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Review On LoRaWan Technology-based Irrigation system

1. Vijaykumar Kamble, 2.Vaishnavi Chaudhari, 3.Akshata Kulkarni, 4.Vaibhav khedekar,

5. Dnyaanesh Khadke

Student Electrical Engg.Dept, AISSMS Institude of Information and Technology, Pune-01

1. Asst. Prof. Electrical Engg.Dept,AISSMS Institude of Information and Technology Pune-01

I. ABSTRACT

This project aims to implement smart agricultural methods using IoT technology, with the objective of enhancing crop yield and reducing the need for human intervention in farming tasks. The success of any IoT system in agriculture depends on its accuracy and power efficiency, both of which have been taken into consideration in this project. The project proposes a water flow control mechanism that will adjust the amount of water supplied to farms based on the specific moisture requirements of the crops being grown. This adjustment will be based on real-time sensing of humidity and temperature levels in the soil, and farmers will be able to take specific actions based on this data. Long-distance data transmission is made possible by incorporating LoRa technology, which ensures reliable communication over extended distances.

Keywords-.Lorawan Technology, Irrigation system.

II. INTRODUCTIION

The Internet of Things (IoT) technology enables the interconnectedness of devices that possess inherent computing, communication, and sensing capabilities.The advent of IoT has driven the automation and digitization of agriculture. A precision irrigation system optimizes water usage by delivering the exact amount of water at the right time and place, leading to improved energy efficiency and labor costs. However, using GPRS for irrigation systems incurs high power consumption and maintenance costs. Meanwhile, ZigBee or Wi-Fi systems suffer from low coverage. In contrast, LoRaWAN can provide high coverage for irrigation systems, covering up to 20 km in rural areas and 8 km in urban areas, with low power consumption that can last up to a decade. As a long-term solution, implementing a LoRa-based irrigation system can yield significant benefits, including water conservation and lower maintenance and operationcosts.

Consequently, this project puts forward an irrigation system based on LoRa technology as a viable solution to tackle the aforementioned issues. The proposed framework facilitates seamless communication between irrigation devices and applications using the LoRaWAN protocol.

III. LITERATURE REVIEW

Maksudjon Usmonov and Francesco Gregoretti present a research paper where they showcase an implementation of LoRa technology for the cost-effective remote control of drip irrigation systems. Their system utilizes LoRa modules to establish dependable wireless connections and a customized data transfer protocol that specifies the necessary requirements. Through their study, they illustrate that this solution offers benefits over the prevailing LORAWAN protocol in terms of affordability and simplicity for this particular application.

Wenjo Zhao, Shengwie Falsehood, Jiwen Han, Rongtao Xu, and Lu Hao also introduce a LoRa-based solution for intelligent remote control of drip irrigation systems in their scholarly article. They devise a dependable wireless communication system using LoRa modules and a tailored data transfer protocol. Their research demonstrates that this solution surpasses the existing LORAWAN protocol in terms of cost-effectiveness and simplicity for this specific application.K. Zheng, S. Zhao, and Z. Yang present a paper on an air quality monitoring system that employs advanced IoT techniques. By leveraging the LPWA technology, the system gathers air-quality data over a large coverage area and transmits it to the IoT cloud in real-time.

Santoshkumar and colleagues conduct an investigation where they implement an array of sensors and techniques for precision agriculture. They incorporate temperature and humidity sensors as well as Arduino (ATMega328) microcontroller boards within a wireless sensor network. The network's purpose is to remotely collect data from designated locations and transmit it wirelessly to a receiver for analysis. Previous monitoring systems faced limitations in terms of range and dependability. Earlier wireless networks used RF technology, which was later replaced by Bluetooth technology, and subsequently by Zigbee technology. The authors elaborate on the development of a wireless sensor network system for precision agriculture based on the Zigbee wireless sensor network. Zigbee operates within the frequencies of 868 MHz, 902-928 MHz, and 2.4 GHz, and it is a specification for wireless personal area networks (WPANs). WPANs are characterized by short-range device connections.

Zigbee serves as a LR-WPAN, signifying a low-rate wireless personal area network. According to the researchers, Zigbee devices in a WPAN can achieve speeds of up to 250 Kbps and transmit data over distances of up to 50 meters in typical greater distances in optimal conditions.

IV. METHODOLOGY

In this project, we propose an IoT-based smart farming and automated irrigation system using an Arduino Nano. Agriculture plays a critical role in the development of rural areas, but a number of challenges have hindered its progress. To address these challenges, we propose modernizing traditional farming methods through smart farming.

The system focuses on monitoring and controlling the flow of water by continuously measuring soil moisture. This information can then be used to establish soil boundaries for specific crops. If the readings from the soil moisture sensors exceed a predefined threshold, the water pump is automatically turned off. At the collector end, the user can access all the data via a LoRa WAN gateway.

By constantly monitoring the moisture levels in the soil, this system has the potential to optimize crop yields and conserve water resources. Automated irrigation can also save farmers time and reduce the risk of crop failure due to over- or under-watering.

Overall, this proposed system is a promising example of how IoT technology can be used to address the challenges faced by agriculture in rural areas.

V. SYSTEM REQUIREMENT

Hardware

Arduino Nano: Is an ATmega328P or ATmega628 microcontroller-based board that offers the same connectivity as the Arduino UNO board. It is characterized by its compact size, reliability, consistency, and adaptability. The Nano board provides a sustainable and flexible solution for various microcontroller projects. It is notably smaller in size compared to the UNO board. To work with the Arduino Nano board, one must utilize the Arduino Integrated Development Environment (IDE), which is compatible with multiple platforms. In order to get started with projects using the Arduino Nano, one needs to have the Arduino IDE software installed on their laptop or desktop. The code can be transferred from the computer to the Arduino Nano board using a mini USB cable.

Features:

The ATmega328P Microcontroller is part of the 8-bit family.

- It operates at a voltage of 5V.
- The input voltage (Vin) ranges from 7V to 12V.
- It offers 22 Input/Output pins.
- There are 6 analog input pins, labeled from A0 to A5.
- The microcontroller provides 14 digital pins.
- The power consumption of the ATmega328P Microcontroller is approximately 19 Ma The maximum DC current for the I/O pins is 40 mA

The ATmega328P Microcontroller is equipped with 32 KB of flash memory.

- It features 2 KB of SRAM for data storage.
- Additionally, it includes 1 KB of EEPROM for non-volatile data storage.
- The microcontroller operates at a clock speed of 16 MHz.
- It has a weight of approximately 7g.
- The printed circuit board (PCB) size measures 18 x 45mm.
- The ATmega328P Microcontroller supports three communication protocols: SPI (Serial Peripheral Interface), IIC (Inter-Integrated Circuit, also known as I2C), and USART (Universal Synchronous and Asynchronous Receiver-Transmitter)

1. SX1278 Lora module:

The LoRa SX1278 RA02 module is designed to work with the SPI communication protocol, allowing it to be compatible with various microcontrollers that support SPI. It is crucial to use an antenna in conjunction with the module to prevent potential permanent damage. The module requires a power supply of 3.3V, as it operates at this voltage. It operates at a frequency of 433 MHz, enabling the transmission and reception of packets up to a maximum size of 256 bytes. However, it's important to note that the extended usage of the 433MHz frequency module may be subject to legal restrictions and should primarily be limited to educational purposes.

2. Motor:

DC-powered pumps utilize direct current from various sources such as motors, batteries, or solar power to facilitate the movement of fluids. Motorized pumps typically operate on DC power voltages of 6, 12, 24, or 32 volts. In the case of solar-powered DC pumps, they utilize photovoltaic (PV) panels with solar cells that generate direct current when exposed to sunlight.

The DC motor is enclosed in a sealed housing and connected to the impeller through a simple gear drive system. The motor's rotor, surrounded by coils, enables continuous rotation through a series of pushes. This rotational motion drives the impeller, allowing the pump to operate and facilitate fluid movement.

3. Soil Sensor:

The soil moisture sensor is a specific type of sensor used to determine the amount of water present in the soil. Unlike traditional methods that involve laborious processes such as drying and weighing soil samples, these sensors employ various techniques based on factors like dielectric constant, electrical resistance, or neutron interaction to indirectly measure the volumetric water content.

The relationship between the measured property and soil moisture content requires calibration and can be influenced by environmental factors such as temperature, soil type, or electrical conductivity. Soil moisture sensors are commonly utilized in agricultural and remote sensing applications, particularly in hydrology, as they make use of microwave emissions and reflections that are affected by soil moisture levels.

4.Relay:

Relays are essential components used for the protection and control of various electrical circuits and devices. They are designed to respond to changes in voltage or current by either opening or closing contacts or circuits. In this article, we will provide a brief overview of relay fundamentals and explore the different types of relays commonly employed in various applications.

A switch is a device that enables the opening (turning off) or closing (turning on) of an electrical circuit. On the other hand, a relay functions as an electrical switch that controls the operation of high voltage circuits using a low-voltage source. Notably, relays offer complete isolation between the low-voltage circuit and the high-voltage circuit, ensuring safety and protection.

5. Arduino UNO IDE:

- The Arduino IDE is a software tool developed by Arduino.cc, available as open-source. It is primarily used for writing, compiling, and uploading code to various Arduino modules.
- As the official Arduino software, it offers a user-friendly interface that simplifies code compilation, making it accessible even to individuals without prior technical knowledge.
- The Arduino IDE is compatible with multiple operating systems, including MAC, Windows, and Linux. It runs on the Java Platform and provides built-in functions and commands for code editing, debugging, and compilation.
- Arduino offers a wide range of modules, such as Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and more. Each module includes a microcontroller that can be programmed to receive and execute code instructions.
- The main code, often referred to as a sketch, is created within the IDE platform and ultimately converted into a Hex File. This Hex File is then transferred and uploaded to the microcontroller on the Arduino board.
- The IDE environment consists of two key components: the Editor, which is used for writing code, and the Compiler, responsible for compiling and uploading the code to the Arduino module.
- The Arduino IDE supports both C and C++ programming languages, providing flexibility and compatibility for developers.

6.Proteus:

The software suite is a comprehensive package that encompasses schematic drawing, circuit simulation, and PCB design.

- ISIS, one of the software tools within the suite, is specifically used for creating schematics and conducting real-time circuit simulations. It allows users to interact with the simulation during runtime, providing an immersive and dynamic simulation experience.
- ARES, another component of the software suite, is dedicated to PCB design. It offers a range of features, including the ability to view the designed PCB and its components in a 3D representation. Additionally, designers can create 2D drawings to further enhance their product visualization.
- With its combined features, the software suite provides designers with a comprehensive solution for circuit design and PCB development, integrating schematic drawing, real-time simulation, and advanced PCB design functionalities.

Features

- ISIS, as part of the software suite, offers an extensive component library. It includes a wide range of components such as sources, signal generators, measurement and analysis tools like oscilloscopes, voltmeters, and ammeters.
- The library also contains probes for real-time monitoring of circuit parameters, switches, displays, loads such as motors and lamps, as well as discrete components like resistors, capacitors, inductors, transformers, digital and analog integrated circuits, semiconductor switches, relays, microcontrollers, processors, sensors, and more.
- Similarly, ARES, the PCB design tool in the suite, supports PCB design with up to 14 inner layers and provides options for both surface mount and through-hole packages.
- It comes with preloaded footprints of different component categories like ICs, transistors, headers, connectors, and discrete components. ARES offers

features such as auto-routing and manual routing for the PCB designer's convenience. Furthermore, the schematic drawings created in ISIS can be directly transferred to ARES for seamless integration between the schematic and PCB design stages.

VI. BLOCK DIAGRAM

(1)Block Diagram of Transmitter Lorawan Module with two nano boards.

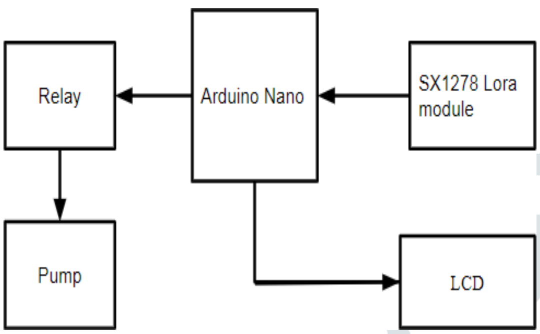


Fig:01

The main objective of our system is to monitor and control the water flow by continuously assessing the soil moisture levels. By implementing IoT technology and leveraging the capabilities of the Arduino Nano, we can create an efficient and automated irrigation system that optimizes water usage and promotes sustainable agriculture practices.

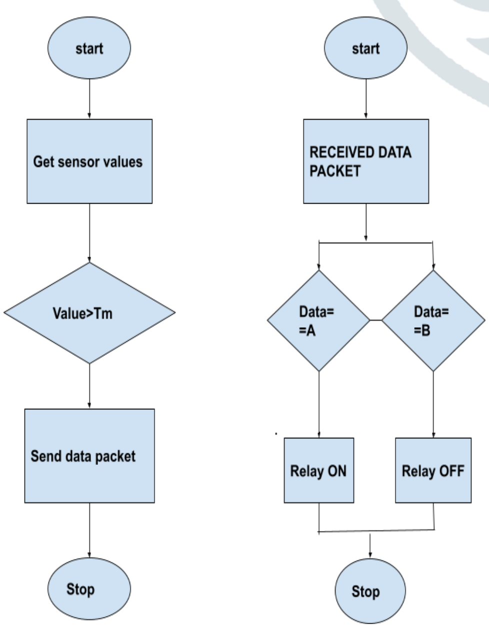


Fig:02

(2) block diagram for receiver module

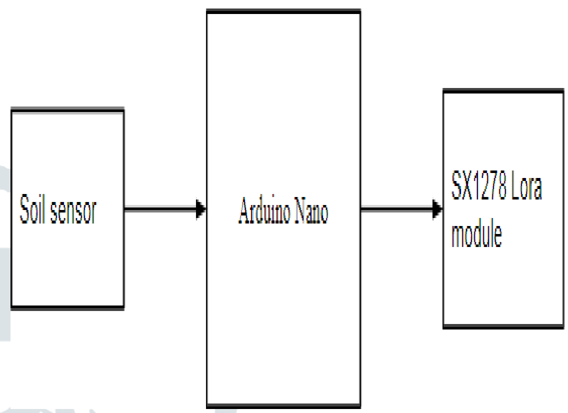


Fig:03

Therefore, the system allows for the configuration of specific crop-related parameters for the land. In the event that the readings from the soil sensors surpass the predetermined threshold voltage set in the program, the water pump is automatically switched off. Through the LoRaWAN Gateway, the user can retrieve all the required sensor data at the receiver end. Our implementation involves the utilization of soil moisture sensors to continuously monitor the moisture levels in the soil. Based on the information gathered from these sensors, the water motors are able to function automatically.

VII. CONCLUSION

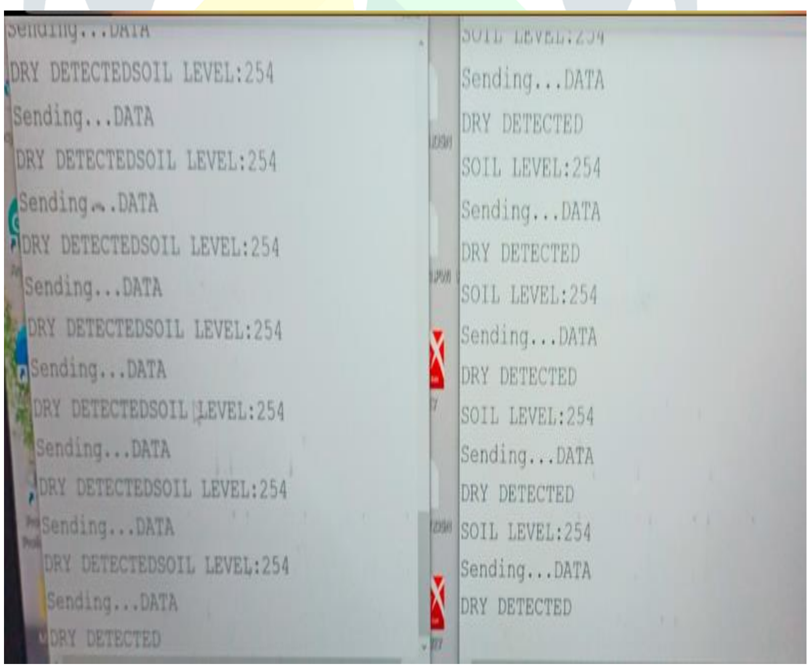
The device has been designed with the goal of achieving comfort, affordability, and upgradability. It aims to enhance the standard of living for individuals involved in food production by increasing their income and fostering growth within the industry. In the future, it may be possible to integrate a security system using CCTV and utilize the same LORA technology to transmit recorded footage directly to farmers via an application notification.Utilizing LORA technology, the device has been engineered to optimize yield and income for those involved in the food production industry. This may lead to higher profits and cost savings, while also enabling the device to be more efficient and affordable. Future development could potentially involve the integration of CCTV as a safety measure, with recorded footage being transmitted via the LORA network and received by farmers through a mobile application.

Overall, this device has the potential to significantly benefit the food production industry by improving profitability, efficiency, and safety measures.

VIII. FUTURE SCOPE

The implementation of this system relies on cloud systems to host the applications. In this case, a public cloud infrastructure is utilized as a supervisor for field monitoring. The cost factor associated with hosting and maintaining a private cloud can be high. On the other hand, public clouds are more cost-effective and offer advantages such as pay-as-you-go pricing. In addition to real-time data monitoring, there is a wide range of future possibilities for leveraging public cloud infrastructure in various other ways.

IX. RESULT



X.REFERENCE

[1]. Maksudjon Usmonov and Francesco Gregoretti "Plan and execution of a LoRa based remote control for trickle water system frameworks" IEEE xplore, February 2020

[2]. Wenjo Zhao, Shengwie Falsehood, Jiwen Han, Rongtao Xu, Lu Hao "Plan and Execution of Savvy Water system Framework In light of LoRa" 2021 IEEE Globecom Studios (GC Studios)

[3]. K. Zheng, S. Zhao and Z. Yang, "Plan and Execution of LPWA-Based Air Quality Observing Framework," IEEE Access, vol. 4, pp. 3238-3245, June 2020

[4] Poonam Jakhotiya, Dr. N. N. Kasat, Dr. A. D. Gawande, "Sensor Information The executives of LoRawan Innovation "Global Exploration Diary of Modernization in Designing Innovation and Science (IRJMETS) Volume : 03/Issue:06/June-2021

[5] Santoshkumar and Udaykumar R.Y, "Improvement of WSN framework for accuracy horticulture," in 2015 Worldwide Meeting on Advancements in Data, Implanted and Correspondence Frameworks (ICIIECS), Blemish. 2015, pp. 1-5, doi: 10.1109/ICIIECS.2015.7192904.

[6] M. Dholu and K. A. Ghodinde, "Web of Things (IoT) for Accuracy Horticulture Application," in 2018 second Global Meeting on Patterns in Hardware and Informatics (ICOEI),May 2018, pp. 339-342, doi: 10.1109/ICOEI.2018.8553720.

[7] D. Davcev, K. Mitreski, S. Trajkovic, V. Nikolovski, and N. Koteli, "IoT horticulture framework in view of LoRaWAN," in 2018 fourteenth IEEE Worldwide Studio on Production line Correspondence Frameworks (WFCS), Jun. 2018, pp. 1-4, doi: 10.1109/WFCS.2018.8402368.

[8] Y. Kim, R. G. Evans, and W. M. Iversen, "Remote Detecting and Control of a Water system Framework Utilizing a Conveyed Remote Sensor Organization," IEEE Trans. Instrum. Meas., vol. 57, no. 7, pp. 1379-1387, Jul. 2008, doi: 10.1109/TIM.2008.917198.

[9] A. Hanggoro, M. A. Putra, R. Reynaldo, and R. F. Sari, "Nursery checking and controlling utilizing Android portable application," in 2013 Global Gathering on QiR, Jun. 2013, pp. 79-85, doi: 10.1109/QiR.2013.6632541

[10]P. Gangurde and M. Bhende, “A Novel Approach forPrecision Agriculture Using Wireless Sensor Network,” p. 8, 2015.

[11]D. I. Săcăleanu, R. Popescu, I. P. Manciu, and L. A. Perişoară, “Data Compression in Wireless Sensor Nodes with LoRa,” in 2018 10th International Conference on Electronics, Computers and Artificial Intelligence (ECAI), Jun. 2018, pp. 1–4, doi: 10.1109/ECAI.2018.8679003.