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Smart Farming Via IoT: A solution for monitoring Rice Productions

Rovina Mariam Jose
Department Of Computer science
Digital University
Kerala,India

Naveen Thomas Joseph
Department Of Computer science
Kristu Jyoti College
Kerala,India

Binny S
Associate Professor
Department Of Computer science
Kristu Jyoti College
Kerala,India

***Abstract*—Emerging technology makes a brand-new shape for the future. Automation gives an advanced way to boom the productiveness in the agricultural zone. Iot devices are playing a totally vital function in automations. With the help of some sensors, we are able to realize the chemical and physical properties of soil which includes its Moisture, temperature, soil nitrogen, phosphorous and potassium. These facts aid the farmers to increase the productivity. Since the Kerala's paddy cultivation goes down despite the fact that there are acres of l a n d as compared to other states in India. This is due to the less awareness of soil characteristics among the framers. In this work, we will learn about IoT based soil nutrient monitoring and analysis can be done using IoT gadgets like temperature sensor, NPK, moisture sensor.**

***Index Terms*—IoT, NPK, Temperature sensor, moisture sensor,**

I. Introduction

In order to increase the agricultural productivity and farming processes a new cost-effective technology such as Internet of Things (IoT) is a proven solution for the existing problem. It refers to a machine of interrelated, net-linked gadgets which might be able to acquire and transfer data over a wireless net-work without human intervention. Iot facilitates in agriculture and farming through automating all the conventional techniques to make the entire process more efficient and effective. It helps the farmers in livestock analysis, monitor the climate conditions, monitoring in crops, automation in greenhouse and so on.

As the population increases food production and farming needs to get increasingly productive and capable to meet the high yields in limited time. According to the UN Food and Agriculture Organization, "the world will need to produce 70 percent more food in 2050 than it did in 2006. So to meet these demands the farmers has to increase the production.

Paddy cultivation in Kerala has witnessed a regular decline since the 1980s. For the paddy cultivation, external factors along with climate, surroundings Which include water, soil, and so forth, would be affective the overall Increase of the paddy. In paddy cultivation water Consumption, spends on pesticide and insecticide, capability Reduction of labor wages in paddy cultivation through Technological development such as iot are been used. The manufacturing of rice is decreasing through the years. The purpose for the motive is loss of monitoring. Like human's plants also has different stages in their lives [7]. It is clearly shown in the figure 1. In order to produce a healthy vegetation farmer has to correctly monitor each of the stages.

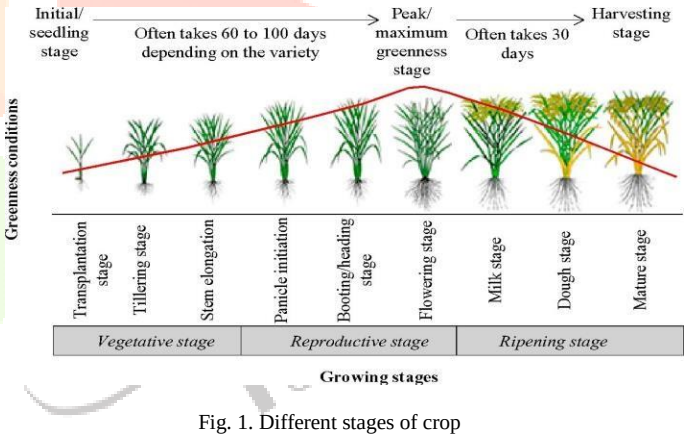

Fig. 1. Different stages of crop

This works aims to analysis moisture, temperature, nitrogen content, phosphorous and potassium content using three types of sensors such as temperature sensor, Moisture senor and finally NPK sensor.

II. Related Works

A researcher setup a process which comprises Iot and deep learning for monitoring paddy field remotely [1]. By using per trained CNN network like VGG16 can identify the damages in the leaf and nitrogen status estimation. Apart from this they suggested models can control humidity and temperature. And get a result of about 84.67%

Another work shows how technology can be used in the agricultural sector and points out the advantages [2]. It provide a deep understanding of IoT, IoT in agriculture, trending wireless technologies of IoT, architectures and applications of IoT. It also mention how IoT has made a specification in the technologies in order to become backbone in the field of agriculture.

Another work shows a technology that notify climate data to

the farmers through SMS [3]. It provides live data about temperature , humidity ,soil moisture, UV index, IR from the field to take necessary actions and to helps them in the smart farming by saving using the resources like water, fertilizers and also increase in the crop production. The gadgets like ESP32s Node MCU used for moisture, breadboard like Arduino,

DHT11 Temperature for monitoring temperature. They conclude that this prototype will surely help all the farmers in small farmland to effectively monitor their crops with the user-friendly app and other alert means

Another research shows the various contributions by the different researchers over the years about smart farming [4]. It also points out the functional aspects of Iot. Furthermore, all the challenges in the agricultural activities along with the advanced research steps to overcome the existing system. This equip the novel researchers of the agricultural domain to assess the current trends of Iot.

Another research paper extends a temperature compensation capacity within the sensor. It extends the sensor by using WiFi-based Internet of Things has been included, making it a connected sensing system [5]. As a result, they build system which is capable of sending data directly to an IoT-based web server, and which will be useful to develop distributed monitoring systems in the future. Finally, the propose system has the potential to monitor the impact of industrial, agricultural, or urban activity on water quality, in real time.

III. METHODOLOGY

The Kerala has a huge acres of land availability for paddy cultivation but people are not utilizing properly. This is because farmers are in lack of knowledge about soil , nutrients etc. So this existing problem can be resolved with the help of Internet Of Things(Iot). Some of the variants of paddy crops (rice) cultivated in Kerala are in the Table 1. These are the most

Variety	Duration (Days)	Bran Color and Grain Type	Characteristics
Hraswa (Cul 24-20)	75-80	Red medium and bold	Extra-short duration variety. Ideal as a contingent variety for areas where there is crop loss. Susceptible to leaf folder. Raised only as direct sown crop.
Kattamodan-Tall (PTB 28)	110-115	Red	For uplands (modan). Tolerant to drought.
Karuthamodan-Tall (PTB 29)	105-110	Red	For uplands (modan). Tolerant to drought.
Chuvannamodan-Tall (PTB 30)	105-110	Red	For uplands (modan). Tolerant to drought.
Annapurna (PTB 35)	95-100	Red short and bold	Suitable for direct seeding. Susceptible to blast, sheath blight and Brown plant hopper. Suited for I and III crop seasons.
Rohini (PTB 36)	85-105	White	Performs well during virippu season. Not recommended for mundakan season. Suitable for direct seeding.
Triveni (PTB 38)	100-105	White	Tolerant to Brown plant hopper. Susceptible to blast and sheath blight.
Jyothy (PTB 39)	110-125	Red	Moderately tolerant to Brown plant hopper and blast; susceptible to sheath blight; suitable for direct seeding, transplanting and special systems of Kole and Kuttanad.

Table. 1. Different varieties of rice cultivated in Kerala

common varieties of rice production. with the help of these sensor's, we are able to collect details that help to increase the productivity. The details like moisture, temperature, nitrogen content , phosphorous content and potassium content needed for the above crops.

The proposed system works in the following manner, for this we are using two sets of Iot components like the sender and the receiver component.

A. Sender

In the sender side an Arduino nano board is used for the inter-related connections. All the three sensors Temperature , moisture and NPK are connected with Arduino. This Arduino is connected with transceiver module.

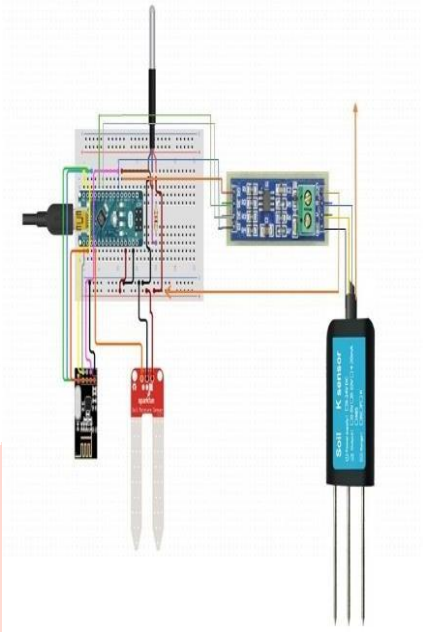

Fig. 2. Sender Component Circuit Diagram

1) Arduino: Arduino is an open-source electronic software. The board has been used for many applications like read inputs activating a motor, turning on an LED and so on. In this case we are using an Arduino nano with an operating voltage of about 5V and recommended input voltage for Vin pin around 7V-12V. It has flash memory of 32Kb and 2kb is used for bootloader.

2) Temperature Sensor: For the proposed system we are using a DS18B20 Waterproof Temperature Sensor. It is pre-wired and used to measure the temperature between -55 to 125°C (-67°F to +257°F). It is placed inside the soil.

3) Moisture Sensor: To measure the soil moisture level in the we are using an capacitive soil moisture sensor of version 2.0 and measures by capacitive sensing. This is because the capacitance is varied on the basis of water content present in the soil. The calculated capacitance is converted into voltage level from 1.2V to 3.0V maximum. They are made of materials that are corrosion-resistant that guarantees long life.

At the time of seeding and transplanting stages the required water level is minimum. This cause variation in the moisture level. When the moisture level increases it results more losses

from poor quality while the lower moisture results more losses from shattering. But the time of tillering and flowering stages required maximum amount of water and the moisture sensor show high values. In the Dough and Mature stage again the water amount is minimum. The capacitive sensor is shown in the figure4

Fig. 4. Capacitive Moisture Sensor

4) NPK: The NPK sensor is used for detecting the content of nitrogen, phosphorus, and potassium in the soil. Nitrogen, is the most important nutrient for rice, and is globally limiting the rice productivity. Phosphorus is mainly important in the initial growth stages of rice. Potassium increases the ability of the plants to resist from diseases, insect attacks, cold and other adverse conditions. The sensor can be buried in the soil for a long period of time. To read the NPK Data we use any Modbus Module like RS485/MAX485.The nitrogen, phosphorous and potassium measuring resolution is about 1mg/kg (mg/l).

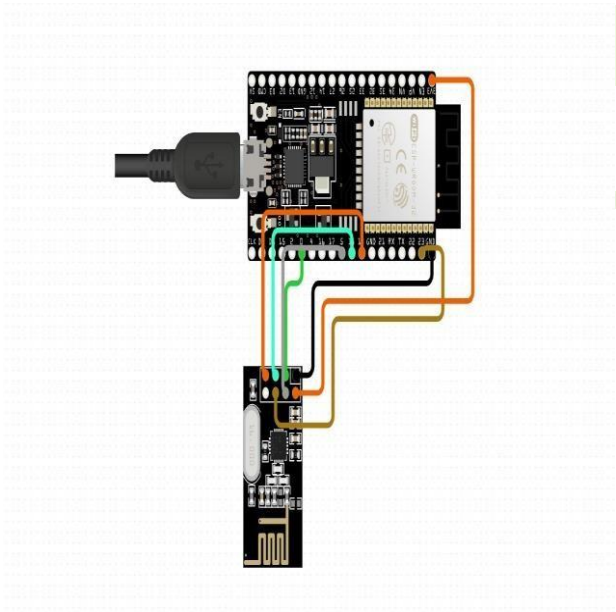

Fig. 5. Receiver Component Circuit Diagram

B. Receiver

The data prepared by the sender can be wirelessly transmitted . This is achieved by using an ESP32 WiFi Module. The received data is handover to the NRF24L01 module. The circuit diagram can be shown in the figure 5. We can generate a statistical analysis of the data can be made.

1) ESP32 WiFi Module: It is a powerful, generic Wi-Fi and Bluetooth/Bluetooth LE module that targets a wide variety of applications. It is a series of low-cost, low-power system on a chip micro- controllers with integrated Wi-Fi and dual-mode Bluetooth.

2) NRF24L01 module: It is a is a single chip radio transceiver and contain a power amplifieralong with a fully integrated frequency synthesizer, and a crystal oscillator, a demodulator, modulator

IV. Result

The output generated by the receiver module is monitored based on the time of period of the rice grain about 1-17 weeks. It helps farmers to maintain and monitor the water level at the beginning stage. After the 4 weeks ,if Moisture data will be low it alerts the Farmer to increase the water level. After the transplanting stage the farmers monitor the nutrient content across soil, if it is low senor informs to add artificially maintain the nutrient value of the soil by adding the needed fertilizers. The statistical measure of the proposed system is shown in the Figure 6

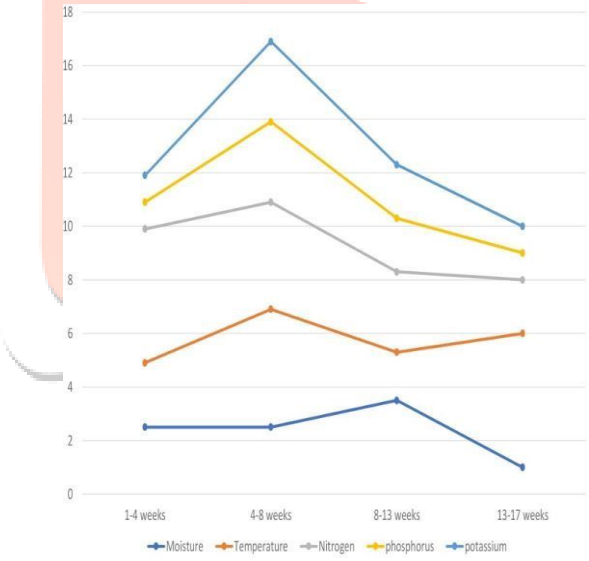

Fig. 6. Statical Graph

V. Conclusion

Iot devices can be used to converts the conventional framings to a smart farming. From our results we can conclude the sensors like temperature sensor, NPK, moisture sensors , helps the farmer's to monitor each stages of the rice cultivation and increases the productivity.

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