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Research Paper

Soil nutrient measurement in paddy farming using IoT

K. Goutham Chand [1] *, M. Sidhendra [2], Dr. Mohammed Ali Hussain [3]

[1] B. Tech Final Year, Dept. of ECM, Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
[2] Professor, Dept. of ECM, Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
**Corresponding author E-mail: gouthamchandkota@gmail.com*

Abstract

In India agriculture is a major factor in the development of an economy. It plays a major role in eradicating the world hunger, but farmers in India still use primitive and old ways to grow their crops especially paddy which even though is not wrong but doesn't help farmers to get the maximum yield out of their paddy farms. To do that they need to utilize the modern technology that will not only help them increase their paddy yield but also reduce their dependency on weather conditions and also on manual labor. One such technology is discussed in this paper, here we are proposing a way to measure soil nutrients in real time and send that data to the farmer so that he can plan the type of seed for paddy crop he wants to grow for that season. This paper mainly measures nitrogen phosphorous potassium (NPK) in the soil which means nitrogen sodium and potassium which are major micronutrients in the soil. Farmers start using fertilizers which are not only harmful to the environment but also are damaging to the humans and animals who consume them. Not only do we provide a way to avoid this but also help the farmers which variety of seed to a farm to increase their yield. We also send a notification to the farmer's phone about the values in the soil and also the market values of the paddy crop they are farming in particular season.

Keywords: *Arduino; NPK; Paddy; Fertilizers and Soil.*

1. Introduction

To consummate incrementing injunctive authorization of growing population from year to year is a desideratum and incrimination in aliment engenderment. [1] To increase the crop yield fertilizers which contain nutrients like nitrogen phosphorous and potassium plays a key role. Uneven utilization of the fertilizers results in poor quality of rice in terms of color and grain size. In China over usage of the fertilizers resulted in low rice quality and also effects the environment.

The Quantity of NPK is dependent on crop type and on plant magnification status. How much quantity of fertilizer to be used is further dependent on present contents of NPK nutrients in the soil. Researchers in agriculture are probing for ways to optimize plant yield while minimizing the consumption of fertilizer. Since these macronutrients vary even on a diminutive scale throughout a cultivated field, numerous researchers have endeavored to develop the sensors to map these nutrient contents. Integrated crop management systems have been designed to study spatial and temporal comportment of NPK. Perpetual monitoring of soil is leading to an automation in agricultural areas to ameliorate crop productivity.

As we said in the abstract we not only [2] take these values we send those values to the farmer in real time using NODEMCU. By using NODEMCU we collect the data from sensors and send it to cloud, where these values are displayed in their personal accounts and also notification is sent to their mobile phones .daily market values of the particular crop will be sent to farmer which helps in knowledge the farmer. This information helps the farmer in fertilizing the exact required amount of the nutrients that help in reducing the investment in the crop this also effect in reducing the government subsidy amount

2. Existing work

In the existing model the nutrients of the soil are detected using multimode plastic fiber optic sensor and data is displayed in the LCD display. The sensor measures the values those values are collected by the microcontroller and later values are displayed. This process is implemented manually requires the human presence. The Sensor is manually inserted into the soil in different places of the field and the values are collected and displayed in LCD and among multiple places of the field. These require a lot of man power and not much farmer friendly and does not continuously monitor. This drawback is results ineffective farming due to sudden changes in NPK values are not identified because there is no continuous monitoring.

3. Proposed work

3.1. Algorithm

Step 1: Initializing the sensor to measure the values. Step 2: Collecting the values and send them to the NODEMCU for the processing.

Step 3: Data is sent to cloud from the NODEMCU for the further processing of the data.

Step 4: Values of NPK are classified by their percentage If the value is > 65 % (nutrient levels are good) If the value is >45% & <65% (nutrient level is okay low amount of fertilizing is suggested).

If value is <40% (nutrient levels are poor immediate fertilizing is suggested).

Step 5: Information is sent to the farmer through SMS.

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3.2. Fiber optic based NPK sensor

This fiber optic sensor uses optical fiber as sensing element or as a means of relay signal from a remote sensor. Where it can be used as an intrinsic sensor or extrinsic sensor. This sensor consists of NPK sensor probe it is configured to chemical sensing. [3]The sensor probe is of seven probes which are arranged in a circular manner. The fiber is a multimode plastic fiber which enclosed in a brass cylinder and a round cut glass is fitted to avoid the damage of polished tip during the chemical test. This sensor works on colorimetric principle it deals with the measure of color intensity. The absorbing the light by solution resulted in excitation of electrons in its molecule. The different colored lights are emitted at same intensity and wavelength they pass through the solution towards the reflector and comes back. Those colored intensities are measured by absorption spectrum at discrete wavelengths and simplified detection mechanism is developed. In figure 1 sensor probes are displayed as accordingly they are arranged. The source fiber and receiver fiber are as shown in the figure those colors help in identification of deficient nutrients as by the reflection of the colors through the solution.

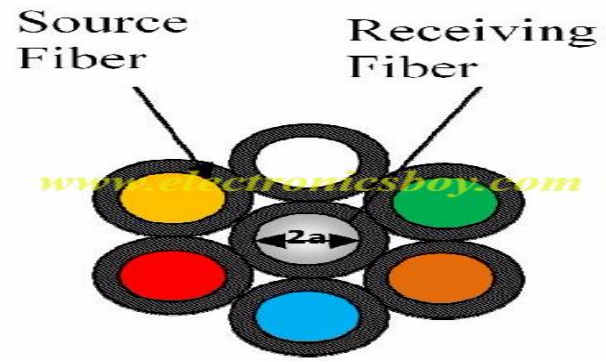


Fig. 1: Sensor Probes.

3.4. Think speak

Thing speak is an open cloud which can be used as a platform for measuring the statistics of the measured values in the form of a graph or can be exported in the form of CSV which appears in an EXCEL sheet. Here we can create a channel for the specific issue and in that we specify the number of fields we require. Field information will be given based on the sensors used. [4] This has an option even to track the geographical location with the latitude and longitude values of the live location. Channel description can be given. It has two options of private view and public view. Private view, it will be visible only to the owner and if the public view is activated the data can be viewed by the users also. This will help while proceeding to the next stage. The Application peripheral Interface (API) keys are used to upload data to the cloud and retrieve data from the cloud. Sharing option is used to set the viewing.

3.5. Web application

This application is used to store information in bulk and display it when needed. It contains data regarding the week analysis about the market price and up and downs in the price with respect to climatic conditions.[5] The data regarding the minerals present in the soil will also be displayed. This helps in taking the decision of minerals added to the crop in the time fertilizing. This ratio helps to save the soil natural fertility. Every farmer will have a private account in this. Here the farmers and the research persons will have good interaction. So that the farmer will get the information about the new variety of seeds and any suggestions if required. This also displays every date market price of the crop and even the farmer will get an SMS regarding the details of market price and soil contents.

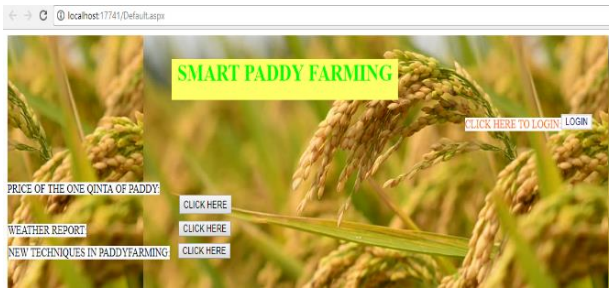


Fig. 2: Homepage.

These web pages are developed using visual studio it has the various tools that help in designing and developing the web application the starting page consists of login button and other farmer informative related matter.

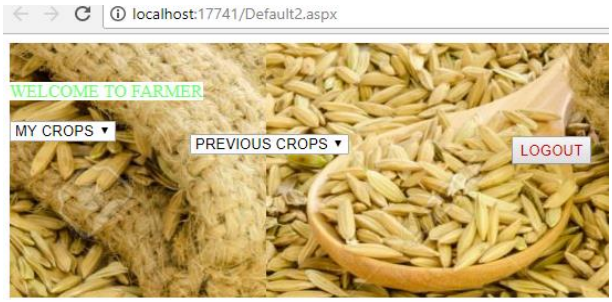


Fig. 3: Welcome Page.

After the login, the farmer has the multiple dropdown lists displaying various information in it like present crop statistics and previous crops details can also be displayed for references which helps in overcoming the mistakes and improving the yield from the previous year.

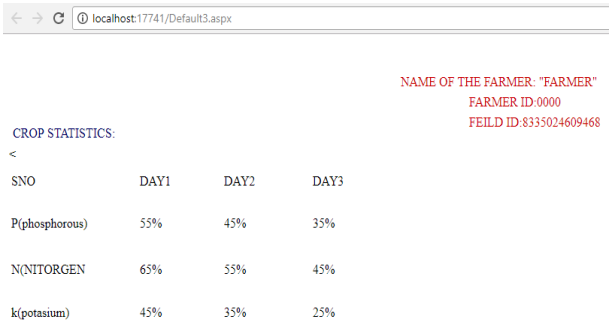


Fig. 4: Statistics Page.

In the above figure, the statistics of NPK nutrients values are displayed weekly analysis which is obtained from the sensor through the cloud.

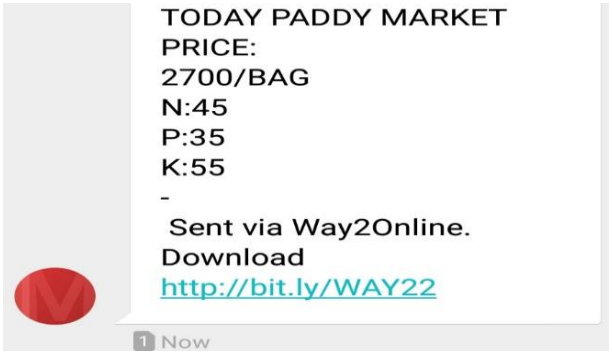


Fig. 5: Mobile Message.

The values sent to the farmer through SMS as shown in the above figure 5. The market price of paddy in particular area will be updated to the farmer. This is the fastest way that farmer [1] can get updated gradually many other new variety of seeds which give better yield are updated to the farmer. Nowadays mobile is used by each and every farmer. This point says the reason behind selecting this way of acknowledging the farmer.

3.6. Node MCU

NODE MCU V3 is an open source IOT stage. It utilizes the LUA scripting dialect. [6] The LUA venture is the premise of board and based on the ESP8266 SDK 1.4. NODE MCU utilizes many open sources. The NODE MCU continues running on the ESP8266 Wi-Fi Source module.
In this board, the advertisements USB/UART converter chip and also decoupled LDO control supply. Likewise, the board includes 2 smaller than usual push catches.



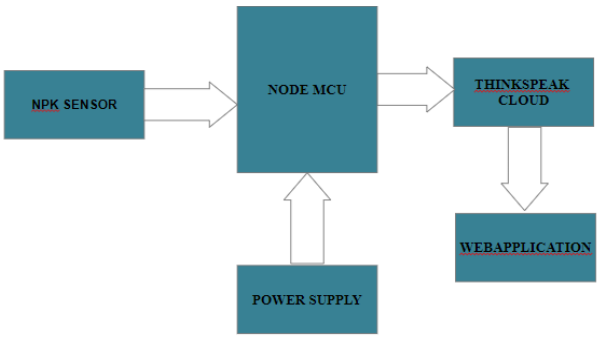
Fig. 6: NODEMCU.

Majorly it consists of inbuilt Wi-Fi module it is required for clouding the data. [8]It consumes very less power and has its advantages . Those sensors are connected to its pins and configured as we required that to collect the data and process it to cloud.

4. Methodology

The sensor is inserted into the soil and with the interfacing of the fiber optic sensor with Node MCU the data can be drawn. It will be given power supply. The data will be uploaded to the cloud using the WI-FI module in Node MCU. [7] The data which will be uploaded to the cloud are soil minerals percentage and the number of fertilizers to be added to the soil. It also gives the information about the fertility of the soil. This data can be verified in the Thing speak cloud in the form of graphs or a message will be sent from the cloud to the farmer's mobile. This same data will be uploaded to the web application to save the whole data in a tabular form for comparison at the weekend or yearend. For security purposes, each farmer will be given a private account so that his data can be secure and personalized and in a way to customize in any way the farmer pleases.

5. Block diagram



6. Future scope

- Web application can be a good interface between new researches , inventions in paddy crop and farmers
- Linking the web application with farmer aadhar details helps the government in less investing in fertilizer subsidy and also help reduce pollution in water bodies and also help farmer grow a healthy and clean crop.
- The current system can be expanded in such a way that it can include other crops too. So farmers who are harvesting other crops can also use this system.
- Furthermore we can integrate other sensors like rain sensors, soil moisture sensors so that this module can be used for all the purposes of farming and crop monitoring.

7. Conclusion

NPK sensor helps to determine the values of the nutrients present the soil and it is farmer friendly consumes less power and cost-efficient suitable for any type of climatic conditions. Not only does it detect the nutrition's values in the soil but also sends the data to the farmer's phone so that he can monitor the field condition in real time from a different location. Farmer can also access the real -time prices of the paddy in the market which can help him in a lot of ways when the crop is ready and he wants to sell. All this data is also available in the which means he can access the same data in his phone, computer or any device which can access the internet. So, in conclusion, we have created a low cost, efficient system which can help the farmers in many ways, Form beginning of the crop till it is harvested.

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