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Review on "Agricultural Service Platform with Wireless Sensor Network Using LoRa Technique"

Shamali K.Makode[1] and Radhika R. Harne[2]
(P.G. Scholar)
Electronics System And Communication Engineering GCOEA, Amravati
Email: shamalimakode20@gmail.com[1] , harne.radhika@gmail.com[2]

Abstract — Traditional agriculture is converting into smart agriculture due to the bulge of the IoT (Internet of things). An agriculture service platform is developed to support environmental monitoring and to improve the efficiency of agricultural management. Climate change has already shown its negative impact that has on agriculture and food production, particularly because of rainfall deficit or excess of temperature changes and other associated environmental variations. LoRa allows very long range transmission with low power consumption. In our approach we used unsupervised clustering algorithm for data mining an also find the fault of the particular sensor.

Keywords: Agriculture, LoRa techniques, IoTs (Internet of Things), Wireless Sensor Network, clustering algorithm.

1. INTRODUCTION

In daily life agriculture is most important service platform. Agriculture technology based on wireless network and LoRa communication. It has low power high range communication and improves the efficiency of agriculture management. LoRa over 55 millions devices connected to network growing in 95 countries, it's a DNA of Internet of things. LoRa essentially is a clever way to get very good receiver sensitivity and low bit rate from inexpensive chip that has low data rate. LoRa permits long range inexpensive connectivity for IOT's device in rural and seawards industries. Low power high range area network created for wireless battery devices. LoRa is deployed.

The goal of this work is to communicate technology and integrate IoTs awareness into an agricultural platform. It used different types of wireless sensors for agriculture purpose. An solve the problem of communication failure and save energy at huge amount.

2. BACKGROUND KNOWLEDGE

A. Environment Sensors

Natural changes in temperature, humidity, Soil moisture, carbon dioxide level and direction may cause poor crop growth or disease, reducing crop yields. Therefore, in this work, an environmental sensor is used to reminds changes in the physical atmosphere. The information is collected and sent to an ESP32 controller platform for preprocessing. ESP32 controller uses a LoRa communication component to send data to a server for analysis [6] humidity and temperature Sensor.

The temperature sensor uses Thermally Sensitive Resistance (TSR). TSR is very sensitive to temperature changes, and obtained changes in resistance values can be converted into temperature values. The humidity sensor is used to define the quantity of water vapours in the atmosphere [4,5].

Soil Moisture

The Soil moisture sensor measures the water level of the environment. It helps for the growth of plants in agriculture [3].

Carbon Dioxide Sensor

The carbon dioxide sensor is used to detect carbon dioxide concentration. Carbon dioxide sensors has low cost, low power consuming it is well suited for production in large quantities at low cost[12].

B. Temperature Control

To ensure the accuracy of sensed data, the sensor must be placed in a suitable environment. The inaccuracy of measurement as a result of long-term operation is eliminated by using a temperature-controlled fan to ensure that the sensor is properly ventilated.

3. SURVEY ON AGRICULTURE SERVICE PLATFORM

One of the targets of this study is to design a node whose power requirement is low. If such a characteristic is satisfy, then a direct effect would be an extension of the battery lifetime which directly minimized of human interval to replace them. However, the fulfillment of this project specification is pretty challenging during the design phase of a wireless sensor node since it is mandatory to include a data transmission module. This component is one of the most power-hungry though, therefore at least one energy-saving approach, or even more than one at the same time, must be adopted. In this work four sensor on outdoors farms are used to monitor the environment. Actual measurement an best sensor are identified. One of the method of comparison is to set sensor with the same function a particular environment at the same time and analyze differences.

Block Diagram:

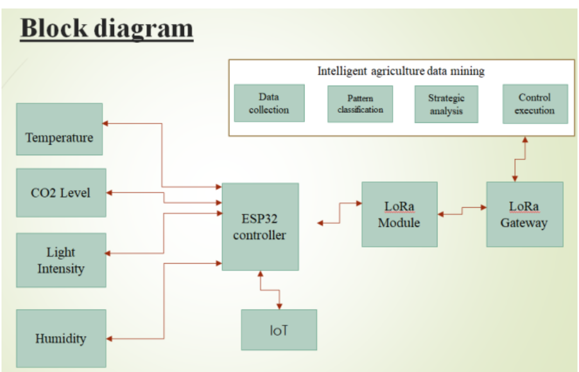

Fig 1. Methodology In Agriculture Platform Reference [1]

Wifi- IEE802.11 has 5KHz- 60GHz frequency and 2mb/s-6.75Gb/s data rate with 20-100 m transmission range and high energy consumption.

Wi-max- IEE802.16 has 2KHz- 66GHz frequency and 1 Mb/s–1 Gb/s (Fixed) 50–100 Mb/s (mobile)data rate with greater than 30 m transmission range and medium energy consumption.

LR-WAN-IEEE 802.15.4 (ZigBee) has 868/915MHz 2.4 GHz frequency and 40–250 Kb/sdata rate with 10-20m transmission range and low energy consumption.

Mobile communication- 2G-GSM, CDMA.-3GUMTS, CDMA2000, 4G-LTE has 865 MHz, 2.4 GHz frequency and 2G: 50–100 kb/s 3G:200 kb/s 4G:0.1–1 Gb/s data rate with Entier Cellular Area is transmission range and medium energy consumption.

Bluetooth- IEEE 802.15.1 has 2.4 GHz frequency and 1–24 Mb/s data rate with 8–10 m transmission range and very low energy consumption.

LoRa- LoRaWAN R1.0 has 868/900 MHz frequency and 0.3–50 Kb/s data rate with greater than 50 m transmission range and low energy consumption.

I. Comparative Analysis With Different Wireless Techniques.

LoRa is a low power, designed wide area networking. They enables very long range transmission with low power consumption as compare to Wi-Fi, mobile communication, Bluetooth an other wireless techniques.[Table 1] In this work, the technical differences of Wifi, LoRa, Bluetooth and mobile communication are present and compared in terms of physical or communication features. In addition, to these technologies are compared in terms of IoT factors such as coverage, transmission range, frequency, battery life, Data rate, deployment, and cost. Further, we consider application scenarios and explain which technology fits best. LoRa has a lower range (i.e., range <50 km) that requires three base stations to cover an entire city such as Barcelona. Bluetooth has the low range and coverage capability (i.e., range <11 m). [Table 1]

Applications:

Smart City: LoRa WAN will be inevitable technology in future smart city applications together with Internet of Things.

Industrial Applications: LoRa WAN is suitable for wide range of industrial applications such as Radiation and leak detection, smart sensor technology.

Smart home applications: In future, billions of smart devices and home appliances will be connected to internet.

Healthcare: LoRa is one of the best solutions for connecting healthcare devices efficiently such as Health monitoring devices and Wearable technology.

4. LITERATURE SURVEY

A. ***"****Toward Intelligent Agriculture Service Platform with LoRa-based Wireless Sensor Network"*

Yi-Wei Ma1 and Jiann-Liang Chen2 work is presented [1] in 2018 in which The intelligent agriculture platform can be used to collect environmental information in agricultural areas an transmit that data to remote computers through the LoRa for analysis, to make decisions concerning equipment control an various sensors are used. In this work, experimental measurements are made to determine sensor accuracy, select sensors for intelligent agriculture. A multi-sensor component and an integrated communications network are established. Wireless sensor networks and network communication technology are used to support intelligent agricultural data collection and equipment control

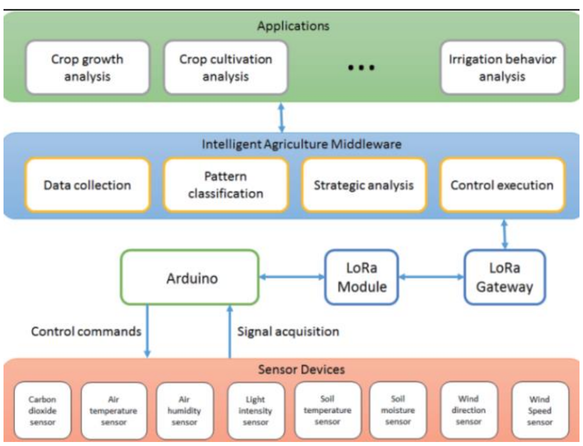

Fig. 2 Intelligent Agriculture Service Platform Reference [1]

B. *"Problem-oriented Pedagogy Using Temperature and Humidity Sensor Network Optimization*"

Z. Liu, Z. Luo, T. Su, C. Liu and W. Jiang,[5] in 2014, this work describes an acquisition system which has been used to demonstrate the effectiveness of problem-based pedagogy. The system was based on a high-performance microcontroller, an integrated temperature and humidity sensor and real-time data hard drive storage functionality. According to the characteristic analysis method, this work illustrated the benefits of wireless sensor network optimization by applying concept of contact sample to assess the sensors' relevancy of each position which depends on the correlation and classifies the collected temperature and humidity information.

C. *"Environment Monitoring System using Raspberry-Pi"*

Gaurav Jadhav, Kunal Jadhav, Kavita Nadlamani [10] has presented that The project aims to monitor the parameters in a given environment. With evolution of miniaturized sensor devices coupled with wireless technologies it is possible to remotely monitorized the parameters such as temperature, humidity amount of co2 in air. In paper using as main board of raspberry-pi and sensors will collect all the real time data from environment variations and this real time data will be made by the web server and display it. User can access this data from anywhere through Internet.

D. "An agricultural monitoring system based on wireless sensor and depth learning algorithm"

Liwei Geng!!", Tingting Dong Hebei Agricultural University, baoding, China presented [6] that The agricultural IoT can be combined with Zigbee, a short-range wireless network technology for monitoring systems, and To solve too large planting area and other faults in agricultural production. ZigBee -based low-rate and short-distance wireless communication technology used to create Low Rate–Wireless Personal Area Networks (LRWPANs). It includes the star, tree and mesh topology. It extend the WSN to include ZigBee technology as the wireless medium. ZigBee is a wireless standard based on IEEE802.15.4 which is low cost, low power, low data rate and more importantly, highly reliable and secure medium of networking.

5. CONCLUSION

In this work experiment measures to determine sensor accuracy, select sensor and develop a long range low power communication platform. The humidity, light intensity, temperature sensors are used for measuring other environmental parameters. In our approach we used unsupervised clustering algorithm for data mining and also can find the fault of a particular sensor network.

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Table 1- Comparison between wireless technologies***:***

Parameter	WiFi	Wimax	LR-WAN	Mobile Communication	Bluetooth	LoRa
Standerd	IEEE 802.11 a/c/b/d/g/n	IEEE 802.16	IEEE 802.15.4 (ZigBee)	2G-GSM, CDMA.- 3GUMTS, CDMA2000, 4G-LTE	IEEE 802.15.1	LoRaWAN R1.0
Frequency	5 GHz–60 GHz	2 GHz–66 GHz	868/915MHz 2.4 GHz	865 MHz, 2.4 GHz	2.4 GHz	868/900 MHz
Data Rate	1 Mb/s– 6.75 Gb/s	1 Mb/s–1 Gb/s (Fixed) 50–100 Mb/s (mobile)	40–250 Kb/s	2G: 50–100 kb/s 3G:200 kb/s 4G:0.1–1 Gb/s	1–24 Mb/s	0.3–50 Kb/s
Transmission Range	20–100m	<30 Km	10–20 m	Entier Cellular Area	8–10 m	<50 Km
Energy Consumption	High	Medium	Low	Medium	Very Low	Low