

Smart Homes

Jinal Shah¹, Semil Shah², Monulal Vishwakarma³, Amey More⁴

¹Jinal Shah : Student, Dept. of Computer Engineering, Thakur Polytechnic, Maharashtra, India

²Semil Shah : Student, Dept. of Computer Engineering, Thakur Polytechnic, Maharashtra, India

³Monulal Vishwakarma : Student, Dept. of Computer Engineering, Thakur Polytechnic, Maharashtra, India

⁴Amey More : Student, Dept. of Computer Engineering, Thakur Polytechnic, Maharashtra, India

Abstract- *The science of today is the technology of tomorrow. This paper presents a low cost and user friendly home automation system. The term home automation we usually infer it as a costly complex circuitry system which automatically controls our home according to the surrounding environment. But it is not so, home automation is not at all complex and can be implemented to our home directly by adding a small hardware to our switchboard and the results vary according to the users choice. This system can have more application based on user, the only things which is to be added is the sensors. The hardware is based on an Arduino and Bluetooth board and via relays the home appliances are connected to the input/ output ports of this board. This system contains temperature, motion, IR and light sensors, for controlling it remotely we have used Bluetooth module to connect it with user's Smartphone. To give a user interface an app was built by us which connects to the hardware of the home automation system. The proposed prototype of the home automation system is been implemented and tested to give the exact and expected results. The communication between the cell phone and the Arduino Bluetooth board is wireless. The system was created by keeping in mind the features like low cost and scalability, which allows variety of devices to be controlled with minimum changes to its circuit.*

Keywords: Home Automation; Arduino; Embedded Systems; Android; Sensors.

1. INTRODUCTION

In today's generation our life is being automated at a drastic rate so do our home. Digital devices form a network in which the appliances and devices can communicate with each other using the embedded Bluetooth technology. In order to integrate new devices the system should be scalable. The devices can be easily controlled, monitored and setup. So it should provide user friendly interface. Moreover to realize the true power of iwireless technology the overall system should be quick enough and has high response time. Wireless technologies have become popular around the world and the consumers appreciate this wireless lifestyle which gives them relive of the well-known "cable chaos" that tends to grow in their homes. But to find an application to an

existing platform is a main deal. So we have come up with this project which automates our home on an existing platform. This means we don't have to change the layout of the home but to just add a small circuit to our switch board. This will change the way of living of a common man because this is affordable and has a great impact. One of its application deals with powering off the home appliances which are not in use to save electricity. So in total we have 5 application which has been implemented, but there are many other applications which can be implemented according to the users wish.

2. LITERATURE SURVEY

We conducted a survey and there exists no system at cheaper rates and which can be easy to maintain. Some systems are hard to install, some are difficult to handle and some are not much customizable by the user.

N. Sriskanthan [1] implemented the system for home automation using computer and hence it doesn't support mobile technology.

Muhammad Izhar Ramli [2] explained the model of home automation control using web. Also their server will auto restart if server is down.

Al-Ali and Al-Rousan [3] implemented a Java based automation system through WWW. Their model was a embedded board which was integrated into a computer based server at home.

Pradeep G [4] had a great idea and implemented a home automation system using Bluetooth which saves a lot of time and power using mechanism to save preloaded list by not making it to setup connection all the time when required.

Hasan [5] proposed a telephone and PIC remote control system for controlling devices but lacked wireless communication because of cable networks.

Neng [6] developed a system which only shows how to solve automation problems at software level.

Google and Microsoft [7] have recently entered the home automation domain. At the 2011 conference on I/O, Google announced “Google home”, its first standard to communicate with hardware by Android devices. The Android Open Accessory and the Accessory Development Kit (ADK) is the key for communicating with hardware and building external devices for Android.

3. OBJECTIVE

The basic idea of the home automation system is to use the sensors to get the inputs and according to that get the corresponding outputs. We have used Atmega328p [8] as a microcontroller and various sensors such as PIR sensor, IR sensor, LM35 temperature sensor and LDR sensor. We have implemented 5 applications which are:

1. Switching on the light when motion is detected.

In this application PIR sensor is used which senses motion and turns the light on. This application can be used in a corridor or a balcony.

2. Varying speed of the Fan in accordance with the temperature.

This application has a predefined temperature, beyond that temperature the speed of the fan increases so that the temperature of the room can be kept constant.

3. Switching on the electrical appliances remotely with the help of the smart phone.

Here we can connect any electrical appliances to the output which are relays. The number of appliances can change in accordance with the user. The system is been connected with the smart phone via a Bluetooth module and for an interface between them we have made an app which can be installed on an android device.

4. Automatic turning the lights on as the intensity of sunlight decreases.

In this application we have used LDR sensor which senses the intensity of light, if it decreases beyond a certain level then the lights in the house is been turned on.

5. Turning off the electrical appliances when no one in a room.

This is basically the main application which focuses on saving the electricity when there is no one in the room. This can be implemented on various levels such as our home, in schools, colleges, office, etc.

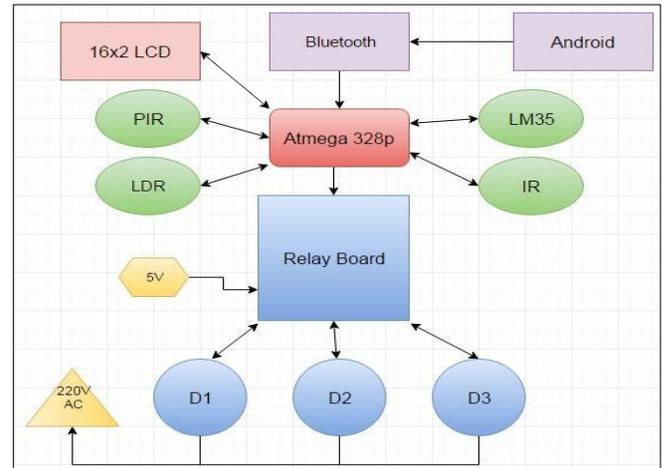


Fig. 1: Block Diagram of Home Automation

4. HARDWARE

4.1 LCD Display:

An LCD is an electronic embedded module which uses liquid crystal to produce visible image on screen. We are using 16x2 LCD which means 16 columns and 2 rows and is the most basic module used in every project. LCD can support two types of modes, 4-bit mode and 8 bit mode. In our project we are using 4-bit mode which overall requires 6 input from Atmega328p chip. LCD works on 5V supply and also has contrast control. This project uses LCD to display the count of people who enters a specific room using IR sensor module. LCD has two register one used for command and other for data. RS pin is used to select one of this registers. LCD also has background display led which can be used by giving 5V supply.

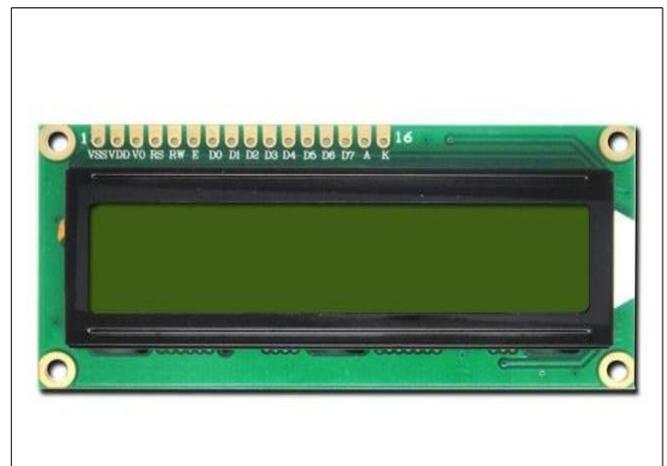


Fig. 2: Liquid Crystal Display 16x2

4.2 PIR Sensor:

The PIR sensor detects the infrared radiation from the surrounding. The infrared radiation varies for different objects depending on temperature and surface characteristics. Suppose a human passes in front of the wall, the temperature at that point in the sensors field of view rise from the room temperature to the body temperature. The sensor converts the resulting change in the infrared radiation into a change in the output voltage which results in the triggering of the detection. PIR sensors come in various configurations but the most widely used sensor comes in numerous Fresnel lenses which have a range of about 10 meters and the field of view of 180 degree.

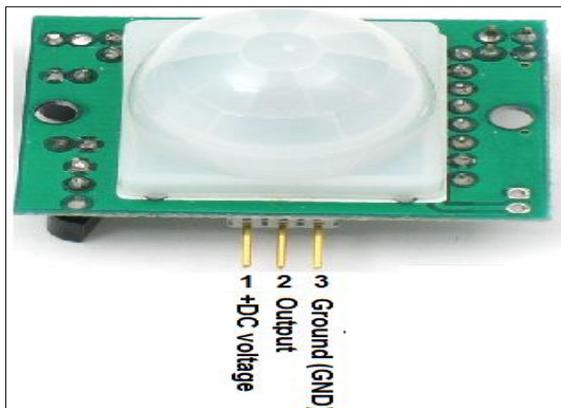


Fig. 3: PIR Sensor

4.3 LM35 Temperature Sensor:

The LM35 series is a precision integrated circuit with the output voltage directly proportional to the centigrade temperature. It has an advantage over the linear temperature sensor calibrated in Kelvin's as the user is not supposed to subtract a large constant voltage to convert it to centigrade. It is rated from -55 degrees to 150 degree Celsius and has an accuracy of 0.5 degree Celsius. It has some other features such as low heating, low output impedance, low cost and works from 4V- 30V.

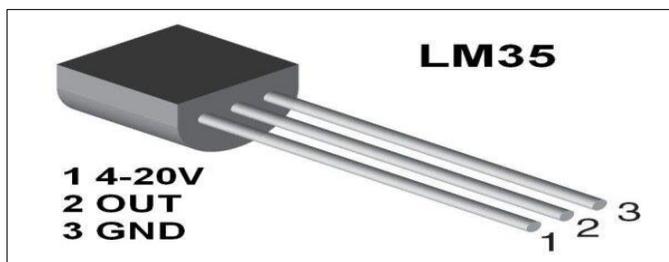


Fig. 4: LM 35 Temperature Sensor

4.4 LDR Sensor:

LDR is a type of a light controlled variable resistor. The resistance change depends on the intensity of the light. In dark the resistance of a LDR can go up to a few MΩ and in a room with high light intensity can be as low as few hundred ohms. It works on the principle of photoconductivity. In this project LDR is used as a sensor to sense the amount of light intensity and as per the conditions turn on/off the lights.

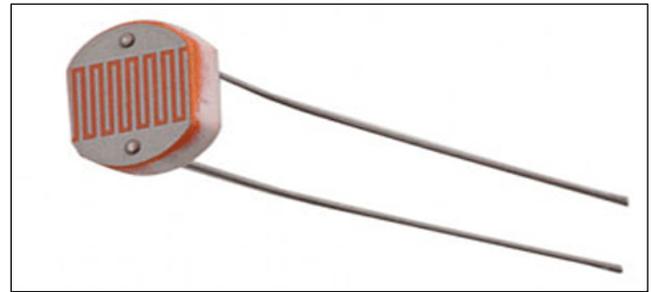


Fig. 5: LDR

4.5 IR sensor module:

The IR sensor is one of the most popular sensor which is used to detect obstacles. The IR sensor has a IR transmitter as well as a IR receiver. The IR transmitter transmits the IR rays which is been received by the receiver module. The IR output terminal varies depending upon the received IR rays. But first the received rays is been applied to the comparator circuit along with the transmitted rays which gives a overview of the temperature change in front of the sensor thus giving a corresponding output at the output terminal of the IR sensor.

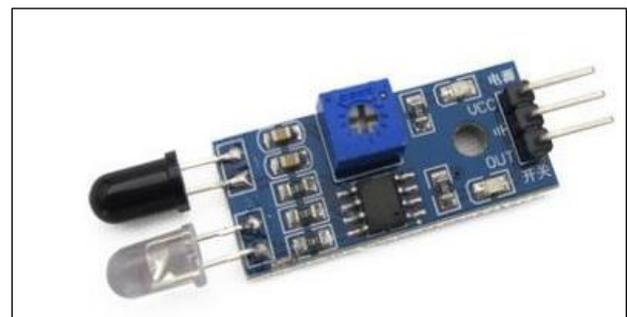


Fig. 7: IR Sensor Module

4.6 Relay:

Relay in simple language is a switch. Relays are used to drive external applications connected to the board with the help of microcontroller. In this system 5V relays are used to drive

the applications. Relays normally have 5 terminals. Two coil terminals, one common terminal, one normally open (NO) and one normally close (NC) terminal. Different types of relays works on different principle but most of the relays works on electromagnet principle to mechanically operate a switch.



Fig. 7: Relay

5. WORKING

There are 2 microcontrollers been used so that we can give more application to our home automation system. The 1st Atmega328p microcontroller has 3 applications.

1. The PIR sensor is been used in this application. When the motion is detected by this sensor, the output of the sensor turns high which is been fed to the microcontroller. If a high is been detected by it than it turns on the led which is been connected to one of its output. The led is been used in place of tube lights and bulbs to display the output.
2. In this application LM35 temperature sensor is been used to sense the temperature. A predefined value of the temperature is been set so that if the temperature rises beyond that value, than the DC fan connected to the output starts. The speed of the fan is been increased as the temperature increases with the help of pulse width modulation.
3. The third application turns on the electrical appliances like AC, Fan, Tube light, etc. by the user's Smartphone via Bluetooth. An interface of this was made in the form of an app which connects the module through Bluetooth. When a button (there are 3 buttons which performs 3 different actions such as switching the AC, Fan and Tube light on or off) on the app is been pressed , then it sends the message to the module which forwards it to the microcontroller. The microcontroller in return changes the state of the relay which is been

connected to its output. The relay than switches the state of the appliances to on/off.

The other 2 application is been implemented on the 2nd Atmega328p microcontroller.

4. The LDR senses the intensity of the light, when it falls beyond a predefined value then the microcontroller turns on a led which is been used to display the output.
5. There are 2 IR sensors been used, the 1st counts the number of people entering the room while the other counts the people exiting the room. As the count becomes 0 then after a certain interval of time the connected electrical appliances switches off. To display the output we have used a led and a relay.



Fig. 8: App for Home Automation

6. FUTURE SCOPE

All the above applications can be applied to the home automation system. This system is not only meant for our home but at various other places such as school, colleges and offices. The number of applications to this system varies according to the user. There are many other applications which are not been mentioned but can be implemented to this system. The working of this system can be more automated with the help of artificial intelligence which senses the action, gesture as well as the mood of the user and can give a corresponding result.

7. CONCLUSION

It is evident from the project that an individual home automation system can be cheaply made from locally available components and can be used to control many home

appliances. We have seen that the home automation system can be even used on an existing platform with minor changes and a small hardware required to attach with the existing power supply of the house. This system was also used in our project to save electricity by switching off the home appliances which weren't in use. This application can revolutionize the way of using the technology for the betterment of our life as well as conserving the valuable resources. Finally the project tested a number of times and was certified to control different home appliances

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