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

LoRa Automation for Smart Farming

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Abstract:. Controlling electrical pumps on farms can be problematic, especially if there are a small number of people managing or working on huge areas of land and if the provision of electricity is not consistent. Therefore further techniques for the management of plant irrigation on this type of land are being invented to make the process of irrigation easier. In this project, a new intelligent device is designed and utilized to control the operation of irrigation pumps using a robust method of communication to transfer information at long distances, for the lowest cost, and the longest battery life.

This technology is called LoRa (Long Range) communication, which is a low-power technology. The unit consists of two circuits: the first one is for switching the pumps ON and OFF, while the second one controls and monitoring the work of the pumps. Monitoring of the pumps can also be carried out through smart phones by measuring the voltage. The most important features of this new design are its intelligent control for long distances, cheap price, and a long operational life of more than five years. The goal of this project is to help farmers by designing and manufacturing a remote-control system that switches irrigation pumps on and off using LoRa technologies.

` **INTRODUCTION**

India is basically an agricultural country, and all its resources depend on the agricultural output. Even in the modern span of industrialization, agriculture is the key area that decides the economic growth of the country. Agriculture also accounts for 8.56% 0f the country's total exports. Agriculture is the most important field compared to others in India.

The underground water level is slowly falling and as well as rainfall is also reduced due to deforestation. In order to get the maximum yield in the agricultural process, it is necessary to supply the optimum quantity of water and it should be supplied periodically.
This is achieved only through a systematic irrigation system. Irrigation is the science of planning and designing an efficient, low-cost, economic irrigation system designed in such a way to fit natural conditions. By the construction of proper distribution system and providing an adequate water supply will increase the yield of crops.

Our goal in this research is to help these farmers by designing and manufacturing a remote-control System that runs and shuts down irrigation pumps through the use of modern technology called Lora communication.

LoRa (Long Range) represents the physical layer or the wireless modulation used to build peak range communication connection. It is built on "chirp spread spectrum modulation" and has similar small energy features to FSK modulation. "Chirp spread spectrum" was applied in army and galaxy communication years ago for more widespread communication distance strength against interference. LoRa is the primary cheap application for marketable usage. The benefit of LoRa is its extended distance ability. It has a more economical connection than any other uniform communication technique. The general specification of LoRa technology can be summarized as: Single Operating Voltage: 2.1V to 3.6V (3.3V typical), Temperature Range: - 40°C to +85°C, Low-Power Consumption, Programmable RF Communication Bit Rate up to 300 kbps with FSK Modulation, 10937 bps with LoRa Technology Modulation, Integrated MCU, EUI-64 Node Identity Serial EEPROM, Radio Transceiver with Analogue Front End, Matching Circuitry, 14 GPIOs for Control and Status, Shared with 13 Analog Inputs, Low Power Long Range Transceiver Operating in the 433 MHz and 868 MHz Frequency Bands, High Receiver Sensitivity: Down to -146 dB, up to 15 km Coverage at Suburban and up to 5 km Coverage in an Urban Area.

LITERATURE SURVEY

1) GSM Based Agricultural Motor Control: India is the country of agriculture. Agricultural sector is very important as far as villager's point of view. Productivity in the agriculture field depends on a main factor: water supply. Irrigation is a scientific process of artificially supplying water to the land or soil that is being cultivated. Agriculture motor is used to irrigate fields by pumping groundwater to the surface. This project eases the farmer's work by controlling their field's motor by their mobile. This project is used to control the agricultural motor using a GSM module according to the moisture of the soil and it also indicates the status of the field on the LCD [1].

2) A LoRa-Based IoT Platform for Agriculture Monitoring Pump Controller: Agriculture is a subject where water is needed in greater quantities. As a result of high crop yields, Oversight is an important job for farmers. Due to a variety of agricultural issues, further development is also urgently required and practical economic strategies for growing plants. Wasteful water is a real issue in agriculture. During cultivation, the fields receive a larger amount of water. There are several strategies for saving or manipulating water waste in agriculture LoRa Automation for Smart Farming 3 PES Modern College of Engineering pune Deployment of a LoRa-based Network and Web Monitoring Application for a Smart Farm: The integration of Industry 4.0 technologies in agriculture will reduce the increasing challenges of the agricultural process around the globe[3].

3) LoRa Based Smart Irrigation System for Remote Areas: Lora devices and wireless radio frequency technology (LoRa Technology) into its Autonomous Irrigation Solution (AIS). Water Bit provides irrigation automation for growers based on analysis of granular, ground-truth data collected through the Water Bit system, including line pressure and flow, soil moisture and temperature and more. With Water Bit's AIS, growers maximize yield on all soil types, while optimizing labor and other input resources. The complete solution is used in a wide range of crops including grapes, berries, nuts, cotton, corn and green leaves. The purpose of water bit in the development of its solution was to create the most reliable and highest quality network product in agriculture. To achieve this, Water Bit disposed of the batteries in its production units and allowed duplex communications as well as better control with LORA Technology [4].

4) This paper proposes to use a system to monitor the field data, which provides additional attention to the field. Make agriculture smart by embedding the IoT. This document is intended for an intelligent irrigation system based mainly on ESP32 LORA. The video displays different environmental elements such as temperature, humidity and the amount of water required across crops, using sensors such as temperature, soil moisture and water flow. The information is accumulated and given to the ESP 32 located in the farm that is linked to any other ESP32 located inside the variety of two to 9KM (variety may be advanced if an antenna with excessive benefit is used) via LORA protocol and the motor is controlled automatically by using moisture sensor and water flow sensor [5].

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WORKING

A) Description:

This project involves an irrigation system that is controlled and monitored using various components. A water level sensor measures the water level in the well, while a current sensor detects the electricity status of the motor. An Arduino board processes the sensor data and determines whether the motor should be turned on or off. A relay module is used to switch the motor on or off accordingly. The Arduino communicates with a LoRa module, which sends data wirelessly to another Arduino on the receiving side. The receiving Arduino processes the data and displays the information on an LCD screen and provides audio output through a speaker. A keypad matrix allows users to enter commands and control the system. The system continuously monitors the water level and electricity status, providing feedback to the users. The power supply for the system can be batteries or an external power source. Overall this system enables remote monitoring and control of the irrigation system enhancing efficiency and saving resources for farmers

B) Methodology :

1) System START System.
2) Check Status (i.e. electricity supply is ON/OFF, Motor ON/OFF, Auto/ Manual Mode, Water Level %, Fault Status).
3) Transfer Status Information to Receiver Side from Transition side through LoRa SX1278 Transmitter module by Antenna.
4) Receiver LoRa SX1278 Module Receive Status information.
5) Display Status Information On LCD 16*2 Display And Also Speak through Speaker.
6) Continue Run this process in loop till the system will not off.
7) When System off the Project will STOP

C) Block Diagram:

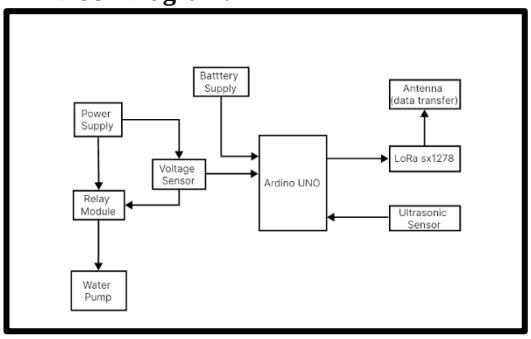

Fig 1: Transmitter Block Diagram

Hardware Description:

- Power Supply - Power Source: This component supplies the necessary voltage and current to all connected components in the system. It ensures stable and reliable operation of the sensors, controllers, and peripheral devices
- AC Voltage Sensor-The voltage sensor used in this project is a module that measures the voltage level of the power supply connected to the motor. It converts the analog voltage signal into a digital value that can be read by the Arduino or ESP32 NodeMCU board. The voltage sensor module is compatible with the microcontroller board and is connected to the power supply line of the motor. By reading the voltage values from the sensor using the analog input pin, you can monitor the electricity status. The sensor readings can be used to determine if the motor is receiving a sufficient voltage supply or if there is a low voltage condition. This information is important for controlling and monitoring the irrigation system.
- Antenna -The LoRa antenna in this project is responsible for transmitting and receiving the wireless signals used for communication. It emits electromagnetic waves carrying the encoded data from the transmitting side and captures incoming signals on the receiving side. The antenna's design and characteristics influence signal propagation, range, and performance. It plays a crucial role in establishing reliable long-range communication between the transmitting and receiving components of the system.
- Relay-A relay module is a device used to control the power supply to the motor pump in this project. It acts as an electrical switch, allowing the system to turn the motor pump ON or OFF. The relay module has an electromagnetic coil and switch contacts. When a control signal is received from the Arduino, the coil creates a magnetic field, activating the switch contacts to open or close the circuit, controlling the flow of electricity to the motor pump.

ESP32 **Wate**

- The water pump in this project is responsible for drawing water from a source, such as a well, and delivering it to the irrigation system. It is powered by electricity and controlled by the system through a relay module. The pump can be turned on or off based on the water level in the well and the irrigation requirements. The system can operate in auto mode, where the pump is controlled automatically, or manual mode, where it can be manually controlled. The pump's connectivity is established through the relay module, which receives signals from the Arduino or microcontroller.

D) FLOWCHART

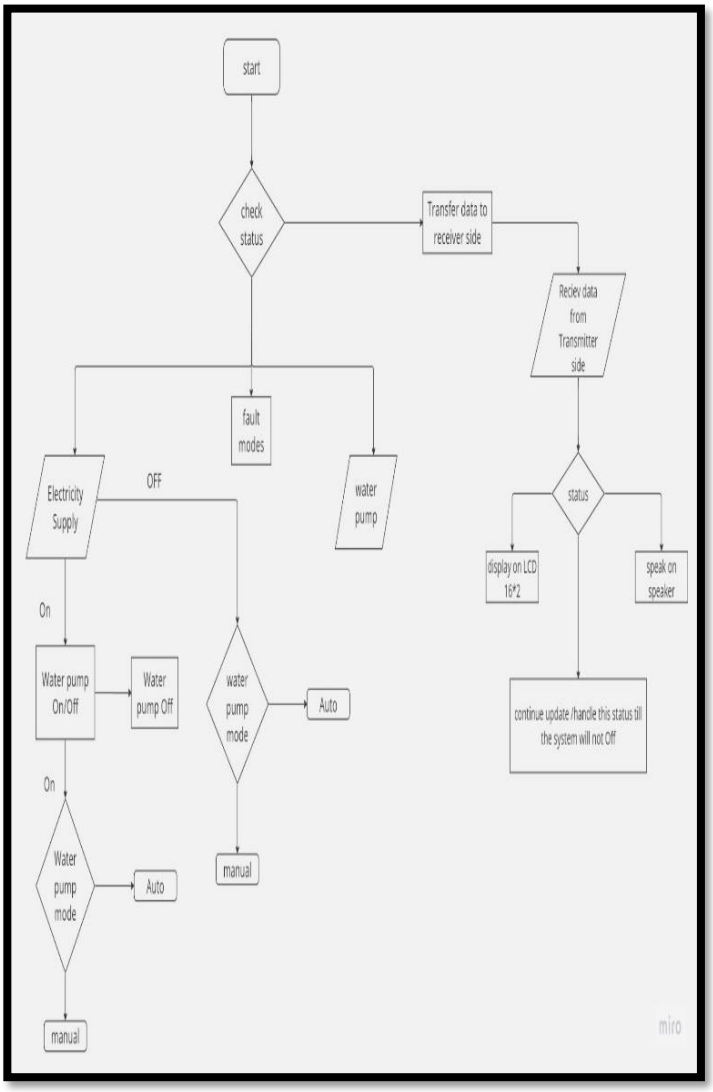

Fig 2: Flowchart

RESULTS

This project involves an irrigation system that is controlled and monitored using various components. A water level sensor measures the water level in the well, while a current sensor detects the electricity status of the motor. An Arduino board processes the sensor data and determines whether the motor should be turned on or off A relay module is used to switch the motor on or off accordingly. The Arduino communicates with a LoRa module, which sends data wirelessly to another Arduino on the receiving side. The receiving Arduino processes the data and displays the information on an LCD screen and provides audio output through a speaker. A keypad matrix allows users to enter commands and control the system. The system continuously monitors the water level and electricity status, providing feedback to the users.

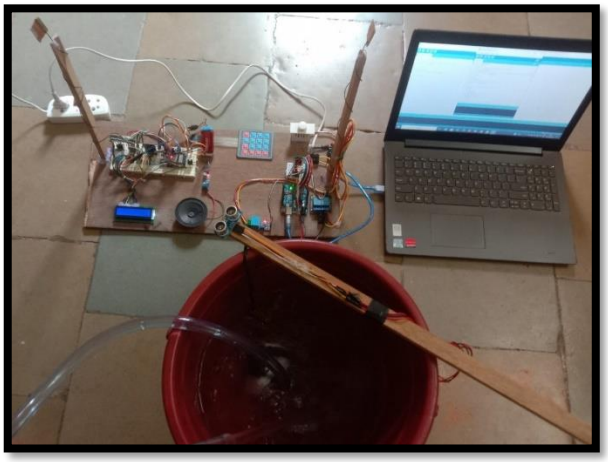

Fig 3: System Design

CONCLUSION

In conclusion, the project successfully demonstrates the development of a remote irrigation control system using Arduino, LoRa communication, and various sensors. The system effectively automates the control and monitoring of irrigation pumps based on water level and electricity status. It provides farmers with time savings, remote monitoring capabilities, cost-effectiveness, and improved efficiency in managing their irrigation systems.

The project showcases the potential benefits of integrating technology into the agricultural sector, specifically for irrigation management. It offers farmers the convenience of remotely controlling and monitoring their irrigation systems, allowing for better resource management and decision-making. The use of low-cost components It offers farmers the convenience of remotely controlling and monitoring their irrigation systems, allowing for better resource management and decision-making. The use of low-cost components

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