

Implementation of Solar Based Multipurpose Agriculture Robot using Random Forest Algorithm

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Abstract: *In India majority of the people depends only on agriculture. Agriculture is the process of working on the ground, planting seeds and growing the crops. Nowadays only few are involved in farming it is because of the increasing of the cost for the pesticides, seeds and equipment, and also increasing of the man power. The major drawback in agriculture field is due to reducing of the crop yield. It is because of lack of awareness towards soil i.e., which crop should be grown on particular area. All these factors will make the farmers not to do the farming in an efficient way. This paper proposes Solar based multipurpose agriculture robot using Random Forest Algorithm. This system will reduce the manpower and increase the crop yield. This proposed system will do operations like seed sowing, pesticide spraying, solar panel for getting the energy to run the robot etc. The total work should be done with almost emerging technology like Machine learning. In this we are using a random forest algorithm concept for getting an efficient output which will be more helpful to the farmers and output can be displayed with a mobile app so that he/she can see the details of the field in an easier manner.*

Keywords: Random Forest algorithm, IoT Cloud, Seed Sowing, Pesticide Spraying, Solar panel, Robot mechanism

I. INTRODUCTION

Agriculture is one of the main occupations in India. 60-70% of people in India are in agriculture sector. India is also second largest producer of rice, sugarcane, groundnut, cotton, fruits, vegetables. As the population is increasing day by day the consumption of food is also increased so in order of that the farming has also increased. To also benefit in time, quality and quantity of food there are various technologies being used and invented to use in the fields of Agriculture. Some of those technologies are like internet of things, machine learning. So, these technologies are used for monitoring and controlling of a device anywhere in the world. So as the population has been increasing enormously, there is also a study saying that food demand may increase between 59%-98% by 2050. But due to the present environmental conditions and climate changes such a high cultivation of crop may become difficult. So, more advanced technology, equipment's may be used for farming at a very low price.

India is rich in agriculture. So, in a way to increase more yielding, every agriculture procedure come under the point like irrigation, seed sowing, pesticide spraying, excess water removal, checking crop and the environmental conditions.

But due to the modern civilization, the adults now a days are not interested in the field of agriculture as there are very less opportunities in the field of agriculture. So subsequently there will decrease in labor or people to work in the farm field and the farmer of the field have to work alone for longer time in the field and it is also a time taking process and there may also not a guarantee of the harvest, the case of misfortune due to unexpected climate and environmental conditions.

We can use the solar energy from the sun which gives less electricity bill and environment friendly can be a very good advantage in farming. So the work presented in this paper is highly motivated by the future low scarcity of labor in agriculture that is going to create a great problem. So, in order to decrease that a model was proposed for multipurpose

use in agriculture which is automated. In [1] they performed one operation with the help of sensors that is to send the surrounding temperature and humidity values and amount of light absorbed by the plant. In [2-3] similar type of works has been performed they are seed sowing, pesticide spraying and sending water through the plant. In [4] crop monitoring from animals and pH value was done.

Machine learning is the capability of a machine to imitate the intelligent human behaviour. It is the most popular technology and it is subset of Artificial intelligence. With the help of this advanced concept, we are going to make a machine which can perform multiple operations and gives the better result to the labor. In [5] they designed a system by using machine learning technology, in that the machine is capable to send the water to the plant and also measures the temperature and humidity of the surrounding atmosphere. Here it works with a decision tree algorithm. Decision tree algorithm is a supervised machine learning algorithm, with the help of decision trees we can estimate the output and dataset is used for identifying the sensor readings and temperature and humidity values. But the efficiency with decision tree was not that good and if more number of applications were added then approach will not be sufficient.

II. METHODOLOGY

The methodology for solar based multipurpose agriculture robot using Random Forest Algorithm consists of two parts. First part is working principle of the proposed system and second part is overall block diagram of the proposed system.

2.1 Working Principle:

The proposed system does mechanism such as: Ploughing Mechanism, Seed sowing Mechanism, Pesticide Spraying Mechanism, Water Spraying Mechanism, Excess water removal, Grass cutting Mechanism, Crop Monitoring Mechanism. The proposed system uses the Raspberry Pi Pico board. The proposed system integrates all the above-mentioned functions into a single robot and perform the operation automatically. There will be various types of sensors will be used in the system such as Water level sensor, DHT sensor, soil moisture sensor for monitoring the crop using Random Forest algorithm. So, our proposed system will be integrated in such a way that it takes all the required information from the sensors. The proposed system works using the machine learning technology. Machine learning algorithm which will be used is the random forest algorithm. The code for the above-mentioned algorithm will be written in micro python.

The proposed system detailed flow or working will be as mentioned below:

1. Firstly, all the sensors will be initialized.
2. Then after the sensors start detecting the values.
3. The values which are detected are read i.e., displayed.
4. Next the ideal measurement values that will be needed will be already dumped into the program and then the taken sensors detected measurements and the ideal measurement values are compared.
5. Then our Machine code will be run which uses the random forest algorithm and sensor readings.
6. Next the NPK values will be entered and then will be processed and there will be some output.
7. Based on that output the farmer can also decide which crop should be yielded.
8. Next the hardware information is shared to the mobile app through the IoT cloud.
9. Then the required command can be given to the farmer.

2.2 Random Forest Algorithm:

Random forest algorithm is one of the machine learning algorithms which is supervised. It is mainly used for classification and regression problems. It is a classifier that contains several decision trees on various subsets of the given dataset to improve the accuracy of dataset. It contains more decision trees and it is useful whenever more number of applications are present. It is the fastest algorithm and accuracy for this will be very high. Output for this will be very high. Output for this will be based on the majority of the voting or averaging of the output that will be the final output.

Steps Involved in Random Forest Algorithm:

1. Selecting samples from given data.
2. Construct a decision tree for training data.
3. Voting will be done by averaging decision tree.
4. Majority of voted result is the final output.

About usage of Algorithms:

In [5] they used a Decision Tree Algorithm, this algorithm is not stable and accurate for more number of applications. It can be worked for two to three applications so it might be not efficient. In case of Random Forest Algorithm we are having the accuracy around 80 to 90 %. And also it can work with more number of applications, and based on the majority or voting we can predict the output. So, Random Forest Algorithm will be more preferable compared to the Decision Tree Algorithm.

Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence.

In this project we are using Random Forest Algorithm from the machine learning Algorithms because the Random Forest Algorithm gives the accurate result compared to the other algorithms in the Machine Learning and this Random Forest Algorithm is very much useful for our project in giving the accurate results and giving the proper suggestions for the farmer

2.3 Block Diagram

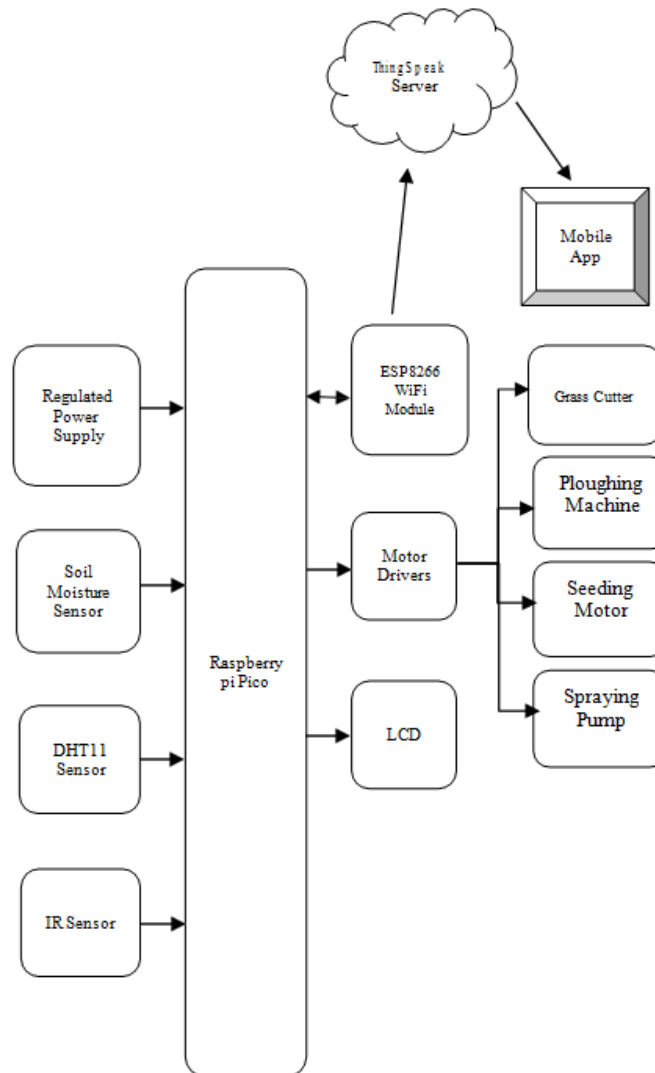


Fig 1: Block Diagram

The above Block Diagram shows the components used in our Project. We have used ESP8266 WiFi module to inter connect the kit with the mobile to control it. We have used three different types of sensors in our project they are Soil moisture sensor, DHT11 sensor, IR sensor these Sensors are used to monitor the environment conditions of the field which helps the farmers to know the weather conditions.

We are using a LCD display to display the temperature and humidity values of the atmosphere which is very needed to the farmer to know. In our project diagram there are four different types of motor drivers like Grass cutter, ploughing mechanism, seeding mechanism, Spraying mechanism. These all are run using ThingSpeak Server using IoT cloud.

III. FLOW CHART

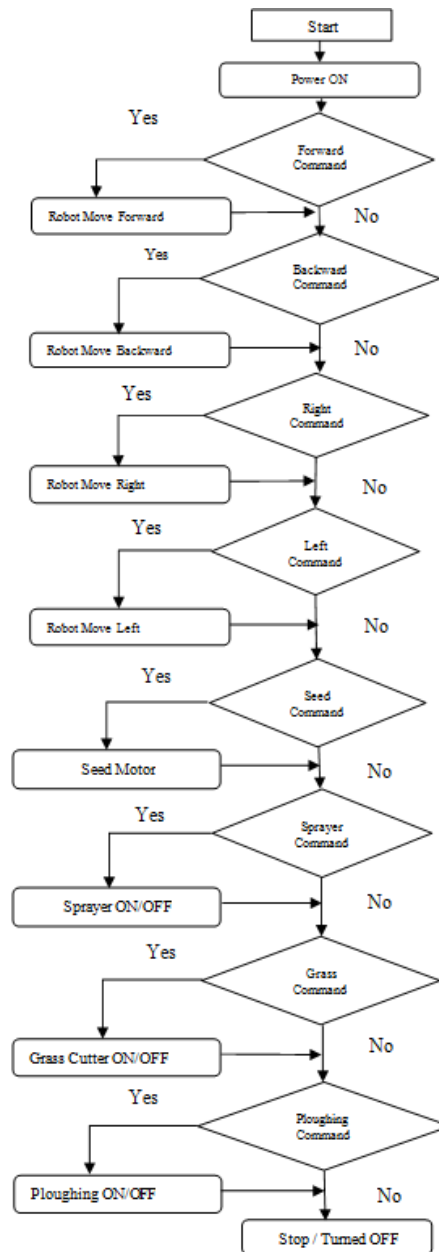


Fig 2: Flow Chart

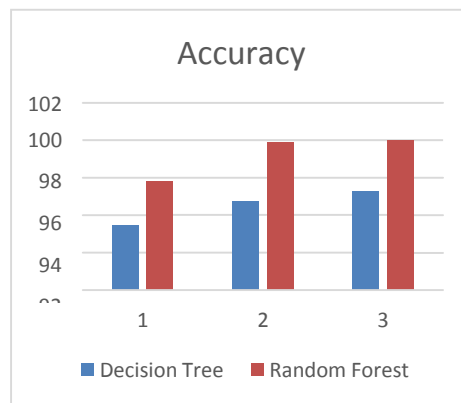
IV. SAMPLE DATASET

Data set containing the values are loaded into Random Forest Algorithm. These values are used to train the model accurately.

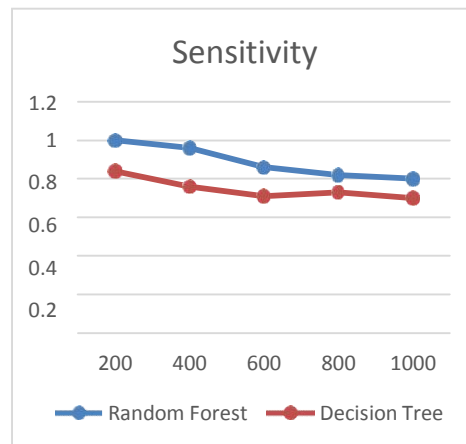
S.No	Temperature	Humidity	Moisture
1	36	76	81
2	40	86	70
3	41	79	71
4	43	75	76
5	29	76	67

Table.1: Sample Dataset

4.1 Graph



Graph.1: Accuracy for DT & RF



Graph.2: Sensitivity of DT & RF

Formulae:

- Formula for Regression Problems is
- Formula for Classification Problem is

V. EXPERIMENTAL RESULTS

The designed robot will work with the help of solar panel, this solar panel will take the energy from the sunlight and converts it into electricity. This robot contains a button and the person will give the directions to the robot by clicking on /off, left, right etc.

The entire prototype of solar powered multipurpose agriculture robot is shown in Fig.3.

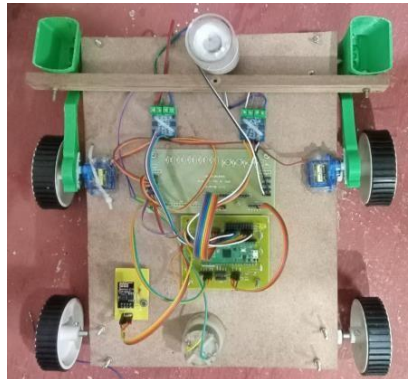


Fig 3: Prototype of Robot



Fig 4: Crop monitoring System



Fig 5: Agricrop Suggestion

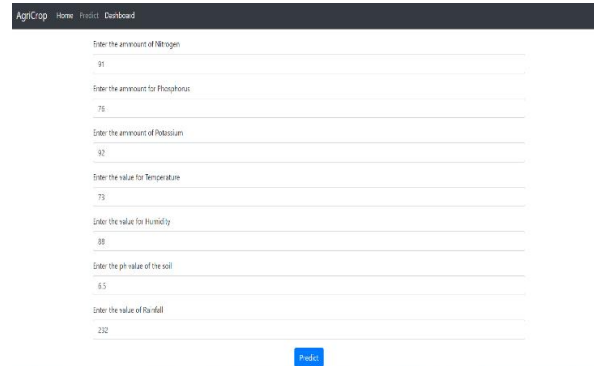


Fig 6: Agricrop Prediction

VI. CONCLUSION

In this proposed system we are going to perform enormous operations like seed sowing, pesticide spraying, water pumping and removing excess water from the field by using pipes, harvesting, checking the nutrients like Nitrogen, Phosphorous, Potassium values in the field by using an efficient code. All these things will be effectively done by writing the code using Random Forest Algorithm concept with efficient output. This will give a more amount of efficiency and by using a robot we can perform multiple operations.

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