Automated Plants Watering System Using Arduino UNO Board

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Abstract

Watering is the most important cultural practice and most labor intensive task in daily greenhouse operation. Watering systems ease the burden of getting water to plants when they need it. Knowing when and how much to water is two important aspects of watering process. To make the gardener works easily, the automatic plant watering system is created.

Keywords: ***Cultural; Intensive; Burden***

1. INTRODUCTION

Watering is the most important cultural practice and most labor intensive task in daily greenhouse operation. Watering or 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. Watering systems ease the burden of getting water to plants when they need it. Knowing when and how much to water is two important aspects of watering process. To make the gardener works easily, the automatic plant watering system is created. There have a various type using automatic watering system that are by using sprinkler system, tube, nozzles and other. This project uses watering sprinkler system because it can water the plants located in the pots.

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, dessert environments benefit greatly from evaporative cooling systems because large amounts of water can be evaporated into the incoming air, resulting in significant temperature drops.

This project uses Arduino board, which consists of ATmega328 Microcontroller. It is programmed in such a way that it will sense the moisture level of the plants and supply the water if required. This type of system is often used for general plant care, as part of caring for small and large gardens.

. Table 1 Degrees in path and name of the Rashi (Sign) are according to astrology. (The degrees are divided with respect to Earth) shows the name of sections of sign as per 30^0. This type of calculation can be observed from astrological books.This research work is divided into some phases of experiment to understand relation between scientific and astrological details of planets. So those phases are described in the Experiment design section of papers.

2. Experiment design

There are two functional components in this project. They are the moisture sensors and the motor/water pump. Thus the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the level of moisture in the soil. The motor/water pump supplies water to the plants.

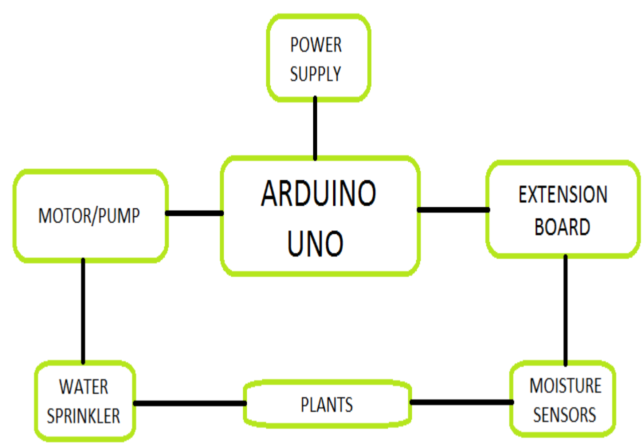

Fig. 1-Block Diagram of Automated Plants Watering System

Arduino UNO :

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Fig 2.1.1 Arduino Uno The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig. 2- Arduino UNO Board

Table. 1- Feature Specification of Arduino UNO Board

FEATURE	SPECIFICATION
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

Moisture Sensor:

Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. Technologies commonly used in soil moisture sensors include:

- Frequency domain sensor such as a capacitance sensor.
- Neutron moisture gauges, utilize the moderator properties of water for neutrons.
- Electrical resistance of the soil

In this particular project, we will use the moisture sensors which can be inserted in the soil , in order to measure the moisture content of the soil. Moisture 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. 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.

Methods for exploiting soil dielectric properties actually measure proxy variables that more or less include a component due to the soil electrical conductivity and are thus inherently sensitive to variations in soil salinity and temperature as well as water. Measurements are also affected by soil bulk density and the proportion of bound and free water determined by the soil type. Nevertheless, good accuracy and precision can be achieved under specific conditions and some sensor types have become widely adopted for scientific work.

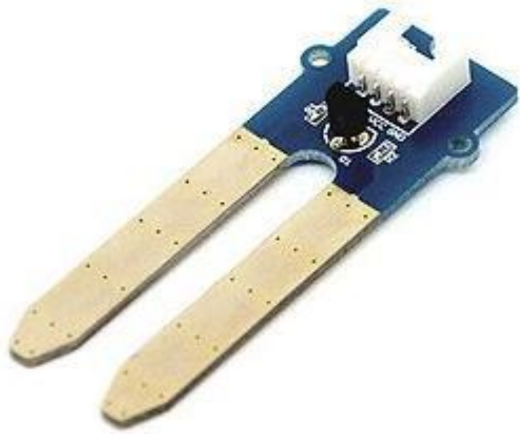

Fig. 3- Moisture Sensor

In general, conversions from raw sensor readings to volumetric moisture content or water potential using secondary or tertiary methods tend to be sensor or soil specific, affected or precluded at high salinity levels and dependent on temperature. Research-grade instruments typically have laboratory measured accuracy worse than +/- 4% when relying on factory settings or as good as +/- 1% when calibrated for the specific soil. Sensors based on the TDR method seem to require least calibration but may be unsuitable for soils with very high salinity or clay content. There are no comparable laboratory specifications for granular matrix sensors, possibly because they are technically more difficult to calibrate, their response times are relatively slow and the output is hysteretic for wetting and drying curves.

Soil dielectric measurement is the method of choice for most research studies where expertise is available for calibration, installation and interpretation, but scope for cost reduction through sensor multiplexing is limited due to the possibility of stray capacitances. A lower manufacturing cost is possible through development of application specific integrated circuits (ASICS), though this requires a high level of investment. Multiple sensors are required to provide a depth profile and cover a representative area, but this cost can be minimized through use of a computer model to extend the measurements in a predictive way. Thus, by using the moisture sensors, the over-riding factor will be reliable, cost-effective sensors and electronic systems for accessing and interpreting the data.

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

Fig. 4- Water Pump

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 a fresh 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.

Programming:

The Arduino Uno can be programmed with the Arduino software. Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on your board).

The ATmega328 on the Arduino Uno comes preburned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).We can also bypass the boot loader and programs the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

• On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
• On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1

(TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required.

3. Conclusion

Thus the "ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM" has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed

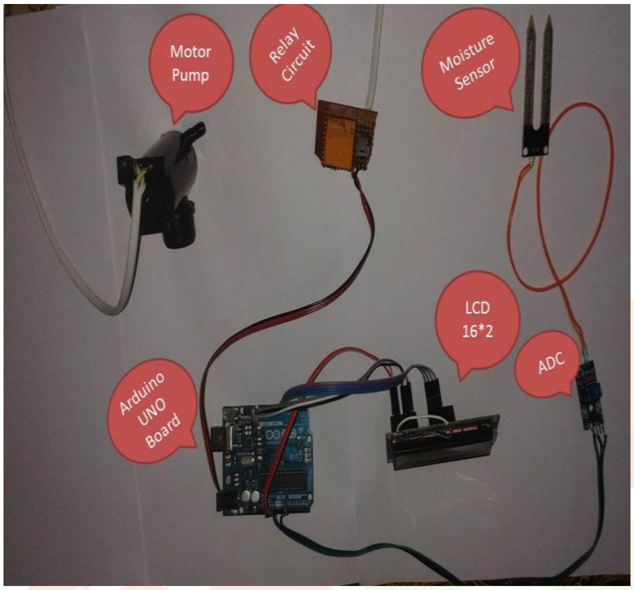

Fig. 5- Real Time circuit of project

carefully, thus contributing to the best working of the unit. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) 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 plant using the Rotating Platform/Sprinkler. When the desired moisture level is reached , the system halts on its own and the Water Pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

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