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Prediction of Fertilizer in Horticulture through IoT Enabled Technology

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Abstract

Wireless sensor networks due to their vast area of application being used in current research areas. In agricultural field like greenhouses, various climatic condition parameters are essential to monitored for regulation of crop production. Smooth farming by means of the use of web of things advances will assist agriculturalists with limiting delivered wilds and further develop productivity. That can emerge out of how much fertilizer that has been applied to the wide inconstancy of endeavors the ranch vehicles have totaled. Thus, brilliant lacking is basically a welcome tech gadget of arising food this is even and is viable for the groups. This paper gives a sign of the current condition and future computations of web of things requesting in horticulture.

Keywords: Automation, Wireless sensor network, Controller, Sink, Sensing node.

1 | Introduction

Internet of Things (IoT) is closed loop system of interconnected computing devices with exclusive identifiers and data the ability to transfer data over a network without intervention of human interaction [1]. Wireless sensor refers to spatially dispersed and dedicated sensor to monitor and gather the physical condition of the environmental factors and centralize it. The smart irrigation plays an important role in optimizing the irrigation with proper scheduling of automatic irrigation with consideration of environmental factors of inter and intra farm fields. IoT based sensors helps in determining the right amount of water at appropriate time to the desired place [2].

To produce more nutritious food with less water and to ensure a greener and more sustainable food production optimized water saving solution has to be developed. Development of innovative irrigation systems that efficiently use water is a major priority [3]. All these data should be properly interpreted to decide the most suitable actions to carry out [4]. Precision Agriculture (PA) is a set of techniques that provide a suitable solution to optimize field level management with regard to crop science by matching farming practices more closely to crop needs [5]. The main objective of this work is focused on designing a micro controller based intelligent irrigation system controller which will allow irrigation to take place from remote places where manual inspection is not needed. Through

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this project, the drawbacks due to less technological advancements were to be reduced by eliminating the strenuous efforts put in by farmers by saving their time and improving the quality of labor and efficiency. And also optimize the amount of water utilized in irrigation [6].

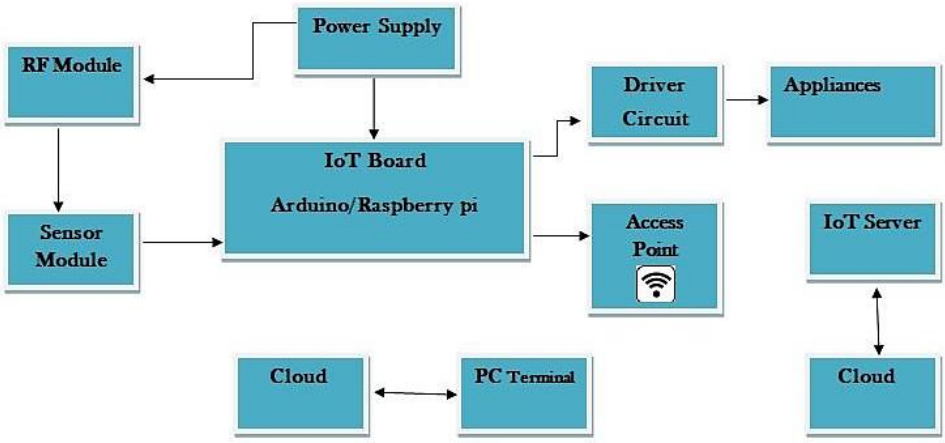

Fig. 1. IoT access.

2 | Literature Review

A literature review or narrative review is a type of review article. A literature reviews is a scholarly paper, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic [7]. In such an UN-supervised training area, this group suggested model, neural network would outperform human performance in tasks such as speech recognition, image recognition, predicting. We can render any standard model capable of solving multiple tasks in various application domains. Authors developed an automated irrigation system to reduce the usage of water and power loss in agricultural fields [8]. The system consists of a soil moisture sensor, temperature sensor, water availability sensor, level sensor, EB power availability sensor. Once the sensor information is collected, this automated system gives triggering signals to the actuators and also transmits the data to farmers through SMS. A fuzzy based algorithm is developed with set values of temperature and soil moisture and the level of water is programmed into a micro controller-based controller system to control the water flow. A GSM modem is used to transmit the information about the crop collected from the sensors [9]. Authors worked on automating the agricultural environment in real time using IoT. In this paper, they have used PIC16F877A and GSM SIM300 modem for automating the irrigation system for the social welfare of Indian agriculture system. This system is used for monitoring the soil moisture condition of the farm and also for controlling the soil moisture by monitoring the level of moisture content in the soil and accordingly switching the motor ON/OFF for irrigation purposes [10]. The system purposes a soil moisture sensor where the moisture has to be monitored. Once the moisture content in the soil reaches a particular level, the system takes appropriate action to stop the water flow [11]. This system also monitors the water in the water source so that if the water level becomes very low, it switches OFF the motor to prevent damage. The system also consists of a GSM modem through which the farmer can easily be notified about the critical conditions in his farm.

Authors madly worked on system aims at increasing the yield of crops by using an intelligent irrigation controller that makes use of wireless sensors. Sensors are used to monitor primary parameters such as soil moisture, soil PH, temperature and humidity. Irrigation decisions are taken based on the sensed data and the type of crop being grown [12]. The system provides a mobile application in which farmers can remotely monitor and control the irrigation system. Also, the water pump is protected against damages due to voltage variations and dry running [13].

3 | Proposed System

Advancement in technology allowed human beings to ease their work at the same time complete the work with less human force, less time and with better results. The basic idea behind this project is to optimize the water and control the functioning of the agricultural load using wireless technology [14]. This project is a transform from the natural irrigation technique which was followed by the farmers to the automatic irrigation which for sure has benefited in the less wastage of water and lessens the hard work of the farmers in farms [15]. Controlling of remotely located irrigation water pumps for an agricultural site without going and visiting the site again and again. With this project, the system results in achieving adequate water management due to which there is almost no wastage of water, saves men power, saves time, and is efficient [16].

3.1 | Working of Sensor

Soil moisture sensor consists of two electrodes attached to it, where it measures the volume of water in the soil. The electrodes allow the electric current to pass through the soil, by proportionally varying the electricity i.e. conductivity with resistance values [17]. DHT11 sensor used to measures the temperature and relative humidity content in the air, the relative humidity is the measures of actual water vapour content in the air. The DHT11 works on the negative temperature coefficient for reading temperature and substrate mounted back for reading relative humidity [18]. Water level sensor works on the indication point with indicating different levels of water in tank, for experiment purposee considered 5 levels. Here 5 LED's with buzzer are used to indicate the water level inside the tank. Passive Infra-Red (PIR) sensor used to detect the object or obstacle for the security system with a calibration of 10 to 60 Seconds [19].

3.2 | Steps for Effective Irrigation

To facilitate effective irrigation of crops and to avoid wastage of water, a soil moisture detection module, a DTH11 module and a water level sensor module has been combined and their values are used to draw the conclusion whether the crop can be watered or not. At first, the soil moisture is taken into account [20]. If the water level in the soil is below the required water level essential for the plant, then temperature and humidity is checked. Temperature and humidity are checked in the view that watering the crops when it is about to rain then the plants will not be watered. When all the aspects do not meet the preconditioned value sufficient for the plant, then the plant has to be irrigated, the water level in the tank or well is to be checked. This is done by considering the necessity of water during inevitable plight. If the water level is low, it is indicated to the farmer and they can take the suitable actions [21].

PIR is used to detect animal invasion in the field to protect the crops from the wild animals. If any animal is found then PIR Sensor goes high it will turn on because of the buzzer/speaker sound the animal go away from the field [22]. The GSM module is used to send the message to the farmer in a remote area about the field regarding motor ON/OFF, animal intrusion and water level in the tank or well. For experimentation purpose considered horticulture crops like Beans and Okra. Where this crops have different growth stages such as germination, seedling, pollination and fruit-set stages. For each stage, the requirement of irrigation will be different based on soil and crops. The real-time gathered datasets are compared with the intermediate values of specified irrigation based on decision model. The decision model controlled by Arduino Uno decimates the information to farmers and control the flow of water through DC motor [23].

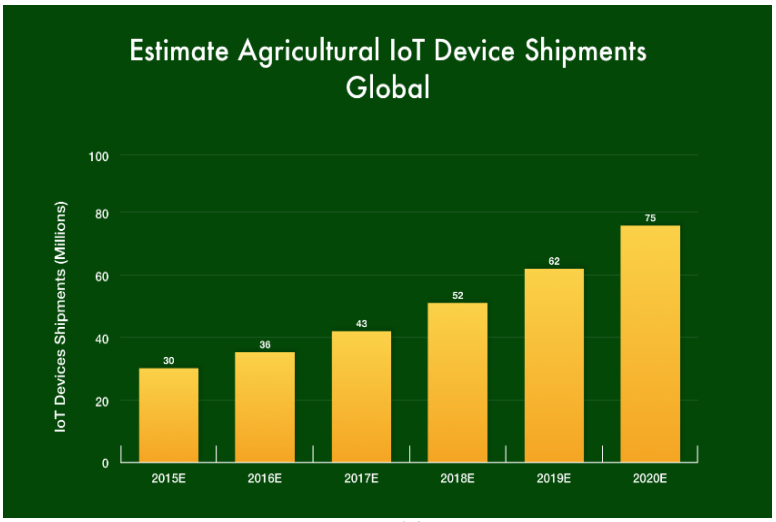

Fig. 2. Estimation of IoT device shipments.

3.3 | IOT- Future of Agriculture

IoT solutions are focused on helping farmers close the supply demand gap, by ensuring high yields, profitability, and protection of the environment. The approach of using IoT technology to ensure optimum application of resources to achieve high crop yields and reduce operational costs is called PA. IoT in agriculture technologies comprise specialized equipment, wireless connectivity, software and IT services [18]. Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc. IoT smart farming solutions is a system that is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, crop health, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere. They can also select between manual and automated options for taking necessary actions based on this data. For example, if the soil moisture level decreases, the farmer can deploy sensors to start the irrigation. Smart farming is highly efficient when compared with the conventional approach.

3.4 | Various Fields Where IoT Is Used

IoT have the potential to transform agriculture in many aspects and these are the main ones.

- *Data collected by smart agriculture sensors: in this approach of farm management, a key component are sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, motion detectors, button camera, and wearable devices. This data can be used to track the state of the business in general as well as staff performance, equipment efficiency. The ability to foresee the output of production allows planning for better product distribution.*
- *Agricultural drones: ground-based and aerial-based drones are being used in agriculture in order to enhance various agricultural practices, crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.*
- *Livestock tracking and geo fencing: farm owners can utilize wireless IoT applications to collect data regarding the location, well-being, and health of their cattle. This information helps to prevent the spread of disease and also lowers labor costs.*
- *Smart greenhouses: a smart greenhouse designed with the help of IoT intelligently monitors as well as controls the climate, eliminating the need for manual intervention.*

Fig. 3. Horticulture using IOT.

– *Predictive analytics for smart farming: crop predication plays a key role, it helps the farmer to decide future plan regarding the production of the crop, its storage, marketing techniques and risk management. To predict production rate of the crop artificial network use information collected by sensors from the farm. This information includes parameters such as soil, temperature, pressure, rainfall, and humidity. The farmers can get an accurate soil data either by the dashboard or a customized mobile application.*

4 | Result and Discussion

If the soil moisture value is less than 1000, an alert message is sent MOTOR ON to the mobile then water will be supplied till the plants reach the moisture level. If the soil moisture value is less than 250, an alert message is sent MOTOR OFF to the mobile then water supply will be stopped. The GSM module is used for message interfaced with arduino Uno. The LCD display acts as an output system that displays the status of system. The LCD display provides the message about the both irrigation need and field protection.

5 | Conclusion

The proposed system provides an attractive user interface with the most efficient way of controlling the irrigation system. It gives the idea to monitor the soil moisture content and temperature in a farming area and the user can control watering system using the IoT based sensors with decision support system. The result shows that by adopting water around 50 60 percentage compared to normal irrigation method carried nowadays. The use of IoT has enabled farmers and ranchers to go for smart farming. A technique that is capital-intensive and hi-tech. Smart farming provides twofold benefits as farmers can spend a lesser time in fields and yet increase the crop yields. The IoT-based ecosystem has several applications in the agricultural sector. We have discussed the applications in detail. We can conclude with the fact that IoT applications are making it possible for farmers to collect meaningful data that is utilized to increase efficiency. Large landowners and small farmers must understand the potential of IoT-based smart farming and they must implement IoT solutions in a prosperous manner.

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