Wireless Based Irrigation Automation Using Pressure Controller

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Abstract

Agriculture is a source of livelihood of majority Indians and great impact on the economics of the country. In dry areas or in case of inadequate rainfall, irrigation becomes difficult. A low cost alternative solution for efficient water management currently in use is drip irrigation system that consists of a pressure controller to turn on and off the control valve, which in-turn helps the farmers by managing the water supply to the crop fields and further maintains the moisture level of soil. When the soil is dry condition the soil moisture sensor measure the resistance and send the signal to relay to actuate the solenoid valve. If solenoid valve open the pump is ON then the flow can happen by pressure controller, whereas the soil is wet condition, the solenoid valve closes. Based on this technique, automated the irrigation system without wire and wireless technology using pressure controller.

Introduction

Water and nutrients are two important inputs to agriculture which are determining the whole gamut of agricultural productivity and production in India in addition to the soil and seeds. In the changing climate scenario, the water resource has become very scarce and also being unscientifically used in the farming fields. India, consuming almost 80% of its total water resources for agriculture sector, needs to reduce the consumption of water and nutrients to substantial levels using advanced scientific methods of irrigation like drip and sprinkler irrigation systems and real time sensor based scheduling with electronic gadgets or sensors to enhance water use efficiency (WUE) and fertilizer efficiency in India.

These recent irrigation techniques introduce automated irrigation using sophisticated equipments to supply water and nutrients to the plant as soon as they need it. Today in India inclination towards automization of drip / micro irrigation is gaining momentum due to: Automation eliminates manual operation of opening or closing the valves, especially in intensive irrigation process. The automation of the irrigation process is important for three main reasons: scarcity of water, timely irrigation and maximum crop profit. Automatic irrigation systems presently available are costly and are not adopted by most of the Indian farmers (Rajakumar *et al.,* 2008). Therefore, appropriate low cost technology has to be developed to facilitate high water use efficiency.

A low cost alternative solution for efficient water management currently in use is drip irrigation system that consists of an automated pressure controller to turn on and off the control valve, which in-turn helps the farmers by managing the water supply to the crop fields and further maintains the moisture level of soil (Yoder *et al.,* 1998).

Methodology and Components

The main hypothesis in regards to this work is that using sensor technology to automate irrigation in which it improves water usage efficiency. Soil moisture Sensor is made up of two electrode probes to pass current through the soil, and then we read that resistance to get the moisture level (Figure 1). More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity more poorly (more resistance). A relay is usually an electromechanical device that is actuated by an electrical current (Figure 2). The current flowing in one circuit causes the opening or closing of another circuit. Solenoid valve is used to control the flow of irrigation water automatically (Figure 3). Pressure controller is designed to maintain constant pressure (Figure 4). It does not permit the pump to operate without water and avoids water hammering. It requires no preloading of air or adjustment. Arduino is open-source electronics prototyping platform based on flexible, easy-to-use hardware and software (Figure 5). A laboratory model setup was shown in Figure 6.
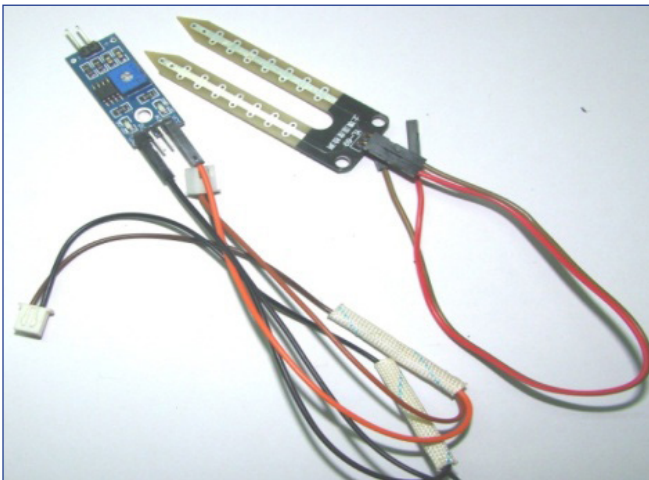

Figure 1: Soil moisture sensor

Figure 2: Relay

Figure 3: Solenoid valve

Figure 4: Pressure controller

Figure 5: Arduino

Figure 6: Laboratory model setup

Working Principle of the System

A system is proposed for automatic irrigation system based on soil moisture requirement. This system uses three nodes which communicate each other and irrigate agricultural field automatically. When the soil is dry condition the soil moisture sensor measure the resistance and send the signal to relay to actuate the solenoid valve. If solenoid valve opens the pump is ON then the flow can happen by pressure controller, whereas the soil is wet condition, the solenoid valve closes. The obtained irrigation system not only prevents the moisture stress on crops, but also provides an efficient use of water resource. The proposed technique can help in automatic ON/OFF the motor by using soil moisture sensors at small scale fields and also in gardens which avoid the need of a human being. Based on this technique, automated the irrigation system without wire and wireless technology using pressure controller (Figure 7 & 8).
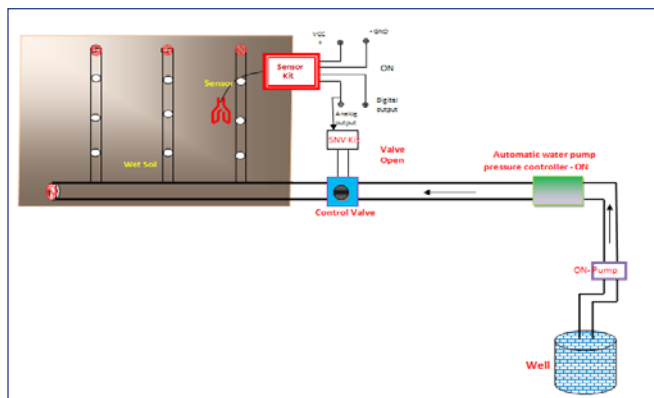

Figure 7: Layout of Irrigation automation using pressure controller (ON position)
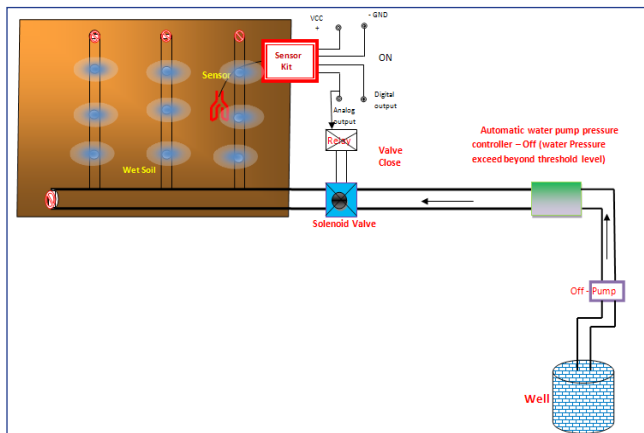

Figure 8: Layout of Irrigation automation using pressure controller (OFF position)

Conclusion

In present days, especially farmers are facing major problems in watering their agriculture fields, it's because they have no proper idea of when the power is available so that they can pump water. Even after then they need to wait until the field is properly watered, which makes them stop doing other activities. Here is an idea that helps not only farmers even for watering the gardens also, which senses the soil moisture and switches the pump automatically when the power is ON. Automatic Irrigation system is very useful to farmers.

References

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