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Smart Farming with Fertilizer Dispenser and Predictive Analysis

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Abstract
Agriculture is the key to the development of human civilization. In developing and underdeveloped countries most of the populations depend on agriculture. There are many challenges faced by the farmers in agriculture like getting expert advice, monitoring of crops and manual methods of doing the necessary activities required for farming like irrigation etc. Recently, some web-based models have been developed to assist the farmer in agriculture but they are not very effective due to complex interface and lack of technical knowledge of the farmer. In this paper, we propose an IoT based smart agricultural device controlling system to help the farmer effective agriculture. We explore the integration of current environment and agriculture production to the farmer in a simple way. In this the information is provided for pre agriculture and post agriculture to determine activities required before starting rowing of seeds in the field. Deployed sensors identify the soil type by measuring its PH value and moisture contents.On-agriculture involves activities needed during agriculture the deployed sensors like LDR sensors, temperature sensors, moisture sensors and wind speed Sensors.

Keywords— Smart farms; sensors; IoT; agriculture; data analysis.

I. INTRODUCTION

Smart farming is a capital-intensive and hi-tech system of growing food cleanly and is sustainable. It represents the application of modern Information and Communication Technologies and embedded systems into agriculture. It has a real potential to deliver a more productive and sustainable agricultural production based on a more precise and a resource-efficient approach. It is provided with an added value in the form of better decision making and is mostly related to three interconnected technology fields. Planned systems for collecting processing and storing data in the form needed to carry out farms operations and functions. In real time robotics, artificial intelligence techniques and automatic control at all stages of agricultural production including farm drones and farm bots. Smart systems are used for innovation in all field of society and industry. Highly automated, intelligent systems are taking over tasks and services.Leaf colour chart (LCC) is one of the important informative innovation in the agricultural sector. First time it was prepared by Japan scientists. They used this for estimation of chlorophyll formation rate in the rice crop and then more various investigations on leaf colour chart were done which showed that it is important for better nitrogen management. The topmost, youngest, fully expanded leaf from a plant is selected.The middle part of the leaf is placed on the LCC and it's colour is compared with the colour palette. The leaf colour is measured under the shade. Direct sunlight affects leaf colour readings. If the colour of a rice leaf is in between two shades, the average of the two values is taken as the reading and the fertilizer amount is given based on the palette number.

Figure 1 LEAF COLOR CHART

TABLE 1 RGB values corresponding to palettes

PALETTE NUMBER	R	G	B
1	117	137	25
2	101	126	25
3	82	123	39
4	59	98	35
5	34	73	31
6	31	67	37

From the table 1 the calculated RGB values of leaf colour chart's colour palettes. From these calculated RGB values different leafs are compared in general and specific amount of the fertilizer is given .The existing leaf chart system does not support for quality production and hence the colour sensor

Usage of LCC

1. Select the plant for testing
2. Match the leaf to the chart
3. Measure the leaf colour
4. Determine the average LCC

Use the LCC once every 7-10 days starting from the beginning of tillering and continue this process up to panicle initiation

II. SMART FARMING METHODOLOGY

In the proposed system colour sensor is used to find the RGB values of the leaf which helps to find the exact value of fertilizer depending on palette number instead of taking the mean of two palette numbers and also to reduce the observational errors. It helps us to give the accurate values to dispense. This system helps us in improvement of the quality and the quantity of the crop production compares to the LCC existing system. This method favors us in different ways like saving the time and decreasing the difficulty of working on it. The colour sensor not only helps to dispense the fertilizers it also detects whether the leaf is affected with diseases.

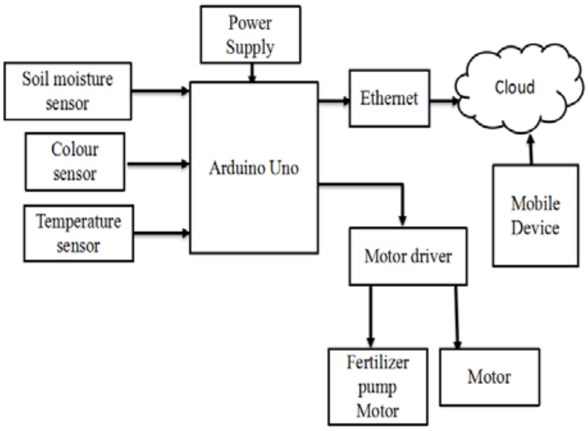

Figure 2 Smart Farming Methodology

The block diagram shown in Figure 2 shows the components used in the smart farming methodology. Temperature sensor and soil moisture sensor are connected to continuously monitor the temperature surrounding the farm and water the soil for any change in the moisture level respectively. An Ethernet connection is given to connect the controller setup to internet

Based on the RGB values of the leaf exact amount of nitrogen required for the crops can be found and any amount either organic or inorganic fertilizers can be provided in addition to supplying water for crops based on moisture level in soil. It also determines the temperature whether a crop is comfort with the temperature or not for example the rice crop grows in extreme high temperature compared to others.

Table 2 NITROGEN PERCENTAGE IN ORGANIC MANURES

ORGANIC MATERIALS	PERCENTAGE OF NITROGEN
Crop Residue	0.5 – 0.8
Cattle manure	0.8 – 1.2
Compost	0.5
Pig manure	0.7 – 1.0
Goat manure	2.0 – 3.0
Poultry manure	1.5 – 3.0
Sewage sludge	1.6

The type of fertilizer required, either organic or inorganic is used for the crop by calculating the amount of nitrogen in the manure. Table 3.1 shows the percentage if the nitrogen present in different organic manures. Thus the fertilizer issuance depends Upon the N content in the leaf.

III. EXPERIMENTAL SETUP

The experimental setup of the proposed system is shown in the fig. 3 of the hardware circuit. The setup works for the proposed system of predictive analysis and fertilizer distribution. The fig. 3 shows the combination of all the components used

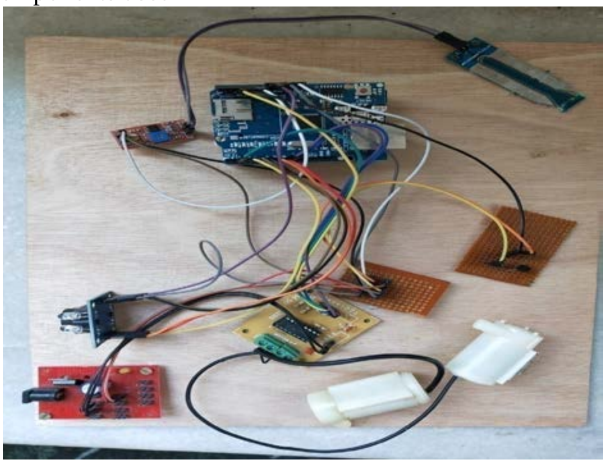

Figure 3 Hardware Circuit

IV. PERFORMANCE ANALYSIS

Four samples of rice leaves are taken and each are named Sample1, Sample2, Sample3 and Sample4 respectively. The colour values of each are measured and are tabulated.

(sample 1)

(sample 2)

(sample 3)

(Sample 4)

Figure 4 SAMPLE LEAVES

The above Figure 4 of sample leaves 1 to 4 pictures describes the four different samples of leaves which are going to be tested by the colour sensor for finding their intensities in colour.

V. EVALUATION USING COLOR SENSOR

The experimental evaluation gives palette numbers in exact values which helps in calculating exact value of fertilizer to be dispensed.

Table 3 RGB VALUES CORRESPONDING TO CROP SAMPLES

CROP SAMPLE	RGB
Sample 1	102 138 58
Sample 2	124 170 70
Sample 3	170 234 95
Sample 4	174 167 21

MANUAL EVALUATION

The manual evaluation causes the palette number to be in 0.5 precision.

Table 4 MANUAL EVALUATION OF CROP SAMPLES

CROP SAMPLE	PALETTE NUMBER
Sample 1	3
Sample 2	2.5
Sample 3	3
Sample 4	1

TEMPERATURE MEASUREMENT

The temperature data observed is shown in the following figure.

Temperature = 37.62

SOIL MOISTURE LEVEL MEASUREMENT

The soil moisture level is shown in percentages.

Percentage of soil moisture = 90

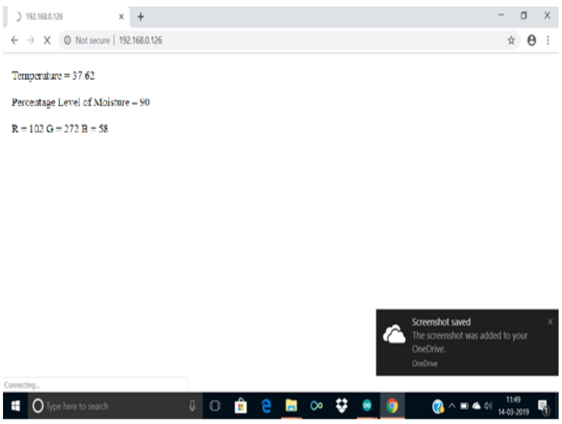

Figure 5 output d

The above Figure 5 shows the output that is displayed in the webpage.

The image shows about the prediction and fertilizer dispension regarding a crop. The above temperature can be used for the rice crop and it also shown the soil moisture value which also suits for the growth of the crop .

The leaf colour shown is up to 272 where the fertilizer dispensed to be taken from the above table which may be organic or inorganic fertilizers.

Using the soil moisture sensor the moisture level is measured and the water is supplied depending on the threshold value given. The temperature is monitored continuously using an analog temperature sensor. Saturation in the rice crop samples are observed using the TCS3200 colour sensor. Fertilizers are applied to the rice crops during the third and sixth week of seed planning. When the crop reaches it's maturity, it is harvested and grain yield is obtained for each crop. From this an accurate amount of fertilizer is given to crops which to increase in the productivity. The experimental results cause an increase in productivity by 5%.

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