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Design and Development of Automatic Drip Irrigation System

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Abstract— *This system provides development of mobile phones as remote control application for the drip irrigation which is used in the agriculture. Due to abnormal rain fall conditions in India, it is necessary to distribute water efficiently to the fields during normal conditions. This is carried out by exchanging the information between the user phone and GSM in the form of messages. This system is developed with arduino which in connected to the GSM and the relays. 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. The proposed design also has the features of which make the system wireless with the help of GSM. User control that system from anywhere with the help of mobile. GSM is used for wireless communication from anywhere. As soil reaches its maximum upper threshold value which is decided by user, the motors automatically stop after sending the message from mobile. To control the solenoid valve Arduino kit is used. Screen filters can be used to filter out organic and inorganic debris, sand, Silt and general soil particles. The major advantage of system include avoidance from water wastage, growth of plant to their maximum potential, less chances of error due to less labor. This system can be implementing in agriculture, polyhouse, garden, nurseries, etc.*

Keywords: Solenoid Valves, Screen Filter, Self priming pump, GSM Module, Arduino, Soil Moisture Sensor.

Introduction

India is basically an agricultural country, and all its resources depend on the agricultural output. The income of many countries depends directly on agriculture advancement. .In some countries, agriculture is considered as one of the major source of economic progress .With the rapid development of agriculture in India, many automatic technologies have been introduced into agricultural productions. Irrigation in agriculture is one of the main tasks. It is very much important to water the crops as per their need. Very less watering or too much watering can damages the crops. The total rainfall in a particular area may be either insufficient, or ill-timed. In order to get the maximum yield, it is essential to supply the optimum quantity of water, and maintain correct timing of water. This is possible only through a systematic irrigation system. By the construction of proper distribution system, the yield of crop may be increased because of controlled water supply. In present irrigation system, a farmer cannot check the moisture level of soil. A new idea for saving each drop of water by the way to test the soil condition before supplying water to the crop field. Hence sometimes it may happen that the watering is more than the need of the crop and sometimes water doesn't reach upto the roots of the plants. This will waste the water and efforts. If water doesn't reach upto the plants roots then it will directly affect the plant growth and profit. Traditional irrigation system requires manpower. Hence, it becomes necessary to do something so that the irrigation will become more convenient. Automatic Drip Irrigation System is a project which is developed to automate the traditional irrigation system. It is a simple system, using Arduino to automate the irrigation and watering of crops. This system is developed with arduino which in connected to the GSM and the relays.

Literature review

In 2001, Kyada P.M.et.al [1]. Proposed Study on Pressure-Discharge Relationship and Wetting Pattern Under Drip Irrigation System. It could be seen that the discharge from different drippers of all rating was increased with increase in operating pressure. The maximum co-efficient of manufacturing variations of

7.95% was obtained for 2 lph dripper rating while that was minimum of 0.86% for 20 lph dripper rating. The water application through 2 lph drippers for the 1,2,3,4 and 5 hours duration can yield wetted bulb having maximum radius of 21cm, 27cm, 36cm, 41cm, 52cm and 55cm respectively.

In 2005, C.M.Burt [2] Proposed Selection of Irrigation Methods for Agriculture: Drip/ Micro Irrigation. Drip/Micro irrigation Refers to Variety of Irrigation methods in which water is delivered to directly to small areas through emitters. The emission devices are spaced closely enough so that the capillary action of soil provides water to each plants root zone. Chemigation is generally required to avoid plugging due to bacterial growth and/or chemical precipitation in the laterals and emission devices. Due to use of drip irrigation system labour cost decreases but capital cost is high.

In 2011, Tom Gill et.al. [3] Proposed Venturi Meters Constructed with Pipe Fitting: an Under- Appreciated Option for Measuring Agriculture water. Venturi Meters constructed of pipe fittings can be a practical means of measuring flow with reliable accuracy for range applications. Actual head loss through a venture meter is commonly quite small. Pipe Venturi meters are widely recognized as a measurement technology in piped system offering a high degree of accuracy while imposing comparatively small head loss.

In 2014, T. Veeramanikandasamy et.al. [4] Proposed Remote Monitoring and Closed Loop Control System for Social Modernization in Agricultural System using GSM and Zigbee technology. In this system they used GSM for Modernization and wireless communication. With the help of GSM user can operate the system from anywhere. They used RS232 for interfacing GSM module and microcontroller. In this system zigbee technology is used in irrigation control centre for better wireless data transmission. The main advantages of this system, one can save man power, water and power consumption is reduced by 20% and 30% when compare to existing method. The zigbee technology having limited range of wireless data transmission, so user can't use this system for long distance this is the disadvantage of this system.

In 2015, Prof. R.R.Jadhav et.al. [5] Proposed Three Phase Motor Control Using GSM. The system ensures protection of motor against overloads, overheating and phase unbalances. It also provides automated restarting if normal conditions are re-established. The system proves to be great boon to farmers whose pump sets are located far away from their homes due to capability of remote control using cell phone and intimation about any abnormal conditions.

In 2017, Ateeq Ur Rehman et.al. [6] Proposed GSM Based Solar Automatic Irrigation System using Moisture, Temperature and Humidity Sensors. In that YL69 soil moisture sensor is used. It senses the water content of the soil. Soil moisture is a key variable in controlling the exchange of water and heat energy between the land surface and atmosphere through evaporation of plant transpiration. The main advantage of this system is that use of mini resources, the system can save lot of water and electricity hence system becomes economically favorable. User can easily know water sucking capacity of soil with the help of soil moisture sensor YL69. Cost is the main factor of any system so as solar is very costly, so it is not affordable to farmer, this is disadvantage of system.

In 2017, Kriti Taneja et.al. [7] Proposed Automatic Irrigation System using Arduino UNO. In this system soil moisture sensor is used to sense the water sucking capacity of soil or moisture level of soil. Also they used water level sensor. LCD is connected with Arduino and the entire sensor to display the status of moisture content in the soil and water level in tank. The main advantages of this system, system helps in irrigation areas with low water level and leads to sustainability. This system is very volatile and low maintenance and could be adjusted according to various types of crops without much human efforts. Other than cost reduction this project helps to save vital element of life that is water. The disadvantage of this system is that this project only limited to farming at home, user can't apply this project to bigger level of agriculture.

In 2017, Prateek Jain et.al. [8] Proposed Irrigation Management System with Micro-controller Application. The proposed system is based on micro-controller

based automation based automation for optimizing utilization of water resources and reducing labour cost in agriculture applications. System consists of Arduino platform and functional components like moisture sensor and motor load. A moisture sensor detects the humidity level of soil. Soil moisture and temperature predetermined range is set particularly for specific plants requirements, and according to that system is being operated. The system is not intimate the current status of field.

In 2017, R. Nandhini et.al. [9] Proposed Arduino Based Smart Irrigation System Using IOT. The main objective of this smart irrigation system is to make it more innovative, user friendly, time saving and more efficient than the existing system. If the sensed value goes beyond the threshold values set in program, the pump will be connected to driver circuit which helps to switch the voltage. The farmer will be intimated about the current field condition through GSM module. By using this system, the farmer can access the details about the condition of the field anywhere at any time. The system is not used for number of plots.

Basic Methodology

This system consists of mainly Arduino, GSM module, Solenoid Valve, Soil moisture Sensor also Filter and Pump. In proposed system the human factor is reduced by Arduino which specially programmed to monitor any parameter changes in sensor. In our system, if we will send message from our Smartphone that time GSM receive and send signal to Arduino for turning ON motor according to program burn into Arduino kit. As well as motor will turn ON that time water will flow through the pipeline and reach into the plot that we will referred as plot 1. Proposed system having two different plots of farm and each plot consist of different electronic kit which contain GSM module, Arduino and Sensor. In the plot 1 we will placed Soil moisture sensor for checking the moisture content of soil. As water sucking capacity of soil will get fulfill that time sensor send signal to Arduino for turning OFF valve and with the help of corresponding GSM module the signal send back to Smartphone. In this system the soil moisture sensor having fixed threshold value which will programmed into corresponding Arduino, if actual value greater than that of fixed threshold value then also it will send message to user through GSM. As the water sucking capacity of plot 1 get fulfill we have to turn ON the valve 2 and at the same time we have to turn OFF valve 1 with the help of Smartphone. Again sensor present in plot number 2 start the same operation as plot number 1.In this way user will be operate this system from anywhere by Smartphone . The proposed system will use the screen filter to filter out organic and inorganic debris, sand, Silt and general soil particles.

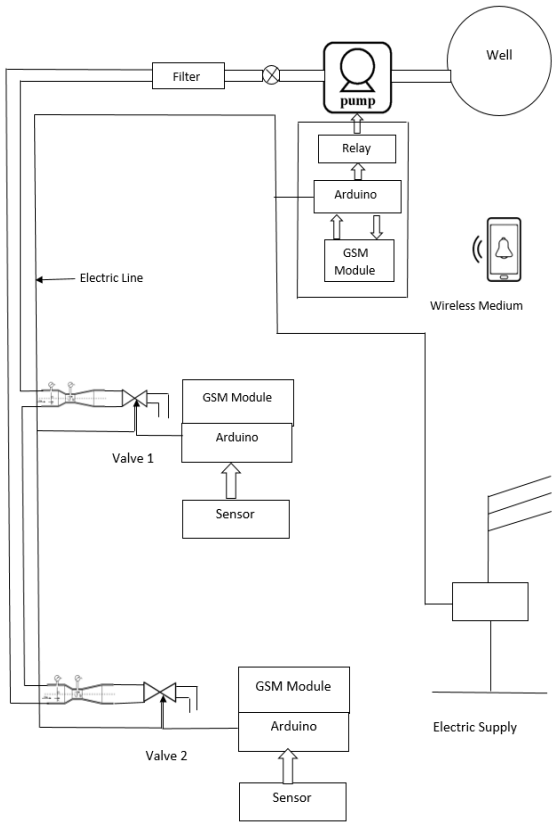
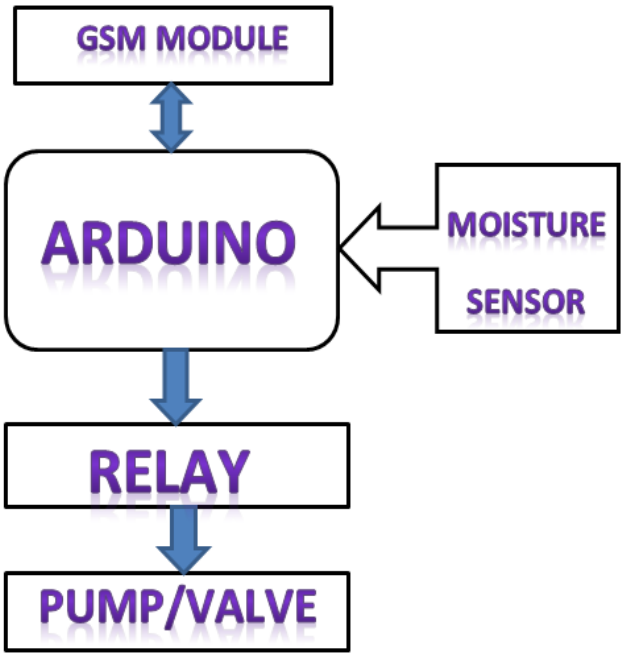


Figure 1. General Block Diagram of Automatic Drip Irrigation System

FLOW CHART



B. Hardware used

1. Arduino

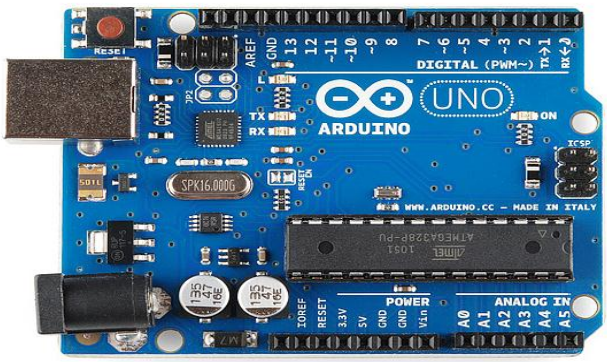


Figure 2- Arduino Uno

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 cable It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts.

2. GSM Module

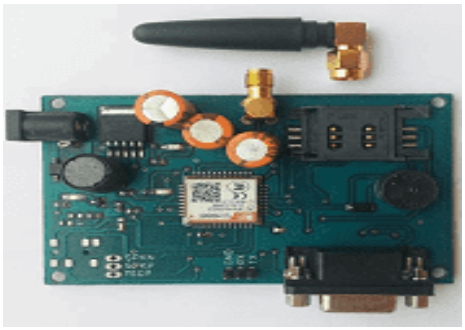


Figure 3- GSM Module sim 800C

GSM (Global System for Mobile Communication) is a standard developed by the European Telecommunication Standards Institute (ETSI) to describe protocols for second-generations (2G) digital cellular networks used by mobile phones. GSM describes a digital, circuit-switched network optimized for full duplex voice telephony and also expanded to include data communications, packet data transport via GPRS (General Packet Radio Services).

3. Soil Moisture Sensor

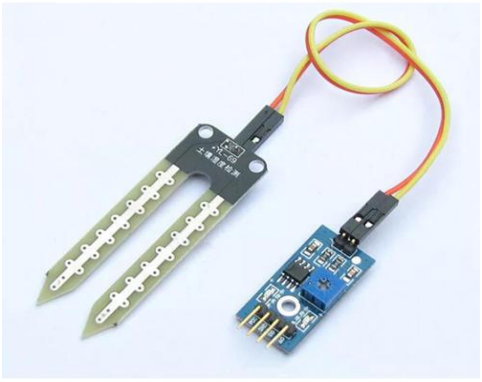


Figure 4.- Soil Moisture Sensor YL69

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

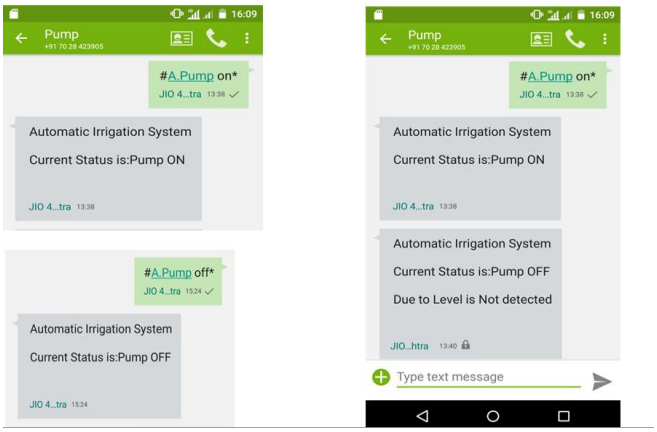
4. Solenoid Valve

Figure 5- Solenoid Valve

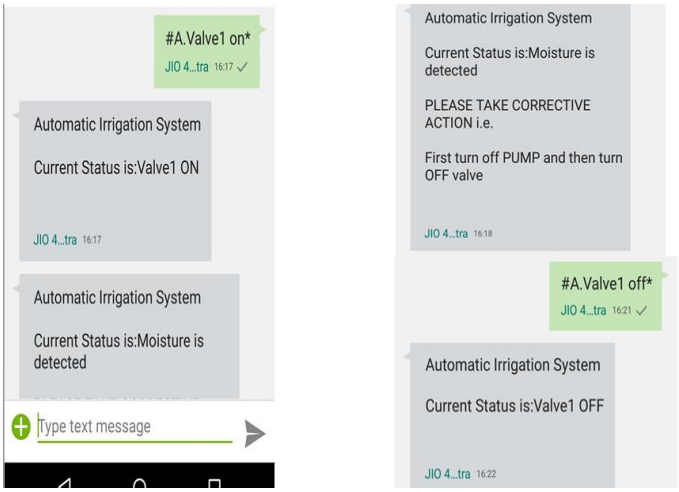
A solenoid valve is an electromechanical device in which the solenoid uses an electric current to generate a field and thereby operate a mechanism which regulates the opening of fluid flow in a valve. Solenoid valves differ in the characteristics of the electric current they use, the strength of the 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.

RESULT

Testing result for pump



Testing result for valve



Conclusion

The use of proposed method would allow us to save the excess water which may be wasted during manual methods. In proposed system the real time updated information is gathering from sensors node about the crop field which is transmitted wirelessly through GSM. With the help of solenoid valve and corresponding Arduino system becomes affordable to farmers. The proposed 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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