SMART HOME AUTOMATION SYSTEM USING MOBILE APPLICATION

A DESIGN PROJECT REPORT (EEB4333)

Submitted by

S. AJAY KUMAR (18117014)

Under the guidance of

Mr. N. KARTHIK

Assistant Professor (SG)

In partial fulfillment of the award of the degree

of

BACHELOR OF TECHNOLOGY

in

ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHOOL OF ELECTRICAL SCIENCES
HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

PADUR, CHENNAI 603 103

NOVEMBER 2020

BONAFIDE CERTIFICATE

Certified that this design project report titled "SMART HOME AUTOMATION SYSTEM USING MOBILE APPLICATION" is the bonafide work of S.AJAY KUMAR(18117014) who carried out the design project work under my supervision. I further certify that to the best of my knowledge, the work reported here does not form part of any other design project based on which a degree or award was conferred on an earlier occasion on this or any other candidate.

HEAD OF THE DEPARTMENT   **SUPERVISOR**

Dr. AK PARVATHY   Mr.N. KARTHIK
Head of the department   Assistant Professor (SG)
Electrical and Electronics Engineering   Electrical and Electronics Engineering
Hindustan institute of technology and   Hindustan institute of technology and
science   science
Padur- 603 103   Padur – 603 103

The design Project Viva-Voce Examination is held on   …………….

INTERNAL EXAMINER   **EXTERNAL EXAMINER**

ABSTRACT

The main objective of this project is to develop a home automation system using an Arduino board, which can be remotely controlled by any Android or iOS smartphone via Bluetooth. As technology is advancing, so houses are also getting smarter. Modern homes are gradually shifting from conventional switches to centralized control systems involving remote-controlled switches. Presently, conventional wall switches located in different parts of the house make it difficult for the user to go near them to operate. Even more, it becomes more difficult for the elderly or physically handicapped people to do so. Remote-controlled home automation is a most modern solution with smartphones. In order to achieve this, a Bluetooth module is interfaced to the Arduino board at the receiver end, while on the transmitter end, a Bluetooth application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the Bluetooth, loads can be turned ON/OFF remotely through this technology.

INTRODUCTION

Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives really easy. Have you ever wondered about home automation, which would give you the facility of controlling tube lights, fans, and other electrical appliances at home using a remote control? Of course, yes! But are the available options cost-effective? If the answer is no, we have found a solution to it. We have come up with a new system called Arduino-based automation using Bluetooth. This system is super cost-effective and can give the user the ability to control any electronic device without a remote control. This project helps the user to control all the electronic devices using his/her smartphone. Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time. To save people's time, introduce a home automation system using Bluetooth. With the help of this system, you can control your home appliances from your mobile phone. You can turn on/off your home appliances within the range of Bluetooth.

ACKNOWLEDGEMENT

LIST OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION, SCOPE & OBJECTIVES OF THE INVESTIGATION

1.1   INTRODUCTION

1.1.1 What is HOME AUTOMATION?

Automation is used for monitoring systems and information technology to decrease the need for a human job in products and facilities production. Home automation has become more contemporary and accurate to monitor the areas nowadays. In contemporary home automation, there are so many difficulties, such as temperature, oil, heat, flame, barriers, and smart home healthcare.
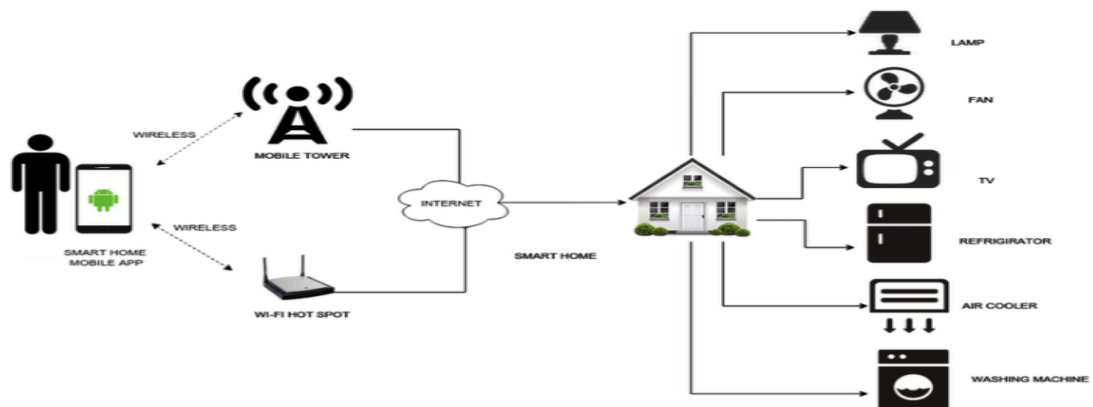
Fig 1.0.1 Home automation

1.2 BASIC WORKING PRINCIPLE OF HOME AUTOMATION

Home automation is the automatic control of electronic devices in your home. These devices are connected to the Internet, which allows them to be controlled remotely. With home automation, devices can trigger one another so you don't have to control them manually via an app or voice assistant. When the circuit of the relay senses the fault current, it energizes the electromagnetic field, which produces the temporary magnetic field. This magnetic field moves the relay armature for opening

or closing the connections. Connect a resistor of 10k with pins 4, 5, and 6 of the Arduino, and then attach a transistor with the resistors and ground its emitter pin, and connect a relay at its collector pin, and then add a diode in parallel with the coil.

1.3 Circuit Diagram

The complete circuit diagram for this Smart Home Automation is given below
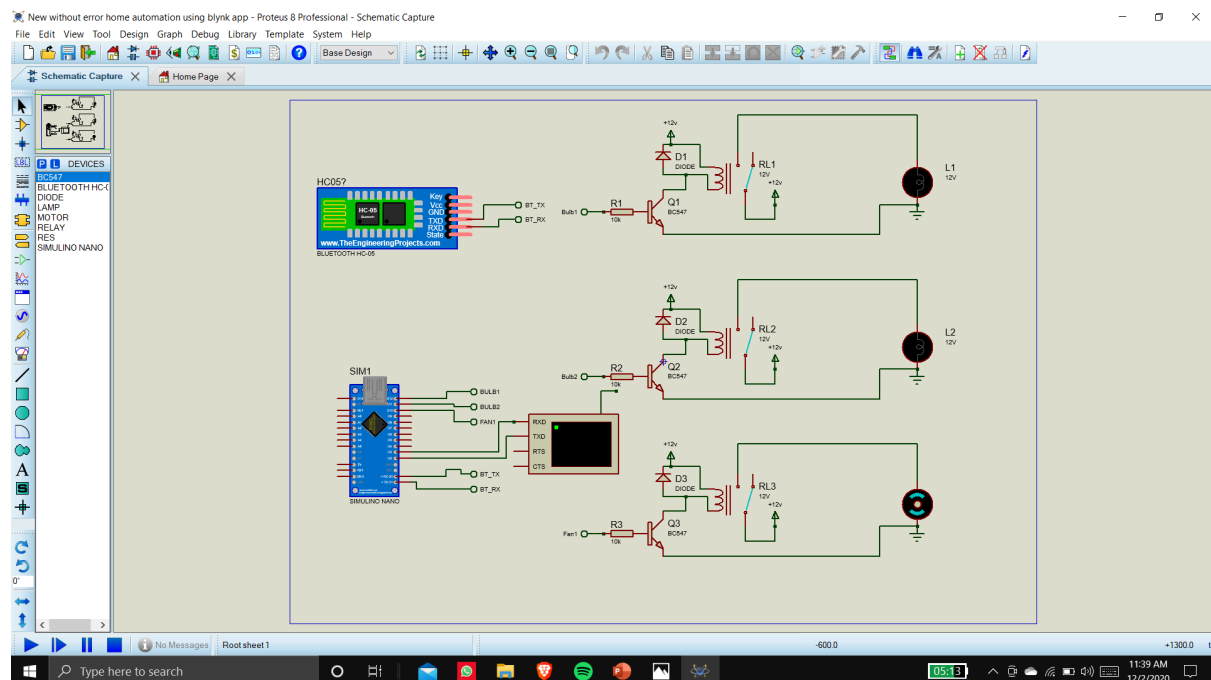
Fig. 1.3 Smart Home Automation Circuit diagram

Connect the transmitter pin of Arduino with the receiver pin of HC-05, and connect the receiver pin of Arduino with the transmitter pin of HC-05. After that, connect a resistor of 1k with pins 4, 5, and 6 of the Arduino, and then attach a transistor with the resistors and ground its emitter pin, and connect a relay at its collector pin, and then add a diode in parallel with the coil. Then adding an AC lamp whose one end would be connected to the normally open pin of the relay and the other two ends would be connected with the AC voltage source and common pin of   Do the same connections with the DC motor and LED, connecting with the remaining diodes. In the end,   up the relay module will require a 12V supply.

1.4 Applications of Home Automation

- The inefficiency of operation of conventional wall switches can be overwhelmed using various home automation systems (without using conventional switching methods).
- The loss of power can be reduced, and the manpower required for home automation is much less compared to conventional methods.
- Provides safety from electrical power short circuits while using conventional wall switches to operate loads.
- This project can be further expanded to a smart home automation system by including some sensors like light sensors, temperature sensors, safety sensors etc. and automatically adjust different parameters like room lighting, air conditioning (room temperature), door locks etc. and transmit the information to our phone.
- Additionally, we can connect to the internet and control the home from a remote location over the internet and also monitor the safety. Future Development of the Project.
- Arduino-based device control using Bluetooth on a smartphone project can be enhanced to control the speed of the fan or volume of the buzzer, etc.

1.5 OBJECTIVES

The objective of this project is to

1. Design of Home Automation.
2. To develop an Arduino-based home automation system with Bluetooth.
3. Test the system.

1.6 METHODOLOGY

To implement a new system called Arduino-based home automation using Bluetooth. This system is low cost and can give the user the ability to control any home appliance. This project helps the user to control all the home appliances using the smartphone.

CHAPTER 2

LITERATURE SURVEY

R. Harinath and Dr. S. Santhi, "GSM-BASED HOME AUTOMATION SYSTEM USING APP-INVENTOR FOR ANDROID MOBILE PHONE," International Journal of Computer Science and Mobile Computing, Vol. 4, Issue 4, April- 2018, 158-167.

In this paper, the system deals with a GSM automation system using App Inventor for Android mobile phones.

Poonam, Gaikwad, Yoginath, R. Kalshetty, Bluetooth Based Smart Automation System Using Android," International Journal of Science and Research, Volume 6, Issue No. 5, May 2017

The paper deals with the Bluetooth-based Smart Automation System Using Android.

CHAPTER 3

OPERATING PRINCIPLE OF HOME AUTOMATION SYSTEM

A home automation system makes the operations of various home appliances more convenient and saves energy. With the energy-saving concept, home automation or building automation makes life very simple nowadays. It involves automatic controlling of all electrical or electronic devices in homes or even remotely through wireless communication. Centralized control of lighting equipment, air conditioning and heating, audio/video systems, security systems, kitchen appliances, and all other equipment used in home systems is possible with this system.

Controllers may be personal computers/laptops, touchpads, smartphones, etc., attached to the controlling devices via Bluetooth, WIFI, Hotspot, etc., that receive the information from the sensors and, based on the program, control the actuators.

Actuators are the final controlling devices, like limit switches, relays, motors, and other controlling mechanisms, that finally control the home equipment. By using the Blynk, we can communicate with the actuators. Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi, and the like over the Internet. You can easily build graphic interfaces for all your projects by simply dragging and dropping widgets. Communication plays an important role in this home automation system for remote access to these operations. This smart home system also provides continuous monitoring through video surveillance with cameras, scheduling, and energy-saving operations.

This is the best solution even for the elderly and disabled persons to operate the equipment.

CHAPTER 4

SIMULATION RESULTS

4.1   SIMULATION CIRCUIT DIAGRAM AND OUTPUT

OUTPUT

CHAPTER 5

HARDWARE DESCRIPTION

5.1 BLOCK DIAGRAM FOR HARDWARE CIRCUIT
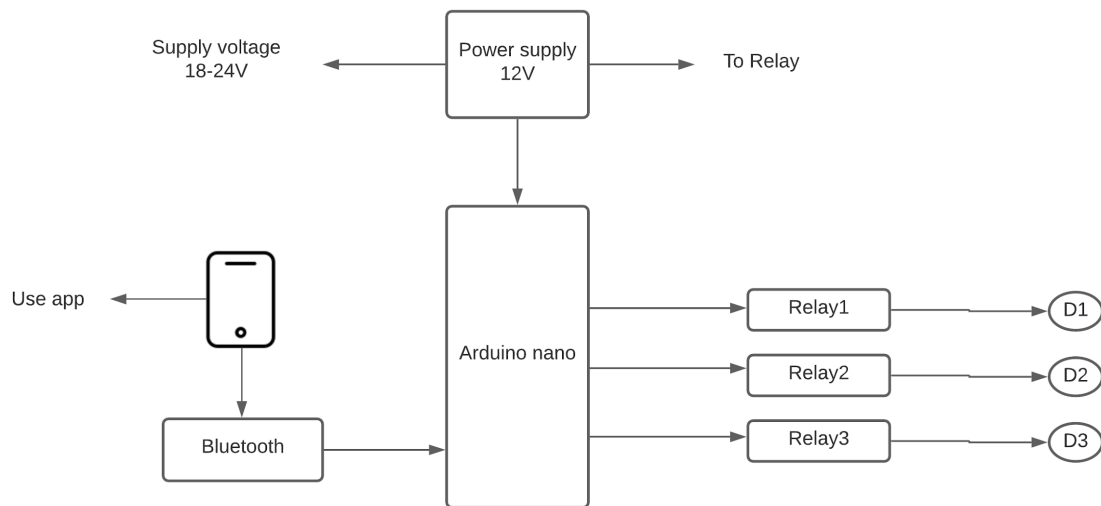
5.2 COMPONENTS REQUIRED

1. **Arduino Nano**
2. **Bluetooth Module.**
3. **10k ohm Resistors.**
4. **2N2222 NPN Transistor.**
5. **1N4007 Diodes.**
6. **5 V Relay module.**
7. **Dc motor.**
8. **Connecting wires.**
9. **Smartphone or Tablet.**
10. **LEDs.**
11. **Arduino 1.6.9 compiler.**

12. Proteus Software.

13. Android application.

<div align="center">

5.3 COMPONENTS DESCRIPTION

5.3.1 Arduino Nano

</div>

Arduino Nano is a small, compatible, flexible, and breadboard-friendly microcontroller board developed by Arduino.cc in Italy, based on. It comes with exactly the same functionality as the Arduino UNO but in a quite small size. It comes with an operating voltage of 5V; however, the input voltage can vary from 7 to 12V. Arduino Nano Pinout contains 14 digital pins, 8 analog pins, 2 reset pins, and 6 power pins. Each of these digital & analog pins is assigned multiple functions, but their main function is to be configured as input or output. They act as input pins when they are interfaced with sensors, but if you are driving some load, then use them as output. Functions like PinMode() and digitalWrite() are used to control the operations of digital pins, while AnalogRead() is used to control analog pins.
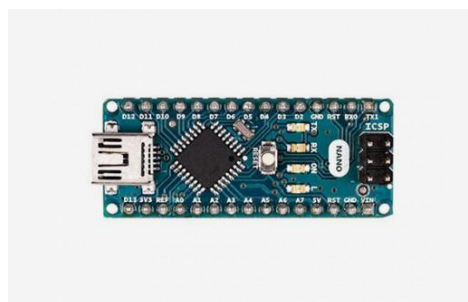
The analog pins come with a total resolution of 10 bits, which measures the value from zero to 5V. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage. There is one limitation

using Arduino Nano . It doesn't come with a DC power jack, which means you cannot supply an external power source through a battery. This board doesn't use standard USB for connection with a computer; instead, it comes with Mini USB support. Tiny size and breadboard-friendly nature make this device an ideal choice for most of the applications where the size of the electronic components is of great concern.

FEATURES

- It has 22 input/output pins in total.
- 14 of these pins are digital pins.
- Arduino Nano has 8 analog pins.
- It has 6 PWM pins among the digital pins.
- It has a crystal oscillator of 16 MHz.
- Its operating voltage varies from 5V to 12V.
- It also supports different ways of communication, which are
  - Serial Protocol.
  - I2C Protocol.
  - SPI Protocol.
- It also has a mini USB pin, which is used to upload code.
- It also has a reset button on it.

Applications

Arduino Nano is a very useful device that comes with a wide range of applications and covers less space as compared to other Arduino boards. Breadboard-friendly nature makes it stand out from other boards. Following are the main applications of the board.

- Arduino Metal Detector

- Real-Time Face Detection

- Medical Instrument

- Industrial Automation

- Android Application

- GSM-Based Projects

- Embedded Systems

- Automation and Robotics

- Home Automation and Defence System

- Virtual Reality Applications

5.3.2 **HC-05 Bluetooth Module**

The HC-05 module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module designed for transparent wireless serial connection setup. The serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3 Mbps modulation with a complete 2.4 GHz radio transceiver and baseband. It uses CSR Bluetooth 04, an external single-chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has a footprint as small as 2.7 mm x 2.7 mm. Hope it will simplify your overall design development cycle,, HC-05.

The HC-05 is a very cool module that can add two-way (full-duplex) wireless functionality to your projects. You can use

this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. However do not expect this module to transfer multimedia like photos or songs, you might have to look into the CSR8645 module for that.

5.3.3 RESISTOR

10K ohm
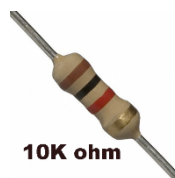
10k resistor colour code is as shown in the image it is brown/black/orange/gold, colour code of resistors does not depend on the power rating of resistor, the power rating of the resistor depends on

its physical size and comes under standard wattage rating of 1/4 W,1/2W,1W,10W, etc.

5.3.4 **TRANSISTOR**

The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds. It was originally made in the TO-18 metal.

The 2N2222 is considered a very common transistor, and is used as an exemplar of an NPN transistor. It is frequently used as a small-signal transistor, and it remains a small general purpose transistor of enduring popularity.

The 2N2222 was part of a family of devices described by Motorola at a 1962 IRE convention. Since then it has been made by many semiconductor companies.

5.3.5 **DIODE**

1N4007 is a PN junction rectifier diode. These types of diodes allow only the flow of electrical current in one direction only. So, it can be used for the conversion of AC power to DC. 1N 4007 is electrically compatible with other rectifier diodes and can be used instead of any of the diode belonging to 1N400X series. 1N-4007 has different real-life applications.

5.3.6 **4-CHANNEL RELAY MODULE**

This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V l0A. It has a standard interface that can be controlled directly by microcontroller.

From the picture, you can see that when the signal port is at low
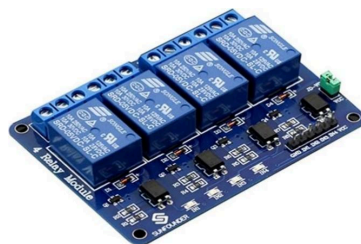
level, the signal light will light up and the optocoupler 7817c (it transform electrical signals by light and can isolate input and output electrical signals) will conduct, and then the transistor will conduct, the relay coil will be electrified, and the normally open contact of the relay will be closed. When the signal port is at high level the

normally closed contact of the relay will be closed. So you can connect and disconnect the bad by controlling the level of the control signal port.

5.3.7 DC MOTOR

A Dc motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.
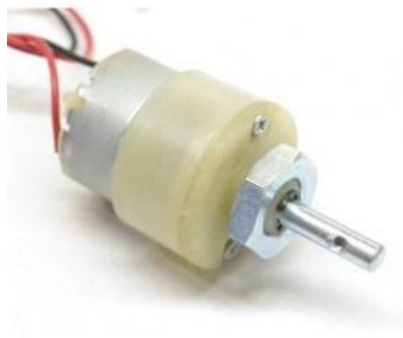
5.3.8 ARDUINO COMPLIER

The Arduino Integrated Development Environment **(IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written

in functions from C and C++.It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

5.3.9 PROTEUS SOFTWARE

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities.

5.3.10 ANDROID APPLICATION

Android App is a software designed to run on an Android device or emulator. The term also refers to an APK file which stands for Android package. Android apps can be written in Kotlin, Java, and

C++ and are run inside Virtual Machine. The official development environment is Android Studio.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

Smart Home System provide interface between various types of home and electrical appliances like lights and fans etc. It Provide control and ease of use of appliances as per users need. After analysing other existing systems, we propose the novel technique for better human interaction and for providing better utilization of android and Arduino. By using Home automation system we can manage cost, flexible and energy efficient smart homes. The home automation system has been proven to work by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. I learned skills such as simulation the circuit and other tools that The Bluetooth client was successfully tested on different mobile phones from different manufacturers, thus proving its portability and wide compatibility. Thus a low-cost home automation system was designed, implemented and tested.

6.2 FUTURE SCOPE

 Home Automation is the future of space for the digital natives. With the invention of lots of automation technologies featuring IoT and AI, home

automation has become a reality. One can implement several of their tasks with just a single command of verbal instructions. These technologies can be used to build a fully functional home automation system and control smart home devices including smart lights, connected thermostats, and appliances.

6.3   REFERENCES

1. D. Bordencea, H. Valean, S. Folea, A. Dobircau, "Agent Based System for Home Automation, Monitoring and Security.",International Conference on Tele - communications and Signal Processing TSP 2011, Budapest, Hungary, Aug. 18–20, pp. 165–169, ISBN 978-1-4577-1409-2.
2. Mitali Patil, Ashwini Bedare, Varsha Pacharne "The Design and Im-plementation of Voice Controlled Wireless Intelligent Home Automation System Based on ZigBee." International Journal of Advanced Research in Computer Science and Software Engineering.
3. Sharon Panth, Mahesh Jivani "Home Automation System (HAS) using Android for Mobile Phone" International Journal of Electronics and Computer Science Engineering ISSN 2277-1959/V3N1-01-11.
4. Vinay sagar K N, Kusuma S M "Home Automation Using Internet of Things" International Research Journal of Engineering and Technology(IRJET) e-ISSN:2395-0056.

5. Kallakunta. Ravi Kumar, Shaik Akbar "Android Application Based Real Time Home Automation." Indian Journal of Applied Research ISSN 2249-555X.

6. Mahara Jothi, T, Periyanayaki, A, Srimathy, R, Vinotha, M, and Gopika, G. (2018) "GSM Based Home Environment Monitoring System." In 2018 2nd International Conference on Trends in Electronics and Informatics (ICOEI) 1263–1268.

7. Kevin Andrews, S, Rajavarman, VN, and Rajkumar, N. (2017) "Remote Digital Circuit Emulation and Verification Using Adruino Board through WIFI Enabled Internet of Things (IoT)." International Journal of Control Theory and Applications, 10 (11): 421-427. 11.

8. Saiteja, K, Aruna deepthi, S, Raghu, G, and Ravali B. (2017) "Home Automation Using IOT." International Journal of Engineering Trends and Technology 229–233.

9. Mujcic, E. Drakulic, U. Upotreba android operating system mikokontrolera ATMega2560 za upravljanje 3D-LED matricnim displejem.

10. 11th International Scientific Conference on Production Engineering, RIM (2017).

11. Technical Specification Microcontroller ATMega 2560. http://www.mantech.co.za/ datasheets/products/A000047.pdf. Accessed 21 Apr 2018.