Survey of traditional irrigation system Vs microcontroller irrigation system

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Abstract: *India's population is reached beyond 1.2 billion and the population rate is increasing day by day then after 2530 years there will be serious problem of food, so the development of agriculture is necessary. Today, the farmers are suffering from the lack of rains leading to scarcity of water. The main objective of this paper is to provide an automatic irrigation system thereby saving time, money & power of the farmer. The traditional farm-land irrigation techniques require manual intervention and also involves quick water evaporation.*

Sprinkler irrigation is a method of providing rainfall-like irrigation to the crops. Water is distributed through a system of pipes usually by pumping. Spray heads at the outlets distribute the water over the entire soil surface. Some of the disadvantages of sprinkler method comprise of High initial capital costs (investment in equipment - sprinklers and pipes) and high operation costs due to energy requirements for pumping and labour costs. Sensitivity to wind, causing evaporation losses (under high wind condition and high temperature distribution and application efficiency is poor). Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation. In spite of the fact that drip irrigation has so many potential benefit, they're a certain limitation also, there are as follow: Sensitivity to clogging, Moisture distribution problem, Salinity hazards, High cost compared to furrow.

With the automated technology of irrigation, the human intervention can be minimized, simple and easy to install and can sense the soil nutrient requirements. There will be moisture sensors installed on the field. Whenever there is a change in water content of soil these sensors sense the change gives an interrupt signal to the micro-controller which in turn alerts the pump to irrigate the field thereby reducing human intervention.

Key words: Micro controller, moisture sensors, Regulator, water pump, farmland.

Introduction

Agriculture is only the source to provide continuously increasing demand of food necessities. It is important to rapid improvement in production of food technology. The automatic irrigation system on sensing soil moisture is intended for the development of an irrigation system that switches submersible pumps on or off by using relays to perform this action on sensing the moisture content of the soil. The main advantage of using this irrigation system is to reduce human interference and ensure proper irrigation. Improving irrigation efficiency can contribute greatly to reducing production costs of vegetables, making the industry more competitive and sustainable.

Need of Automatic Irrigation:

1. Simple and easy to install and configure.

2. Saving energy and resources, so that it can be utilized in proper way.

3. Farmers would be able to smear the right amount of water at the right time by automating farm or nursery irrigation.

4. Avoiding irrigation at the wrong time of day, reduce runoff from Overwatering saturated soils which will improve performance.

5. Automated irrigation system uses valves to turn motor ON and OFF.

The main objective of this study is to:

1. Study of microcontroller irrigation system.

2. Why majority of the farmers are not aware of this automatic irrigation system?

3. Why factors makes farmers comfortable with the sprinkler and drip irrigation method?

Literature Review

The automatic irrigation system mainly involves soil moisture sensor and a microcontroller, some people have used Raspberry pi as the microcontroller. Basically this automatic irrigation system is very much needed for the upcoming years especially in India because, India is a

country where the water resources are very less and water generation is expensive, so this system involves less water consumption and the evaporation of the water in the field is avoided thereby human intervention can be minimized and consumption of power money and time can be reduced.

One of the method includes, Raspberry pi (Microcontroller) will compare the values received from moisture sensor with the predefined moisture levels already stored in the system. Based on the values received from the sensors, the Raspberry pi will turn the irrigation system ON/OFF. The Raspberry pi will also provide the functionality of calculating the pH value of soil. PH is a term that is used to describe the degree of acidity or basicity. The Raspberry pi uses pi camera for capturing the images of the Soil and after calculating the pH values the particular crops that can grow in the field are suggested to the farmer (this involves image processing).

Another way of implementing the automatic irrigation system is that, microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. This is achieved by using an op-amp as comparator which acts as interface between the sensing arrangement and the microcontroller. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. An LCD display is also interfaced to the microcontroller to display status of the soil and water pump. Network of soil-moisture and temperature sensors placed in the root zone of the plants. Some have used Arduino board ATmega328 as the microcontroller to receive the input signal which triggers the motor pump resulting in the irrigation of the crops.

These methods also has the advantage of calculating the PH values of the soil through the concept called image processing which analyses the data and gives output as what kind of crops can be grown in the particular field resulting in the growth in crop production using simple technology and analytics.

This concept can also be converted as semi-automatic by connecting a GSM (global system for mobile) device to the microcontroller, such that instead of using the internet to receive the information of the moisture content of the soil the information is passed via Bluetooth which then triggers the motor pump stating that the particular crops requires water.

Problem Definition

With the increasing water scarcity in India, the farmers face irrigation problems in their everyday life due to less resource of water. The traditional methods of irrigation is not suitable for this condition, whereas with the automated technology of irrigation, the human intervention can be minimized, simple and easy to install and can sense the soil nutrient requirements. There will be moisture sensors installed on the field. Whenever there is a change in water content of soil these sensors sense the change gives an interrupt signal to the micro-controller which in turn alerts the pump to irrigate the field thereby reducing human intervention.

Objective of Research and Research Methodology

o Study of microcontroller irrigation system.
o Why majority of the farmers are not aware of this automatic irrigation system?
o What factors makes farmers comfortable with the sprinkler and drip irrigation method?

Methods and Materials

For the survey, a sample of farmers are chosen in such way that they are categorized as:

- A sample from framers having between 2-4 acres of cultivation land.
- Sample from framers having between 7-12 acres of farming area.
- Sample from farmers having more than 12 acres of farming land.

The selecting criteria of the farmers are, the crop they cultivate must be rice, maize, millet and other crops which requires standing water. And the basic questions regarding the topic chosen is asked.

Recommended Methods:

Various methods have been tried and implemented using emerging technologies. Some of the methods are explained below with the respective working process.

Method #1:

Automatic irrigation system switches the pump motor ON/OFF on sensing the moisture content of the soil. The advantage of using this method is to reduce human intervention and still ensure proper irrigation thereby saving time, money, power of the farmer & optimise water use for agricultural crops. It uses a microcontroller which is programmed to receive the input signal of varying moisture condition of the soil through the sensing arrangement. This is achieved by using an op-amp as comparator which acts as interface between the sensing arrangement and the microcontroller. Once the controller receives this signal, it generates an output that drives a relay for operating the water pump. An LCD display is also interfaced to the microcontroller to display status of the soil and water pump. Network of soil-moisture and temperature sensors placed in the root zone of the plants. This automated system was tested in a sage crop held for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved.

Hardware used:

LM7805 Regulator, Microcontroller, Soil Moisture Sensor

Method #2:

The traditional farm-land irrigation techniques require manual intervention. With the automated technology of irrigation, the human intervention can be minimized. There will be moisture sensors installed on the field. Whenever there is a change in water content of soil these sensors sense the change gives an interrupt signal to the micro-controller. Soil is recognized as one of the most valuable natural resource whose soil pH property used to describe the degree of acidity or basicity which affect nutrient availability and ultimately plant growth. For capturing the images, the phone camera is used and after processing the captured image the PH value of the soil is determined and accordingly crops or plants are suggested that can be grown in that field. Due to detection of soil pH value the chances of crops destruction becomes less.

Hardware used:

Raspberry Pi, Pi camera.

Method #3:

Another method is done like, the entire system is controlled using ATMEGA 328 microcontroller which is giving the interrupt signal to the motor. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, whenever there is a fluctuation in temperature and humidity of the environment these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and

thus the motor is activated, along with this buzzer is used to indicate that pump is on. This paper designs a model of automatic irrigation system which is based on microcontroller ATMEGA328. Temperature and soil moisture sensors are placed in the field. Sensors sense the moisture content of the soil and give the information to farmer through GSM Module. Farmer gets to know the status of the pump installed in the field via GSM Module without going into the field. When the moisture content reaches above the desired threshold value the pump automatically turns off and the message is conveyed to the farmer.

Hardware used:

Microcontroller ATMEGA328, Humidity/Temperature sensor(DHT11), Voltage regulator(7805), LCD display, LEDs, diode(IN4007), RC filter circuit, buzzers, potentiometer, oscillator, power supply.

Software used:

Arduino (C Programming)

Data Analysis

Results and Discussions

The study population comprised about 52 farmers from various groups. The study reveals that among different categories of sample of farmers with 2-4 acres of land 21 of them uses drip irrigation system. Farmers with 7-12 acres of land 4 of them uses drip irrigation method, 16 uses sprinkler system and 2 uses automatic irrigation method, And among rest 5, 2 farmers uses drip method and 3 uses sprinkler system.

ACRES	DRIP	SPRINKLER	AUTOMATIC	OTHER
2-4	21	-	-	4
7-12	4	16	2	-
Above 12	2	3	-	-

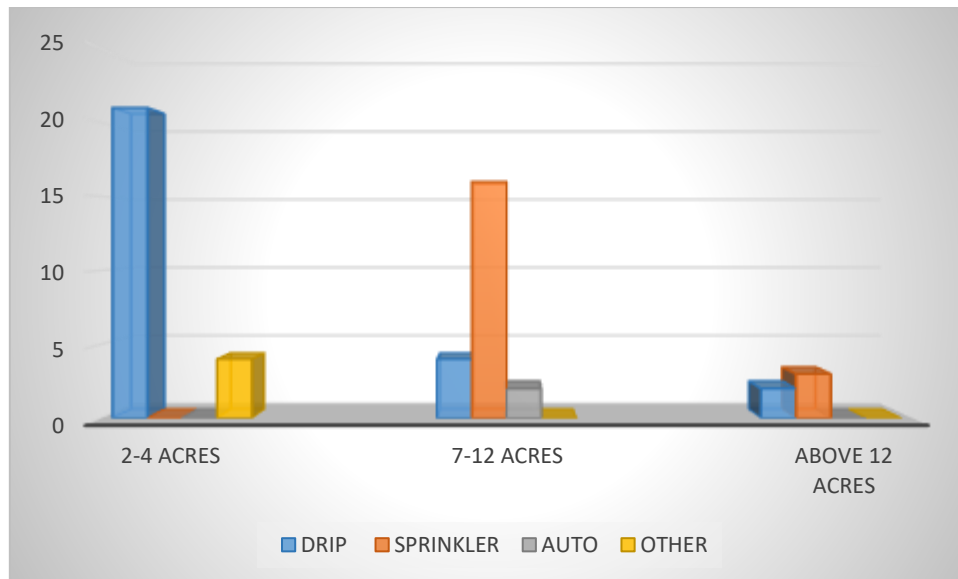Table-I: Irrigation method used by sample of farmers

Fig -1

The result of the study of average gallons of water spent for irrigating the farm in terms of per acre per minute is that (in thousands) 8.4 is used during drip irrigation system, 10.2 is used for sprinkler method of irrigation, 6.2 is used under automatic method of irrigation and 9.8 is used for other methods of irrigation system.

METHODS	WATER INN GALLONS (IN THOUSANDS)
Drip	8.2
Sprinkler	10.2
Automatic	6.2
Other	9.8

Table-II: Average amount of water spent for one time of irrigation (per acre, per min)
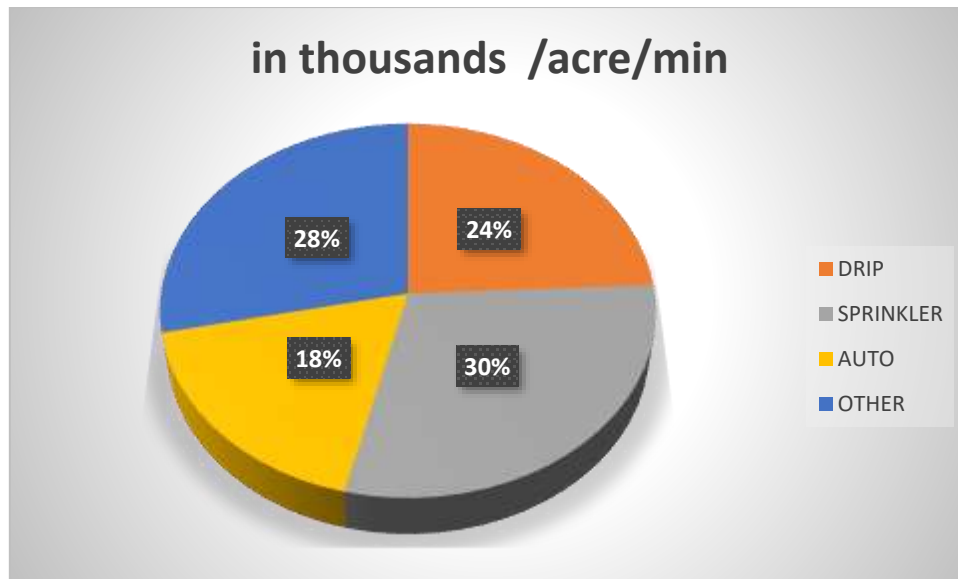
Fig- 2

The major disadvantages of automatic irrigation method mentioned by the farmers are expensive installation with is not applicable and feasible for the farmers coming under the category of 2-4 acres, and among farmers with 7-12 acres of land have mentioned that awareness of matainence of this technology is less. And lastly among farmers with more than 12 acres of land have said that this technology consumes electricity which leads to increase in the irrigation cost.

Conclusion

In conclusion, majority of the farmers are not aware of the microcontroller or in general automatic irrigation method. Some of the sample had difficulty in installing this technology. And other percentage of the sample do not have proper guidance to maintain the microcontroller method. The study reveals that among 52 farmers 75% of them are not aware of this automatic irrigation method and from the rest 25% only 15% have installed and are able to maintain this technology, the other 10% have had tried and were not able to take of the technology and came back following the traditional method.

Appendix

Questionnaire:

1) What are the crops that are cultivated in your field?
2) How do you irrigate your field?
3) What is the name of the method of your irrigation system?
4) Approximately how many gallons of water is spent for one time of irrigation?
5) How many times a day you irrigate your crops?
6) What do you think are the advantages and disadvantages of the irrigation method that you use?
7) How long the crops are irrigated? (in the measure of time)
8) Are you aware of the automatic irrigation system?
9) If yes, why aren't you not using that method?
10) What are the difficulties you face in terms of irrigating the field?

Acknowledgement

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