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Smart Drip Irrigation for Agricultural Development

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Abstract
Water is very important for optimum production of crops both in terms of quality and quantity. About 70% of the global freshwater is used in agriculture. In many developed countries this use has been decreased because of increase in the use of irrigation practices with higher water use efficiency like drip irrigation. Farmers are aware of the current and the upcoming competition for water so they know that the adoption of efficient irrigation systems is beneficial for them. Drip irrigation is an efficient irrigation method that delivers water slowly and directly to the plant root systems network of pipes. It reduces the loss of water due to evaporation which is very common in other type of irrigation methods like flooding. It is also called as micro irrigation. Management of the drip irrigation system requires proper knowledge of the system, climate and environmental conditions for the growing crop.

Keywords: Drip irrigation, Water use efficiency, Water scarcity, Scheme on Micro Irrigation, Dry land agriculture, Irrigated agriculture

I. Introduction

In drip irrigation, water is applied to each plant separately in small, frequent, precise quantities through dripper emitters. The water is delivered continuously in drops at the same point and moves into the soil and wets the root zone vertically by gravity and laterally by capillary action. The planted area is only partially wetted. In drip irrigation system, water is supplied to the crop drop by drop at very low rate from a system of small diameter plastic pipes fitted with outlets called emitters for drippers. It is also called as trickle irrigation. It does not wet the whole soil profile like surface or sprinkler method of irrigation, it only gets a part of soil in which roots grow. In other words, it delivers water and nutrients directly to the plant roots on in the right amount at the right time so that each plant can achieve its proper growth and development. Drip irrigation is 40% more efficient because it uses 40% less water than conventional method of irrigation. Usage of fertilizer can also be optimized this way. Due to globalization of trade and economic liberalization of policies it has become inevitable to use modern irrigation practices in agriculture, especially in horticultural crops to obtain higher yields of good quality products and to earn good revenue by the farmers.

II. Methodology

The devices used for automation of micro-irrigation (MI) system are: controller, control valves, metering pumps, flow transducers, sequencers sensors, master relay etc. The brief description of these hardware equipment is presented below. This study shows an embedded system for automatic control of irrigation. This has wireless sensor network for real-time sensing and control of an irrigation system. This system provides uniform and required level of water for the agricultural farm and it avoids water wastage. When the condition of water in the agricultural farm is abnormal then the system automatically switches ON the motor. When the water level reaches normal level the motor automatically switch OFF. We are interfacing microcontroller through temperature sensor, humidity sensor and also interfacing to GSM through wireless network. In this we set specified values of temperature, humidity and the conditioned is uniformly monitored by any programming language.

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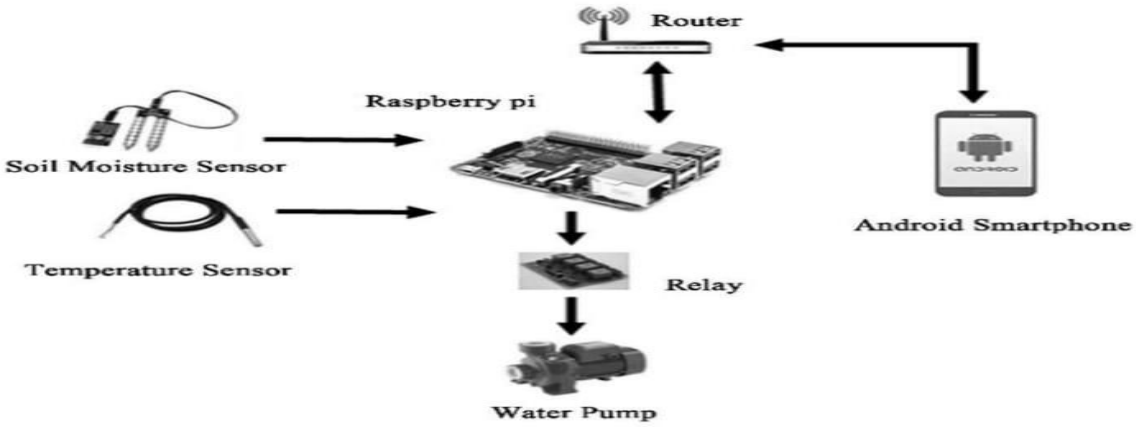

Automated Irrigation System

Different flowering plants and vegetables grown in the present study site:

a) Grass b) Rose plant C) Tomato d) Egg plant

Grass

Rose plant

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Tomato

Egg plant

The entire field is first divided into small sections such that each section should contain one moisture sensor. These sensors are buried in the ground at required depth. Once the soil has reached desired moisture level the sensors send a signal to the micro controller to turn on the relays, which control the motor. Automated irrigation mechanism turns the pumping motor ON and OFF on detecting the dampness content of the soil. In the domain of farming, utilization of appropriate means of irrigation is significant. This automated irrigation project, the soil sensor senses the moisture content by giving input signal to an Arduino board which operates on 8051 series micro-controller is programmed to collect the input signal of changeable dampness circumstances of the earth via dampness detecting system.

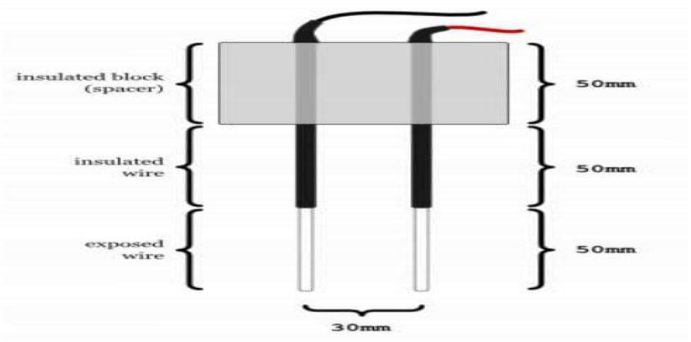

Fig : Soil moisture sensor

Soil moisture sensors measure the volumetric water content in the soil. Measuring how strongly the soil resists the flow of electricity between two electrodes can be used to determine the soil moisture content.

The microcontroller used is 8-bit microcontroller. The main functions of the microcontroller are reading the values from the soil moisture sensor, displaying appropriate messages on the LCD and controlling the relay to the motor. The soil moisture sensor is inserted in the soil.

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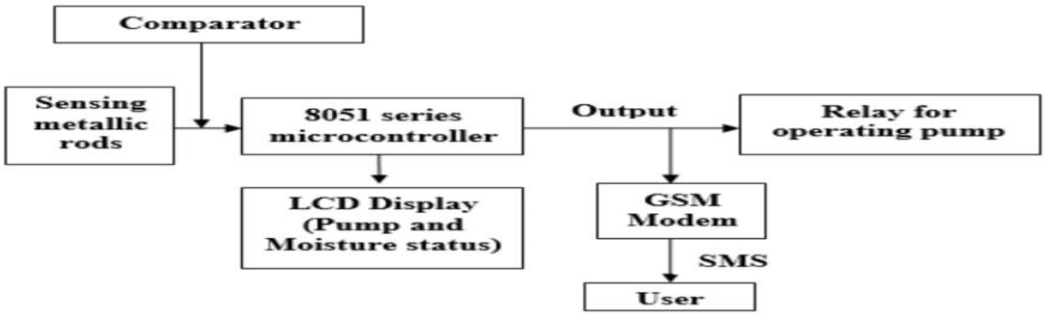
Depending on the quality of the sensor, it must be inserted near the roots of the plant. The soil moisture sensor measures the conductivity of the soil. The soil moisture sensor module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry. This output from the soil moisture sensor is given to the analogue input pin of the microcontroller. The microcontroller continuously monitors the analogue input pin. When the moisture in the soil is above the threshold, the microcontroller displays a message mentioning the same and the motor is off. When the output from the soil moisture sensor is high i.e. the moisture of the soil is less. This will trigger the microcontroller and displays an appropriate message on the LCD and the output of the microcontroller, which is connected to the base of the transistor, is high. When the transistor is turned on, the relay coil gets energized and turns on the motor. The LED is also turned on and acts as an indicator.



Methodology Diagram

III. Result & Discussion

Irrigation becomes easy, accurate and practical with the idea above shared and can be implemented in agricultural fields in future to promote agriculture to next level. The output from moisture sensor and level system plays major role in producing the output. The chosen approach is expected to yield the following results.

- Reduced labour
- Reduced monitoring
- Decrease in water input
- Low maintenance
- Low power consumption

The advantage of using this method is to reduce human intervention and to ensure proper irrigation.

- Minimizes water waste and improves plant growth.
- This system is designed to work automatically and hence, there is no need for any human intervention.

IV. Conclusion

Smart Drip irrigation is one of the important methods to do farming where water scarcity is there. By using drip irrigation not only we can increase productivity but also improve the livelihood of the farmers. The farmers can be greatly benefitted from this system which would reduce the labour charges and increase the efficiency in farming. By modernizing the farming techniques, we get high yields and increase the living standards of farmers. It will be very useful in arid and semi-arid areas. The main advantage of this system is the farmer can remotely control drip irrigation devices by using his mobile phone can be anywhere in the world. An automated system can save you thousands of gallons of water a year simply by a drop-wise water supply. Using these systems productivity increases and water consumption reduces. The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants.

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