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A Review on Smart Plant Monitoring System

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Abstract
Environmental factor monitoring is very important since the last few decades. It has become very significant to monitor the agricultural environments for various factors such as temperature, moisture, humidity along with other factors can be of more significance. Automated plant monitoring system consists of a feedback control system that employs monitoring of environmental parameters such soil moisture, temperature and humidity are measured which plays an important role in overall development of the crop and good yield. Conservation of water and other resource can be achieved by optimizing these parameters. A traditional approach for measuring these factors in an agricultural environment meant individuals manually taking measurements and checking them at various times. In this paper, plant monitoring systems using wireless protocols used by different researchers for betterment of agricultural yield with best possible technologies is reviewed. The paper also reviews the various sensors available to monitor above environmental parameters and focuses on smart plant monitoring to suite such types of end application.

Keywords: *Global positioning system (GPS), wireless fidelity (Wi-Fi), SMS, radio frequency (RF), wireless sensor network (WSN), GSM, zigbee, bluetooth, microcontroller*

INTRODUCTION

India's most important source of economy is agriculture which is totally dependent over the availability of water for their growth and development. But the quantity of water on the earth surface is decreasing since last few decades. This is due to the insufficient availability and lack of water and variable atmospheric conditions in the environment. The method of irrigation is an important and essential factor for the growth and enrichment of the fields. Irrigation techniques reduce the farmer's dependency on the natural source of water, i.e., rainfall. There are many such techniques developed nowadays which are supported with improved technology.

This paper gives the review of all such techniques which are implemented using various platforms like microcontroller and Arduino etc. These techniques are-

1. Application of Wireless Sensor Networks (WSN).
2. GPRS modems based internet monitoring.
3. Using GSM module separately or along with internet Technologies.
4. Bluetooth, Wi-Fi, Zigbee and RF based wireless monitoring.

LITERATURE REVIEW

Various researchers have done their work in the field of agriculture; they have proposed various technical systems to overcome the issues regarding the water scarcity. This paper reviews the different techniques of irrigation and plant monitoring.

Prof. Pranit P. Kathale, Jyoti Mankari *et al*. gives a paper which introduces the automation in the greenhouse environment. This automation is found to be a sophisticated and reliable system

which is well designed to react with the climate changes occurring in the environment. Feedback control system is used, which helps it to respond to the external changes efficiently. This paper presented the one of the new systems for monitoring the greenhouse to make it automated and to enhance the current situation. More production as well as low labour cost comparing with the present condition can be achieved with the implementation of this system [1].

Ms. Deweshree Rane, Prof. P. R. Indurkar *et al.* gives some solution for the problems like security issues, low transmission rate, etc. in the irrigation systems using GPRS techniques. To overcome this problem, this paper gives an automatic irrigation system based on RF module. For passing the necessary signals RF module is used. The different nodes are connected which will be centralize nodes and these nodes are used with ARM and other two nodes are used with microcontroller which is low power device. Node to node communication is added to have better results and to cover more area. The system senses the conditions and transfers the information to centralize node and other nodes using distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants .The system will start automatically when the nodes receives the information [2].

Er. Anshoo Sarswat, Hitendra Pratap Singh, *et al.* presents a work which attempts to save the natural resources available for human kind. Continuously monitoring the status of the soil, the flow of water can be controlled and thereby reduce the wastage of water. The GSM is used to know the status of moisture and temperature through with the use of moisture and temperature sensors connected. Just by sending a message from our mobile, the water flow can be controlled. Since the systems are automatic and they do not require continuous monitoring by labour the conservation of water and labour can be achieved. Thus, this system avoids over irrigation, under irrigation, top soil erosion and reduce the wastage of water. The main advantage is that according to the situation like crops, weather conditions, etc., the system's action can be changed. The agricultural, horticultural lands, parks, gardens, golf courses can be irrigated by implementing this system. Thus, this system is an efficient system compared to other type of automation system [3].

Nilesh Kuchekar and Prof. Pagare R. A. *et al.* proposed an embedded system for automatic irrigation which has a wireless sensor network placed in root zone of the plant for control of an irrigation system and real time infield sensing. In their proposed system the humidity and soil moisture and temperature is measured and it will be displayed for information of further action taken in consideration. The application of android mobile phones have almost become an integral part of human life which serves the human and uses GSM to inform the user about the exact field condition. This system uses both GSM and zigbee technology which eliminates the cost of network usage to a great extent. The microcontroller based this irrigation system will monitor the activities of irrigation system efficiently and it has some advantages such as it saves lot of time of farmer, can be adjusted to variety of specific crop needs and preventing moisture stress of trees. It will avoid over irrigation, under irrigation and top soil erosion. The proposed system can be used for agricultural, horticultural lands, parks, gardens irrigation. The configuration of the irrigation system allows it to be scaled up for larger greenhouses or open fields [4].

Akash Jain, Suraj Kudre, *et al.* gives a paper in which remote monitoring systems

using wireless protocols used by different researchers for betterment of agricultural yield with best possible technologies is discussed. This paper is followed by proposed model for agricultural monitoring with wireless protocol implemented using FPGA, i.e., Field programmable gate array. To increase the yield of plants by monitoring the environmental conditions or parameters, smart sensors based monitoring system for agriculture have been used and thus providing the necessary information to the farmers. The proposed system is mainly developed for the betterment of farmers. Re-configurability and re-programmability according to different environmental condition is facilitated with the use of FPGA elements for deploying it in any type of environment for monitoring, making it flexible and robust [5].

Pavithra D. S, M. S. Srinath *et al.* gives a system which has an incorporated Bluetooth for remote monitoring which reduces the problem of range with GSM network and saves SMS cost for the farmer. The smoke sensors used to send emergency information to user in case of fire in field or burning of motor. The design is low power, low cost, small size, robust and versatile. Thus, the system avoids under irrigation, top soil erosion, over irrigation, and reduce the wastage of water. The main advantage is that according to the situation (crops, weather conditions, soil etc.) the system's action can be changed. With this system, agricultural, horticultural lands, parks, gardens, golf courses can be irrigated. Thus, the system is cheaper and efficient as compared to other type of automation system. For large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands [6].

Jia Uddin, S. M. Taslim Reza, and *et al.* designs a model of automatic irrigation system which is based on microcontroller and solar power used only for source of power supply. In the paddy field various sensors are placed, this sensors senses water level continuously and provide the information to farmer through cellular phone without visiting the paddy fields, the information about the water level is given to the farmer. Based on the level of water, motor can control by the farmer by sending a message from his cellular phone even from a remote place. However, without confirmation of farmer the motor will automatically start to ensure the proper water level in the site, if the water level reaches to the danger level [7].

Abhishek Barve, Pragnesh Shah *et al.* proposed a system which describes an intelligent Monitoring System based on android platform gives facility to access monitored parameters on mobile handsets quickly anywhere from the world. As the mobile phones and the application supportability given by the android system provide mobility over 2G and 3G network there are infinite possibilities to expand monitoring system. In this paper, a smart remote monitoring system is explained which does data acquisition from various channels in analog form digitizes it in high 10-bit resolution, then stores into database server. This paper uses an innovative idea of making GUI in android application which can access the data stored in dedicated web server just by touch of ones anywhere from the world. A build application is user friendly and more importantly a complete monitoring system is portable that one can carry in mobile phone [8].

D Dursun M, Ozden S, *et al.* developed a drip irrigation automated system using wireless technology whose objectives was to develop a low cost wireless controlled irrigation system, real time monitoring of water content of soil, to fulfil the need of workmanship for flooding irrigation. The designed system has three unit namely

base station unit (BSU), valve unit (VU) and sensing unit (SU) which were applied system was applied to an area of 8 decares in a venue located in central Anatolia for controlling drip irrigation of dwarf cherry trees. From the trees sensors were placed 20cm deep and 50cm away. The analysis of the system produced the circa linear graph between volumetric water content (VWC) and time values for which system was analysed. System was low cost and reliable having advantages such as preventing moisture stress of trees, diminishing of excessive water usage, ensuring of rapid growing weeds and derogating salification [9].

PROPOSED SYSTEM ARCHITECTURE

FIG. 1: *PROPOSED SYSTEM ARCHITECTURE.*

This paper proposed a smart plant monitoring system as shown in Figure 1. A prototype of this smart plant monitoring system has been designed and consists of a sensing module, controller module and output module. Sensing module consist of different wireless sensors like soil moisture, temperature and humidity sensors. The controller module consists of Arduino uno microcontroller which behaves like the brain of the system and controls the operation according to the status given by the sensors. Output module has devices like GSM, Bluetooth, indicators like LED, buzzer and water pump.

This electronic system is capable of watering the plants by using water pump and also provides the lighting to the plants by using deep red high power Light Emitting Diode (LED) when the sufficient light is not available. The LED indicator is used to indicate users about condition of their plants. Furthermore, buzzer is also used to give an alert or guidance to the user. The Bluetooth is used to give the status about the watering process in the absence of internet whereas the GSM is used to give an indication when the network is available.

CONCLUSION

In plant monitoring, temperature, humidity and soil moisture are the most essential parameters. The growth of crops is mainly depending on these three parameters. We do not know that when humidity is increased or soil moisture level increased, because of it crop/plant growth gets affected and there is wastage of water as well as energy.

The paper reviews different systems to monitor these changes periodically and take an action automatically or pretend the required action to the plant. Systems have a provision to visualize the graphical representation of all the streaming data from the plants.

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