

Analysis of IoT based crop field monitoring and leaf nutrients

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Abstract: Internet of things provides interaction among device using internet connection. IOT plays a major role in agriculture industry. Crop monitoring and Irrigation automation plays a vital role in the growth of agriculture. In this paper we are going to develop a system that monitors the crop using sensors and automate the irrigation system with the help of internet of things. The data collected from the sensors are stored in a database for periodical monitoring and notification will be send to the farmer or owner when the water level goes down below the brink. Three methods of Irrigation are applied according to the needs they are Drip irrigation (water dropped periodically to the root of plants), Pot irrigation (Holes are made into the pitchers to keep the soil moist) and Evapotranspiration (Moisture from the earth is transferred to the atmosphere) .It is easy to adapt in all fields and it is inexpensive. The analysis of leaf disease is done by using machine learning algorithms.

Keywords: IoT, Machine Learning, Agriculture, Crop monitoring, leaf

1. INTRODUCTION

Agriculture is the important research field since it is a backbone of the country. IoT plays a major role in efficient crop monitoring and agriculture field. IoT constructs a network by connecting different devices. IoT provides connected devices to identify and communicate with each other. This system is more efficient and less expensive. IoT in environmental monitoring provides monitoring of temperature, soil, and humidity level of the agriculture field. Cloud computing provides global access of data. The data regarding agriculture are stored in cloud and it can be accessed from anywhere at any time. Cloud computing is used to store, analyze and process the data related to agriculture field. Irrigation method such as drip irrigation, pot irrigation and evapotranspiration are used for automatic irrigation. The leaf is analyzed using machine learning algorithm. Machine learning algorithm is used to measure the nutrients in the leaf. The nutrients present in the leaf is analyzed using convolution neural network and support vector machine

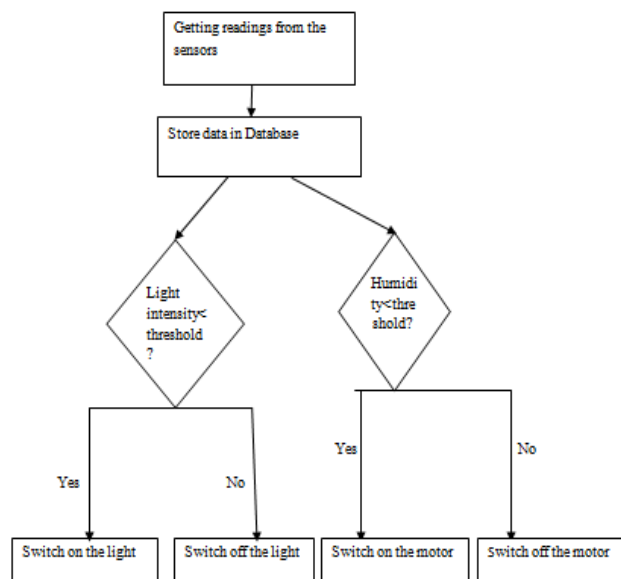


fig1: Flow diagram

2. RELATED WORK

IoT Based smart security and monitoring devices for agriculture

This system mainly focused on the methods to solve problems like identification of spoiled, threats to crop and delivery time notification based on information analysis. It achieve success at the rate of 84.8%.PIR sensor and URD sensor are used to incorporate pattern recognition techniques

Smart management of crop cultivation using IoT

Novel smart IoT based agriculture system was developed to help farmers in crop management by updating the data regarding the field. This system integrates the concepts of machine learning, IoT and thing speak. It provides greater climate adaption and it also consider the overall benefit of adopting the model is greater remote monitoring of connected farm

IoT Based drone for crop quality management

Sensor such as gas sensor, RGB-D sensor, Adafruit AMG883 IR Thermal camera were used to monitor the crop quality .Hyper spectral imaging technique was difficult to implement and it provides greater accuracy. Several solutions were combined regarding agriculture drones for the betterment of agriculture.

3. PROPOSED SYSTEM

In this system temperature sensor, soil moisture sensor and light sensor are used to the measure the temperature value, moisture level and light intensity level of the plants. The readings will send to the arduino and then the signals are processed .The readings will be checked if it is not equal to threshold value then it will send an alert message to the farmer .When moisture level is not equal to threshold value then the motor will be switched on and then the light will be switched on when the light intensity is not equal to the threshold value. The leaf disease is analyzed using machine learning algorithm

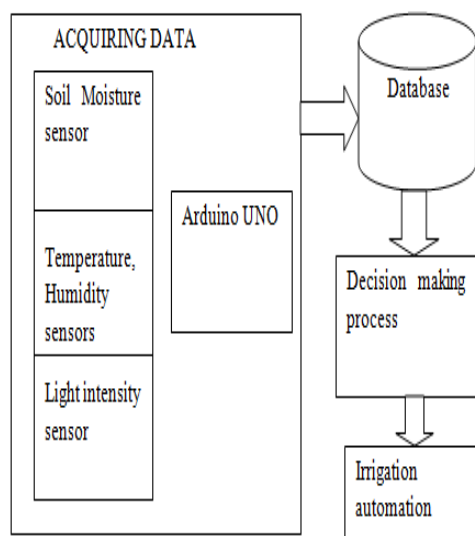


Fig2 System architecture

There are three modules in this system they are sensing module, Alerting module, analysis module and .this represents the process of the system

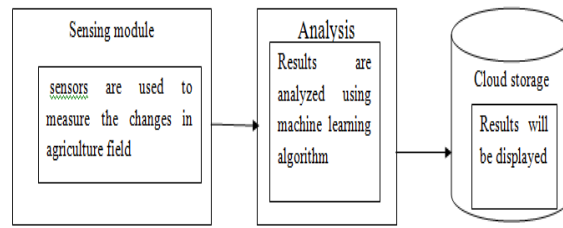


Fig 3 Modular Description

a) Sensing module

In this module sensors are used to monitor the agriculture field. Light sensor is used to measure the light intensity in the field. When the light intensity value is not equal to the threshold value then the light will be switched on. Soil moisture sensor is used to measure the humidity level in the field. Temperature sensor is used the atmosphere temperature in the agriculture field. When the moisture level and the temperature level is below the threshold value then the motor will be switched on. LCD is used to display the temperature, moisture level and light intensity of the agriculture field. GSM is used to send alert message to the farmer and the care taker in an emergency situation.

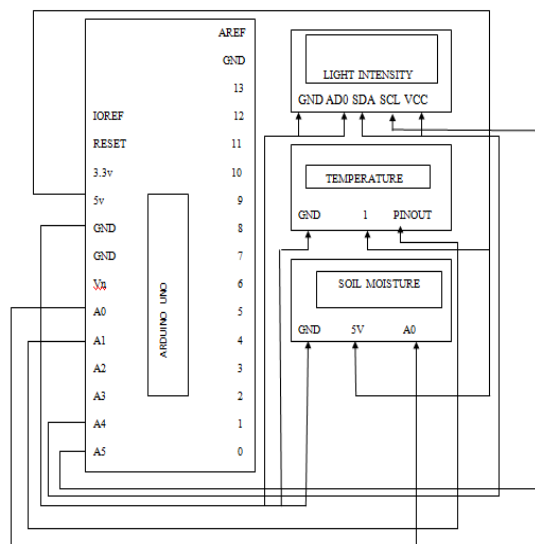


Fig 4Pin diagram for agriculture monitoring

b) Cloud storage

Cloud storage can be accessed from anywhere at any time and it also provide backup files when any disaster occur. It also gives remote access of data and files. Cloud computing sustain global access of data by farmers. The main advantages of using cloud computing are security, minimum expenses and provide faster data transmission rate.

c) Analysis

The analysis of leaf disease is detected using machine learning algorithm. It can be done using mat lab. Machine learning is used to measure the nutrients in the leaf. It is analyzed using convolution neural network and support vector machine. From these algorithms support vector machine gives more efficiency and gives more accuracy. It will give the nutrients details such as Chlorophyll, potassium and nitrogen

d) Algorithm

Support vector machine is a machine learning algorithm used to analyze the data for classification and regression .It is capable to handle the large data. Over fitting is controlled by using this algorithm. This system gives more accuracy and efficiency

Steps for Support Vector Machine

- | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Load the data set • The right hyper plane is identified that splits the input space • Classify the class values • Train and test the classified data • The accuracy is detected |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Convolution neural network

Convolution neural network has three layers such as input layer, output layer and hidden layer .There are several stages in CNN they are input, convolution, detector, pooling, Normalization, output. This system reduces the complexity and reduces the number of connections

Steps for Convolution neural network

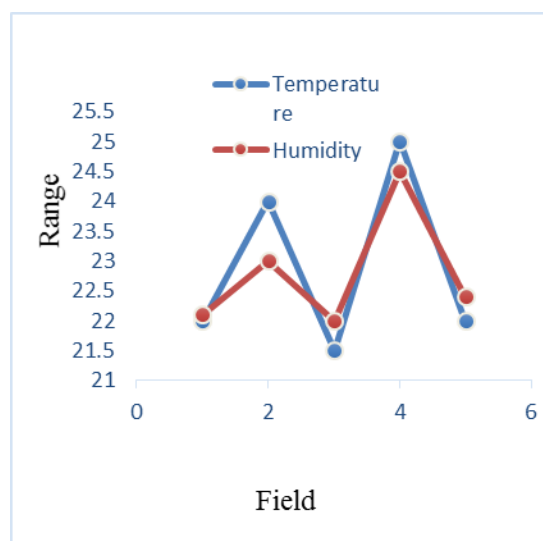
- | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Load the dataset • Select the required features and then train the model • Test the required features and then the accuracy level is detected • Accuracy level is compared with other algorithms |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

4. RESULT ANALYSIS

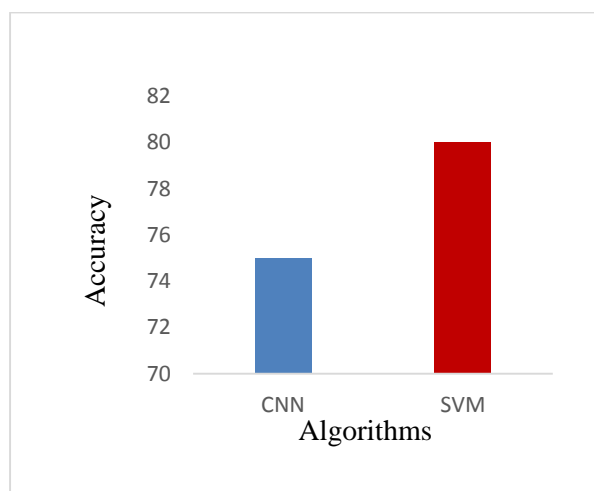


Fig 5 Connection of monitoring system

The above fig 5 represents the connections of the agriculture monitoring system. Temperature sensor, soil moisture sensor, light intensity sensor are connected and the signals are amplified are send to the arduino and then they are processed.LCD is used to display the values from the sensors.GSM is used to send the alert message to the farmer.



The above graph represents the level of temperature, humidity in different agriculture fields. The temperature and the humidity of the field is linear to each other



The above figure represents the accuracy level of both the algorithms from that SVM gives more accuracy level

5. CONCLUSION

Monitoring the crop in agriculture field is not easy process and analyzing the nutrients present in the system. In this system a solution is developed to monitor the agriculture field and to analyze the nutrients present in the system using MATLAB. Temperature, humidity and light intensity of the agriculture field is monitored and when the measures are not equal to the threshold value then the motor and the light will be switched on. The nutrients present in the leaf are analyzed using MATLAB. Convolution neural network and support vector machine algorithm is used to analyze the leaf. From this machine learning algorithm support vector machine gives more accuracy and efficiency.

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