IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Green IOT Solutions For Intelligent Farming In Ranipet District

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ABSTRACT

Green IoT solutions for intelligent farming using NodeMCU with IoT technology aims to demonstrate the transformative potential of IoT-based System for Monitoring Smart Agriculture's Automated Irrigation practices, elevating the efficiency and productivity of agricultural management. IoT sensors can be used to collect environmental and machine metrics, enabling farmers to make informed decisions and improve every aspect of their work, from livestock to crop farming.

The use of Green IOT solutions for intelligent farming will give farmers better control over the process of raising livestock and growing crops, making it more predictable and improving its efficiency. This Project is used to build a Smart Farming System using IoT technologies. The objective of this project is to offer assistance to farmers in getting live data such as temperature, humidity, soil moisture, soil temperature for efficient environment monitoring which will enable them to increase their overall yield and quality of products.

The system is powered by NodeMCU and consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip. When the IoT-based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, and soil temperature. It then sends this data to the IoT cloud for live monitoring. If the soil moisture goes below a certain level, it automatically starts the water pump. It also generates Weather forecast details inthe cloud Interface.

The IOT cloud used for live monitoring the data is Adafruit IO. Adafruit IO is a cloud service that allows you to stream, log, and interact with your data from any device. Adafruit IO is built from the ground up to be easy to use, and it provides a powerful API that is useful for assistance. IoT solutions in agriculture have tremendous potential to improve nearly every facet of farming. By using IoT sensors to collect environmental and machine metrics, farmers can make informed decisions and improve just about every aspect of their work – from livestock to crop farming.

1. INTRODUCTION

1.1 IOT Technology

An Intelligent Farming system that uses IoT technology to monitor and control the growth of crops in real-time. The system uses a NodeMCU ESP8266 microcontroller, a soil moisture sensor, DHT11 Sensor, DS18B20 Waterproof Temperature Sensor Probe, LDR, 7805 Voltage Regulator and a water pump to automate the irrigation process. IoT solutions in agriculture have tremendous potential to improve nearly every facet of farming. By using IoT sensors to collect environmental and machine metrics, farmers can make informed decisions and improve just about every aspect of their work – from livestock to crop farming.

- Green - IOT Solutions For Intelligent Farming in Ranipet District is a cutting- edge solution that leverages the power of Internet of Things (IoT) to enable intelligent farming in the Ranipet district.

- The solution uses NodeMCU with IoT devices to create a smart farming environment that is sustainable, efficient, and profitable.

- With Green, farmers can remotely monitor and control their farms using a laptop, computer, or mobile phone with internet connectivity.

- The system uses a NodeMCU ESP8266 microcontroller, a soil moisture sensor, and a water pump to automate the irrigation process.

- The solution is designed to collect data on plant growth, Temperature, Humidity, Temperature and moisture content in the soil, energy consumption by smart appliances, and more.

- The data is then sent to the Adafruit IO cloud, where it is analyzed to provide insights into the farm's performance. The use of NodeMCU with IoT devices ensures that the devices function in an energy-efficient manner, reducing electricity consumption.

1.2 Microcontroller

NodeMCU is an open-source firmware and development board specially targeted for IoT-based applications. It is a low-cost IoT platform that uses the ESP8266 microcontroller chip. NodeMCU is designed to be easy to use and provides a powerful API that is available for assistance. The firmware uses the Lua scripting language and is built on the Espressif Non-OS SDK for ESP8266.

NodeMCU is an open-source firmware, and open-source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) that integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards.

1.3 DHT11 Sensor

DHT11 is a digital temperature and humidity sensor that can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi, etc. to measure humidity and temperature instantaneously. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The DHT11 sensor is factory calibrated and outputs serial data, making it highly easy to set up. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracyof ±1°C and ±1%.

The DHT11 sensor can either be purchased as a sensor or as a module. Either way, the performance of the sensor is the same. The sensor will come as a 4-pin package out of which only three pins will be used, whereas the module will come with three pins. The only difference between the sensor and module is that the module will have a filtering capacitor and pull-up resistor inbuilt, and for the sensor, it is needed externally if required.

1.4 DS18B20 Sensor

DS18B20 Waterproof Temperature Sensor Probe is a pre-wired, one-meter-long, sealed, waterproof digital temperature sensor probe that can be used to measure temperature in any environmental conditions. It is based on the DS18B20 sensor and is easy to use, well-designed, and handy. The sensor provides an accuracy of

±5°C from -10°C to +85°C and has an operating temperature range of -67°F to

+257°F or -55°C to +125°C. The sensor is factory calibrated and outputs serial data, making it highly easy to set up.

The DS18B20 waterproof temperature sensor can be interfaced with any micro controller such as Arduino, Raspberry Pi, etc. to measure temperature instantaneously. The sensor can be purchased as a sensor or as a module. The module comes with a filtering capacitor and pull-up resistor inbuilt, whereas for the sensor, you have to use them externally if required.

1.5 Soil Moisture Sensor

Soil Moisture Sensor is a device that measures the water content in the soil. It is used to gauge the volumetric content of water within the soil. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. The relation among the calculated property as well as moisture of soil should be adjusted & may change based on ecological factors like temperature, type of soil, otherwise electric conductivity.

1.6 Light Dependent Resistor

A Light Dependent Resistor (LDR), also known as a photoresistor, photocell, or photoconductor, is a passive electronic component that decreases resistance with respect to receiving luminosity (light) on the component's sensitive surface. The resistance of an LDR decreases with an increase in incident light intensity; in other words, it exhibits photoconductivity. LDRs are often used in many circuits where it is required to sense the presence of light. They are commonly used in light-sensitive circuits such as streetlights, photographic light meters, solar cells, and automatic lighting systems. They are also used in some electronic musical instruments, where they can be used to control the pitch or volume of the sound.

2. LITERATURE SURVEY

Title: IoT Based Polyhouse Farming with Controlled Environment andMonitoring

Author: Jose Reena K

Year: 2019

Description: The growth potential of the embedded industry is enormous and the way forward becomes clear every day. It's time to start building our own IoT system which will add value to you. IoT is supposed to connect 28 billion things

[3] from smart watches and other wearable devices to cars, home appliances and industrial equipment on the Internet by 2020. Agriculture plays an important role in the development of farmland. In India, about 70% of the population depends on agriculture, and one third of the country's capital [4] is engaged in agriculture. Henceforth agricultural problems have always hindered the development of the country. The

most possible and only solution to this problem is intelligent farming by modernizing current traditional farming methods. The paper therefore aims to make agriculture intelligent using automation and IoT technology. All these operations are controlled by any remote smart device or computer connected to the Internet, and the operations are performed by the interface sensors.

Title: Smart Farming Based on IoT: Nepal PerspectiveAuthor: Anup Acharya

Year: 2020

Description: This paper is about how Internet of Things (IoT) plays a vital role in farming. IoT based farming is the smart farming system so that if we apply thistechnology with traditional farming then it would definitely be emerging because of its ability for providing information about the farming field. The main aim of this paper is making use of latest technology like Internet of Things in agriculture for smart farming with the help of different sensors like temperature, humidity, and pressure through wireless network system. These sensors are used for monitoring environment and farming area as well as for sending the exact data tofarmer through server and android system.

Title: Big Data in Smart Farming – A reviewAuthor: Sjaak Wolfert a,b,∗, Lan Ge a

Year: 2021

Description: Smart Farming is a development that emphasizes the use of information and communication technology in the cyber-physical farm management cycle. New technologies such as the Internet of Things and Cloud Computing are expected to leverage this development and introduce more robots and artificial intelligence in farming. This is encompassed by the phenomenon of Big Data, massive volumes of data with a wide variety that can be captured, analysed and used for decision-making. This review aims to gain insight into the state-of-the-art of Big Data applications in Smart Farming and identify the related socio-economic challenges to be addressed. Following a structured approach, a conceptual framework for analysis was developed that can also be used for future studies on this topic. The review shows that the scope of Big Data applications in Smart Farming goes beyond primary production; it is influencing the entire food supply chain. Big data are being used to provide predictive insights in farming operations, drive real-time operational decisions, and redesign business processes for game-changing business models. Several authors therefore suggest that Big Data will cause major shifts in roles and power relations among different players in current food supply chain networks. The landscape of stakeholders exhibits an interesting game between powerful tech companies, venture capitalists and often small startups and new entrants. At the same time there are several public institutions that publish open data, under the condition that the privacy of persons must be guaranteed. The future of Smart Farming may unravel in a continuum of two extreme scenarios: 1) closed, proprietary systems in which the farmer is part of a highly integrated food supply chain or 2) open, collaborative systems in which the farmer and every other stakeholder in the chain network is flexible in choosing business partners as well for the technology as for the food production side. The further development of data and application infrastructures (platforms and standards) and their institutional embedment will play a crucial role in the battle between these scenarios. From a socio-economic perspective, the authors propose to give research priority to organizational issues concerning governance issues and suitable business models for data sharing in different supply chain scenarios.

Title: IoT Based Smart Agriculture SystemAuthor: Arka Ghosh,Sayan Dalui

Year: 2021

Description: Smart farming, precision agriculture and Agriculture 4.0 all involve the integration of advanced technologies into existing farming architecture. The goal is to increase production efficiency and product quality, as well as reducing overall costs. To this end, the inclusion of Smart technologies into Irish agriculture has been inevitable with increased pressure being placed on farming practices to remain profitable, as well as adhere to environmental regulation. The global Smart Agriculture Solution Market is

said to have stood at around US
$10.2 Billion in 2016, and is projected to reach a valuation of US $38.1 Billion by the end of 2024. The growing adoption of advanced technology in farming, from agricultural drones, precision seeding systems, auto-steering, automatic feeding systems and fruit-picking robots (amongst others), have all incentivised traditional agri-companies to invest in smart agriculture technology. The deployment of advanced agri-tech has the potential to allow for an increased focus on non-profitable tasks, such as farm maintenance and environmental practices. The reduction of heavy labour and tedious tasks can also lead to improvements in the health and work/life balance of farming staff

Title: An IoT-Based Solution for Intelligent Farming †Author: Luís Nóbrega,1,* Pedro Gonçalves

Year: 2019

Description: Intelligent farming is one of the vast range of applications covered by the Internet of Things concept. Notwithstanding, such applications present specific requirements and constraints that are dependent on their purpose. A practical case on which that is particularly relevant is the SheepIT project, where an automated IoT-based system controls grazing sheep within vineyards, guaranteeing that they do not threaten cultures. Due to its rigid requirements, particularly regarding the deployment of the Wireless Sensor Network, Machine- 2-Machine communications and necessary interactions with a computational platform available through the Internet, Internet Protocol-based solutions are not suitable. Consequently, a customized communication stack has been developed, that intends to meet the project requirements, from the physical to the Application Layers. Although it has been developed considering the SheepIT requirements, its use may be extended to more generic intelligent farming applications, since most of the requirements are directly related with the farming environment. This paper reviews the proposed stack and details the recent developments. Particularly, we focused on Internet of Things/Machine-2-Machine interaction, describing the design and deployment of a gateway that addresses the SheepIT service requirements. Additionally, and complementary to previously published results, we evaluate the gateway performance and show its feasibility and scalability in a real scenario.

3. PROPOSED SYSTEM

This Green IOT solutions for intelligent farming in Ranipet district using IoT system powered by NodeMCU consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip.

When the IoT-based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, soil temperature and weather forecast details.

It then sends this data to the IoT cloud for live monitoring. The IOT cloud used for live monitoring the data is Adafruit IO.

Adafruit IO is a cloud service that allows you to stream, log, and interact with your data from any device.

Adafruit IO is built from the ground up to be easy to use, and it provides a powerful API that is useful for assistance. If the soil moisture goes below a certain level, it automatically starts the water pump.

4. MODULES

NodeMCU Microcontroller:

At the heart of the intelligent farming system is the NodeMCU microcontroller. It serves as the central processing unit, connecting sensors, and facilitating communication with the Ada fruit IO platform. NodeMCU is chosen for its compatibility with the ESP8266 Wi-Fi module, making it suitable for IoT applications in agriculture.

Fig 1: NodeMCU ESP8266

Sensor Array:

A diverse set of sensors forms the sensor array, providing real-time data on crucial environmental parameters. These sensors include:

SM Sensor:

Monitor soil moisture levels for precise irrigation control.

Fig 2: SM sensor

DHT11 Sensor:

Measure ambient temperature and Humidity to assess environmental conditions.

Fig 3: DHT11 sensor

DS18B20 Sensor:

Track soil humidity and soil temperature levels for a comprehensiveunderstanding of the atmosphere.

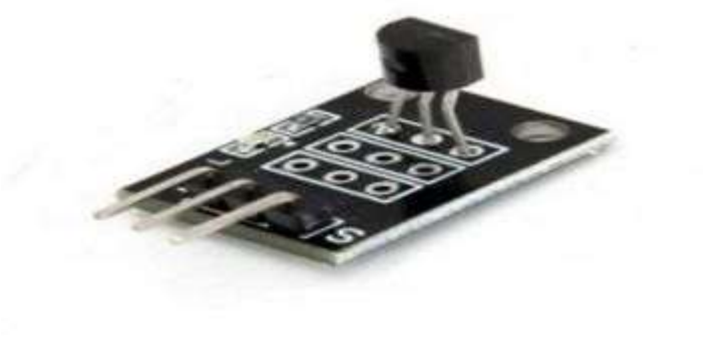

Fig 4: DS18B20 sensor

LDR:

Gauge sunlight intensity, aiding in optimal crop placement and growth.

Fig 5: LDR

Cloud Service Interface:

Ada fruit IO serves as the cloud-based platform for data storage, analysis, and visualization. It allows seamless communication between NodeMCU and the cloud, enabling farmers to remotely monitor and manage their farms through a user-friendly dashboard.

Communication Protocols:

Reliable communication protocols ensure seamless data exchange between NodeMCU devices and the Ada fruit IO platform. Common protocols include MQTT (Message Queuing Telemetry Transport) and HTTP (Hypertext TransferProtocol), providing efficient and secure communication.

Power Supply:

NodeMCU devices and sensors require a stable power supply for continuous operation. Power sources can range from traditional electricity to sustainable options like solar panels or rechargeable batteries. The choice of power supply impacts the system's reliability and environmental sustainability.

Enclosures and Weather Proofing:

To protect electronic components from environmental factors, sturdy enclosures and weatherproofing measures are essential. These safeguards shield the system from moisture, dust, and other external elements, ensuring the longevity of the hardware components.

User Interface:

A user interface, typically accessed through a web-based dashboard, provides farmers with a visual representation of the data collected by the system. This interface, often part of the Adafruit IO platform, allows users to monitor sensor readings, receive alerts, and make informed decisions remotely.

Security Measures:

Robust security measures, including encryption protocols and secure authentication, protect the data transmitted within the IoT network. These measures safeguard sensitive information from unauthorized access, ensuring theconfidentiality and integrity of farm-related data.

Remote Monitoring and Control Devices:

Devices such as smartphones, tablets, or computers enable farmers to remotely monitor and control the intelligent farming system. Farmers can access the user interface, receive alerts, and make adjustments to the system parameters, enhancing the flexibility and convenience of farm management.

Understanding the interplay between these system components is essential for the successful implementation of green IoT solutions for intelligent farming. Each component contributes to creating a comprehensive and effective system that optimizes resource usage, enhances crop health, and fosters sustainable agricultural practices.

5. CONCLUSION

This Green IOT solutions for intelligent farming in Ranipet district using IoT system powered by NodeMCU consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip. When the IoT- based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, soil temperature and weather forecast details. It then sends this data to the IoT cloud for live monitoring. The IOT cloud used for live monitoring the data is Adafruit IO. Adafruit IO is a cloud service that allows you to stream, log, and interact with your data from any device. Adafruit IO is built from the ground up to be easy to use, and it provides a powerful API that is useful for assistance. If the soil moisture goes below a certain level, it automatically starts the water pump.

Implementing a green IoT solution for intelligent farming using NodeMCU and Adafruit IO can help farmers overcome the challenges of unpredictable weather conditions and water shortages. The system should be able to measure the moisture content of the soil, light intensity in the environment, Temperature, Humidity, Soil Temperature, control the flow of water to the plants, and indicate the status of the system. The NodeMCU ESP8266 should be able to connect to the internet and send data to Adafruit IO, which should be able to store and display data from the sensors.

6. RESULT

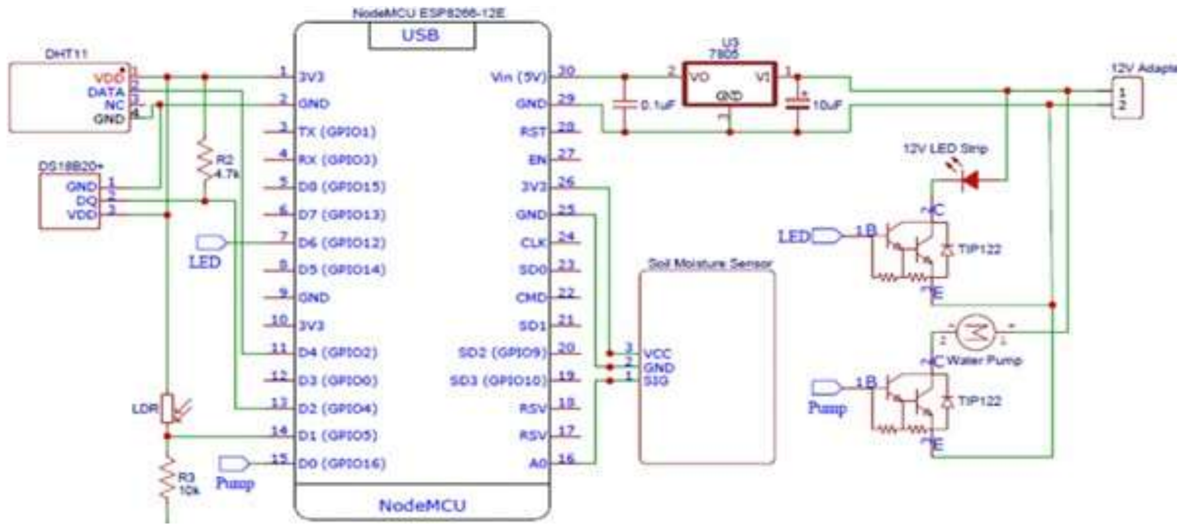

Fig 1: Circuit Diagram of Green IOT solutions for Intelligent farming

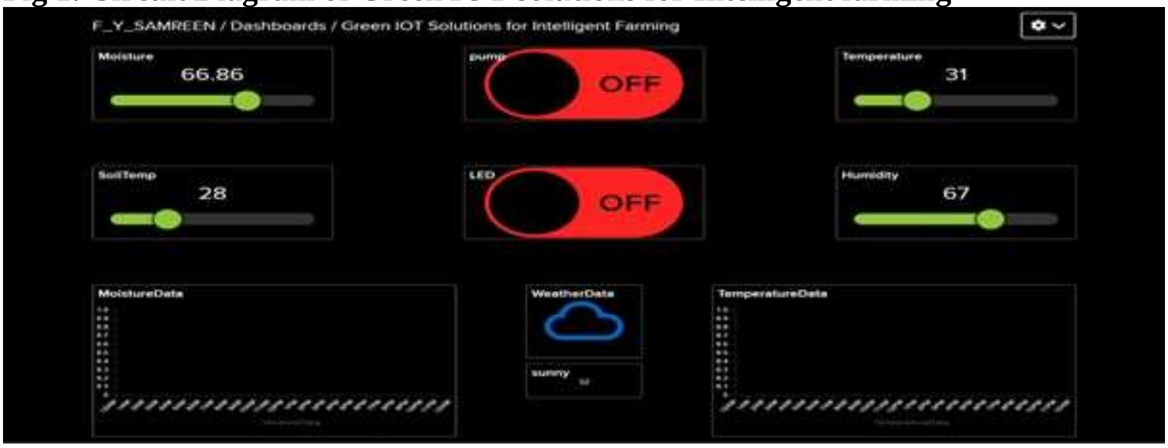

Fig 2: Screen Shot of Green IOT solutions for Intelligent farming

7. FUTURE SCOPE

Here are some future enhancements that can be made to Green IOT solutions for Intelligent farming using IoT:

1. Precision agriculture: Precision agriculture involves using IoT sensors to collect data on soil quality, temperature, humidity, and other environmental factors to optimize crop yields and reduce the use of pesticides and fertilizers.

2. Livestock monitoring: IoT sensors can be used to monitor the health and well-being of livestock, track their movements, and optimize their feeding schedules.

3. Crop monitoring: IoT sensors can be used to monitor crop growth patterns, detect diseases and pests, and optimize the use of fertilizers and pesticides.

4. Smart supply chain management: IoT sensors can be used to track the movement of crops from farm to market, monitor storage conditions, and optimize logistics.

5. Conducting more testing and evaluation of the Green IOT Solutions for Intelligent Farming system

using IOT devices.

6. This device can also collect more data and feedback from the Green IOT Solutions for Intelligent Farming system using IOT sensors, devices and cloud database.

7. This device can also analyse and visualize more data and feedback from the Green IOT Solutions for Intelligent Farming system using IOT analytics and dashboard tools.

8. Implementing the improvements and additions to the Green IOT Solutions for Intelligent Farming system using IOT devices.

9. This device can implement the improvements and additions to the design and performance of the device.

10. This device can also implement the improvements and additions to the features and functions of the device.

11. This device can also implement the improvements and additions to the communication between the Green IOT Solutions for Intelligent Farming systemand the user using IOT services.

12. This device can also disseminate the application and impact of the device to other stakeholders and organizations, such as government agencies, NGOs, etc.

8. REFERENCE

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