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Access Control and Voice Response in IoT Based Home

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Abstract: *The goal of this project is to design a smart phone application-controlled home automation system. The system will monitor and manage several elements of the house, including lighting, and security, using a combination of sensors, microcontrollers, and communication protocols. The system will be created to be user-friendly, secure, and economical with energy. Users will be able to establish routines, get notifications, and remotely operate and monitor their house via the smart phone app. To further improve the system's functioning, the study will investigate the integration of voice assistants and machine learning techniques. The ultimate objective of this project is to develop a complete home automation system that offers its consumers comfort, convenience, and peace of mind.*

Keywords: *Access control system Home automation, Microcontrollers Node MCU, Voice assistants.*

I.INTRODUCTION

The home automation project is a system of interconnected devices and appliances designed to automate and simplify routine tasks in a home. This project involves integrating sensors, and other technologies to monitor and control various home functions, including lighting, temperature, entertainment, and security systems. By using a single interface, such as a smart phone or tablet, homeowners can remotely control and customize their home environment to their liking. The benefits of a home automation project include improved energy efficiency, enhanced safety and security, and increased comfort and convenience. With this project, homeowners can enjoy a more connected, efficient, and enjoyable home experience.

II.PROPOSED SYSTEM

The objective of this device is to design a home automation system that is affordable, dependable, and measurably effective at remotely switching on or off any electrical appliance using a microcontroller and basic hardware. Using a microcontroller and an Android software on a tablet, the project aims to set up and construct a home automation system that can respond to any instruction provided to household equipment with a single click. Home automation is a system that seeks to provide you instant access to control of your home's gadgets and appliances, enabling you to enjoy low-cost lighting, improved energy efficiency, and optimised energy use.

III.HARDWARE REQUIREMENTS

Microcontrollers are the brain and heart of today's technologically advanced world. Almost every application that is in use today uses a microcontroller as it is the central processing unit.

Arduino UNO: Arduino is used as microcontroller kit around the world by students to conduct various electronics interactive projects. Arduino offers different kinds of microcontroller kit.

Node MCU: Node MCU has grown in popularity as a result of its affordable price and Wi-Fi capabilities. Additionally, it offers Nodejs, which uses Lua script and requires less computing time to complete the work..It also provides the Nodejs that require less computation time to perform the task and use Lua script. Thus making the device to operate much faster and making it as a first choice for IoT applications.

Fingerprint sensor: Fingerprint identification is also known as dactyloscopy. Fingerprint identification is the process of comparing two examples of friction ridge skin impression from human fingers, palm or toes. Today fingerprints are considered to be one of the oldest and most popular biometric technologies. The major hardware used in this system

comprises of fingerprint sensor, also known as biometric identification module. (Fig.1 shows a fingerprint sensor)This sensor produces a digital print of the ridges in the skin of the fingers which could be uniquely defined for authentication

Fig. 1 Fingerprint sensor

LCD:A Liquid Crystal Display is a combination of states of matter, liquid and solid. It uses liquid crystal to display visible images on a thin and flat technology display screen. It is a widely used in most common electrical and electronic devices like laptop, cell phones, TVs, etc. LCD display operates using two polarizing sheets with liquid crystal solution between them. The liquid crystal acts like a shutter, when an electric current is passed through the liquid, the crystals align so that the lissght cannot pass through them. LCDs do not emit light themselves, so backlight is required to produce.

Relays: In electronics, relays are the most used switching device. Using the needs of the system as our guide, let's discover how to employ one in our circuits. We must take into account two key relay parameters before moving further with the circuit to operate the relay. The voltage needed to turn on the relay and switch the contact from Common->NC to Common->NO is known as the trigger voltage. A relay module is shown in Fig.2. Although this relay has a 5V trigger voltage, there are alternative relays with 3V and 6V values available.

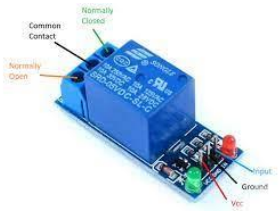


Fig. 2 Relay module

Keypad: Keypad modules are made of thin, flexible membrane material. The 4x4 keypad module consists of 16 keys, these Keys are organized in a matrix of rows and columns. All these switches are connected to each other with a conductive trace. Normally there is no connection between rows and columns. When we will press a key, then a row and a column make contact.

LDR: The **Light Dependent Resistor (LDR)** or also popularly known as Photo resistor is just another special type of Resistor and hence has no polarity so they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also. A **photo resistor** or **LDR** (Light Dependent Resistor), as the name suggests will change it resistance based on the light around it.

PIR*:* PIR (passive infrared) sensors utilise the detection of infrared that is radiated from all objects that emit heat. This type of emission is not visible to the human eye, but sensors that operate using infrared wavelengths can detect such activity. They are sometimes referred to as 'motion-based detectors', as they sense the presence of people, animals and objects through the movement of their infrared wavelengths. They are referred to as "passive" due to the fact that no heat or energy is emitted by the sensor itself. It is also important to remember that PIR sensors detect the emission of infrared radiation, and not heat.

III.METHODOLOGY

System Work Flow: This system has three different sub-systems using Arduino UNO as controller for two sub systems and Node mcu (ESP8226) the system layout of each sub systems are as the following circuit diagrams.

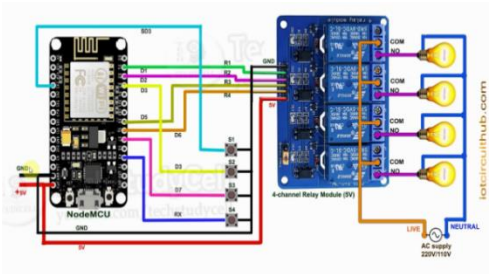


Fig. 3 Circuit Diagram For Node MCU

All the home appliances will be controlled by mobile app. The appliances are connected as shown in the circuit diagram fig.3.The appliances in the industry or home will be interfaced with centralized micro controller Node MCU for the systematic Working.

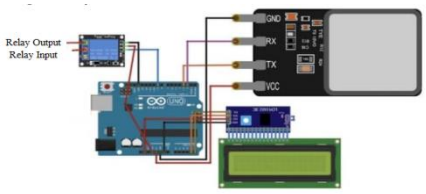


Fig. 4 Circuit Diagram Fingerprint access control system

This system will control access to a particular device by fingerprint identification and can also regulate access using a password input through the keypad. The appliance that has to be protected against unauthorized users should be connected as illustrated in the Fig 4.

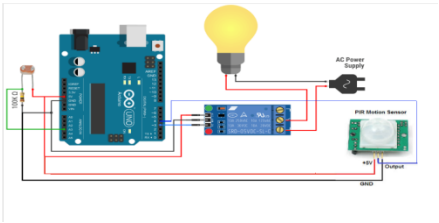


Fig. 5 Circuit Diagram For Motion Based Light

The system for autonomous motion-based lighting shown in the circuit diagram above fig 5 is designed to increase user interfacing comfort.

IV.WORKING

1. IOT BASED CONTROLLING: The IOT based controlling is done using the *SINRICPRO* application in which the *Node MCU* is programmed to get trigger from.

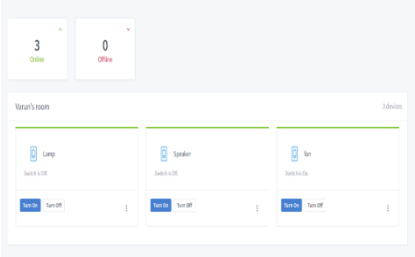


Fig. 6 Sinric Pro Control

The Sinric Pro is a open source application which allows the user to interface with the IOT applications. This application also allows the user to interface with the IOT applications through the Voice Assistants such as ALEXA and GOOGLE ASSISTANT , and also with GOOGLE HOME app.

Control From Google Home: Any Android device that has the google home application installed can activate the srinric pro application, which in turn triggers the Node MCU.

ControlFrom Alexa*:* Alexa can also be used on any android smart phone, much as the Google Home app, to activate the Srinric Pro, which then triggers the Node Mcu

2. AUTOMATIC LIGHT USING MOTION DETECTION: This system is more useful for the old age people where there are ore movements in night time the *light setup* can be placed at any corner of the room focusing at the end where the movement of people starts. This system first checks for the outside light using the *LDR sensor* .If the light is below a certain level then it starts to check the movement through the PIR sensor . If there is any movement then it opens the relay which turns on the light for a specific time here the light is turned on for 8 seconds . The below Figure 7 shows the light turned on.

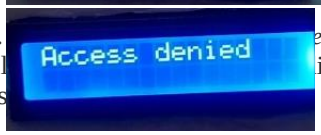
Fig. 7 Automated Motion Based Light

3. ACCESS CONTROL SYSTEM: This system will control access to a particular device by fingerprint identification and can also regulate access using a password input through the keypad. The appliance that has to be protected against unauthorized users should be connected as illustrated in the diagram above

The system startup is shown figure 8 with two ways for the authentication which are password entry and the fingerprint entry

Fig. 8 System Start Up

Fig. *entry*



PASSWORD ENTRY: The password entry all igit password(figure 9)The figure 10 shows that the entered code is wrong and the access to the s

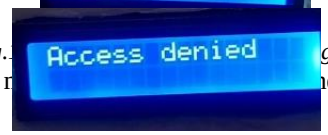
Fig.10 Access Denied for wrong code

Fingerprint Entry: The fingerprint entery is to the users who have alredy enroled their fingerprints durint the installation of the system. The startup of the fingerprint verification is as shown in the fig11.

Fig.11 System Start up for fingerprint Access

The user is allowed to keep his finger in the fingerprint sensor for the validating purpose . If the users fingerprint matched with the stored fingerprints then the user as allowed to access the system and the system shows the message of the welcome followed by the users Id as shown in the Figure 12 .

Fig. *ger*



If the fingerprints of the user did not r hen the access denied message is shown in the display as shown in the below figure

Fig.13 Access Denied for Invalid Finger

V.HARDWARE SETUP

The figure shows the setup of the project where the circuits are integrated inside the electrical switch board for the aesthetic.

Fig.14 Hardware Setup

VI.CONCLUSIONS

In conclusion, our home automation project has successfully demonstrated the benefits of integrating technology into everyday living. Through the use of sensors and connected devices, our system has improved energy efficiency, increased security, and provided homeowners with greater convenience and control. The project's implementation and testing phases have shown that home automation technology has great potential to enhance our daily lives, and we look forward to seeing further advancements in this field in the future. Overall, our home automation project has been a valuable contribution to the growing body of research on smart homes and their impact on modern living.

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