

IMPLEMENTATION OF SMART HOMES USING IOT

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ABSTRACT

The recent trends in IoT help making homes and other industries automated. The system which allows devices to be interfaced by humans is known as home automation system. Home automation can be achieved through interconnection of devices or appliances through an Internet gateway or by means of communication protocols like Zigbee, Wi-Fi etc. The system which enables human to automate a bulk of electronic, electrical and mechanical appliances within home is known as home automation system. Basically this automation is a combination of software and hardware technologies which enables the homes to be automated. The main objective of this project is to develop a home control system in which a NODEMCU board is used which is controlled by an internet facilitated android system. The advancement in technology has made smarter homes. Conventional devices have been changed into control based devices like remote control switches in modern homes. In our homes the switches are placed in diverse parts of walls. Old people and physically challenged are facing many difficulties to operate these switches. Our project act as a solution for these problems as it helps to access the house hold appliances with smart phones.

Keywords : NodeMCU, MIT AppInventers, Solid State Relay.

I. INTRODUCTION

In this fast growing world IoT(Internet of Things) has become an aid to most of the problems. IoT and its applications has opened a wide gateway to a number of modernized applications for example purchasing of goods, monitoring of resources and control them from any remote corner of the world. An application of IoT provides the list of the stuff needed based on the utilization of it from the household refrigerator (Personalized refrigerator). Even the fridge is interactive and it monitors the conditions in home and switches automatically to the required control. Household devices such as TV, light bulb, fan, etc. can be controlled with the help of IoT by assigning an unique address to them and by connecting them in common gateway.

Along with the quick growths in technology, the devices in the current past are becoming smarter. The real-world appliances are being prepared with intellect and computing capability, so that they can configure themselves consequently. Sensors are attached with the embedded devices along with wireless connectivity can simplify to remotely monitor and control the devices. This forms an integral component of the Internet of Things (IoT) network. IoT also helps in transferring of data from sensors through a wireless network, achieving recognition and informational exchange in the open computing network. Whatever appliance that we are using in our day today life is becoming smarter with the current technologies. But it is not enough until we link them to act with the dynamic environment and in addition to make their own inter-network, that is, machine-to-machine communication.

The Items like electronics devices, software's, sensors, actuators, home appliances and vehicles are connected to a wireless network. Internet of Things is considered as a wireless network of these objects and they can exchange their data through light weight protocols like MQTT, CoAP etc. There are different types of radio modules out of which GSM, 3G, Wi-Fi, Bluetooth, ZigBee, etc. are common. However, owing to the surging number of Wi-Fi hotspots and range sufficient to perform the required control and monitoring, Wi-Fi is chosen as the mode of communication in the prototype and the devices are controlled through website implemented using ESP8266.

II.LITERATURE REVIEW

Homera Durani, et al (2018) has presented a home management system. In this paper he mainly focused on everyday problems faced by the people in the world where the regular power cutoff, unmanaged urbanization, lack of manpower in agriculture and farming, etc. are blatantly evident. Their prototypical system is applicable to real-time home security, automation, monitoring and controlling of remote systems. This implementation delivers an intelligent, comfortable and energy efficient home automation system. It also assists the old and differently abled persons to control the appliances in their home in a better and easier way. Further, this system can be employed in many places such as banks, hospitals, laboratories, traffic situations, residential apartments, house, streets, poultry farms, greenhouse, etc. In a nutshell, this system can be used in multiple fields and areas in order to make them operate smarter.

Sourabh Sarkar et al (2018) introduced a home automation and security using the Internet of Things is realized using a low-cost microcontroller-based NodeMCU (Esp8266), an Android device and Firebase services. NodeMCU is used for prototyping purposes. It connects to the Internet through WI-FI hotspot. The NodeMCU can be easily configured to connect to the internet and can be programmed easily. This security home automated system has the main objective to monitor the home and keep it safe and secure. It mainly focuses on the wireless transmission of data from NodeMCU to Firebase and then to the Android application of the authenticated user. Robust and reliable high-quality sensors have been used to build up the automated IoT system. In addition, several features are present in this system other than security. PIR sensor and flame sensor are used to detect the fire which is transferred to the mobile by using NodeMCU. Embedded C and Java Script are used for Application Development.

Brundha S.M, et al (2017) has developed an efficient home automation system along with security using low cost Wi-Fi modules. The security system alerts the user about the condition in the home by giving the notifications to the user mobile phone. A camera module is connected to the Microcontroller which captures the image of the intruder. The prototype module of our proposed system does a facial recognition and raises an alarm if an intruder is present. As a future scope for this project the image captured can be sent to the police station for further actions. Also, a greater number of sensors and actuators can be added to the home actuation pot to make a smart home. They have created an own server by using PHP and SSID, and used MATLAB for face recognition. By using this they implemented the Security Alerting System.

S. Kanagasabapathy et al (2020) developed the module for the staffs at deaf and dumb school to manage the students while they are not able to hear or speak. In their proposed system, the staffs who was in charge of the impairment students can able to watch a vast number. The developed model interfaced with the wireless module along with the controller. It helps the staff to alert the student in the form of vibration. The system provided specific timing vibrations for indicating the exam timings, working hours, and state of emergency. S. Amutha et al (2019) developed the automated system to monitor the late comers in class room. They used Passive Infrared Sensor to detect the motion of the object whereas RFID is used to retrieve the student details which can be mapped from their unique Id. Along with this, a camera module is used to capture the images of the unidentified entries those

does not wear ID cards. The activation of the monitoring system can be customized with the help of the application deployed at a local server.

V.K. Raja Priya et al(2018) develop the Smart Vehicles for collect, store and exchange monitoring sensory content about urban streets. Uploading such monitoring data by all vehicles to the infrastructure is challenging. In-order to avoid such situations, they developed the appropriate vehicles important for different urban sensing tasks is identified by measuring its relative importance in the network. First, the different location-aware content is autonomously ranked by a vehicle. Based on the vehicle's centrality score the best content hubs in the network are identified to provide efficient collect, storage and exchange of sensory data based on content centric networking (CCN) where content request/response data are characterized. T.Saraswathi et al(2016) proposed a system for real time monitoring continuously reads patient's pulse rate or heart beat rate and body temperature through Fingertip Measuring Heart rate sensor and Thermistor Temperature Sensor. These values will be sending to mobile and webpage using wireless communication for further analysis.

Santhi S et al(2017) proposed system the voice disorder is identified by determining the source signal from the communication through the Mel-Frequency Cepstral Coefficients (MFCC) analysis and it calculates the features from normal and disordered subjects. These features are fed into Gaussian Mixture Model (GMM) which provided distribution of energy in normal and voice disordered subjects to differentiate between them. These systems measure auditory characteristics, are more computationally efficient but tended to provide inferior levels of performance which provides a smarter healthcare. P.Golda Jeyasheeli et al(2018) proposed a logic based security method to improve the smart home security. Two access points, primary access point and secondary access point are identified. The main door act as a primary access point to the home as it will be always used by the occupants to enter/exit the home. The other doors such as balcony or windows are the secondary access points. Sensors and microcontrollers are used to identify the user movement near the access points. A logic based security method is implemented. An application is developed for android Smart phone to perform Identification, Verification and Authentication of the inhabitant. The status of the home is monitored using the application such as state of the door, number of person inside the home and state of the home. Whenever intruder is identified alert messages are sent to the authorized users.

III. PROPOSED METHODOLOGY

The Proposed system consists of a processing unit and a control unit. The processing unit is NodeMCU and control will be achieved through Relay module. The system overview is as shown in Figure 1.1.

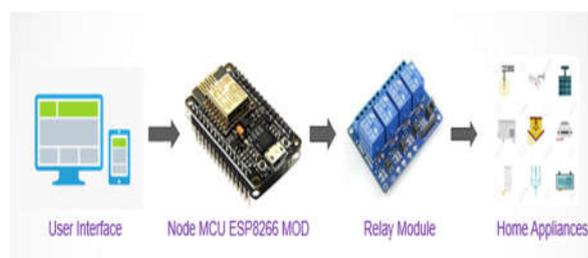


Figure 1.1 Schematic diagram of proposed system

The module consists of the processing unit, relay module and user interface. The user Interface components are mobile phones and Laptop. The user can be able to give the necessary actions to control the Home appliances via user interface. The data

signal can be sent to website using HTTP server port and the Server to give the acknowledgement of the signal, and then the server to send the control signal in NodeMCU. With the help of the NodeMCU the Home appliance can be controlled.

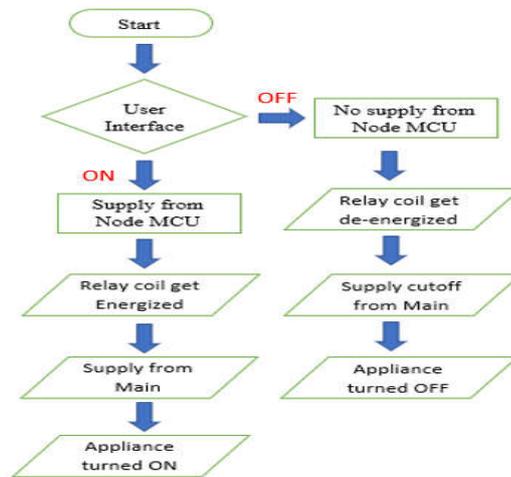


Figure1.2 Flow diagram of the proposed system

The flow diagram of the proposed system shown in figure 1.2. In GUI there are two provisions for each appliance like ON and OFF. If the switch is ON, then the command will be sent to NodeMCU and the output will be logic 1. If the output is logic 1 then it gives 5V as an output. The 5V output will be supplied to energize the Relay coil. If the coil gets energized, then the circuit will become closed and the appliance will turn ON. If we give OFF command to NodeMCU, then it will check the input and generates the output as logic 0, it gives 0V as an output. That 0V output will be given as the input to the relay. Due to that Relay will get de-energized, and the circuit becomes open. The appliance will turn OFF.

IV. HARDWARE DETAILS

4.1. NodeMCU

The NodeMCU Development board is featured with Wi-Fi capability, analog pin, digital pins and serial communication protocols. ESP8266 is a low-cost, Wi-Fi module chip that can be configured to connect to the Internet. Basically, Electrical and Mechanical equipment's cannot connect to the Internet on their own. They don't have the inbuilt setup also.

NodeMCU is a Wi-Fi SOC (System On Chip) produced by Espressio Systems. It consists of ESP8266 -12E Wi-Fi module. It is a highly integrated chip designed to provide full internet connectivity in a small package. It can be programmed directly through the USB port using LUA programming or Arduino IDE. By simple programming it can be used to establish a Wi-Fi connection and defines input/output pins according to the needs exactly like Arduino, turning into a web server.

NodeMCU is the Wi-Fi equivalent of ethernet module. It combines the features of Wi-Fi access point, the station and the microcontroller. These features make the NodeMCU extremely powerful tool for Wi-Fi networking. It can be used as an access point and/or station, host a web server or connect to the internet to fetch or upload data.

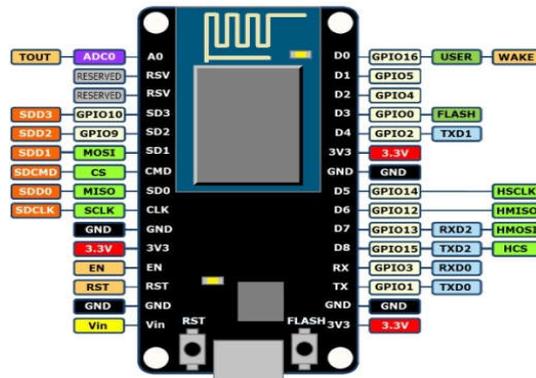


Fig.1.3 Node MCU

4.1.1 Features

- ✓ Arduino-like (software defined) hardware IO.
- ✓ Can be programmed with the simple and powerful LUA programming language or Arduino IDE.
- ✓ USB-TTL included, plug & play.
- ✓ 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication,
- ✓ 1-Wire and ADC A0 etc. all in one board.
- ✓ Wi-Fi networking (can be used as an access point and/or station, host a web server), connect to the internet to fetch or upload data.
- ✓ Event-driven API for network applications.
- ✓ PCB antenna.

4.2 Relay

The relay is a device that opens or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus, it protects the system from damage.

4.2.1 Internal Diagram of Relay

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field.

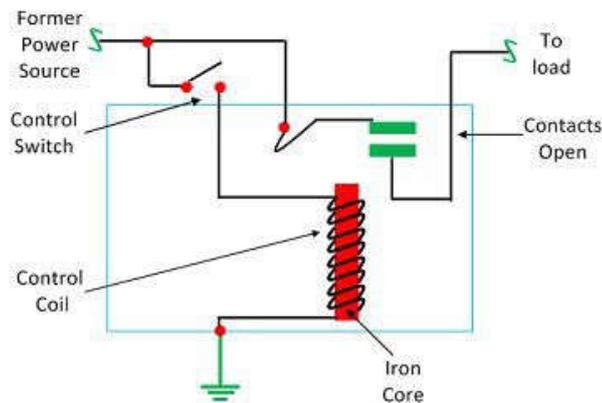


Fig.1.4. Relay Internal Diagram

In the relay board the magnetic field moves the relay armature for opening or closing the internal connections. The small power relay consists of only one contact, and the high-power relay has two contacts for opening the switch. The inner part of the relay is shown in the figure 1.4. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flowing through the coil produces the magnetic field around it.

Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence it closes the circuit, which makes the current flow through the load. If the contact is already closed, then it moves opposite and opens the contacts.

4.2.2 SPDT Solid State Relay

A solid-state relay is a non-contact switch fully composed of solid state electrical-element, which can drive high-current load with a small control signal. It can achieve switching on and off with no contact and no spark due to the switching characteristics of electrical element. The relay module is an electrically operated switch that allows turning ON or OFF a circuit using voltage and/or current much higher than a microcontroller. There is no connection between the low voltage circuit operated by the microcontroller and the high-power circuit. The relay protects each circuit from each other. Each channel in the module has three connections named Normal Close - NC, COM, and NO. Depending on the input signal trigger mode, the jumper cap can be placed at the high level effective mode which 'closes' the Normally Open (NO) switch at the high level input and at the low level effective mode which operates the same but at low level input.

4.2.2.1 Specifications

- ✓ On-board 5V, 10A / 250VAC, 10A / 30VDC relays
- ✓ Relay long life can absorb 100000 times in a row
- ✓ Module can be directly and MCU I/O link, with the output signal indicator
- ✓ Module with diode current protection, short response time
- ✓ PCB Size: 45.8mm x 32.4mm

4.2.2.3 Features

- ✓ Trigger Voltage (Voltage across coil) : 5V DC
- ✓ Trigger Current (Nominal current) : 70mA
- ✓ Maximum AC load current: 10A @ 250/125V AC

- ✓ Maximum DC load current: 10A @ 30/28V DC
- ✓ Compact 5-pin configuration with plastic moulding
- ✓ Operating time: 10msec Release time: 5msec
- ✓ Maximum switching: 300 operating/minute

4.3 Power Supply

The power supply board is a basic essential interface for regulating and supplying power to the connected components. The female barrel jack connector on the power supply board acts as the input terminal and the terminal blocks on the board enables to connect to the components using the male bread board wires. Simply use a USB to barrel jack cable to connect the power supply with the board. Power supply circuit indicates that this circuit is used to supply the power to other electrical and electronic circuits or devices. There are different types of power supply circuits based on the power they can be used to provide for devices. For example, the microcontroller-based circuits, usually the 5V DC regulated power supply circuits, are used, which can be designed using different techniques for converting the available 230V AC power to 5V DC power.

4.4 Home Appliances

Nowadays home appliances play a key role in the domestic life of the modern man. It has always had a significant place in the life of man ever since the Stone Age when man began to use tools. Today, the twenty-first century human beings use more sophisticated tools and home appliances for his daily life. The more we try to make our life convenient and easy, the more the role of appliances turns out to be in determining the lifestyle of man.

4.4.1 LED Tube Light

The LED Tube Light emitting diodes are usually producing light when a current passed through them. This occurs when specific types of semiconductor materials are used to create PN diodes. The N side injects electrons into the P side and the P side injects holes into the N side. Then on each side the majority carrier types react with these injected carriers and produces light in the process taking the energy from the electrical current.

Lighting with LEDs work exactly like mercury-tube-based fluorescents only the source of stimulating light energy comes from an LED rather than a discharge in mercury vapor which produces ultraviolet radiation.

4.4.2 Specifications

The followings specifications are shown in the table

Lighting Color :	Warm White
Tube Base Type:	T5, T4, T10, T8, T12
Lighting Type :	LED
Length :	2 Feet
IP Rating :	IP66, IP40, IP33, IP44, IP55
Wattage :	9 W

4.4.3 Fan

Pedestal fans are also called as oscillating fans. It has an adjustable metal stand so the head of the fan can be set anywhere from 2 to 4 feet off the ground. Also, the head connects to the pedestal on a platform which can be angled up or down. Inside, the fan head is comprised primarily of an alternating current electric motor with a secondary output, which attaches to a worm gear at the base of the platform.

V. IMPLEMENTATION

The Implementation phase consists of the two sections. The first Phase consists of software and the Second Phase consists of the Hardware. In the first Phase we have developed the Website using HTML and PHP Code. The Website consists of two primary things like Domain and Server. In this project we have used the free Domain from freedom site to purchase the free Domain. 000Webhost used as a Server. The HTML code is used to create small GUI page, This GUI page consists of the project details and the home appliance button for control. To process the code the backend site of PHP code has to create. The Arduino IDE consists of many lib functions to process the code. In this project we have used two lib functions like ESP8266HTTPclient and ESP8266wifi. The ESP8266wifilib to be connects the NodeMCU as the External Wifi, Otherwise It will act as a Hotspot. ESP8266HTTPclient used to communicate the NodeMCU to server. Second Phase consists of the Hardware design module. It contains relay circuit, bulb and home appliance. When the user interface is activated, the data sent to server via HTTP protocol to communicate NodeMCU. Then the signal from NodeMCU sent to the relay module to activate the home appliances. Figure 1.5 shows the hardware design of IOT home automation system.

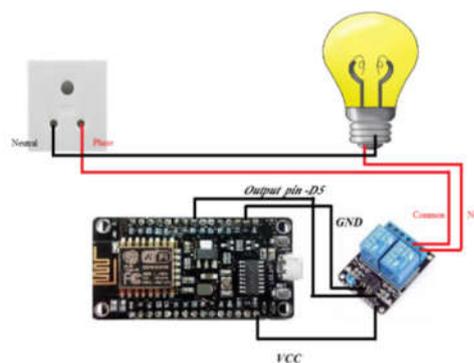


Figure 1.5 Hardware Design

VI. RESULTS AND DISCUSSION

The proposed system of our project can able to control the various home appliances like Light, Fan etc. The obtained sample results and the discussions are presented below. The following figure shows the obtained result by connecting Relay, NodeMCU and 30 watts Bulb.

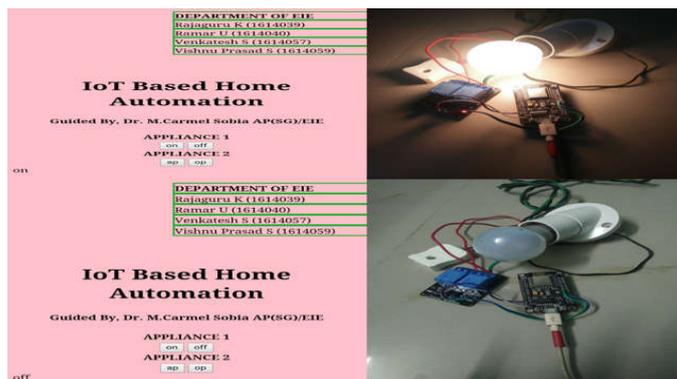


Figure 1.6 Controlling of light alone

The following figure shows the obtained result by connecting Relay, NodeMCU and Fan and light.

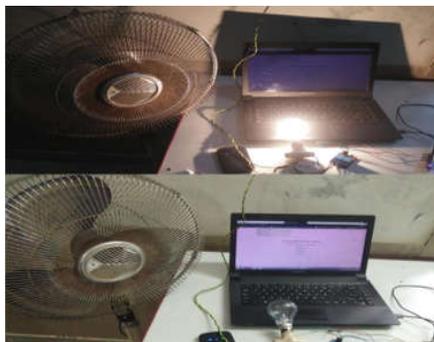


Figure 1.7 Controlling of light and Fan

All the expected outcomes are successfully attained, and the overall control has implemented for various home appliances such as AC, Refrigerator, etc., likewise, n number of devices can be included based on the relay module and NodeMCU.

VII. CONCLUSION AND FUTURE SCOPE

This project has been experimentally proven to work successfully. We can control any home appliances using Android app or through website. The designed system can control the instruments from anywhere. This will help the user by saving the power by switching off the home appliances in case they forget to switch off. This will also help the physically disabled people and other persons who require caretakers. Additional improvement of this project can be done by implementing the same project in an industry. This implementation provides an intelligent, comfortable and energy efficient home and Industrial automation system.

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