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IOT and Cloud Based Weather Forecasting System

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ABSTRACT

The critical prerequisite for day-to-day operation is intelligent environmental monitoring. The solution to the problem is many. The project proposed gives a solution to these problems. The proposed technology behind the Internet of Things (IoT) is an innovative and powerful way to link things to the internet and through the network worldwide. It is proposed to measures parameters like Temperature, humidity, rain and speed of the using DH11 sensor, Rain sensor respectively. The data is acquired by the controller device. The data obtained is processed and communicated via networking to cloud and it is stored in the cloud. From the system the implemented data can be accessed at any internet available locations in the world. All measured data will be controlled and monitored using LCD 16x2, Android application and using Web application as well.

Keywords : IOT, DHT11 Sensor, Rain Sensor, Cloud, LCD 16x2, Web application, Android app

I. INTRODUCTION

Monitoring weather condition shows a wide part in every person's life. The influence of environments condition causes several challenges in different fields like agriculture, industry, constructions as well as other fields but the major impact occurs mostly in agriculture and industry. The smart word of IoT indicates that the use of minimum parameter produces an improved result. It decreases the use of land, time water and enchantment of crops. The security is one of the important issues in IoT network. In agriculture, before the yield farming process consists of different phases and in that weather plays major role. The farming problem occurs due to heavy rainfall or underflow rainfall. In this situation, an indication of weather condition is important aspect before sowing or reaping the crops. Hence in this situation, monitoring of weather condition will helps the farmer using weather forecasting system.

II. LITERATURE REVIEW

IoT Based Weather Station - Ravi Kishore Kodali and Snehashish Mandal et al [1]: In this system, an IoT-based weather monitoring system. In this research, the

environmental parameter can be retrieved through sensors. The author uses a different sensor to scale the various parameter like humidity, temperature, pressure, rain value & the LDR sensor is used. The system also calculates the dew point value from the temperature prototype. The temperature sensor can be used to measure the value of the particular area, room, or any place. With the help of the LDR sensor, the light intensity can be used as described by the author. The author in this used an additional functionality of the weather monitoring as SMS alert system based on the exceed the value of the sensing parameters as temperature, humidity, pressure, light intensity, and rain value. The author also adds an email antweet post alerting system. The author in this system uses node MCU 8266, and various sensors.

An IoT based Weather Information Prototype Using WeMos - Ravi Kishore Kodali and Archana Sahu et al [2]: In this system, the author represents a low- cost live weather monitoring system using LCD display, in which the author displays the various fields where the IoT has produced innovative things in the system. The author described a new revolutionary system. This measures the real-time Weather's condition. The monitoring weather situation is very much helpful for everyone either for farmer or industry or daily working people or for school as well. So, the author by developing a live weather monitoring system reduced the difficulty level for farmers and industry as well. In this paper, the author uses an LCD display that will display the weather conditions and in the proposed model, the author uses an ESP8266-EX microcontroller-based WeMos D1 board executed on Arduino that retrieved the data from the cloud. WeMos D1 is a Wi-Fi module that is developed on ESP- 8266EX microcontroller. It has a 4MB flash memory. It one of the Excellent which is programmed with node MCU and Arduino ide. Author uses only two gadgets to measure the weather conditions i.e., Wemos and LCD, after the connection, it will store the data on the cloud for storing data a thing speak website is used to display the data regarding weather. The system displays the data on LCD and thing speak cloud. The author's aim is to obtain live information on weather conditions on LCD display.

IOT Based Weather Reporting System to Find Dynamic Climatic Parameters - Kavya Ladi, A V S N Manoj, G V N Deepak et al [3]: In this system implement an IoT-based weather monitoring system, in this research paper, the author describes that how with the help of IoT technology, the weather can be monitored. And which provide the info of climate-changing conditions. With the help of this project, people can be aware of the climate condition changes. It gives an accurate and efficient output and the algorithm as the swarm is used to implement for further improving the accuracy. So, in this project, the author aims to make a weather monitoring with the help of IoT. In this project, the hardware and software are used which makes it easy to implement. In the project, the author uses a different sensor to collect the information of the climate and stored it in the cloud. For this storage, the website www.thingspeak.com is commonly used for Internet of things projects. And from the cloud storage space, it extracts the whole weather data and uploads it to the android mobile application using an API key. Tools which detect the rain drops, is called rain sensor. Once the plague reveals the raindrops on the strips and the voltage is considered from that. And there is no short circuit condition that occurs because water is a bad conductor and the sensor acts like variable resistance. Once a measurement of voltage is completed then the circuit takes the output. The voltage is measure through a potentiometer and to transfer analog signal to digital signal the system applies LM393 Comparator. The LED turns on when the power supply system is observed and there have no water drops on the sensor then the digital output is high. And the sensor also dictates when the sensor has moisture on the sensor plate the digital output is actively low. For measuring the humidity three sensors can be used as humidity sensing

components, TC thermistors, and An IC at the back of sensors. For humidity measurement humidity component is used it has two electrodes. Node MCU is used as a controller. In IoT projects, the Node MCU is basically used. This programmed using Arduino IDE. The scripting language LUA is used for programming. Node MCU runs on the ESP8266 WIFI module. This Android STUDIO is used it is developed by Google developers. The aim of this application is to make processing easier. Android studio is used to implement a common application to show the streaming of data from thing space. With this smartphone application, the weather condition can be monitored. Now after designing the application, it will display temperature, humidity, heat, and raindrops and is stored on the cloud.

Towards a robust and affordable Automatic Weather Station - Mary Nsabagwaa, Maximus Byamukamab, Emmanuel Kondelaa, et al [4]: In this system, a robust and affordable Automatic weather station. In this paper, the author elaborates how the weather prediction system is becoming a crucial challenge in every Weather extreme event that causes an adverse effect of the system on lives and property as well. Hence the accuracy of weather data is being one of the critical challenges to enhance the weather prediction skills and build up the resilience to effect of detrimental weather report condition. The author describes that Uganda and various other developing countries have looked challenges in developing timely & accurate weather data due to scarce weathers observation. The scarce weather monitoring is a part of the high cost of developing automatic weather situations. The restricted funding is available to national meteorological services of the respective countries. In this proposed system the author firstly takes care of the problems and then applies them. The author proposed an Automatic weather monitoring Station based on a wireless sensor network. The planning of the author is to develop three generations of Automatic weather stations or AWS prototypes. In this research, the author evaluates the 1st-generation AWS prototype to improve the 2nd generation depending upon the need and generation. The author provides a suggestion to improve the nonfunctional requirement such a power consumption, data accuracy, reliability, and data transmission in order to have an Automatic Weather Station. The non-functional requirement collapsed with cost reduction in order to produce a robust and affordable Automatic Weather Station (AWS) Therefore the proposed work, like developing countries like Uganda will be able to acquire the AWS in suitable quantities. So that it can improve the weather forecasting.

Real-Time Weather Monitoring and Prediction Using City Buses and Machine Learning - Zi-Qi Huang, Ying-Chih Chen and Chih-Yu Wen et al [5]: In this system monitors and predicts the weather condition by which anyone can plan for our day-to- day life. This activity became helpful in every field either in agriculture or industry. So as to achieve monitoring and predicting weather info, the author uses 2 stages of the weather management system. In which they amalgamated the information from the sensors, bus mobility, and deep learning technology is used to allow a weather reporting system in stations and buses in real-time. Forecasting of weather is achieved through the friction model. Depending upon the sensing measurement from vehicles like buses, the work incorporates the strength of local information processing. The author talks about in Stage-I, sensing of weather's condition, multilayer perception model and long-term memory are trained and then it will verify using temperature data, humidity, and air pressure of test environment. In Stage-II, the training is applied to learn the time series of weather information. To get accurate data or not, to check the system performance, the author comparing the predicted weather data and actually obtained data from the environment Protection Administrator and central Baeuro of Taichung observation system that calculate the prediction of accuracy. The author finally talks about the proposed

system has reliable performance on monitoring of weather. And this model also proposed a one-day weather forecast or prediction via the training model.

RDPC: Secure Cloud Storage with Deduplication Technique by R. Patil Rashmi, Y. Gandhi, V. Sarmalkar, P. Pund, and V. Khetani et al [6] investigated a secure cloud storage system that employs deduplication. They used cloud storage for storing the data and applied several encryption techniques to secure it. Their literature review outlines the study's objectives, methodology, and the significance of secure storage techniques. It emphasizes the benefits of deduplication, such as cost reduction and improved data transfer speeds. The review also summarizes the study's findings, demonstrating the effectiveness of the RDPC technique in achieving secure cloud storage with deduplication. Furthermore, the review summarizes the results and findings of the study, showcasing the effectiveness of the RDPC (Redundant Data and Privacy Check) technique in achieving secure cloud storage with deduplication. It discusses the implications of the findings and suggests potential applications of the technique in various domains. Overall, the review provides a concise overview of the study, showcasing the importance of secure cloud storage and the advantages of deduplication in optimizing storage efficiency and maintaining data security.

Astute Farm Monitoring Using WSN and AI - A Solution for Optimally Monitoring Environmental Conditions, the study by Kulkarni, Budhavale, and Langote et al [7] explores the integration of Wireless Sensor Networks (WSN) and Artificial Intelligence (AI) for efficient farm monitoring. The work discusses the importance of real-time monitoring in agricultural practices and the benefits of integrating WSN and AI technologies. It highlights the IoT devices used in the study, which may include temperature sensors, humidity sensors, soil moisture sensors, and atmospheric pressure sensors, among others. Their literature review focuses on the study's methodology, findings, and the IoT devices utilized for astute farm monitoring. The research combines WSN, which comprises interconnected IoT devices, with AI techniques to optimize the monitoring of environmental conditions in farms. Furthermore, the literature review summarizes the study's findings, showcasing the effectiveness of the proposed approach in accurately monitoring and analyzing crucial environmental parameters. It discusses how the integration of WSN and AI facilitates data-driven decision-making for farmers, enabling them to take proactive measures to ensure optimal crop growth and resource utilization. The review also emphasizes the significance of the research in the context of smart agriculture, highlighting the potential for widespread adoption of astute farm monitoring systems based on WSN and AI.

The research study titled "Intensification of Agriculture using Deep Learning and Machine Learning: A Survey" by T. Mehta, O. Manolkar, S. Multaikar, S. Patil, and N. Gawande et al [8] addresses the need for enhancing agricultural productivity, sustainability, and efficiency through the integration of deep learning and machine learning algorithms. The review highlights the potential benefits of these techniques, such as improved crop yield prediction, disease detection, and irrigation optimization. The review also presents the key findings from the survey, emphasizing the effectiveness and practicality of deep learning and machine learning techniques in intensifying agriculture. It discusses the potential challenges and limitations associated with implementing these technologies and highlights the need for further research and development. Moreover, the literature review explores the implications of the study's findings for sustainable farming practices, resource management, and agricultural decision-making. It emphasizes the potential of deep learning and machine learning to revolutionize traditional

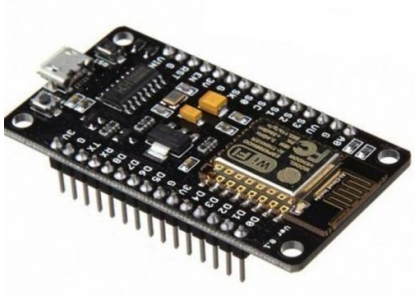
farming methods and improve overall agricultural outcomes.

The study titled Cloud Based Location and Message Sharing System by Gaikwad, Bhise, Salunkhe, Kalbhor, and Bangar et al [9] explores the development and implementation of a cloud-based system for location tracking and message sharing. Their study addresses the increasing need for efficient and reliable location tracking and message sharing systems. It highlights the advantages of cloud-based solutions, such as scalability, accessibility, and cost-effectiveness. The review emphasizes the importance of leveraging cloud computing technology to enhance location tracking accuracy and enable seamless communication. Furthermore, the literature review summarizes the methodology used in the study, which may include the design and implementation of a cloud-based platform, integration with location tracking technologies, and the development of message sharing functionalities. It discusses the potential challenges encountered during the implementation process and the strategies employed to overcome them. The review also highlights the key findings and outcomes of the research, showcasing the effectiveness and practicality of the proposed cloud-based system. It discusses the improved accuracy of location tracking, the efficiency of message sharing, and the overall user experience. Additionally, the literature review identifies the implications of the study's findings for various domains, such as transportation, logistics, emergency services, and social networking. It emphasizes the potential benefits of cloud-based location and message sharing systems in terms of improving efficiency, enhancing communication, and streamlining operations.

III. SYSTEM ARCHITECTURE

A. NODE MCU microcontroller:

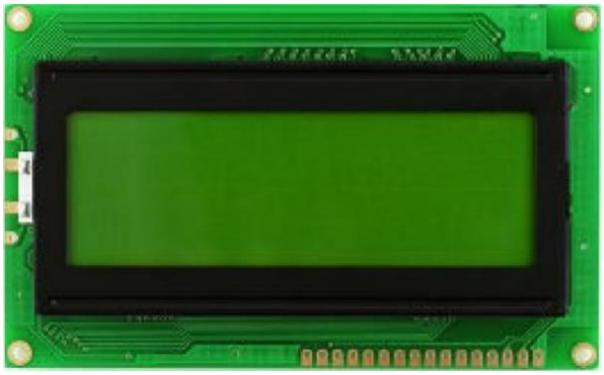
Node MCU is an IoT module based on esp8266 Wi- Fi module. Node MCU uses lua scripting language and is an open source internet of things (IoT) platform. This module has ch340g usb to ttl ic.



B. LCD 16x2:

JHD204/JHD629-204A is a 16x2 (16 character, 2 line) Green Alphanumeric LCD Display. Alphanumeric displays are pretty neat. Use them for numbers, use them for letters, or both. They are a good size and brightness for easy reading. The decimal digits aren't connected, so keep that in mind when ordering.

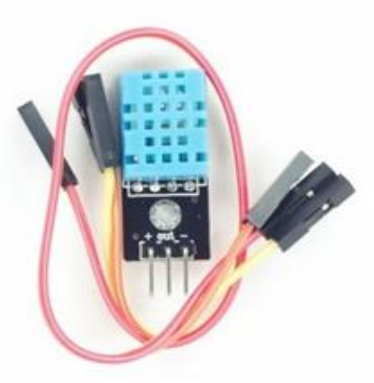
- Module Size: - 80.036.0
- VA Size: - 64.016.0
- Character Size: - 2.965.56
- Dot Size: - 0.560.66
- Dot Pitch: - 0.600.70
- Duty Bias: - 1/16 - 1/5



C. DHT11 Sensor:

It uses thermistor to measure the surrounding air temperature and a capacitive humidity sensor to measure the moisture content. It sends digital readings on data pin so there is no need to use an Analog to Digital Converter (ADC) chip. It is very easy to use but the only problem with this sensor is that it sends data every 2 seconds. There are lot of resources online on

hot to interface DHT11 Sensor to Arduino which will make this sensor easy to interface to any Arduino Board.



Features of DHT11 sensor:
- Humidity measurement range: 20%~90%RH
- Humidity measurement error: ±5%RH
- Temperature measurement range: 0~50°C
- Temperature measurement error: ±2°C
- Working voltage: DC5V/3.3V

D. Rain Sensor:

It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

Specification of Rain Sensor:
- High quality of RF-04 double sided material.
- Area: 5 cm x 4 cm nickel plate on side.
- Anti-oxidation, anti- conductivity, for long use time.
- Potentiometer adjust the sensitivity;
- Working voltage 5 volts
- Output format: Digital switching output (0 and 1) and analog voltage output AO;
- With bolt holes for easy installation;
- Small board PCB size: 3.2cm x 1.4cm;
- Uses a wide voltage LM393 comparator

IV. SOFTWARE REQUIREMENT

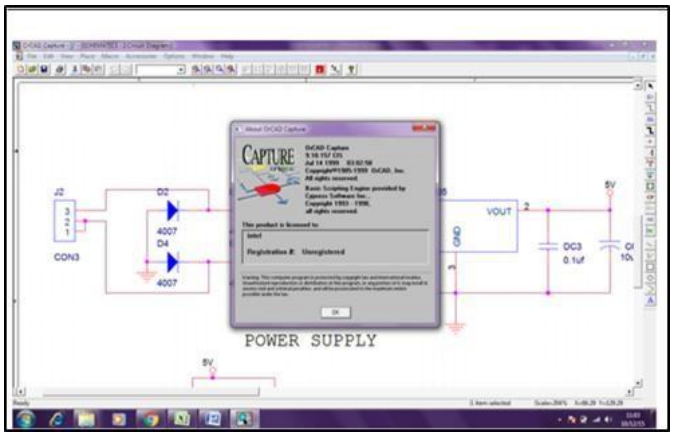
A. ARDUINO IDE:

The Arduino Uno can be programmed with the Arduino software. Select "Arduino Uno w/ATmega328" from the Tools > Board menu (according to the microcontroller on your board) The ATmega328 on the Arduino Uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

B. ORCAD:

OrCAD is a proprietary software tool suite used primarily for electronic design automation (EDA). The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing

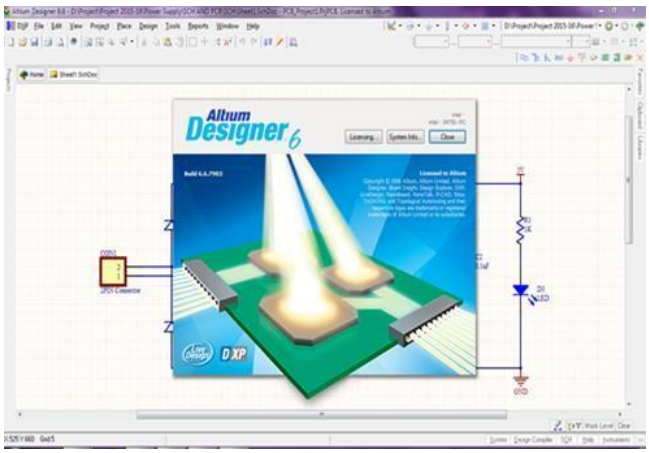
printed circuit boards. The name OrCAD is a portmanteau, reflecting the company and its software's origins: Oregon + CAD.



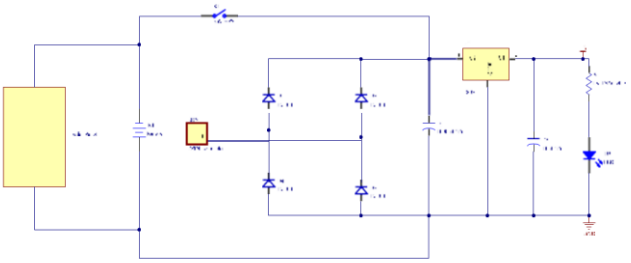
OrCAD PCB Designer is a printed circuit board designer application, and part of the OrCAD circuit design suite. PCB Designer includes various automation features for PCB design, board-level analysis and design rule checks (DRC). The PCB design may be accomplished by manually tracing PCB tracks, or using the Auto-Router provided. Such designs may include curved PCB tracks, geometric shapes, and ground planes. PCB Designer integrates with OrCAD Capture, using the component information system (CIS) to store information about a certain circuit symbol and its matching PCB footprint.

C. Altium:

Altium Limited is an Australian owned public software company that provides PC-based electronics design software for engineers. Founded in Tasmania, Australia 1985, Altium now has regional headquarters.



POWER SUPPLY DESIGN:



V. CONCLUSION

The proposed system work is based on Cloud with IoT technology which is observed different environmental information using multiple sensors. The main aim of our system is that everyone case use it freely, capturing multiple data from multiple sensors and send all data to webpage as well as on android application. It is very helpful for farmers to collects environmental data making an interpretation for the farmers as well as it is important for making another decision such as industrial work purpose or transportation.

In future work, we can also add GPS devices in the design so that location of the surrounding will also be mailed or messaged to user along with the surrounding parameters such as temperature, humidity, pressure, light intensity etc. we add various other sensors for measure various parameter related to weather like solar radiation, visibility etc.

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