SRI SAI RAM ENGINEERING COLLEGE

SAI LEO NAGAR, WEST TAMBARAM,
CHENNAI-44
(An Autonomous Institution)

NAME :

REGISTER NUMBER :

20CIPL501 – INTERNET OF THINGS ARCHITECTURE AND PROGRAMMING IN IOT LABORATORY

(III YEAR / V SEM)

(BATCH: 2022 – 2026)

B. E. COMPUTER SCIENCE – INTERNET OF THINGS

ACADEMIC YEAR: 2024 – 2025

SAI RAM ENGINEERING COLLEGE
An Autonomous Institution | Affiliated to Anna University & Approved by AICTE, New Delhi
Accredited by NBA and NAAC "A+" | An ISO 9001:2015 Certified and MHRD NIRF ranked institution
Sai Leo Nagar, West Tambaram, Chennai - 600 044. www.sairam.edu.in
Founder Chairman : MJF. Ln. Leo Muthu

Certificate

Certified that this is the Bonafide Record of the work doneby Mr./Ms.___________in the Semester - V of Degree Course B. E. CSE – Internet of Things in the **20CIPL501 – INTERNET OF THINGS ARCHITECTURE AND PROGRAMMING IN IOT LABORATORY** during the academic year 2024 - 2025.

Station: Chennai – 600044
Date :

STAFF IN CHARGE **HEAD OF DEPARTMENT**

Submitted for University Practical Examination held on________at Sri Sai Ram Engineering College,

Chennai– 600044.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

VISION OF THE DEPARTMENT

To emerge as a "Centre of Excellence in the field of IT" offeringTechnological Education and Research opportunities of high standards to students, develop high degree of digital knowledge and skill set, making our students technologically superior and ethically strong, who in turn shall contribute to the advancement of society and humankind.

MISSION OF THE DEPARTMENT

M1	Provide quality education in Information Technology and alsocreate technologically new and intellectually inspiring environment.
M2	Focus on research and development of technologies by engaging invalue added courses and on evolution of digital environment.
M3	Design and Develop state-of-the art on learning, creativity, innovationand inculcate in them ethical, social and moral values.
M4	Establish continuous Industry Institute Interaction, participation and collaboration to contribute job oriented skilled IT Engineers by improving their entrepreneurial skills.

Program Educational Objectives (PEOs)

PEO1	Graduates will embed in applying the engineering knowledge and problem solving analysis in digital environment and understanding Industrial Requirements.
PEO2	Graduates will excel in Research, designing & developing solution for complex problems in the field of IT by adapting to the rapid technological advancements.
PEO3	Graduates are inculcated with lifelong learning to function as an individual or team with ethics & social responsibility, for the advancement of society and service to humankind.

PEO4	Graduates are trained using modern tools to be strong in technical foundation and evolve as entrepreneurs in the field of Information Technology.

Program Outcomes	
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solutionof complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusionsusing first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts,and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics andresponsibilities and norms of the engineering practice.

PO9	**Individual and team work**: Function effectively as an individual, and asa member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation andability to engage in independent and life-long learning in the broadest context of technologicalchange.
Program Specific Outcomes	
PSO1	Ability to build network based web application using different securedsoftware design concepts
PSO2	Ability to design, implement and test information systems architectureto meet specific software requirements following the ethical values 3

SYLLABUS

OBJECTIVES:

- To implement Programming using Arduino/Raspberry Pi
- To implement the interfacing with ESP 32 & ESP8266
- To get familiarized to Xbee
- To study about open vino tool kit and 6

LIST OF EXPERIMENTS :

1. Air and Noise Pollution Monitoring System Over IOT
2. Weather Reporting Over IOT
3. IOT based Anti-theft Flooring System
4. IOT Garbage Monitoring
5. IOT Based Heart Monitoring System Using ECG
6. IOT Water Pollution Monitor RC Boat
7. IOT Based Automatic Vehicle Accident Detection and Rescue System
8. IOT Smart Parking Using RFID
9. IOT based Manhole Detection and Monitoring System
10. IOT based Three Phase Power Failure Monitoring with SMS Alerts
11. IOT based Intelligent Gas Leakage Detector
12. IOT based Smart Agriculture Monitoring System Project
13. Contactless IOT Doorbell
14. Study the basics of OpenVINO toolkit and it general functions
15. Study of Smart Edge Open software with general functionalities

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

Arduino/ Raspberry Pi/ ESP32 /ESP8266/ Systems with Linux Operating System

OUTCOMES:

Upon completion of the course, students should be able to

1. Implement automatic accident detection. [K3]
2. Determine the garbage level using Io. [K3]
3. Read the Three Phase Power Failure Monitoring with SMS Alerts [K2]
4. Read the weather temperature and humidity value from the sensor.[K2]
5. Implementing the Smart Agriculture Monitoring System. [K3]
6. Identify the vehicle using Smart Parking Using RFID. [K3]
7. Implementing Contactless IOT Doorbell [K3]
8. Acquire knowledge on open source software and open vino tool kit [K3]

INTRODUCTION

Weather monitoring is a critical aspect of various sectors, including agriculture, urban planning, environmental conservation, and disaster management. Understanding weather patterns and environmental changes enables better decision-making, minimizes risks, and optimizes resources. However, traditional weather monitoring systems often face challenges such as high costs, limited accessibility, and lack of real-time responsiveness.

The Internet of Things (IoT) introduces a game-changing approach to weather monitoring. With IoT, weather monitoring becomes more dynamic, real-time, and scalable. An **IoT-based Weather Monitoring System** integrates advanced sensors with cloud-based platforms, enabling continuous data collection, analysis, and visualization. This system connects environmental sensors—such as temperature, humidity, soil moisture, and rainfall detectors—to a microcontroller (ESP32), which transmits the data to a cloud service.

The system provides real-time insights accessible through mobile or web interfaces, allowing users to monitor environmental conditions remotely. Such systems are particularly beneficial for applications like precision agriculture, where real-time weather data influences irrigation, planting schedules, and crop management. Additionally, urban planners can use these systems for efficient resource allocation, while disaster management teams benefit from early alerts for adverse weather conditions.

The IoT-based approach ensures that the system is not only cost-effective but also energy-efficient, making it accessible to small-scale farmers and remote communities. It combines affordability, accuracy, and intelligence, creating a reliable solution for weather monitoring and predictive analytics.

LITERATURE SURVEY

1. **"Weather Monitoring System using IoT" (2020)** by R. Kavin.: This study explores the application of IoT for environmental monitoring. It uses basic sensors and a microcontroller to gather weather data. While the framework is scalable and cost-effective, it lacks integration with AI and predictive analytics, limiting its functionality for precision applications.

2. **"DIY IoT Weather Station" (2024)** by Stoyan Stoyanov.: Focuses on developing customizable weather stations using open-source technologies. The project emphasized affordability and ease of use, inspiring the modular design of the proposed system.

3. **"IoT Weather Monitoring for Smart Homes" (2022)** by Shashidhara K.:
   Examines localized weather monitoring systems optimized for residential purposes. This system provided insights into remote accessibility and integration with smart home ecosystems, forming the basis for user-friendly dashboard designs.

4. **"IoT Weather Monitoring for Smart Agriculture" (2024)** by Hassan.:
   Highlights the application of IoT in precision farming. Real-time data on weather parameters helps farmers optimize irrigation schedules and planting patterns. This study emphasizes the need for low-cost systems capable of handling real-time data for small-scale farming.

5. **"IoT Weather Systems with Renewable Energy" (2022)** by Vinoth Kumar:
   Explores the integration of renewable energy sources like solar panels with IoT systems to enhance sustainability. The idea of energy-efficient, autonomous systems inspired the design of the power supply module in the proposed system.

EXISTING SYSTEM

1. **Davis Instruments Vantage Pro2**:
    - **Description**: A high-end weather station featuring sensors for temperature, wind speed, humidity, and rainfall.
    - **Limitations**: The system is costly and complex to set up, limiting its use to large-scale enterprises. It lacks predictive analytics and smart irrigation integration, reducing its utility for precision farming.

2. **Netatmo Weather Station**:
    - **Description**: A consumer-friendly weather station designed for home use.
    - **Limitations**: Limited to monitoring basic parameters like temperature, humidity, and air quality. It is not designed for agricultural applications or integration with smart irrigation systems.

3. **Pessl Instruments iMetos**:
    - **Description**: An IoT-based weather monitoring system tailored for agriculture.
    - **Limitations**: The system is expensive and better suited for large-scale agricultural operations, making it inaccessible to small-scale farmers.

4. **FarmLogs**:
    - **Description**: A software-based platform for farm management, including weather monitoring.
    - **Strengths**: Offers historical weather data analysis and forecasting tools.
    - **Limitations**: Primarily software-focused, lacking real-time hardware integration for immediate actions like irrigation control.

PROPOSED BLOCK DIAGRAM

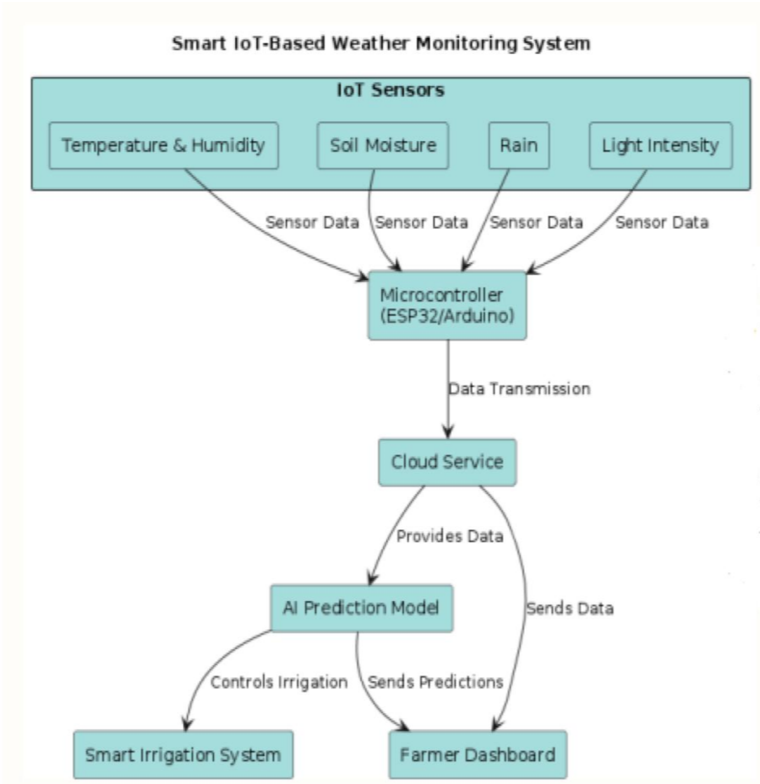
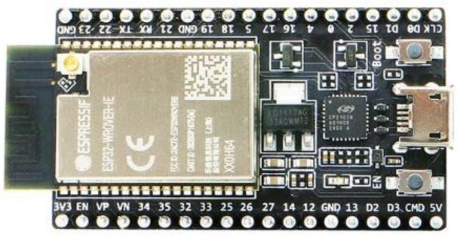


Fig: Block Diagram

HARDWARE COMPONENTS

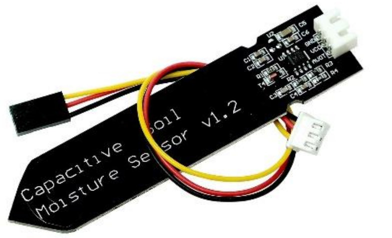
[1] MICROCONTROLLER

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module.

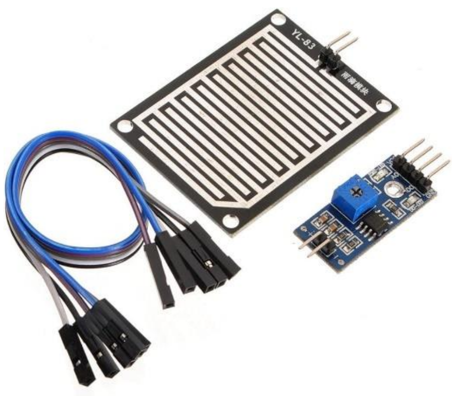


[2] DHT11 SENSOR: Measures temperature and humidity.

[3] CAPACITIVE SOIL MOISTURE SENSOR: Provides accurate soil moisture levels.



[4] RAIN DETECTION MODULE: Detects precipitation events



[5] BH1750 LIGHT INTENSITY SENSOR: Tracks sunlight exposure.

[6] POWER SUPPLY: A stable 5V/12V source ensures consistent operation.

[7] ACTUATORS: Relay modules control water pumps for irrigation.

[8] ENCLOSURE: A weatherproof box protects sensitive components.

SOFTWARE COMPONENTS

[1] ARDUINO IDE:

It is an open-source software platform that makes it easy to write code and upload it to the board.

[2] CLOUD PLATFORM:

ThingSpeak, Firebase for data storage, and visualization.

[3] AI AND ANALYTICS:

TensorFlow and Pandas enable predictive modeling and data processing.

[4] DASHBOARDSD:

A user-friendly interface using Blynk App and web dashboards (HTML, CSS, JavaScript).

[5] COMMUNICATION PROTOCOLS:

MQTT ensures real-time data transfer.

[6] FIRMWARE UPDATES:

Over-the-air updates via PlatformIO enhance maintainability. This robust software architecture ensures seamless integration between hardware components and user interfaces.

RESULT

Parameter	**Sensor**	**Accuracy**	**Update Frequency**	**Application**
Temperature	DHT11	±2°C	Every 1 second	Crop growth monitoring
Humidity	DHT11	±5%	Every 1 second	Greenhouse management
Soil Moisture	Capacitive Sensor	±3%	Every 5 second	Smart irrigation control
Rainfall	Rain Module	**-**		Preventing over-irrigation
Light Intensity	BH1750	±1 Lux	Every 10 second	Scheduling optimal watering

CONCLUSION

The IoT-based Weather Monitoring System demonstrates a cost-effective, scalable solution for environmental monitoring. By integrating IoT with AI, it bridges the gap between data collection and actionable insights. Its applications in precision agriculture, disaster management, and urban planning emphasize its versatility. Key highlights include real-time monitoring, predictive analytics, and automated irrigation, making it a vital tool for smart agriculture and resource optimization.

FUTURE SCOPE

The system can be enhanced by:

1. **Advanced AI Algorithms**: Incorporate deep learning for better weather prediction.

2. **Renewable Energy**: Solar panels to ensure sustainability.

3. **Extended Parameters**: Adding air quality and noise pollution monitoring.

4. **Edge Computing**: Reducing dependency on cloud services for real-time decision-making.

5. **Mobile Apps**: Enhanced user interfaces for better interaction and alerts.

REFERENCES

[1] Patel, H., & Sharma, M., "Weather Monitoring System using IoT for Smart City Applications," *International Journal of Advanced Research in Computer Science and Engineering*, vol. 5, no. 3, pp. 105-110, 2016.

[2] Chandran, K., & Singh, S., "IoT-based Real-TimWeather Monitoring System for Agriculture," *IEEE International Conference on Cloud Computing and Internet of Things (CCIOT)*, Proceedings, pp. 34-39, 2017.

[3] Jain, P., & Gupta, S., "Smart Weather Station using IoT for Environmental Monitoring," *International Journal of Engineering Science and Technology*, vol. 8, no. 9, pp. 2005-2012, 2017.

[4] Ravi, A., & Kumar, R., "IoT based Weather Monitoring System for Disaster Management," *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, vol. 4, no. 1, pp. 112-117, 2018.

[5] Patil, S., & Desai, N., "Cloud-based Weather Monitoring System using IoT," *International Journal of Engineering and Computer Science*, vol. 6, no. 2, pp. 4347-4350, 2017.

[6] Sharma, T., & Arora, A., "IoT-based Smart Weather Station for Urban and Rural Applications," *IEEE 7th International Conference on Computational Intelligence and Communication Networks (CICN)*, Proceedings, pp. 55-59, 2019.

Smart IoT-Based Weather Monitoring for precision agriculture

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***Abstract*-IoT is an emerging technology in today's world. Things are widely used for collecting and storing the data from sensors to the cloud. Weather parameters can be easily accessed remotely using IoT applications. This is an IoT based system to collect the real-time weather parameters and store the data to the cloud platform. The collected data is displayed through the webpage. The stored data is of great advantage where weather forecasting is required. The weather parameter includes temperature, humidity, dew point, light intensity, air pressure, precipitation, and smoke percentage. The NodeMCU is used as an MQTT client to transfer the sensed data to the Thingspeak cloud platform.**

***Keywords*: - IoT, Sensors, NodeMCU**

I. Introduction

With the drastically changing climate, it becomes very important to collect weather parameters and monitor it continuously to predict future weather. Typical weather conditions-based database can be formed using weather monitoring. Weather events can be predicted or explained using this information. It thus helps people to plan their day-to-day activities. Weather forecasting plays a very crucial role in the Agriculture sector. Crop harvesting and planting require weather information. Accurate knowledge of real-time weather parameters such as temperature, humidity, precipitation helps protect crops and produces a good yield. Also, Life and property can be protected by weather forecasting [1].

IoT has made it possible to connect things and places in the world. It establishes a connection between not only humans but devices that can communicate among themselves [2]. The weather parameters can be easily measured with the help of sensors and can be communicated to humans through the internet. Therefore, IoT enables us to monitorreal- time data remotely.

IoT operates on various protocols. To communicate between microcontrollers, low power sensors, and various computing devices, the lightweight attribute of MQTT makes it suitable for all the IoT based applications. It is designed for low bandwidth-constrained devices. It is based on the publish-subscribe model.

It has three essential components: Publisher, Broker, and Subscriber. The Publisher/client publishes the data. NodeMCU works as a client to publish the data sensed by the various sensors to the Thingspeak. The broker is responsible for sharing the published data to interested subscribers. The subscribers can access the data through a webpage. This paper describes an IoT based system consisting of various weather measuring sensors like Temperature and Humidity (DHT11), Air Pressure (BMP180), Dew Point, Light Intensity (LDR), Precipitation (FC37), Smoke percentage (MQ135). The sensed data is published to cloud platform Thingspeak through the MQTT protocol. The data is stored for analysis and visualized suitably to be displayed through a webpage.

II. System Architecture

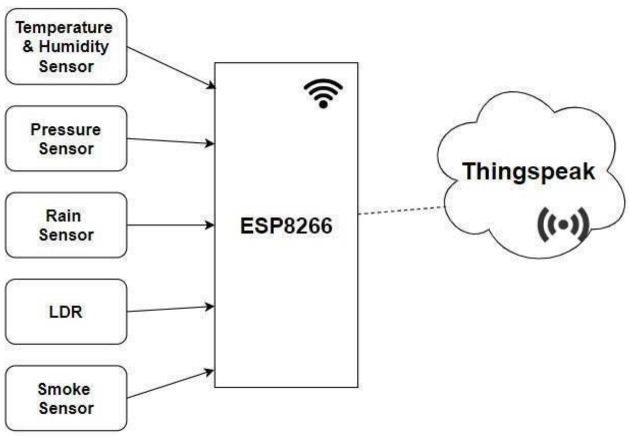


Fig.1: Architectural Diagram of System

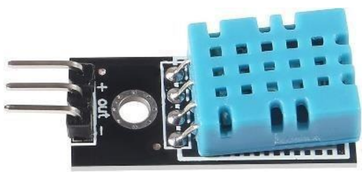
The architectural model is shown in Fig.1. The system consists of various sensor nodes, Wi-Fi- based microcontroller (esp8266) and IoT cloud platform Thinkspeak. The weather parameters are measured by sensor nodes and data is sent to the Thingspeak via ESP8266 microcontroller.

III. HARDWARE COMPONENTS

The Smart IoT-Based Weather Monitoring System requires various hardware components, each serving a specific purpose for effective monitoring and control:

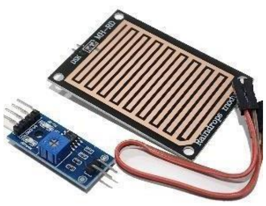
1. **Microcontroller:** Devices like ESP32 or Arduino UNO act as the central control units, collecting data from sensors and transmitting it for processing and analysis.

2. **Temperature & Humidity Sensor:** Sensors such as DHT11 or DHT22 monitor ambient temperature and humidity, providing crucial environmental data.



3. **Soil Moisture Sensor:** Capacitive soil moisture sensors determine the soil's water content, which is essential for irrigation control.

4. **Rain Sensor:** Rain detection modules help identify rainfall conditions, enabling the system to prevent over- irrigation.



5. **Light Intensity Sensor:** Sensors like BH1750 or LDR measure sunlight exposure, offering insights into crop health and growth conditions.

6. **Water Pump:** A water pump suitable for the scale of the system is used to irrigate crops based on real-time sensor data.

7. **Relay Module:** 1 or 2-channel relay module is employed to control the water pump's operation, managed by the microcontroller.

8. **Power Supply:** A 12V adapter ensures a stable power supply for all components.

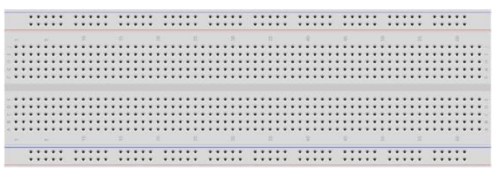
9. **Cloud Connectivity Module:** Modules like ESP8266 provide wireless communication capabilities, enabling real- time data transmission to the cloud.

10. **Display:** Displays such as OLED or 16x2 LCD are used for local visualization of sensor data.

11. **Enclosure:** A weatherproof box protects the hard- ware components from environmental factors.

12. **Jumper Wires & Cables**: Male-to-male, male- to-female, and other wires establish secure connections between components and the microcontroller.

13. **Breadboard or PCB:** Used for prototyping and assembling connections in an organized manner.



IV. SOFTWARE COMPONENTS

1. Integrated Development Environment (Arduino IDE, PlatformIO):

These environments are used for developing and uploading firmware to the microcontroller, ensuring smooth interaction between sensors and actuators.

2. Programming Language (C/C++, MicroPython):

The firmware logic is written in these languages to control the microcontroller and manage sensor data acquisition.

3. Sensor Libraries (DHT, Soil Moisture, BH1750):

Libraries simplify the integration of sensors, reducing the complexity of code and ensuring accurate data retrieval.

4. Cloud Platform (ThingSpeak, Blynk, Firebase):

These platforms provide storage for sensor data, facilitate data visualization, and allow remote control through a user-friendly interface.

5. Data Processing and AI (Python, TensorFlow):

Python libraries such as Pandas and TensorFlow enable advanced data processing and prediction models for efficient irrigation scheduling.

6. Web/Mobile Dashboard (HTML, CSS, JavaScript, Blynk App):

Dashboards are developed to present real-time data and provide control options to users for easy monitoring of weather conditions and irrigation systems.

7. Database (SQLite, MySQL, Firebase):

Databases are employed to store historical sensor data and predictions, ensuring reliability and accessibility for analysis.

8. Communication Protocols (MQTT, HTTP/HTTPS):

These protocols enable real-time data exchange between the microcontroller, cloud platform, and user interfaces.

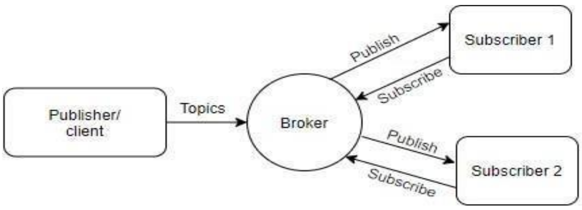


Fig.2: Architecture of MQTT Protocol

9. Data Analytics Tools (Jupyter Notebook, Google Colab):

These tools support data preprocessing, visualization, and training of machine learning models for improved system efficiency.

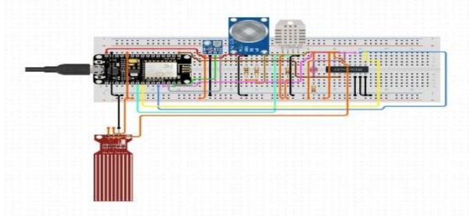
10. Firmware Update System (OTA: PlatformIO/Arduino OTA):

Over-the-air firmware update systems allow remote updates to the microcontroller, reducing the need for manual intervention.

11. Version Control (Git: GitHub/GitLab):

Version control systems are employed for managing code, ensuring collaboration, and tracking changes during the development lifecycle

VI. IMPLEMENTATION



Weather parameters include Temperature, Precipitation, Wind speed, Wind direction, Dew Point, Atmospheric Pressure, Humidity, Light Intensity and Smoke Percentage in air. In this paper, out of 9 above parameters, 7 parameters are interfaced except for wind speed and direction. ESP8266 microcontroller is used to process and sense information. Thingspeak is preferred as a cloud platform for this system because it is an open data platform for IoT based application in the actual circuit connection DHT11, BMP180, MQ135, LDR, FC37 these all sensors are used to get data of weather parameters like temperature & humidity, pressure, smoke percentage, the intensity of light and rain percentage respectively. Dew point percentage is also part of this system and is calculated using humidity's and temperature's data. All of the above sensors are interfaced with NodeMCU digitally except LDR, FC37 (Rain sensor) these two are interfaced using analog input. To program ESP8266, Arduino IDE is used. The output is being uploaded timely on Thinkspeak cloud platform that uses MQTT protocol and the result is displayed in the form of Graph to allowed users only on a webpage designed using HTML.

IV. RESULTS

A. *Thinkspeak Channel Status*

Fig.3: Temperature Analysis

Fig.4: Humidity Analysis

Fig.5: Dew Point measurements

Fig.6: Air Pressure Analysis

Fig.7: Smoke Percentage in air

Fig.8: Light Intensity

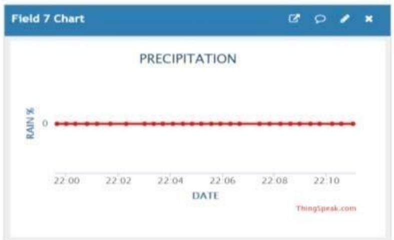


Fig.9: Rain Percentage

All the above figures show the connection and graph of various parameters in the Thinkspeak platform respectively. The system is implemented to a keep record on different environmental conditions and also the measurement of the required data and then represented effectively with the help of the charts. Sensed data updates with real-time features on Thinkspeak cloud and allowed user can analyze the parameters through the webpage.

B. *Display of google gauges on the website*

Fig.11: Google gauge of the current temperature

Fig.12: Google gauge of current Humidity

Fig.13: Google gauge of current Dew Point

Fig.14: Google gauge of current Air Pressure

Fig.15: Google gauge of current Smoke Percentage

Fig.16: Google gauge of current Light Intensity

Fig.17: Google gauge of current Rain Percentage

All the above figures show the different google gauge for various measured weather parameters. These gauges are displayed on the website by using HTML, CSS and JavaScript along with Thinkspeak plugin feature.

C. MATLAB Visualization of Collected Data

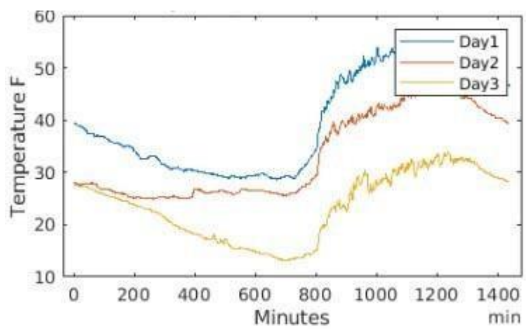


Fig.18: Visualization of 3-day Temperature comparison

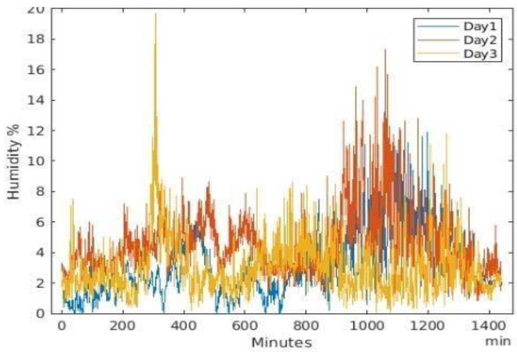


Fig.19: Visualization of 3-day Humidity comparison

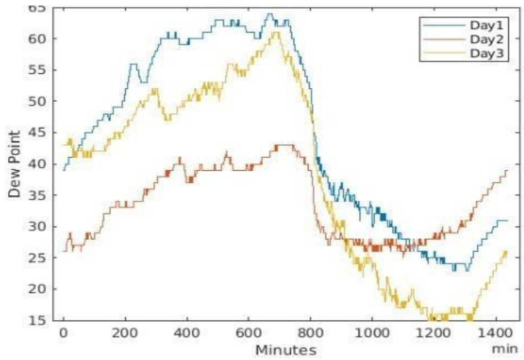


Fig.20: Visualization of 3-day Dew Point comparison

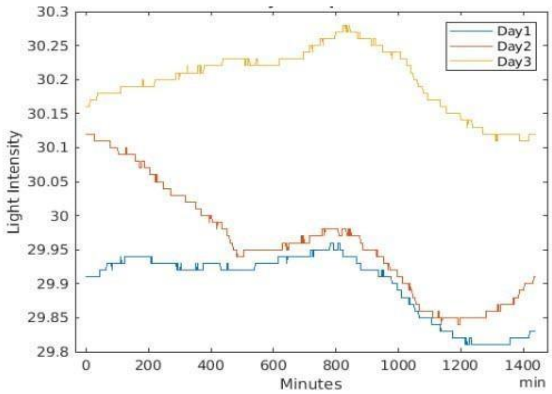


Fig.21: Visualization of 3-day Light Intensity comparison

All the above figures show the visualizations of three-day Temperature, Humidity, Light Intensity and Dew Point Percentage comparison. Different MATLAB plots can be used to visualize and analyze the collected data on Thingspeak

V. CONCLUSION

Weather monitoring system is designed by using NodeMCU, DHT11 sensor, BMP180 pressure sensor, Light Dependent Resistor, rain sensor and a gas sensor which can measure the physical parameters like temperature & humidity, pressure, smoke percentage, intensity of light and train percentage respectively. This system uses MQTT protocol which can publish /subscribe for controlling and graphically monitoring environmental parameters. The measured data is sent to the cloud through the internet, here Thinkspeak platform analyses real-time data. Data can be accessed and controlled remotely from internet-connected devices like mobile computers and laptop.

VI. FUTURE SCOPE

In the future, this system can be interfaced with LoRa in place of Esp8266 to provide long-range connectivity. Development can be done in a mobile application to monitor the data and alert feature can be added to get the notification in case of emergencies. Also, more sensors could measure for more weather conditions.

ACKNOWLEDGMENT

Specially thanks to Dr. Adhikari, Dean, School of Electrical Eng. and Sandeep S. Nagre for continuous guidance throughout the project and paper.

THE PROJECT AND PAPER REFERENCES

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Real Time Weather Monitoring using Internet of Things

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2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE) 978-1-7281-4142-8/20/$31.00 ©2020 IEEE 10.1109/ic-ETITE47903.2020.348

***Abstract*— A Green city enables the perfect usage of resources and more dependable quality of services to the masses. To supply inspection and repairs such as air quality management, weather monitoring and automation of homes and edifices in a smart city, the basic parameters are humidity, water level temperature, gas level. This task delivers a customized blueprint of an Internet of Things (IoT) enabled environment monitoring system to monitor temperature, water point, humidity and gas level. In developed system, information is transmitted from the transmitter tx node to the receiver rx node using the Bluetooth sensor module. The data received at the receiver node is entered in a database and is monitored as logs into a personal data processor (PC) through an Arduino IDE. An Android application has also been broken through which information is transferred from Arduino IDE to a smartphone, for monitoring data remotely. The settlements and the carrying out of the proposed strategy is discussed.**

Keywords – Iot,Android App,component,IDE;

I. INTRODUCTION

The IoT (Internet of Things) is a network of physical objects that consists of sensing elements, software and electronics which have the power to intercommunicate with each other as well as with others. It is rapidly developing due to the convergence about information and communication technologies and the net. It likewise improves the lifestyle of the citizens by offering better facilities and simultaneously cuts the administrative efforts for management of the city, enabling effective utilization of resources and better quality of service offerings. Regarding the parameters like humidity, temperature and CO2, there are many applications in weather monitoring in it (i) quality air management for reduction of pollution and healthy environment, (ii) weather monitoring for future agricultural activities and human comfort and (iii) automation of public buildings for reducing the human endeavor and energy expenditure. To achieve this wireless sensor node is required to collect and supervise the information wirelessly [2].

Internet of Things (IoT) is an innovative paradigm in wireless tele-communications, whose adoption will bring drastic changes in the way we contemplate, withstand and work. IoT can be viewed in two terms as the world wide network with interconnected devices viz., "Internet" and Things i.e., real world living and non-living things which are uniquely identifiable via their embedded Information systems. The two terms are combined together to define IoT as: "a worldwide network of inter-connected objects/things uniquely identifiable via communication protocols like TCP/IP [1]. This implies objects in inter connection are heterogeneous in nature. It enables effective transfer of data among various real world objects without having Human to Human (H2H) and Human to Computer (H2C) interaction. To make this interaction among physically existing things and information systems, it embeds Electrical, Electronics, Computer Software and networks together. IoT senses the objects under interaction - integration and controls them remotely from the network infrastructure. The terms interaction and integration are used interchangeably because IoT allows the physical objects to interact by exchanging data and integrate among themselves by improvising the effectiveness in communication. IoT uses varied protocols and technologies to provide communication than what expected to be delivered by Computer to Computer (C2C) interaction. This integration takes along the world to fully automatic and digitized world where all the entities the world will be described by the term "smart objects". Some of the prospective are smart cities, smart restaurants, smart transportation, smart health devices, smart learning tool; smart farms in agriculture; smart home appliances and so, most of us are being benefited by some of these techniques now.

To continue the benefits that we are enjoying now and much more in future, IoT must assure the safety and security in adopting these technologies. When everything is meant by means of internet then how can you ensure that your data is safe? IoT make use of (Radio -Frequency Identification (RFID), actuators, sensors, and Internet (e.g.: WiFi) for monitoring the connections among the various entities remotely. US National Intelligence Council (NIC) has listed IoT as one of the six "Disruptive Civil Technologies" and foretells that by 2025 all the real world things like home appliances, packaged food, and other movable and immovable things will be hosting at least a node in Internet [1]. Adoption of IoT could invent more security risks and will distribute them faster than our Internet, as almost most of the real world entities will be manipulated by information systems.

From the definition [1], IoT is resulted as the convergence of three different visions viz. Things-oriented, Internet-oriented and Semantic Oriented depicted. The visions are derived from various perspectives of IoT viz. various

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objects (RFID, Sensors), standards organization (IP Protocol) and communication mechanism (Middleware) respectively. IoT because of its ubiquitous nature and its varied visions can be redefined as a paradigm that enables communication among "anything, anywhere and at any time". There are various issues in IoT to be addressed. Some of them are Network communication, Standardization of technologies, research concerns, privacy and security issues. Of these the most prominent issue that requires immediate attention is "Security and privacy" because that is been incorporated in all aspects of technology. This chapter provides the various security issues in IoT.

This paper discusses an user defined IoT based environment monitoring system to monitor important values such as temperature, water level, humidity, and CO2.

Environmental monitoring IoT applications typically use detectors to aid in environmental security by air monitoring or water quality, atmospheric or soil conditions, and could even include areas like monitoring the trends of every object and existing things. Development of resource constrained components which connects to the Internet also means that other applications like weather and environmental conditions could also be practiced by emergency services to provide more effective assistance during natural disasters or disasters. It components in this system application typically spans a wide geographic expanse and could also be mobile. It has been suggested that the standardization it brings to wireless sensing will revolutionize this area.

The Objective of this task is to create customized design of an Internet of Things (IoT) enabled environment monitoring system to monitor temperature, water level humidity, and CO2. In developed system, information is transfered from the transmitter node to the receiver node. The information data set received is monitored at the receiver node and stored in a database in a personal data processor (PC) through using the Arduino IDE or Serial monitoring is analyzed and weather predicting API is implemented for it. At last an Android application has also been broken through which information is transferred from Arduino IDE to a smartphone, for monitoring data remotely and get status anywhere anytime

II. LITERATURE SURVEY

In the paper [3], the detailed explanation of the IOT with the real world objects with their respective interaction has been explained detailed considering the example of SMART CITY. The main aim is to provide the advanced communcation technologies to support added value services for the administration of the city and the citizens. Urban IOT is a concept where the various heterogeneous types of data will be embedded into a single system for the easy access over the data in the city. The reason behind this is to convey the environmental data details of the city to the citizens of the city. The details that are combined together are as follows structural health data of buildings, waste management, Air quality, Traffic Congestion, City energy consumption, Smart Parking etc. All of these can be achieved by the means of Web Service Based Architecture for IOT, which contains various protocol stacks to process the heterogeneous data and faster way of accessing them. It follows the Protocol named REST. The data representation is done in the form of XML scripting.

It is been a clear note that, all the communications in IoT is wireless, any components can join and leave the network as per their interest in sharing information and they all use computing resources. In this environment Security is the biggest challenge. IoT doesn't have any robust infrastructure to secure its components and data communications [1].

In [5], deals with how the mobile is been used in the capturing of the environmental data like temperature, humidity with the help of the available sensors that are there in the mobile device. The main reason to choose the mobile is that, it's been acting down as the daily parameter and been useful in every situation in the real world scenario. The capturing of the data can be done in two ways, Firstly by the means of the wearable devices such as smart watch where the data of the surrounding environments will be predicted and records it and send those data to the mobile device by the means of wireless communications or by Bluetooth. Secondly Phone mobile to web where the pictures will be captured and send those to web for the temperature and humidity prediction based on the image processing. The results can be achieved by the means of 2 ways (i) Bluetooth based temperature and humidity acquisition system is a device that consists of sensors and micro controller which transmits the climatic parameters to the receivers by the means of Bluetooth, it will even consume low power. Secondly with the help of Smart phone application, where the data will be provided from the Bluetooth based system and it contain display to show the details and setting to store the details obtained in text file.

In "Wireless Sensor Network for indoor environmental monitoring"[4], an ad-hoc WSN deployment fo the indoor environment quality monitoring in the office builidings is been done.

III. PROPOSED SYSTEM

Owning a particular device consisting of all operations to detect the Current Temperature, Humidity, Gas Level, Water Level is ensuring the proper alert or warning mechanism in changing the values to developed reliable system with much accuracy much cheaper is actually difficult to get. The present generation of the farmer is still facing the major issue, not having proper weather or environment monitoring device to educate in our nations. Trusting their instincts in this to overcome, a much cheaper it device is being prepared. Securing all the values like Current Temperature, Humidity, Water Level Gas Level, and making this much easier for the farmer to actually know what's been happening in this surrounding. As well with the assistance of our Android app actually one could guarantee the proper monitoring of the environment and get benefited from it and attain the necessary modifications as soon as possible.

Making something favourable to the environment and for the farmers is the least we could do to ensure a proper survival surrounding environment so our future generation could at least have a hope to live safely in this world. People have their right to know what's actually happening to this world making no difference now will surely make us feel later .This made me create a new iot system ensuring all necessary values and parameters to be developed with values like Temperature, Humidity, Water Level, Gas level present and that should be continuously monitored to ensure the values are actually calculated accurately in the environmental surroundings and one could be aware what happening around them and could save lives from accidents happening and other calamities caused by the nature. This low cost weather monitoring system guarantees to provide a high accurate data anywhere and anytime in this scheme.

Arriving at this low cost weather monitoring system is actually the hardest and more over ensuring an accurate system with a reliable one with all the parameters of monitoring weather. Making certain the data gets transferred to the user is another hardest path. Moreover, the actual values should get along with the calculated system value.

The present proposed system contains 19 sensors which will be continuously measuring vibration, temperature humidity, light and carbon dioxide levels in the working areas. The name that was given to this application is POVOMON.The most important aspect of the design includes high reliability ,network communication, tolerance to existing WLAN infrastructure, real time access of the data and storing them in the database. Access to this is provided by the means of GUI. The main moto is to collect the data from the surroundings of the indoor building, which there by requires nodes featuring low power consumption, a sset of integrated peripheral components and a customizable sensory configuration. Peripherals such as timers, DC, DMA channels ,DAC's and number of serial interfaces are used in this paper. It is developed based on the native API network. Various evaluation are been considered such as Air Quality Monitoring, Network Evaluation is been done and results that are deployed are stored in the SQL database.

A.. Components of the Proposed System

This section explains about various components used

- Arduino Uno

The Arduino Uno is reliable microcontroller board which is based on the ATmega328**.** Arduino is an open-source microcontroller compatible with development platforms. The controller appears not to be expensive and uses low electrical power, 5.5 volts. Python is employed for this growth. Arduino can connect to a data processor via the Universal Serial Bus (USB) and perform with compatible connected accessories in both analog signal and digital signal. The Arduino which serves as the microcontroller platform, climbed up on a board that plugs easily into most computers. It permits the user to program the onboard at mega chip to perform several things with programming language, in programs called sketches.

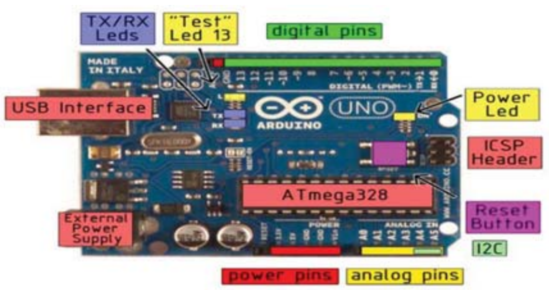

Fig:1 Arduino Uno

- Temperature and Humidity Sensor DHT11 (Temperature and Humidity)

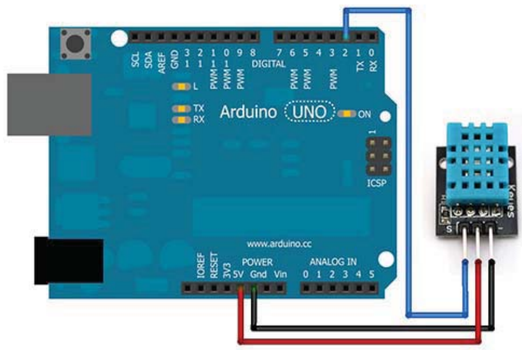

Fig:2 Temperature and Humidity Sensor - DHT11

This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures the highest dependability and excellent long-term stability. A good-performance microcontroller is connected. This detector includes a resistive component and could sense of wet NTC temperature measuring component. It delivers excellent tone, fast reaction, anti-interference ability and high price performance advantages.

Each DHT11 sensor features extremely accurate calibration of humidity calibration chamber. The calibration coefficients stored in the OTP program memory, internal sensors detect signals in the process, and we should call these calibration coefficients. The single-wire serial interface system is integrated to become nimble and gentle. Small size, low power, signal transmission distance up to 20 meters, reaching it a mixture of applications and even the most demanding applications. The product is 4-pin single row pin package. Convenient connection, special packages can be supplied according to users need.

- Gas Sensor – MQ2 (Detects Gas)

Fig.3 Gas Sensor – MQ2

The Gas Sensor (MQ5) module is useful for gas escape detection (in home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol. Due to its accurate sensitivity and faster response time, measurements can be submitted as soon as possible. A gas detector is a device that

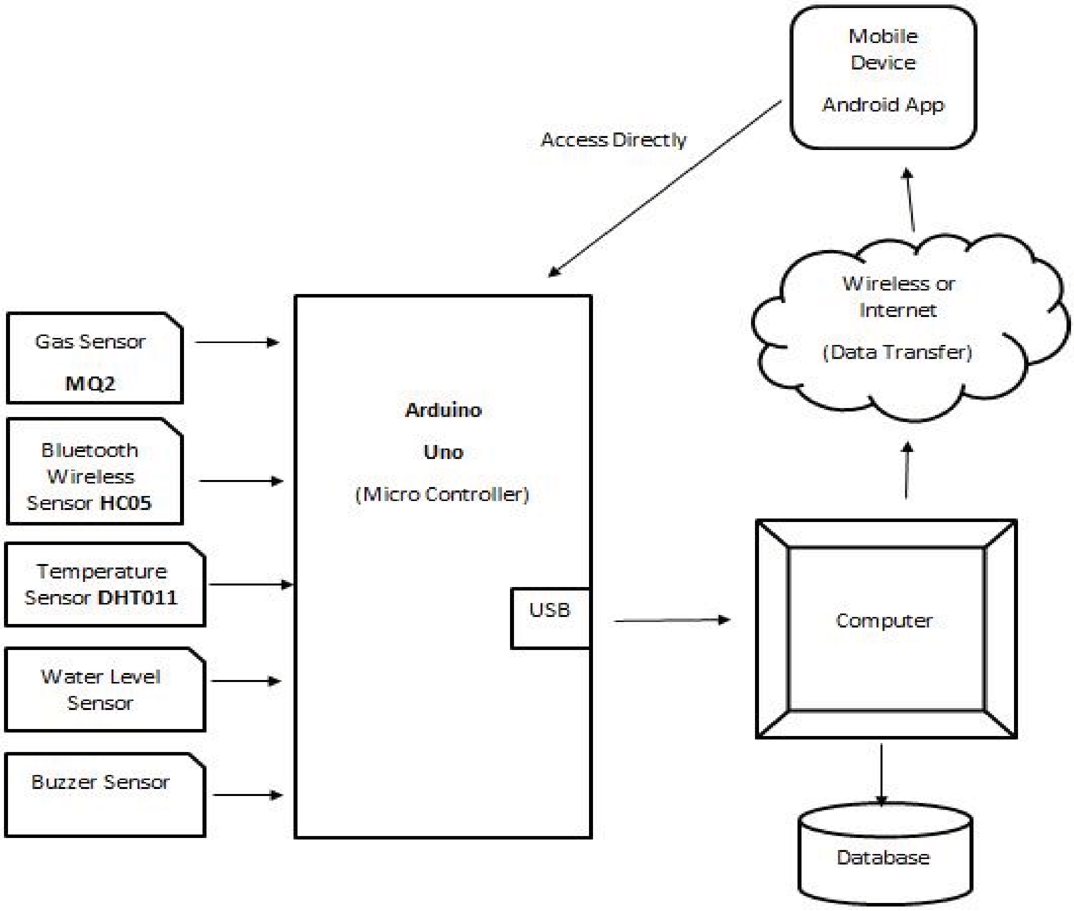

Fig: 7 System Architecture

detects the presence of gases in an arena, often as part of a safety arrangement. This type of equipment is used to detect a gas leak or other emissions and can interface with a command system thus a process could be made automatic system shut down. A gas detector can sound an alarm the region where the leak is found or when is occurring

- Bluetooth Sensor – HC05 (Wireless Transfer (Rx & Tx) and Connections)

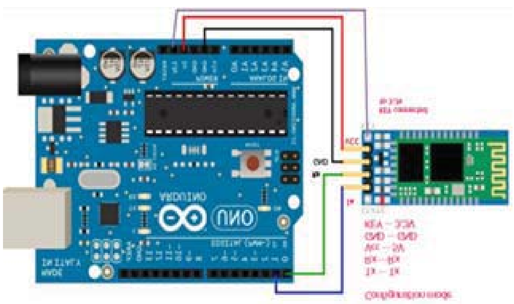

Fig:4 Bluetooth Sensor – HC05

HC□05 module is an easy to use the Bluetooth SPP (Serial Port Protocol) module, used setting up wireless serial connection. The HC-05 Bluetooth Module can be practiced in a Master or Slave configuration, naming it a great solution for wireless communication. . Master module can initiate a connection to other gimmicks.

- Water Level Sensor

Fig:5 Water Level Sensor

Water Level sensors are utilized to discover the level of substances that can fall. Such substances include slurries, liquids, powders and granular material. Level measurements can be done can be in the story of a river or inside containers or lake. These measurements will help us to determine the quantity of materials within a closed container or the flow of water in open channels.

- **Buzzer**

Fig:6 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include user input such as a mouse click, alarm devices, or key stroked confirmation, confirmation of user input such as a mouse clicks, timers.

A) System Architecture

The architecture of the IoT Enabled Sensing and Monitoring System is depicted in fig.7.It uses Gas sensor, Bluetooth, temperature sensor, buzzer sensor and waterlevel sensor

IV. RESULTS AND DISCUSSION

Therefore we propose a Arduino UNO based Wireless low cost Automatic Weather monitoring system with remote software application for comfortable monitoring and logging of the weather information. It can monitor temperature, pressure, water level humidity, and it likewise has an Android app to monitor temperature, pressure, water level ,humidity and to generate the short time local alerts. The resolutions have comes to be very serious with a correlation. In future a few more sensors like rain gauge, light detectors can be totalled. This organization can be highly efficient in increasing the accuracy of whatever national or local weather forecasting system by increasing the resolution of stations on the land by going through and installing more number of weather monitoring systems over the target geographical region, which is now possible due to its low cost constraints, particularly in Indian market. The result obtained are depicted in the fig8a) and 8b).

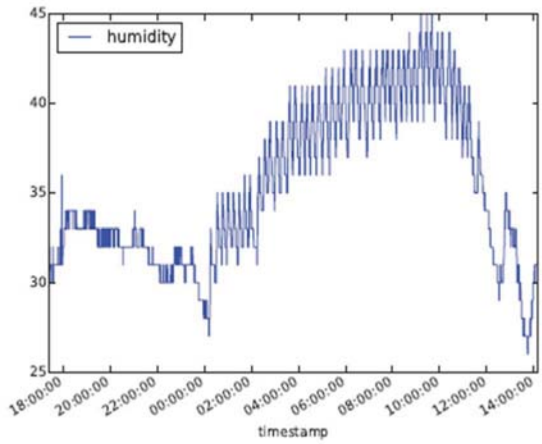

Fig: 8a) Humidity Graph Results

It could be highly useful in setting down the aircraft, navigational and the ship borne effects, tornado, tsunami, cloud bursts and in healthcare alerts, etc. In future we can also relate it with satellite system as a global feature of this arrangement.

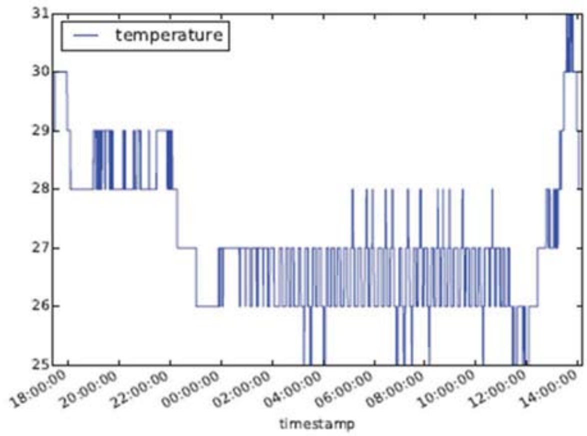

Fig: 8a Temperature Graph Results

The figures Fig 9 to 12 depict the Serial monitoring, variation in values, weather forecast and output values obtained respectively.

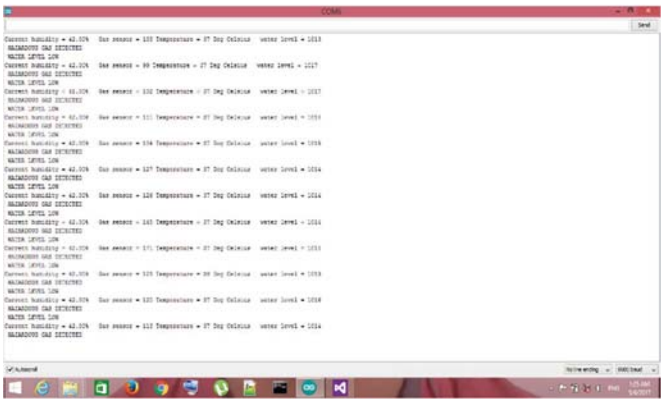

Fig: 9 Serial Monitoring in Ardunio IDE

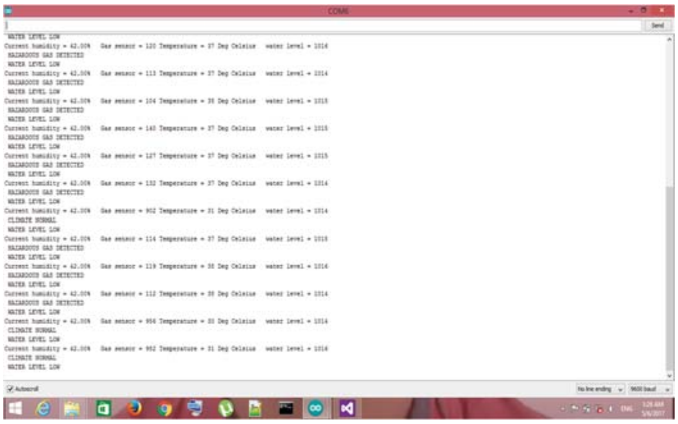

Fig.10 Variation of Values In Arduino IDE

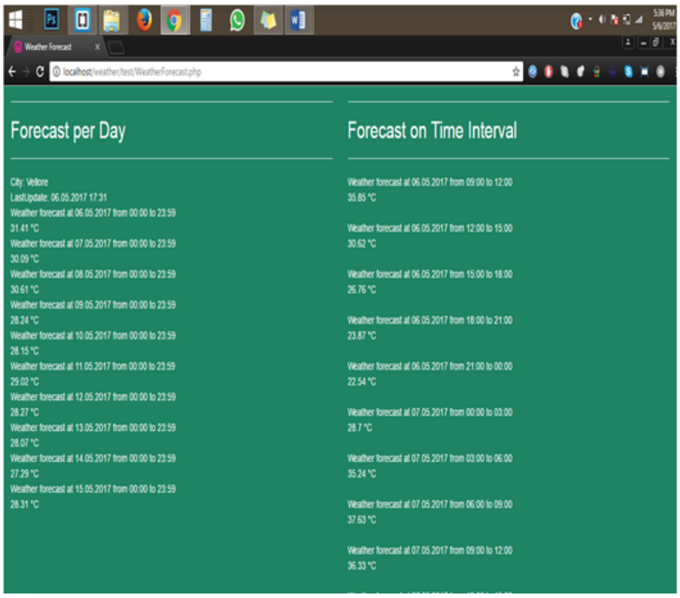

Fig.11 Weather Forecast Report

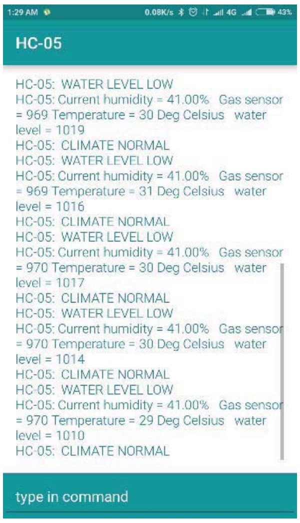

Fig.12 Arduino output values display on Android App

V. CONCLUSION AND FUTURE WORK

The developed IoT enabled environmental monitoring system for monitoring temperature, water level, humidity and gas level has been successfully carried out and validated at various locations. Apart from sensing temperature, water level humidity and gas level; the sensor node has a lower power consumption

Furthermore, the proposed IoT-SN has an added advantage of remote access to the sensing data through an application that is tested on a smart phone based on Android. These effects were likewise usable on the mobile device instantly; validating the proposed it enabled environmental monitoring system. This pattern has lots of characteristics, such as, small size, low power consumption, low cost, high accuracy, superior anti-interference performance, and it can be a real-time and easy development, human-interactive concisely and understandably. The system suitable for all kinds of short distance work conditions of wireless data acquisition and transmission.

VI. FUTURE WORK

The proposed IoT-SN has only remote access to the sensing data through an application that is tested on a smart phone based on Android more over the whole system need to be held over the Android app need to be produced which could be yet more helpful accordingly. The smart drip irrigation system provides to be a useful system as it ensuring automating and regulating the watering without any manual human interference. Sending the emails to the scheme can be automated, but manual sending of the emails has control over organization. Going through the GSM Module to this labor and ensuring the values and notifications are actually transported to user to his/her phone number.

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