TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS

A Minor Project Report
On
Home Automation Using Android Application
Using Wifi Connectivity

Submitted By:

Akash Ranpal (071/BEX/304)

Dipesh Shrestha (071/BEX/314)

Kshitiz Bajgain (071/BEX/320)

Shiva Aryal (071/BEX/340)

Submitted To:

Department of Electronics and Computer Engineering

Thapathali Campus

Kathmandu, Nepal

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Submitted To:

Department of Electronics and Computer Engineering
Thapathali Campus
Kathmandu, Nepal
In partial fulfillment for the award of the Bachelor's Degree in

Electronics and Communication Engineering.

Under the Supervision of

Er. Anup Adhikari

November, 2017

DECLARATION

We hereby declare that the report of the project entitled **"Home Automation Using Android Application Using Wifi Connectivity"**which is being submitted to the **Department of Electronics and Computer Engineering, IOE, Thapathali Campus**, in the partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in **Electronics and Communication Engineering**, is a bona fide report of the work carried out by us. The materials contained in this report have not been submitted to any University or Institution for the award of any degree and we are the only author of this complete work and no sources other than the listed here have been used in this work.

Akash Ranpal	(071/BEX/304)	_____
Dipesh Shrestha	(071/BEX/314)	_____
Kshitiz Bajgain	(071/BEX/320)	_____
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Date: November, 2017

CERTIFICATE OF APPROVAL

The undersigned certify that they have read and recommended to the **Department of Electronics and Computer Engineering, IOE, Thapathali Campus**, a minor project work entitled "**Home Automation Using Android Application Via Wifi Connectivity**" submitted by **Akash Ranpal, Dipesh Shrestha, Kshitiz Bajgain and Shiva Aryal**in partial fulfillment for the award of Bachelor's Degree in Electronics and Communication Engineering. The Project was carried out under special supervision and within the time frame prescribed by the syllabus.

We found the students to be hardworking, skilled and ready to undertake any related work to their field of study and hence we recommend the award of partial fulfillment of Bachelor's degree of Electronics and Communication Engineering.

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November, 2017

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We are indebted to our subject teachers, seniors and classmates for their regular backups in every requirements and circumstances we went through to complete this project. It was always a pleasure to work in the inspirational and incentive environment provided by Robotics and Automation Center, Thapathali Campus and its members. We are always grateful to them.

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ABSTRACT

Today's world is of advanced ubiquitous mobile applications which are used exhaustively to save time and energy. These applications ease day-to-day life of a common man. Based on these technologies and applications we designed a Home Automation System. In this paper, we propose design and prototype implementation of home automation system that uses Wi-Fi technology and Android operating system. An attractive market for Home Automation System is for busy families and individuals with physical limitations. Users can control electrical appliances in home or office via smart phone. Application will also provide secure notifications and alarm for Burglary, fire hazards and LPG leakage. This project aims at controlling every happening at home or office on your fingers.

This paper presents a design and prototype implementation of a new home automation system that uses WIFI technology as a network infrastructure connecting its parts. The proposed system consists of two main components: the first part is server (web server), which presents system core that manages, controls and monitors users home. Users and administrator can locally (LAN) or remotely (internet) manage and control system code. Second part is hardware interface module, which provides appropriate interface to sensor and actuator of home automation system.

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List of Abbreviations

2D	Two Dimensional
3D	Three Dimensional
AC	Alternating Current
ADC	Analog to Digital Converter
ARES	Advanced Rheometric Expansion System
ARM	Advanced RISC Machines
ATMEL	Advanced Technology for Memory and Logic
CAD	Computer Aided Drawing
CAGR	Compound Annual Growth Rate
CDMA	Code Division Multiple Access
CISC	Complex Instruction Set Computers
DC	Direct Current
EDGE	Enhanced Date rates for GSM Evolution
EEPROM	Electrically Erasable and Programmable Read Only Memory
EMF	Electro Motive Force
GCC	GNU Compiler Collection
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
HVAC	Heating, Ventilating and Air Conditioning
IC	Integrated Circuit
IDP	Integrated Development Platform
ISIS	Intelligent Schematic Input System
ISP	In-System Programming
JTAG	Joint Test Action Group
KHz	Kilo Hertz
LCD	Liquid Crystal Display
LDR	Light Dependent Resistor

LED	Light Emitting Diode
LTE	Long Term Evolution standard
MHz	Mega Hertz
MIPS	Millions of Instructions Per Second
MODEM	Modulator Demodulator
NRE	Non Recurring Cost
PCB	Printed Circuit Board
PIR	Passive Infrared Sensor
RISC	Reduced Instruction Set Computer
SIM	Subscriber Identity Module
SMART	Self-Monitoring, Analysis and Reporting Technology
SMS	Short Message Services
SPI	Service Provider Interface
SRAM	Static Random Access Memory
TDMA	Time Division Multiple Access
UART	Universal Asynchronous Receiver/Transmitter
UMTS	Universal Mobile Telecommunication System
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
USI	User System Interface
WIFI	Wireless Fidelity

1. INTRODUCTION

Smart Home Automation is an efficient way where a user can control the home appliances with an android application no matter whether he is near or far away from his home. The mobile application aims in controlling the light, fan, door and sense the over-heating of the kitchen

1.1 Background Introduction

We have used IR sensor, temperature sensor to sense the light and temperature parameter, keeps the status continuously tracking to the server computer and automatically alarms the android user with some notification in case of unfavorable conditions, and the android user can control the appliances through the user friendly layout of the android application.

1.2 Scope and Application

In the world of rush, in the world of developing technology it will be a great initiation to make the home appliances controlled through an android application. Let's imagine a world where human rests on his/her bed and gets his light off or have the fan on through an android application.

1.3 Problem Definition

Home automation is a rapidly expanding industry in the current context. Different techniques have been developed and improvised for the purpose of automatically operating the household appliances thereby reducing the manual labor and at the same time saving considerable time. But the defect with most of this techniques is that they require advanced equipment which are beyond the purchasing capacity of common people. Also these techniques are messier as they require installation of bulky devices and need incessant wiring. To overcome these defects, this very new method of home automation using Wi-Fi connectivity has been proposed which makes use of android application and other network devices for controlling and monitoring the household appliances.

1.4 Objectives

i.To make the house works more easy and android controlled.

ii. To have the appliances controlled even when he/she is very far away from the home in case of unfavorable conditions.

1.5 Report Organization

• Introduction

Home automation project is intended to optimize the electric cost and to make easy access to the home electric appliances from the distant via Wi-Fi connectivity. This project enables the proper use of electricity and the electrical appliances which results in the conservation of energy through regular status checking of the appliances via browser. Home automation provides easiness to the human being as home appliances can be controlled without reaching the home and taking any action to the controlling switch.

In future this type of system will reduce the human effort along with digitizing the world and dragging human in the world of IOT.

• Literature Review

Automation is a technique, method or system of operating and controlling a process by electronic devices with reducing human involvement to a minimum. The fundamental of building an automation system for an office or home is increasing day by day with numerous benefits. Industrialist and researchers are working to build efficient and affordability automatic systems to monitor and control different machines like lights, fans, AC based on the requirement. Automation makes not only an efficient but also an economical use of the electricity and water and reducing much of the wastage.

IOT grant to people and things to be connected any-time, any place with anyone ideally using any network and any service. Automation is another important

application of IOT technologies. It is the monitoring of the energy consumption and the controlling the environment in buildings, schools, offices and museums by using different types of sensors and actuators that control lights, lamp and humidity.

The smart home known as home automation with the use of new technology to have the domestic activities more convenient, comfortable, secure and economical. The home automation system includes main components which are:

- **User interface**: as a monitor, computer or phone for example, that can give orders to control system.
- **Mode of transmission**: wired connections (example Ethernet) or wireless (radio waves, infrared, Bluetooth, GSM) etc.
- **Central controller**: It is hardware interface that communicates with user interface by controlling domestic electronic devices: a lamp, an AC or a heater, which is compatible with the transmission mode, and connected to central control system.

Requirement analysis

Requirement analysis include various functional and non-functional ambitions that are designed to meet by our project. This section also comprises of feasibility study performed for the project.

System Design and Methodology

This section include the main explanation of project system. It also define and describe its architecture along with its block diagrams detail algorithms, data flow diagram procedures, circuit diagrams and overall methodology implied in the project.

Implementation Details

This section of our project defines the various hardware and software components that are used in the process of completion of this project. The basic working and the principles on which the components used are described in this section. It also show the way of implementing and the difficulties faced at the time of working on the project.

Conclusion and Future Enhancement

This section include the limitation of system development and also describe the further way to eradicate the way of present performance to meet the future requirement.

2. LITERATURE REVIEW

2.1 Historical Backgrounds

The first smart homes were ideas, not actual structures. For decades, science fiction has explored the idea of home automation. Prolific writers, such as Ray Bradbury, imagined a future where homes were interactive, and seemingly ran themselves. In Bradbury's cautionary short story, "There Will Come Soft Rains" he describes an automated home that continues to function even after humans have died out. It's all well and frightening, until you consider the actual benefits of home automation, and then the idea becomes more comforting than chilling.

Although the idea of home automation has been around for some time, actual smart homes have only existed a short while. This timeline focuses on hardware; meaning actual inventions leading up to the smart homes we know today and can expect from the near future.

1901 – 1920–The invention of home appliances – Although home appliances aren't what we'd consider "smart," they were an incredible achievement in the early twentieth century. These achievements began with the first engine-powered vacuum cleaner in 1901. A more practical electricity-powered vacuum was invented in 1907. Throughout two decades refrigerators would be invented, as well as clothes dryers, washing machines, irons, toasters, and so much more. It was a fantastic time for anyone who was employed as a maid by a very affluent family

1966 - 1967 – ECHO IV and the Kitchen Computer –Although it was never commercially sold, the ECHO IV was the first smart device. This clever device could compute shopping lists, control the home's temperature and turn appliances on and off. The Kitchen Computer, developed a year later, could store recipes, but had the unfortunate tagline, "If she can only cook as well as Honeywell can computer" and therefore sold no models.

1991 – Gerontechnology – Gerontechnology combines gerontology and technology and makes the lives of senior citizens easier. In the 1990s, there was a lot of new

research and technology in this sector. Remember, “I’ve fallen and I can’t get up?” Life Alert is one example of gerontechnology.

Today’s Smart Homes – Today’s smart homes are more about security and living greener. Our smart homes are sustainable, and they help to ensure that our homes aren’t expending unnecessary energy. They also help alert us to intruders (whether we’re home or not).

Current trends in home automation include remote mobile control, automated lights, automated thermostat adjustment, scheduling appliances, mobile/email/text notifications, and remote video surveillance

2.2 Market Reports

According to the new market research report "Home Automation System Market by Protocol and Technology (Network and Wireless), Product (Lighting, Security and Access Control, HVAC and Entertainment Control), Software and Algorithm (Behavioral and Proactive), and Geography - Global Forecast to 2022", the home automation system market was valued at USD 39.93 Billion in 2016 and is expected to reach USD 79.57 Billion by 2022, at a CAGR of 11.3% during the forecast period.

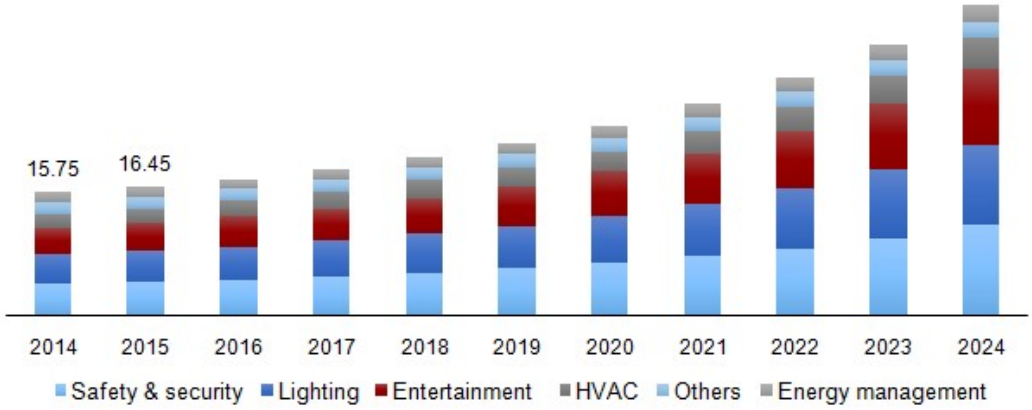


Figure 2-2. Global-home-automation-market[1]

The global home automation market size was USD 17.48 billion in 2016 and is expected to grow over the forecast period. The market is being primarily driven by increasing awareness for less energy consumption, the rise in electricity prices, and advancement in technology. Furthermore, increase in safety & security concerns and additional services such as locking or doors and windows along with surveillance of cameras is expected to boost the market growth.

2.3 Research on Home automation System

A research for home automation was performed which concluded that the IR sensor can be used to detect the brightness in the room and if it is not as required then, the signal from it can be fed to microcontroller that turn ON/OFF the power supply to the bulb and thus save the electricity. This work can be considered as the root path for automatic monitoring of home. We can make further integration in this concept to compensate the overall requirements and make it more versatile.

2.4 Existing Concepts

IR sensor had been used in several projects to detect the brightness within its range. So the concept of such research can be employed to detect the intensity of light in room which further facilitates in controlling the light in the room as per received status and command.

2.5 Wi-Fi communication

The radios used for Wi-Fi communication are very similar to the radios used for walkie-talkies, cell phones and other devices. They can transmit and receive radio waves, and they can convert 1s and 0s into radio waves and convert the radio waves back into 1s and 0s. But Wi-Fi radios have a few notable differences from other radios:

- They transmit at frequencies of 2.4 GHz or 5 GHz. This frequency is considerably higher than the frequencies used for cell phones, walkie-talkies and televisions. The higher frequency allows the signal to carry more data.
- They use 802.11 networking standards, which come in several flavors:
- 802.11a transmits at 5 GHz and can move up to 54 megabits of data per second. It also uses orthogonal frequency-division multiplexing (OFDM), a more efficient coding technique that splits that radio signal into several sub-signals before they reach a receiver. This greatly reduces interference.
- 802.11b is the slowest and least expensive standard. For a while, its cost made it popular, but now it's becoming less common as faster standards become less expensive. 802.11b transmits in the 2.4 GHz frequency band of the radio spectrum. It can handle up to 11 megabits of data per second, and it uses complementary code keying (CCK) modulation to improve speeds.
- 802.11g transmits at 2.4 GHz like 802.11b, but it's a lot faster -- it can handle up to 54 megabits of data per second. 802.11g is faster because it uses the same OFDM coding as 802.11a.
- 802.11n is the most widely available of the standards and is backward compatible with a, b and g. It significantly improved speed and range over its predecessors. For instance, although 802.11g theoretically moves 54 megabits of data per second, it only achieves real-world speeds of about 24 megabits of data per second because of network congestion. 802.11n, however, reportedly can achieve speeds as high as 140 megabits per second. 802.11n can transmit up to four streams of data, each at a maximum of 150 megabits per second, but most routers only allow for two or three streams.
- 802.11ac is the newest standard as of early 2013. It has yet to be widely adopted, and is still in draft form at the Institute of Electrical

andElectronicsEngineers (IEEE), but devices that support it are already on the market. 802.11ac is backward compatible with 802.11n (and therefore the others, too), with n on the 2.4 GHz band and ac on the 5 GHz band. It is less prone to interference and far faster than its predecessors, pushing a maximum of 450 megabits per second on a single stream, although real-world speeds may be lower. Like 802.11n, it allows for transmission on multiple spatial streams -- up to eight, optionally. It is sometimes called 5G WiFi because of its frequency band, sometimes Gigabit WiFi because of its potential to exceed a gigabit per second on multiple streams and sometimes Very HighThroughput (VHT) for the same reason.

- Other 802.11 standards focus on specific applications of wireless networks, like wide area networks (WANs) inside vehicles or technology that lets you move from one wireless network to another seamlessly.
- WiFi radios can transmit on any of three frequency bands. Or, they can "frequency hop" rapidly between the different bands. Frequency hopping helps reduce interference and lets multiple devices use the same wireless connection simultaneously.

As long as they all have wireless adapters, several devices can use one router to connect to the Internet. This connection is convenient, virtually invisible and fairly reliable; however, if the router fails or if too many people try to use high-bandwidth applications at the same time, users can experience interference or lose their connections. Although newer, faster standards like 802.11ac could help with that.[2]

3. REQUIREMENT ANALYSIS

3.1 Functional Requirements

The expected functions of this system are as follows:

• The system should be able to contrast the inputs from different sensors and handle them simultaneously.

- The system should be able to drive the output devices from supplied source as per the requirement.

- The system should be able to send all the useful updates to the distant user/personnel.

3.2 Characteristic requirements

The characteristics features for this system are:

- **Accuracy:** The system should be as accurate as possible. It should be able to inspect the status of different parameters correctly and decide to use the appropriate output device at the same time.

- **Performance:** The system is intended to respond extremely fast due to use of RISC based microcontroller and give as much throughput as possible.

- **Wide Ranged:** Used Wi-Fi module in this system has distant range communication in comparison to other communication module.

3.3 Feasibility Study

The automation of the home requirements is a “must need” in the context of the world today. Firstly, the cost requirement to complete this project is not much high and is easily affordable. Also, the commercial application of the obtained product would be a wise deal for consumers also. Secondly, the time limitations provided by syllabus is enough for completion of this task. Thirdly, the power supplement required for the project is also not high and thus is power efficient. The hardware required for the project are also easily available and their assembly is challenging but not that big deal. Similarly, the software required for this project are available with us. Hence we concluded that this project is a feasible one and its output is also a good product for commercial implementation.

4. SYSTEM DESIGN AND METHODOLOGY

The designing issues and methods used for the development of this system can be divided into these main parts:Hardware development, Hardware assembling and Firmware supplement to the assembled hardware. Besides, the block diagram of the system and the data flow diagram are proper tools to depict the concept employed in it.

4.1 Block Diagram of the system

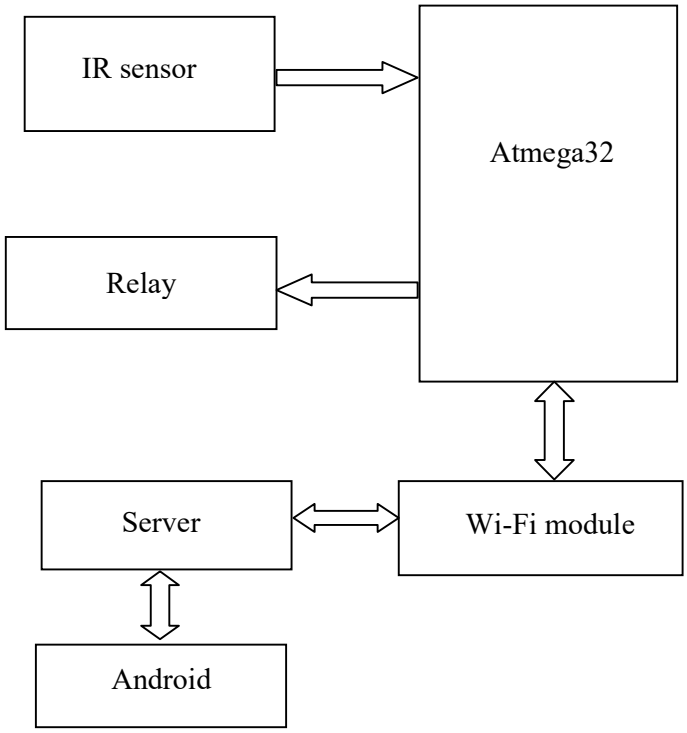


Figure 4-1.Wi-Fi based home automation system

4.2 Hardware and Software Development and Assembly

Following are the steps involved for the development and assembly of the system hardware. Also, the firmware for each implementations are attached with respective sections.

4.2.1 PCB design

At first the schematic circuit was designed and connected using Proteus tool. Then accordingly, the PCB layout was also designed. For routing purpose, the bottom copper is mostly used.

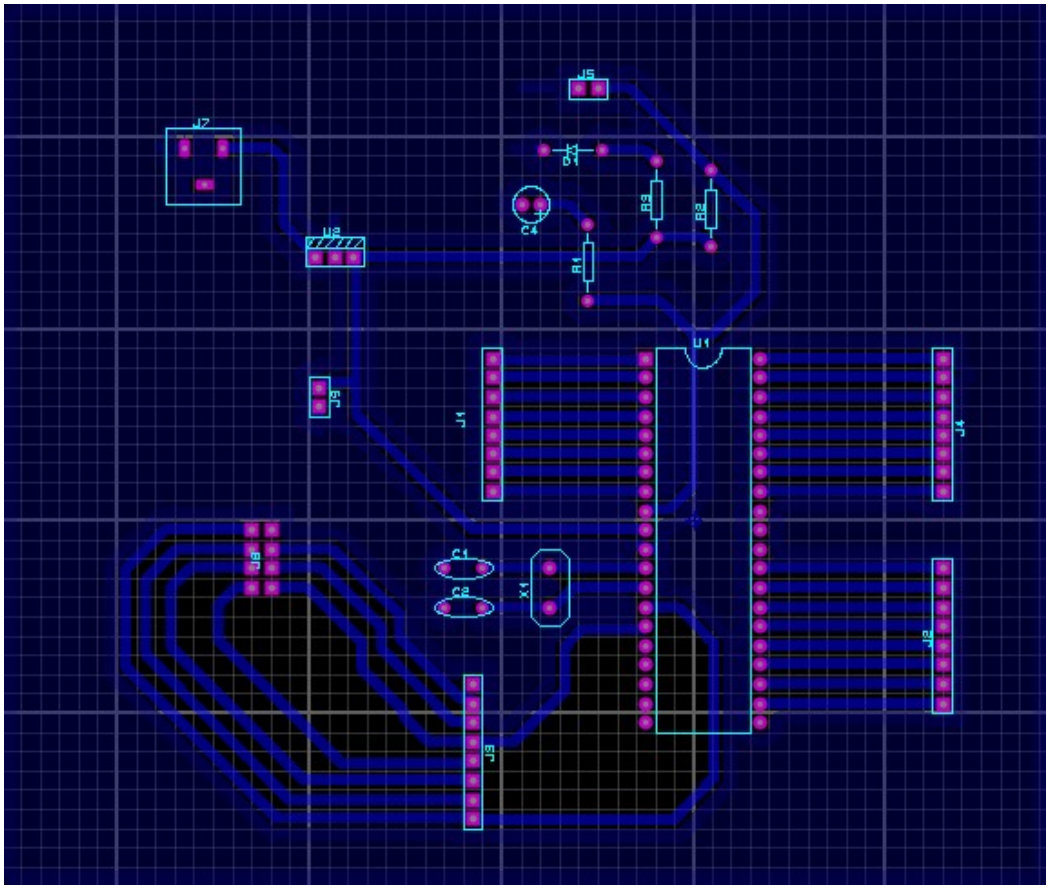


Figure 4-2. PCB design of system

4.2.2 UART initialization for Wi-Fi module

UART is one of the basic interface which we will find in almost all controller available in market. This interface provide a cost effective, simple and reliable

communication between one controller to another or between a controller and pc. It is a protocol used for communication with serial input and serial output devices. Serial transmission encounters reduced rate of communication but also helps in dwindling cost and complexity of wirings.[1]

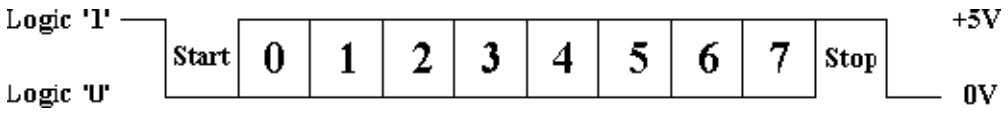


Figure 4-3. Frame format for UART communication**[2]**

UART support data transmission from 5bits to 9 bits, with parity option for data integrity checking and option for 1, 1.5 and 2 to stop point. UART can work on various speed starting from 300bps to 4mbps. Most commonly used baud rates are 9800 and 115200. In simplicity an 8-bit UART protocol consist of start bit, 8 data bits and one stop bits.

4.3 Dataflow diagram

The sequence of data flow in this system can be captured using the diagram shown below:

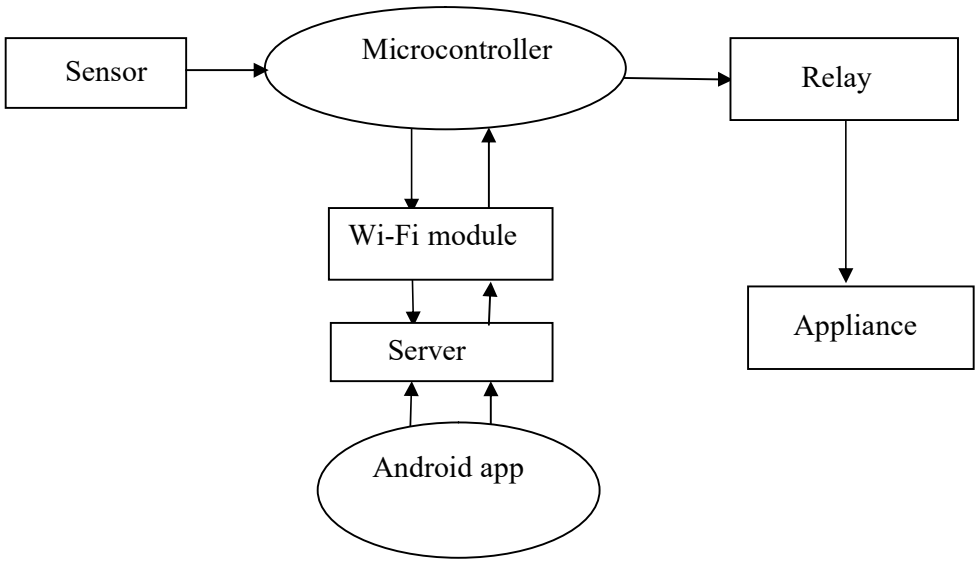


Figure 4-4. Data flow diagram of the system

5. IMPLEMENTATION DETAILS

Different hardware and software are used to implement this system, which are described in details below.

5.1 Hardware Components

5.1.1 AVR ATMega32

ATMega32 is a high-performance low power microchip AVR RISC-based microcontroller. It combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 54/69 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for boundary-scan and on-chip debugging/programming, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a universal serial interface (USI) with start condition detector, an 8-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, SPI serial port, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

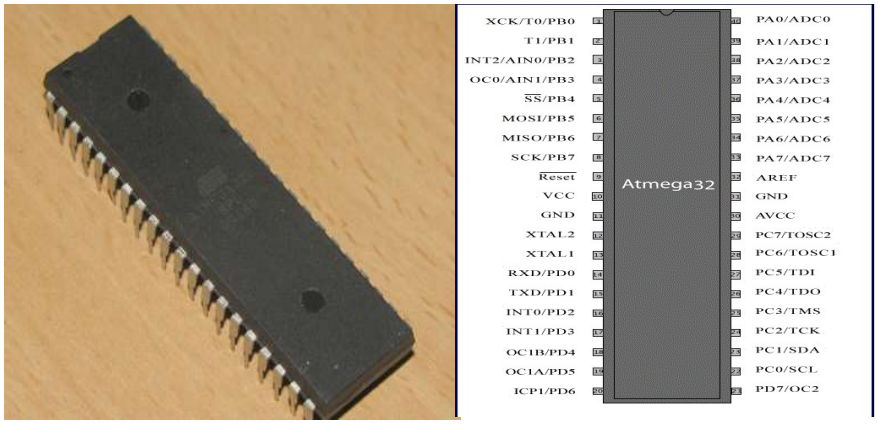


Figure 5-1. Schematic representation and Pin diagram of ATMega32 [2]

5.1.2 IR sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects

the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor.The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

Figure 5-2. IR sensor[3]

5.1.3 Relay

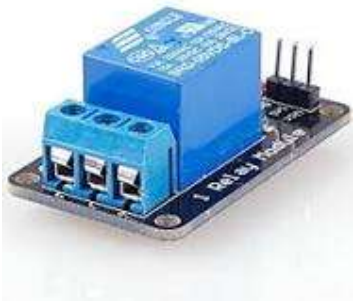
A relay is an electrically operated switch. Many relays use an electromagnetto mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and

will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands



. Figure 5-3. Relay[4]

5.1.4 Transformer

A transformer is a static (or stationary) piece of apparatus by means of which electric power in one circuit is transformed into electrical power of the same frequency in another circuit.[3] The transfer of electrical energy between circuits takes place through electromagnetic induction. Transformers are used to increase or decrease the alternating voltages in electric power applications. A transformer consists of two electrically isolated coils and operates on Faraday's principle of “mutual induction”, in which an EMF is induced in the transformers secondary coil by the magnetic flux generated by the voltages and currents flowing in the primary coil winding. If we apply DC to it, there won’t be varying magnetic flux and as there is no change in magnetic flux linking to the coil, emf is not induced on the secondary side.

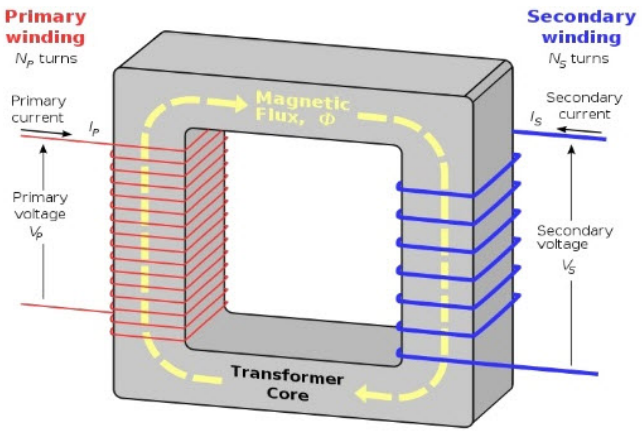


Figure 5-4. Schematic representation of Transformer[5]

5.1.5 Wi-Fi module

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. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Figure 5-5. Wi-Fi Module[6]

5.2 Software Details

The various software used for this project are listed below:

5.2.1 Proteus 8.0

Proteus is a simulation and design software tool developed by Lab center electronics for Electrical and Electronics circuit design. It possess 2D CAD drawing feature. The Proteus design suite is a Window application for schematic capture, simulation and PCB design. ISIS is the software used to draw schematics and simulate the circuits in the real time.

The simulation allows human access during the run time, thus providing real time simulation. ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also help 2D drawings for the product. ISIS has the wide range of components in its library. It has sources signal generators, measurements an analysis tool like oscilloscope, voltmeter, ammeter etc. probes for real time monitoring of the parameter of the circuit, switches, displays, load like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog integrated circuits, semi-conductors switches, relays, microcontrollers, processors, sensors etc. ARES offers PCB designing up to 14 inner layers, with surface and through whole packages. It is embedded with the foot prints of different category of the components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB designer. The schematic drawn in the ISIS can be directly transferred to ARES.

5.2.2 Atmel studio

It is an Integrated Development Platform (IDP). It give us seamless and easy to use environment to write, build and debug a program written in C/C++. It comes with its own integrated C compiler the AVR GNU C Compiler (GCC). It provides support for 300+ Atmel AVR and Atmel SMART ARM devices. In this project we use Atmel studio 7.0 to code in ATMega32 microcontroller.

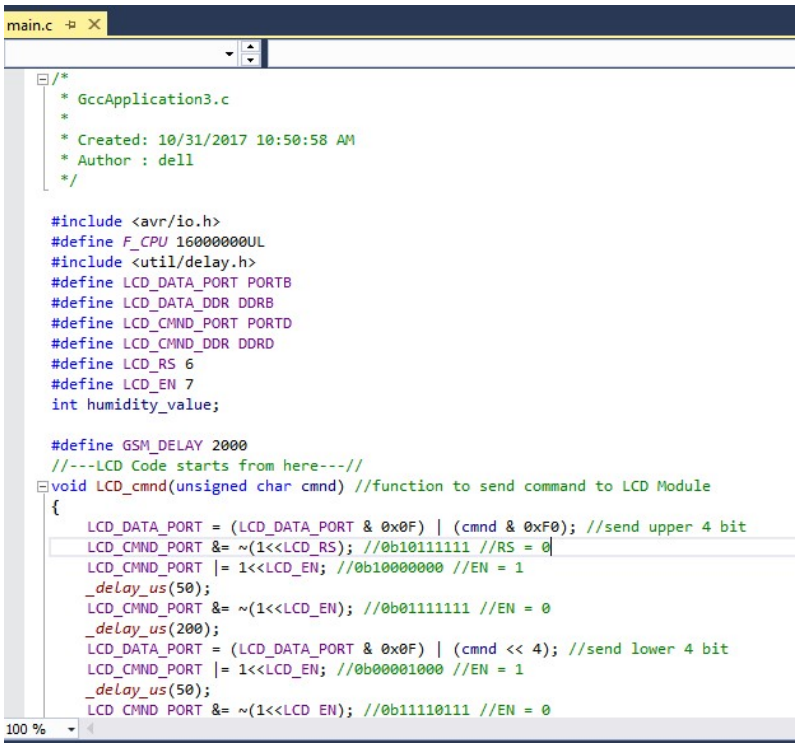


Figure 5-6. Coding window of Atmel studio

5.2.3 PROGISP

PROGISP can be used for programming AVR chips. Due to the fact that all the configuration and programming data can be put in a package of a single file, this software can be used for managing a project. Its operation is rather intuitive and there should be no difficulties while using it. We must be careful about selecting the type of chip we want to program before starting the process.

At first, the USB ISP Programmer is connected to USB Port of PC. We have to make sure if it is connected to that USB Port which is installed during installation. A “Ding” sound from PC is produced to inform that the programmer is installed correctly. The RED LED will glow to indicate that programmer is ready.

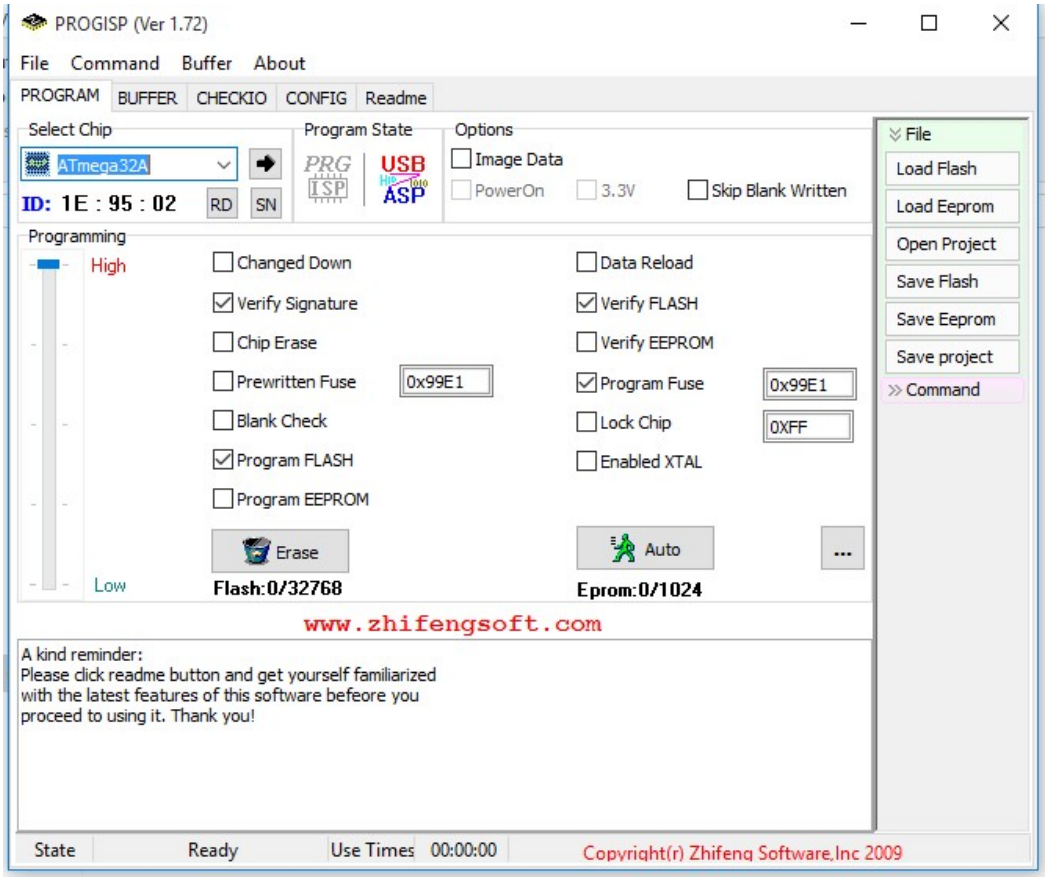


Figure 5-7. PROGISP window

6. RESULTS AND ANALYSIS

The theme requirement of any work is the reasonable output from it. So, to analyze whether the system has been developed as expected or not, various testing and analysis were performed which are described below.

6.1 Software Schematic

Before assembly of hardware components, the schematic circuit designed in Proteus was slightly changed removing non-simulating components with available scheme of hardware to be connected at those junctions. The hex file obtained from firmware was loaded into the ATMega32 and then the simulation was started which successively generated the desired conditions. The screenshot of the simulation is attached below.

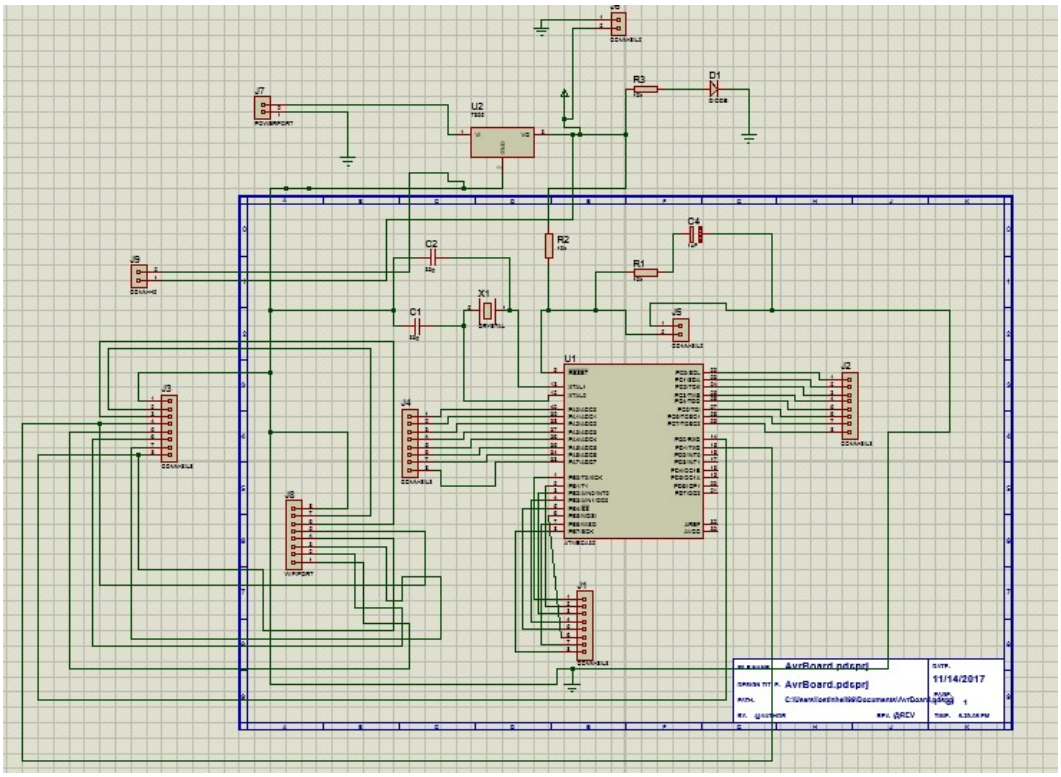


Figure 6-1. Screenshot of Simulation screen

6.2 Hardware Test

The individual hardware components that are to be used were inspected one by one using breadboard circuit.After individual testing of each components the breadboard circuit was connected with Wi-Fi module and LEDat a time and the background. The code was also changed accordingly and testing was performed which gave the desired response from each components. Finally the overall component were connected, full firmware was burnt in the microcontroller and then the power was supplied to the system. The system again respond with least margin of errors.Hence,they were passed to be perfect and then they were used for soldering in the real system circuit.

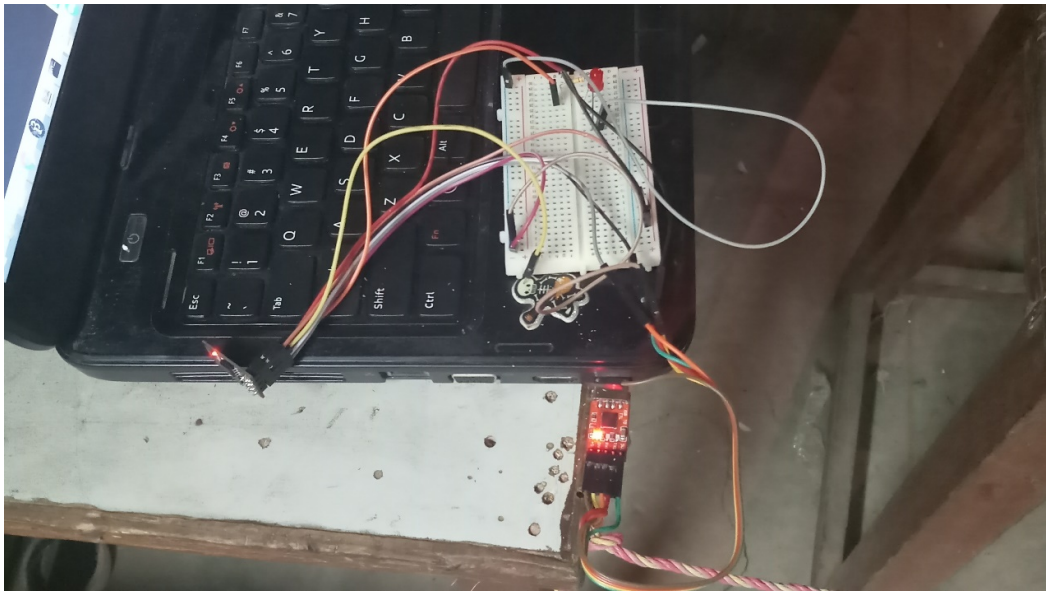


Figure 6-2. Test of Wi-Fi module

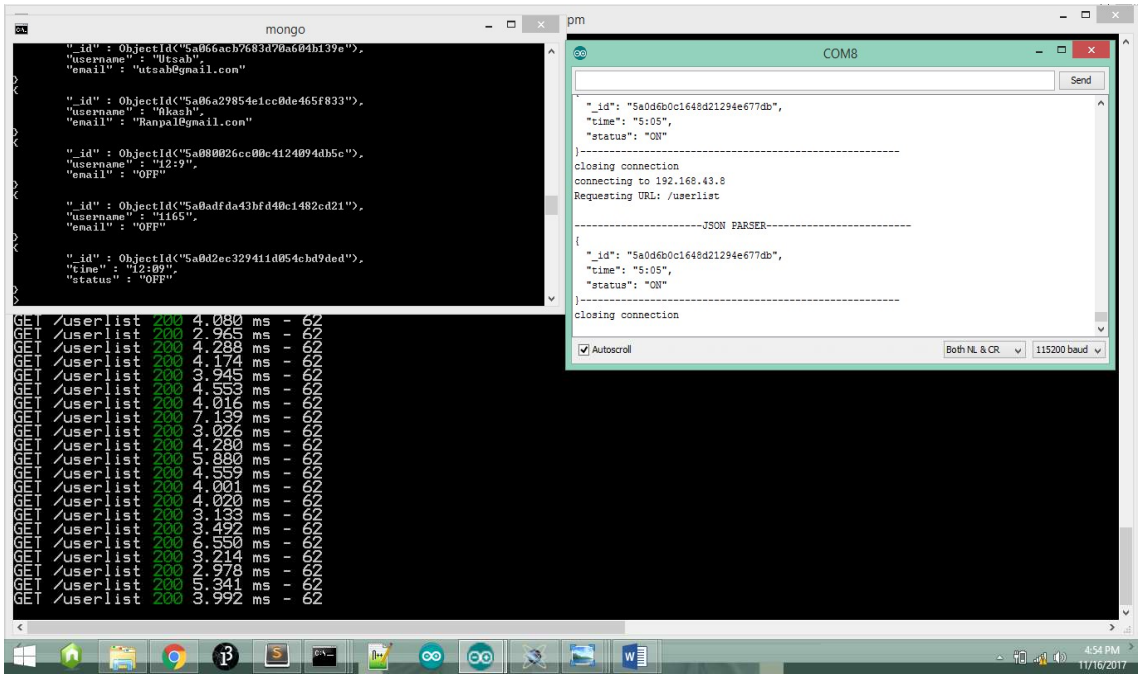


Figure 6-3. ESP8266 extracting data from local server

6.3 Output Inspection

After the hardware is assembled the output generated by it is inspected. The SMS messages were received as expected in reasonable situations. Similarly, the temperature and moisture level were also recorded with least margin of errors and displayed in LCD. Whenever the read valued were not in required margins, the output devices were initiated to normalize them.There were no any signs of infinite loop or suchambiguous problems. Hence the proposed system is developed with properaccuracy.

7. CONCLUSION AND FUTURE ENHANCEMENT

7.1 Conclusion

The use of Wifi in the home automation technique is a revolution in the modern world context. The project has further immensely helped us to be better in the server site development as well as esp8266 and AVR programming

This system is composed of cheap components and simple concepts. So we can easily develop them in numbers and supply them to number of consumers.

Hence we conclude that the Wifi based Home Automation is feasible, simple, cost effective and a revolutionary concept and addition in research made in the field of Home Automation.

7.2 Limitations

Followings are some of the major limitations detected in Wi-Fi based Home Automation.

- Wi-Fi module must be supplied with power of 3.3v instead of commonly used 5v supply.
- In absence of Wi-Fi network our system is meaningless.
- Maximum probability of facing the short circuit problem.
- Need of real time server.
- IR sensor requires proper intensity range of light to respond.

7.3 Future Enhancement

Following can be the further paths of improvement for Wi-Fi based Home Automation system:

- Wifi based home automation can further be implied upon different home appliances as well as image processing can be used for safe home security in which the database can contain the image of respective house members.

- A smart home and further a smart city can enhance the life style of people.

8. APPENDICES

The additional topics, data sheets, reference sheets, user manual, etc. are listed below.

Appendix A: Circuit Diagram

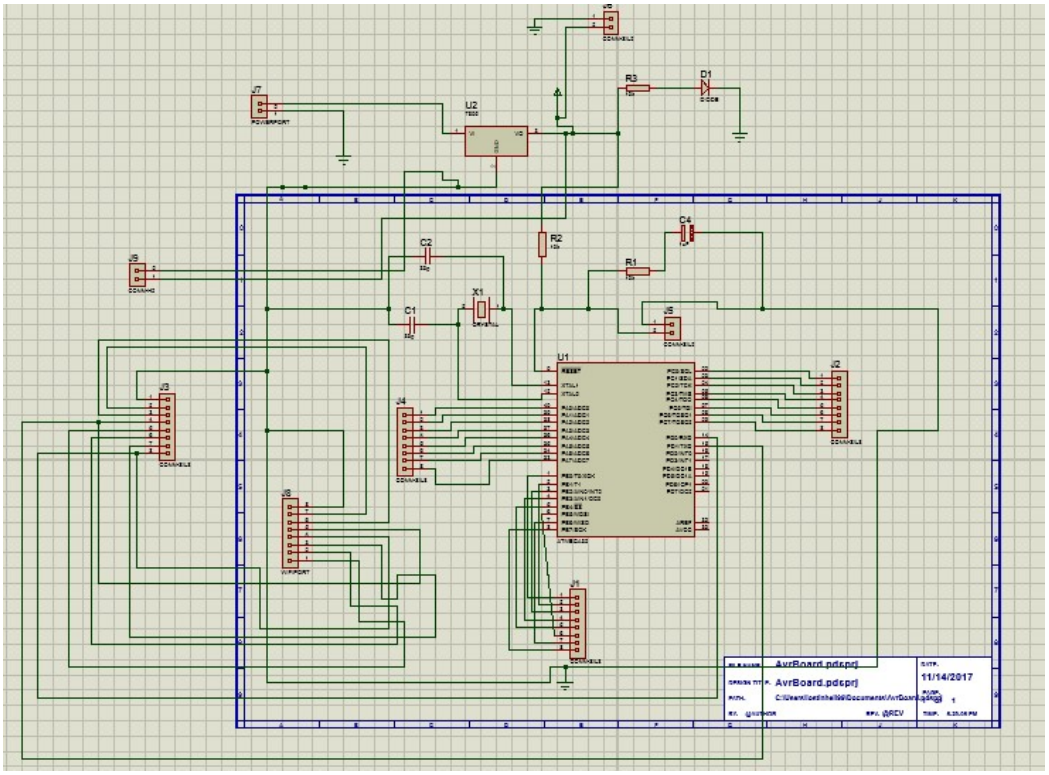


Figure 8-1. Circuit diagram of Wifi module based home automation

Appendix B: PCB Diagram

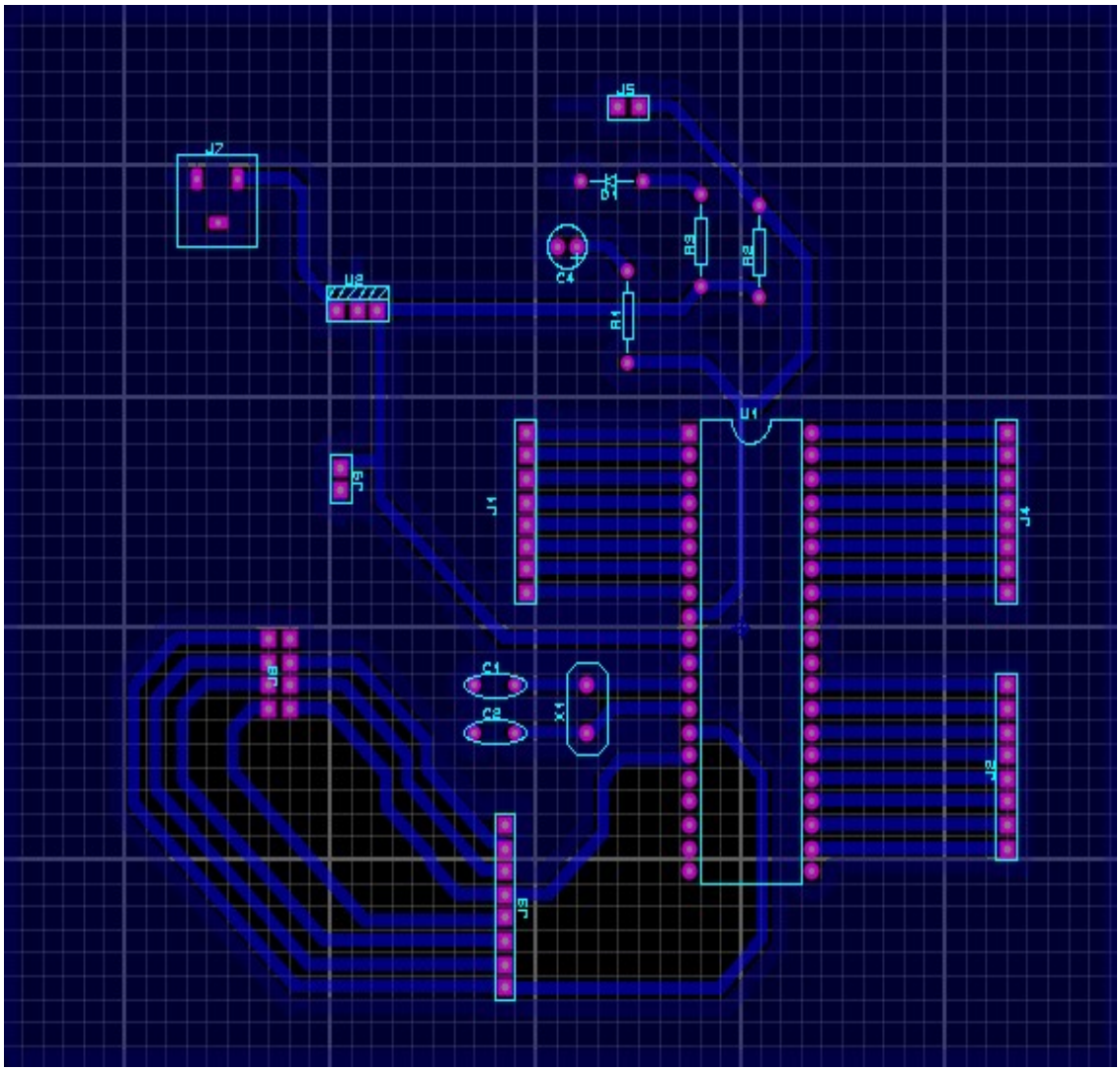


Figure 8-2. Bottom layer of PCB design

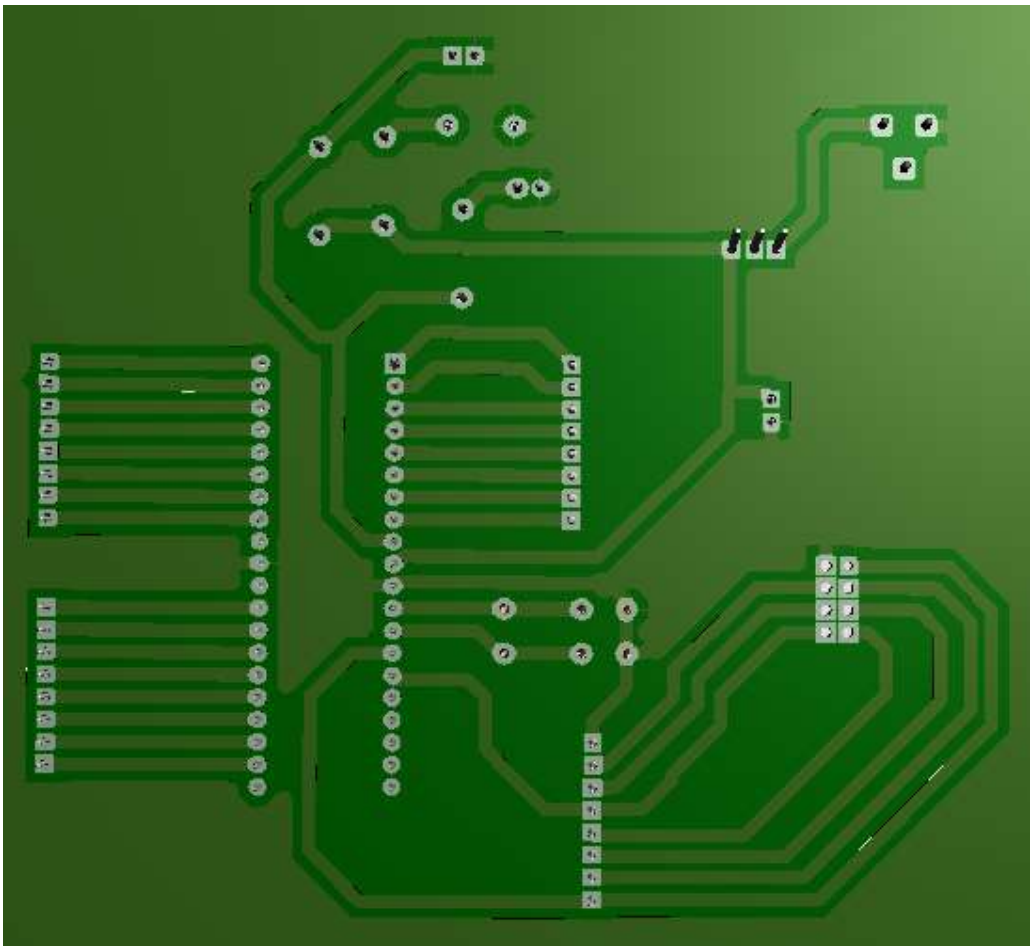


Figure 8-3. Top layer of PCB design

Appendix C: Datasheet and Pin details

Table 8-1. Datasheet of Wifi Module**[4]**

Pin No	Function	Name
1	Ground (0V)	Ground
2	General I/O pin 2	GPIO2
3	General I/O pin 0	GPIO0
4	Receiving data	RxD
5	Transmitting data	TxD
6	Chip enable	Chip Enable
7	Reset	RST
8	Input Voltage	Vcc

References

[1] F. Donald, "AVR Serial Communication (UART) Programming tutorial," 26 September 2014. [Online]. Available: http://www.gadgetronicx.com/avr-serial-communication-uart/. [Accessed 10 November 2017].

[2] 8051projects, "UART Communication Tutorial," Rikipedia, 6 April 2015. [Online]. Available: https://www.8051projects.net/wiki/UART_Communication_Tutorial. [Accessed 10 November 2017].

[3] B. Thereja and A. K. Thereja, "Working Principle of a Transformer," in *A Textbook Of Electrical Technology Vol II*, S. Chand, 2011, pp. 1116-1117.

[4] Kushagra, "16x2 lcd module datasheet," Engineers Garage, 2012. [Online]. Available: https://www.engineersgarage.com/electronic-components/16x2-lcd-module-datasheet. [Accessed 10 November 2017].

[5] Digi.com, "Documentation for XBee ZB (S2B) Modules," [Online]. Available: http://ftp1.digi.com/support/documentation/90000976_W.pdf. [Accessed Jun 2015].

[6] Circuitbasics.com, " Useful Raspberry Pi Commands," [Online]. Available: http://www.circuitbasics.com/useful-raspberry-pi-commands/. [Accessed Aug 2015].

[7] EY performance , "Digital Agriculture:helping to feed a growing world," *Performance,* vol. IX, no. 1, 2017.

[8] United Nations, "World Population Prospects: the 2012 Revision," United Nations, Department of Economic and Social Affairs, Population Division

(2013), New York, 2013.

[9] MarketsandMarkets Research Private Ltd , "MarketsandMarkets," MarketsandMarkets Research Private Ltd , [Online]. Available: http://www.marketsandmarkets.com/PressReleases/smart-greenhouse.asp. [Accessed 10 june 2017].

[10] PA consulting group, "Digitising Agriculture-unlocking the potential in the agricultural value chain," PA consulting group, London, 2016.

[11] Zion Market Research, " Zion Market Research," 18 january 2017. [Online]. Available: https://www.zionmarketresearch.com/news/smartgreenhouse-market. [Accessed 2 june 2017].

[12] A. Tyagi, N. Gupta, D. J. P. Navani and R. Tiwari, "Smart Irrigation System," *IJIRST –International Journal for Innovative Research in Science & Technology, vol. 3, no. 10, 2017. ,* vol. 3, no. 10, 2017.

[13] M. A. Mazidi, S. Naimi and S. Naimi, The AVR microcontroller and embedded system using assembly and C, New Jersey: Pearson Eduction, 2011.

[14] Kushagra, "Engineers Garage," [Online]. Available: https://www.engineersgarage.com/electronic-componenets/atmega32-avr-microcontroller. [Accessed 10 November 2017].

[15] Robotshop inc, "Robotshop," Robotshop inc, [Online]. Available: http://www.robotshop.com/en/parallax-pir-motion-sensor.html . [Accessed 10 June 2017].

[16] S. Bisht, "Remote Controlled Robot Using Arduino," Instructables, [Online]. Available: http://www.instructables.com/id/Remote-Controlled-Robot-Using-Arduino/. [Accessed 10 November 2017].

[17] B. Raj, "16x2 LCD Display Module," Circuit Digest, 2017. [Online]. Available: https://circuitdigest.com/article/16x2-lcd-display-module-pinout-datasheet. [Accessed 2017 November 09].

[18] rees52, " SIM900 GSM Module Arduino Compatible ER005," [Online]. Available: http://rees52.com/89-sim900-gprs-gsm-module-arduino-compatible.html. [Accessed 10 November 2017].

[19] Pantech Solutions, "Basic AT Commands for SIM900A GSM/GPRS Module," Pantech Solutions, 16 September 2012. [Online]. Available: https://www.pantechsolutions.net/blog/basic-at-commands-for-sim900a-gsmgprs-module/. [Accessed 09 November 2017].

[20] ModMyPi LTD, "ModMyPi," ModMyPi LTD, [Online]. Available: www.wikipedia.com/relay. [Accessed 10 November 2017].

[21] Edge FX kits and Solutions, "Why Do Transformers Work With Alternating Current Only?," Edge FX kits and Solutions, 2017. [Online]. Available: http://www.edgefxkits.com/blog/why-transformers-works-only-alternating-current/. [Accessed 9 November 2017].

[22] Autodesk, "Instructable," Autodesk, [Online]. Available: www.wikipedia.com/IRsensor. [Accessed 3 June 2017].