

Automatic Plant Watering System Using Arduino Controller

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Abstract

INDIA is agriculture based country continuous water monitoring system is necessary for some plants. During summer, most of the people are too lazy to water the plotted plants on their roof top gardens every day. An adequate water supply is important for plant growth. When rainfall is not sufficient, the plants need additional water. For that Automatic Plant Watering system is implemented by using Arduino. In this automatic watering on plants is done with the help of soil moist sensors which is connected with Arduino, it sends the information about the % of moist present in the soil to the Arduino and then watering is done through the servo motor based on programing delay.

Keywords: Soil moist sensors, Servo motor, Arduino, Automatic watering

I. INTRODUCTION

Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and re vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. When a zone comes on, the water flows through the lateral lines and ultimately ends up at the irrigation emitter (drip) or sprinkler heads. Many sprinklers have pipe thread inlets on the bottom of them which allows a fitting and the pipe to be attached

to them. The sprinklers are usually installed with the top of the head flush with the ground surface. When the water is pressurized, the head will pop up out of the ground and water the desired area until the valve closes and shuts off that zone. Once there is no more water pressure in the lateral line, the sprinkler head will retract back into the ground. Emitters are generally laid on the soil surface or buried a few inches to reduce evaporation losses.

Healthy plants can transpire a lot of water, resulting in an increase in the humidity of the greenhouse air. A high relative humidity (above 80-85%) should be avoided because it can increase the incidence of disease and reduce plant transpiration. Sufficient venting or successive heating and venting can prevent condensation on plants surfaces and the greenhouse structure. The use of cooling systems during the warmer summer months increases the greenhouse air humidity. During periods with warm and humid outdoor conditions, humidity control inside the greenhouse can be a challenge. Greenhouses located in dry, desert environments benefit greatly from evaporative cooling systems because large amounts of water can be evaporated into the incoming air, resulting in significant temperature drops.

In the mid 20th century, the advent of diesel and electric motors led to systems that could pump groundwater out of major aquifers faster than drainage basins could refill them. This can lead to permanent loss of aquifer capacity, decreased water quality, ground subsidence, and other problems.

II. RELATED WORKS

1. Embedded system:

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

2. Micro controller:

A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

III. HARDWARE PLATFORM:

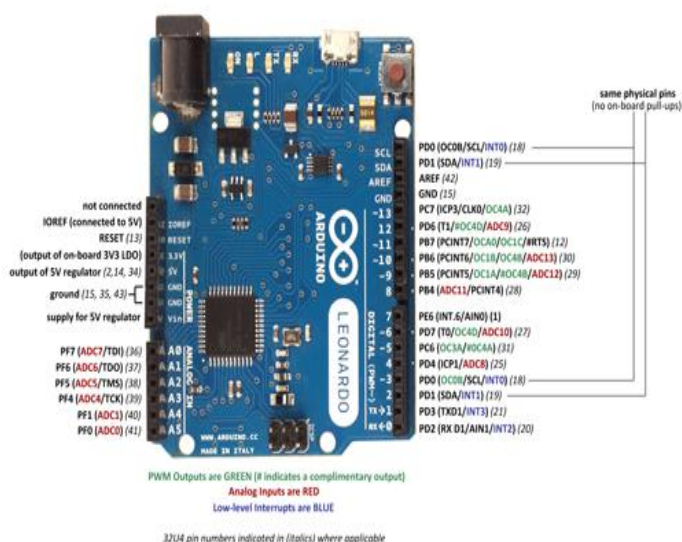
The hardware platform mainly consists of an Arduino board, LCD display, soil sensors, servo motor and the power supply which are being discussed as below.

1. Arduino microcontroller:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by

sending a set of instructions to the microcontroller on the board. Basically, the processor of the Arduino board uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories such as program memory and data memory. Wherein the data is stored in data memory and the code is stored in the flash program memory.

The Atmega328 microcontroller has 32kb of flash memory, 2kb of SRAM 1kb of EPROM and operates with a 16MHz clock speed.



Arduino Leonardo Pinout Reference

June 2012 by J. M. De Cristofaro/johngineer

from pin map data at:
<http://arduino.cc/en/Hacking/PinMapping32u4>

Figure: 1

2. LCD Display:

A liquid crystal each pixel consists of a column of liquid crystal the liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. Without the liquid crystals between them, light passing through one would be blocked by the other. LCD display is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular.

Non-dissolving granular matrix sensors are now available with a more exacting specification for the range 0 to -200 kPa and use internal calibration methods to offset variations due to solutes and temperature. Common LCDs connected to the controllers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

3. Soil Moist Sensor:

Soil electrical conductivity is simply measured using two metal conductors spaced apart in the soil except that

dissolved salts greatly alter the water conductivity and can confound the measurements. An inexpensive fix is to embed conductors in a porous gypsum block which releases calcium and sulphate ions to swamp the soil background level of ions. The water absorbed by the block is correlated with soil water potential over the range -60 to -600 kPa providing a tertiary indicator for use in medium to heavy soils.

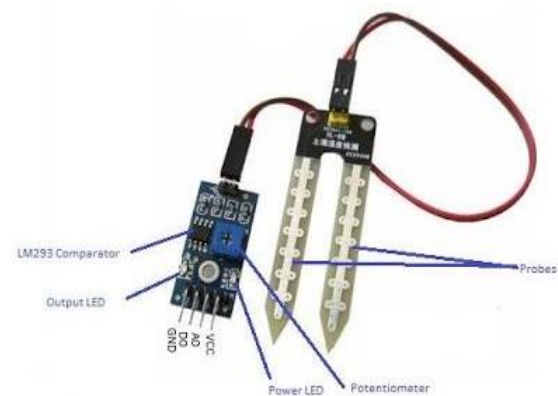


Figure: 2

4. Water Pump:

The water pump is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. This project employs the use of a small water pump which is connected to a H-Bridge.



Figure: 3

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from afresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location.

Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

5. Servo Motor:

A servo is a rotary actuator that allows for precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a

relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.



Figure: 4

Servomotors are not a different class of motor, on the basis of fundamental operating principle, but use servo mechanism to achieve closed loop control with a generic open loop motor. In other words, a servomotor is just a regular motor with a sensor installed, typically to measure angular position during operation. A servo motor is a specific type of motor and rotary encoder combination that forms a servo mechanism.

Servomotors are used for both high-end and low-end applications, although the mid-range is generally handled by stepper motors. Most servomotors, at least under this name, are precision industrial components. However the very cheap radio control servo, because it combines a

free-running motor and a simple position sensor with an embedded controller, also qualifies as a servomotor.

6. METHODOLOGY

Soil sensors are placed in the soil that is two soil probes are placed at the root part of the two different plants these sensors sense the percentage of the moist present in the soil. Whenever the soil is dry and the water level is full or middle then the motor is activated i.e., the motor is in ON condition. When the soil is dry, the soil moist sensor sense the percentage of moist present in the soil and sends the information to the Arduino then water pump is turned ON and OFF with the help

of the relay circuit. When the soil is dry LCD shows moist1 is dry and then motor1 is ON, watering is done on the respective plant. When soil sensor is wet then it shows on LCD display i.e., moist1 is wet then the motor1 is OFF. Similarly same process is done with moist2 respective motor2.

In this project there are two sensors that is moist1 and moist2 and two motors that is motor1 and motor2 similarly watering is done on their respective plant with the respective sensor and motor based on the relay circuit which acts as bridge between the sensing set-up and motor set with the Arduino.

Block diagram

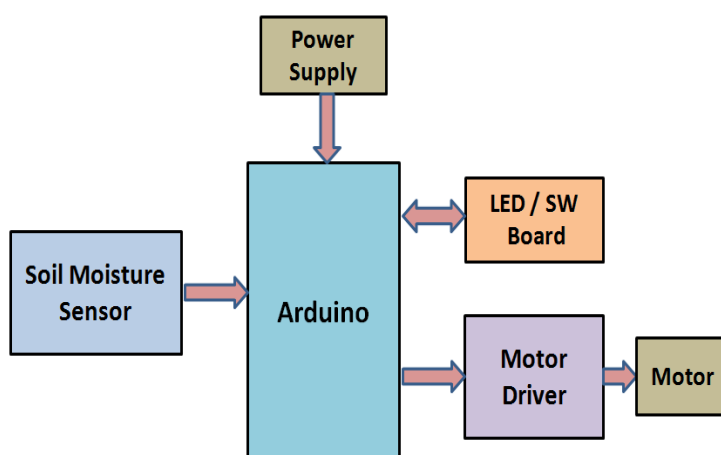


Figure: 5

Circuit diagram:

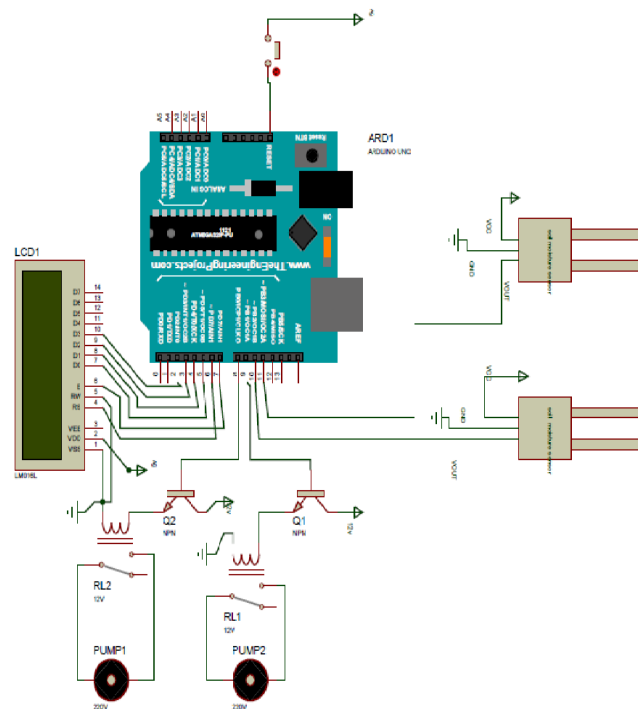


Figure: 6

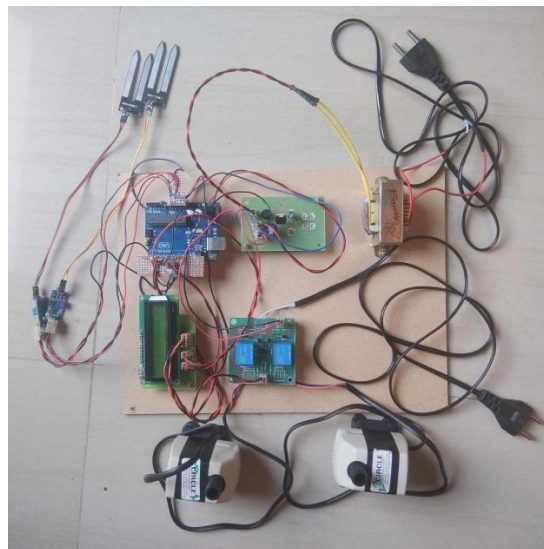


Figure: 7

CONCLUSION

AUTOMATIC PLANT WATERING SYSTEM USING ARDUINO CONTROLLER has been designed and

tested successfully. It has been developed by integrated features of all hardware components used. Presence of every module has been reasoned out and placed

carefully, thus contributing to the best working of the unit. The system has been tested to function automatically.

Moisture sensors measure the moisture level of the different plants if the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the water pump to turn ON and supply the water to respective plants. When the desired moisture level is reached, the water pump is turned OFF. Thus the functionality of entire system has been tested successfully.

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