International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 07 | July - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

SMART AGRICULTURAL MONITORING AND IRRIGATION SYSTEM

M.Pavani[1], Ch.Aishvarya [2], Ch.Sai Kiran[3], D.Chaitanya[4]

[1] *Assistant Professor*
[2-4] *B. Tech Student, LIET*
[1,2,3,4] *Electronics & Communicaton Engineering, Lendi Institute of Engineering and Technology, Vizianagaram*

---***---

Abstract – In today's world, technology is continually evolving in order to reduce human labour through the use of IOT, artificial intelligence, and machine learning. It is extremely difficult to grow any agricultural food in areas with sporadic rainfall patterns and high mean temperatures, putting additional pressure on farmers to irrigate at regular intervals without any basic understanding of the rainfall pattern and soil humidity. The crop plant is either under-watered or over-watered as a result of ignorance and irregular irrigation. This study attempts to create a basic and low-cost automatic watering system utilizing a soil moisture sensor, a DHT11 sensor, and a NodeMCU. To accurately manage the water levels required by each unique plant, a fuzzy logic model based on soil moisture, temperature, humidity, and precipitation forecast is being developed. Finally, this model is fuelled by solar energy, which not only helps in achieving true independence from conventional forms but also helps to lessen the carbon footprint problem.

Key Words: NodeMCU, SmartIrrigation, DHT11,ThingsSpeak

1.INTRODUCTION

As rapid change in technology always aims to serve the mankind, the expectation for living a simple yet advance life keeps on increasing. Internet has become an important part of human's social life and educational life without which they are just helpless. The Internet of Things (IOT) device not only control but also monitors the electronic, electrical and various mechanical systems which are used in various types of infrastructures. Agriculture is critical to the development of humanity's population. Even the first civilization arose quickly after some people began cultivating one kind of crop and relied on others for other meals, clothes, housing, and information. Agriculture is critical to India's economic development and accounts for around 17% of the country's GDP & employs over 60% of the workforce. With an ever-increasing population, there is always a need for more food. But, our farmlands are already being exploited to their full potential, necessitating a transition to more effective agricultural and irrigation methods. Our paper proposes a strategy for irrigating agricultural plants just when they need it, based on numerous climatic parameters and precipitation projection, promoting prudent water management and enhancing crop yield, all while using sunlight as the sole source of energy.

2. EXISTING METHODOLOGIES

Smart irrgation systems are equipped with where a microcontroller called NodeMCU this microcontroller is interfaced with sensor for carring the smartirrigation.An application known as Blynk is used to keep track of the moisture content and temperature of the soil. This helps in carrying out the irrigation of crops. All the statistics for each crop are considered and irrigation is carried out accordingly and in this used a another application is ThingsSpeak for display the moisture of the soil and temperature.

3.PROPOSED SYSTEM

In order to increase the quality of our crop, we must use technologies that analyze the essence of the harvest and offer advice to benefit both farmers and government. The Internet of things (IOT) is the revamping the agribusiness engaging the farmers by the broad assortment of techniques, for that the instance, accuracy and conservative cultivation to go up against challenges in the field.Use of the Wireless sensor Networks In Precision Agriculture.The benefit in this report is to continuously used to evaluate various differentiated factors for yield and location. Precision Agriculture, as its name implies, is precise both in the area of its commodity territories and in the transport steps of soill fertilizer etc. This invention will isolate a single plant in ten or many square meters for testing. This invention will isolate a single plant in ten or many square meters for testing. Exactness Agriculture requires a novel programming model for each land territory,the main and characteristic soil write and the specific harvest or plants. For instance, every area will get its own particular ideal measure of water, compost and pesticide. In general, data collection is for recommended on an hourly basis. Visitor information collection does not offer the product display extra helpful data and turns the wireless sensor network into a weight for power usage and data transmission. Fewer ongoing studies could be sufficient in respect of some moderate harvests and regions with highly stable and uniform conditions of atmosphere.

The system architecture can be divided into 2 sections. The section on the left represents all the external devices connected to the NodeMCU block which take input from the microcontroller and function according to the commands received. This section consists of the water pump receiving on and off commands, the solenoid valve and relay which help with functioning of the water pump. The right section of the architecture consists of three types of sensors namely Soil moisture sensor, DHT (Digital Humidity and Temperature) sensor which sends Analog data to NodeMCU.

4.SYSTEM ARCHITECTURE:

The system uses various sensors to detect the local environment conditions (using DHT11 sensor and LM 393 soil moisture sensor) to decide the best timing, duration and amount for supplying water to crop plant. Data acquired by the sensors are then processed by the Tensilica Xtensa 32-bit LX106 RISC microprocessor present in NodeMCU and blynk IoT app. The device is itself autonomous and need only a small fraction of power supply to keep it running for days. The NodeMCU and motor and hence once install it has very low cost of running and maintenance. It require only 5V and 200mA for routine running (including sensors and microprocessor).

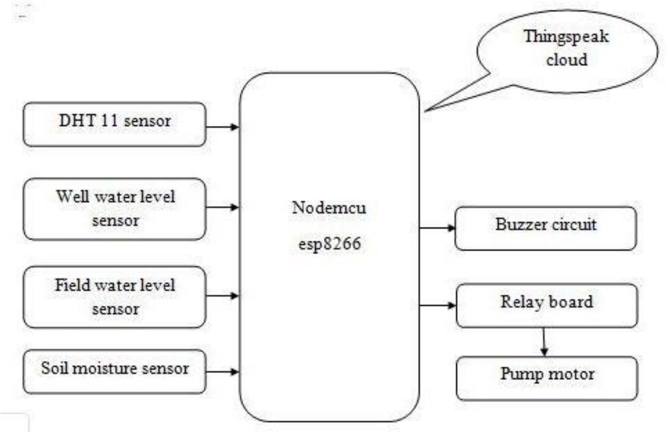

Fig:1:System Design

1.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. ESP8266 is a system-on-chip (SoC) which integrates a 32- bit microcontroller, standard digital peripheral interfaces,antenna switches, RF balun, power amplifier, and low noisereceive amplifier, filters and power management modules intoa small package

2.Soil moisture sensors determine the volumetric water content of the soil. Because direct gravimetric measurement of free soil moisture necessitates the removal, drying, and weighting of a sample, soil moisture sensors indirectly measure the volumetric water content by using another property of the soil as a proxy for the moisture content, such as electrical resistance, dielectric constant, or interaction with neutrons

3.The DHT11 is a temperature and humidity sensor that is widely used. The sensor has a dedicated NTC to detect temperature and an 8-bit microprocessor to output temperature and humidity measurements as serial data. The sensor is factory calibrated as well, making it simple to interface with other microcontrollers.

The IoT-based Smart Agriculture Monitoring and Irrigation System utilizes sensors deployed across the field to collect real-time data on soil moisture, temperature, humidity, and other relevant parameters. This data is transmitted to a centralized platform hosted on the cloud. Farmers can access this platform through a mobile or web application, enabling them to remotely monitor farm conditions and receive instant alerts in case of abnormal events.

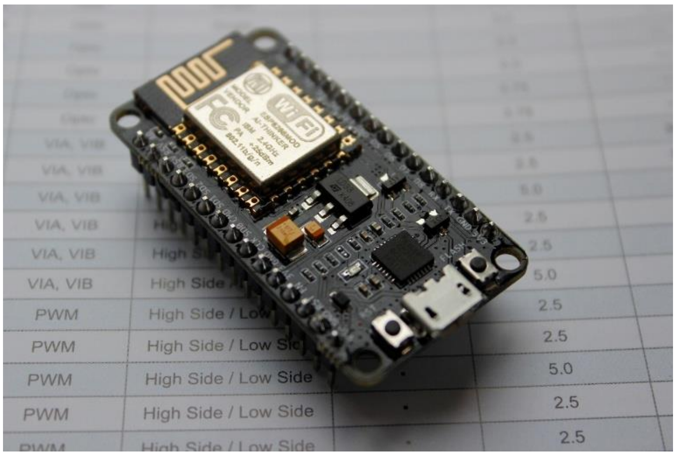

Fig-2 : NodeMCU ESP8266

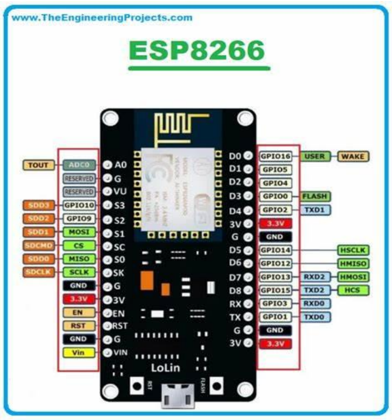

Fig:3 NodeMCU pins

ESP8266 comes with capabilities of:

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
- General-purpose input/output (16 GPIO).
- Inter-integrated Circuit (I^2C) serial communication protocol.
- Analog-to-digital conversion (10-bit ADC).
- Serial Peripheral Interface (SPI) serial communication protocol.
- I^2S (Inter Ic Sound) interfaces with DMA(Direct Memory Access)(Sharing pins with GPIO).
- UART (on dedicated pins, plus a transmit only UART can be enabled on GPIO2), and Pulse width Modulation (PWM).
- The processor has around 16 GPIO lines, some of which are used internally to interface with other components of the SoC, like flash memory.
- Since, several lines are used internally within the ESP8266 SoC, we have about 11 GPIO pins remaining for GPIO purpose
- Now again 2 pins out of 11 are generally reserved for RX and TX in order to communicate with s host PC from which compiled object code is downloaded.
- Hence finally this leaves just 9 general purpose i/o pins i.e., Do to D8

- The ADC channel on ESP8266 is multiplexed with the battery voltage. Hence, we can set it to measure either on board system voltage or external voltage. The input voltage range for ADC pin is 0-1.0V while reading external voltage.

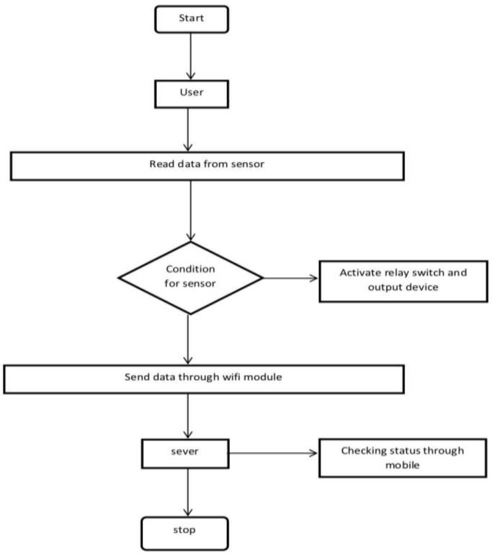

Fig.4:work flow

Hardware Setup:

Step 1: Gather the relay module, NodeMCU board, jumper wires, and a USB cable.

Step 2: Identify the pins on the relay module: typically Vcc, GND, and control pin(s).

Step 3: Connect the Vcc pin of the relay module to a suitable power source (e.g., 5V or 3.3V) on the NodeMCU board using a jumper wire.

Step 4: Connect the GND pin of the relay module to the GND pin on the NodeMCU board using a jumper wire.

Step 5: Identify the control pin(s) on the relay module, which will be used to control the relay switch.

Step 6: Connect the control pin(s) of the relay module to any digital pin(s) on the NodeMCU board (e.g., D4) using jumper wires.

Step 7: Use a USB cable to connect the NodeMCU board to a computer (PC) for power and programming.

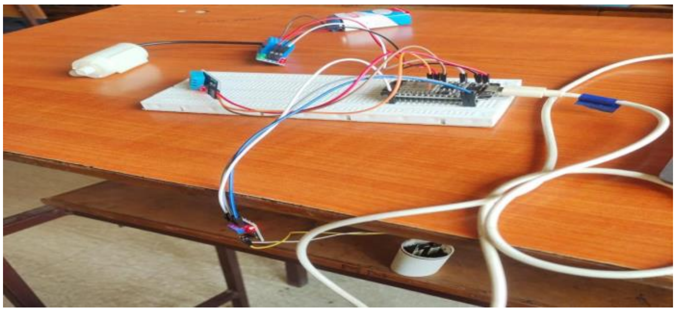

Fig.5:Hardware Design

5.RESULTS AND DISCUSSIONS:

The software design of the project depicts a Web UI consisting of blocks to control the flow of water for irrigation from the Water storage to the fields. Initially the data from the microcontroller is sent as digital signals to the IoT cloud - ThingSpeak. It is an open-source Internet of Things (IoT) application and API to store and retrieve data from IoT devices using the HTTP and MQTT protocol over the Internet or via a Local Area Network. The Web User Interface is designed using the basic knowledge and idea of HTML, Bootstrap and JavaScript. The Interface consists of interactive and easy to use buttons to control and command the water supply to the fields for better automated irrigation facilities to save water and bring about better yield of crops thus increasing profits.

The ThingSpeak API enables the connection of the designed front end to the cloud resting on its own platform.

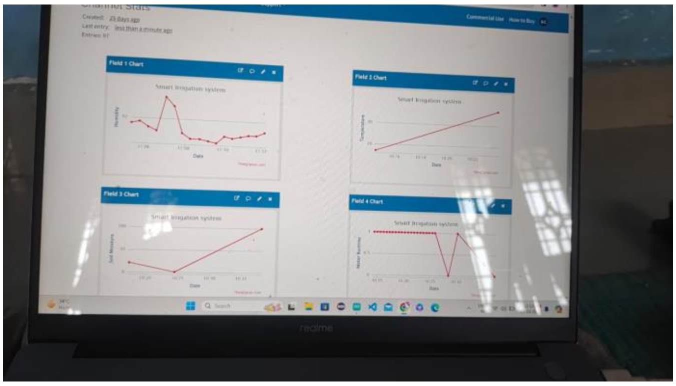

Fig -6: ThingsSpeak results

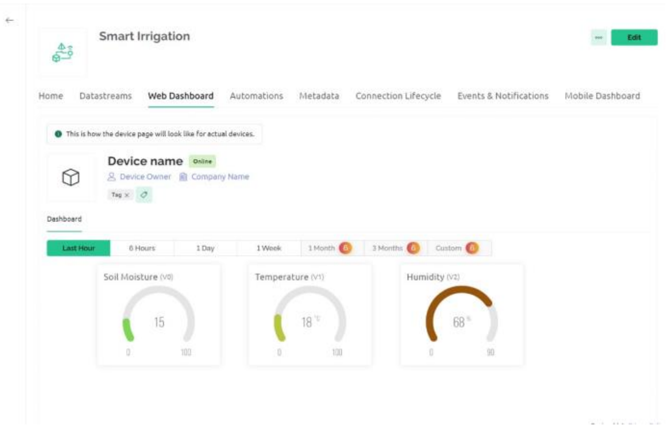

Fig-7: Blynk results

.

6. CONCLUSION

The IoT-based smart agriculture monitoring and controlling system presented in this project document leverages cutting-edge technologies to revolutionize traditional farming practices. By integrating sensors, automation, and data analytics, the system enables farmers to remotely monitor crop conditions, optimize resource usage, and enhance overall productivity. Through real-time data collection and analysis, farmers can make informed decisions, improve crop yield, and reduce manual labor. The system's ability to monitor soil moisture, temperature, humidity, and other vital parameters ensures efficient crop management and irrigation practices. Overall, this project demonstrates the immense potential of IoT in transforming agriculture towards sustainability, efficiency, and increased yields.The adoption of IoT devices in agriculture is expected to reach 75 million by 2020, with the global smart agriculture market projected to triple by 2025, reaching $15.3 billion. IoT applications in agriculture include agricultural drones, livestock tracking, smart greenhouses, analytics for crop management. These technologies aim to increase agricultural production cost-effectively and offer opportunities forbusinesses to innovate in the agricultural sector

7.REFERENCES

[1] Tragos, E. Z., Angelakis, V., Fragkiadakis, A., Gundlegard, D., Nechifor, C. S., Oikonomou, G & Gavras, A. (2014, March). Enabling reliable and secure IoT-based smart city applications. In 2014 IEEE International Conference on Pervasive Computing and Communication Workshops (PERCOM WORKSHOPS) (pp. 111-116). IEEE.

[2] Shah, J., & Mishra, B. (2016, January). IoT enabled environmental monitoring system for smart cities. In 2016 International Conference on Internet of Things and Applications (IOTA) (pp. 383-388). IEEE.

[3] Pasha, S. (2016). ThingSpeak based sensing and monitoring system for IoT with Matlab Analysis. International Journal of New Technology and Research, 2(6).

[4] Khan, R., Khan, S. U., Zaheer, R., & Khan, S. (2012, December). Future internet: the internet of things architecture, possible applications and key challenges. In 2012 10th international conference on frontiers of information technology (pp. 257-260). IEEE.

[5] https://components101.com/development-boards/nodemcu-esp8266- pinout-features- and-datasheet

[6] Kumar, N. S., Vuayalakshmi, B., Prarthana, R. J., & Shankar, A. (2016, November). IOT based smart garbage alert system using Arduino UNO. In 2016 IEEE Region 10 Conference (TENCON) (pp. 1028-1034). IEEE.

[7] Kumar, S., & Jasuja, A. (2017, May). Air quality monitoring system based on IoT using Raspberry Pi. In 2017 International Conference on Computing, Communication and Automation (ICCCA) (pp. 1341-1346). IEEE.

[8] Talari, S., Shafie-Khah, M., Siano, P., Loia, V., Tommasetti, A., & Catalao, J. (2017). A review of smart cities based on the internet of ˜ things concept. Energies, 10(4), 421

[9] Lakshmisudha, K., Hegde, S., Kale, N., & Iyer, S. (2011). Smart Precision Based Agriculture Using Sensors. International Journal of Computer Applications, 146(11), 25-29.

[10] Gondchawar, N., & Kawitkar, R. S. (2016). IoT Based Smart Agriculture. International Journal of Advanced Research in Computer and Communication Engineering, 5(6), 101- 105.

[11] Gayatri, M. K., Jayasakthi, J., & Anandhamala, G. S. (2015). Providing Smart Agriculture Solutions to Farmers for Better Yielding Using IoT. IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR).

[12] Dwarkani, C. M., Ram, G. R., Jagannathan, S., & Priyatharshini, R. (2015). Smart Farming System Using Sensors for Agricultural Task Automation. IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR).

[13] Nandurkar, S. R., Thool, V. R., & Thool, R. C. (2014). Design and Development of Precision Agriculture System Using Wireless Sensor Network. IEEE International Conference on Automation, Control, Energy and Systems (ACES).

[14] Gutiérrez, J., & Villa-Medina, J. F. (2018). IoT for Agriculture: A Comprehensive Review. Computers and Electronics in Agriculture, 153, 8-22.

[15] Ouma, Y. O., Okeyo, G. M., & Mwangi, K. W. (2019). Precision Agriculture using Internet of Things (IoT): A Review. International Journal of Advanced Computer Science and Applications, 10(1), 144-154.

[16] 8. Kumar, N., Chauhan, G., & Singh, S. P. (2019). Internet of Things (IoT)-based Smart Agriculture: A Comprehensive Review. Journal of Ambient Intelligence and Humanized Computing, 10(3), 1131-1153.

[17] 9. Arafat, A. M., Islam, M. A., & Haque, M. E. (2020). IoT-Based Smart Agriculture System: A Comprehensive Review. SN Computer Science, 1(5), 1-19. 10. Maity, S., Naskar, S., & Pradhan, A. (2021). Internet of Things (IoT) in Agriculture: A Comprehensive Review. Journal of Ambient Intelligence and Humanized Computing, 12(4), 4023-404