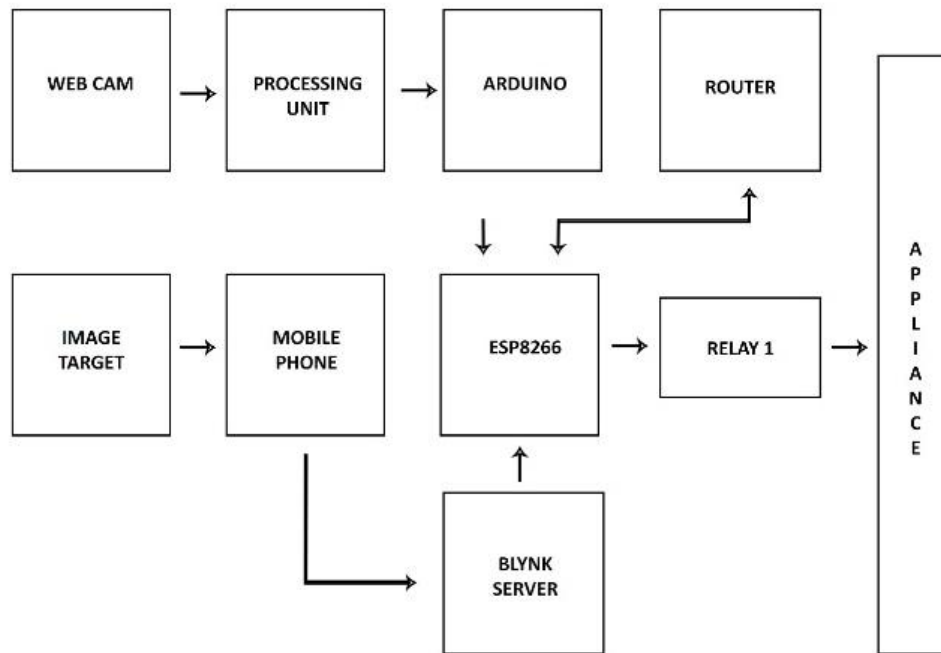
Fig -2: Block diagram of control unit

4. WORKING

In this proposed system, we are controlling the appliances using AR & AI with a help of IOT. For the first step the system must connect to an AC power supply of 230V to turn on the Controller board, the Router must have the same SSID and password as we instructed in the code, once the board is turned on it automatically connect with the router. When the connection is established, it will start sending appliance state requests of that particular device Id to the server, User touches the virtual button the server responds to the request by fetching the switch state from the Vuforia database. As soon as the data is fetched from the Vuforia database, the server sends the data back to ESP8266 in the JSON format. When the data is received by the ESP8266, it parses the required information from the response and then triggers the relay according to the data received. This system can also be controlled by using the hand gestures, when user shows hand gesture in front of the camera the processing unit (Visual studio code) will start to recognize the figures and as per the fingers instruction processing unit will command the Arduino to do the process. The Blynk service is also provided additional to control the appliance. In case of any machine error Manual switches can also been used.

5. SOFTWARE

5.1 Unity Hub

Unity is a cross-platform game engine which support a variety of desktop, mobile, console and virtual reality platforms. The engine may be used to create three-dimensional (3D) and two-dimensional (2D) AR visuals, as well as interactive simulations and different reports.

5.2 Vuforia Engine

Vuforia is an augmented reality software development kit (SDK) for mobile gadgets that helps to create the augmented reality applications. It uses computer technology to recognize and track 2D images and 3D objects in real time.

5.3 Visual Studio Code

Visual Studio Code is a source-code editor which consists of variety of programming languages, including Java, JavaScript, Go, Node.js, Python and C++. This platform is used to create an Artificial Intelligent projects.

6. IMPLEMENTATION

The outcome of this system is to build an AR virtual button interacts with the physical world which commands to switch ON and OFF the appliances which is connected through IOT and to control the appliance using AI based gesture control. This project can be operated in three ways one purely based on IOT where Blynk app used to control the appliances and on second AR part is integrated to the IOT part of the appliances to switch ON and OFF and on third method we can control the appliance using gesture movements. The AR part of the project is made possible by the UNITY Platform and Vuforia developer portal where an app is created to recognize the image target using mobile phone camera shows the virtual buttons. These virtual buttons are intractable in physical world, we need to place the finger on the virtual buttons which commands the microcontroller to switch the appliances ON and OFF. Another part is IOT part where the Blynk app is used to control the appliances directly. This flexibility of the project is distinct feature where the user can choose any three ways to switch the appliances. The proposed system is lower in cost, compact and ease of use so the implementation will be easy.
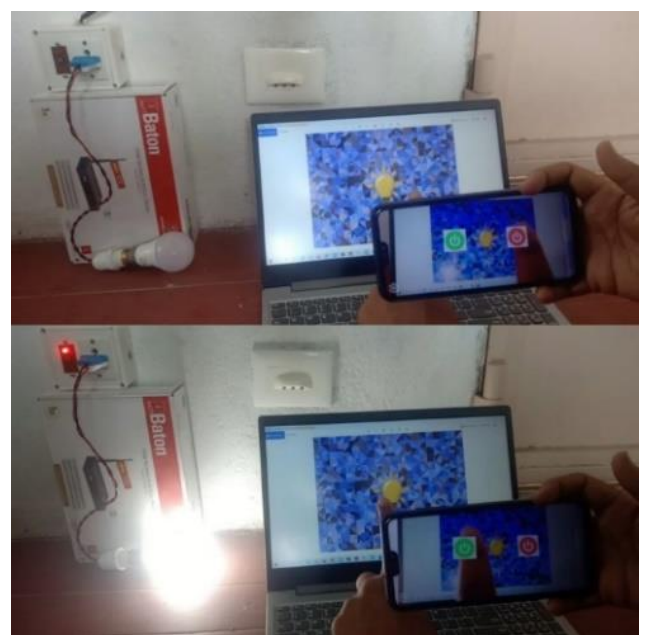

Fig -3: ON/OFF using Blynk App
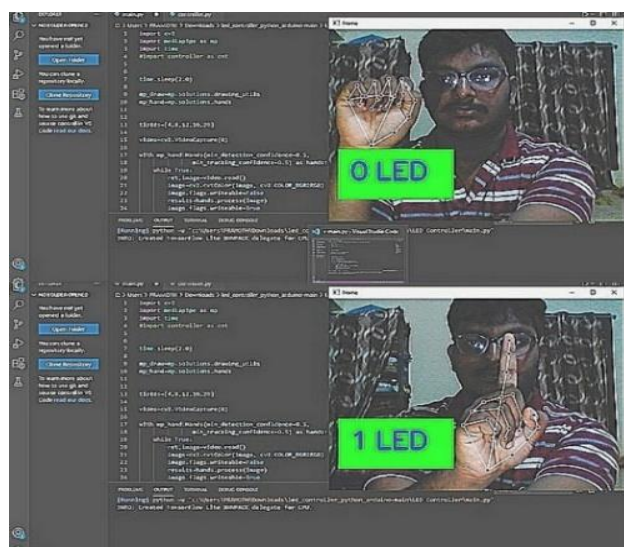

Fig -4: ON/OFF using AR

Fig -5: ON/OFF using AI

7. CONCLUSION AND FUTURE POSIBILITY

As AR (Augmented Reality) and AI (Artificial intelligence) is one of the driving forces of technology in future and will be applied every part of the technology that we use now, IOT is going to be the base of all technology because of the seamlessly connectivity between the appliances. Bringing the best out of both the technology into one project is a technological innovation. This project helps us to control the appliance in an easy way that it helps the physically challenged and elderly person. Not only helps the elderly and physically challenged, it can replace the normal switches helps to reduces the physical contact so that the spread of the disease can be reduced and decrease the chances of having a pandemic which are easily spread through the physical touch. This project improves the quality of life. It improves the efficiencies of IOT Technology due to interaction to the physical world through the virtual buttons. Switching is way faster than the normal mechanism of switch we use daily.

A prototype was built and confirmed functional. This would help to assist people, especially the physically challenged people and elderly who cannot do their own work and need help from others for doing simple tasks such as controlling the electrical appliances in the home. The proposed idea is used to control particular home appliance by using any of the three (AR, AI & IoT) technology. In future we will be using four channel relays, temperature sensors and advanced processors. To control many appliances and to automatically switches the fans if the temperature raises. In future automation-based products will be produced in large numbers to reduce labor efficiency, to help physically challenged people and to save time.

8. REFERENCES

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