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AUTOMATED IRRIGATION AND FERTIGATION SYSTEM

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Abstract: **The Automated Irrigation and Fertigation System is the scheme designed for the automation in the agriculture. The traditional irrigation system as well as the fertilizer application system is modified to achieve modern approach of automation. Automation provides the less human interference, reduced cost as well as the remote access. This system uses mainly the ARM7 (LPC2148), Raspberry-pi and zigbee modules. The humidity, soil moisture and temperature sensors are used in this system. The sensor part is controlled by the ARM7. There is function of the controlling the fertigation pump via E-mail, this part is organized by the Raspberry-pi. The zigbee modules which are known for the short range communication are used for the communication between the raspberry and the controller. There are mainly two sections one is the field section which consists ARM7, zigbee and sensors whereas the second section is the control section which includes the raspberry pi and the zigbee. This scheme we are going to design is helpful not only for the small/ big farms but also for the greenhouses and the home gardening systems.**

Keywords: **Raspberry-pi, Zigbee, ARM7, Fertigation, Automatic drip irrigation.**

I. INTRODUCTION

Day by day there is deficiency of water capitals in India. There are the drought like conditions after gap of every certain years in the country. So efficient use of the water is became necessary. Also the chemical enrichers used in the excess amount are harmful for the health of the soil, so need of the optimum use of the fertilizers. These causes lead to the automation of the irrigation and the fertilizer application i.e. the fertigation.

Modern irrigation techniques saves water as well as the having efficiency to get this water to plants is higher than conventional method. Fertigation is nothing but the irrigation + fertilizer application but in this case fertilizers are the water soluble fertilizers. In the agriculture there are lot many soil nutrients have to be provided to the plants. These kind of work is done through insertion of them into the existing drip laterals.

Considering the parameters like atmospheric temperature, soil moisture and humidity we are going to design the automation. This paper presents a clever system for drip irrigation and fertilizer application to water the plants using devices like raspberry pi, ARM7, zigbee. Zigbee plays the role of wireless communication between short ranges. Python is the standard programming language for raspberry-pi programming. This system provides an economy and effectual automation system. After installation also it has minimum upkeep as well as it is operator friendly.

II. RELATED WORK

There are different papers which are working on this type of automation in irrigation. I have gone through some of them.

The base paper used [1] gives the system which is based on the Raspberry-pi and the arduino. Which use the e-mail to On/OFF the pumps. I have used this technique to turn ON/OFF the fertigation pump remotely. Accordingly the ARM7 used for the irrigation automation purpose whereas this paper uses the arduino for that.

An automated irrigation system [2] the author is developing a system to optimize the water use for agricultural crops. Using the threshold values of the sensors of temperature and moisture, algorithm is planned for the controller. Additionally the other info like sensor information is shared on web application. Cellular-internet interface provides data inspection and irrigation scheduling. Author have tested this system in a sage crop field for 136 days, also they claimed of saving up to 90% of water compared to traditional systems.

In this paper [3] author is using PIC controller. Here, by using the sensors the humidity and temperature level parameter values are conveyed at certain regular time to display on the LCD through a serial port and for analysis. A 16×4 LCD is used to displays the level of soil moistures. Switching is done by separate solenoid valves to control the water flow to the field. To make the system cost efficient simple sensors are used. Humidity sensor made using Al sheets. There are two relays used, one for controlling solenoid valve another for shut-off main motor.

This paper presents a smart drip irrigation and fertigation system to water plants with the use of devices like raspberry pi, ARM7. Xbee controls the system wirelessly. Automation done using python language. This is very effective system as well as cheap also.

III. DESIGN OF THE SYSTEM

The block diagram of the Smart irrigation and fertigation system is as shown in the Fig.2. The meaning and functionality in short w.r.t. block diagram is as follows:

P) Sensor for soil moisture: The soil moisture sensor basically used to measure the content of the water in the soil present. According to that the water is dropped to the crop area. The sensor used here is made up of the two probes and the variable resistors. The resistance between two points is further represented as the electrical voltage.

Q) Temperature sensor: Here LM35 is used. The LM35 is an IC sensor. The temperature is measured and according to that the output is displayed, which is proportional an in degree Celsius.

R) Humidity sensor: It gives the humidity in the atmosphere.

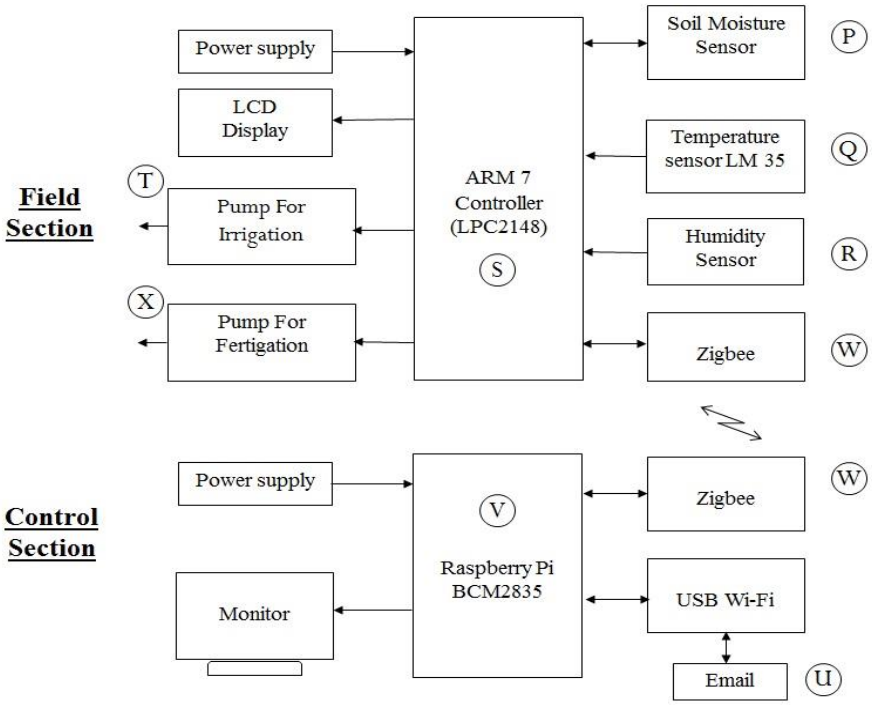

Fig.1: Proposed System.

S) ARM 7: ARM7 is basically LPC2148, it is having 32 bit microcontroller architecture. It is having advantages that, very less power required, less price and high performance. RISC is its basic architecture. The ARM is having facility of the related decode mechanism also it is having simpler set of instruction than other controllers. The other complex instruction set computers are not having that kind of simpler mechanisms. Here the sensors are connected to the ARM7 and according to the threshold values the irrigation pump will be controlled.

T) Pumps: We are using 19 watt submersible motor. It is low voltage fully submersible motor having no noise, small size and no maintenance. The sensors are placed in the fields to collect the data from the environment and send it to the controller. After processing the data, if the value is above the threshold then the pump will be off and if it is below the threshold then it will be started feeding water to the field.

U) Email: To start the fertigation system we are sending an email to a defined account. Raspberry-pi is polling for emails in this defined email account. We are using Gmail account here with subject line PUMPON or PUMPOFF to ON or OFF the pump respectively.

V) Raspberry pi: We are using model B of Raspberry. Immediately after the mail is received, the pi makes the GPIO pin high. A program for Pi which is in Python programming language is used to receive the email. After receiving the mail GPIO pin is turned high for the further processing. Using the same program the status is updated to user's email address. Pi uses zigbee module to send and receive commands from controller. Zigbee uses the python language.

W) Zigbee: Zigee is transceiver. Here it is used for the data transfer between the field section to the control section and vice-versa. Zigbee modules having feature of a UART interface. Zigbee having feature to allow any controller to use immediately the services of the Zigbee protocol.

IV. FLOW OF THE SYSTEM

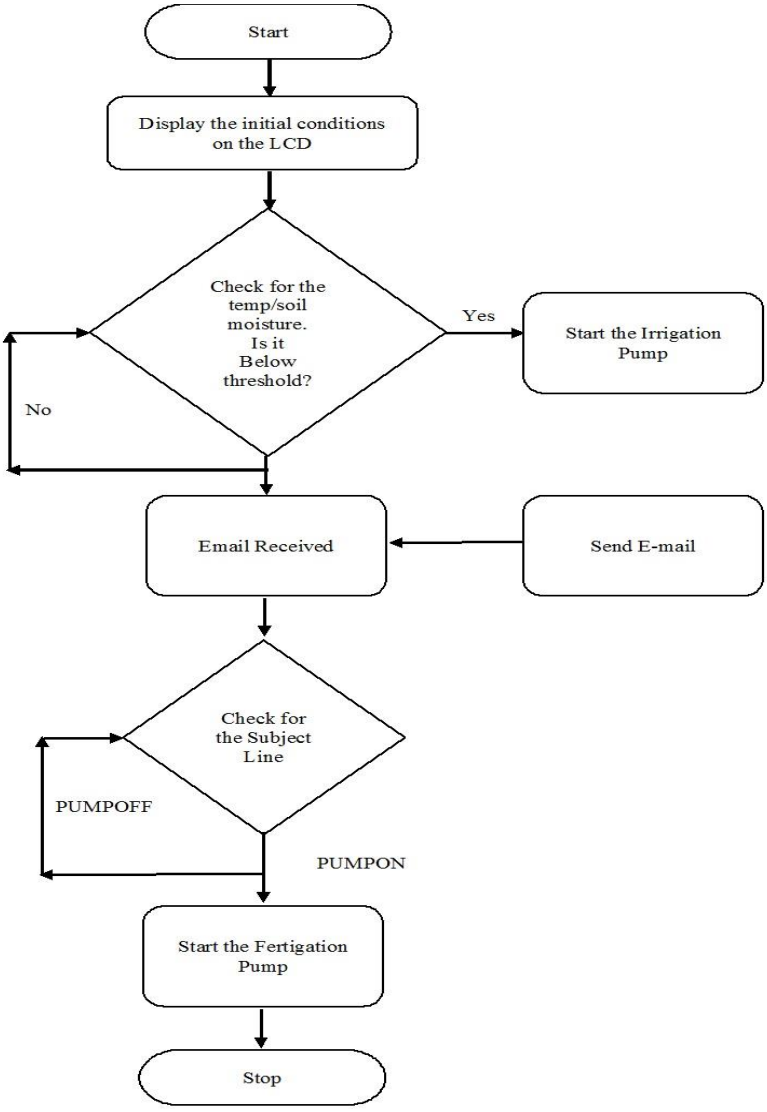

Fig.2: Flow diagram of the system

V. RESULTS

The system we have designed is automating the scenario. Also helpful to save water, manpower and finally the money.

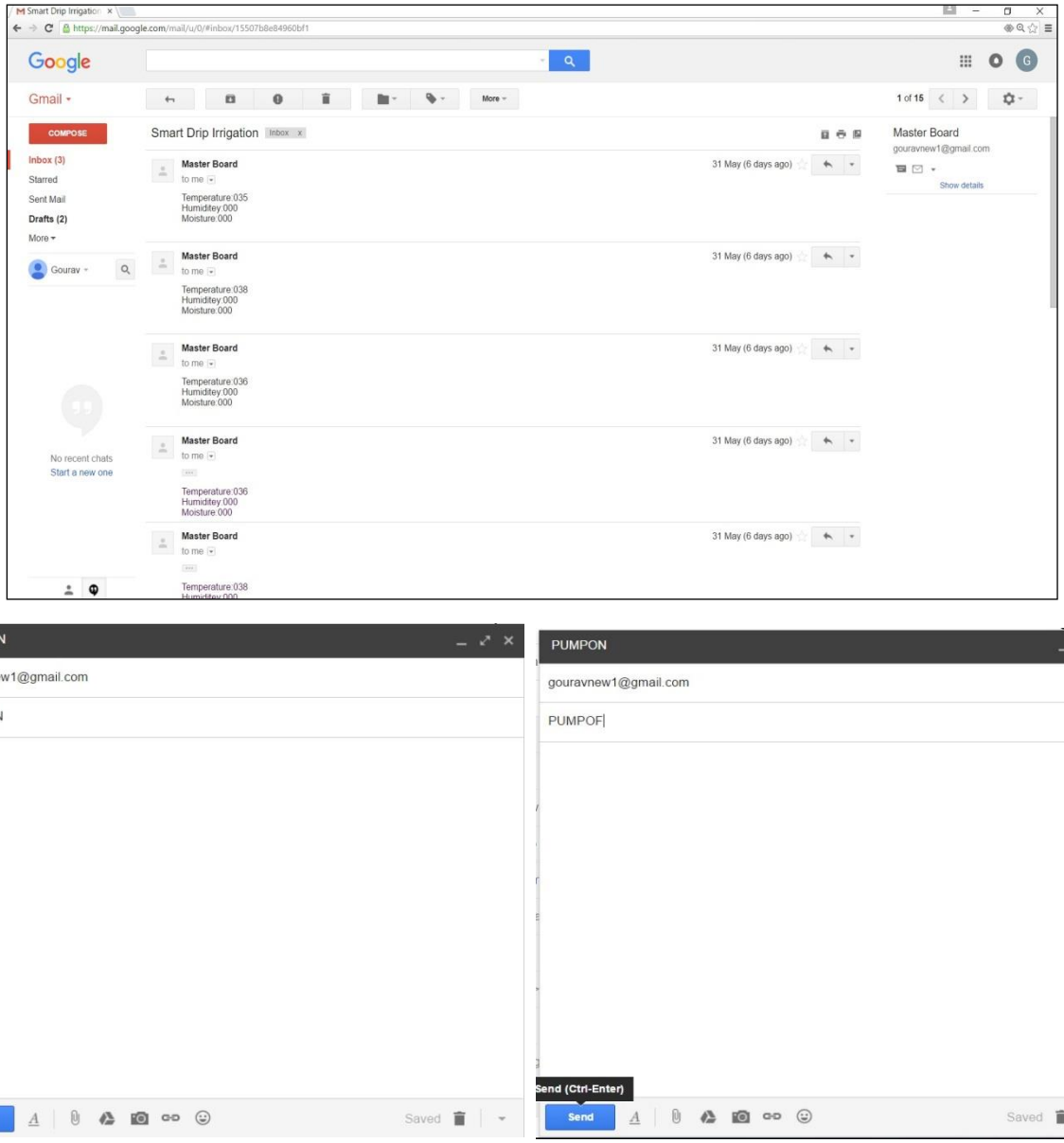

Fig.3: The received E-mail Status and screenshots of Subject Lines.

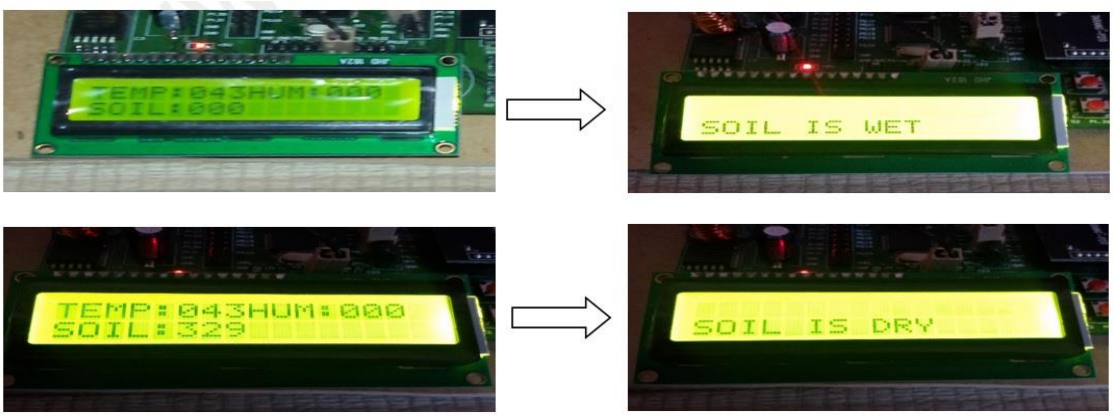

Fig.4: The sensors conditions on LCD

VI. CONCLUSION

This Automated irrigation and fertigation system giving the conclusion that it is helpful system as it successfully implementing the automation of irrigation and fefrtigation. The threshold values of the sensors are monitored continuously and according to that the irrigation automation works. On demand of the fertilizers the email is sent and the fertigation starts/stops immediately also we are getting the status of the sensors continuously on the email. Finally using this system we are able to access and control the system remotely which can control the electrical as well as the water flow.

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