Internet of Things Program

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Course Title : Microcontroller and Interfacing IOT Lab.

Project Report

Project Name: Home Automation.

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Abstract

The main objective of this project is to develop a home automation system using an Node Mcu board with Wi-fi being remotely controlled by any Android OS smart phone. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, 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 so. Remote controlled home automation system provides a most modern solution with smart phones. In order to achieve this we use Node Mcu. A Blynk application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the Blynk, the loads can be turned ON/OFF remotely through this technology.

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Chapter 1

1.1 Introduction

Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives real easy. Have you ever wondered about home automation which would give the facility of controlling tube lights, fans and other electrical appliances at home using a remote control? Off-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 and Node MCU ESP-8266 based home automation using a app which is BLYNK app. This system is super-cost effective and can give the user, the ability to control any electronic device without even spending for 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 we are introducing Home Automation system using BLYNK app . With the help of this system you can control your home appliances from your mobile phone. You can turn on/off your home appliances from any distance by connected with wi-fi and using BLYNK app.

1.2 Background and Motivation

Home automation is anything that enables you to use your home's lighting, heating and appliances more conveniently and efficiently. It can be as simple as remote or automatic control of a few lights, or it can be a complete system that controls all major parts of your home, custom set to your own personal preference. The motivation for radiating smart home systems comes from mores reasons, but maximum great are benefit, security, energy management connectivity and luxury. Smart Home systems are one of the modern areas of test that have not been completely integrated into our society. This is because the test requires many other rules of test and engineer-ing to generate a functional smart home. The additional cost of the install is from the fact that even though a majority of homes were built in the near past, technology has been growing exponentially.

This means that most homes were built before this technology was available, and this creates a defenses for the development and sales of smart home systems. However, the technology is becoming better and cheaper, and this will help to make smart home systems a consumption worth having when upcoming homes are being built. The biggest motivation backward smart home systems is the benefit. Benefit is really another way of saying "time saver", and into day's world where every-thing is moving faster, every second has value. Most of the technology we use today is based of benefit, for example cars get us where we need to go faster, phones get us information from other people faster, and computer's get work done faster. Smaller conveniences in the home will be charming because they allow the home to save the user time as well. There are already many convenient technologies in the home like the dishwasher, washing machine, and microwave ovens. These technologies are more mechanical in nature and often there are much less computerized conveniences in the home. A Smart home systems goal is to introduce the benefits of computerized technology.

1.3 Objective

The main objectives of our project are as follows:

- To remotely control home appliances and monitor them.
- To save the time and utilize the energy efficiently.
- It works on Nodemcu based system, so we can easily understand how it-works.
- Full home appliance can control by one android application
- It is control by mobile application so, no extra training is required

1.4 Organization of Report

- To introduce the concept of Home Automation to the Bangladeshi Market.
- To create market presence foe the brand DOMOTICS in home security industry.
- To create awareness about home automation and security products.
- To exploit the first mover advantages in the home security industry.

1.5 Conclusion

Hence, the idea to create a fully working home automation system with facility to control and monitor appliances has been finally realized. The output of this project is an array of home appliances that are controlled over the smartphone with connection to wi-fi module. This project has been a really great experience and opportunity to learn and to experiment. Moreover, the authors got the chance to closely experiment and learn about what goes into designing and developing home automation systems. We are very much delighted that we explored this topic as our major project title and in a way, created a version of home automation system of our own, and to be closely related with the technology that is of a great interest of study and research today and is sure to revolutionize the way of living of people in the days to come.

Chapter 2

2.1 Introduction

Home automation refers to the automation of housework or household activities in the home. It also allows for the use of a computer to control panel infections in other work. It involves, for example, centralized lighting infection control. It can integrate centralized lighting control, security, and the lack of gates and doors to provide a growing benefit case in terms of energy ability and security. In today's world, home automation is becoming incredibly popular because of the convenience of having a flexible means of monitoring and managing infections and other things according to the comfort and demands of the user. The difficult aspect is making them simple and inexpensive to install in the home, especially as the number of services to be monitored and controlled. The project "Home Automation" is based on the concept of home automation through the use of technology. The "Home Automation" project is an idea for home automation using an Android. Be-cause of the significant capability and refers to the consumer by Android phone connectivity, home automation has become increasingly popular. A home automation system connects all of your electrical equipment. Home automation techniques include those used in building automation and the control of household activities such as lighting control systems and the use of other electrical appliance devices. These devices may be connected via a home network to provide control by a computer and may allow remote access via the internet. Method and appliance can be connected in a mobilizing process through the integration of information technology with the home environment, power efficiency, and security.

2.2 Literature Review

1.IOT Based Smart Security and Home Automation: This paper focuses on a system that provides features of Home Automation relying on IOT to operate easily, in addition to that it includes a camera module and provides home security. The android application basically converts Smartphone into a remote for all home appliances. Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of house entrance in real time. This notification will be received by the owner of the house via internet such that app can trigger a notification. So owner can raise an alarm in case of any intrusion or he/she can toggle the appliances like opening the door if the person is a guest. The system uses Raspberry Pi, a small sized computer which acts as server for the system. The smart home consist two modules. Home automation that consists; fan light and door controller, and security module that consists; smoke sensor motion sensor and camera module.

2.A Dynamic Distributed Energy Management Algorithm of Home Sensor Network for Home Automation System: This paper proposes an optimization of home power consumption based on PLC (Power Line Communication) for an easy to access home energy consumption. This also proposes a Zigbee and PLC based renewable energy gateway to monitor the energy generation of renewable energies. ACS and DDEM algorithm are proposed for the design of an intelligent distribution of power management system to make sure ongoing power supply of home networks. To provide efficient power management the power supply models of home sensor network are classified groups viz. main supply only, main supply and backup battery, rechargeable battery power and non-rechargeable battery power. Devices with particular features are assigned to these groups. It targets to establish real time processing scheme to address variable sensor network topologies.

3.“Enhance Smart Home Automation System based on Internet of Things”: This paper proposes a system that develops a model to reduce the computation overhead in existing smart home solutions that uses various encryption technologies like AES, ECHD, hybrid, etc. these solutions use intermediate gateway for connecting various sensor devices. The proposed model provides a method for automation with sensor based learning. The system uses temperature sensor for development but other sensors can also be used as per requirement. These smart home devices with sensors can configure themselves autonomously and can operate without human intervention. This work minimizes encryption decryption and focuses on authentication and automation of smart home devices with learning. The system bypasses local gateway mentioned in existing system to provide better security for smart home devices and sensor data and save computation overhead. The real time broker cloud is directly connected with smart home and manages all incoming and outgoing request between users and devices. The main purpose to use real time broker cloud is save time of cryptographic operations.

4.“Visual Machine Intelligence for Home Automation”: The pa-per present a vision-based machine intelligence system to sense on/off state of common home appliance. The proposed method of sensing the state of appliances results on a novel home automation system. The accessibility of the suite of devices in the home over a remote network is facilitated by the IP Addressing methods in the IOT. This project uses two boards viz. Raspberry Pi and Intel Galileo Gen 2. The communication between the User devices, Raspberry Pi and the Intel Galileo boards happens over a wireless network. The UDP protocol is deployed to facilitate the wireless communication of the nodes present in the home automation network. A Pi Cam and a USB Logitech camera attached to the rotating shaft of two different servo motor capture snapshots that are passed as inputs to the Machine Learning based models trained using dlib-C++ to detect the state of the operation of the appliances.

The proposed method uses visual modality to automate the appliances, as privacy concerns may emerge while using the images from some specific places, as a counter to this issue, an SPDT switch is added to the Raspberry Pi which when turned off ensures that even if the images are taken from the webcams, they are just passed as inputs to the machine learning models and are not displayed on the website when the users access the website on the server address obtained from Raspberry Pi.

2.3 Summary

A smart house is a home with internet-connected gadgets that allow for remote monitoring and control of appliances and systems like lighting and heating. Smart home technology, also known as home automation allows homeowners to control smart equipment via a smart home app on their smart-phone or another networked device, providing security, comfort, convenience, and energy efficiency. Smart home systems and devices, which are part of the internet of things (IoT), frequently work together, sharing consumer usage data and automating activities depending on the homeowners' preferences.

Chapter 3

3.1 Introduction

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 nodeMcu to achieve hardware simplicity. “Home automation” refers to the automatic and electronic control of household features, activity, and appliances. In simple terms, it means we can easily control the utilities and features of our home via the Internet to make life more convenient and secure, and even spend less on household bills.

3.2 Proposed System

Nowadays, we have remote controls for our television sets and others electronic Systems, which have made our lives real easy. Have we ever wondered about home automation which Would give the facility of controlling tube lights, fan and other electrical appliances at home using a remote control? Off-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 which is super-cost effective and can give the user the ability to control any electronic device without even spending for a remote control. This project helps the user to control all the electronic devices using his/her smartphone.

3.2.1 Block Diagram

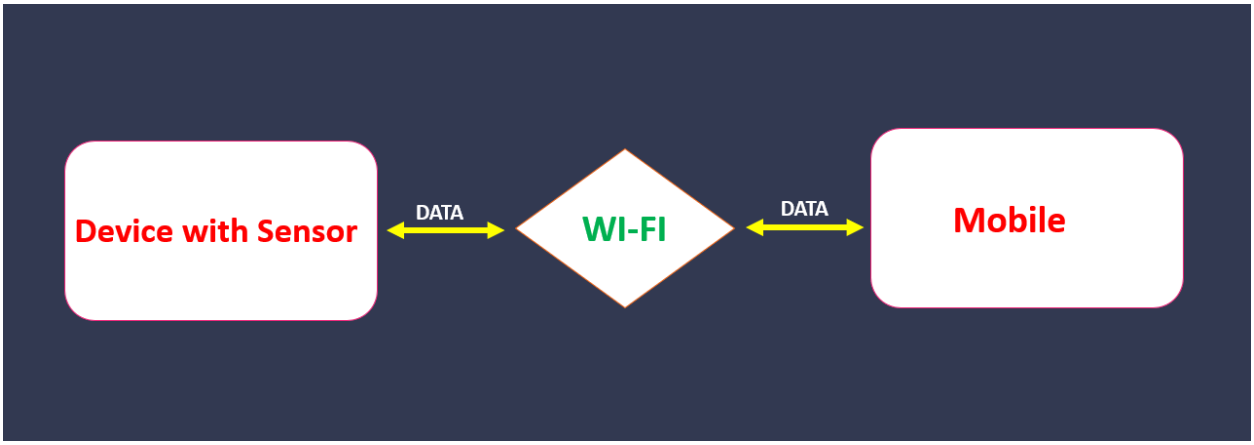


Fig: Block Diagram

3.2.2 Components

ESP8266 NodeMCU: NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It's hardware which is based on the ESP-12 module. MCU stands for Microcontroller Unit - which really means it is a computer on a single chip. A micro-controller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. They are used to automate automobile engine control, implantable medical devices, remote controls, office machines, appliances, power tools, toys etc.

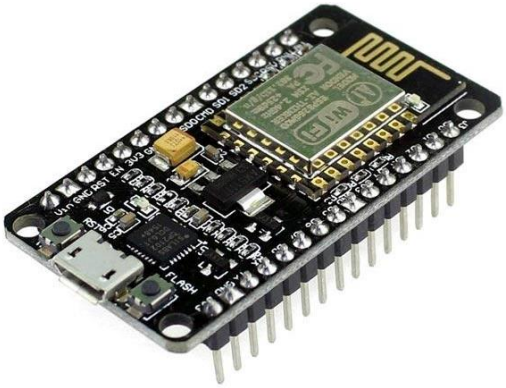


Fig: Node Mcu

AM2301 Temperature Humidity Sensor: AM2103 Capacitive Digital Humidity And Temperature Sensor is a new high precision single bus temperature and humidity detector, which is based on AM2103 humidity capacitive digital temperature and humidity sensor chip. The AM2103 chip is a high quality, fast response, anti-interference, but a little expensive chip. This sensor is composed of a capacitive humid sensor to detect humidity in a wide range from zero up to 100percent and a high precision temperature sensor in climate range from -40℃ up to +80℃, which is connected to a high-performance 8-bit microcontroller.

Fig: Temperature & Humidity Sensor

The humidity and temperature sensor is calibrated in the clean room (laboratory), then calculates calibration coefficients and stored in the microcontroller program, to call it while sensing and during signal processing. This sensor module is ultra-low power consumption, small size, and full auto calibration, which make it very suitable for portable applications. It can transmit the data to long distances up to 20 meters, thus is suitable for the industrial control from far away process. It is easily and completely interchangeable, so repairing process is simple and easy. It supports standard digital single bus output with long period stability. This module can be used in test and measurement tools and devices, HVAC equipment, dehumidifier, inspection equipment, consumer goods, automatic control, data loggers, home appliances, humidity regulator, medical projects, weather stations, and other humidity measurement and control and so on.

Flame sensor: A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm– 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital signal. These sensors are used in fire fighting robots like as a flame alarm.

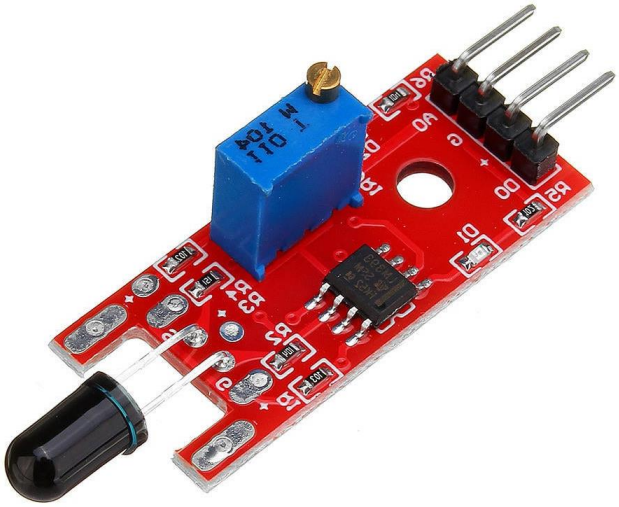


Fig: Flame Sensor

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat or smoke detector because of its mechanism while detecting the flame. This sensor or detector can be built with an electronic circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

Blynk platform: Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. Using the widgets, you can turn pins on and off or display data from sensors.

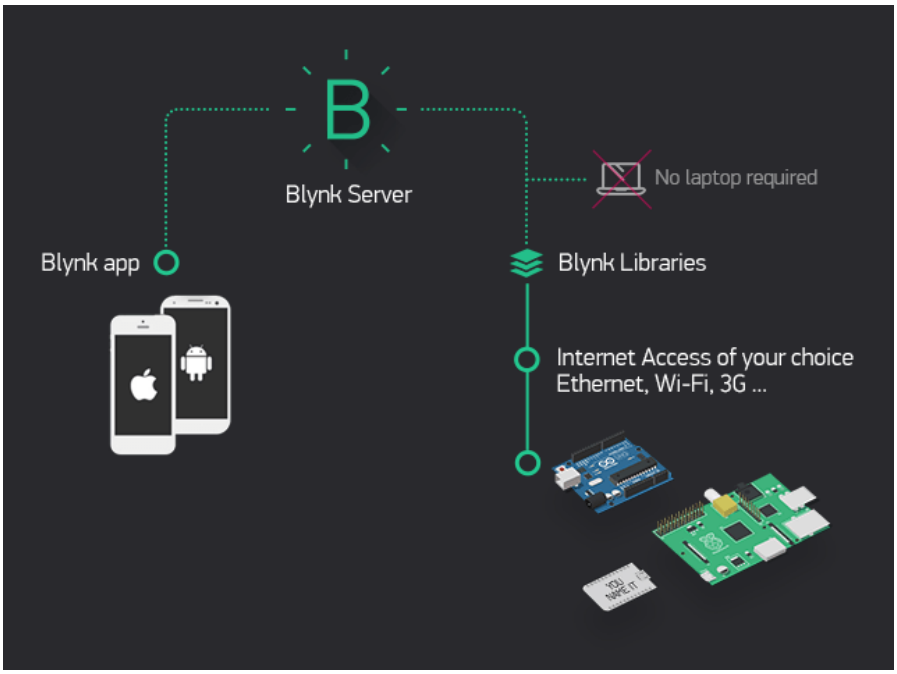


Fig: Blynk system

3.3 Workflow

1. Configure all the sensors and Actuators properly
2. Set up the Blynk app.
3. Connect Node MCU with Wi-fi.
4. Upload the source code.
5. Then Arduino Uno sends values to the display.
6. Control the system using mobile.

3.4 Conclusion

Time is 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 we are introducing Home Automation system with your mobile phone. You can turn on/off your home appliances the range of wifi. In present world, home automation is being popular due to comfort ability flexible means of monitoring and controlling the infections and other things according to users comfort and needs. The challenging part lies in simplify and cost of installing them in home and various with increasing number of services to be monitored and controlled. The project named "Home Automation" is idea of home automation using android phone. The popularity of home automation has been rising comprehensively because of considerable capability and simplicity through android phone and tablet connectivity. A home automation system integrates electrical devices with each other. The technique applied in home automation include those in building automation and the control of house hold activities such as lighting control system and the use of other electrical appliance devices may be connected via a home network.

Chapter 4

4.1 Introduction

The idea of a smart home is getting attention for the last few years. The key challenges in a smart home are intelligent decision making, secure identification, and authentication of the IoT devices, continuous connectivity, data security, and privacy issues. The existing systems are targeting one or two of these issues whereas a smart home automation system that is not only secure but also has intelligent decision making and analytical abilities is the need of time.

4.2 Experimental Setup

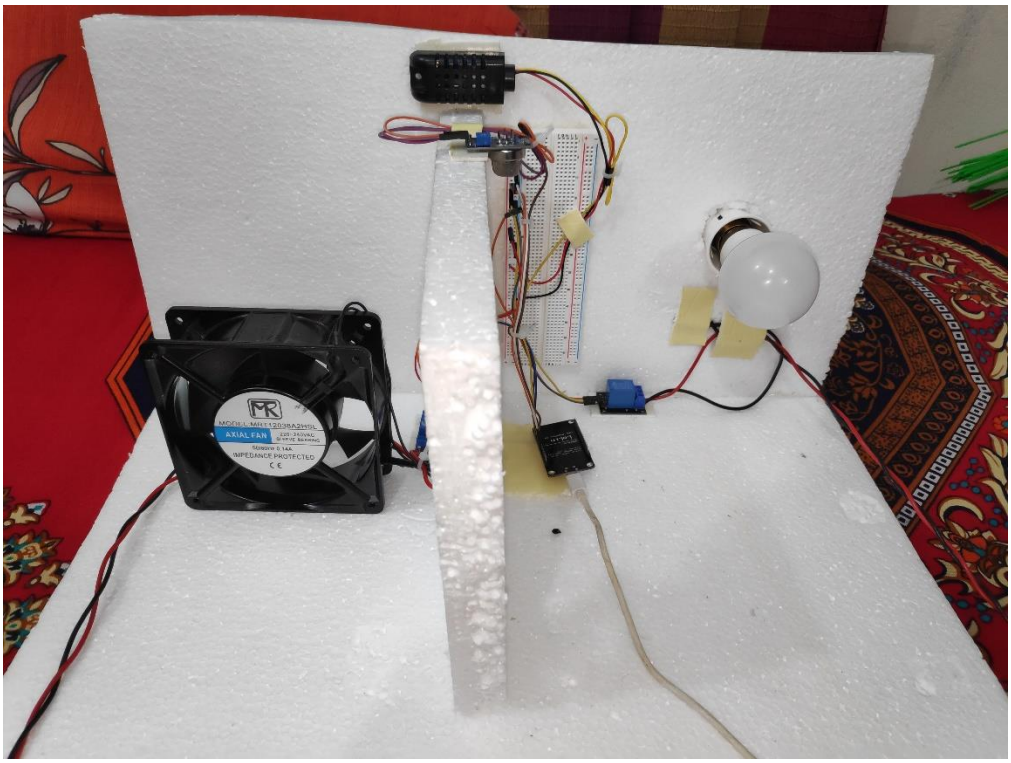


Fig: Project outlook

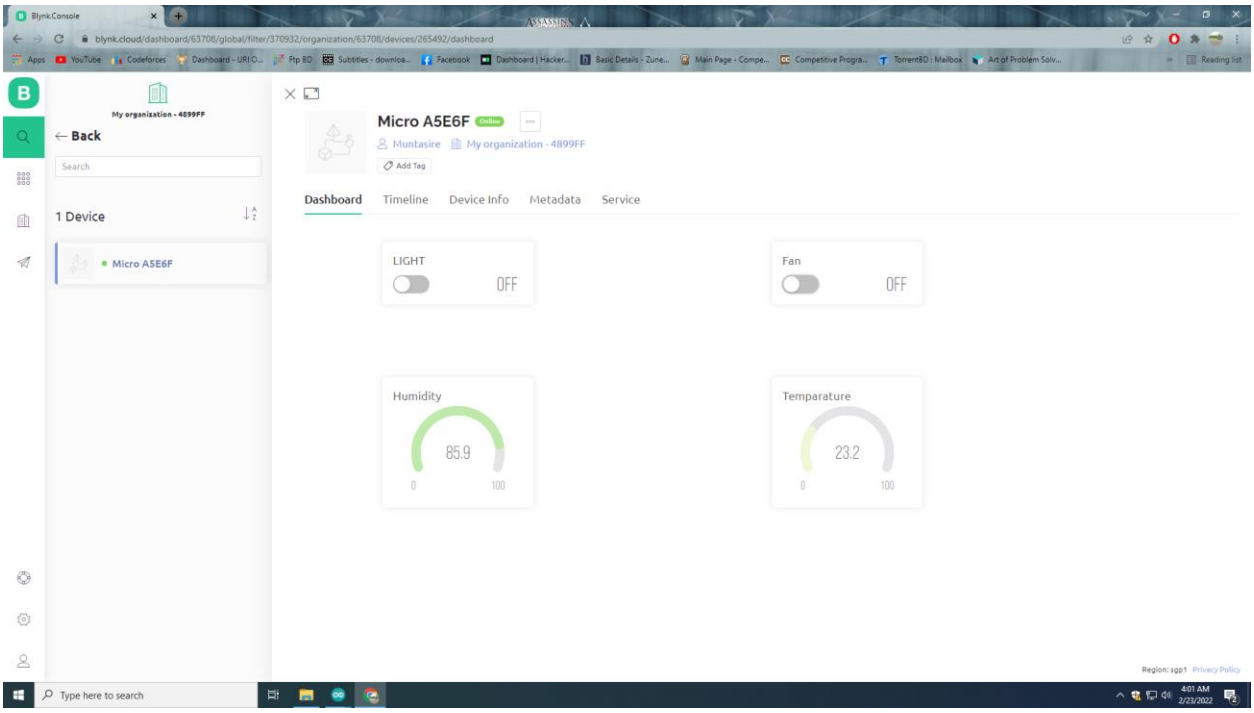
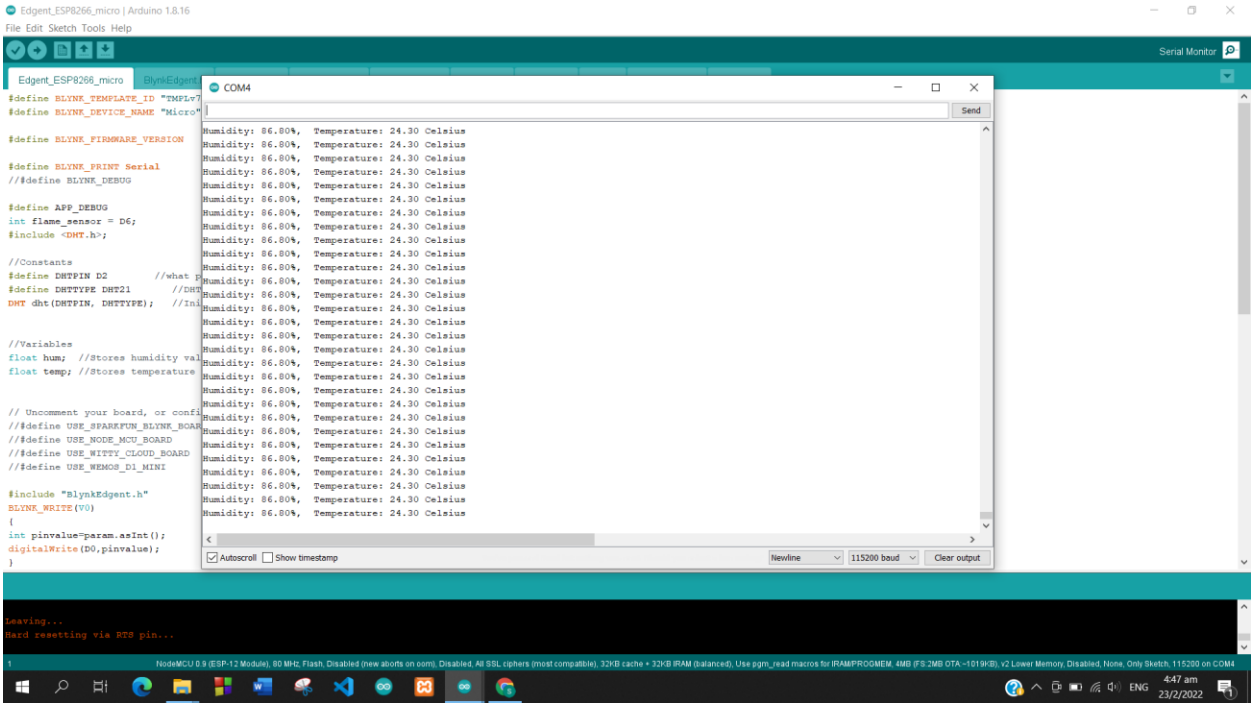


Fig: Blynk Dashboard

4.3 Experimental Result



4.4 Conclusion

In this research paper, the complete design scheme and working methodology of a home automation project are explained. The reason behind the paper is to get enhancement ideas to make it better and user friendly. This proposed system comprises two modes, the admin side in which the user able to design the complete prototype of the home and the user side in which the user able to control each device of the home .

Chapter 5

5.1 Summary

The final outcome of this project is a prototype for a simple home automation system which can control home AC appliances with a touch of a finger. On the front end, there is an android app to control the home appliances and PCB board to which a number of home appliances are connected. Then on the backend, there is nodemcu which has been programmed to control the appliances. Hence, the idea to create a fully working home automation system with facility to control and monitor appliances has been finally realized. The output of this project is an array of home appliances that are controlled over the smartphone with connection to wi-fi. The aim of this project was to build a home automation system so that the householder could dial into their house with a modem, from the office or even the other side of the world, and control their home appliances. The system as the name indicates, 'Home automation' makes the system more flexible and provides attractive user interface compared to other home automation systems. A novel architecture for a home automation system is proposed using the relatively new communication technologies.

This paper proposes a low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution. The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the Wi-Fi technology to connects system parts, satisfying user needs and requirements. Wi-Fi technology capable solution has proved to be controlled remotely, provide home security and is cost effective as compared to the previously existing systems. The project has proposed the idea of smart homes that can support a lot of home automation systems.

A smart home contains a connection between wireless communication, sensors, monitoring and tracking. Smart homes are a huge system that includes multiple technologies and applications that can be used to provide security and control of the home easily. Hence we can conclude that the required goals and objectives of home automation system have been achieved. The system design and architecture were discussed, and prototype presents the basic level of home appliance control and remote monitoring has been implemented. The main contribution of this paper is to satisfy the basic needs of a people who want his home to be automated. Finally, the proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems.

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