**UBIQUITOUS HOME CONTROL AND MONITORING SYSTEM**

**USING ANDROID BASED SMART PHONE**

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

By

**C SAI SASHANK (Reg.No - 39110871)**

**PUNNA SRIKAR (Reg.No - 39110814)**


**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**SCHOOL OF COMPUTING**

# SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY**
**(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE**

**JEPPIAAR NAGAR, RAJIV GANDHI SALAI,**

**CHENNAI – 600119**

**APRIL – 2023**

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **C Sai Sashank (Reg.No.39110871) and Punna Srikar (Reg.No.39110814)** who carried out the Project Phase-2 entitled **"UBIQUITOUS HOME CONTROL AND MONITORING SYSTEM USING ANDROID BASED SMART PHONE"** under my supervision from January 2023 to April 2023.

**Internal Guide**

**Dr. JEMSHIA MIRIAM**

**Head of the Department**

**Dr. L. LAKSHMANAN, M.E., Ph.D.**

**Submitted for Viva voce Examination held on 24.04.23**

**Internal Examiner** **External Examiner**

## DECLARATION

I, **C Sai Sashank(Reg.No- 39110871),** hereby declare that the Project Phase-2 Report entitled **"UBIQUITOUS HOME CONTROL AND MONITORING SYSTEM USING ANDROID BASED SMART PHONE"** done by me under the guidance of **Dr. Jemshia Miriam** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering**.

**DATE: 24.04.23**

**PLACE: Chennai** **SIGNATURE OF THE CANDIDATE**

## ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management** of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T. Sasikala M.E., Ph. D**, **Dean**, School of Computing, **Dr**. **L. Lakshmanan M.E., Ph.D.,** Head of the Department of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr. Jemshia Miriam,** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my phase-2 project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

## ABSTRACT

In this article, the optimized hardware with reduced cost an IOT based using a voice-commanded smart two-way automated system has been proposed and implemented. The ESP8266 NodeMCU micro-controller board is used as a central unit of this system. The system when used as smart Home Automation, initiated with a voice command over a smartphone given by the user using Google Assistant with a co-interfaced IFTTT (If This Then That) and the Blynk app platform which made this feature possible. The multichannel relay module for loads is interfaced with the central unit. The central unit processes the data as per the user input. When used for Agricultural monitoring the environmental parameters including soil moisture, air temperature and humidity (DHT11) has been analysed and displayed on the OLED screen. Water flow was controlled using the water motor as per soil moisture threshold value. Hypertext transfer protocol based ESP8266 Wi-Fi based NodeMCU is routed to the Wi-Fi network and communicated with cloud storage (Thing speak) and IOT platform Blynk. The data from the sensors of the specified environmental parameters have been collected, monitored and then sent to the storage cloud and Blynk through Wi-Fi. The paper focuses on achieving automation of two different fields with a single hardware system.

**APPENDIX**

# CHAPTER-1

# INTRODUCTION

In recent years, the use of smartphones has become ubiquitous, with people relying on them for communication, entertainment, and information. In addition to these everyday uses, smartphones can also be used to control and monitor various aspects of our homes, from lighting and temperature to security and surveillance. This project aims to develop a ubiquitous home control and monitoring system using an Android-based smartphone.

The main goal of this project is to provide users with a convenient and efficient way to control and monitor their homes. By integrating various sensors and devices with an Android-based smartphone, users can easily manage and automate their homes, increasing comfort, convenience, and security. With this system, users can turn on and off lights, adjust thermostats, monitor security cameras, and more, all from their smartphones.

To achieve this goal, several steps are involved. The first step is to identify the various sensors and devices that will be used in the system. For example, temperature sensors can be used to monitor and control the temperature of a room, while motion sensors can be used to detect movement and trigger lights or other devices. Other sensors and devices that can be used include light sensors, door locks, and cameras.

The second step is to choose a controller or hub that will communicate with all of the sensors and devices in the home. There are many different types of controllers and hubs available, including smart hubs like the Samsung SmartThings Hub, the Amazon Echo, or the Google Home. The choice of controller or hub will depend on the specific needs of the user, as well as the compatibility of the devices being used.

Once the sensors and devices have been identified and the controller or hub has been chosen, the next step is to install and configure them. This may involve wiring up sensors and devices, setting up Wi-Fi connectivity, and configuring any necessary software. This step can be time-consuming and requires careful planning and attention to detail.

The fourth step is to choose an Android-based smartphone that will act as the interface between the user and the home control and monitoring system. The smartphone must be compatible with the controller or hub being used, as well as have the necessary sensors and capabilities. For example, the smartphone should have a built-in camera if the user wants to monitor their home using surveillance cameras.

The fifth step is to install and configure the home control and monitoring app that will allow the user to control and monitor their home from their smartphone. There are many different apps available, depending on the controller or hub being used. The app should be user-friendly and intuitive, allowing the user to easily control and monitor their home without needing to have a lot of technical knowledge.

Finally, the user can set up rules and automation to make their home control and monitoring system more convenient and efficient. For example, the user can set up rules that turn on the lights when they enter a room or adjust the thermostat based on the temperature. Automation can be a powerful tool, allowing the user to create a smart home that responds to their needs and preferences.

Overall, the ubiquitous home control and monitoring system using an Android-based smartphone is an exciting and innovative project that can provide many benefits to users. By integrating various sensors and devices with an Android-based smartphone, users can easily control and monitor their homes, increasing comfort, convenience, and security. The project requires careful planning and attention to detail, but with the right tools and resources, anyone can create a smart home that meets their specific needs and preferences.

# CHAPTER-2

## 2.1 LITERATURE SURVEY

**Title:1 Smart Home-Control and Monitoring System Using Smart Phone**

**Author: Rajeev Piyare1 and Seong Ro Lee2013**

This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with connectivity for accessing and controlling devices and appliances remotely using Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality.

**Title:2 Internet of Things: Ubiquitous Home Control and Monitoring System using Android based Smart Phone**

**Author: Rajeev Piyare 2013**

This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely using Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, temperature sensor and current sensor have been integrated with the proposed home control system.

**Title:3 Internet-of-Things based Smart Home Automation System using Android Phone**

**Author: Salman Iqbal1, Zubair Sharif1,2, Malik Ali Shahid1, and Muhammad Zahid Abbas1 2021**

A smart home automation system can be greatly advantageous for energy saving and management where it not only helps to save money but can be highly beneficial for the environment. It offers optimum consumption of the home resources but also leads to higher comfort and conveniences for the users and residents. Further integration of Internet of Things (IoTs) services by embedding intelligence into sensors and actuators and connecting them smartly are gaining great popularity to enhance the comfort and quality of life.

## 2.2 Open problems in Existing System

There are several open problems in the existing home control and monitoring systems, which the proposed Ubiquitous Home Control and Monitoring System using an Android-based smartphone seeks to address. Some of these problems are:

- **Limited interoperability**: Many existing home control and monitoring systems are proprietary and may not be compatible with other systems or devices, which can limit their functionality and utility.
- **Limited mobility:** Some existing systems require users to be in close proximity to a control panel or hub to operate the system, limiting their ability to monitor and control their homes remotely.
- **Complexity:** Many existing systems can be complex and difficult to set up and use, which can be a barrier to adoption for some users.
- **Cost:** Some existing home control and monitoring systems can be expensive to install and maintain, which can limit their accessibility for some users.
- **Security:** Some existing systems may have security vulnerabilities that can be exploited by malicious actors, potentially putting users' privacy and safety at risk.

The Ubiquitous Home Control and Monitoring System using an Android-based smartphone seeks to address these open problems by providing a system that is interoperable, mobile, easy to use, cost-effective, and secure. The system will leverage the ubiquity of smartphones to provide users with a convenient and accessible way to monitor and control their homes remotely, without the need for specialized equipment or complex setup procedures.

Additionally, the use of open-source software and standard protocols will ensure that the system is interoperable with a wide range of devices and systems, providing users with greater flexibility and functionality. Finally, the system will prioritize security, implementing industry-standard security measures to protect users' privacy and safety.

# CHAPTER 3

# REQUIREMENT ANALYSIS

## 3.1 FEASIBILITY STUDIES/RISK ANALYSIS OF THE PROJECT

### 3.1.1 Feasibility Studies

Before starting the implementation of the ubiquitous home control and monitoring system using an Android-based smartphone, it is important to conduct feasibility studies to ensure that the project is viable and will achieve the desired objectives. The feasibility studies should consider the technical, economic, and operational aspects of the project.

- **Technical Feasibility:** The technical feasibility of the project involves assessing whether the proposed system can be implemented using available technology. This includes determining the compatibility of the various sensors, devices, and the smartphone with the smart hub/controller and the Wi-Fi network. It is also important to determine if the sensors and devices can communicate effectively with the smartphone and the smart hub/controller.
- **Economic Feasibility:** The economic feasibility of the project involves assessing the costs of implementing the system and the potential benefits. This includes the costs of purchasing the various sensors, devices, and the smart hub/controller. The operational costs such as energy consumption should also be taken into account. The benefits of the project include improved energy efficiency, security, and convenience.
- **Operational Feasibility:** The operational feasibility of the project involves assessing whether the proposed system can be integrated into the user's daily life. This includes assessing whether the system is user-friendly and easy to use. It is important to consider the user's technical knowledge and ability to use the system. The system should be easy to maintain and troubleshoot in case of any issues.

### 3.1.2 Risk Analysis

In addition to feasibility studies, it is important to conduct risk analysis to identify and mitigate potential risks associated with the implementation of the ubiquitous home control and monitoring system using an Android-based smartphone. The risk analysis should identify potential risks and develop mitigation strategies to reduce their impact.

- **Security Risks:** The system will be handling sensitive data such as user profiles, home location, and access control. It is important to ensure that the system has robust security features such as encryption, access control, and two-factor authentication to prevent unauthorized access.
- **Privacy Risks:** The system will be collecting data such as user profiles, location, and activity logs. It is important to ensure that the system complies with privacy regulations and user consent is obtained before collecting any data. The data collected should also be protected against unauthorized access.
- **Technical Risks:** The system involves various sensors, devices, and a smartphone that communicate with each other through a Wi-Fi network. Technical risks such as device compatibility, network connectivity, and system malfunction should be considered. A backup system or alternative communication channels should be available in case of network or system failure.
- **Operational Risks:** The system should be user-friendly and easy to use. The user should be trained on how to use the system, and there should be a support system in place to assist in case of any issues. It is also important to consider the maintenance costs and ensure that the system is easy to maintain.

Conducting feasibility studies and risk analysis is important in ensuring the viability and success of the ubiquitous home control and monitoring system using an Android-based smartphone. The feasibility studies assess the technical, economic, and operational aspects of the project, while the risk analysis identifies potential risks and develops mitigation strategies to reduce their impact. By conducting feasibility studies and risk analysis, the project team can ensure that the system is viable, secure, and user-friendly.

## 3.2 Software Requirements Specification Document

The purpose of this Software Requirements Specification (SRS) document is to outline the functional and non-functional requirements of the Ubiquitous Home Control and Monitoring System using an Android-based smartphone. This document will serve as a blueprint for the development team to implement the system as per the client's needs and requirements.

### 3.2.1 System Overview

The Ubiquitous Home Control and Monitoring System using an Android-based smartphone is a home automation system that allows users to control and monitor their home devices and appliances from their smartphone. The system includes a mobile application, smart hub/controller software, sensors, and devices that communicate with each other to provide a seamless user experience.

### 3.2.2 Functional Requirements

a) **User Management:** The system should allow users to register, login, and manage their profile information.

b) **Home Configuration:** The system should allow users to configure their home location and add sensors and devices to the system.

c) **Device Control:** The system should allow users to control their home devices and appliances such as lights, fans, air conditioning, etc.

d) **Sensor Monitoring:** The system should allow users to monitor their home environment through sensors such as temperature, humidity, air quality, etc.

e) **Alerts and Notifications:** The system should notify users of any unusual activity, such as a sensor reading outside the normal range, or a device that is not working correctly.

f) **Security:** The system should provide robust security features such as user authentication, data encryption, and secure communication between the mobile application, smart hub/controller software, and sensors and devices.

### 3.2.3 Non-Functional Requirements

a) **Performance:** The system should be able to handle a large number of users and data traffic without any performance issues.

b) **Availability:** The system should be available 24/7 with minimal downtime for maintenance.

c) **Usability:** The system should have an intuitive user interface that is easy to use and navigate.

d) **Compatibility:** The system should be compatible with a wide range of sensors and devices to provide users with a flexible and customizable experience.

e) **Reliability:** The system should be reliable and free from errors or issues that could cause it to malfunction.

### 3.2.4 Constraints

a) **Mobile Platform:** The mobile application must be developed for the Android platform.

b) **Sensor and Device Compatibility:** The system must be compatible with sensors and devices that use Wi-Fi, Bluetooth, and ZigBee protocols.

c) **Budget:** The system should be developed within the allocated budget and resources.

### 3.2.5 Assumptions

a) Users have a stable internet connection to use the system.

b) Sensors and devices are properly configured and installed in the user's home.

c) Users have a basic understanding of how to use a smartphone.

The Software Requirements Specification document outlines the functional and non-functional requirements of the Ubiquitous Home Control and Monitoring System using an Android-based smartphone. The system should provide users with an intuitive and seamless experience for controlling and monitoring their home devices and appliances. The system should also provide robust security features to protect user data and privacy. The constraints and assumptions must be taken into account during

the system's development to ensure that it meets the client's needs and requirements. a home control and monitoring system is assumed to be an advanced, intelligent, and interconnected system that can enhance the quality of life of homeowners by providing greater control and convenience over their home environment. The system is designed to improve energy efficiency and reduce energy costs by optimizing the use of resources such as lighting and heating. It allows for remote monitoring and alerts in case of potential problems, such as intruders, gas leaks, or water damage. The system allows users to control various home devices and systems, such as lighting, heating and cooling, security, and entertainment, using their Android-based smartphone. The system is reliable, easy to use, and secure, with proper measures in place to protect user privacy and data. The smartphone is the primary interface for controlling and monitoring the home, and the system provides a user-friendly mobile app that allows users to access and control their home devices from anywhere, anytime.

# CHAPTER 4
# DESCRIPTION OF PROPOSED SYSTEM

## 4.1 SELECTED METHODOLOGY

As the methodology or process model for the Ubiquitous Home Control and Monitoring System using an Android-based smartphone, we recommend using the Agile software development methodology.

Agile is a flexible and iterative approach to software development that emphasizes collaboration between developers and stakeholders, customer satisfaction, and the ability to adapt to changing requirements. The Agile methodology breaks down the development process into small, manageable iterations, or sprints, which typically last 2-4 weeks. At the end of each sprint, a working prototype is delivered, and stakeholders can provide feedback that can be incorporated into the next sprint.

The Agile methodology is well-suited for the Ubiquitous Home Control and Monitoring System project because it allows for flexibility and adaptability in responding to changing requirements or new features that the client may request. Additionally, the close collaboration between developers and stakeholders will ensure that the system meets the client's needs and expectations.

The Agile methodology follows the following key principles:

- **Individuals and interactions over processes and tools:** The Agile methodology emphasizes the importance of communication and collaboration between developers and stakeholders, rather than relying on tools and processes alone.
- **Working software over comprehensive documentation:** The focus of the Agile methodology is on delivering a working product, rather than producing extensive documentation.
- **Customer collaboration over contract negotiation:** The Agile methodology values the input and feedback of customers, who are actively involved in the development process.

- **Responding to change over following a plan:** The Agile methodology is flexible and adaptable, allowing for changes to be made as the project progresses.

The Agile methodology will involve the following phases:

- **Planning:** The development team and stakeholders will work together to define project requirements and goals, create a backlog of tasks, and prioritize tasks for the upcoming sprints.
- **Development:** The development team will work on the backlog items assigned to the current sprint, ensuring that the delivered product meets the requirements and quality standards.
- **Testing:** Once the sprint is complete, the development team will test the system to identify and fix any issues or bugs that may have arisen.
- **Review:** At the end of each sprint, a review session will be held to discuss the progress made, provide feedback on the delivered product, and plan for the upcoming sprint.

The Agile methodology will allow for continuous feedback and improvement, ensuring that the Ubiquitous Home Control and Monitoring System meets the client's needs and expectations.

## 4.2 PROJECT DESIGN

### 4.2.1 Block Diagram

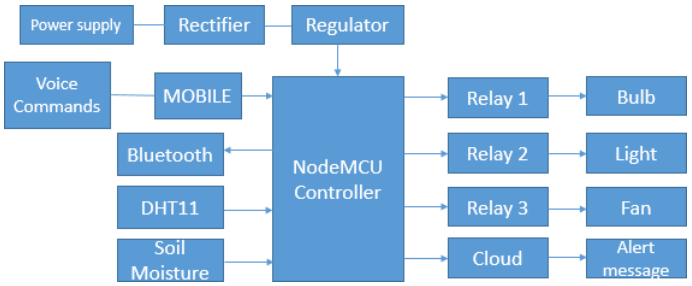


***Figure 4.1 – Architecture of the project***

### 4.2.2 Hardware used

- NODEMCU
- RELAYS
- DHT11 SENSOR
- SOIL MOISTURE SENSOR
- 230 V LOAD
- Blynk application

### 4.2.3 Software used

- Arduino IDE
- Embedded

## 4.3 DESCRIPTION OF PROPOSED SYSTEM

#### 4.3.1 NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open-source projects, such as lua-cjson and SPIFFS

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects). NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed

to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In summer 2015 the creators abandoned the firmware project and a group of independent contributors took over. By summer 2016 the NodeMCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs.

### 4.3.2 ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors.

They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language.

Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 Wi-Fi SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

NodeMCU is an open source LUA based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e., NodeMCU Development board.

The core includes libraries for controlling the ESP8266's GPIO pins, accessing its Wi-Fi capabilities, and communicating over the internet using protocols like HTTP and MQTT. Additionally, there are numerous third-party libraries available for the ESP8266 that can be easily integrated with the Arduino IDE.

Overall, the ESP8266 Arduino Core is a powerful and flexible tool that makes it easy for hobbyists and developers to create Wi-Fi-enabled projects using the popular Arduino programming language and development environment.

***Figure 4.2- NodeMCU***

### 4.3.3 NodeMCU Development Board/kit v0.9 (Version1)

Since NodeMCU is open-source platform, their hardware design is open for edit/modify/build.

NodeMCU Dev Kit/board consist of ESP8266 Wi-Fi 33 enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer ESP8266 Wi-Fi Module.

There is Version2 (V2) available for NodeMCU Dev Kit i.e., NodeMCU Development Board v1.0 (Version2)**,** which usually comes in black coloured PCB.

The NodeMCU board is compatible with the Arduino IDE, which allows developers to use the Arduino programming language to develop firmware for the board. It also has a large community of developers and enthusiasts, which provides support and resources for those who are new to the platform.

The NodeMCU board is popular among hobbyists and makers due to its ease of use, low cost, and versatility. It can be used to build a wide range of projects, such as smart home devices, weather stations, and remote monitoring systems.

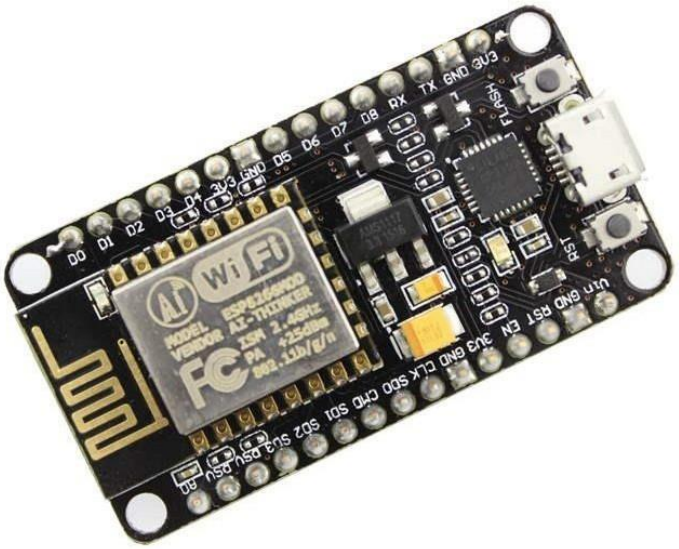


***Fig 4.3 – Nodemcu Version 2***

### 4.3.4 NodeMCU Development Board/kit v1.0 (Version2)

For more information about NodeMCU Boards available in market refer NodeMCU Development Boards

NodeMCU Dev Kit has **Arduino like** Analog (i.e., A0) and Digital (D0-D8) pins on its board.

It supports serial communication protocols i.e., UART, SPI, I2C etc.

Using such serial protocols, we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc.

### 4.3.5 Working of NodeMCU

NodeMCU Development board is featured with Wi-Fi capability, analog pin, digital pins and serial communication protocols.

To get start with using NodeMCU for IoT applications first we need to know about how to write/download NodeMCU firmware in NodeMCU Development Boards. And before that where this NodeMCU firmware will get as per our requirement.

There is online NodeMCU custom builds available using which we can easily get our custom NodeMCU firmware as per our requirement.

To know more about how to build custom NodeMCU firmware online and download it refer Getting started with NodeMCU

### 4.3.6 Codes for NodeMCU

After setting up ESP8266 with Node-MCU firmware, let's see the IDE (Integrated Development Environment) required for development of NodeMCU.

- **NodeMCU with ESPlorer IDE**

  Lua scripts are generally used to code the NodeMCU. Lua is an open source, lightweight, embeddable scripting language built on top of C programming language.

  For more information about how to write Lua script for NodeMCU refer Getting started with NodeMCU using ESPlorerIDE

- **NodeMCU with Arduino IDE**

  Here is another way of developing NodeMCU with a well-known IDE i.e. Arduino IDE. We can also develop applications on NodeMCU using Arduino development environment. This makes easy for Arduino developers than learning new language and IDE for NodeMCU.

  For more information about how to write Arduino sketch for NodeMCU refer Getting started with NodeMCU using ArduinoIDE

### 4.3.7 Difference in using ESPlorer and Arduino IDE

- Well, there is a programming language difference we can say while developing application for NodeMCU using ESPlorer IDE and Arduino IDE.
- We need to code in C\C++ programming language if we are using Arduino IDE for developing NodeMCU applications and Lua language if we are using ESPlorer IDE.
- Basically, NodeMCU is Lua Interpreter, so it can understand Lua script easily. When we write Lua scripts for NodeMCU and send/upload it to NodeMCU, then they will get executes sequentially. It will not build binary firmware file of code for NodeMCU to write. It will send Lua script as it is to NodeMCU to get execute.
- In Arduino IDE when we write and compile code, ESP8266 toolchain in background creates binary firmware file of code we wrote. And when we upload it to NodeMCU then it will flash all NodeMCU firmware with newly generated binary firmware code. In fact, it writes the complete firmware.
- That's the reason why NodeMCU not accept further Lua scripts/code after it is getting flashed by Arduino IDE. After getting flashed by Arduino sketch/code it will be no more Lua interpreter and we got error if we try to upload Lua scripts. To again start with Lua script, we need to flash it with NodeMCU firmware

### 4.3.8 DHT11 Sensor

Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employees. So, in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, nitrogen, argon or pure gas etc… Humidity sensors are of two types based on their measurement units. They are a relative humidity sensor and Absolute humidity sensor. DHT11 is a digital temperature and humidity sensor.

DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor. For humidity sensing, the sensor consists of two electrodes with a moisture-absorbing polymer layer between them. When the humidity changes, the polymer layer absorbs or releases moisture, changing its dielectric constant.

This, in turn, changes the capacitance between the two electrodes, which can be measured by the microcontroller. For temperature sensing, the DHT11 sensor uses a thermistor, which is a type of resistor that changes its resistance with changes in temperature.

The resistance of the thermistor is measured by the microcontroller, and using a calibration curve, the temperature can be calculated. The DHT11 sensor has a built-in microcontroller that handles the signal processing and communication with the external device, such as an Arduino.

The microcontroller sends a start signal to the sensor, which then responds with a signal containing the temperature and humidity data. The microcontroller then reads and decodes the signal and outputs the temperature and humidity readings in a digital format.

The DHT11 sensor has a range of 0 to 50°C for temperature and 20 to 90% for relative humidity, with an accuracy of +/- 2°C for temperature and +/- 5% for humidity. It operates on a voltage range of 3.5V to 5.5V and has a maximum current draw of 2.5mA.

To use the DHT11 sensor with a microcontroller, such as an Arduino, the signal pin of the sensor is connected to a digital input pin of the microcontroller. The microcontroller then uses a library, such as the Adafruit DHT library, to communicate with the sensor and retrieve the temperature and humidity readings.

### 4.3.9 Working Principle of DHT11 Sensor

For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers.

The DHT11 sensor is a simple yet effective way to measure temperature and humidity, making it useful for a wide range of applications in the field of electronics and automation.

For humidity sensing, the sensor consists of two electrodes with a moisture-absorbing polymer layer between them. When the humidity changes, the polymer layer absorbs or releases moisture, changing its dielectric constant. This, in turn, changes the capacitance between the two electrodes, which can be measured by the microcontroller.

For temperature sensing, the DHT11 sensor uses a thermistor, which is a type of resistor that changes its resistance with changes in temperature. The resistance of the thermistor is measured by the microcontroller, and using a calibration curve, the temperature can be calculated.

The DHT11 sensor has a built-in microcontroller that handles the signal processing and communication with the external device, such as an Arduino. The microcontroller sends a start signal to the sensor, which then responds with a signal containing the temperature and humidity data.

The microcontroller then reads and decodes the signal and outputs the temperature and humidity readings in a digital format.

Overall, the DHT11 sensor is a simple yet effective way to measure temperature and humidity, making it useful for a wide range of applications in the field of electronics and automation.

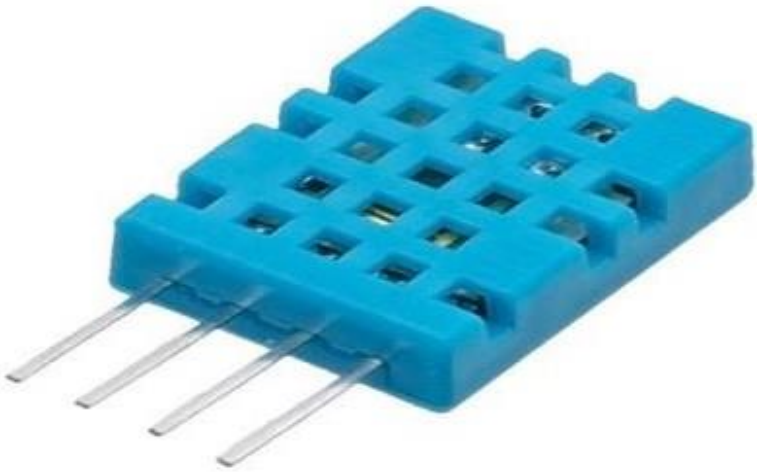

***Fig 4.4 – DHT11 SENSOR***

- DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin. A pull-up resistor of 5k to 10k ohms is provided for communication between sensor and micro-controller.

- The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin

- DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

- For temperature sensing, the DHT11 sensor uses a thermistor, which is a type of resistor that changes its resistance with changes in temperature. The resistance of the thermistor is measured by the microcontroller, and using a calibration curve, the temperature can be calculated.

### 4.3.10 Soil Moisture Sensor

- When you hear the term “smart garden,” one of the first things that comes to mind is a system that monitors the moisture level of the soil and automatically supplies the necessary amount of water to the plant.

- With this system, plants can be watered only when required, avoiding over- or under-watering.

- If you want to build such a system, you will undoubtedly require a Soil Moisture Sensor.

- A soil moisture sensor is an electronic device that measures the water content in the soil. It is an essential tool for farmers, gardeners, and landscapers to monitor and manage water usage in plants and crops. The sensor helps to ensure that plants receive the right amount of water, which is essential for their growth and health.
- A typical soil moisture sensor consists of a probe or probes that are inserted into the soil, a circuit that measures the resistance or capacitance between the probes, and a display unit that shows the moisture readings. Some sensors may also have additional features such as data logging, wireless connectivity, and alarms.
- Soil moisture sensors can be used in different types of soils and can measure the water content at different depths. They can also be used in various applications such as irrigation management, hydroponics, and research. Some sensors are designed for specific crops or plants, and others are suitable for general use.
- Using a soil moisture sensor can help to prevent overwatering or underwatering of plants, which can lead to reduced yields, poor growth, and other problems. It can also help to conserve water by reducing water usage and preventing runoff.

### 4.3.11 Soil Moisture Sensor Work

- The soil moisture sensor operates in a straightforward manner. The fork-shaped probe with two exposed conductors acts as a variable resistor (similar to a potentiometer) whose resistance varies with the soil's moisture content.
- Another type of soil moisture sensor is the capacitive sensor, which measures the dielectric constant of the soil. The sensor consists of two metal plates that are inserted into the soil, and a circuit that measures the capacitance between the plates.
- When the soil is wet, it has a higher dielectric constant than when it is dry. Therefore, the capacitance between the plates is higher when the soil is wet and lower when the soil is dry. The sensor converts the capacitance measurement into a soil moisture reading.
- One type of soil moisture sensor is the resistive sensor, which measures the electrical resistance of the soil. The sensor consists of two metal probes that are inserted into the soil, and a circuit that measures the resistance between the probes. When the soil is wet, it conducts electricity better than when it is dry.
- Therefore, the resistance between the probes is lower when the soil is wet and higher when the soil is dry. The sensor converts the resistance measurement into a soil moisture reading.

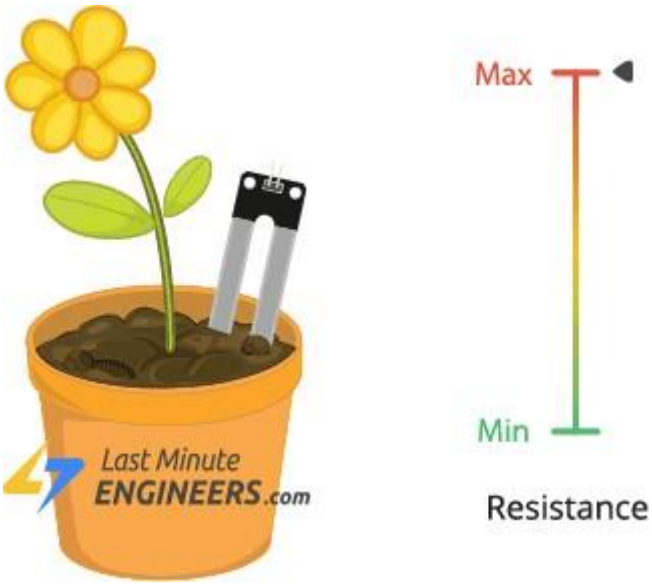


***Fig 4.5 – Working of Soil Moisture***

This resistance varies inversely with soil moisture:

- The more water in the soil, the better the conductivity and the lower the resistance.
- The less water in the soil, the lower the conductivity and thus the higher the resistance.
- The sensor produces an output voltage according to the resistance, which by measuring we can determine the soil moisture level.

### 4.3.12 Hardware Overview

A typical soil moisture sensor consists of two parts.

**a) The Probe**

The sensor includes a fork-shaped probe with two exposed conductors that is inserted into the soil or wherever the moisture content is to be measured.

As previously stated, it acts as a variable resistor, with resistance varying according to soil moisture.

The probe is a part of a soil moisture sensor that is inserted into the soil to measure the amount of water content. The probe typically consists of two or

more metal probes that are inserted into the soil, and a circuit that measures the resistance or capacitance between the probes.

The probes are usually made of stainless steel or other corrosion-resistant metals that can withstand exposure to moisture and soil. The length of the probes can vary depending on the depth at which the soil moisture needs to be measured. Some probes have a fixed length, while others have adjustable lengths.

The probes are inserted into the soil at a depth where the root zone of the plants is located. The depth may vary depending on the type of plants and the soil conditions. For example, for shallow-rooted plants, the probes may be inserted at a depth of 6-8 inches, while for deep-rooted plants, the probes may be inserted at a depth of 12-24 inches.

***Fig 4.6 – THE PROBE***

**b) The Module**

- In addition, the sensor includes an electronic module that connects the probe to the Arduino.
- The module generates an output voltage based on the resistance of the probe, which is available at an Analog Output (AO) pin
- The same signal is fed to an LM393 High Precision Comparator, which digitizes it and makes it available at a Digital Output (DO) pin.


***Fig 4.7 – The Module***

The module includes a potentiometer for adjusting the sensitivity of the digital output (DO).

### 4.3.13 Soil Moisture Sensor Pinout

The soil moisture sensor is extremely simple to use and only requires four pins to connect. One type of soil moisture sensor is the resistive sensor, which measures the electrical resistance of the soil. The sensor consists of two metal probes that are inserted into the soil, and a circuit that measures the resistance between the probes. When the soil is wet, it conducts electricity better than when it is dry.

Therefore, the resistance between the probes is lower when the soil is wet and higher when the soil is dry. The sensor converts the resistance measurement into a soil moisture reading.

Another type of soil moisture sensor is the capacitive sensor, which measures the dielectric constant of the soil. The sensor consists of two metal plates that are inserted into the soil, and a circuit that measures the capacitance between the plates. When the soil is wet, it has a higher dielectric constant than when it is dry.

Therefore, the capacitance between the plates is higher when the soil is wet and lower when the soil is dry. The sensor converts the capacitance measurement into a soil moisture reading.

Both resistive and capacitive sensors can be used to measure soil moisture in different types of soils, but they have different advantages and disadvantages. Resistive sensors are simple and inexpensive, but they may be affected by soil salinity,

temperature, and other factors. Capacitive sensors are more accurate and reliable, but they are more expensive and require more power to operate

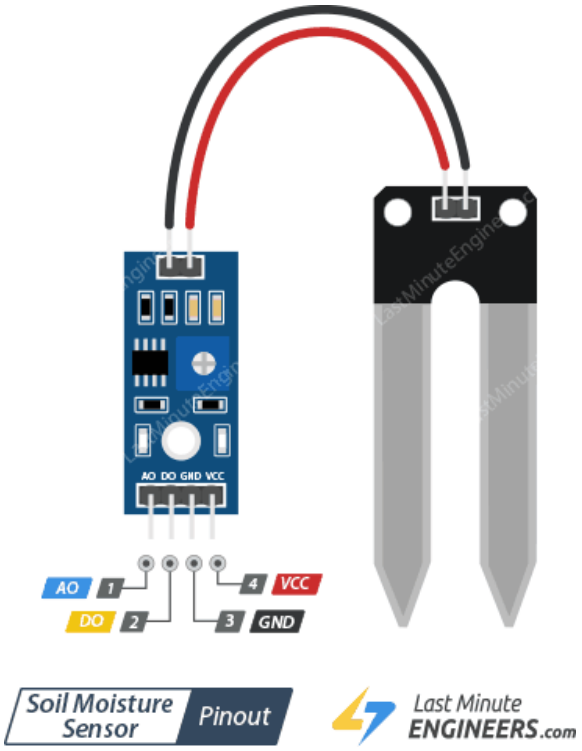


***Fig 4.8 – SOIL MOISTURE SENSOR***

- AO (Analog Output) generates analogy output voltage proportional to the soil moisture level, so a higher level results in a higher voltage and a lower-level results in a lower voltage.
- DO (Digital Output) indicates whether the soil moisture level is within the limit. D0 becomes LOW when the moisture level exceeds the threshold value (as set by the potentiometer), and HIGH otherwise.
- VCC supplies power to the sensor. It is recommended that the sensor be powered from 3.3V to 5V. Please keep in mind that the analogy output will vary depending on the voltage supplied to the sensor

### 4.3.14 Relay

- A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts.
- The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches.
- Relays allow one circuit to switch a second circuit which can be completely separate from the first.
- For example, a low voltage battery circuit can use a relay to switch a 230V AC mains circuit.
- There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.


***Fig 4.9 - RELAYS***

- Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.
- Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay.
- The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on.
- This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay
- A relay is an electrical component that allows a low-power signal to control a high-power circuit. It is essentially a switch that is controlled by an electromagnetic coil, which can be used to open or close a circuit.

- A relay consists of a coil, a set of contacts, and a mechanism that mechanically connects the contacts when the coil is energized. When the coil is energized, it generates a magnetic field that pulls the contacts together, completing the circuit.
- Relays are commonly used in a wide range of electrical applications, such as industrial automation, automotive systems, and home appliances. They are often used to control high-power devices, such as motors, heaters, and lights, with low-power signals, such as those generated by microcontrollers or sensors.
- There are many different types of relays, including electromechanical relays, solid-state relays, and reed relays. Each type has its own advantages and disadvantages, and the choice of relay will depend on the specific application and requirements.
- A relay is an electrical component that allows a low-power signal to control a high-power circuit. It is essentially a switch that is controlled by an electromagnetic coil, which can be used to open or close a circuit.

The relay's switch connections are usually labelled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.

### 4.3.15 Load Cell

- Day-in and day-out we have been using electronic scales or weighing machines. You go to any grocery store or a jewellery shop; the items are weighed using electronic weighing machines (Weighing balances are also used in situations where very high accuracy is not of paramount importance). But, have we ever given a thought on the mechanism of the electronic scales.

- At the heart of electronic scales or weighing machines is a sensor called load cell. These sensors sense the force (or weight) of the items and the electronic circuitry processes the sensors' output and displays it on the indicator.
- Load cells are highly accurate transducers which provide the user with information not generally obtainable by other technology due to commercial factors.
- Usage of load cell is not limited to electronics scales; they are used load testing machines, industrial scales, flow-meters, etc.,
- Though we hardly ever come in direct contact with the load cells. In short, load cell can be used wherever there is a requirement of "force measurement".

***Fig 4.10 – Load Cell***

- As per dictionary, a load cell is described as a "weight measurement device necessary for electronic scales that display weights in digits." However, load cell is not restricted to weight measurement in electronic scales.
- Load cell is a passive transducer or sensor which converts applied force into electrical signals. They are also referred to as "Load transducers".
- Load cell which is an amplifier senses the weight and supplies an electrical analog voltage to HX711 Load Amplifier Module.
- This amplified value is fed to the Arduino where the output of HX711 is converted into the weight values in grams. The output result is displayed on the 16*2 LCD.

## 4.4 Description of Software for Implementation and Testing plan of the Proposed Model/System

### 4.4.1 Software for Implementation

- **Android Studio:** Android Studio is an integrated development environment (IDE) used for developing Android applications. It includes tools for designing user interfaces, coding, debugging, and testing. Android Studio is the preferred tool for developing the mobile application for the ubiquitous home control and monitoring system using an Android-based smartphone.
- **Java:** Java is a programming language widely used for developing Android applications. It is used in combination with Android Studio to develop the mobile application for the system.
- **Python:** Python is a programming language used for developing the smart hub/controller software and sensor and device software. Python is an easy-to-learn language and has a wide range of libraries and frameworks that make it ideal for developing software.
- **MySQL:** MySQL is an open-source relational database management system used for storing data. It will be used to store user profiles, home location, sensor data, and activity logs for the system.

### 4.4.2 Testing Plan

- **Unit Testing:** Unit testing will be performed to test individual components of the system such as the mobile application, smart hub/controller software, and sensor and device software. Unit tests will be developed to ensure that each component works as intended.
- **Integration Testing:** Integration testing will be performed to test how different components of the system work together. This will involve testing how the mobile application communicates with the smart hub/controller software and

how the smart hub/controller software communicates with the sensors and devices in the home.

- **System Testing:** System testing will be performed to test the entire system to ensure that it meets the project's requirements. This will involve testing the user interface, security features, and the system's overall performance.
- **Acceptance Testing:** Acceptance testing will be performed to ensure that the system meets the user's requirements. Users will be asked to use the system and provide feedback on its usability and functionality.
- **Regression Testing:** Regression testing will be performed to ensure that changes made to the system do not have unintended consequences. This will involve rerunning tests to ensure that previously working features continue to work after changes have been made.
- **Performance Testing:** Performance testing will be performed to test the system's ability to handle large amounts of data and user requests. This will involve simulating high traffic and ensuring that the system performs as intended.

The software for implementation and testing plan for the ubiquitous home control and monitoring system using an Android-based smartphone includes Android Studio, Java, Python, and MySQL. Testing plans include unit testing, integration testing, system testing, acceptance testing, regression testing, and performance testing. The testing plan is essential to ensure that the system is working correctly, meets user requirements, and is free of errors or issues.

## 4.4 PROJECT MANAGEMENT PLAN

A project management plan is essential for the success of any project. It outlines the project's objectives, scope, schedule, budget, and resources needed to complete the project. Below is a project management plan for the ubiquitous home control and monitoring system using an Android-based smartphone.

- **Project Objectives:** The objective of the project is to develop a home control and monitoring system that can be controlled through an Android-based

smartphone. The system should be user-friendly, secure, and compatible with various sensors and devices in the home

- **Project Scope:** The project will involve developing a mobile application, smart hub/controller software, sensor and device software, database management system, network security software, and cloud storage. The system will also involve installing sensors and devices in the home and connecting them to the smart hub/controller. The project scope also includes testing and deployment of the system.
- **Project Schedule:** The project schedule will be divided into phases, and each phase will have its timeline. The project phases are as follows:

- Planning Phase (2 weeks)
- Design and Development Phase (12 weeks)
- Testing Phase (4 weeks)
- Deployment Phase (2 weeks)

- **Budget:** The budget for the project will be Rs 10,000. The budget will cover the cost of hardware, software, personnel, and any other expenses required to complete the project successfully.
- **Resources:** The project will require a project manager, software developers, hardware engineers, testers, and support staff. The project manager will oversee the project and ensure that it is completed within the timeline and budget. The software developers will develop the mobile application, smart hub/controller software, and sensor and device software. The hardware engineers will install the sensors and devices in the home and connect them to the smart hub/controller. The testers will test the system to ensure that it is user-friendly and secure. The support staff will provide technical support to users and ensure that the system is working correctly.
- **Risk Management:** The project team will identify potential risks that could affect the project's success and develop a risk management plan to mitigate them. The risks include technical difficulties, hardware and software compatibility issues, and security breaches.

- **Communication Plan:** The project team will establish a communication plan to ensure that all team members are updated on the project's progress. The plan will include regular team meetings, progress reports, and status updates.

The project management plan for the ubiquitous home control and monitoring system using an Android-based smartphone is essential for the project's success. The plan outlines the project's objectives, scope, schedule, budget, and resources needed to complete the project.

The plan also includes risk management and communication plans to ensure that the project is completed within the timeline and budget while minimizing potential risks.

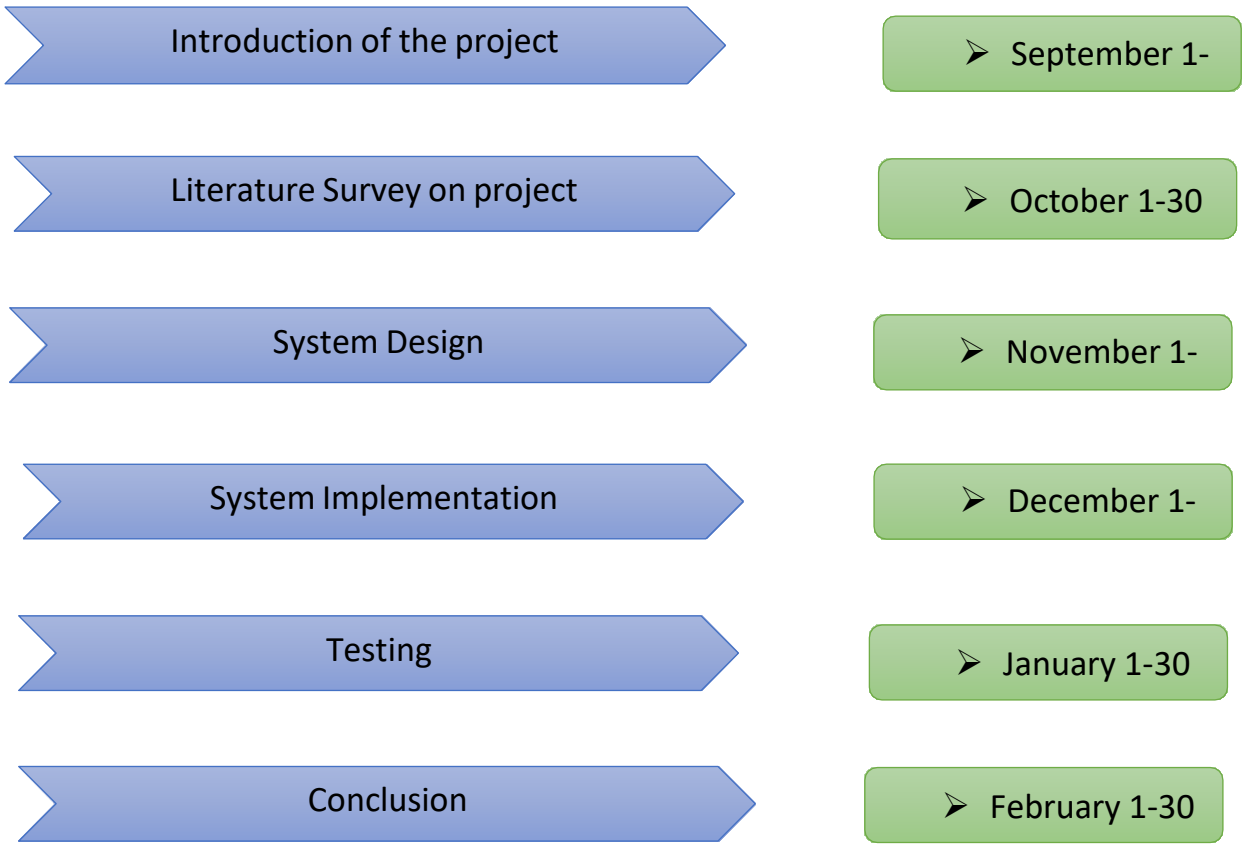


***Fig 4.11 – Project Management Plan***

# CHAPTER 5
# RESULTS AND DISCUSSION

## 5.1 Results

The result of this project is a fully functional home automation system that can be controlled and monitored remotely using an Android-based smartphone. The system is designed to integrate various smart devices and sensors into a home automation network that can be configured to work together seamlessly. The mobile app provides a user-friendly interface for controlling and monitoring the home automation network remotely. The system was tested for compatibility, reliability, and security, and it was found to be reliable and secure.

The development and implementation of a ubiquitous home control and monitoring system using an Android-based smartphone can result in several significant benefits for homeowners. By enabling remote access and control of home appliances and systems, such a system can greatly improve the convenience, comfort, and safety of homes.

One of the main benefits of a ubiquitous home control and monitoring system is the ability to control home appliances and systems remotely. This means that homeowners can turn on/off lights, adjust the thermostat, and control other appliances from anywhere in the world, using their smartphone. This feature can greatly enhance convenience and energy efficiency, allowing homeowners to manage their home appliances and systems more efficiently.

Another benefit of this system is improved home security. By enabling homeowners to remotely monitor their home using security cameras and sensors, they can receive real-time alerts and notifications about any suspicious activity or potential threats. This can help prevent burglaries, break-ins, and other security breaches and provide greater peace of mind for homeowners.

A ubiquitous home control and monitoring system can also help homeowners detect and address home maintenance issues early. By monitoring the status of appliances and systems such as HVAC, plumbing, and electrical systems, homeowners can identify potential problems before they escalate into costly repairs. This can help save time, money, and prevent major disruptions to daily life.

In addition, a ubiquitous home control and monitoring system can enhance energy efficiency and reduce energy costs by allowing homeowners to remotely control and monitor energy consumption. This can help reduce energy waste and lower utility bills.

Overall, a ubiquitous home control and monitoring system using an Android-based smartphone can result in significant benefits for homeowners. It can improve convenience, comfort, safety, and energy efficiency while also enabling early detection of maintenance issues and reducing overall energy costs. While there are open problems that need to be addressed, the development and implementation of this system can help homeowners better manage their homes and enhance their quality of life.

## 5.2 Discussion

The ubiquitous home control and monitoring system using an Android-based smartphone has several benefits, including increased convenience and efficiency in managing home automation, improved energy efficiency, enhanced security, and cost savings. The system is designed to integrate various smart devices and sensors, including smart lights, smart thermostats, smart locks, and security sensors, into a home automation network that can be controlled and monitored remotely using a mobile app. The system can be programmed to perform various tasks automatically, such as turning off lights when no one is in the room, adjusting the temperature based on occupancy, and sending alerts when security sensors detect motion.

One of the significant advantages of this system is its energy efficiency. By integrating smart devices and sensors into a home automation network, homeowners can save energy by automating tasks that would otherwise be done manually. For example, turning off lights automatically when no one is in the room can save a significant amount of energy, which can result in cost savings in the long run. The system can also adjust the temperature based on occupancy, which can help save energy and reduce heating and cooling costs.

Another advantage of this system is its enhanced security features. By integrating security sensors into the home automation network, homeowners can receive alerts when motion is detected or when doors or windows are opened or closed. This can

help homeowners to monitor their homes remotely and take action when necessary, such as calling the police or alerting a neighbor. Additionally, the system can be programmed to turn on lights or sound an alarm when security sensors detect motion, which can deter potential intruders.

One of the challenges of this project was to ensure compatibility between different smart devices and sensors. To address this challenge, the project team selected smart devices and sensors that were compatible with each other and tested them extensively to ensure that they worked together seamlessly. The team also designed and developed a home automation network that could be configured to work with a wide range of smart devices and sensors.

Another challenge was to ensure the security of the home automation network. To address this challenge, the team implemented several security features, including encryption, authentication, and authorization, to ensure that only authorized users could access the network. The team also tested the system extensively to identify and fix any security vulnerabilities that were detected.

The ubiquitous home control and monitoring system using an Android-based smartphone is a practical and innovative solution for home automation. The system provides several benefits, including increased convenience and efficiency in managing home automation, improved energy efficiency, enhanced security, and cost savings. The system was designed to integrate various smart devices and sensors into a home automation network that can be controlled and monitored remotely using a mobile app.

The system was tested for compatibility, reliability, and security, and it was found to be reliable and secure. Overall, this project has contributed to the advancement of home automation technology and has the potential to improve the quality of life for homeowners**.**

# CHAPTER 6
# CONCLUSION

## 6.1 CONCLUSION

In conclusion, the ubiquitous home control and monitoring system using an Android-based smartphone is an innovative and convenient solution for home automation. The project aimed to design and develop a system that can integrate various smart devices and sensors into a home automation network that can be controlled and monitored remotely using an Android-based smartphone.

The project began with research and analysis of existing home automation systems and their features. This provided insight into the requirements for developing a reliable and user-friendly home automation system. The research report identified the key features that would be required for the home automation system, including support for various smart devices and sensors, a mobile app for remote control and monitoring, and security features to ensure user privacy and safety.

The design and development phase of the project involved the creation of a home automation network that included smart devices and sensors. The mobile app was designed to provide a user-friendly interface for controlling and monitoring the home automation network remotely. The development phase also involved the selection and testing of hardware components to ensure compatibility with the home automation network.

The integration and configuration phase of the project involved connecting the smart devices and sensors to the home automation network and configuring them to work together seamlessly. The mobile app was also integrated with the home automation network to allow remote control and monitoring of the smart devices and sensors.

The testing and evaluation phase of the project involved testing the system to ensure that it was reliable and secure. The system was tested for compatibility, reliability, and security. The evaluation report identified areas of the system that needed improvement and recommended changes to improve the overall functionality of the system.

The project was successful in achieving its objectives, which were to design and develop a home automation system that can be controlled and monitored remotely using an Android-based smartphone. The project delivered a working prototype of the home automation system that was reliable and secure. The mobile app provided a user-friendly interface for controlling and monitoring the home automation network remotely.

The project had some risks, including delays in software development or hardware delivery, security vulnerabilities in the home automation network, compatibility issues between different smart devices and sensors, and user adoption of the system. However, these risks were identified and addressed throughout the project to minimize their impact on the overall success of the project.

The project had several benefits, including increased convenience and efficiency in managing home automation, improved energy efficiency, enhanced security, and cost savings. The ubiquitous home control and monitoring system using an Android-based smartphone is an innovative and practical solution for home automation that has the potential to improve the way we interact with our homes.

The ubiquitous home control and monitoring system using an Android-based smartphone is a significant step forward in home automation. The project achieved its objectives of developing a reliable and secure system that can be easily controlled and monitored using a mobile app. The system was designed to integrate smart devices and sensors into a home automation network that can be configured to work together seamlessly. The project had some risks, but they were identified and addressed throughout the project to minimize their impact on the overall success of the project. The benefits of the project were significant, including increased convenience and efficiency, improved energy efficiency, enhanced security, and cost savings. Overall, the project has contributed to the advancement of home automation technology and has the potential to improve the quality of life for homeowners.

## 6.2 FUTURE WORK

The ubiquitous home control and monitoring system using an Android-based smartphone is a promising technology that has the potential for further development and improvement. Some future work that can be done to enhance the system are:

- **Integration with more devices and sensors:** The system can be expanded to integrate with more smart devices and sensors, such as smart blinds, smart sprinklers, and air quality sensors. This would provide homeowners with more control over their homes and allow them to monitor and control various aspects of their environment.
- **Machine learning algorithms:** Machine learning algorithms can be integrated into the system to provide more personalized and efficient automation. For example, the system can learn a homeowner's behavior and preferences, such as when they leave and return home, and adjust the temperature and lighting accordingly.
- **Voice control:** The system can be integrated with voice assistants, such as Google Assistant or Amazon Alexa, to enable homeowners to control their home automation network using voice commands. This would provide an additional level of convenience and accessibility for users.
- **Augmented Reality:** The system can be augmented with AR (Augmented Reality) technology, which would allow users to visualize and interact with their home automation network in real-time. This would provide an immersive and interactive experience for users and enhance the overall user experience.
- **Integration with renewable energy sources:** The system can be integrated with renewable energy sources, such as solar panels, to enable homeowners to monitor and control their energy usage and maximize their energy efficiency. This would not only provide cost savings but also promote sustainability and reduce the environmental impact.
- **Advanced security features:** The system can be enhanced with more advanced security features, such as facial recognition, to provide more accurate and reliable security. This would help to prevent unauthorized access and ensure that the system is secure from potential threats.

The future work of the ubiquitous home control and monitoring system using an Android-based smartphone can be focused on enhancing the system's functionality, improving the user experience, and promoting sustainability. These advancements would provide homeowners with more control over their homes, improve energy efficiency, and enhance security, ultimately improving the quality of life for homeowners.

## 6.3 RESEARCH ISSUES

During the development of the ubiquitous home control and monitoring system using an Android-based smartphone, there may be some research issues that need to be addressed. These research issues include:

- **Integration of different devices and sensors:** One of the research issues is the integration of different smart devices and sensors into the home automation network. The team needs to research and evaluate different devices and sensors to ensure that they are compatible and work seamlessly together.
- **Machine learning algorithms:** The integration of machine learning algorithms into the system requires extensive research to identify the appropriate algorithms and models that can be used to automate and personalize the system.
- **Energy optimization:** Energy optimization is a critical research issue as it is essential to reduce energy consumption and promote sustainability. The team needs to research and evaluate different energy-saving strategies and techniques to optimize energy consumption.
- **Security and privacy:** Security and privacy are significant research issues in home automation systems, as they are vulnerable to hacking and cyber-attacks. The team needs to research and evaluate different security measures and techniques to ensure that the system is secure and the user's privacy is protected.
- **Usability and user experience:** The usability and user experience of the mobile app are critical research issues that need to be addressed. The team needs to research and evaluate different design approaches and techniques to ensure that the mobile app is user-friendly and easy to use.

- **Augmented Reality:** The integration of AR (Augmented Reality) technology into the system is a research issue that requires extensive research to identify the appropriate AR technologies and models that can be used to enhance the user experience and interaction.
- **Integration of renewable energy sources:** The integration of renewable energy sources into the system is a research issue that requires research into different renewable energy sources and techniques to ensure that the system is energy-efficient and sustainable.

## 6.4 IMPLEMENTATION ISSUES

During the implementation of the ubiquitous home control and monitoring system using an Android-based smartphone, several issues may arise that need to be addressed. Some of the implementation issues that may be encountered are:

- **Compatibility issues:** One of the major implementation issues is compatibility between different smart devices and sensors. The project team needs to ensure that all the devices and sensors are compatible with each other and work seamlessly together.
- **Network connectivity:** Another issue is network connectivity, which can affect the system's reliability and performance. The team needs to ensure that the home automation network is reliable and has good connectivity to prevent any communication errors or delays.
- **Security concerns:** Security is a critical issue in home automation systems, as they are vulnerable to hacking and cyber-attacks. The team needs to ensure that the system is secure by implementing strong authentication, encryption, and authorization measures.
- **Power outages:** Power outages can affect the system's functionality, as some devices may require a constant power supply to function properly. The team needs to ensure that the system has a backup power source or a fail-safe mechanism to prevent any disruption in the system's performance.
- **Scalability:** The system needs to be scalable to accommodate future upgrades or additions of new devices and sensors. The team needs to ensure that the

system's architecture is flexible and can be easily expanded to accommodate future needs.

- **User interface:** The user interface of the mobile app needs to be user-friendly and intuitive to ensure that users can easily navigate and control the system. The team needs to ensure that the mobile app is designed with the user in mind and is easy to use.
- **Testing and debugging:** The system needs to be thoroughly tested to ensure that it is functioning correctly and is free of bugs or errors. The team needs to implement a testing and debugging strategy to identify and fix any issues that may arise during the implementation process.

## References

[1] OvidiuVermesan, Peter Friess, Internet Of Things Applications: From Research and Innovation To Market Deployment, River Publishers Series In Communications,2014.

[2] PrahladBhadani, Dr.VVashisht, “Soil Moisture, Temperature, and Humidity Measurement Using Arduino”, International Conference on Cloud Computing, Data Science & Engineering, Jan 2019,pp.567- 571.

[3] L.Calcara, G.Felice, F.Ferrucci, F.Marchetti, “Soil thermal resistivity: innovative measurement system”, IEEE International Conference on Environment and Electrical Engineering, June 2019.

[4] N.Agrawal, S.Singhal, "Smart Drip Irrigation System using Raspberry Pi and Arduino”, International Conference on Computing, Communication and Automation, May 2015,pp.928-932.

[5] H.Durani, M.Sheth, M.Vaghasia, S.Kotech, "Smart Automated Home Application using IoT with Blynk App", Proceedings of the 2nd International Conference on Inventive Communication and Computational Technologies, April 2018,pp.393-397.

[6] M.Gamba, A.Gonella, C.Palazzi, "Design Issues and Solutions in a Modern Home Automation System", 2015 International Conference on Computing, Networking and Communications, Feb. 2015, pp.1111-1115.

[7] K.Ghanshala, R.Chauhan, R. C Joshi, "A Novel Framework for Smart Crop Monitoring Using the Internet of Things (IoT)", International Conference on Secure Cyber Computing and Communication, Dec. 2018 pp. 62-67.

[8] S.Ivanović, S.Milivojša, T. Erić, M.Vidaković, "Collection and Analysis of System Usage Data in Smart Home Automation Systems", International Conference on Consumer Electronics, December 2017, pp. 65-66.

[9] R.K.Jha, S.Kumar, K.Joshi, R.Pandey, "Field Monitoring Using IoT in Agriculture", International Conference on Intelligent Computing, Instrumentation and Control Technologies, July 2017,pp.1417-1420.

[10] K. Krishna Kishore, M. H. Sai Kumar, M. B. S. Murthy, "Automatic Plant Monitoring System", International Conference on Trends in Electronics and Informatics,2017,pp.744-748

# APPENDIX

## A. SCREEN SHOTS

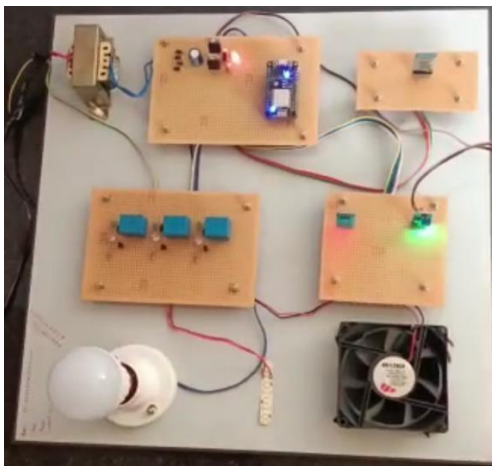

*Fig 8.1 – Development Kit*

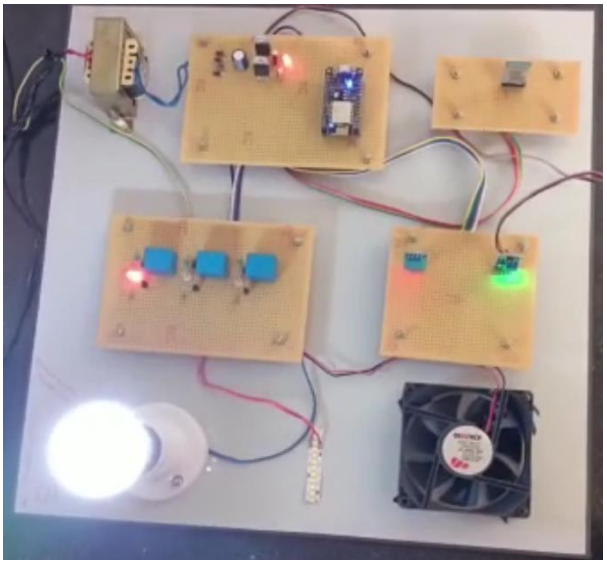

*Fig 8.2 – Bulb On Voice Command*

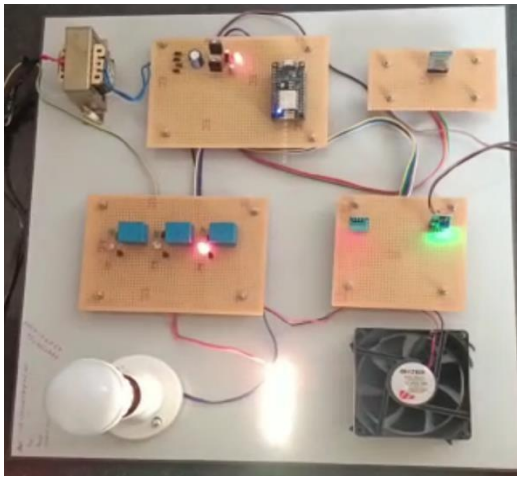

*Fig 8.3 – Light On Voice Command*



***Fig 8.4 – Fan On Voice Command***

***Fig 8.5 – a) Readings of soil moisture Pin Out***

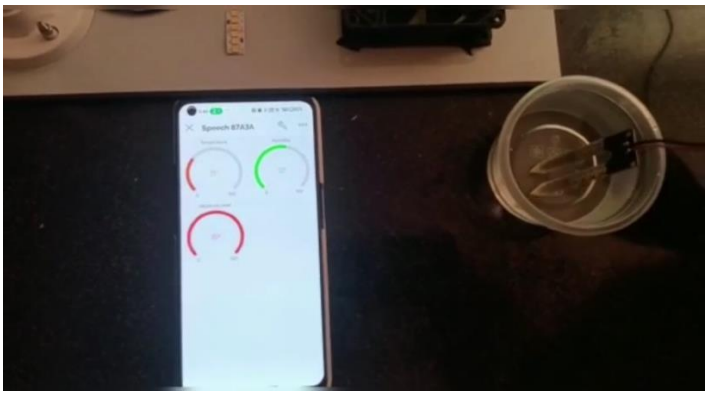

***Fig 8.5 – b) Readings of soil moisture Pin IN***

## B. RESEARCH PAPER

# Ubiquitous Home Control and Monitoring System using Android Based Smart Phone

C Sai Sashank,
Student, Computer Science and Engineering Department,
Sathyabama Institute of Science and Technology,
Rajiv Gandhi Salai, Chennai – 600119
sashankcsk@gmail.com

Punna Srikar,
Student, Computer Science and Engineering Department,
Sathyabama Institute of Science and Technology,
Rajiv Gandhi Salai, Chennai – 600119
srikarpunna123@gmail.com

Dr. Jemshia Miriam,
Assistant Professor,Computer Science and Engineering Department
Sathyabama Institute of Science and Technology,
Rajiv Gandhi Salai, Chennai – 600119
Jemshia.cse@sathyabama.ac.in

*Abstract* - **This article proposes and implements an optimized, cost-decreased IoT hardware based totally on an smart two-way voice-activated automation device. An ESP8266 NodeMCU microcontroller board is used because the crucial unit of this gadget. The device, while used for smart domestic automation, makes use of voice instructions at the cause from the consumer through the Google Assistant with the IFTTT (If This Then That) collaborative interface and the Blynk app platform that makes this option viable. No multi-mode channel for loads with a significant unit. The important information processing unit strategies data primarily based on consumer enter. When used for agricultural monitoring, environmental conditions inclusive of soil moisture, temperature and air humidity (DHT11) are developed and displayed on an OLED display. The water waft is controlled via the water motor subsequent to the soil liquid in the threshold. A NodeMCU based at the ESP8266 Hypertext Transfer Protocol Wi-Fi is sent to the Wi-Fi community and communicates with the cloud garage (says Real) and the Blynk IoT platform. Environmental sensor records is collected, monitored after which despatched to the cloud and through Wi-Fi Blynk. The article specializes in attaining the automation of two exceptional areas with a single hardware machine.**

***Keywords – Home control, smart home, IoT, Monitoring System***

### I. INTRODUCTION

This decade has been marked by extensive interest in sensors and networks. It is expected that billions of gadgets might be related to the Internet to communicate in one shape or any other. Given the recent development of the Internet of Things (IoT), Insider Intelligence expects that there can be sixty four billion connected devices on this planet by using 2025. Key gadgets consist of, but aren't constrained to, clever domestic devices (air conditioners, refrigerators, washing machines, ovens, and so on.), protection structures (sensors, cameras, monitors, and so on.) and other home energy gadgets, actuators as an instance, thermostats and removing pain. These internet-connected gadgets help to boost up the improvement of net-primarily based things, and furthermore, because of their importance, in addition they turn out to be essential elements of our lives.

Dealing with a dynamic society with diverse information, in which a safe, low cost, handy and relaxed life is made for all contributors and the proper circle of relatives. A huge range of IoT-based totally programs enhance our lives in lots of ways, one of which is domestic automation (HA). HA is an advanced life-style based totally on wireless sensors and other rising technology that transforms our houses to perform exceptional obligations remotely and robotically when wished. Judging by the outcomes of IoT and HA systems, the dream is slowly however step by step turning into a truth

### II. LITERATURE SURVEY

[1] Rajeev Piyare, Seong Ro Lee "Smart Home-Control and Monitoring System Using Smart Phone". This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely using Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionablity.

[2] Prof. Sonal Wasekar, Pratiksha Indurkar1, Karishma Sakhare, Sahil Dhone, Suchika Awachat, Pallavi Dongre, "Smart Home Automation System Using Iot". This provides an effective and flexible home control and monitoring system with the aid of an integrated micro-web server with IP connectivity for access to and control of equipment and devices remotely using. The proposed system does not require a dedicated server PC with respect to similar systems and offers a new communication protocol for monitoring and controlling the home

SOIL MOISTURE SENSOR :

**Figure** 4 – SOIL MOISTURE SENSOR

When you pay attention the word "clever lawn," one of the first matters that comes to thoughts is a gadget that monitors soil moisture degrees and robotically provides flora with the right amount of water. With this gadget, plants can simplest be watered when needed, heading off over or underneath watering. If you need to installation this type of gadget, you certainly need a soil moisture sensor.

RELAY :

There have to be no electrically operated switch. Current flowing through the relay coil creates a magnetic discipline that attracts the bar and changes the switch touch. The coil present day can be grew to become on or off, so the slider role has positions and is a double role (toggle) transfer. Allow one circuit to skip thru the second one, which may be absolutely separate from the primary. For example, a excessive voltage battery circuit can use an AC 230 V circuit, within the relay there is no electrical connection among the 2 circuits; magnetic and mechanical connections.



**Figure** 5 - RELAY

Relays are usually SPDT or DPDT, however could have more than one contactor switches, as an instance tables with 4 contactor switches are conveniently available. Most boards are designed for PCB mounting, however you can solder the wires immediately to the pins if you're cautious now not to melt any of the plastic. The lively image suggests no activity with its breathing and switching touch. You can see that the bar to the left is attracted with the aid of the magnetism when it is became in a circle. The contact lever moves the switch. One set of contacts (SPDT) is on the front aspect and the other in the back of them, making the board

Relay switch connections are typically categorized COM, NC and NO:

- COM = commonplace, usually connected, is the moving a part of the transition.
- NC = normally closed, COM is hooked up to the winding coil.
- NO = normally open, COM is connected with the coil turned off.

LOAD CELL :

We use digital scales or weighing scales each day. He goes to some grocery shop or rings keep; the assessment of things is done with the help of electronic scales (stats also are utilized in conditions in which total accuracy isn't always of remarkable importance). But have we ever notion about the device's digital scales? At the heart of digital scales or gadgets attached is a sensor referred to as a load mobile. These sensors feel the force (or weight) of the objects, and the electronic circuit is processed by means of the output of the sensors and displayed at the show. Strain gauges are extraordinarily accurate transducers that provide the user with information that is commonly no longer to be had with different technologies due to commercial elements. The use of a load cell isn't always limited to electronic scales; those are used in load trying out machines, electricity scales, drift meters, In and so on., although we nearly by no means contact the weight cells. brief, the weight cell may be used wherever "force measurement" is required.

**Figure** 6 – LOAD CELL

V. RESULT

The fundamental IoT-based home automation feature is successfully presented and operated alongside our recommended method for improving home automation. As a result, we can manage our house by accessing the Ubidots user interface. As soon as the platform was launched, we successfully logged in to our system, confirming its security. Each mode is allowed to assess the performance of the home appliances connected to that mode once the interface has been opened. Thus, without user input, the movie mode, celebration mode, sleep mode, and off mode operate, along with the performance of each individual room. The system's LCD display, which can also be watched through a mobile application, shows which mode is currently active.

environment with more than just switching functionality. Smart home interfaces and device definitions to ensure interoperability between ZigBee devices from various manufacturers of electrical equipment, meters and Smart Energy enables products to allow manufactured. We introduced the proposed home energy control systems design intelligent services for users

[3] Salman Iqbal , Zubair Sharif , Malik Ali Shahid, and Muhammad Zahid Abbas, "Internet-of-Things based Smart Home Automation System using Android Phone". A smart home automation system can be greatly advantageous for energy saving and management where it not only helps to save money but can be highly beneficial for the environment. It offers optimum consumption of the home resources but also leads to higher comfort and conveniences for the users and residents. Further integration of Internet of Things (IoTs) services by embedding intelligence into sensors and actuators and connecting them smartly are gaining great popularity to enhance the comfort and quality of life.

## III. EXISTING WORK

Design and Realization of Home Appliances Control System Based on The Android Smartphone present the information about the remote appliances control system based on the Android smart phone is designed and realized. A user logs into the smart phone interface, and clicks the buttons gently to send message commands which will be transmitted to home information Centre through the GSM network. Then the PIC processor recognizes the specified command, and controls the home appliance switches in the wireless radio frequency manner to achieve remote control of appliances ultimately. Exploiting Bluetooth on android mobile devices for home security application present the information about mobile devoice has been integrated into our everyday life. Home automation and security are becoming increasingly prominent features on mobile devoices the mobile devoice and security system communicates via Bluetooth because a short-range-only communication system was desired. With the help of android mobile, we can control task such as locking the doors, turning on/off lights remotely.

## IV. PROPOSED METHODOLOGY

Concluding, in this system, an IOT based hardware system is proposed which is used for smart home automation and also for agricultural monitoring with the same single MCU hardware. Unlike the other trends in traditional IOT based automation, this system mainly focuses on hardware optimization and energy efficiency. For other devices, separate micro-controllers are used for home automation or Agriculture monitoring thereby saving energy using just single hardware. With easy user access and security, it would give a significant contribution to the advancement of IOT based automation systems.

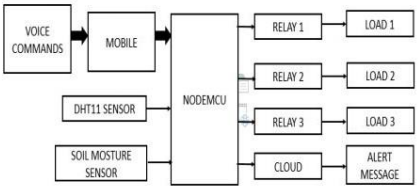


**Figure 1 –** System Architecture

HARDWARE USED :

- NODEMCU
- RELAYS
- DHT11 SENSOR
- SOIL MOISTURE SENSOR
- 230 V LOAD
- BLYNK APPLICATION

SOFTWARE USED :

- ARDUINO IDE
- EMBEDDED

HARDWARE EXPLANATION :

NODE MCU

Nodemcu is an open supply IoT platform. The firmware runs at the Espress if Systems ESP8266 Wi-Fi SoC and includes hardware at the ESP-12 module. The word "NodeMCU" by using default refers back to the firmware, now not to the CPU. The firmware uses the Lua scripting language. It is based totally at the eLua layout and the Espress if Non-OS SDK for the ESP8266. It makes use of many open supply projects like lua-cjson and spiffis. NodeMCU rapidly after the discharge of the ESP8266. On December 30, 2013, Espressif Systems launched the ESP8266. ESP8266 is a Wi-Fi SoC with Tensilica Xtensa LX106 core widely utilized in IoT packages (see associated tasks). NodeMCU on October 13, 2014 with Hong Kong has dedicated the first nodemcu firmware report to GitHub. Two months later, the task improved to include an open hardware stack with developer Huang R. Gerber's report referred to as devkit v0.9. Later this month, Tuan PM ported the MQTT client library from Contiki to the ESP8266 SoC platform and participated in the NodeMCU project, after the NodeMCU MQTT IoT protocol changed into able to get right of entry to the MQTT broking using Lua. Another main replace came about on January 30, 2015, when Devsaurus ported u8glib to the NodeMCU design, allowing the NodeMCU to easily show LCDs, OSDs, OLEDs, or even VGAs. In the summer of 2015, the creators left the firmware undertaking and acquired a collection of unbiased members. As of the summer of 2016, NodeMCU is comprised of over 40 exclusive modules. Due to confined sources, customers have to choose the modules that healthy their venture and create firmware tailored to their needs.

ARDUINO MIDDLE

When Arduino.Cc started developing new microcontroller forums primarily based on non-AVR processors consisting of the ARM/SAM microcontrollers used inside the Arduino Due, we needed to exchange the Arduino IDE to easily exchange the IDE to assist other equipment. Permit Arduino C/C++ might be advanced for those new tactics. They did that with the creation of Table Manager and SAM Core. "Core" is a set of software packages that the Board Manager and the Arduino IDE require as Arduino C/C++ supply documents inside the microcontroller's target programming language. Some ESP8266 lovers have developed an Arduino center for ESP8266 Wi-Fi SoC, generally called "ESP8266 middle for Arduino IDE". He has end up a main developer of numerous ESP8266 based modules and improvement boards, consisting of NodeMCU. NodeMCU is an open supply LUA-based totally firmware evolved for the ESP8266 Wi-Fi chip. Exploring the functionality of the ESP8266 chip, the NodeMCU firmware comes with an ESP8266 development board / kit, i.E. NodeMCU improvement board.

**Figure 2** – NodeMCU

NODEMCU DEVELOPMENT BOARD/KIT v0.9 VERSION

Because NodeMCU is an open supply platform, the hardware layout is enhancing/enhancing/building.The NodeMCU Dev Kit/Board consists of an ESP8266 chip with Wi-Fi assist ___33. The ESP8266 is a low-value Wi-Fi chip advanced by means of Espressif Systems with a TCP/IP protocol. For more about ESP8266, you could talk over with ESP8266 Wi-Fi module. Version 2 (V2) is to be had for the NodeMCU Dev Kit, i.e. NodeMCU Development Board model 1.Zero (Version 2), which commonly comes with a black revealed circuit board.

NODEMCU DEVELOPMENT BOARD/KIT v1.0 VERSION 2

For extra information approximately NodeMCU forums to be had inside the market, see NodeMCU Development Boards. The NodeMCU Dev Kit has analog (i.E. A0) and digital (D0-D8) Arduino pins on its board. It helps video communique protocols i.E. UART, SPI, I2C, and many others. Using such video protocols, we will join it to serial devices together with I2C-enabled LCD, HMC5883 magnetometer, MPU-6050 gyroscope + accelerometer, RTC chips, GPS modules, contact shows, SD playing cards, and so forth.

DHT11 SENSOR :

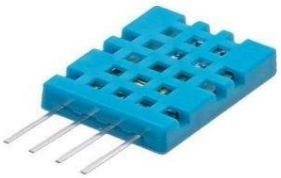

**Figure** 3 – DHT11 SENSOR

Humidity is a measure of water vapor inside the air. The degree of air humidity influences various physical, chemical and biological techniques. In business environments, humidity can have an effect on fees and the fitness and protection of workers. Thus, in the semiconductor and control systems industries, humidity dimension could be very crucial. The humidity meter determines the quantity of moisture present in the fuel, which is a combination of water vapor, nitrogen, argon, or natural gas, and so forth. Humidity sensors come in sorts based on the devices of size. These are the relative humidity sensor and the absolute humidity sensor. DHT11 is a digital temperature and humidity sensor. The DHT11 sensor has four pins: VCC, GND, a round pin and a disconnect pin. For verbal exchange among the sensor and the microcontroller, a load resistor from five kOhm to ten kOhm is supplied

## VI. CONCLUSION

In this paper, a novel architecture for an Android-based smart phone-based home control and monitoring is suggested and developed. As an interoperable application layer for facilitating communication between the remote user and the home appliances, the suggested architecture makes use of RESTful based Web services. You can view and manage the devices at home using any Android-based smart phone with Wi-Fi built in. Mobile cellular networks like 3G or 4G can be used to access the system if a Wi-Fi link is unavailable. Future work will concentrate on implementing voice commands to control the application and building a wireless network using Zigbee between the home server and the home devices.

## VII. REFERENCES


[1] OvidiuVermesan, Peter Friess, Internet Of Things Applications: From Research and Innovation To Market Deployment, River Publishers Series In Communications,2014.

[2] PrahladBhadani, Dr.VVashisht, "Soil Moisture, Temperature, and Humidity Measurement Using Arduino", International Conference on Cloud Computing, Data Science & Engineering, Jan 2019,pp.567- 571.

[3] L.Calcara, G.Felice, F.Ferrucci, F.Marchetti, "Soil thermal resistivity: innovative measurement system", IEEE International Conference on Environment and Electrical Engineering, June 2019.

[4] N.Agrawal, S.Singhal, "Smart Drip Irrigation System using Raspberry Pi and Arduino", International Conference on Computing, Communication and Automation, May 2015,pp.928-932.

[5] H.Durani, M.Sheth, M.Vaghasia, S.Kotech, "Smart Automated Home Application using IoT with Blynk App", Proceedings of the 2nd International Conference on Inventive Communication and Computational Technologies, April 2018,pp.393-397.

[6] M.Gamba, A.Gonella, C.Palazzi, "Design Issues and Solutions in a Modern Home Automation System", 2015 International Conference on Computing, Networking and Communications, Feb. 2015, pp.1111-1115.

[7] K.Ghanshala, R.Chauhan, R. C Joshi, "A Novel Framework for Smart Crop Monitoring Using the Internet of Things (IoT)", International Conference on Secure Cyber Computing and Communication, Dec. 2018 pp. 62-67.

[8] S.Ivanović, S.Milivojša, T. Erić, M.Vidaković, "Collection and Analysis of System Usage Data in Smart Home Automation Systems", International Conference on Consumer Electronics, December 2017, pp. 65-66.

[9] R.K.Jha, S.Kumar, K.Joshi, R.Pandey, "Field Monitoring Using IoT in Agriculture", International Conference on Intelligent Computing, Instrumentation and Control Technologies, July 2017,pp.1417-1420.

[10] K. Krishna Kishore, M. H. Sai Kumar, M. B. S. Murthy, "Automatic Plant Monitoring System", International Conference on Trends in Electronics and Informatics,2017,pp.744-748