International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 04 | Apr 2024 www.irjet.net p-ISSN: 2395-0072

Smart Farming Using LoRa and IoT

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Abstract – *Farming is the root of india , today every sector is going digital but the farming sector is not getting digital due to network issues and also due to the short range of communication also due to the lack of some kind of knowledge of farmers towards the mobiles or laptops. The farming sector must get into the digital zone which will definitely help the farmers and also can reduce their stress of work for some level. So the one small try to get the farming sector into the digital zone is done by us by using some IoT and electronics devices and the major role played by the radio communication. Most of the farms are located in that region where any network is not able to work properly but the radio waves can be able to work at that region and also the range of communication is also very large about 10 – 15Km. Due to use of the radio communication we don't need to use the internet for any way of communication for at least farm unit.*

Key Words: Radio Communication, IoT, Digital Farming, Literate India, Smart Farming, LoRa.

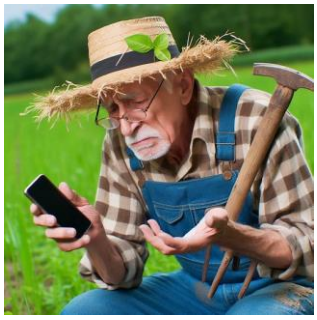
1.INTRODUCTION

.his study addressing the issues faced by the farmers to become digital. The farmer needs to visit the farm in any condition no matters it is rainy season or summer. To make the farmers life bit easy and reduce their stress of visiting the farm. The government is also taking the initiative to make the farmers life easy and digital. The study of this project is taking some bit to solve the problems of the farmers. We can not say that our project is best solution for these problems but we are trying our best to make the solution more better and more suitable to solve the problems. The system of the project includes different components which plays the role to make the system more compatible and more problem solving. The system consists of Atmega-328P microcontroller which is the brain of the system which process the inputs and outputs of the system. The major issue to make the farm accessible on fingertips is the network issues, means there are so many lands are located in hilly and mountain area, where we can not use the network like internet so we are unable to make the connection between the land and the home of the farmer. So to overcome this issue we used LoRa Ra-02 device which is the heart of the system, with the help of LoRa we made possible to communicate long distance about 10Km without the help of the internet. Using our system the farmer can control the various parameters like water pumps also can monitor the different environmental parameters like temperature, humidity, moisture, rain and water level of the tank. Also we can add more input devices but at the beginning level we had interfaced only some devices. In short the system can give the access to the farmer to give input to the system and also take the output from the system at remote location.

2. Need and Necessity

2.1 Problems Faced by the Farmers

2.1.1 Illiterate Farmer



2.1.2 Network Issues

And many more problems are faced by the farmers to reduce their stress we are going to represent the system.

2.2 Hurdlers to Develop the System

2.2.1 Finding the long range device

The major challenge to develop the system is to increase the communication range and the communication

compatibility in the farm where the network is not available, network in the sense the internet.

2.2.2 Interfacing More Devices

This is another challenge to interface more devices with the microcontroller i.e. Atmega-328P. To measure more parameters we need to interface more devices with microcontroller.

2.2.3 Sending the Data to IoT Platform

The another but important issue is to send the data received from the farm location to the home location and then send the data to the IoT platform with the help of the internet.

2.2.4 Electricity

This is another one challenge in the system development. Due to we are going to implement this system in the farm, where there are many chances of electricity cutoff.

3. Literature Review

2.2.4 Electricity

3.1 Pathan S.K. et.al(2020) IoT Based smart agriculture : Trends, challenges and Future Directions. Computer Electronics in Agriculture , 181 , 105884.

3.2 Singh D. et.al(2019) IoT based smart farming system using Raspberry Pi. Procedia Computer Science, 132, 1059-1065.

3.3 Kim, S. et al. (2017). The Smart Farm: A Case Study of IoT Applications in Aquaculture. In 2017, the IEEE International Conference on Big Data (Big Data) took place (p. 2736-2743). IEEE.

3.4 Vidhya, K. et al. (2018). Design and development of a LoRa-based wireless sensor network for precision agriculture. In 2018, the International Conference on Communication and Signal Processing (ICCSP) took place (p. 1031-1035). IEEE.

3.5Kumar, A. et al. (2021). A smart farming system using IoT and LoRa. In 2021 International Conference on Energy, Communications, Data Analytics and Soft Computing (ICECDS) (pp. 1-5). IEEE.

3.6 Kamble, S.S. et al. (2020). A comprehensive overview of smart agriculture using IoT and machine learning. The 11th International Conference on Computing, Communication and Network Technologies (ICCCNT) will be held in 2020 (p. 1-5). IEEE.

4. Methodology

4.1 Block Diagram

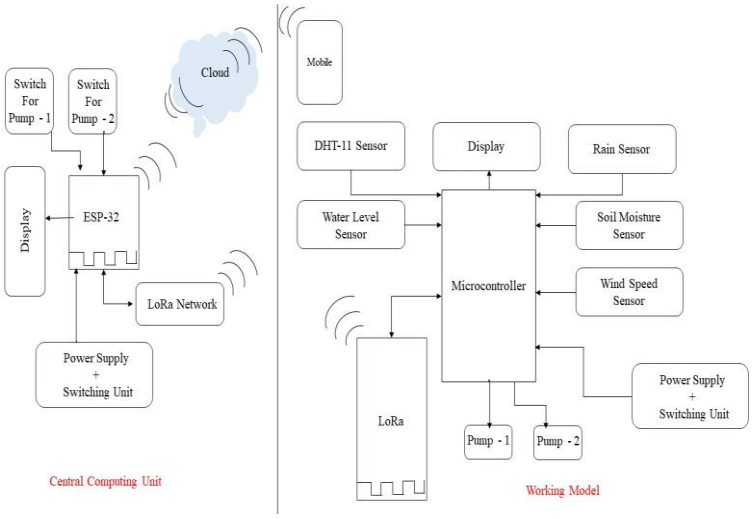


Figure 3.1 System Block Digarm

4.1.1 Essential System Components

4.1.1.1 ESP-32

As per the requirement and also we are going to send the data on the IoT platform that's why we need to use a WiFi enabled system. That's why we are going to use the device called ESP-32 which has embedded wifi system. The ESP-32 is fixed on the home module means at the receiver end.

Fig 4.1 ESP-32

4.1.1.2 Atmega – 328P

For developing the system and to make it possible to work the controller is required. So we had used the controller Atmega-328P which is one of the best and powerful microcontroller. Since our system works in I2C protocol and we had used WSN technology to distribute the different sensors at various location in the farm so we must need to include the controller which has capacity to interface more and more sensors.

Figure 4.2 Atmega-328P

4.1.1.3 LoRa Ra-02

LoRa Ra-02 is the heart of the system which is most important for communicate at long distance. In our system we had interfaced two LoRa devices one at transmitting side and one at receiving side. The data speed for transmitting the data is 50Kbps so the devices at both the end must be synced together. The LoRa device is worked on the radio frequency of 468MHZ. For communicating at long range about 8 to 10km we used the LoRa Ra-02 version.

Figure 4.3 LoRa Ra-02

4.1.1.4 Battery

For operate the system we must have to give the power supply and in the farm there is issue of power failure so we had used the Li-Ion battery of 3.7V at both the units i.e. at transmitting and receiving unit which will power the system for few hours of the power failure and continues the system operation. One of the best advantage of the Li-Ion batteries is that they are rechargeable that's why after the electricity is available then we can charge the batteries.

Figure 4.4 Li-Ion Battery

4.1.2 Working Principle

This system is distributed system, there are two units i.e. Transmitting unit which is fixed at the farm and another is the receiving unit which is fixed at the home.

As the system is worked on the principle of WSN technology in which there are various sensor nodes are fixed at various locations so at the transmitting unit various sensors are used. The sensors are used to measure the environmental conditions like temperature, moisture of soil, Humidity of the air, Level of water at the water tank and so on. The sensors measures this quantities and sends the data to the farm unit as input. After receiving the data the farm unit process the data and the processed data is sent to the home unit or the receiving unit using LoRa Transmitter and receiver.

Another unit is the receiving unit, the unit includes ESP-32 a wifi enabled device and a LoRa device which is used as the receiver. As the data speed of the system is slow i.e. 50Kbps so the time delay between the sending and receiving the data is about 1 - 1.5s. So the data received at the receiving unit is processed by the wifi device ESP-32 and the processed data is send to the IoT platform i.e. Ubidots if the internet is available at the receiving unit or the home module.

The system did not required any internet connection to send and receive the data at both the end the ESP-32 is only used to send the data at IoT platform. The data available at IoT platform is can be accessible through mobile, laptop or computers. Also the farmer can monitor the real time data on the LCD displays attached at both the ends. Also he can control the motors located at farm using the buttons fixed at the receiving unit for this operation also we don't need to use the internet whole process can be done using the radio communication.

4.2 Circuit Diagram

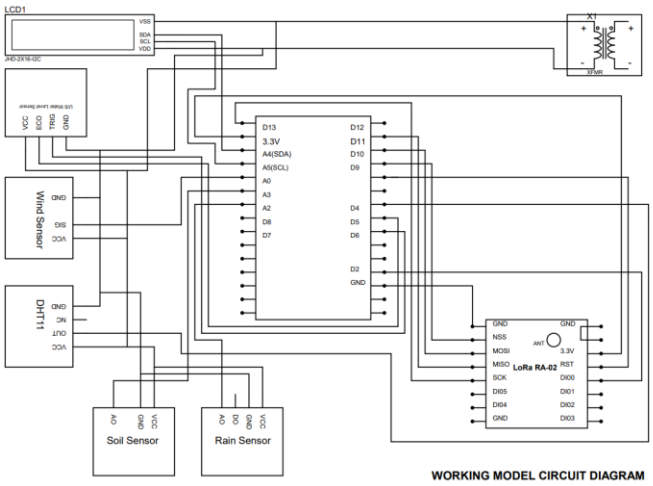


Figure 4.5 Working Model (Transmitter)

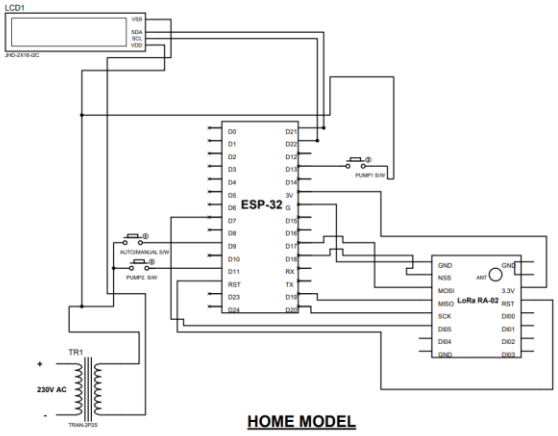


Figure 4.6 Home Model(Receiver)

In this circuit diagram as our system is distributed and works on two model hence there are two circuit diagrams are created.

5. Model Views(Actual)

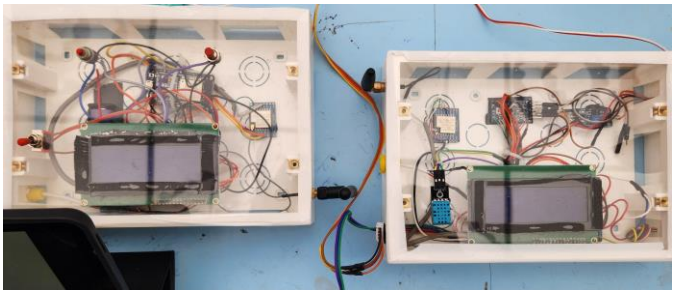


Figure 5.1 Actual Project View

6. Conclusion

The final product developed is found helpful for the farmers. This system is consumes low power and can measure various parameters like Temperature, Humidity , Moisture and others.

The farmers are feels relaxed and their stress is reduced in some bit. Farmers did not required to visit the farm for small cases he can monitor the farm also he can monitor the wind speed which will help while spreading the pesticides.

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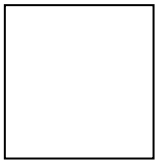
ACKNOWLEDGEMENT

We would like to take this opportunity to sincerely thank everyone who helped us to successfully complete this study. First and foremost , we would like to express our sincere gratitude to Mr. Choudhary S.K.

Dr. Rahane S.B. (HOD, E&CE Department), Dr. Ubale V.S who served us as our mentor and guide, for their steadfast support, wisdom, and direction during this attempt.

BIOGRAPHIES



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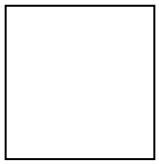

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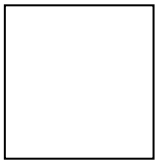

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