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IOT Based Smart Irrigation System using Sensors and Image Processing

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Abstract:
Agriculture is the worldwide prime occupation of human being. Due to globalization and population growth the amount of water consumption has increased up to 85% of fresh water which is available. Therefore this is challenge for everyone to minimize the use of fresh food requirement and reducing the requirement fresh water consumption. Due to this maintaining a good irrigation system is necessity in today's water scarcity environment. For this current situation, we are proposing our project. In this project we are using 3 sensors (ultrasonic sensors, soil moisture sensors, temperature sensors) which are interfaced with a Raspberry pi. The system will draw data from the plants using the concept of image processing. These information will be compared with LCC chart and further process of providing the fertilizers will be done.The project is to develop IOT based Efficient Irrigation system Using sensors and Image Processing which will increase irrigation efficiency and will keep a track of Humidity, moisture and Temperature level of the soil throughout the year.

Keywords: Raspberry pi, Image processing, Smart irrigation, LCC.

I. INTRODUCTION

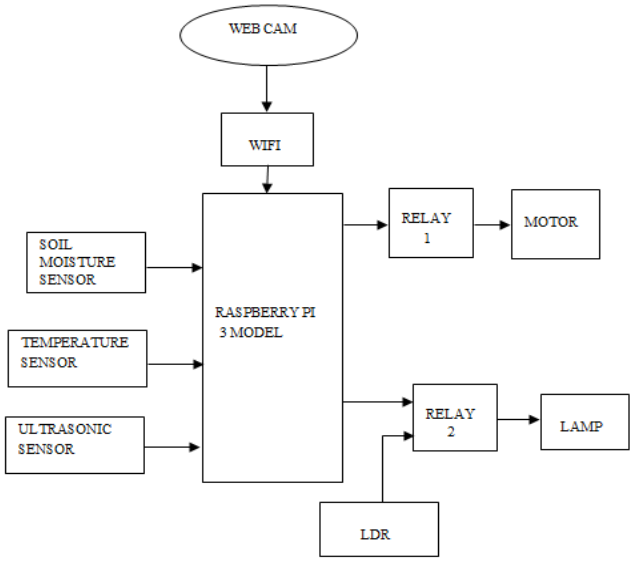
Agriculture plays a vital role in every country economy. Generally agriculture uses 85% of fresh water this percentage will be dominant in water consumption because of population growth so this becomes very important to create a system which is based on science and technology for sustainable use of water. There are so many systems available to achieve water savings in various techniques from basic ones to more technologically advanced ones. Our proposed project will minimize the work load of the farmers.We need to build a smart irrigation technique which will work according to the predefined process of supplying water according to the amount of water required by the crops. It will also keep a track of moisture level and temperature of the soil throughout the year. By this the amount of production will increase and farmers will gain more profit as compared to the previous amount of profit. Due to the monitoring technique of our projects, the work load of the framers of visiting the felid will get reduce. By the use of installed cameras framers will be able to monitor the real time images of the crop and will be able to detect the degradation of the plant which can stop the further degradation of the field. The system has a distributed wired network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers the motors, and transmits data to a web page. The sensors used here are soil moisture sensor and soil temperature sensor and ultrasonic sensors. The Base station microprocessor which is programmed such that if the either soil moisture or temperature parameters cross a predefined threshold level, the irrigation system is automated.
Now the next parameter which will trigger the motor is the concept of image processing. LCC are used to compare the greenness of the plant and will provide the value according to it. After comparing the acquired value with user feed value the amount of fertilizer(i.e. the N-level) will be provided to the plants. All the values of the system will be demonstrated in a tabular form with date and time stamp.

II. METHODOLOGY:

A. Proposed Design

After studying literature survey and understanding need globally these papers are modified and a novel technique is build called Automated Irrigation system using sensors and image processing.

In this project we are using two units-
A) Sensor unit
B) Image processing unit



B. Hardware and Software Requirement

1. PC with MATLAB
2. Raspberry pi
3. Temperature Sensor
4. LDR
5. Soil Moisture Sensor
6.Relay circuit

7. Motor

A) Sensor unit: The system consist of three sensors which are as follows-

1] Soil Moisture Sensor: - It will measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil such as electric resistance, dielectric constant, interaction with neutron. as a proxy of the moisture content.

2] Temperature and Humidity Sensor: - It is a DHT-11 sensor ,that provides for temperature measurement through an electrical signal. To greater or lesser degrees all electrical conducting material have some amount of resistance to the flow of electricity .when a known electric voltage passes through a conductor, the resistance varies based on the temperature of the conductor.

B] Image Processing Unit:-Digital image processing is the use of computer algorithms to perform image processing on digital image. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as buildup of noise and signal distortion during processing. This paper presents an algorithm for image segmentation technique used for automatic detection of N content in the leaf with the help of standard LCC chart, as well as classification of plant leaf diseases i.e. detection of unhealthy region of plant leaves using image processing and genetic algorithm.

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III. DESIGN / IMPLEMENTATION

Raspberry Pi is the heart of the system. In this project, webcam is interfaced to Raspberry Pi via Wi- Fi module. Sensors connected to the Raspberry Pi board give a resistance variation at the output. This signal is applied to the comparator and signal conditioning circuit which has potentiometer to decide the moisture level above which the output of comparator goes high. This output signal is given to the Raspberry Pi board. If the soil moisture value is above the moisture level then the 3 phase induction motor will be OFF. Whereas if the moisture level is low motor will be ON through the relay.

IV. ALGORITHM

Step 1:Start.
Step 2:Initialize the system on Raspberry Pi.
Step 3: The water level sensor constantly checks for the water level of the motor.
Step 4: The soil moisture sensor checks the soil moisture level constantly.
Step 5: The USB camera installed with the Raspberry Pi gives the complete surveillance of the field and this can be monitored in the internal network system.
Step 6: The DHT11 sensor constantly senses the temperature and humidity of the field and updates the date in the web server.
Step 7: If the water level reduces the permissible level, the relay which is connected to the Raspberry Pi will turn on the motor.
Step 8: Similarly, if the soil becomes dry, the motor which is connected to the relay will be turned on to wet the field.
Step 9: If the step 8 is completed, it will go to the step 4.
Step 10: Similarly, if the step 7 is over, the command will go to the step 3.

Figure: Steps of Implementation

V. RESULT

Nitrogen and chlorophyll contents are closely related to greenness of the leaf. The greenness of the leaf can effectively used for nitrogen estimation using image processing technique The proposed technique of estimating nitrogen by image processing method can be time and cost effective .The changes in correlation may occur according to different soil conditions and plant varieties. According to moisture level of the soil, water is supplied at regular interval based on frequent time check. Once the threshold value is reached the regulation of water is controlled. Thus right amount of water is supplied to the ground which increases the efficiency of farming and reduces the usage of water .It will also minimize the work load of the farmers. It is a sustainable and profitable irrigation system which is going to increase/maximize the Crop production. And will keep track of moisture level and Temperature of the soil throughout the year..

Figure.1. Analyzing output

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