

Home Automation System

(Wi-Fi based home automation system using cell phones)

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Abstract:-

Home Automation System with advancement of technology things are becoming simpler and easier of us. Automatic systems are being preferred over manual system. Automatic Room Lights System using Arduino is a very useful project as you need not worry about turning on and off the switches every time you want to turn on the lights. The main components of the Automatic Room Lights project are Arduino, PIR Sensor and the Relay Module. Out of the three components, the PIR Sensor is the one in focus as it is the main device that helps in detecting humans and human motion. In this paper we have presented a Home automation using Arduino and IOT. Our project proposes a low cost solution and Home automation is done using IOT system which uses mobile devices to control and analyze the basic home functions and features automatically through internet from any corner within short span of time. Arduino microcontroller is used to upload computer code to the physical board and controls sensors, relays as well as actuators.

Keywords-Component:- Automation, Arduino, PIR sensor, Relay Module, LED, Android and IOT.

I. INTRODUCTION

Now a days home and building automation systems are used more and more. Home Automation System project is designed to control home devices using Wi-Fi through a website or any android app which has internet connection. Home automation allows to control house appliances like door, light, fan, oven [1] and so on. It also provides emergency system and home security. Mainly we working on first only lights, It enables the consumer more control of his home it facilitates many conditions, for example if the consumer is on his way for the work and forgot to switch off the light then he or she can control it through the web page on the basis of IOT, many manual actions is replaced by home automation which reduce human efforts and time saving. The main purpose of this project is to develop a home automation system using Arduino and Application through IOT. In this project we have used PIR sensor to detect the any movement and motion in home and PIR sensor is used to detect the presence of unknown person which also ensures the safety of home.

This paper is organized in following manner. Section I starts with the brief introduction to our project that is home automation and the need to built it. The project aims at designing an advanced home automation system using Wi-Fi technology. The devices can be switched ON/OFF using a Personal Computer (PC) and Mobile Remote Application through Wi-Fi. Wi-Fi (Short for Wireless Fidelity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in

the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.

II. LITERATURE SURVEY

Wi-Fi based home automation system mainly consist three modules, the server, the hardware interface module, and the software package. The figure shows the system model layout^[4]. Wi-Fi technology is used by server, and hardware Interface module to communicate with each other. The same technology uses to login to the server web based application. The server is connected to the internet, so remote users can access server web based application through the internet using compatible web browser. Software of the latest home automation system is split to server application software, and Microcontroller (Arduino) firmware. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and preprogramed in the server. Another job is to report the and record the history in the server DB. The server application software package for the proposed home automation system, is a web based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole home automation system, setup, configuration. Server use database to keep log of home automation system components, we choose to use XML files to save system log.

III. SPECIFICATIONS

Serial No.	System	Communication interface	Controller	User Interface	Applications	Merits
1	Wi-Fibased using Arduino microcontroller through IOT	Wi-Fi (ESP8266-01)	Arduino	Web Application and android App	Temperature and motion detection, monitoring and controlling appliances	Low cost, Secure, Remotely controlled

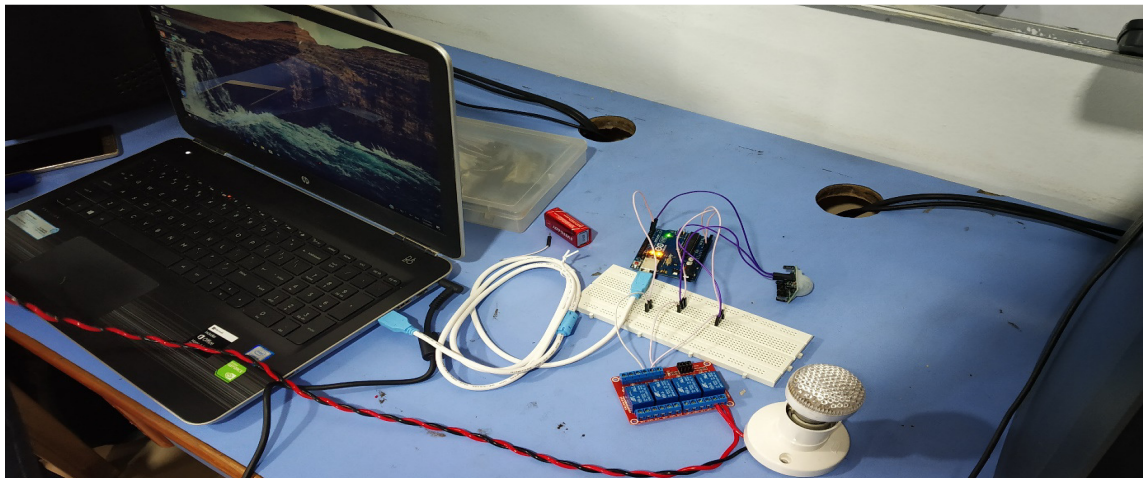


Fig:1.1 (Initial Setup)

IV. SYSTEM ARCHITECTURE

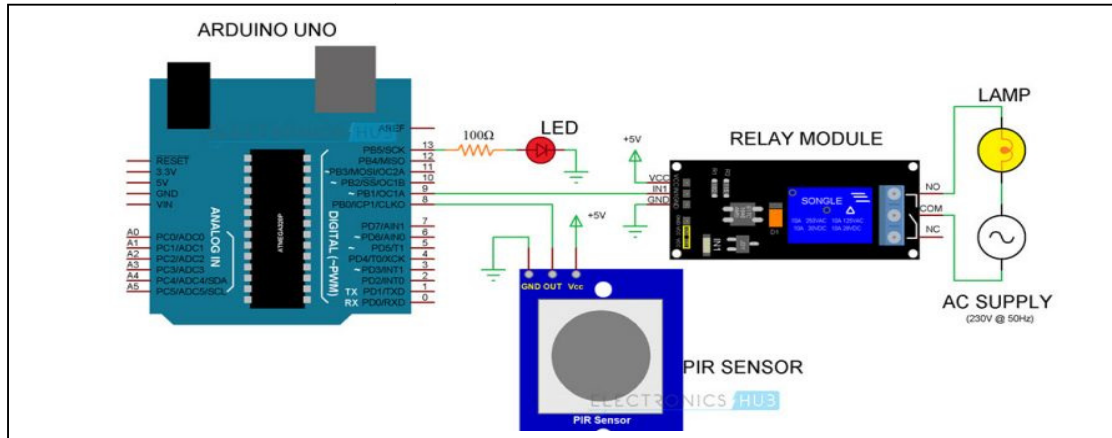


Fig:1.2 (System Architecture)

- The main objective of this project is to build a smart home device which can be used to control the home appliances via internet. The home automation device that you build can be integrated with almost all the home appliances and can be used to control them remotely from any part of the world.
- To facilitate the wireless connectivity with the system, the Arduino Uno will be embedded with a Wi-Fi module. This establishes the internet connection to the system and all the home appliances can in turn be connected and controlled by internet.[5]

• Project Description

NodeMCU ESP8266 :NodeMCU includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. (It also included Arduino and wi-fi module, it helps to build project)



fig:2.0 (Node MCU ESP8266)

Arduino Uno: The digital and analog input/output pins are equipped in boards that may be interfaced to various expansion boards and other circuits. Serial communication interface is a feature in this board, including USB which will be used to load the programs from computer. Above block diagram gives the representation of Home automation using arduino and IOT. Figure shows the connection between sensors, Wi-Fi module and microcontroller. When gas or person is detected the information will be displayed on LCD and buzzer will be on[2]. Using microcontroller information will be updated on webpage with the help of Wi-Fi module. The high-performance Microchip 8-bit AVR RISC based microcontroller combines 32KB ISP flash memory with read-while-write capabilities

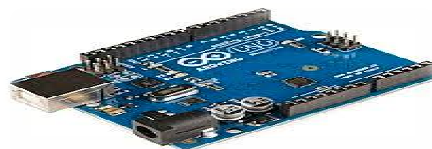


Fig:2.1 (Arduino UNO R3)

Wi-Fi Module: ESP8266 Wi-Fi module is generally used to establish the wireless communication between the devices. But this module is not capable of 5-3V logic shifting and will require an external logic level converter. The ESP8266 **Wi-Fi Module** is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor^[6].

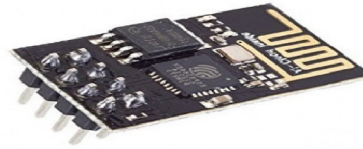


Fig:2.2 (ESP8266 Wi-Fi module)

PIR Sensor: It is capable of sensing motion of the human and therefore it is also called as a motion sensor. Whenever a human pass through this sensor it will automatically sense the motion through IR radiation and send the data to the microcontroller. A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) radiation being emitted from objects in its field of view. They are most often used in PIR-based motion detectors. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves.

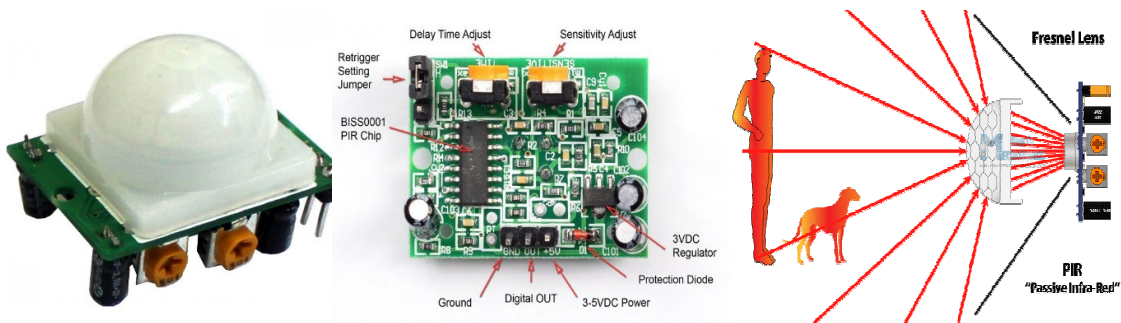


Fig:2.3 (Passive Infrared Sensor)

Relay Module:

The relay module is a separate hardware device used for remote device switching. With it you can remotely control devices over a network or the Internet. Devices can be remotely powered on or off with commands coming from ClockWatch Enterprise delivered over a local or wide area network. The relay driver IC that you use will have the following characteristics, 500-mA rated collector current, High voltage outputs – 50 V, Output clamp diodes, Inputs compatible with various types of logic^[7]. Relays are **switches** that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized.

Relay Pinout:

The following figure shows the relay pinout.

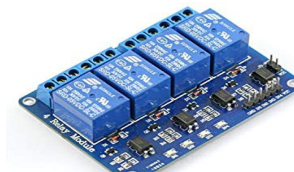


Fig:2.4 (Relay Module)

The six pins on the left side of the relay module connect high voltage, and the pins on the right side connect the component that requires low voltage the Arduino pins.

V. COMPARISON ON ALREADY EXISTING SYSTEM

Technology has now advanced in which we wish to take an integrated approach to home automation, allowing appliances to communicate with each other and to be controlled in flexible ways. A wireless network approach provides an easy, cost-effective and scalable solution to home automation. We have taken two ways to compare between Wi-Fi module and Bluetooth module. We think Wi-Fi Module is much better than Bluetooth module because Wi-Fi module is access wide range network, it can be access anywhere in the that place where wi-Fi module is placed. But Bluetooth Module is access only specified range so we overcome this problem, that's the reason we are using Wi-Fi module. Comparison between Wi-Fi module and Bluetooth module is shown in below.

1. Bluetooth based home automation system using cell phones: In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth[8]. The password protection is provided so only authorized user is allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicate the status of the device.

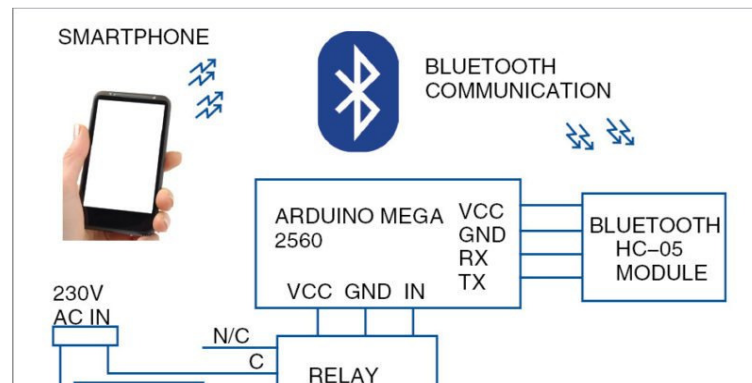


Fig:3.1 (Bluetooth Communication)

2. Wi-Fi based home automation system using cell phones: Wi-Fi based home automation system mainly consist three modules, the server, the hardware interface module, and the software package. The figure shows the system model layout. Wi-Fi technology is used by server, and hardware Interface module to communicate with each other. The same technology uses to login to the server web based application. The server is connected to the internet, so remote users can access server web based application through the internet using compatible web browser. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and preprogramed in the server. Another job is to report the and record the history in the server DB. The server application software package for the proposed home automation system, is a web based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole home automation system, setup, configuration. Server use database to keep log of home automation system components, we choose to use THINGSPEAK to save system log[9].

That's the reason Wi-Fi based home automation system is much better than Bluetooth technology. Wi-Fi is a technology that can control remotely and easily. In case future technology can improve or upgrade home automation system is involve in AI(Artificial Intelligence) Everything is automatically controlled by the robots and machines.

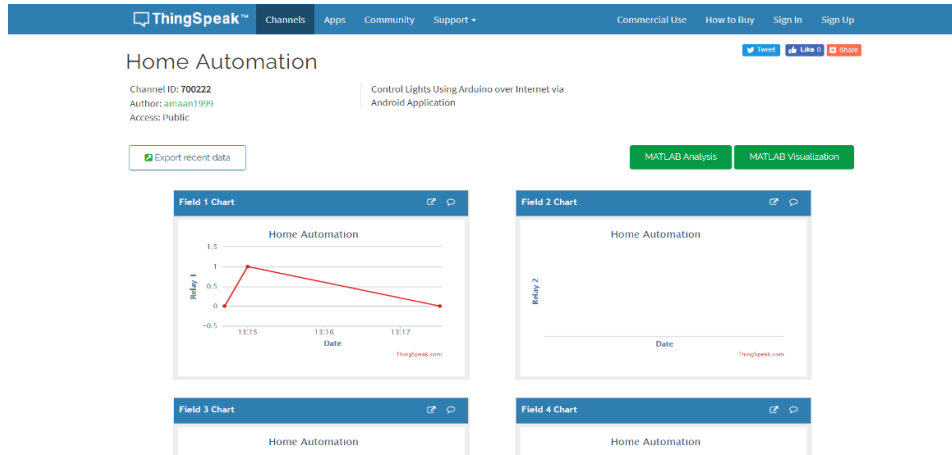


Fig:3.2 (Thingspeak Channel ID-700222)

According to its developers, "Thingspeak is an [open-source Internet of Things \(IoT\)](#) application and [API](#) to store and retrieve data from things using the [HTTP](#) protocol over the Internet or via a Local Area Network. Thingspeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates". In addition to storing and retrieving numeric and alphanumeric data, the Thingspeak API allows for numeric data processing such as timescaling, averaging, median, summing, and rounding. Each Thingspeak Channel supports data entries of up to 8 data fields, latitude, longitude, elevation, and status. The channel feeds support JSON, XML, and CSV formats for integration into applications[10].

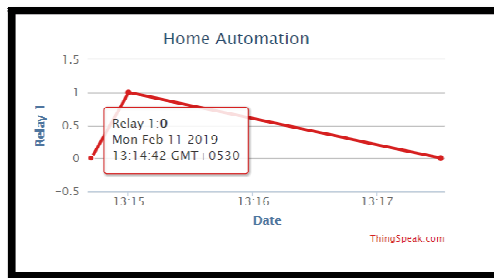


Fig:3.3 (Relay Off 13:14:42)

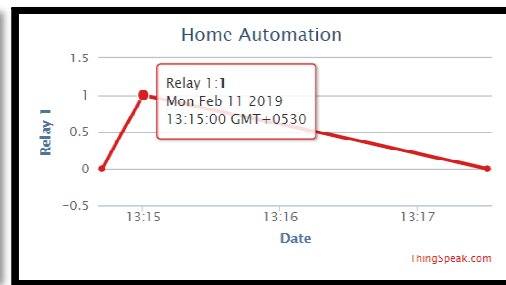


Fig:3.4 (Relay ON 13:15:00)

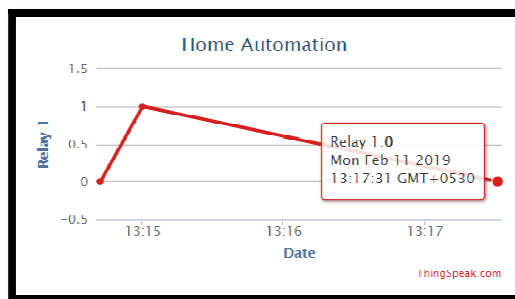


Fig:3.5 (Relay Off 13:17:31)

1. In Fig:3.3 Relay Module is OFF and initial time is 13:14:42 it means 13 hour, 14 minutes, 42 seconds.
2. In Fig:3.4 Relay Module is ON and time is 13:15:00 it means 13 hour, 15 minutes, 00 seconds.
3. In Fig:3.5 Relay Module is OFF and it takes time is 13:17:31 it means 13 hour, 17 minutes, 31 seconds. It takes more time because light is on for 2 minutes and 31 seconds. After 2 minutes and 31 seconds, the relay is off.

VI. CONCLUSION

This paper proposes a low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution. The approach discussed in the paper is novel and has achieved the target to control home appliances like a lights and others remotely using the Wi-Fi technology to connects system parts, satisfying user needs and requirements. Wi-Fi technology capable solution has proved to be controlled remotely, provide home security and is cost-effective as compared to the previously existing systems.

Hence we can conclude that the required goals and objectives of home automation system have been achieved. The system design and architecture were discussed, and prototype presents the basic level of home appliance control and remote monitoring has been implemented.

VI. ACKNOWLEDGMENT

We are feeling very proud and honoured to submit We want to give special thanks to our guide Asst. Prof. V.T . Thakare We are feeling very proud and honoured to submit We want to give special thanks to our guide Prof. V.P. Bhade Sir for guiding us very well. Also, we wish to give this project report on “Home Automation System using Arduino and IOT” .

VII. SCOPE OF PROJECT

Such Automatic Lights can be Implemented in our Rooms, Classrooms Offices, Stairs, Garages, and Wash-rooms Etc. where we do not need continuous lights but only when we are present. Also, we need not to worry about electricity as the lights get automatically off when there is no person. Hence, it will reduce electricity consumption by turning off lights when no human presence is detected.

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