Design and Development of Automatic Drip Irrigation System

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Abstract— An automatic irrigation control system has been designed to facilitate the automatic supply of adequate of water from a reservoir to field or domestic crops in all agricultural seasons. One of the objectives of this work is to see how human control could be removed from irrigation and also to optimize the use of water in the process. The method employed is to continuously monitor the soil moisture level to decide whether irrigation is needed, and how much water is needed in the soil. A pumping mechanism is used to deliver the needed amount of water to the soil. The work can be grouped into four subsystems namely; power supply, sensing unit, control unit and pumping subsystems which make up the automatic irrigation control system. A moisture sensor was constructed to model the electrical resistance of the soil; a regulated 12 volts power supply unit was constructed to power the system; the control circuit was implemented using operational aurdino; and the pumping subsystem consisting of a centrifugal self-priming water pump was constructed using a small ac-operated motor. System response tests were carried out to determine the time taken for the system to irrigate potted samples of different soil types having different levels of dryness.

Keywords: GSM Module, Arduino, Sensors, Solenoid Valves, Screen Filter

I. INTRODUCTION

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. Drip irrigation systems distribute water through a network of valves, pipes, tubing, and emitters. Depending on how well designed, installed, maintained, and operated it is, a drip irrigation system can be more efficient than other types of irrigation systems, such as surface irrigation or sprinkler irrigation.

Generally most of the irrigation systems are manually operated one. These traditional techniques are being is replaced with semi-automated and automated techniques suggested an automated concept of irrigation to use the water efficiently and effectively Automated Drip Irrigation system is implemented either based on the soil humidity or based on the user input via SMS commanding systems.

Former method is an isolated irrigation system where the farmer doesn't updated with the irrigation status and later lags in smart utilization of water due to user command without considering the condition of soil. From that ever growing requirement of the population, modern techniques are introduced to control the system. With this farmers are intimated about fertilizers required for the crops for better yield at various conditions by measuring soil nature and the better crop cultivation based on the climatic conditions. That leads to flexibility in monitoring the irrigation system at anywhere provided with internet. The server side data can be retrieve via the internet to access it for easy to handle the devices and now a day's internet is also necessity for all human beings then only it will become a booming to continuous monitoring and controlling of irrigation system.

II. METHODOLOGY

A. Block Diagram:

Block diagram with explanation of automatic drip irrigation system is as follows

In automatic drip irrigation system total operation carried out with help of mobile phones. In our system there are three different GSM, Arduino and relay driver circuit for the three different electronic circuit. GSM used for the global communication, arduino used for the controlling action and relay driver used for to give corrective action i.e. either ON or OFF. In our system we used three different sim cards for the communication purpose and 4th one sim is used by the user.

In this system suppose we send msg to pump for turning ON the pump that time GSM used in pump circuit receives that msg and send to the arduino and arduino send to the relay circuit, with the help of relay circuit corrective action is take place. During turning ON the pump we have to take one precaution that is nothing but before going to start pump we have to start valve1. Suppose in running condition water from well will get empty that time level sensor turn down and pump will off automatically. As we ON the solenoid valve1 then water flow in the corresponding plot of farm. In the both the plot we place the sensor into the soil that sensors are soil moisture sensors. As the water sucking capacity of soil get fullfill that time sensor send signal to the arduino for turning OFF the solenoid valve1. There are two condition after moisture level detected first one is we can turn OFF the pump or we can turn ON the valve2 and turn OFF the solenoid valve1. Same operation is carried out in case of solenoid valve2. This system having the security during operation means unknown person can't disturb our system.

In this way this is simple, useful and user friendly system using GSM, arduino and the relay circuit

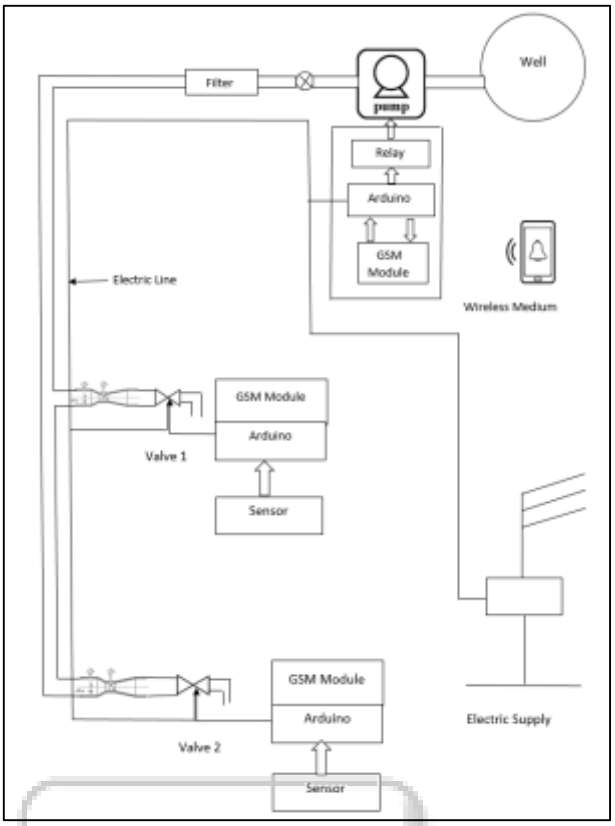


Fig. 1: General Block Diagram of Automatic Drip Irrigation System

B. Working Mechanism

1) Hardware used

The hardware used in automatic drip irrigation system is as follow

a) Arduino

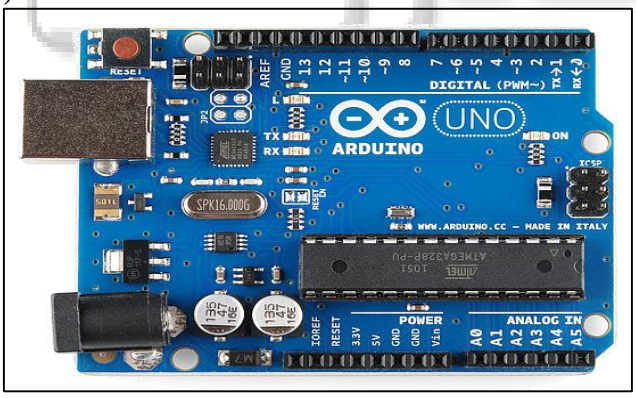


Fig. 1.1: Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328 microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cableIt can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0

b) GSM Module

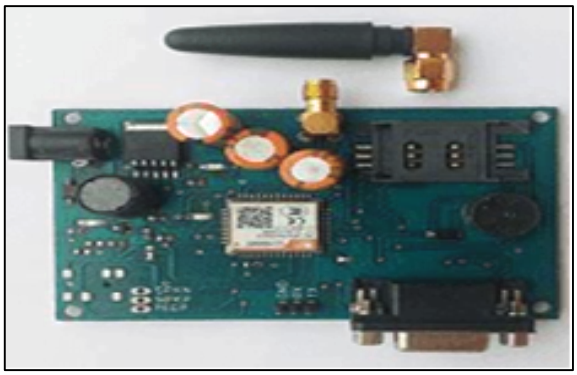


Fig. 1.2: GSM Module sim 800C

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto, and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average rooftop level. Micro cells are cells whose antenna height is under average rooftop level; they are typically used in urban areas. Picocells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

c) Soil Moisture Sensor

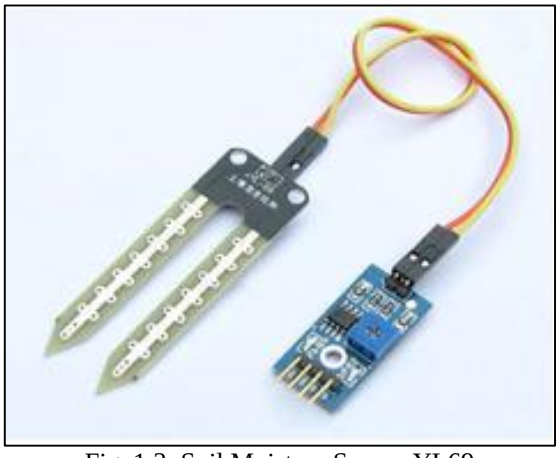


Fig. 1.3: Soil Moisture Sensor YL69

Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks

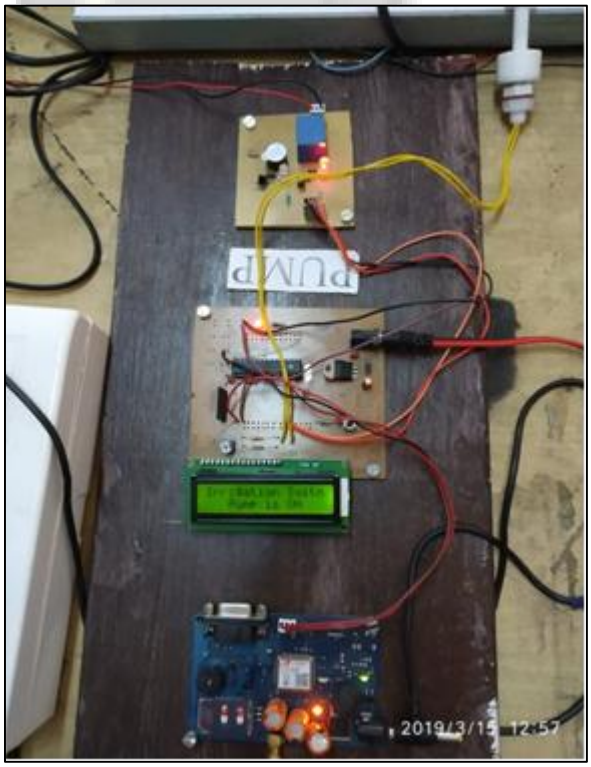
d) Solenoid Valve

Fig. 1.3: Solenoid Valve

A solenoid valve is an electromechanical device in which the solenoid uses an electric current to generate a magnetic field and thereby operate a mechanism which regulates the opening of fluid flow in a valve. Solenoid valves differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid, and the type and characteristics of fluid they control. The mechanism varies from linear action, plunger-type actuators to pivoted-armature actuators and rocker actuators. The valve can use a two-port design to regulate a flow or use a three or more port design to switch flows between ports. Multiple solenoid valves can be placed together on a manifold.

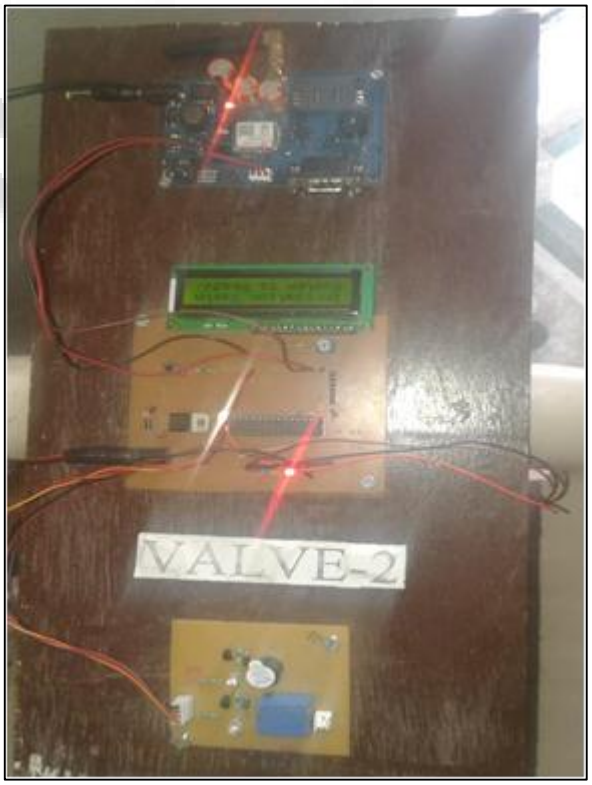
III. FINAL RESULT

A. Pump Circuit

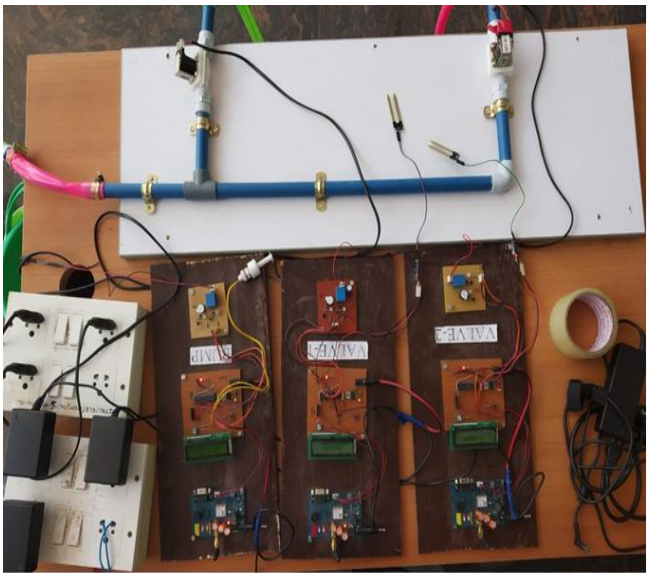


B. Valve1 Circuit

C. Valve2 Circuit



D. Total setup of Automatic Drip Irrigation



IV. CONCLUSION

The use of this method would allow us to save the excess water which may be wasted during manual methods. In this system the real time updated information is gathering from sensors node about the moisture which is transmitted wirelessly through GSM. With the help of solenoid valve and corresponding Arduino system becomes affordable to farmers. This system can save lot of water, human efforts and electricity with the use of minimum resources, hence it will become economically favorable.

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