LORAWAN-BASED SMART FARMING

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Introduction:

In recent years, a challenging trend concerning the transfer of Internet of Things (IoT)-related technologies (such as sensors, micro-controllers, network communication protocols and Cloud platforms) to Smart Farming-oriented domains, has rapidly emerged. Indeed, presently, it is not surprising to find totally automated greenhouses, in which sensor-equipped IoT nodes collect relevant environmental parameters for internal cultures and, through a data analysis stage, automatically control actuators in order to adjust air humidity or soil moisture levels. Similar systems have also been applied to open-field cultivation and livestock management.

In the near future, it is thus expected that highly technological farms will be increasing common. To achieve the best quality product & to get easy control on farming so arranged the LoRa nodes with IoT platform & various types of sensors like soil moisture sensor, temperature sensor, humidity sensor. Lora module controls the activities with help of various node inputs which are arranged in the farm for the working of LoRaWAN very little power is needed also it has along range of communication.

In this system, we used a LoRa module, Arduino uno, Soil moisture sensor, DHT11 sensor, GPRS/GSM, LCD. In this project, an IoT platform is used, LoRaWAN provides connectivity over the large agricultural field with low energy requirement. There is main two parts of the system Transmitter side & Receiver side. On the transmitter side, there is the controller with a sensor node & on the receiver side, there is a Lora module with IoT graphic user interface. To controller connected soil moisture sensor which will sense moisture level of soil. Then the second type of sensor i.e., temperature humidity sensor DHT11 it will sense the temperature level.

These all operations are performed with help of the LoRa module. LoRaWAN stands for Long Range Wide Area Network. It can transmit the data with a distance upto 15km. LoRa node is implemented in the farm. This node will collect all the sensor data like soil moisture level, temperature humidity level, water requirement all these data are collected by the LoRa transmitter & it sends transmits data at the receiver side. This transmitted data received by LoRa receiver. In the receiving side the data is taken and is uploaded to cloud server by using Thing speak. R.Nageswara Rao, B.Shridhar worked on IoT based Smart Crop Field Monitoring and Irrigation System and it was implemented using Wi-Fi. Joaquin Guiterrez, Juan Francisco Villa Medina, Algendra Neito worked on Automated Irrigation System Using a Wireless Sensor Network and GPRS Module and it were implemented using Wi-Fi. Md. Ashifuddin Mondal, Zeenat Rehna carried out the work on IoT Based Intelligent

Agricultural Field Monitoring System and it was developed using Zigbee. Santosh Kumar, Uday Kumar.R.Y worked on Development of WSN System for Precision Agriculture and implemented using Zigbee. From the above survey it is found that, all the systems were developed using Raspberry which is expensive and they were implemented using Wi-Fi, Zigbee that are used for short range communication. In order to overcome the above drawbacks, LoRaWAN based system for smart farming is proposed.

Objectives:

- The objective of the smart agriculture system using LoRa wireless technology is to observe and monitor the temperature, humidity, moisture of the field and uploading the data to Cloud server using thing speak.
- To collect & handle relevant data from farms activities like the growing condition of crops and further processing them for effective farm management.
- To improve the management of the generic farm in a highly customized way.
- To get better quality of crops, reduction in human power, reduce wastage of water.

Methodology:

a) Methods and Materials

1) The proposed project is to design a system that monitors soil moisture, temperature and humidity of field atmosphere, and transmit the information to the remote receiver at the farmhouse or outside the field. The ultimate goal is to collect, monitor, and effectively employ relevant data for agricultural processes, with the purpose of achieving an optimized and more environmentally sustainable agriculture.
2) The proposed system consists of Arduino as processing unit and Wireless Sensor Network (WSN) base station. A soil moisture, temperature and humidity sensor data is fetched to the WSN data collection node.
3) The sensor node consists of a Liquid Crystal Display (LCD) module, where the sensor output is monitored in real time.
4) The sensor node is a building unit of the WSN. Its function is to achieve the perception, collection, processing and wireless transmission.
5) Arduino UNO board controls the processing and manages the different types of sensors for automatic smart irrigation system.
6) In the proposed system, Transmitter consists of soil moisture sensor, DHT11 sensor for sensing the humidity and temperature of the soil. The data of these sensors is directly displayed on the LCD and it is sent to the cloud server using Long Range radio (LoRa) transmitter module. It also consists of relay and pumping motor.
7) The receiver consists of LoRa receiver for receiving the processed data and it also consists of LCD, Cloud server to store the processed databy using Thingspeak.
8) The proposed system is aimed at improving the management of generic farms in a highly customizable way.

Different components and software used in this proposed system areDHT-11 Sensor, LoRa Tx and Rx, Soil moisture sensor, GSM, Arduino UNO, LCD Display and Thingspeak Cloud server.

Block diagram of proposed system:

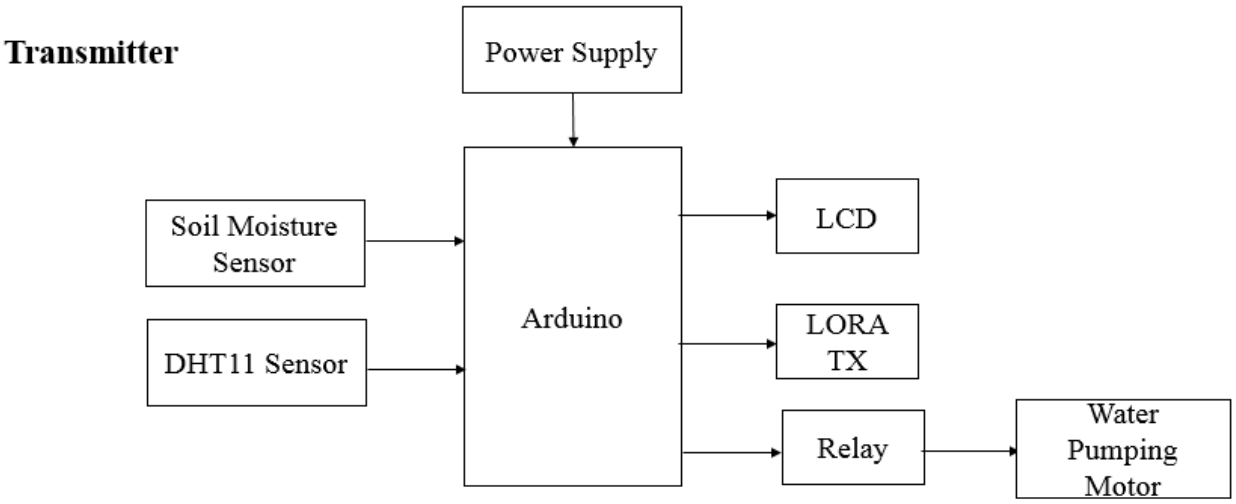

Fig: Block diagram of Transmitter

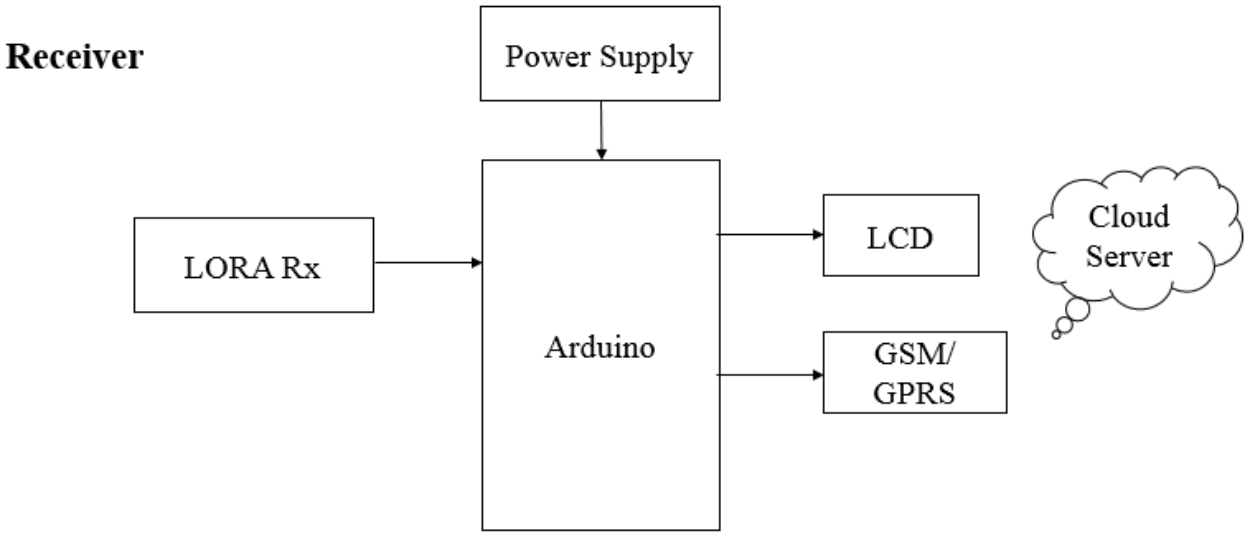

Fig: Block diagram of Receiver

Work carried out:

Before implementing hardware, circuit simulation is carried out using Tinkercad simulation tool. Simulation setup is as shown below

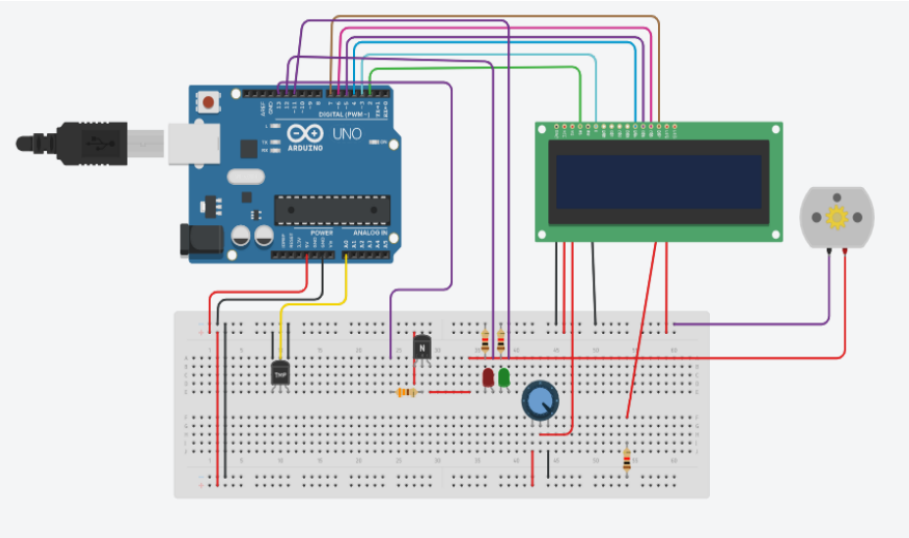

Fig: Simulation setup

Results and conclusion:

The proposed system consists of Transmitter and Receiver module. According to the objectives the system has to monitor the Temperature, Humidity and provides Automatic irrigation. On the basis of these objectives internal circuits of Transmitter and Receiver are designed. The designed system is simulated using Tinkercad simulation tool. This system measures the temperature, humidity. When humidity decrease/increase, the motor is made to become ON/OFF automatically.

The Temperature, humidity requirement is surveyed for different crops such as Onion, Groundnut and Tomato. The average humidity requirement for these crops is around 70%. The provision is made in the system to water the crops when the humidity falls below 70% and automatically switch on the motor.

For remote ON/OFF control of the motor over long range, Lora communication module (LoRa Tx and Rx) is used in the proposed system. The smart irrigation system implemented for optimizing water resources for agricultural crops. The proposed system is used to switch on/off the water sprinkler depending on the soil moisture levels. The proposed project is a solution to smart irrigation system. Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production.

Scope for future work:

Presently, the adoption of Internet of Things (IoT)-related technologies in the Smart Farming domain is rapidly emerging. The ultimate goal is to collect, monitor, and effectively

employ relevant data for agricultural processes, with the purpose of achieving an optimized and more environmentally sustainable agriculture.

In this project, a low-cost, modular, and Long-Range Wide-Area Network (LoRaWAN)-based IoT platform, denoted as “LoRaWAN-based Smart Farming” (LoRaFarm) aimed at improving the management of generic farms in a highly customizable way.The platform, built around a core middleware, is easily extensible with ad-hoc low-level modules (feeding the middleware with data coming from the sensors deployed in the farm) or high-level modules (providing advanced functionalities to the farmer).

The weakness of short-range wireless signal and security issues will make a bad effect on the communication. In this project, we proposed a system, based on Long Range (LoRa) protocol and Long-Range Wide-Area Network (LoRaWAN), to reduce the latency of communication and minimize the data.

In this project we are implementing the system using LoRa communication and IoT, the sensor data is uploaded to the cloud server. This data can be analysed and future predication may be done using machine learning algorithms.