IOT based Home Automation via Bluetooth

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Abstract—**The world is moving rapidly towards automation. People have less time to handle any work so automation is a simple way to handle any device or machine that will work to our desire. This paper presents an ingenious remotely sensible system that controls the home appliances by using Bluetooth. Home automation system gives a simple and reliable technology with Android application. Home appliances like fan, Bulb, AC, automatic door lock are controlled by Home automation system using Arduino Uno with Bluetooth module. The paper mainly focuses on the monitor and control of smart home by Android phone and provides a security based smart home, when the people are not present at home.This paper motive is controlled home appliances in smart home with user friendly, design at low cost, simple installation.**

Keywords—Arduino, Home automation, Bluetooth, Smart phone, Security

I. INTRODUCTION

Nowadays everyone has a smartphone and wants to control everything from it. Everyone knows how to control mobile phones so it is easy to use and understand. Lights, fan, switches, refrigerator are controlled through Bluetooth based remote using arduino.The designing of home automation are going to become simpler and more popular because most people use smartphones these days.

In this device we are using Arduino which is the most commonly used device for automation.Arduino is connected with the Bluetooth module which receives the information from the user. Arduino is also connected to a relay, which receives information from Arduino and performs the operation as a switch. Home automation involves a degree of computerized or automatic control to certain electrical and electronic systems in a building.

a. Problem Statement

To build a mobile application to control all the electric/electronic devices connected to switches to provide flexibility of doing things and above that securing homes or workplaces.

b. Objectives of Home Automation

The objective of this project is to implement a low cost, reliable and scalable home automation system that can be used to remotely switch on or off any household appliance, using a microcontroller to achieve hardware simplicity, low cost short messaging service for feedback and voice dial from any phone to toggle the switch state.

II. LITERATURE SURVEY

1) IMPLEMENTATION OF INTERNET OF THINGS FOR HOME AUTOMATION:

Mamata Khatu, Neethu Kaimal, Pratik Jadhav and Syedali Adnan Rizvi presented a paper on the implementation of Internet of things for home automation. This paper mainly focused on IoT coverage that connects all the variety of objects like smartphones, tablets, digital cameras and sensors to the internet and thus provides many services and huge amounts of data and information. They also focused on Cloud computing, Cloud based platforms help to connect the things that surround us so that we can easily access anything at any time and in any place. They have illustrated sensing as a service on cloud by using certain applications like Augmented Reality, Agriculture, Environment monitoring etc. and finally they have proposed a prototype model for providing sensing as a service

on cloud. The society needs new and scalable, compatible and secure solutions for both the management of the ever broader complexly networked Internet of Things. Security concern is overcome by this model since we are using Wi-Fi Wireless Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA) are two most used security accesses used in Wi-Fi.

2) BLUETOOTH BASED WIRELESS HOME AUTOMATION SYSTEM USING FPGA:

B.Murali Krishna, V.Narasimha Nayak, K.Ravi Kishore Reddy, B.Rakesh, P.Manoj Kumar and N.Sandhya they presented a paper on the Bluetooth based Wireless Home automation system using FPGA.They primarily focused on Bluetooth technology. With the help of the Bluetooth module (HC-05) and Android Phone, they control the home appliances, which are all connected to the FPGA board. Thus, they have mentioned the advantages of home automation, which not only reduces human efforts, but it is also energy efficient and time saving. Moreover, they have included that it is also to help the handicapped and old aged people to control the home appliance without any difficulties. We need a module so that the range will be high as well as it can operate in different frequencies. This drawback is overcome by our model.Wi-Fi based networks work at 2.4, 3.6 and 5 GHz. In addition, it can extend up to a 100m range.

III. EXISTING METHODS

Lately, people have realized the importance of a centralized system in their smart home ecosystem. Instead of individual commands for each device, they can set up a system to command and operate them all. And this centralized, smart system is what makes their home smarter.

1. **Zigbee based home automation system using cell phones:** To monitor and control the home appliances the system is designed and implemented using Zigbee. The device performance is recorded and stored by network coordinators. For this the Wi-Fi network is used, which uses the four switch port standard wireless ADSL modem router. The network SSID and security Wi-Fi parameters are preconfigured. The

message for security purposes is first processed by the virtual home algorithm and when it is declared safe it is re-encrypted and forward to the real network device of the home. Over the Zigbee network, the Zigbee controller sent messages to the end. The safety and security of all messages that are received by the virtual home algorithm. To reduce the expense of the system and the intrusiveness of respective installation of the system Zigbee communication is helpful.

2. **GSM based home automation system using cell phones:** Because of the mobile phone and GSM technology, the GSM based home automation is a lure to research. SMS based home automation, GPRS based home automation and dual tone multi frequency (DTMF) based home automation, these options we considered mainly for communication in GSM. The figure shows the logical diagram of the work of A. Alheraish, it shows how the home sensors and devices interact with the home network and communicates through GSM and SIM (subscriber identity module). The system uses a transducer which converts machine function into electrical signals which goes into the microcontroller. The sensors of the system convert the physical qualities like sound, temperature and humidity into some other quantity like voltage. The microcontroller analyzes all signals and converts them into commands to be understood by the GSM module. Select appropriate communication methods among SMS, GPRS and DTFC based on the command which received the GSM module.
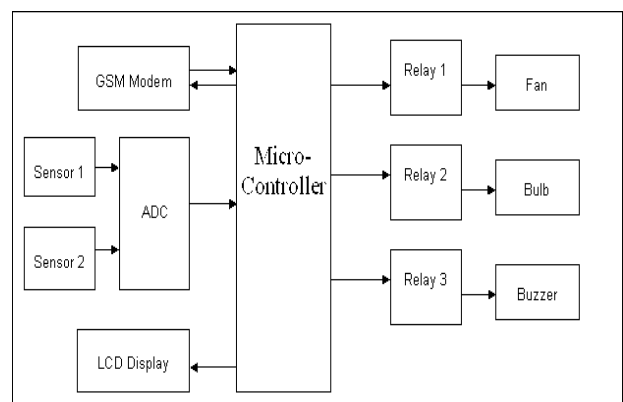
3. **Wi-Fi based home automation system using**

cell phones: This consists of three modules, the server, the hardware interface module, and the software package. Wi-Fi technology is used by server, and hardware Interface modules to communicate with each other. The server is connected to the internet, so remote users can access server web based applications through the internet using a compatible web browser. Software of the latest home automation system is split to server application software, and Microcontroller (Arduino) firmware. The Arduino software, using IDE, comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and pre-programmed 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. Server application software is culpable of maintaining the whole home automation system, setup, configuration. Server uses a database to keep log of home automation system components, we choose to use XML files to save system log.

IV. PROPOSED METHODS

Home automation describes a system of networked, controllable devices that work together to make your home more comfortable, customized, efficient and secure.

In this device there are five main parts: **Arduino, Bluetooth module, Relay drivers, android application and step down transformer.**

1. We provide power to the step down transformer, it steps down the input voltage and is given to the arduino with a VIN pin.
2. The Bluetooth module is also connected with an arduino to Rx and Tx pin that provides the information to the microcontroller.
3. Microcontroller reads the information and sends it to the relay drivers which work as a switch.
4. In Arduino we upload the program as per requirement then it performs some mathematical and logical operation to control the relay drivers.
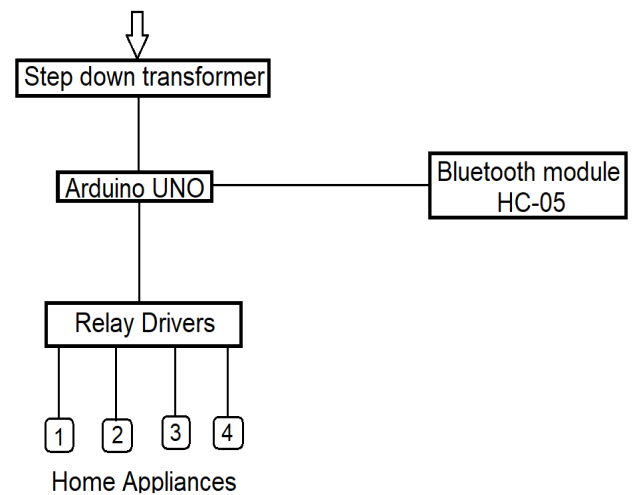
V. DESIGN

1. The Bluetooth module has 4 – pins: VCC, TX, RX and GND.
2. The TX and RX pins of the Bluetooth module must be connected to RX and TX pins of the Arduino. In Arduino UNO, we are defining pins 2 and 4 as RX and TX using software.
3. Hence, TX of Bluetooth is connected to pin 4 of Arduino.
4. But when connecting RX of Bluetooth to TX of Arduino, we need to be careful.
5. A voltage divider network consisting of 10K and 20K resistors are used to reduce the voltage to 3.3V approximately.
6. Connect the digital I/O pins of the Arduino to input of the relay board.

Experimental Setup
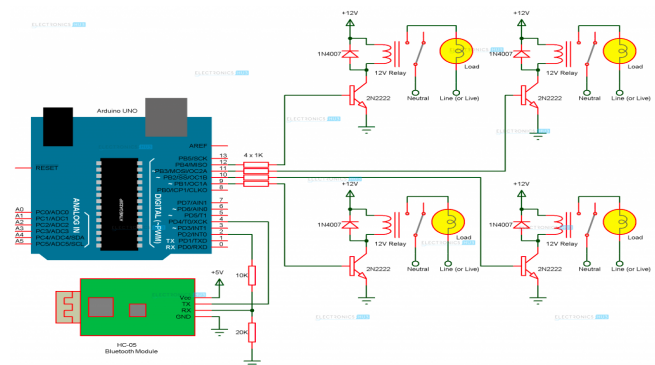
VI. IMPLEMENTATION

. When the power is turned on, the connection LED on the Bluetooth module starts blinking and is connected to the bluetooth app.

. Now, in the app, we need to set different keys for different loads and their corresponding value that must be transmitted when that key is pressed.

3. Then we are ready to control the loads. When a key is pressed in the smartphone, the Bluetooth module receives the corresponding data and in turn transmits that data to Arduino.

4. For example, if we press "LOAD 2 ON", then the data received by the Bluetooth module is "2".

5. This data is transmitted to Arduino. Arduino then compares the received data with the data written in the sketch and accordingly turns on the load 2.

6. Using this type of connection, we can control i.e. turn on or off different home electrical appliances using our smartphones.
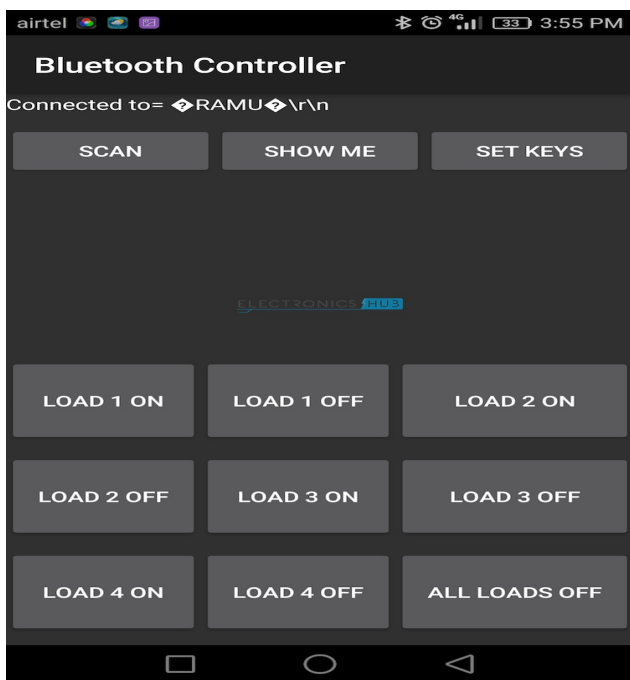
A. Hardware required
1) Arduino UNO
2) HC – 05 Bluetooth Module
3) 2N2222 NPN Transistor * 4
4) 1N4007 Diode X 4
5) 12 V Relay * 4
6) 12 V Power supply
7) Smartphone (Bluetooth enabled)

B. Software required
1) Arduino Integrated Development Environment (IDE)
2) Bluetooth terminal application

C. Algorithm
1) Receive the instructions in ASCII format from the bluetooth enabled Android smartphone using the bluetooth module and pass it on to the microcontroller.

2) The microcontroller does the main processing part.

3) When the controller receives a particular ASCII value it switches ON or OFF a relay. And the relay acts as a switch for appliances.

4) A particular ASCII value is assigned for one and only one relay. When an ASCII value is passed for the first time, it switches ON the relay and if the same value is passed again, the relay gets switched OFF.
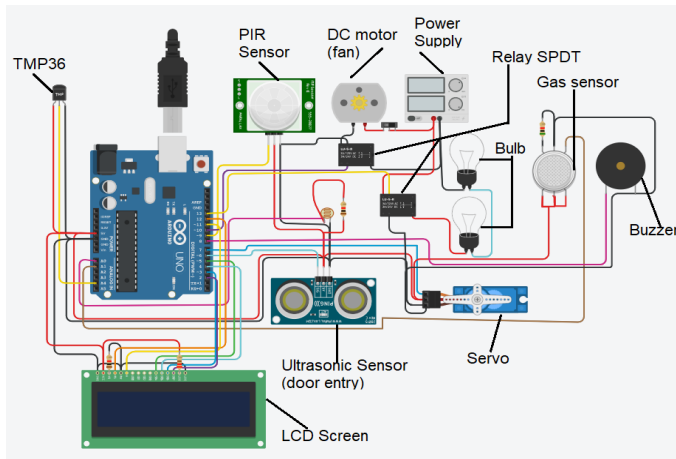
VII. SIMULATION

A. Components
- Arduino Uno
- Ultrasonic Distance Sensor
- Positional Micro Servo
- PIR Sensor
- DC Motor
- Relay SPDT
- 20.8, 5 Power Supply
- Slide Switch
- Photoresistor
- Light bulb
- Gas Sensor
- Piezo Buzzer
- Temperature Sensor [TMP36]
- LCD 16x2

B. Circuit Design

The initial setup is as shown below. The ultrasonic distance sensor is used to measure the distance of the person from the door, if distance is within the range the door opens this is shown by servo motor movement. A PIR sensor is used to know the movement in a room, if any movement then DC motor(fan) and bulb on. Photoresistor is used to check the intensity of light in a room, when the room's dark bulb automatically glows. Gas sensor is used to check if any gas leakage in the home, if there is a gas leakage the buzzer alarm. Temperature sensor is used to check the temperature and if the temperature is greater than 30°C, the DC motor(fan) automatically ons. Relay SPDT is used to connect the appliances in the home and a slide switch is used to manually remove the connection. Power supply is the power source for the whole circuit.

Circuit Design of simulation in Tinkercad

C. Mathematical Equations

1. To change the distance value recorded by the ultrasonic sensor in inches to cm.
   Speed of ultrasonic = 0.034 cm/μs
   Distance = time * speed
   Distance(cm) = (time/2) (μs) * 0.034(cm/ μs)

2. To change the temperature recorded from voltage to degree celsius
   temp = (double)voltage / 1024
   temp = temp * 5
   temp = temp - 0.5
   temp = temp * 100

VIII. RESULTS

A. Simulation Results
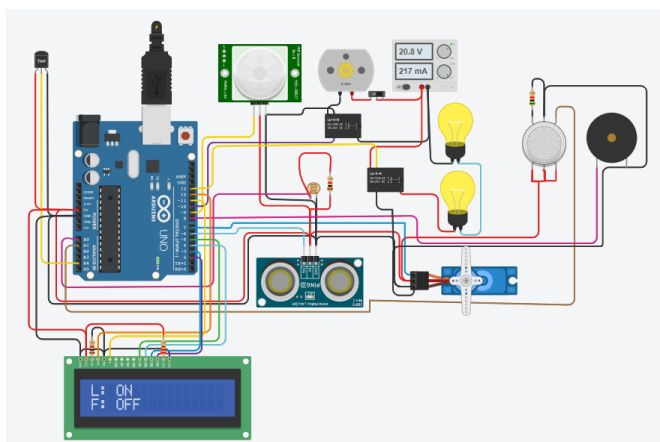
Intensity of light in the home is less, and the bulb glows automatically.
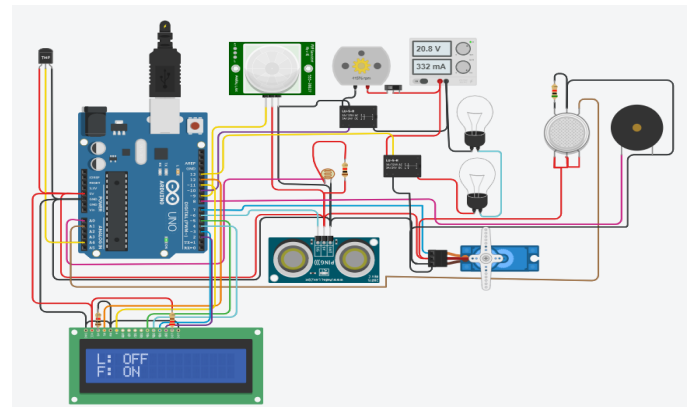
When the temperature is greater than 30℃, the fan will ON.
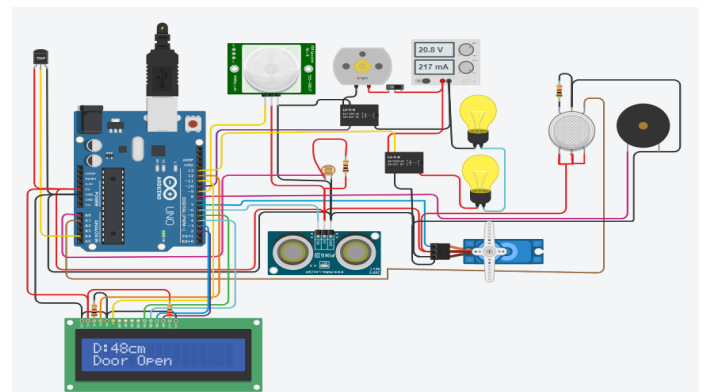
Person is within the range, the door opens.Can be seen through the change in servo position.
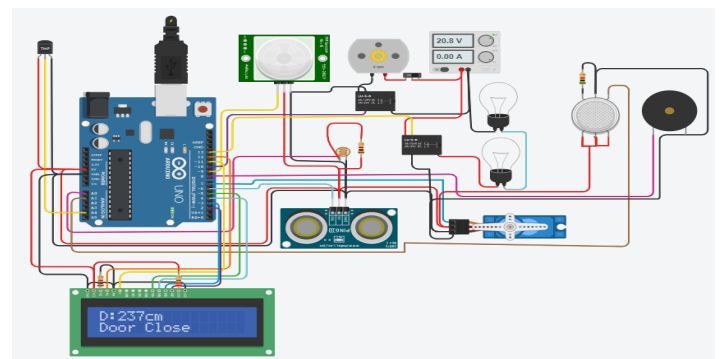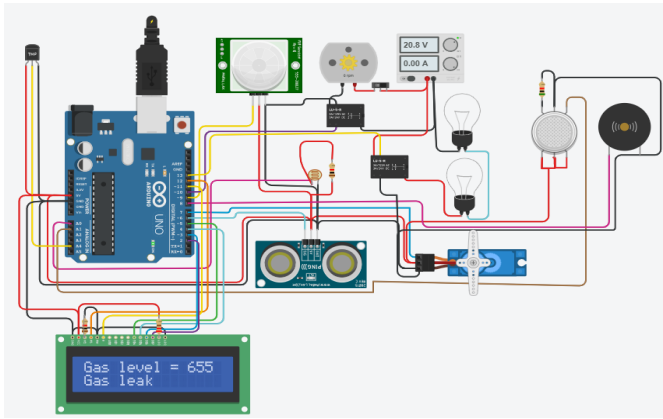

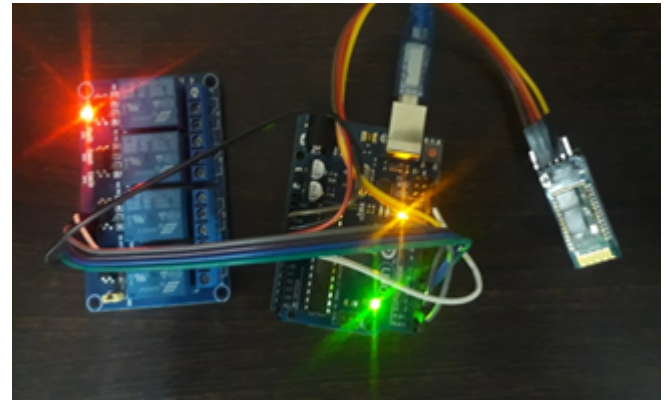Person is not within the range, the door closes. No change in servo position
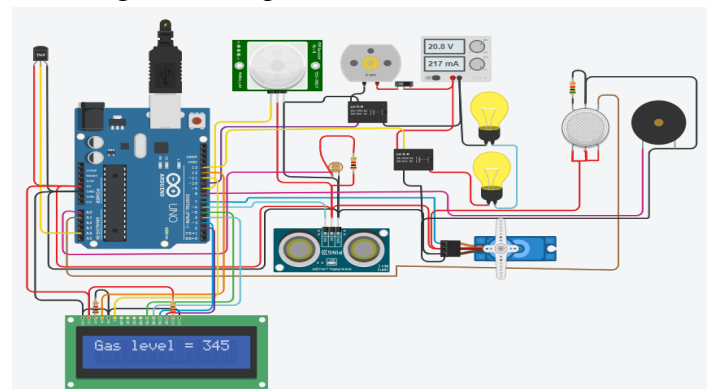
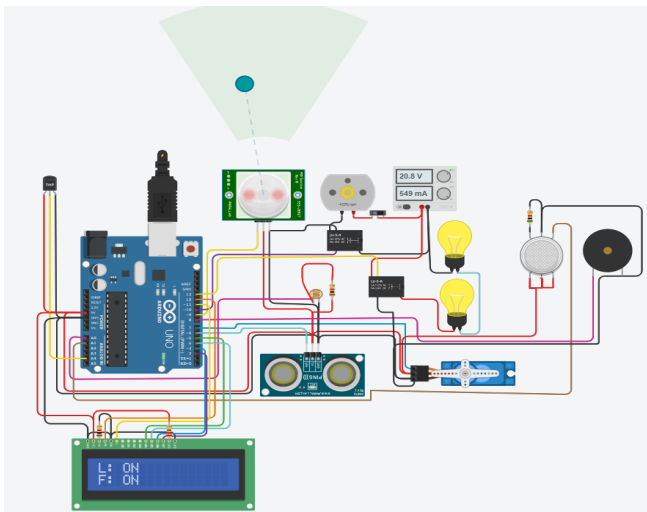Gas level is within range, ie, no gas leakage.

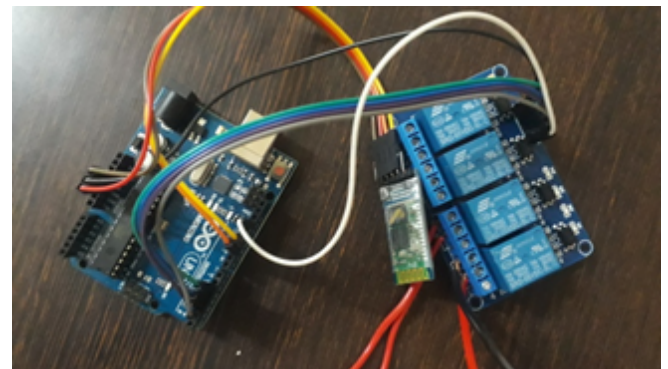Gas value above 600, hence there is "Gas Leak"

When the person enters the room, both fan and light turns ON.

B. Anticipated Results

Through this project, an automation system has been created so that we can easily control home appliances like light, fan, tube light, AC, bulb, and so on. One of the objectives is saving time and low cost projects. It is controlled by a mobile application, no extra training is required. Hence, easy installation and user friendly. We can change the controlling system as our requirement. The system is easy and secured for access from an user or intruder. Final outcome of the project is given below.

Arduino with relay module

Arduino with Bluetooth
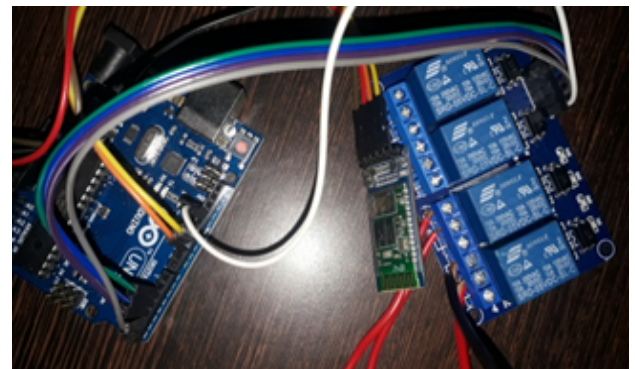
Relay module with Bluetooth
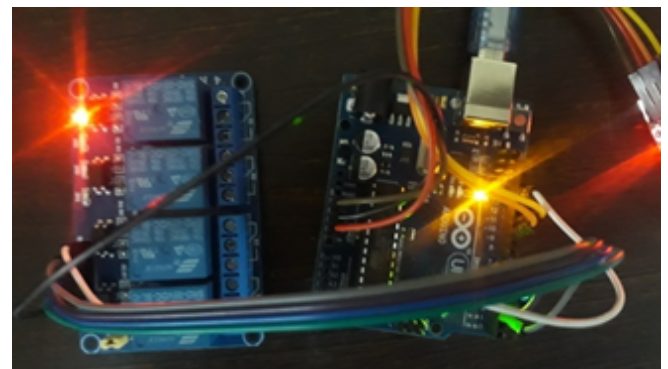
Home Automation

IX. Future Enhancement

1) **Smart Spaces Outside homes:**
Smart parking through sensors will help to recognise whether parking is available or not. Camera monitoring can be done with the help of Artificial Intelligence and computer Vision, both parking facilities and security can be provided. It would be a faster and smoother process and act as a reference for other smart systems to be built accordingly. Streetlights can also be automated through sensors and built for effective use for the people nearby.

2) **Development of smart appliances:**
The devices which we use to use like television, refrigerator and even the mirror are getting smarter today with the evolution of technology. The smart mirror should not only act as a face video but also help with other tasks like listening to music and stuff. The refrigerator has been upgraded to sense the temperature outside and operate accordingly. The washing machine will wash the clothes according to the clothes material and switch off after drying. They will keep on advancing as the technology evolves.

Conclusion

It can be concluded from the above discussion that Home automation is a special kind of device which controls home appliances with extra effort. We demonstrated how home automation is made, discussed methodology and what its application can be. In future, new technology can be included which reduces human effort, which is being researched. We've created a type of device which is compact in size, low cost, more capacity, long life and has more distant signal receivers. The need of this research paper is to create a device which saves electricity and improves human life style. The current system supports efficient power usage, as well as, remote controlling of the home appliances.

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