

IoT Based Smart Home Automation System

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Abstract: Mobile devices are the part of our day-to-day life from last few years. Consequently, providing facilities and security are becoming increasingly prominent features on mobile devices. In this paper, we have to develop a home automation system that interfaces with Android mobile devices. The mobile device and system can communicate with each other via Wi-Fi. The mobile application can be loaded and interfaces with system from any compatible device. Commands to ON/OFF electrical equipment like lights, fans, air conditioners etc. and setting timer at home or any organization can be sent easily and quickly from the mobile devices via a simple and comfortable GUI application, which is easy to use for the any normal users. The system then acts and responds to these commands by taking actions per commands and gives the result to the user. The user can also see the result on Android mobile application within the range of Wi-Fi. Therefore, it's a good choice to design a home automation for luxurious life that aims at designing an advanced home automation system using Wi-Fi technology. This paper presents a low cost and flexible home control and environmental monitoring system. It employs an embedded micro – web server in NODE MCU microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely. These devices can be controlled through a web application or via Bluetooth Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor, gas sensor and motion sensors have been integrated with the proposed home control system. Therefore this system has been successfully designed and implemented in real time.

Index Terms – Node MCU, IOT, Wi-Fi, Relay etc.,

1. INTRODUCTION

Internet of Things is a concept where each device is assigned to an IP address and through that IP address anyone makes that device identifiable on internet. Basically it started as the “Internet of Computers.” Research studies have forecast an explosive growth in the number of “things” or devices that will be connected to the Internet. The resulting network is called the “Internet of Things” (IoT) [1]. The recent developments in technology which permit the use of Bluetooth and Wi-Fi have enabled different devices to have capabilities of connecting with each other. Using a WIFI shield to act as a Micro web server for the Arduino which eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet based home automation system for remote control of home appliances is designed.

In nowadays, development and changes of technologies is happening daily as well as continuous improvement of people's living standards are increasing. The mobile phones are the inspirable part of human lives today. The mobile phone is the most important part of human lives today. With the help of this smart gadgets human can do many works with or without internet like here we can make our home as well as organization smarter or more luxurious. Here we proposed a new technology, so

that mobile phones can be used to communicate with and control electrical appliances like Fans, A.C., Lights etc. using Android App and Wi-Fi module. The transmitter of Wi-Fi transmits the data given by the application using radio waves technology. The Wi-Fi works on radio waves technology, as the data to be passed through Wi-Fi is converted into the electromagnetic signal which is then sent using the antenna. This signal is passed to the Arduino controller. The Arduino further operates the received information and performs operations. This controller can be connected to the Relays of different switches to pass the current after generating the magnetic field. In future, we can use router for a wide range access like for the Smart City projects. New appliances can be added anytime to the system, which provides for the reliability of the system.

Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. These had greater importance than any other technologies due to its user-friendly nature. These can be used as a replacement of the existing switches in home which produces sparks and also results in fire accidents in few situations. Considering the advantages of Wi-Fi an advanced automation system was developed to control the appliances in the house.



Figure.1. Smart Home

2. LITRETURE SURVEY

A. “Home Automation and Security System” (Surinder Kaur, Rashmi Singh, Neha Khairwal and Partyk Jain)

Easy Home or Home automation plays a very important role in modern era because of its flexibility in using it at different places with high precision which will save money and time by decreasing human hard work. Prime focus of this technology is to control the household equipment's like light, fan, door, AC etc. automatically. This research paper has detailed information on Home Automation and Security System using Arduino, GSM and how we can control home appliances using Android application. Whenever a person will enter into the house then the count of the number of persons entering in the house will be incremented, in Home Automation mode appliances will be turned on whereas in security light will be turned on along with the alarm. The count of the number of persons entering the house is also displayed on the LCD screen. In Home Automation mode when the room will become empty i.e. the count of persons reduces to zero then the appliances will be turned off making the system power efficient. Moreover a person can control his home appliances by using an android application present in his mobile phone which will reduce the human hard work. At the same time if anyone enters while security mode is on a SMS will be sent to house owner's mobile phone which will indicate the presence of a person inside the house. The alarm can be turned of using SMS or Android application.

B. “Home Automation using Internet of Things”

(Pooja Patel, Mitesh Patel, Vishwa Panchal and Vinit Nirmal)

The main aim of the project is to develop a system that will provide remote control of home appliances and also provide security against the mishaps when the home

host is not at home. This paper is mainly concerned with the automatic control of light or any other home appliances using internet. It is meant to save the electric power and human energy. This project is made with the help of controller and raspberry pi. The various appliances connected to the micro controller and sensor is connected using wireless network.

C. “A Survey on Internet of Things Based on Home Automation” (Pooja N.Pawar, Shruti Ramachandran, Nisha P.Singh and Varsha V.Wagh)

A low cost and user friendly smart home system, which uses an Android application to communicate with the cloud and provides switching functionalities, is presented. The System eliminates the use of Personal Computer (PC) and other Computer Peripherals which leads to overall reduction in the cost of the system. Unlike the similar system which uses either of the Bluetooth module network, the proposed system uses Internet of Things (IoT) for monitoring and controlling the Electrical/Electronic Appliances, remotely. Switches of Electrical /Electronic appliances are integrated to the system in order to demonstrate the effectiveness and feasibility of the system.

D. “Review Paper on Home Automation Using Internet of Things” (Aarti and Pooja Mittal)

It is Internet of Things (IOT) which allows objects to be sensed & controlled remotely across existing network infrastructure, creating opportunities for more direct integration of physical world into computer-based systems, & resulting in improved efficiency, accuracy & economic benefit. End-to-end health monitoring IoT platforms are coming up for antenatal & chronic patients, helping one manage health vitals & recurring medication requirements. In this paper we use IOT for energy efficient Environmental Conditions sensing and in Home Automation. We have discussed the roles of IOT in automation in this papers and we have also discussed that integration of solar based energy system with IOT for home automation. Integration of sensing & actuation system by connecting to internet is discussed here. Efficient power balance and generation & energy usage is the objective of research.

3. PROPOSED METHOD

Real Time clock based home automation in an advance project to control the devices in timely and systematic manner. The devices can be controlled wirelessly from other places using wireless technology. RTC with EEPROM can

record all the working parameters in the devices or appliances. Basically the project is a concept to bring automation in the industry or home. All the home appliances will be controlled by mobile app. The appliances in the industry or home will be interfaced with centralized micro controller NODE MCU for the systematic working. The inbuilt RTC and EEPROM present in the controller will be activated for the operation. The controller also interfaced with WIFI to receive the control commands from Wi-Fi shield (Wi-Fi hotspot). The operator will be provided with Mobile app having Wi-Fi in that. If operator wants to switch the Light to turn on or off he needs to switch control button provided in app. Once he switched the Wi-Fi will send the data to Wi-Fi present at microcontroller. As and when the request is received the microcontroller activates the RTC and EEPROM and as per request received the operation will be done. In the same way all other appliances can be controlled.

Block Diagram

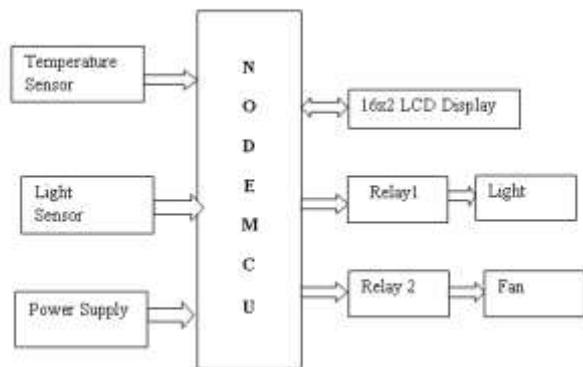


Fig.2 Proposed Block diagram

A. NODEMCU

NODEMCU (esp8266) has been selected as the controller for this system due to its compact size, compatibility, easy interfacing over several other type of controller including Programmable Integrated Circuit (PIC), Programmable Logic Controller (PLC) and others. ESP8266 is an open source firmware that is built on top of the chip manufacturer's proprietary SDK. The firmware provides a simple programming environment, which is a very simple and fast scripting language. The ESP8266 chip incorporates on a standard circuit board. The board has a built-in USB port that is already wired up with the chip, a hardware reset button, Wi-Fi antenna, LED lights, and standard-sized GPIO (General Purpose Input Output) pins that can plug into a bread board. Figure-3 shows the diagram of NODEMCU (ESP8266). It has Processor called L106 32bit RISC

microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz and has a memory of 32 Kbit instruction RAM, 32 Kbit instruction cache RAM, 80 Kbit user data RAM & 16 Kbit ETS system data RAM. It has inbuilt Wi-Fi module of IEEE 802.11 b/g/n Wi-Fi.



Fig. 3. NODEMCU

B. Relay

Relay is nothing but it is the electromagnetic switch. Relay allows one circuit to switch another circuit while they are separated. Relay is used when we want to use a low voltage circuit to turn ON and OFF the device which required high voltage for its operation. For example, 5V supply connected to the relay is sufficient to drive the bulb operated on 230V AC mains. Relays are available in various configurations of operating voltages like 6V, 9V, 12V, 24V and so on. Relay is divided into two parts, one is input and other is output. Input side is nothing but a coil which generate magnetic field when small input voltage is given to it. Relay having three contactors: Normally closed (NC), Normally opened (NO) and common (COM). By using the proper combinations of the contactors electrical appliances may turn ON or OFF. [2]



Fig.4 Relay

C. Light Sensor

A Light Sensor is something that a robot can use to detect the current ambient light level - i.e. how bright/dark it is. There are a range of different types of light sensors, including 'Photo resistors', 'Photodiodes', and 'Phototransistors'.

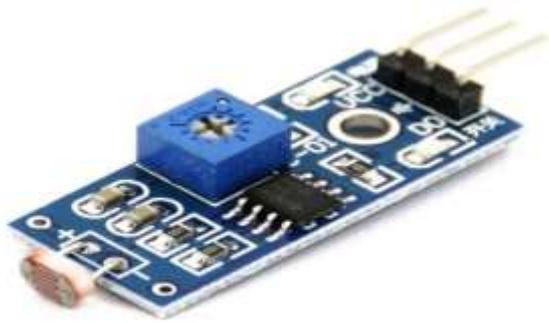


Fig.5. Light Sensor

D. Temperature Sensor

This module is used to measure temperature. DS18B20 are one wire bus protocol, which requires only one data line for communication with Node MCU. LM35 is a temperature sensor that can measure temperature in the range of -55°C to 150°C. It is a 3-terminal device that provides an analog voltage proportional to the temperature. ... Node MCU ADC can be used to measure analog voltage from LM35 and so temperature which is in proportion to the analog voltage.

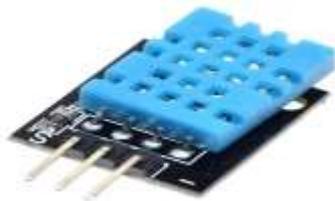


Fig.6 Temperature Sensor

4. EXPERIMENTAL RESULTS

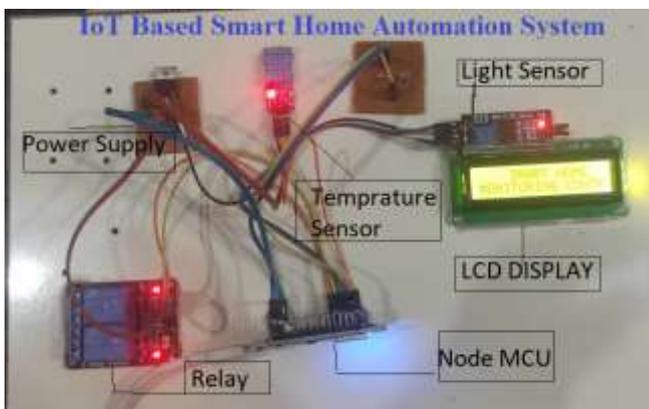


Fig.7: Experimental setup

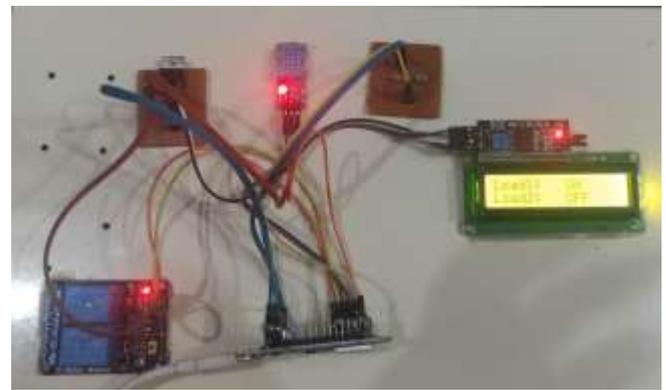


Fig.8: LCD showing the Home system loads status

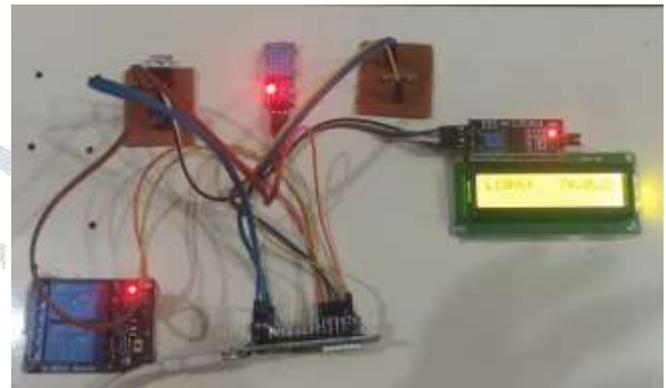


Fig.9: LCD showing the Light Sensor Value



Fig.10 LCD Showing the Sending status of home data to Cloud through Wi-Fi

5. CONCLUSION

It is evident from this project work that an individual control home automation system can be cheaply made from low-cost locally available components and can be used to control multifarious home appliances ranging from the security lamps, the television to the air conditioning system and even the entire house lighting system. And better still, the components required are so small and few that they can be packaged into a small inconspicuous container. The designed home automation system was tested a number of times and certified to control different home appliances used in the lighting system, air conditioning system, home

entertainment system and many more . Hence, this system is scalable and flexible.

Future Scope

This application can be further developed into system with the following enhancements:

- Bill functionality can be added to the home automation system which can predict bill of any selected period.
- Gas leakage and light dimming functionality can also be added in near future.

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