

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

Automatic Drip Irrigation System using Raspberry Pi and Wireless Sensor Networks

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ABSTRACT:- This paper focus on determining the humidity and temperature of the soil using Raspberry Pi controller. The field of the image is recorded by using web camera and it is viewed in the remote server. If any movement is found in the field the web camera will automatically on and capture the images and it is recognised by Pyroelectric Infrared sensor (PIR). The temperature sensor and humidity sensor will measure both the moisture and temperature in the soil. If the water level is found less, it will be corrected automatically using the relay through Raspberry Pi controller. If any disturbance is found in the field the notification will be sent as message through Global System for Mobile communication (GSM) and the recorded video is sent through mail. And to remove the disturbance manual inspection should be carried out.

KEYWORDS: Humidity sensor, Temperature sensor, PIR sensor, Raspberry Pi controller, GSM.

I. INTRODUCTION

In order to minimize the complexities like wastage of water and reducing the man power by using Raspberry Pi controller. The different types of sensors like temperature, humidity and PIR sensor are monitored in the field. Then the sensed information like motor status, soil temperature is send as notification to registered user through GSM technology. Web camera is used to monitor the irrigation field. If any disturbance is found in the field it sends information to the user through mail.

To avoid problems in manual irrigation like wastage of water and human interference the automatic irrigation is used. This system refers to operating systems with no or minimum manual intervention. The introduction of automatic irrigation system has increased application efficiency and drastically reduced labour requirement. In automatic irrigation 'Raspberry Pi controller' is used to control sensors and for communication purposes. In this proposed system Raspberry Pi controller helps to know the conditions of the soil for the irrigation. If the value of sensed data does not match with the threshold values which are coded in the Raspberry pi controller required for the proper crop production and through the controller the relay which act as switch, motor is turned on then the irrigation will start automatically.

Web camera is used to capture the movements in the field. There is a PIR sensor which detects the motion in the field. When motion is detected the camera automatically initiate recording then Raspberry Pi controller device alerts the registered user. The hardware has two main components interacting with each other. One is the web application that executes on the mobile device browser and server-side scripts that run in a cloud which will be operated by the Raspberry Pi controller. GSM technology is to control and monitor the function of agriculture irrigation pump set and remote location using mobile phone. A notification of the captured images in the field is sent to the user through GSM.

II. RELATED WORK

A.R.AI-Ali et.al, by usage of the internet the local control or the remote control can moisten their garden grass and trees physically or mechanically. In these recreations outcomes, format presentations were as likely acceptable. The structure can be combined with other home automation systems with slight changes [1]. Chandankumarsahu et.al, discussed about, the irrigation field, if the soil humidity is not active to the required level before the motor alert message is guide to recorded mobile phones [2]. Pravina B. Chikankar et.al, in these a normal farmer can choose the

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crop by attaching the arrangement to his computer and spontaneously screen the irrigation system for the crop with regulatory moisture and temperature [3]. Pandurang H.Tarangeet.al, discussed an embedded Linux board which allows collecting the sensor information from sensor node continuously, store it in a database and providing the web interface to the user [4]. Yunseop (james) kim et.al, the usage of an automated closed-loop irrigation system requires three major components: machine conversion, navigation, and mission planning to support the solid communication protocol. It provided extensive details for the wireless communication interface of sensors from in-field sensor stations and for a programmable logic controller from a control station to the computer at a base station [5]. Joaquín Gutiérrez et.al, used Wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses Zigbee technology. The WIU has also has a GPRS module to transmit the data to a web server via the public mobile network [6]. Jyotsna Raut and V. B. Shere, Used wireless sensor networks in automation for irrigation, this system provides a low-cost wireless solution for an in-field WSN and remote control of precision irrigation. Data mining algorithms used enhances automatic intelligence for WSN based drip irrigation system [7]. ZhaoLiQiang et.al, has said that application monitors the whole farm from remote location using IOT (Internet of Things). Energy saving algorithm is used in node to save energy. Tree based protocol is used for data collection from node to base station. System having two nodes sensor node which collect all environmental and soil parameters value soil moisture, temperature, air, humidity, light, etc. and second node consist of cam to capture images and monitor crops [8]. Robert W. Coateset et.al, using a Wireless sensor network with valve control unit is developed with actuator hardware and software. Irrigation is control by actuator. Web application is used for manual control and schedule irrigation timing. Water meter indicate the requirement of water. Node unit contain soil moisture sensor and actuator. Two way communications take place from actuator to node and base station [9]. Renua Chuimurkar and Vijay Bagadi, the usage of mobile technology provide essential security to our homes and for other control applications. This system uses webcam but IR filter was removed in order to have night vision. It can also find the number of persons located with the help of the Infrared sensor [10]. Rashid Hussain and J Sahgal, explained about different techniques to measure soil fertility in order to check the productivity of crop Information about the fertility of soil and secondly moisture contenet of soil [11]. S.Muhammad Umair and R. Usman, introduced Artificial Neural Network (ANN) based intelligent control system for effective irrigation scheduling. The proposed ANN based controller is prototyped using MATLAB. The input parameters like air temperature, soil moisture, radiations and humidity are modelled. The amount of water needed for irrigation is estimated and then associated results are simulated [12]. Francisco G. Montoya et.al, developed an android application which was implemented using the latest technologies in order to facilitate simple and easy management and monitoring of an agricultural system, greenhouse or golf course, among other functions. The system can simultaneously operate with several installations, which allows the manager or farmer to control the plantations through a better decision-making process [13]. Xiaoxue yang, Urban irrigation system is designed towards the intelligences and precision of irrigation, which is based on zigbee wireless technology combining with the socket internet programming mathematically modelling and digital control of terminal methods [14].

From the above reference, wireless communication interference sensor and artificial neural based controller and zigbee technology were used

III.PROPOSED SYSTEM

The proposed system has three sensor unit, in which temperature sensor, humidity sensor and PIR sensors. They were used to obtain the soil moisture level, if the moisture level is low, then the water motor is made on by turning the relay on, and if the soil moisture is normal means, the relay is turned off to off the motor. The PIR sensor is used to detect the object crossing the area, if any movement is detected by the PIR sensor; The web camera records the object and mail it to user. In this entire process, all the activities of the irrigation system is notified to the user as text message by sending an SMS, with the parameters like humidity value, temperature value, Motor status.

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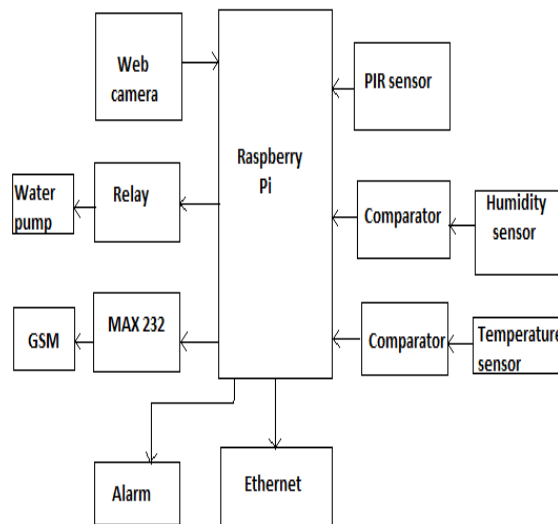


Fig 1.1 Block diagram

The humidity sensors senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Humidity is the ratio. The PIR Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin. This can vary with environmental conditions. The sensor is designed to adjust to slowly changing conditions that would happen normally as the day progresses and the environmental conditions change, but responds by toggling its output when sudden changes occur, such as when there is motion.

Humidity sensor is placed in the soil to measure the soil wet status. If the soil is wet the value is given to the comparator circuit. In comparator circuit, we set the predefined value using the trim pot, and read the humidity value and compare the two values, if the soil is wet the comparator will give high signal otherwise low signal to the Raspberry pi controller. Depending on the signal the controller will give signal to the relay driver circuit to switch ON and OFF the water pump. The controller will send the status of the motor (motor on & motor off). The controller will activate the alarm to intimate that the humidity value is low.

And the temperature sensor is used to sense the weather condition. The temperature sensor value is given to the comparator circuit. In comparator circuit we set the predefined value using the trim pot and read the temperature value and compare the two values, if the temperature value is high the comparator will give high signal otherwise low signal to the Raspberry pi controller. When the controller reads high signal, it sends the message to the predefined number using GSM modem. The controller will activate the alarm to intimate that the temperature value is high. And the PIR sensor is used to sense motion of the person or any animal. If any motion is sensed, the PIR sensor gives high signal to the controller. The controller activates the web camera to capture the object, and sends to the predefined mail ID, and also sends the message to the predefined number. MAX 232 is used to communicate between GSM and Raspberry Pi controller.

In our project we have obtained, a normal farmer can connect this setup to his computer or mobile phones and select the crop type and accordingly he can automatically monitor the irrigation system for the crops along with controlling humidity and temperature in his field. From this it is concluded that we have succeeded in using the technology of "Raspberry pi controller" for an automatic irrigation process using wireless sensor network.

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IV. RESULT AND DISCUSSION

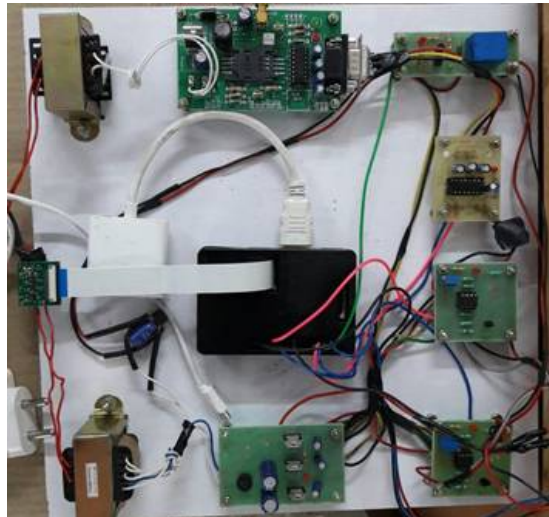


Fig 1.2 Over view of proposed system

The final prototype of an automatic drip irrigation using Raspberry Pi and Wireless Sensor Networks

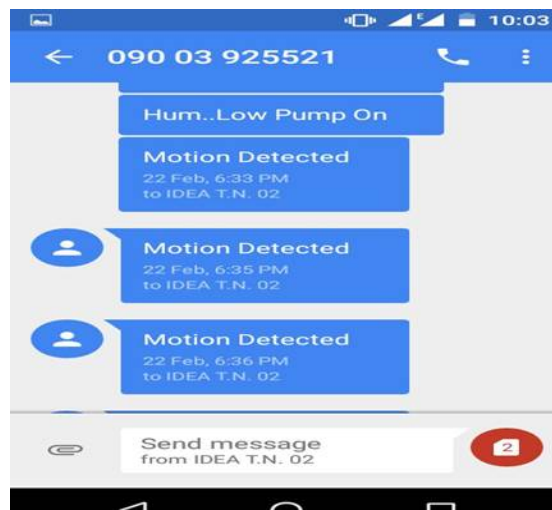


Fig 1.3 Image of the message received from the field

Acknowledge of the message received from the field to the registered user.

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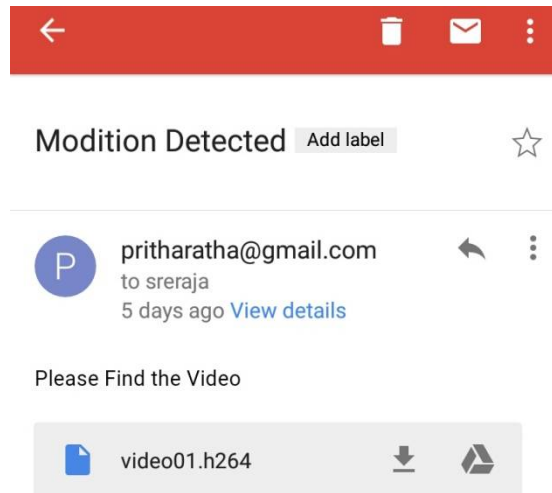


Fig1.4 Image of the mail received from the field.

Acknowledgement of the mail received from the field.

V.CONCLUSION

An automatic irrigation system using Raspberry Pi controller was developed and tested. By using this method of irrigation the water is used to the maximum extent and wastage of water is reduced. This system can be adjusted to a variety of specific crop requires minimum maintenance. It also saves energy as the web cam is turned on only whenever it is necessary and mail will be send to the registered user.

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