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Web based Intelligent Irrigation System

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***Abstract*: The integration of traditional methodology with latest technologies as IoT (Internet of Things) and Wireless Sensor Networks possibly lead to agricultural modernization. IoT based device which is capable of analyzing the sensed information and then transmitting it to the user. This device can be controlled and monitored from remote location and it can be implemented in agricultural fields to resolve challenges related to the agriculture i.e. crop, soil, water level, water pressure, motor related operation purpose. This project is oriented to accentuate the methods to solve such problems like identification of crop is suitable for which soil, level of water in soil, moisture etc. In this project, mentioned sensors and electronic devices are integrated. Agriculture sector being the backbone of the Indian economy deserves security. Security not in terms of resources only but also agricultural products needs security and protection at very initial stage.**

***Keywords*: Internet of Things (IOT), Security, Raspberry Pi, dc motor, Relay, soil moisture, temperature sensor.**

1. Introduction

Agriculture playing an important role in the economy of most nations, agricultural production has been experiencing the continuous improvement of its processes and techniques. Advances in embedded electronics, local wireless connectivity, and efforts in developing communication protocols and hardware for interconnecting networks to IP (Internet Protocol) based Internet has paved the way for the wide scale deployment of IoT network. The objective of the proposed system is to improve products quality, as well as maintaining a sustainable agriculture, by collecting real-time data from the environment. So, there is the need for optimizing the resources employed in the agricultural processes, mainly in the irrigation system. For every crop the water required is different according their growth. The water provided by pump is not enough to provide the amount of water needed by the plants for a healthy growth. So, according to the crop the system provides different water level by monitoring the moisture level of the crop. In a smart farm, proper allocation of resources is required. In order to control the usage of water resources for irrigation, the design of an automated organic irrigation system in controlling and properly allocating the available water resources for the irrigation system and available electricity for the use of the pump. The utilization of water can be decreased by performing efficient water management when it comes to irrigation. The system applies the water efficiently, in the right place, at the right time and in the right amount. It brings wide benefits, such as water savings, improvement of crop quality as well as effective expenditure. This will help in transforming the agriculture industry and enabling farmers to contend with the enormous challenges they face. The industry - must overcome increasing water shortages, limited availability of lands, difficult to manage costs of consumption needs of a global population. The only solution to this problem is bringing smart agriculture by modernizing the current traditional methods of agriculture. The most important agricultural process, which can be controlled and adapted to better suit the plants growth, is related to irrigation. Connection to the IoT of variety of distributed sensors and machinery used in agriculture and livestock can open new implementation.

2. Problem statement

In the era of modern technology, automation allows us to control various appliances in different sectors automatically, keeping this in consideration we are proposing a system which can provide a robust outcome in the agriculture sector. The aim of proposed system is to resolve different problems like crop damage due to water level, parameters of soil and on this parameter control the water supply requirement for farm using IoT.

3. Motivation

Sensor networks and their usage in Farm Monitoring is the most useful innovation for the people of India. As agriculture is the main source of livelihood, there is a need to increase the productivity with decrease in cost, time and human effort. The Information collected from agricultural fields are stored in the database and can be monitored using IoT. In the circumstances of Farm Management System for agriculture with security, the challenging issue is to integrate Raspberry pi with IoT and sensors to increase the efficiency of the agricultural work. As outcome of challenge, temperature, humidity, soil moisture content and fire if occurred in the field are monitored. In the current agriculture system, the specification such as temperature, moisture humidity and fire are detected manually. The disadvantage of this method is increase in labour cost, time and also monitoring cannot be done continuously. Manual Labour is compulsory in the farm. In this paper irrigation process is carried out automatically using different sensors. Soil moisture sensor is used to detect the moisture content in soil, if

soil moisture is less in the field then water pump is switched on automatically with the help of relay. Temperature and Humidity is measured by the DHT11 Module. Master-Slave communication protocol is used in the architecture in which one device (known as master) controls single or multiple devices (known as slaves). Smart farm monitoring using IoT collects the data from different types of sensors which act as slaves and then send it to main server using Raspberry pi which is a master and these parameters can be monitored using LCD display.

4. Related work

- *Smart farming: sensing technologies Author: s. S. Sarmila et.al (IEEE 2017) Description:* Agriculture is the backbone of the India. The degradation of land and surface as well as ground water resources results in fast deterioration of soil health. This paper presents the IoT-based agricultural production system for stabilizing supply and demand of agricultural products while developing the environment sensors and prediction system for the growth and production amount of crops by gathering its environmental information. Currently, the demand by consumption of agricultural products could be predicted quantitatively, however, the variation of harvest and production by the change of farm's cultivated area, weather change, disease and insect damage etc. could not be predicted, so that the supply and demand of agricultural products has not been controlled properly. To overcome it, the proposed work designed the IoT-based monitoring system to analyze crop environment, and the method to improve the efficiency of decision making by analyzing harvest statistics. Indian farmer to get relevant information regarding agro-inputs, crop production technologies. The Internet of Things is the intelligent connectivity of physical devices driving massive gains in efficiency, business growth, and quality of life. It is transforming the agriculture industry and enabling farmers to contend with the enormous challenges they face. The industry - must overcome increasing water shortages, limited availability of lands, difficult to manage costs of consumption needs of a global population. The only solution to this problem is bringing smart agriculture by modernizing the current traditional methods of agriculture. The system aims making agriculture smart using automation and IoT technologies. The highlighting features of the model includes smart GPS based remote controlled robot to perform. Controlling of all these operations will be through any remote smart device or computer connected to Internet and operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera, actuators with micro-controller and raspberry.
- *Name: Design of a fuzzy-based automated organic irrigation system for smart farm Author: John R. Dela Cruz et.al. (IEEE 2016) Description:* Irrigation system plays a very important role in organic farming. It provides the necessary water requirement for the whole farm. But it is necessary for the irrigation system to be efficient, especially in providing the optimal distribution of available water resources. Also, since the water from an irrigation system will come from an underground reservoir, it requires electrical water pump to collect water. In a smart farm, proper allocation of resources is required. In order to control the usage of water resources for irrigation, this paper proposes the design of an automated organic irrigation system in controlling and properly allocating the available water resources for the irrigation system and available electricity for the use of the pump. Experiments through MATLAB simulation were done using a proposed system to achieve the optimum water and electrical resource distribution.
- *Name: Empirical test of Wi-Fi environment stability for smart farm platform. Author: O JiHye et.al. (IEEE 2016) Description:*
With world population growth, increasing agricultural production with a declining agricultural workforce has brought a new spotlight on agricultural ICT. As the cultivable land in South Korea is relatively small, farmers prefer the high productivity of greenhouse cultivation. In this case, labor efficiency can be achieved by developing an integrated smart platform to collect environmental information and control the greenhouse facility. This requires the construction of a network to transfer the sensed information to the control server and transfer commands from the control server to the control device. When installing a Wi-Fi communication network inside a greenhouse, verifying the communication stability is crucial. Therefore, this study measured the wireless communication transmission/reception ratio and confirmed that the communication distance varied according to the crop density.
- *Name: IOT for smart farm: A case study of the Lingzhi mushroom farm at Maejo University Author: Oran Chieochan; Anukit Saokaew ; Ekkarat Boonchieng (Springer 2015) Description:* The research aims to prototype a smart Lingzhi mushroom farm. This research applied the use of IOT with a sensor to measure and monitors the humidity in the Lingzhi mushroom farm. The humidity data processed through NETPIE was developed and provided by NECTEC as a free service for IOT. Humidity data was stored into a NET FEED (a sub service from NETPIE) and displayed on mobile devices and computers through NET FREEBOARD (another sub service of NETPIE). This research also controlled sprinkler and fog pumps

automatically and the functional status (switching on and off for periods of time) pushes notifications through LINE API on the LINE Application. The equipment and tools used in this research were Node MCU, humidity sensor, RTC (real time clock), relay module, sprinkler and fog pumps. C++ and Node.JS were used as programming. The services and protocol used were NETPIE (Network Platform for internet of everything) with subservices such as NETPIE FEED, NETPIE FREEBOARD, and NETPIE REST API. The results of the research showed that using IOT with the sensor enhanced the prototype of smart farming.

5. Proposed system

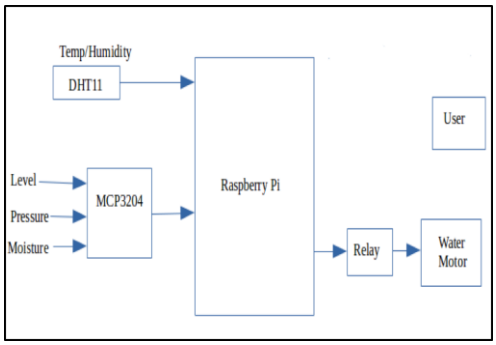

Fig. 1. Architecture diagram of irrigation system

Moisture, water level and rain sensor senses the moisture of soil, level of water and rain respectively and output of this sensor is given to analog to digital converter. This digitally converted signal is then fed to RPi as input. Temperature and humidity is calculated by using DHT11 sensor and the result is fed to the main controller. All this sensor monitors the environmental condition and according to this conditions the system takes its decision. The water motor will be turned OFF if it's raining outside or moisture of soil is more or adequate as shown in figure.

6. Mathematical module

A. Mapping diagram:

Where,
Q = Read Sensor Data.
CB = Convert into millivolt.
C = Calibrate Data into Standard Value.
UB = Apply k mean Clustering and Recommend Crop.

B. Set Theory

Let S be a system is used to recommends the suitable crop by using sensor parameters like temperature and Humidity, moisture, water level etc.

S = {In, P, Op, Φ}
Identify Input In as
In = {Q}
Where,
Q = Sensor Data.
Identify Process P as
P = {CB, C}
Where,
CB = Convert into millivolt
C = Calibrate Data into Standard Value
Identify Output Op as
Op = {UB}
Where,
UB = Recommend Crop

Φ = Failures and Success conditions.

Failures:

- Huge database can lead to more time consumption to get the information.
- Hardware failure.
- Software failure.

Success:

- Search the required information from available in Datasets.
- User gets result very fast according to their needs.

7. Advantages

Following are some of the advantages of the system;

- Increased production for optimized crop treatment such as accurate planting, watering, pesticide application and harvesting directly affects production rates.
- Water conservation by weather predictions and soil moisture sensors allow for water use only when and where needed.
- Lowered operation costs for automation processes in planting, treatment and harvesting can reduce resource consumption, human error and overall cost.
- Remote monitoring local and commercial farmers can monitor multiple fields in multiple locations around the globe from an internet connection. Decisions can be made in real-time and from anywhere.
- Equipment monitoring farming equipment can be monitored and maintained according to production rates, labor effectiveness and failure prediction.

8. Limitations

These are some of the limitations of the system;

- Manual work is more.
- Continuous observation in every part of field is needed.
- Natural disaster may harm the field.
- Heavy rain can damage sensor and readings may not be proper.

9. Applications

- These are the applications where the system can be implemented,
- Agriculture drone, would be a good model to keep the crops and the field healthier.
- Precision farming, this could ensure that the crops and soil receive exactly what they need for optimum health and productivity.
- Livestock Monitoring, animal health and large carnivore programs are some examples which are currently in market.
- Smart Greenhouses, the system can be used to maintain specific crops/flowers and to observe promising development of the crop.

10. Conclusion

In the era of automation and with the rising need to conserve water and electricity, a more advance watering system need to be developed. An economical system that can tell if watering is required based on weather conditions and or other ambient parameters, tells about market rate and helps in selecting perfect crop for particular type of soil. With the help of K- Means Algorithm all the processing work is carried out. If there are any changes in the environment, then the Algorithm carries out all the processing work with the help of the computational power in the system. Thus the system helps in increasing the nutrition and production of the crops.

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