UET LAHORE

UNIVERSITY OF ENGINEERING & TECHNOLOGY

Complex Engineering Problem

Project Report

EE-273L MICROPROCESSOR SYSTEMS

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Automatic Soil Irrigation System

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Introduction

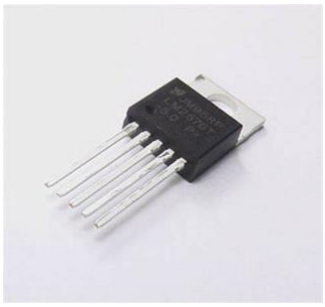
Fig 1: Automatic Soil Irrigation System

Trees perform a very important role in our life, they produce oxygen for us. Almost all of us love to plant trees in our garden, rooftop garden, and house (Indoor plants). It is not only necessary to plant trees, but also to take proper care of them, and water should be given regular basis. But in this busy life sometimes we forgot to water the plants, which damages our plants. Now a day's water is becoming very precious due to scarcity in obtaining clean water for domestic purpose including irrigation. In order to optimize the use of water, mechanism to develop water conversation is the need of the hour. To overcome this problem here we will be going to build an Automatic Plant watering system that automatically waters the plants without any human effort. This system continuously senses the moisture levels of the plant soil. When the soil moisture levels will decrease this device automatically water the plants. This system not only saves your time, it also saves the wastage of water. This system is also known as the Automatic Plant Irrigation System.

List of Equipment and details

Power Source:

To power the solenoid, we require 12 V source. Due to unavailability of 12 V battery, we use two 9 V batteries and connect them in series. So total voltage will be 18 V. Then we use a voltage regulator LM2576T for converting it to 12 V for functioning of solenoid valve. The LM2576 is a voltage Regulator IC, it uses the Buck-converter topology to step-down and regulate higher level voltage values to lower level. It is of non-sync type and can take in an input voltage 40V maximum and source an output current of 3A maximum with a peak efficiency of 90%.



TM4C123GH6PM Microcontroller:

TM4C123GH6PM is a microcontroller. It has 6 ports and 43 pins.

Some of its features are:

• Processor has clock frequency up to 80 MHz with floating point unit (FPU).

• SysTick is 24-bit, clear-on-write, decrementing timer. Can be used for system time base generation due to its flexible control.

• The TM4C123 microcontroller provides a JTAG and SWD (serial wire debug) based debugging interface for programming and debugging purpose.

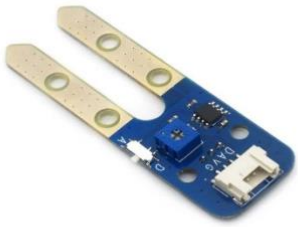
• The microcontroller TM4C123 also includes a nested vectored interrupt controller (NVIC).

A collection of 7 system exceptions and 65 peripheral interrupts are supported by TM4C123.

Analogue soil Moisture Sensor:

The sensor includes a fork-shaped probe with two exposed conductors that is inserted into the soil or wherever the moisture content is to be measured.

- The more water in the soil, the better the conductivity and the lower the resistance.
- The less water in the soil, the lower the conductivity and thus the higher the resistance.
- The sensor produces an output voltage according to the resistance, which by measuring we can determine the soil moisture level.



1 Channel 5V Relay module:

- Relay is an electro-mechanical device which acts as a switch. DC electrical current is used to energize the relay coil which opens or closes the contact switches. Internal circuit of a single channel 5V relay consists of normally open contacts, normally closed contacts and a coil.

Pin Number	Pin Name	Description
1	Relay Trigger	Input to activate the relay
2	Ground	0V reference
3	VCC	Supply input for powering the relay coil
4	Normally Open	Normally open terminal of the relay
5	Common	Common terminal of the relay
6	Normally Closed	Normally closed contact of the relay

12 V Solenoid Valve:

Most 12V DC solenoid valves are of the 2-way type used for the simple on/off control of water, air, petrol/gasoline or diesel fuels or gases such as butane or propane. Because this voltage is compatible with vehicle electrical systems, they are popular for automotive or marine use.

In the case of a normally closed (fail-safe closed) solenoid valve when 12 volts is applied the solenoid valve opens allowing flow. When the 12 volts are removed from the solenoid valve then the valve will automatically close and prevent flow along the pipe. For a normally open solenoid valve then the opposite is true, i.e., the solenoid valve fail-safe position is open and when power (12v) is applied the solenoid valve will power close.

Working of Project

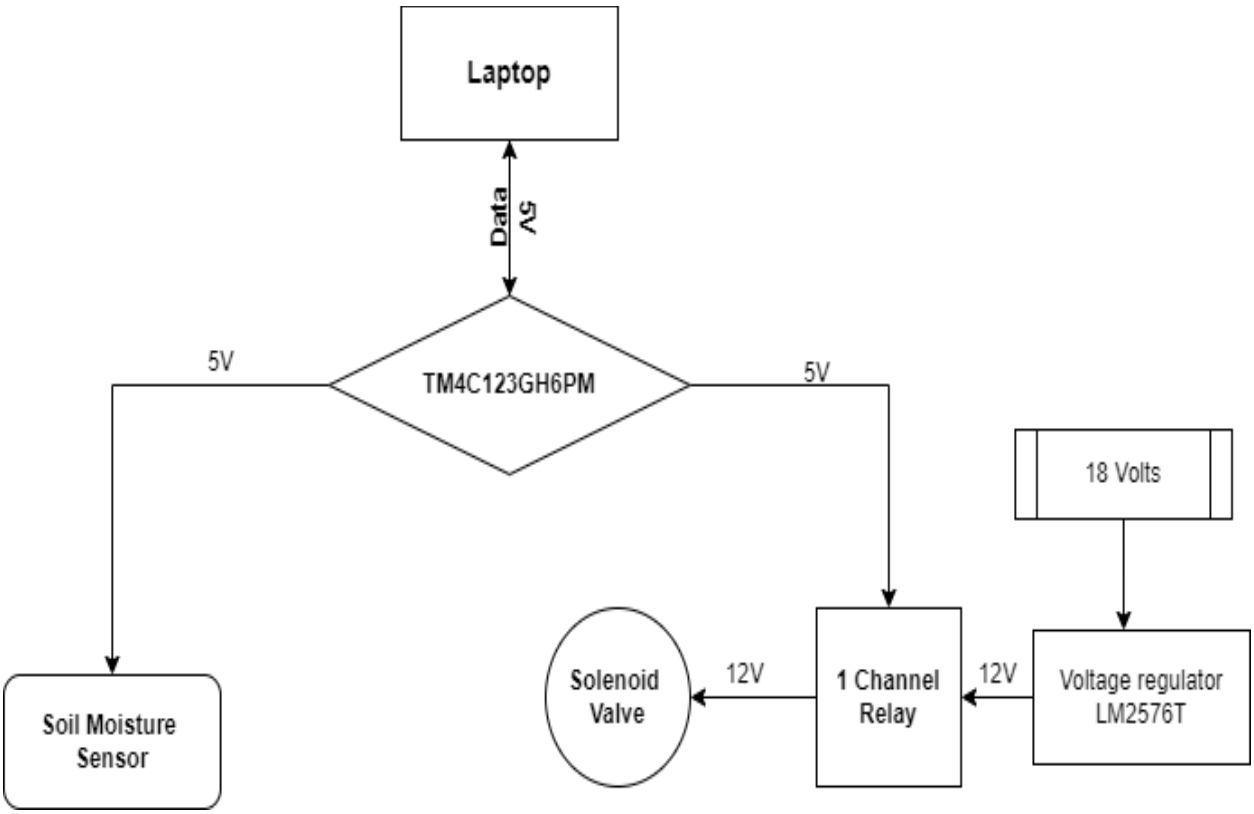
We are aiming to make an automatic soil irrigation system with soil moisture sensor using texas instruments tm4c123gh6pm. This project can be widened to many different automated components i.e., humidity sensor, temperature sensor etc. which will control water flow to plants depending upon temperature and humidity level of atmosphere. But here we are only restricted to soil moisture sensor which will detect the moisture level in soil and then water flow will be controlled depending upon soil moisture sensor's reading.

To power the entire system, we require 12 V source. We connect two 9 V batteries in series so total voltage will be 18 V. It will be converted to 12 V using a voltage regulator. We use **LM2576T** voltage regulator for this purpose. This voltage source is given to relay for the functioning of solenoid valve. We are using 1 channel 5 V Relay module for opening and closing solenoid valve. Relay is also connected to pins of TM4C123GH6PM microcontroller. Soil moisture sensor is connected to pins of tiva. Two conductors in soil moisture sensor are dipped in soil. It detects moisture level in soil and based on its conductivity level (which depends on presence of water in soil) it will give voltage value. Based on its output, we specified a threshold voltage in our code. When there will be water in

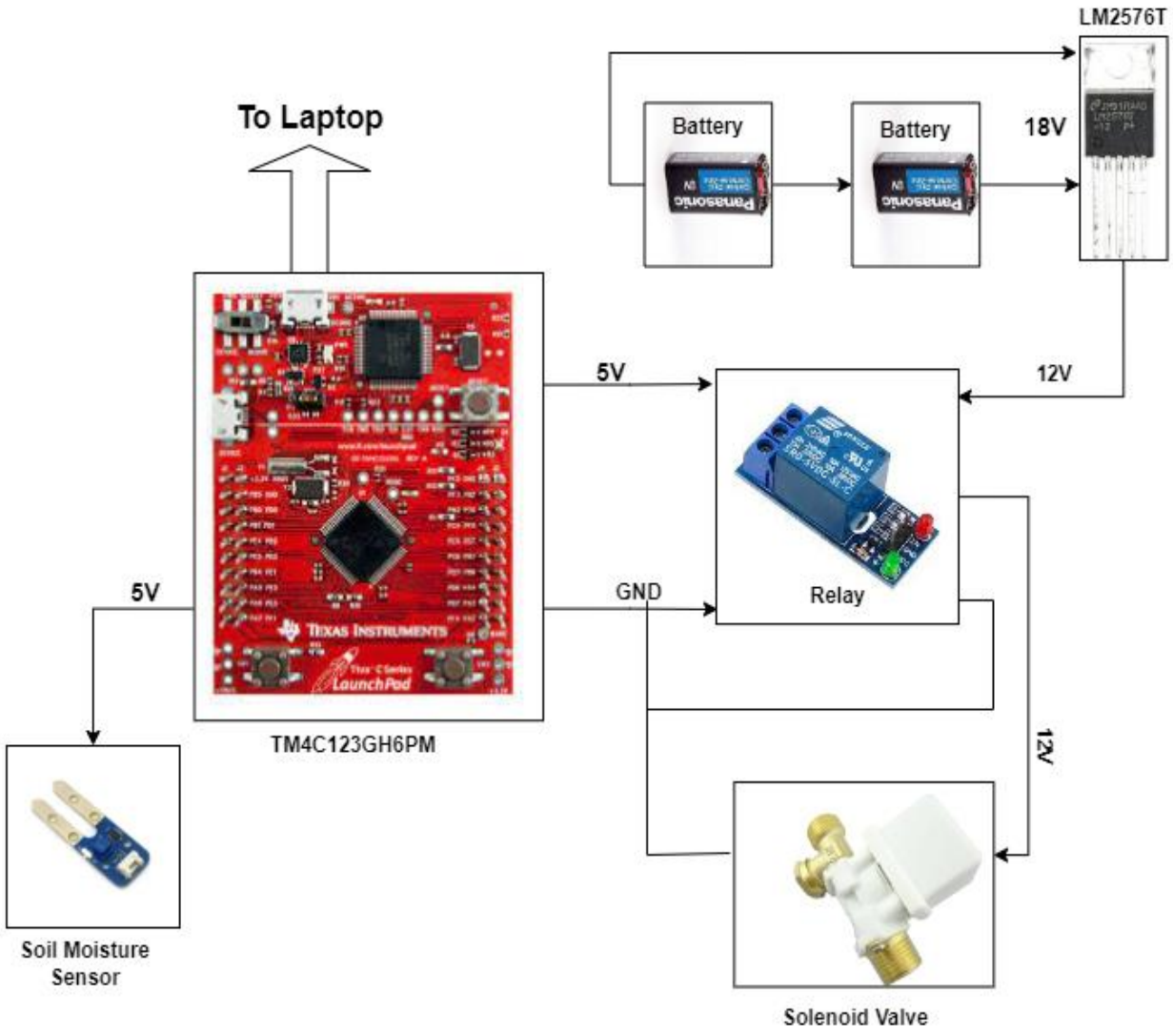
soil, the conductors in soil moisture sensor will have minimum conductance and maximum resistance. It will give minimum voltage as output to tiva. Then tiva will give signal to relay which will open the solenoid valve and it will pull water from beaker to soil. When there will be enough water in soil, the conductors in sensor will have maximum conductance and minimum resistance. It will give maximum voltage as output to tiva. When voltage will exceed our specified value in code, it will give signal to relay for closing the solenoid valve and water flow to the soil will be stopped.

In this way whenever there will be low moisture level in soil and soil requires water, soil moisture sensor will give message to tiva which further give message to relay module and water flow to soil will start. That's why it is called as automatic soil irrigation system as water flow automatically whenever soil need it. So, there will be minimum wastage of water and water requirement of plants will be full filled by this automatic irrigation system.

Block Diagram



Circuit Diagram



Budget of Project

We bought all these components from “The IC Shop” at hall road.

Below are the prices of each component:

TM4C123GH6PM Microcontroller…… 6500 Rs

Analogue soil moisture Sensor…… 100 Rs

12 V DC Solenoid valve……. 1500 Rs

Voltage regulator LM2576T……... 70 Rs

1 Channel 5 V Relay module…… 90Rs

Total Budget on project is 8500

Tasks Performed by Each Group Member

All three group members coordinated very well in making this report and the rest of project as well.

In this report contributions by all three group members are :

AbdurRehman Ejaz (2020-EE-113)

Introduction working of project

Muhammad Amish Abbas (2020-EE-122)

Block Diagram Circuit Diagram

Aown Abbas Shah (2020-EE-125) searched and provide list of equipment and their details to add in this report.

References

We took help from following websites:

https://www.instructables.com/Automatic-Irrigation-System-21/

https://www.eeweb.com/automatic-irrigation-system-on-sensing-soil-moisture-content/

We use following website for drawing block and circuit diagram

https://app.diagrams.net/