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Embedded LoRaWAN for Agricultural Sensing Application

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Abstract - The conception of the wireless detector network in agriculture unfold round the world to assist farmers to reinforce the productivity and quality by endlessly observance the crops development. In distinction, the setting of farms doesn't assist the implementation of IoT thanks to the problem to seek out the ability provide. Sometimes, farmers face some issue to trace their plants thanks to forms of the setting. as an example, the desert and heat, and also the tropical forest and rainy seasons incur harsh operational eventualities. Therefore, this work aims to make a system that helps farmers to trace their crops remotely victimization LoRaWAN technology. The options of the system ar terribly low power consumption and enormous coverage space of the signal that ar the foremost necessary options appropriate for farming setting. The sensors give a really necessary info to farmers too. The work began with choosing the acceptable, cost-efficient sensors to be deployed. Then, a style or integration was planned for the system and also the associated peripherals.

***Key Words*:** *IoT; IoT in Agriculture; LoRaWAN technology; Sensor; Monitoring system*

1.INTRODUCTION

Nowadays, the amount of IoT devices and application is continuously increasing and therefore the market expectation displays this increase conjecture that the amount of IoT devices will expand. In 2015, there have been over 13.4 Billion IoT devices connected to the web and needless to say there'll be 38.5 Billion IoT devices in 2020. IoT has involved in many applications within the environment. These requirements include low power consumption, long range, low rate, and low delay- tolerant wireless communication. So, there's a replacement
communication technology out there called Low Power Wide Area Network (LPWAN) technology which is introduced LoRa modulation from Semtech . Further, LoRaWAN is that the network of the LoRa modulation which features a large signal coverage area. means Long Range, so this is often technology are going to be involved within the manufacturing of the many IoT devices, whereas it provides a coffee power consumption. LoRa means Long Range frequency and this technologyinvolved within the manufacturing of the many IoT devices, whereas it provides a coffee power consumption. LoRa has been manufactured by Semtech, also it uses advance spread spectrum technologies. LoRa to form a choice for controlling the farm. The system consists of two parts, the primary part is sensor system includes the humidity sensor, moisture sensor, and temperature sensor. The second part may be a system and this part has two mains subsystem which is roofing and watering subsystem.

2. Related Work

In the field of IoT devices today, there are lots of different-different communication devices available for our specific requirements, but apart from these, the most popular among them are only Bluetooth and Wi-Fi. However, the issue with Wi-Fi and Bluetooth innovation is high energy utilization. They similarly have various limitations like confined reach, limited paths, etc. Cell networks also have comparative issues of high energy usage and both LAN and Cellular associations networks also have comparative issues of high energy usage and both LAN and Cellular associations are exorbitant to cover a wide district. The IoT undertakings introduced loads of developments; in any case, none of them was ideal for IoT contraptions, as they expected to convey fundamental ongoing information to critical distances without using a ton of energy until the LoRa advancement was introduced. Lora (Long Range) is a far-off progression that offers low-power, long-range and secure data information transmission for IoT applications.LoRa is a spread range tweak innovation that is gotten from tweet spread range (CSS) innovation. LoRa Technology can perform amazingly long-arrived at transmission with

low power use. We use the LoRa Ra-02 Sx1278 model for this project framework purpose having an open-air Frequency band of 868Mhz with up to 15km range of data transmission. On another side, old technology is various drawbacks related to power consumption, cost, complex encryption, channel bandwidth, and so many other things

3. Literature Survey

[1]Konstantin Mikhaylov1 , Marko Pettissalo2 Performance of a low-power wide-area network based on LoRa technology: Doppler robustness, scalability, and coverage. It provides a low power consumption.LoRa has been manufactured by Semtech, also it uses advance spread spectrum technologies [2] K.S.Balamurugan, A.Sivakam In this system there are several blocks namely Microcontroller, Sensors, LCD,WIFI. Sensors- In these we have used many types of sensors such as Rain sensor, DHT11. Turbidity sensors, LDR sensor, Moisture sensor which is used for sensing purpose.

[3] Gaia Codeluppi , Antonio Cilfone: Suppose when there is too much rainfall then Rain sensor will indicate us regarding the water needed by the field.Now DHT11 sensor which means it is a Humidity and Temperature sensor used for measuring the humidity and Temperature of the environment of the agricultural field.Third sensor used is Moisture sensor which is used for measuring the moisture of the soil to supply water and due to use of these type of sensor misuse of water is also elimainated. Turbidity sensor is used for checking the pH value of the water which is very important for our farmers to supply water to the field. LDR is used for the measuring the light density or it checks the day light and night so that agricultural filed gets proper water for the productivity. LCD- It is a 16*2 display unit used for checking the indication or messages given by the sensors.WIFI-Wifi is used for internet purposes or its gives full access to internet and it is full TCP/IP.

4.Proposed System

Proposed System is mainly aiming to develop a system for helping out the farmers to provide a better irrigation system so that growth of the farms increases rapidly. Design and developing an automate the farming sector. Provide quick report via IOT technology. To implement LoRa communication between two nodes. It is design for monitoring the crop, weather, and soil quality.

Fig.

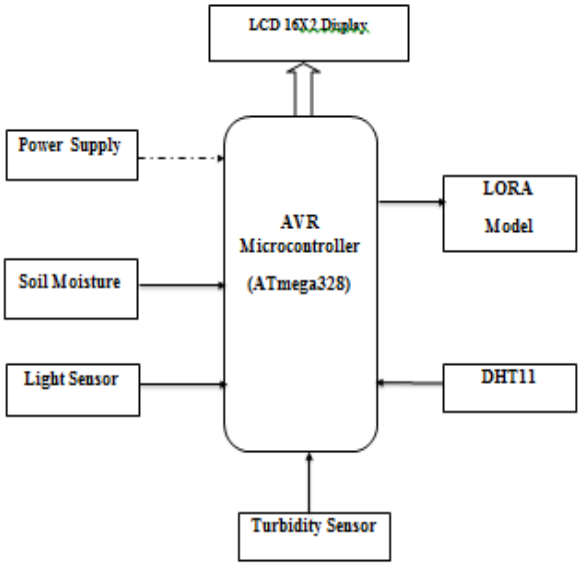


Fig.1Block diagram TX

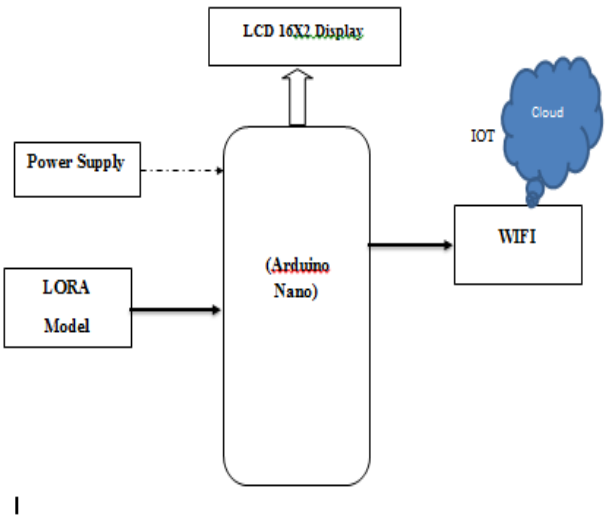


Fig.2 Block diagram R

5. Methodology

This proposed project framework of an advanced Embedded loRawan involves hardware component setup with our spread spectrum based LoRa module in figure 03 with software coding or programming in IDE in figure 02 according to our predefined algorithms and flow chart in Figure 04. In the software section, we use the Arduino Integrated Development Environment (IDE) to configure the LoRa module and all hardware components such as Microcontroller and sensors.

The algorithm we used in this framework according to our flowchart having the following steps:-

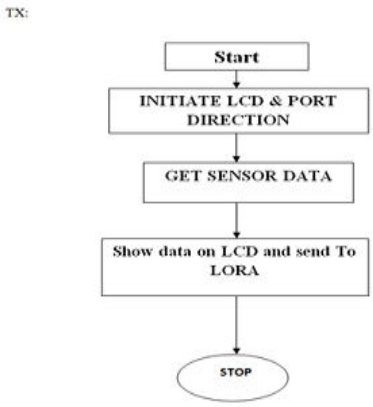


Fig3.Flow chart TX

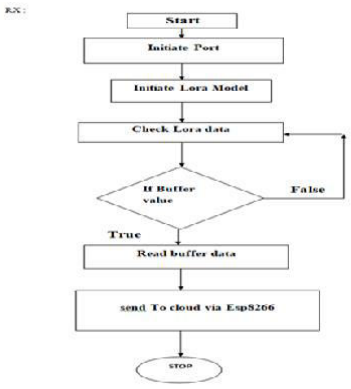


Fig4.Flow chart RX

LoRa Module:Ra-02 SX1278

Fig5.LoRa Module:Ra-02

presented variations in different configurable factors in the Los region. Through my observation and experimental condition, I have seen that the **SF- 10 & 11, BW-250kHz, TP- 17dBm, and CR-4/8** give the best reliable data transmission in the LoRa device for Embedded LoRawan purpose. Apart from this also observed that the Non-Los region dramatically reduces the distance of data transmission. Overall summary in result discussion to improve the reliable data transmission Embedded LoRawan in Remote location, best matching Configurable Lora device parameter is must be required.

Configurable Factors	*Allowed Range*	*Variation in Distance*	*Power Utilization*	*Output Data rate*
Band width (BW)	*41.7,62.5,125,250,500 kHz*	*Decrease sequentially*	*Wide BW increase more power*	*Increases sequentially*
Tx power output(TP)	*2 to 17dBm.*	*Increases sequentially*	*More power utilize as increase TP*	*Increases sequentially*
Code rate(CR)	*4/5, 4/6, 4/7, 4/8*	*Increases sequentially*	*Large CR increase more power*	*Decrease sequentially*
Spreading Factor(SF)	*6, 7, 8, 9, 10, 11, 12*	*Increases sequentially*	*As SF increases more power utilize*	*Decrease sequentially*

Fig. Table1variations presented variations in different configurable factors in the Los region.

6.Hardware Requirements

I. Ardunio Nano

Fig.5 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (ArduinoNano 3.0) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

II. Rain Sensor

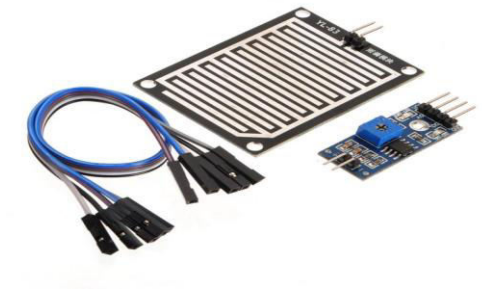


Fig.6 Rain sensor

Rain and snow are quickly and accurately detected with the YL-83 Rain Detector. The YL-83 operates via droplet detection rather than by signal level threshold. A special delay circuitry allows about two-minute interval between raindrops before assuming an OFF (no rain) position.

III. DHT11 Sensor

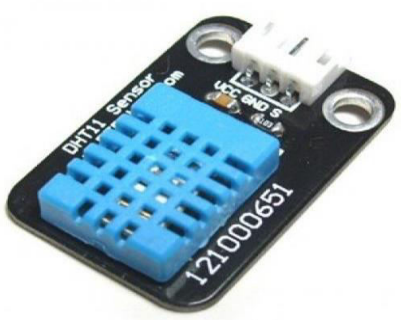


Fig.7 DHT 11

This DFRobot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability.

IV. Moisture Sensor

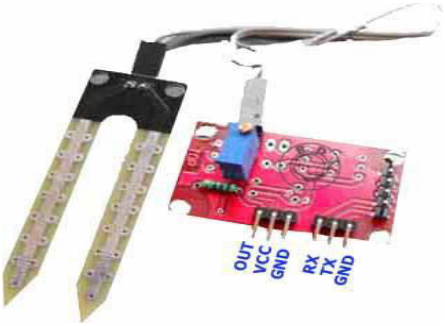


Fig8 Mositure sensor

This sensor can be used to test the moisture of soil, when the soil is having water shortage, the module output is at high level, else the output is at low level. By using this sensor one can automatically water the flower plant, or any other plants requiring automatic watering technique.

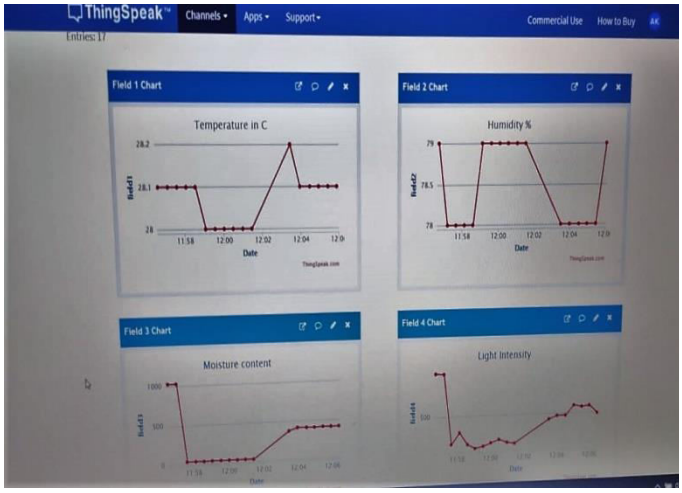
6.Softwares

Programming Tools:The software for the robot is written in Arduino programming language. Arduino UNO is programmed using Arduino IDE software. ATmega328 on Arduino UNO comes with a boot loader that allows you to upload new code to it without using any external hardware programmer.

It uses STK500 protocol to communicate. You can bypass the boot loader and program the MCU through in-circuit serial programming (ICSP) header, but using boot loader programming is quick and easy. Select the correct board from Tools Board menu in Arduino IDE and burn the program (sketch) through a standard USB port in the computer.

PCB & Circuit Design Tools:The ExpressPCB software is very easy to learn and use. For the first time, designing circuit boards is simple for the beginner and efficient for the professional. Best of all &it's FREE. Our electronics design software includes two applications, one for drawing schematics, and the other for PCB layout.

7.Result (Collected Data)



The Internet of Things (IoT) in education includes data storage, processing, and data visualization. ThingSpeak™ has a simple interface that makes it easy to learn cloud analytics and teach IoT. Then use ThingSpeak communities to provide support for your cloud education curriculum. ThingSpeak also supports and integrates with Arduino®, RPI, and other hardware.

8. Conclusion

For monitoring the crops development by using LoRaWAN system.Field testing will be done by using LoRa nodes.It will give information regarding field or crops about Humidity, Temperature etc.The goal of this work is to create a monitoring system in agriculture using one of the IoT technology which is LoRaWAN and implement a field testing on a plant.

9. Acknowledgement

I might want to offer my true thanks and wish for my significant obligation to Prof. Prajakta A. More mam,Department of Electronics and Telecommunication Engineering, Zeal College of Engineering & Research.

10. References

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