Wireless Home Automation System using ZigBee

Aastha Jain[1] Dhruvesh Shah[2] Arbaz Khan[3]

[1,2,3]B. Tech Student

[1,2,3]Department of Computer Engineering

[1,2,3]NMIMS Mumbai, India

Abstract— With the advancement of technology and increase in the demand of automation, it has become very important to have a system that can reduce human efforts and thus make life easier. Our system does the same by controlling various appliances.

Keywords: ZigBee, Arduino, LDR, Temperature Sensors, Internet of Things, Relay, Driver Circuit

I. INTRODUCTION

Home automation is one of the major growing industries that can change the way in which people live. The aim of the reported Wireless Home Automation System (WHAS) is to provide those with special needs with a system that can control the on/off status of electrical devices, such as lamps, fans, television, etc. in our homes. This home automation system is intended to control all lights and electrical appliances in a home or office using sensors. //The emergence of new technologies and smart devices had made peoples' lives very comfortable and convenient. With the increasing demand for a high standard of living, Smart home, which is one of the most popular applications of IoT is grabbing the spotlight on a global level. Though the concept of home automation was conceived a long time ago, the technical complexity, high cost and incompatibility with existing devices prevented it from becoming a reality in every house. But now with the rapid development of internet of things, wireless technology and ubiquity of smart phones and connected devices, home automation in every home is now a very real possibility.//

II. COMPONENTS AND SOFTWARE USED

The components that is used in this project are: -
- Arduino Uno
- ZigBee
- Temperature Sensor
- Light Sensor
- LCD
- Bulb
- AC Fan
- Relay Circuit
- Driver Circuit

The Software that is used in this project are: -
- Arduino IDE
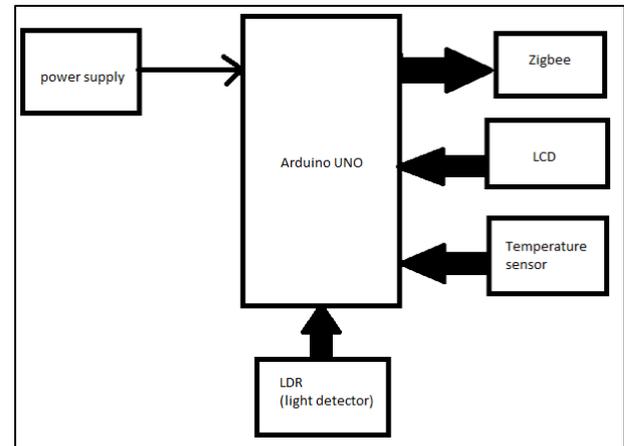- XCTU

III. BLOCK DIAGRAM

Fig. 3.1: Sender Side

A. Sender End Working

- The temperature sensor on the sender side senses the temperature and sends the signals to arduino.
- The coordinator (sender ZigBee) sends these signals to the receiver (receiver ZigBee).
- The required actions performed based on the temperature sensed.
- The light detector detects the light and sends the signals to arduino and then the signal goes to the coordinator and then to the receiver ZigBee and the required action is performed based on the light detected.
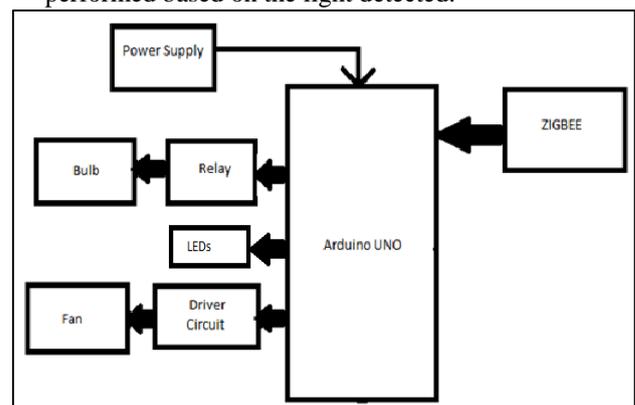

Fig. 3.2: Receiver Side

B. Receiver End Working

- The temperature sensed by the sensor is sent by the coordinator to the receiver and then to the receiver side arduino.
- The arduino compares the temperature with the required temperature and accordingly turns on the bulb or the fan.
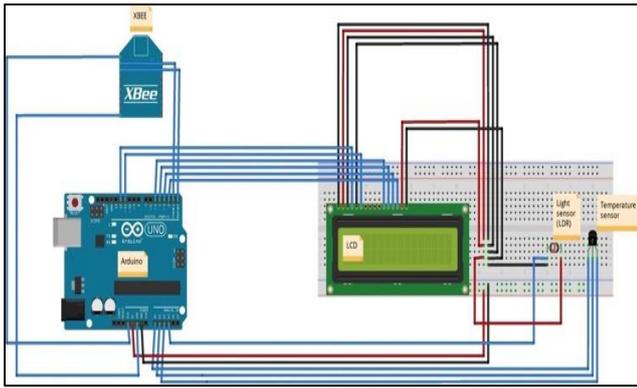
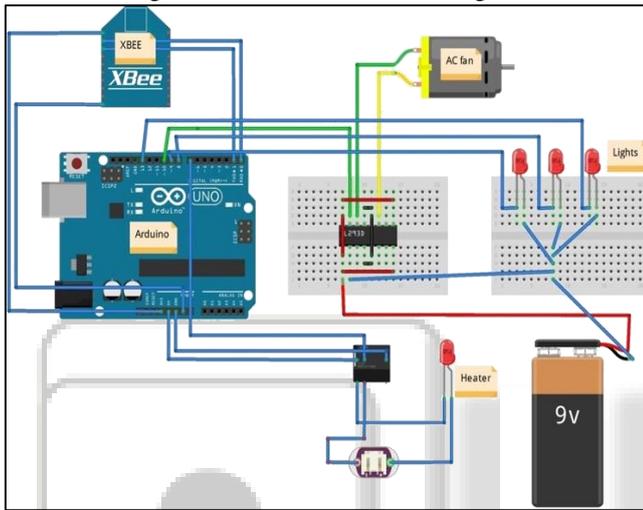## IV. CIRCUIT DIAGRAM

Fig. 4.1: Sender End Circuit Diagram

Fig. 4.2: Receiver End Circuit Diagram

WHAS (wireless home automation system) is a project based on wireless home automation using zigbee.This project consists of a temperature sensor, light detector, a fan, a bulb, a relay circuit, arduino, etc.

The bulb in the project represents a heater and the fan represents an air conditioner, initially the temperature sensor senses the temperature of this houses. This temperature is displayed on an LCD. The temperature required by the user is fed in the system through a program (some modifications can allow the user the set the temperature manually). As the temperature has been set to a particular value through a program, this system tries to maintain that temperature accordingly. If the temperature sensed is greater than the user's requirements then this system sends this signal to the sender zigbee(coordinator) and through the sender zigbee the signal is sent to the receiver zigbee, the receiver gives signal to the arduino on the receiver side.

The arduino on the receiver side then turns on the fan (that represents an air condition), to increase the speed of the fan we have used a driver circuit which gives efficient energy for the fan to rotate at it's maximum capacity with the help of a 9 volts battery (the fan is of 12 volts), using a 12 volts battery to power the fan is more preferable to make it rotate at it's maximum capacity, similarly if the sensed temperature is less than the users requirement a signal is sent to the sender zigbee with the help of the sender arduino this signal is then sent to the receiver zigbee. The receiver zigbee then sends the signal to the arduino on the receiver side and the bulb is turned on, now an arduino with an output of only 5V is not capable of powering a bulb, which requires much more power, the solution to this problem is using a relay circuit that connects to the power supply.

The supply is switched on and the relay circuit is connected to the bulb so that it can supply enough power for it to turn on. As soon as the power supply is given to the relay through a supply that is 220v, the relay provides a resistance so that it can supply only the required power to the bulb (giving too much power to the bulb can destroy the bulb or can even permanently damage the bulb). As the resistance increases it passes only the required power to the bulb power to the bulb and the bulb turns on.

For example if the temperature required by the user is 21 degrees and the temperature sensed by the temperature sensor is 25 degrees clearly the user wants a temperature that is 4 degrees cooler. Now to make the temperature decrease by 4 degrees there is only one solution, that is turn on the fan (Air Conditioner). The zigbee on the sender side gets a signal through the arduino and this signal is then forwarded to the receiver zigbee. The signal is given to the arduino on the receiver side to turn on the fan. The arduino turns on the fan with the help of the driver circuit that is given power through the battery and keeps it on till the temperature reaches 21 degrees.

There is a light detector that detects the light and accordingly turns on the LEDs. The use is that if the light detector detects sunlight the lights in this houses will be off and as the detected light (sunlight) reduces, the lights are turned on accordingly.

The LDR detects the sunlight and gives values in numbers as the light decreases the number decreases as well for example if too much of light is detected the value is above 100 and as the light decreases the number decreases as well i.e. it might reach upto 30 or 35.

In this system if the value goes 25, a signal is sent to the sender zigbee through the sender arduino, the coordinator zigbee sends this signal to the receiver zigbee and the through the arduino on the receiver side three LEDs are turned on and if the value goes beneath 50, a signal is sent to the sender zigbee through the sender arduino, the coordinator zigbee sends this signal to the receiver zigbee and the through the arduino on the receiver side two leds are turned on and if the value is beneath 100 a signal is sent to the sender zigbee through the sender arduino, the coordinator zigbee sends this signal to the receiver zigbee and the through the arduino on the receiver side only one LED is turned on. Accordingly the LEDs are turned on according to the darkness if the room is very dark it will turn on 3 LEDs, if the room is a bit brighter 2 LEDs are turned on and accordingly if the room is too dark all the three LEDs go on.
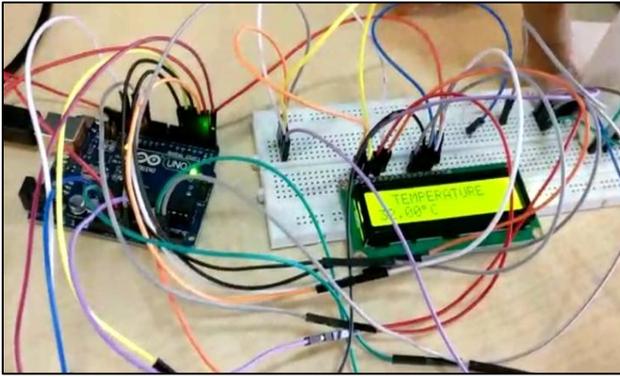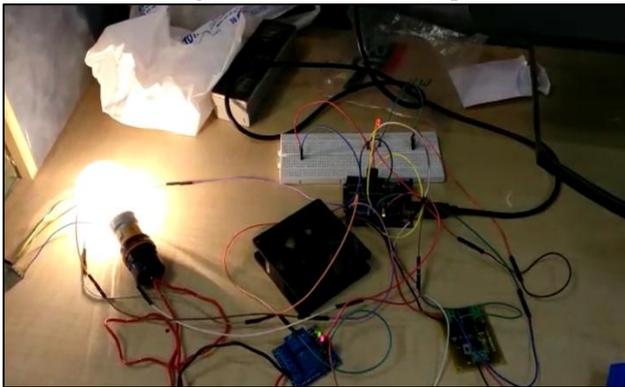
V. SETUP

Fig. 5.1: Sender Side Setup

Fig. 5.2: Receiver Side Setup

VI. ADVANTAGES AND DISADVANTAGES

A. Advantages

- Lazy to turn on /off home appliances are common problem among us. This can be overcome by a smart home system.
- This system has a light sensor (LDR) which controls the number of room lights to be turned on/off.
- Transmission of data is wireless using a device called ZigBee.
- It is low power and low data rate wireless system.
- ZigBee operates at 2.4GHZ and limits the transmission distance to 10-100 meters.

B. Disadvantages

- Lazy to turn on /off home appliances are common problem among us. This can be overcome by a smart home system.
- This system has a light sensor (LDR) which controls the number of room lights to be turned on/off.
- Transmission of data is wireless using a device called ZigBee.
- It is low power and low data rate wireless system.
- ZigBee operates at 2.4GHZ and limits the transmission distance to 10-100 meters.

VII. FUTURE SCOPE

- The user can manually be allowed to set the temperature rather than giving an input through the program.

- Once the required temperature is reached the device that is on (fan or bulb) should be turned off.
- Voice recognition can be integrated in this setup to allow paralyzed individuals to easily use this system.
- Furthermore the system can also be used for enhancing the security of our houses using laser sensors that can detect open door.

VIII. CONCLUSION

As the population increases gradually from last two decades, this wireless network becomes very popular to provide better life. With the more advancement of technology, WHAS (Wireless Home Automation System) becomes common in every home just like Television and Computer. The use of ZigBee communications technology helps lower the expense of the system and the intrusiveness of the respective system installation.

REFERENCES

[1] Voice Recognition Based Home Automation System for Paralyzed People Mukesh Kumar, Shimi S.L (International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 10, October 2015)

[2] Home Automation System Using Zigbee And Arduino As A Gateway by Gaurav Joshi and Shayar Rathod, M.E Electronics and Communication Pursuing M.E. Electronics and Communication, B.H.Gardi College of Engineering and Technology, Rajkot, Gujarat, India (IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 03, 2014 | ISSN (online): 2321-0613)

[3] Enabling mobile devices for home automation using ZigBee Alexandru-Corneliu Olteanu, George-Daniel Oprina, Nicolae pu and Sven Zeisberg † University Politehnica of Bucharest Bucharest, Romania{alexandru.olteanu,george.oprina,nicolae.tapus}@cs.pub.ro (Dresden University of Applied Sciences Dresden, Germany) zeisberg@htw-dresden.de (2013 19th International Conference on Control Systems and Computer Science)

[4] IEEE Transactions on Consumer Electronics, Vol. 55, No. 2, MAY 2009 (A ZigBee-Based Home Automation System : Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu)

[5] Home Automation Using ZigBee Hinal Shah ,Vineeta Chauhan and Rashmi Sharma(Pankaj Jadhav ,Amit Chaudhari , Swapnil Vavale "Home Automation Using Zigbee Protocol", Maturitas, International Journal of Computer Science and Information Technologies, Vol. 5 (2) , 2014)

[6] Home Automation using ZigBee Protocol Pankaj Jadhav ,Amit Chaudhari , Swapnil Vavale Chun-Liang Hsu, Teng-Yaw Hsu, Kuan-Yen Ho, and Wei-Bin Wu "Practical design of intelligent living- space based on Bluetooth System"(Maturitas, vol. 64, issue 2, pp. 90-97, 2009.)

[7] A Zigbee Based Home Automation: System Design and Implementation(C.S.Skrzypczak, "The Intelligent Home

of 2010", IEEE Communications Magazine December 1987, Vol. 25, No. 12, pp.81-84)

[8] Wireless Home Automation System Using Zigbee by S. Benjamin Arul(Additional tests are being planned involving a bigger variety [2]. Population Division, DESA,United Nations. (2009). World Available: http://www.un.org/esa/population/publications/WPA20 09/WP)