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Research Article

Agricultural Resource Sharing And Crop Management

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Abstract: In this paper, agricultural resource sharing and the best suitable crop prediction has been considered. Four-Wheel Robo is built that can move in agricultural fields and the NPK sensor is attached to it which can be controlled using a remote desktop. To get the soil data, the sensor is inserted into the soil with the help of a gear motor and controlled using IR sensors. NPK sensor gives the nitrogen, phosphorous, and potassium values in ppm. The values from the NPK sensor and actual NPK values for each soil got from search engines and websites are compared and the nearest value is mapped, doing this best suitable crop is predicted. The data from the sensor is also stored and accessed from the firebase cloud. .For agricultural resource sharing android application has been built through android studio IDE. The application consists of categories like types of machinery, saplings, seeds, empty fields, laborers, and fertilizers. An application can be differentiated into two parts owner and tenant. The owner uploads the resources that are not currently required to him and the tenant uses the resources by paying the owner with some adequate amount as mentioned by the owner. So, the android application behaves like a platform between owner and tenant. The processor used to process the sensor data, predict the best suitable crop and uploaded it to Firebase cloud using an internet connection. The latest NPK commercial crop and fruit data can be seen in the android application with GPS (latitude and longitude) values.

Keywords: Agriculture, Android, Rpi3

1. Introduction

Agriculture is an important part of the Indian economy and is currently one of the two leading producers of Agricultural Produce worldwide. The Agricultural farming sector provides a major percentage of the total jobs available in India and contributes to about twenty percent to GDP. Agriculture is the only source of livelihood for about two-thirds of the rented sector in India. According to the economic data for the 2006-07 financial year, agriculture accounted for 18 percent of India's GDP. The Indian agricultural sector occupies about 43 percent of the Indian subcontinent. The economic contribution of agriculture to India's GDP is steadily declining mainly because of Urbanization. So, the requirement of proper communication between the farmers becomes necessary to increase the yield. Smart Agriculture allows farmers to increase yields using inputs such as the amount of water, the percentage of N P K fertilizer needed, and the type of seeds to sow. By using sensors and mapping platforms, an understanding can be got to determine the type of crop to be grown, conserve resources, and reduce environmental impacts at the same time thereby increasing the yield [3].

2.Overview

The proposed system shown in figure 1 consists of a Robot with the NPK sensor, RPI-3, and the IR sensor fitted to it. The Robot is designed using a 4-channel relay,30rpm 4 gear motors, and 12v battery,raspberrypi3,5v dc, Two Infrared sensors are used to monitor the depth of the NPK sensor in the ground. Movement of NPK sensor is controlled using gear motor by sending commands using 2-channel relay. Connectivity Established between raspberry pi3 and the phone or Laptop using Wi-Fi and hotspot respectively. Connect RPI and phone using juice application via SSH connection or connect RPI and laptop or Desktop using Remote desktop application or using angry IP scanner, putty, VNC server to access remotely. Authentication is made by using IP addresses. The motor control code which is written in python language makes the robot move in fields using A(Left movement), W(Forward movement), S(Backward movement), D(Right movement), and press the Y (NPK sensor UP movement) and H (Down movement) key to insert the NPK sensor into the soil and get back to the original position of NPK sensor respectively.

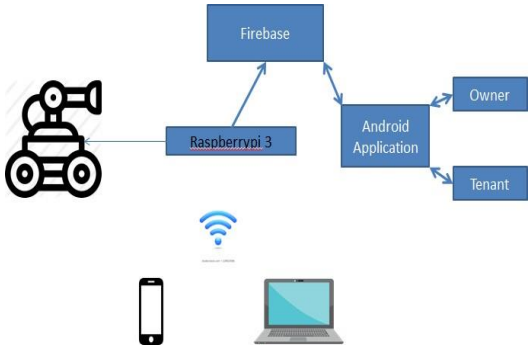

Figure 1. Block diagram of Proposed System

After insertion of NPK SENSOR into the soil, collection of data begins using a command sent using the terminal, and nitrogen, phosphorous, potassium values will be stored in the text file named NPK.txt. While collecting the N, P, K data the NPK sensor will be in soil at that moment if in case of robot movement happens due to the wrong key pressed or some other issues, then NPK sensor will damage to avoid this problem we have coded in such way that if any key pressed, the first sensor should come back to the original position while collecting the data, after that, it should take the remaining commands this is called as fault management.

Run the prediction code which is written in python language and using a machine learning algorithm i.e. KNN algorithm. KNN algorithm predicts the best suitable commercial crop and fruit which can be grown in the soil which we tested using a new dataset i.e. NPK.txt with the sampled data. The output is uploaded to the firebase real-time database. At the same time, the data is sent to an Android application which can be accessed by the user remotely.

We have developed an application which will help farmers to lend their Daily-used products. This is IOT based application, which connects all the resources through the internet to make use of it. So this application behaves as a platform to interconnect farmers. Initially, one who wants to use the application has to create an account then this app allows one to log in. Select the required categories and add button will be their user can access that add button to upload the resources what user wants to share with all the details. Upload all the details which will be authenticated. Add photos, phone number, and cost of the resource/days. Click on Submit button, after the user submits, all the data will be stores onto the firebase. Book now to post the resources. Add the details in the given boxes, Confirmation mail will be sent to your registered email id after booking has been confirmed.

This paper is divided into the following sections:

- Section III: Methodology.
- Section IV: Software part: Here the agricultural resource sharing is done through an android application and also the best suitable crop is shown in the application with the GPS latitude and longitude values.
- Section IV: Hardware part: The NPK values is sensed from the sensor, processed, and compared with the Actual values from the search engines and website. At the same time, the data from the sensor is upload to the firebase real-time database which can be accessed from anywhere.

3.Methodology

- Designing of Robot using a 4-channel relay,30rpm 4 gear motors and 12v battery,raspberrypi3,5v dc.
- Two Infrared sensors are used to monitor the depth of the NPK sensor in the ground
- Movement of NPK sensor is controlled using gear motor by sending commands using 2-channel relay
- Connectivity Established between raspberry pi3 and the phone or Laptop using Wi-Fi and hot stop respectively
- Connect RPI and phone using juice application via SSH connection or connect RPI and laptop or Desktop using Remote desktop application or using angry IP scanner, putty,vnc server to access remotely
- Authentication made by using IP addresses
- Run the motor control code which is written in python language and make the robot move in fields using A(Left movement), W (Forward movement), S (Backward movement), D (Right movement), and press the Y (NPK sensor UP movement) and H (Down movement) key to insert the NPK sensor into the soil and get back to the original position of NPK sensor respectively
- After insertion of NPK sensor into the soil collection of data begins using a command sent using terminal and Nitrogen, Phosphorous, Potassium values will be stored in a text file named NPK.txt

- While collecting the N, P, K data the NPK sensor will be in soil at that moment if in case of robot movement happens due to the wrong key pressed or some other issues, then NPK sensor will damage to avoid this problem we have coded in such way that if any key pressed the first sensor should come back to the original position while collecting the data, after that it should take the remaining commands this is called as fault management.
- Run the prediction code which is written in python language and using machine learning algorithm i.e KNN algorithm
- KNN algorithm predicts the best suitable commercial crop and fruit which can be grown in the soil which we tested using a new dataset i.e. NPK.txt with the sampled data
- The output is uploaded to firebase real-time database. At the same time, the data is sent to an Android application which can be accessed by the user remotely
- We have developed an application which will help farmers to lend their Daily-used products. This is IOT based application, which connects all the resources through the internet to make use of it. So this application behaves as a platform to interconnect farmers.
- Initially, one who wants to use the application has to create an account then this app allows one to log in. Select the required categories and add button will be their user can access that add button to upload the resources what user wants to share with all the details
- Upload all the details which will be authenticated. Add photos, phone number, and cost of the resource/days. Click on Submit button, after the user submits, all the data will be stores onto the firebase.
- Book now to post the resources. Add the details in the given boxes, Confirmation mail will be sent to your registered email id after booking has been confirmed.

4.Software

Agricultural resources like types of machinery, labors, seeds, saplings, empty fields are shown after the login of the user. The user can be either the owner or tenant, the owner can lend his resources and the tenant can get to access the resource after confirmation from the owner. Thus, creating the platform for sharing agricultural resources. The list of Software components used in data transformation are as follows:

a. Android Application (Owner and Tenant)

b. Realtime Database

The android application shown in figure 2, is created using Android studio which includes java and XML programming. Initially, users have to create an account using the signup option in the application. The data to the application is sent over the internet from the firebase. To increase user experience, the sensor values are preprocessed and sent to an android application through WIFI.

Figure 2. Android application.

Data from the mobile application is stored using the Realtime Database i.e Google Fire-Base Realtime Database. Since it is a Realtime Database i.e NoSQL database, as a result, it tends to have different configurations and performance compared to related data. For this reason, it is important to consider how users need to access the data and use it accordingly, Figure 3 gives the graphical representation of the database.

Figure 3. Firebase Real-time database

5.Hardware

At the hardware, the Infrared sensor is made to monitor the depth of the NPK sensor in the ground. The Data from the sensor is collected in Raspberry Pi 3 which is then processed to get the optimized output and the output is uploaded to the firebase realtime database. The list of hardware components used in the robot are as follows:

a) NPK sensor

b) Raspberry Pi 3

c) IR sensor

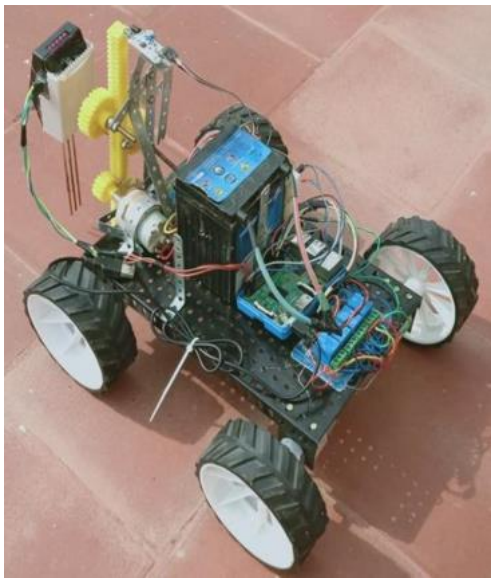

Figure 4 Robot with the sensors

6.Android Application.

An android application is created using Android studio which includes java and XML programming. Initially, users have to create an account using the signup option in the application. The data to the application is sent over the internet from firebase, So the end-user can see the soil parameters along with the best suitable crop prediction.

7.Implementation.

The main parameters for implementation are:

a. NPK values. (in ppm)

b. Predicting the best suitable crop.

The application user assigns the NPK sensor to extracts the N, P, K values from the soil at a provided location. These values are preprocessed in RPI3 before feeding into the model. The processed data is sent to find the best suitable crop which is predicted by using the k-nearest neighbors (KNN) algorithm as shown in figure 5 and figure 6. The latitude and longitude values are detected by an android application to keep track of the location.

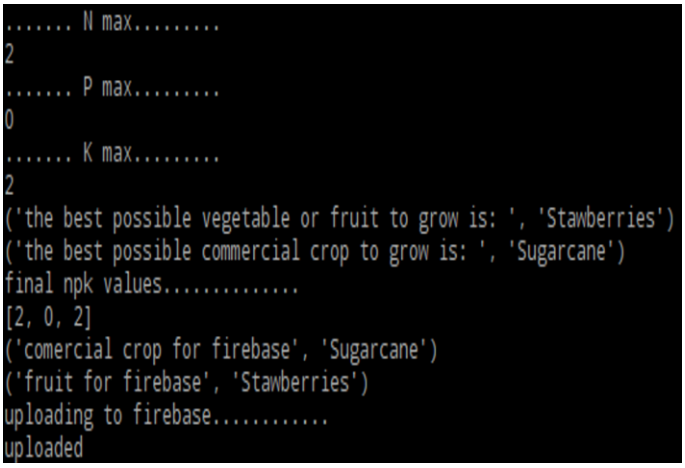

Figure 5. Predicted Results from NPK Values

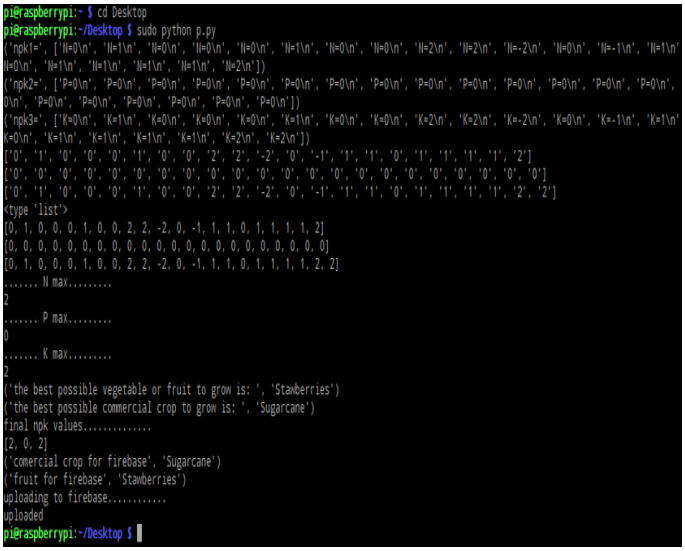

Figure 6. Extracted and Processed NPK Values

8.Results And Discussion

In the Android application, the location and best suitable crop prediction can be seen. The best suitable crop prediction is predicted by considering the data set values and mapping the values with Actual real values from search engines and websites. The data from the sensor can also be seen and analyzed in the firebase real-time database where every value can be viewed in real-time. Figure 7 displays the N, P, and K values transmitted by the robot to the firebase database. The model can be controlled from anywhere by a remote desktop after getting the IP address. Which makes it userconvenient.

Figure 7. Best suitable crop prediction in android application

9.Conclusion And Future Work

The current system is capable of predicting the best suitable crop and sharing agricultural resources among the users. The system can be improved by adding many datasets and as the user increases the efficiency of the system increases accordingly. Optimized hardware can provide strength in the real-time scenarios. The fertilizers and pesticides required for the predicted crop can also be implemented along with the procedure to grow crops.

References

1. Liu-Shihong “Agricultural Technique and Information” Beijing: China Agricultural information Publican 2005, pp.91-130.
2. [online]available:http://www.slideshare.net/maastechlagriculture-projectsembedded-system-based-gsm-communication-for- automatic-irrigation-control-system
3. The impact of irrigated agriculture on a stable food supply", 22nd Annual Central Plains Irrigation Conference, pp. 24-25
4. Ravi Gorli, G. Yamini “Future of Smart Farming with Internet of Things” Journal of Information technology and Its Applications., 2 (1) (2017), pp. 27-38
5. S. jegadeesan, dr. g. k. d. Prasanna venkatesan “Smart cow health monitoring, farm environmental monitoring and control system using wireless sensor networks”, International journal of advanced engineering technology, Jan-March 2016, page 334-339
6. M.K. Anushree, R. Krishna “A smart farming using Arduino based technology”. International Journal of Advance Research Ideas and Innovations in Technology., 4 (4) (2018), pp. 850-856
7. Vaibhavraj S. Roham, Ganesh Pawar, Abhijit Patil & Prasad Rupnar, “Smart Farm using Wireless Sensor Network”, International Journal of Computer Applications, National Conference on Advances in Computing, NCAC 2015
8. Dimitris S. Paraforos et al, "A Farm Management Information System Using Future Internet Technologies", IFAC-PapersOnLine 49-16, 2016, PP 324–329.