RESEARCH ARTICLE

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Intelligent Agriculture System with Crop Selection Using Internet of Things

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Abstract

This paper is about the prototype implementation of Raspberry pi based intelligent agriculture system using IOT. This system tries to implement irrigation from places where the physical examination of data is difficult or not needed. The main objective of this paper is detection of diseases at the early stage. We mainly focus on machine learning algorithm like KNN. This includes a series of steps from capturing the real time image of leaf to spotting the diseases. Irrigation in the India is primarily based on the rainwater, which is also the primary source of water. The soil type is instrumental in deciding in what way crops are to be provided with water by checking water level of soil. From the data established or gets from sensors and current condition of the soil , best suited crop is selected. Parameters such as temperature, humidity, and moisture and water pump status are shown on mobile app. Values of these parameters are changed according to best condition essential for the particular crop.

Keywords: Camera, Mobile app, Moisture Sensors, Raspberry pi, Temperature Sensor, Ultrasonic Sensor.

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Introduction

In Indian subcontinent, farming is a major source of food production due to the rising demand of the human population. In agriculture,irrigation is an essential process that reflects on production of crop by supplying water to the needed crop to be taken on land. Farmers have to visit their respective land to check how much amount of water is required for their crop. This irrigation method is more time and energy intense particularly when a farmer needs to irrigate multiple agriculture fields distributed in different geographical areas. Generally farmers should be present in their fields to do irrigation process. But nowdays many farmers prefer to do other occupation along with farming. Using automation in the smart irrigation system makes farmer work much easier. Smart automated irrigation system using raspberry pi as micro controller provides a solution to farmers where the presence of farmer in the field is not compulsory. Now a day's internet is widely used. Using internet farmer know about the farming field and irrigation status. Thus provided mobile application is helpful in fulfilling this purpose. It benefits farmers to know the current status of farm fields like soil humidity,moisture and temperature over a provided mobile app and it will make the farmer at some remote places to decide whether he/she needs to watering the land/crop or not. The moisture sensor is used to check moisture level present in the soil. From sensor data one can investigate out whether the soil is dry or wet. The moisture sensor and temperature sensor are fixed with raspberry pi as microcontroller. Based on the current sensor values, the controller will activate the water pump by checking water level it will turn on if water level is low . Water is a very precious resource for farming and must be properly utilized. Agriculture is one of those areas which includes consummation of more water. It is important to know the amount of water that has been used in the irrigation process during farming. This paper describes a simple system implementation by using raspberry pi as microcontroller and Android software to automate the existing manual irrigation system.The IOT is the inter connection network of physical

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devices including some security appliances,vehicles,home appliances and some other items embedded with electroni cs,software,sensors,actuators. The interconnection between these devices allow these things to join and exchange data. This also gives results to advance productivity, correctness and financial benefit and it may also diminish human hard work. Sensor based smart farming is a catchy concept in the agricultural business. Using this concept one can achieve high-precision crop disease control, useful data collection, and automated farming techniques.

Motivation

The IOT(Internet of things)allows by collecting the real time values or substances to be measured remotely across network devices or structures.It helps to increases chances for the more direct incorporation of the physical world into computer based structures, and resultant in enhanced productivity, correctness and financial profit in addition to reduced human intervention. The network of devices, security, vehicles, homebased utilizations and other objects fixed with electronics, software, sensors, actuators and the network connectivity which allow these stuffs to attach and exchange data using Internet of things. Smart farming using IOT is a emerging concept in the farming business. Here using IOT we can control crop diseases , useful data collection, and automated farming techniques can be achieved. Due to lack of manpower and other resources there is need of farm automation In our system we have a distributed wireless network of different types of sensors.The main aim of this paper is to measure vital parameters of soil and based on these limits we can regulator the water supply requirement for farm to maintain ambient conditions for selected crop.

Research

The controller demonstrates the number of hours it should work and durations to watering the arena and the distance between each watering cycle in farm. In addition to this Internet of Things based cultivating framework can become amazingly helpful for farmers. It tries to collect record for various climatic conditions such as stickiness, temperature, sogginess. These conditions can be modified based on biological conditions of that particular region. This structure makes the water framework plan in light of the recognized stable data from ground &also the data from the atmosphere store. This structure can recommend for agricultural whether is there a requirement for water or not. The including features of this systems joins sharp GPS based remote-controlled system to do tasks such as weeding, sprinkling, sogginess unique, keeping carefulness, etc. Additionally, it fuses a water framework structure with control and essential management in viewpoint on exact continuous on field data and check water level. It is a splendid dissemination emphasis which joins temperature provision, tackiness maintenance. Monitoring of all of these aspects will be through any greatly device or PC linked with Internet and the trainings will be performed by interfacing the sensors, Wi-Fi, camera and actuators with proper controller and raspberry pi another preparation for any animal remote areas is advanced to enhance the living circumstances of controlled individuals and furthermore decline physical or human work. It is a automated lights, temperature, humidity of soil and sprinklering system. The humidity and moistness control parts guarantee the farmers that the water level in the farm is up to the mark or not. This will achieve a quality and prosperity benefits. For future enhancements, it may be updated by structuring framework up this system is for geographically large pieces of land. Furthermore, the assembly can be used or composed to study the knowledge of the earth and the progression of collect real time values in soil. The actuators/sensors and raspberry pi are directly interfaced and distant correspondence is reached between various centres.All tests exhibit that this model is a response for on ground actions and water problems in farming. Hence use of such a framework construction in the ground can improve the harvesting and the life-span of the farm. The system incorporates a sensor plan for control efficiency, cost-reducing, difficult sections, furthermore versatility. In future, a number of improvements/projects should be done and it would advance the system to a more creative state. 'Web of Things' and 'internet Of Things' is far used in involving devices and get-together experiences. This cultivation framework fills in as a robust and modest system and positive change can be made. The proposed system is very powerful and worth useful for farmers or agriculturists. It gives the data about the temperature, humidity, motor status, water level and the disease of plant field through AAP to the agriculturalist, if it outcome from perfect range. The use of this system in the agree based field can boost the gather of the harvests and overall crop production in farm. The automated water system has been implemented and executed in this paper. The structure made is important and works in a monetarily wise way. It reductions water convention by checking endlessly water level of soil to a progressively unmistakable degree. The system can be used as a piece of greenhouses. The System is amazingly useful in regions or geographical areas where lack of water is a big issue. The performance enhanced and the wastage of harvests & water are especially diminished or low using this computerized water framework system. The made construction is progressively helpful for farmers and gives progressively functional results.

Mathematical Modeling

Figure 1 shows a future system. It contain of sensing units such as Moisture Sensor, temperature sensor to measure the moisturise of the soil and the atmosphere temperature respectively, and a microcontroller i.e. Raspberry Pi for sending and receiving process for transmitting information from sensors to cell phone and receiving commands from a mobile phone. According to the value of different parameters of soil moisture, a list of the best-suited crops is choice from

all harvests. The dynamic values of dissimilar limitations like temperature, humidity, and moisture are shown on the mobile app. The value of monitoring parameters is adjusted according to the different conditions required for particular crop. All the dynamic values are stored on the database and shown into the user mobile at a certain time limit. The image of the leaf is captured using a camera interfaced with Raspberry Pi. This image is pre-processed to denoise it i.e. to remove any unwanted thing, the only region of interest is selected. Main features are extract from the pre-processed image. And then the image of a leaf is classified into diseased or healthy leaf. The progress of a smart agriculture system using sensors, raspberry pi within the IoT system is presented. The main aim is to demonstrate the clever and intelligent capabilities of the system to allow the decisions to be taken for filling the water tank when water gets certain level low and watering the soil based on the continuous monitoring of the soil conditions in the field. It aims at a pre-defined irrigation schedule as per the farmer's convenience. It will upload in the application developed for the same. The system

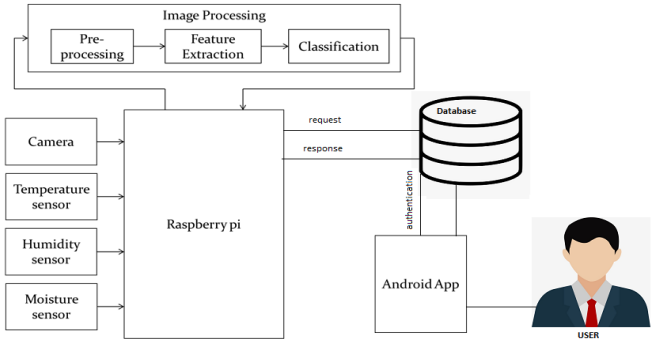

Figure 1: Architecture Diagram of Intelligent Agriculture System

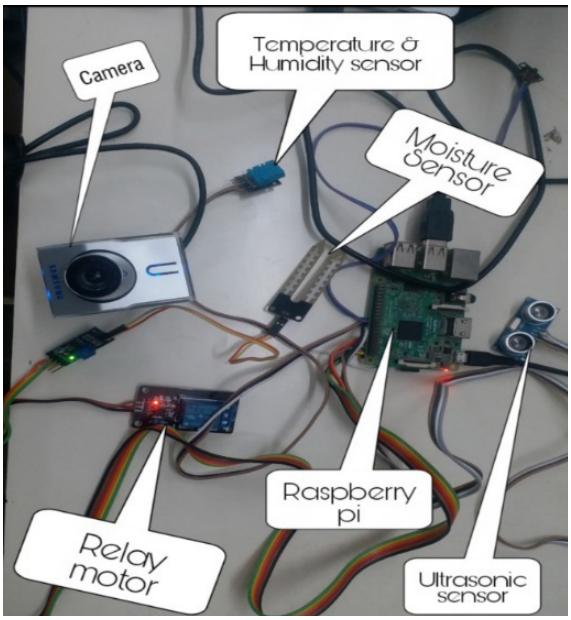

Figure 2: Hardware Implementation

is a low powered automated irrigation system. It will also provide more accurate guidelines for new farmers. Image processing to predict crop diseases and provide guidelines for fertilizer. The project that consists of a wireless network of soil moisture, temperature, ultrasonic sensors that will deployed in soil. These wireless sensors of different types continuously monitor the dynamic values and send it to the Raspberry-pi for further processing the whole system will acts as an IOT. This IOT has been given the wireless capability by installing a Wi-Fi unit which can bring up-to-date the data into the cloud.

K-Means methodology is a group analysis method that leads to the N partitioning of remark tasks into K groups(clusters) where each object of observation is owned by a group with the nearest mean (average). The objective function used for K-Means is determined based on the distance and value of membership data in groups. The objective functions used are as follows:

$$C_l = \frac{1}{M}\sum_{j=1}^{M} x_j \quad \ldots \text{Eq(1)}$$

In this of individually collection taken from the average of all data values for each feature must be recalculated the center point is calculated.If M states the amount of data in a group, i declares the i feature in a group, and p denotes the data dimension, to calculate the feature centroid. The formula is done as many as p dimensions so I starts from 1 to p.

Measurement of Euclidean distance space using a formula:

$$D(x_2, x_1) = \|x_2 - x_1\| = \sqrt{\sum_{j=1}^{p} |x_{2j} - x_{1j}|^2} \quad \ldots \text{Eq(2)}$$

D is the distance between data x2 and x1, and | . | is absolute value.

Results and Discussion

The original image is taken from real time using on filed camera then applies the K-mean clustering so we get the different clustering images after that contrast image and segmented image is taken.There are two diseases are identify from given leaf that are Anthracnose, Phoma blight (Figures 2–4).

Experiment Result

We have provided some random real time pictures of mango leaves using on field camera and after applying knn algorithm it gives different results as shown in screenshots

Figure 3: Contrast & Segmented image

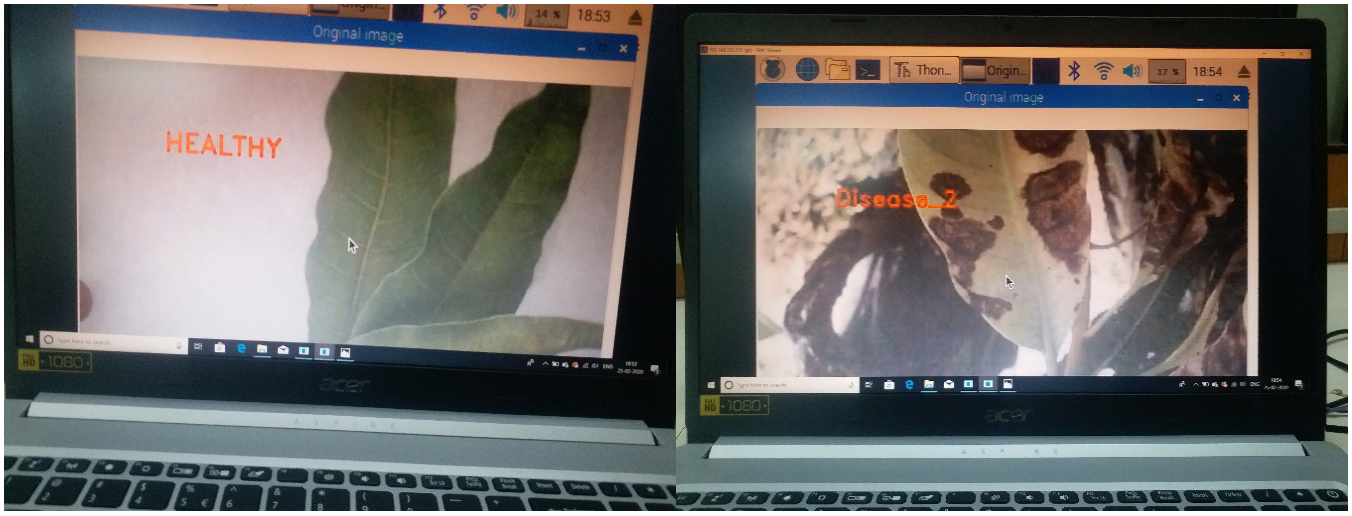

Figure 4: Healthy leaf & Disease detected leaf

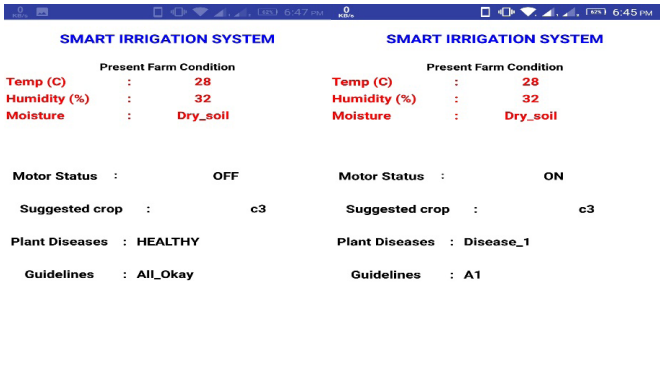

Figure 5: Mobile APP Screenshots

Mobile App Result

Current soli Temperature, moisture, humidity etc. are shown on farmer's mobile app.Depending on current condition of soil it will suggest best crop to be taken in farm,also shows current motor status ON/OFF.

Conclusion

This paper provides an easy to use of interface to control the farm in an efficient way. It monitors the soil moisture, humidity contents and temperature in a farm and the farmer get status of watering motor or pump using Android device. So, the overall design is simple , operation price is affordable and also it is beneficial for a common person.

We have selected Android smartphones platform since it can be used by many people.The plan contains of Android App through which farmer can relate and also send a control signal to the output of the value which will control sensors and also monitor the environmental conditions. This intelligent agriculture system is also very helpful in those areas where there is a scarcity of water and improves their sustainability. Value of required water can also be modified according to the current crop to be taken in farm. Plant Disease identification is a challenging task in farming. For most of the crops the diseases are identified on the leaves of the yield. Basically there are three main cataloguing of Leaf disease: they are Bacterial, Fungal and Viral. Smart IOT based disease detection system improves the speed and accuracy of disease detection.This work can be further extended for development of machine vision system that automatically, classify and quantitatively detects leaf disease symptoms. In this paper three diseases are detected and recognize i.e Aleternaria Atternata, Anthracnose, Bactorial blight One of the major techniques used are K-means clustering. Some of the challenges in these technique are implementation for a explicit plant only.Also effect of the background noise in the taken image ,automation technique for a continuous automated watering system and plant leaf diseases under real world field conditions need to be considered.

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