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Smart Home Automation System using Bluetooth and Infrared

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Abstract— IoT is a fast evolving and ever changing field. IoT enables, from the very basic sensors to intelligent computers to get connected, be a part of one network to share data to achieve wonderful functions which was previously not possible. There are many simple hardware that is common and cheap such as temperature and humidity sensor, PIR sensor, Bluetooth communication module IR emitter-detector pair. PIR sensor senses the presence of infrared rays nearby and is used to detect presence of humans. IR emitter-detector sets up IR field and can detect an intrusion in that field. We have used these technologies to bring a great lot of automation inside the home. They have been connected so as to automatically control the lights inside the house. They are also used to automatically control fan speed and AC to control temperature. These just do not make our life easier but also helps to reduce electricity bills and conserve power. Usually, the home automations lack in any security features. But we are using IR Emitter-Detector pair to sense any intrusion during the night time. Alarm will be raised upon the detection of any intrusion. We aim to provide solution to this problem.

Keywords— Arduino, Bluetooth, Android, RFID, GSM

I. INTRODUCTION

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

This is the era of automation. Everything from automobile assembly to steering and stabilization of ships is happening with minimal or reduced human intervention. But the automation has stayed mostly on industrial applications and has rarely moved to the domestic side. This project tries to bring about that change with the help of Arduino using Bluetooth and infrared technologies. Automation in homes includes features such as automatic lighting, automatic fan and appliances control, night safety alarm and display of current temperature and humidity.



Fig.1 Home automation

This transition has various advantages such as

- Lesser power consumption
- Increases safety

- Increases convenience
- Saves time
- Easier to use

The current project also uses gesture control. Here, commands can be sent to the Arduino microcontroller with the help of gestures given from his mobile device through an app. Even though this feature can be used by anyone, it has been introduced mainly for the benefit of blind citizens for their ease of access.

II. RELATED WORKS

Various methods have been proposed for development of home automation systems. Reference [1] is a home automation system which describes the approach to control various home appliances with ARM7 processor. Another proposed model based on IoT [2] uses Bluetooth and voice command is primarily concerned with the home automation system which uses Bluetooth for interaction between the android mobile application and the appliances under the control of the system. In another paper that tells about Bluetooth based home automation [3], which focuses on the design and implementation of a low cost, flexible and wireless solution to the home automation. Another Bluetooth based work [4] was to outline the design and implementation of an embedded system which can easily interface with the existing home appliances and communicate with a smart phone via Bluetooth using serial interfacing. Another work based on Bluetooth [5] takes care of addressed control of device using Bluetooth and internet/wired. In this paper [6], based on all the systems surveyed and their advantages and drawbacks, it presents the features to be possessed by an ideal system for home automation with remote access. This paper [7] points out the shortcomings of existing home automation systems in identifying and preventing sophisticated intruders in a home environment. Another system [8] has also been proposed by making use of Android application. This system mainly focuses on the Smart Living, more specifically the home lighting control system using Bluetooth technology. In this paper [9] a security interface and home automation system is presented using an Android mobile device. This paper based on real time home automation [10] points out how system is designed at low cost and is used to improve the standard of living in home. This paper [11] points out at Bluetooth Remote Home Automation System Using Android Application. This paper [12] gives basic idea of how to control various home appliances and provide a security using Android phone/tab. This project is based on Android and Arduino platform both of which are FOSS (Free Open Source Software). This home automation project [13] is made using atmega328 microcontroller and android application. This paper [14] have proposed a smart home automation system which is operated with the help of android smart phone by using Bluetooth Technology and home appliances will be controlled through FPGA using relays. This paper [15] focuses on the design and implementation of the Smart Home Automation Controller using Bluetooth and GSM for Android mobile phone. The purpose of this is to use mobile phone's inbuilt Bluetooth, SMS facility and Bluetooth serial module and GSM Modem for automation of Home Appliances.

III. PROPOSED WORK

The proposed system senses the temperature and humidity conditions prevailing inside the house. This enables us to achieve the smart lightning system. The purpose of the automated lightning system is not just to automatically turn on light and off according to the light conditions existing inside house but also to make the house, power efficient. By collecting the data regarding the temperature and humidity we can pre-programme fan speed to be controlled automatically. And we will set a threshold temperature and humidity; as soon as these limits are crossed AC is turned on automatically. Now-a-days smartphone are in wide use. We also designed a way to manually intervene the normal working use mobile application and attaching a Bluetooth module. But the thing that is unique in this work is we will make the app to be Gesture controlled. Thus, it enables even people with poor sight or blind people to be able to use the application efficiently. For the sake of disabled people, we also make the app to be voice command controlled. A user can either enable or disable any device through the voice commands given to the application in his phone.

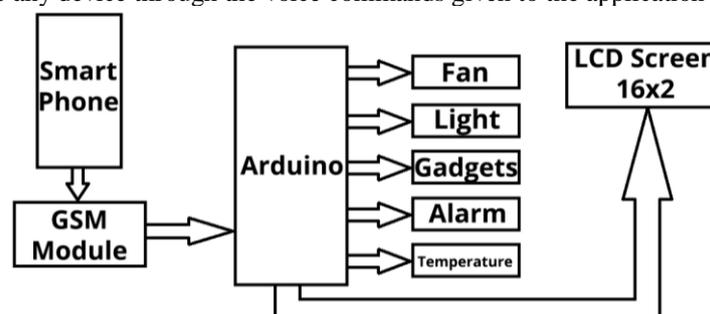


Fig.2 Block diagram of home automation

Sometimes we may need extra light or extra cooling at that time we can control it using Bluetooth app. It also supports the feature to be controlled through IR inputs in case we may want it to be controlled through remote. It also incorporates the security system along with the automation part. The security system is designed so as to work as an intrusion detection system during night. We have setup an IR field in the main entrance of house and backyard if anyone tries to cross this field, an alarm will be raised thus alerting the people nearby and owner. Integration of RFID can also be

tried for wirelessly recognition of owners. As soon as owner brings his car in front of garage the shutters can be automatically opened by confirming identity of owner through RFID tag. RFID tag can also be used to activate the automation system. As soon as owner reaches the main door during night lights inside can be automatically turned on.

The major components of the system architecture are Arduino Uno Board, Bluetooth Module, IR communication module, PIR sensor, DHT sensor and one smart phone. Arduino Uno board is used as a microcontroller. PIR sensor collects the brightness intensity inside the room. Moreover, we are using IR emitter-detector pair for setting up night safety alarm part. Arduino sends the message to the owner in case someone tries to cross the infrared field.

IV. IMPLEMENTATION

The project is an Arduino based implementation of a home automation system which can be remotely operated via a mobile device using Bluetooth and also via remote using infrared connections. The various functionalities of the project are as follows –

A. Connectivity

There are two ways to control the Home Automation System, Bluetooth and infrared.

Bluetooth connectivity is achieved with the help of a Bluetooth module that is connected to the Arduino microcontroller. The mobile device is then connected to the Arduino via the Bluetooth module; hence the mobile device can communicate with the whole system.

Infrared connectivity is achieved with the help of an infrared sensor connected to the Arduino microcontroller. Thus, an infrared remote can also communicate with the whole system.

B. Smart Lights

When movement is detected by the home automation system, the lights switch on.

Here, the movement is sensed through a passive infrared sensor. This sensor controls the value of a digital pin it is connected to. Based on this value the lights are switched on/off.

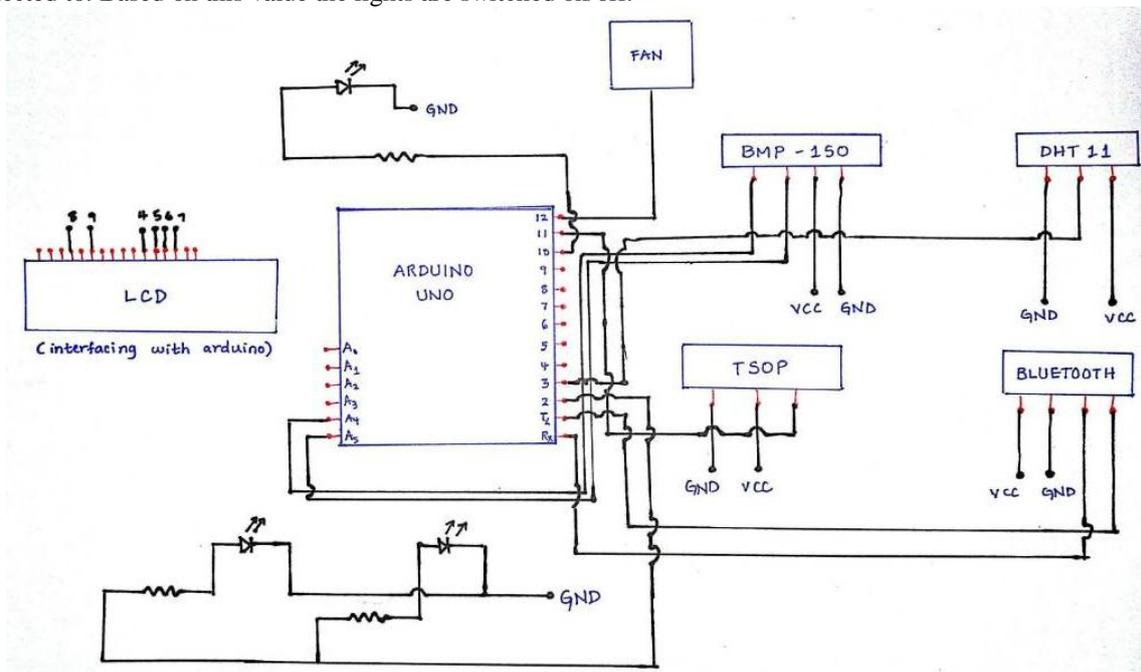


Fig.3 Circuit diagram of home automation

C. Automatic Switching Off All Appliances

The power to all appliances can be cut via the Arduino microcontroller. The command to perform the function can be given through the mobile device or the infrared remote.

D. Temperature Controlled Fan

The speed of the fan is related to the temperature of the environment. Higher the temperature, higher will be the speed of the fan.

The sensing is done with the help of a temperature sensor LM35. This sensor returns the temperature of the surroundings to the Arduino board and the result is forwarded to the fan.

E. Display of Temperature, Humidity and Pressure

These features will be displayed on the mobile device. The sensor used to achieve this is BMP180. This sensor collects all the information and relays it back to the Arduino microcontroller, which in turn sends it to the mobile device for display.

F. Gesture Input and Voice Commands

To make the project accessible to blind and senior citizens, communicating through the mobile device via Bluetooth is also possible with gesture inputs.

Gestures are simple figures drawn on the mobile device, where each gesture stands for a particular command. Also, a person can give the voice commands to the application in the phone which will enable or disable the devices.

G. Security Feature

In order to protect the house from burglars, a night alarm is setup at the main gate of the house. If any shadow of a person is visible at the front gate of the house, a siren will be enabled and with the help of GSM module a message will be sent to the owner which will be helpful if the owner is out of the house.

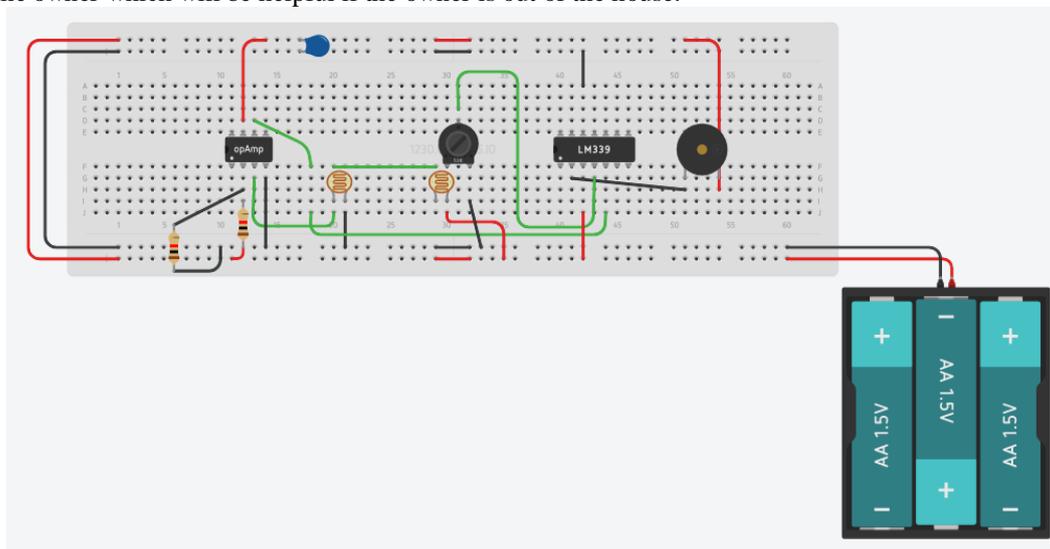


Fig. 4 Circuit diagram of security alarm

V. CONCLUSION

A successful implementation of this project would make available a system which provides complete home automation at a very less cost. It would help in automatically turning lights on and off with changing light conditions. Temperature will be automatically regulated with the combined use of fan and AC. It will also provide night safety alarm system during the night time. Care will be taken of visually impaired persons by including the gesture control features. An implementation of RFID system for confirming the identity of owner can be used as an extra feature for security as a means of confirming identity. Garages can be unlocked automatically. Lights can be turned off even during light if owner carrying RFID tag goes out. It will also automatically turn on light when he re-enters the house. All of this automation will help in reducing the electricity bill and conserving power.

VI. FUTURE WORK

For future work in the field of home automation system and security, we will consider a home automation system as a whole and develop behavior prediction and advanced sensing parameters that can help to identify and prevent skilled and sophisticated intruders. Security is vital for the proper implementation and development of the home automation systems. Moreover, it provides a sense of security to a home's inhabitants and puts their minds at ease. All the future work can be implemented on the same system by changing the application in the Android device.

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