A Project Design on
AUTOMATIC WATER IRRIGATION SYSTEM

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Chapter 1

INTRODUCTION AND PROJECT FORMULATION

1.1 Introduction

The project "Automatic Plant Irrigation System" is intended to create an automated irrigation solution by detecting the moisture level of the soil. It will monitor the soil moisture level continuously to decide whether watering is needed or not, and make a response according to it.
In its most basic form, the system is designed in such a way that the soil moisture sensor senses the moisture level from the plant at a particular instance of time, if the moisture level of the sensor is less than the specified value of threshold which is predefined according to the particular plant than the desired amount of water is supplied to plant till its moisture level reaches to the predefined threshold value. The system involves a humidity sensor that keeps tracking the current moisture of soil and influences when watering happens. Using this response, the system determines whether or not the land needs to be irrigated.
The proposed model consists of three stages: Firstly, sensing the land's moisture levels. The second stage is the determination of its status: dry or wet. The last and third stage is Motor control.

1.2 Project Perspective

In the age of advanced technology and electronics, the lifestyle of humans should be smart, simpler, easier, and much more convenient. So, therefore; there is a need for many automated systems in humans' daily life routines to reduce their daily activities and jobs. Here is an idea of one such system we call it automatic plant watering system that can be very useful. As many people are facing a lot of problems watering the plants in the garden, especially

when they are away from the home. This product will reduce the headache of watering the plants which will give people more time to enjoy their vacations. We can implement different categories and multiple versions of this product. It can be a low-cost general home plant irrigation product or an enterprise-level solution. General home plant irrigation systems can be developed of different kinds. Such as Automatic water pumping or Automatic valve controlling. For an enterprise-level solution, we can develop a custom-made automation system.

We know that plants are very imperative for all humanity in many aspects. As they keep the environment clean by producing fresh oxygen from time to time. To compete with global warming, there's no other way to challenge it than planting more and more trees. People are getting so much busy nowadays. Whenever we're on a vacation it's hard to water the plants or often forget to water plants. As a result, there is a chance of getting the plants damaged. This project is an excellent solution to such kinds of problems. As many people are facing a lot of problems watering the plants in the garden, especially when they are away from the home. From the hobby perspective to an enterprise-level solution, we came up with an idea to make an impact on the tree planting irrigation system. So, in these busy lifestyle eras, we came up with an irrigation solution that'll make everyone's tree-planting experience so much easy.

Further

, in the domain of farming, the utilization of appropriate means of irrigation is significant. Daily operations related to watering plants are the most important cultural practice and the most labor-intensive task. There is a large deficiency in manpower. This makes automated farming a necessary part of the future. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation. An important aspect of this project is when and how much to water. To reduce manual activities for the human to watering plants, and the idea of a plant watering system is adopted.

The automated plant irrigation system will help to reduce the workload on farmers and help to keep the farmlands well irrigated at all times. Its user-friendly simple circuitry will make the user feel comfortable in using this system. The user only needs to install the circuit and sensors and connect the pump to the circuit and it's complete. The system will start functioning upon power-up and will need no trigger to keep it running.

Chapter 2

PROJECT DESIGN

2.1 Steps for the Project

In this project, we are intended to create an automated irrigation solution that turns the pumping motor ON and OFF by detecting the moisture level of the soil. It will monitor the soil moisture level continuously and decide whether watering is needed or not, and how much water is needed in the plant's soil.

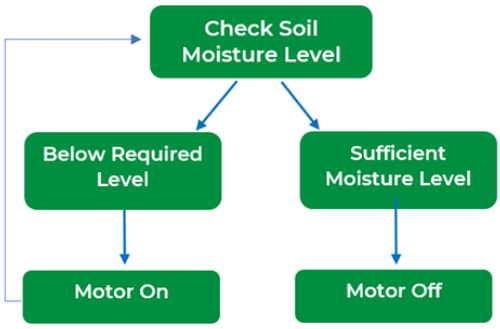

Figure 2.1: Flow Chart for the project.

In Figure 2.1, the flow chart of our proposed project have shown which gives an overall idea of our project architecture.

2.2 Required Equipment for the Project

1. 555 Timer IC
2. 6V Relay
3. 9V DC Pump

4. 15k Potentiometer
5. 1k Resistor
6. Transistor 547ic
7. Soil Moisture Sensor
8. LED
9. 9V Battery

2.3 Circuit for the Project

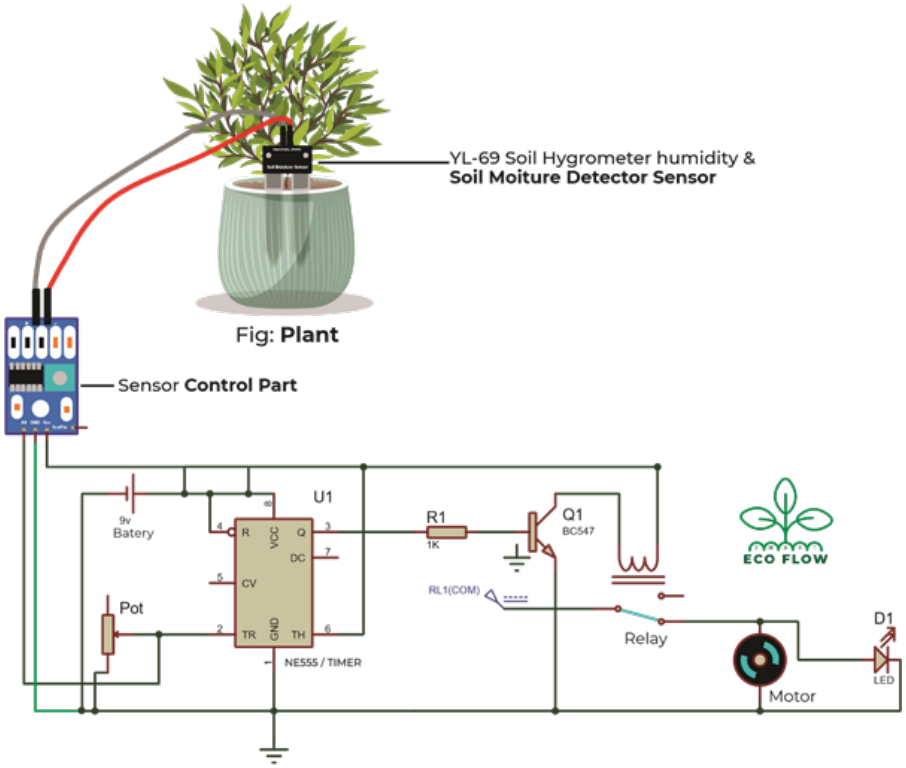

Figure 2.2: Circuit for developing the project.

In Figure 2.2, we have shown our proposed project working circuit along with the sensor part and a visual representation of how the moisture sensor is placed into the plant and get the moisture level reading from the soil.

2.4 Introduction to Equipment

2.4.1 NE555 Timer

In this project, we used NE555 Timer for our main processing IC. This is a very popular and accessible IC for low cost to produce. This circuit can run in either of three modes: bistable (two stable states), monostable (one stable state), or astable (no stable states). In the monostable mode, it can produce accurate time delays from microseconds to hours. We need one stable state so we are using the monostable mood.
The 555 timer contains a voltage divider, two comparators, an RS flip-flop, and an NPN transistor.

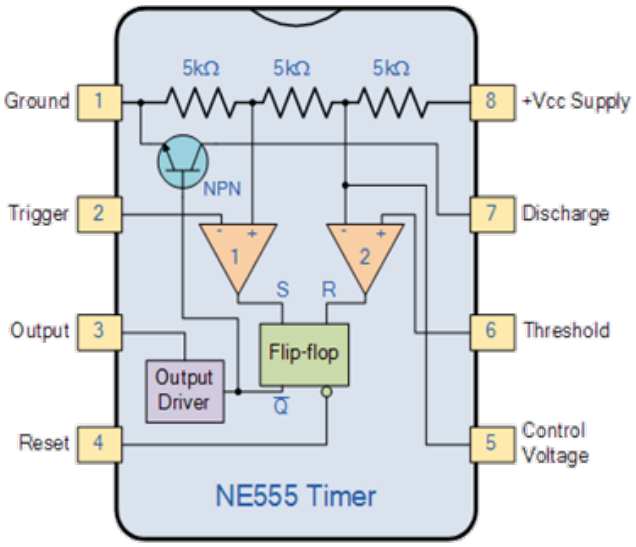

Figure 2.3: Circuit for developing the project.

In Figure 2.3, the Internal block diagram of NE555 TIMER is the main processing component of our project. Since the voltage divider has equal resistors, the top comparator has a trip point (UTP) and the lower comparator has a trip point (LTP) of:

$$UTP = \frac{2V_{cc}}{3} \tag{2.1}$$

$$LTP = \frac{V_{cc}}{3} \tag{2.2}$$

When the threshold voltage is greater than the UTP, the upper comparator has a high output. When the trigger voltage falls to less than the LTP, the lower comparator produces a high output.

- When the threshold voltage is greater than the UTP, the upper comparator has a high output.
- When the trigger voltage is less than the LTP, the lower comparator produces a high output.
- Pin 4 may be used to reset the output voltage to zero and is connected to +VCC.
- Pin 5 may be used to control the output frequency and pin 5 is bypassed to ground.

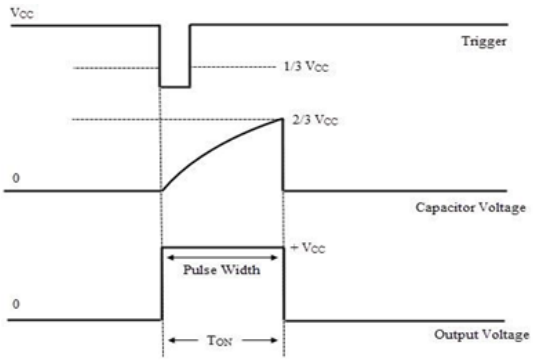

Figure 2.4: Circuit for developing the project.

In Figure 2.4, shows the monostable mood-triggering graph which we have used in implementing our project.

2.4.2 Soil Moisture Sensor

Soil Moisture Sensor is used to sense the moisture of the soil. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.
In Figure 2.5, shows the Soil Moisture Sensor which we have used as our main sensor component for our project.

2.4.3 Relay Board

A relay is an electrically operated switch. Relays use an electromagnet to mechanically operate a switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. Electromagnetic relays are those relays that are

Figure 2.5: Circuit for developing the project.

operated by electromagnetic action.
It will take a much longer time to be replaced all electromagnetic relays with micro-processor-based static relays.

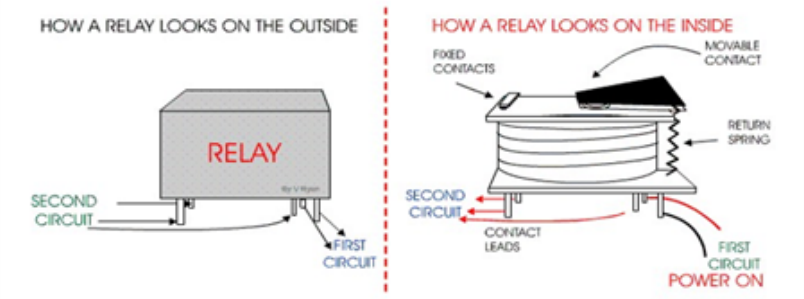

Figure 2.6: Circuit for developing the project.

In Figure 2.6, Relay internal Operational Diagram which is one of the major components in our proposed project.

2.4.4 Dc Motor Pump

A DC motor pump is essentially a DC Motor that is used to circulate water. It is a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used. The DC motor is encased in a waterproof plastic casing and the

shaft is used to drive an external arm that pumps water. The Pump requires a 5V supply, which can be easily provided by batteries or an AC supply. In

Figure 2.7: Circuit for developing the project.

Figure 2.7, a DC Motor Pump is shown which is also major equipment of our project.

2.5 PRACTICAL MODEL

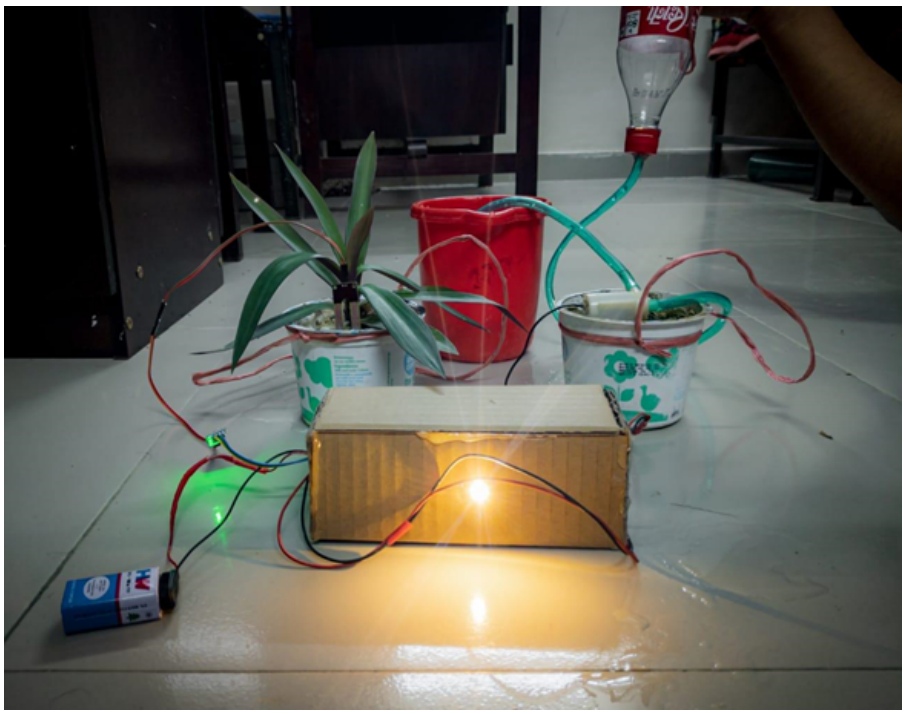

Figure 2.8: Circuit for developing the project.

In Figure 2.8, we have the practical model photograph and, in this photograph, the motor is turned on because of the low moisture level in the soil. After the threshold of the moisture will passed the motor then will be turned off. This is how our practical model is working for this proposed project design.

2.6 COST OF THE MODEL

Serial No:	Component Name:	QTY.	Price
1	555 Timer IC	1	15
2	6V Relay	1	40
3	9V DC Pump	1	100
4	15k Potentiometer	1	5
5	1k Resistor	1	1
6	Transistor 547ic	1	3
7	Soil Moisture Sensor	1	180
8	LED	1	1
9	9V Battery	1	30
	Total Cost:		**375**

Table 2.1: Components List with Price

In Table 2.1,we have shown the estimated cost of our proposed project. We have tried to make a cost-effective solution that's why have chosen these components to create our project.

Chapter 3

DEVELOPMENT AND IMPLEMENTATION

This project consists of two sections: the external sensor unit, and the inbuilt processing unit. In the external sensor unit, the basic requirement of sensing the moistness of the sand or soil through capacitive reactance is performed, the arms of the sensor can detect resistance and provide input to the IC.
When the soil becomes dry, it produces a large voltage drop due to high resistance, and this is sensed by the soil moisture sensor, and this resistance causes the operational amplifier to produce an output that is above the threshold value required. This causes the relay to change from normally open to closed condition – The relay becomes on.
When the relay is turned on, the pump starts, and water through the pipe's rushes to the crops. When the water content in the soil increases, the soil resistance gets decreases and the transmission of the probes gets starts to make the operational amplifier stop the triggering of the relay. Finally, the valve which is connected to the relay is stopped. A transistor is used to drive the relay during the soil dry condition. 6V double pole – a double-through relay is used to control the water pump. LED indication is provided for visual identification of the relay/load status.
When the moisture in the soil is below the threshold, the relay will be turned on. The relay coil gets energized and turns on the motor. The LED is also turned on as an indicator. The soil begins to get supplied with water, and the water level of the soil increases. When the moisture content of the soil increases and reaches the threshold value, the output of the soil moisture sensor is low and the motor is turned off. This prevents a case of over-watering.

3.1 Implementation of this Project

In an Automated Irrigation System, the most significant advantage is that water is supplied only when the moisture in the soil goes below a pre-set threshold value. This system can be used in roof gardens in highly populated areas where land is expensive and gardening on rooftops seems like the only viable option left. The lawns of houses and public buildings can be maintained by these systems, thereby reducing the need for human monitoring. Detection in this manner is cheap, non-invasive, and can be applied on a population-wide scale. The presence of technology in all aspects of life has enabled solutions to real-life problems that were either difficult or unfeasible.

3.2 Advantages

- The main advantage of this project is that it has faster execution when compared to the manual execution of the process.
- It is simple, portable, provides high performance, and consumes less power.
- Dryness can be easily detected in soil.
- Permits a non-expert to do the work of an expert.
- Improves productivity by increasing work output and improving efficiency.
- Saves time in accomplishing a specific objective.
- This system ensures that the plants do not endure the strain or stress of less and over-watering.
- This system saves labor costs and reduces the waste of water.
- The operator does not require any previous training because of its user-friendliness.
- The operator is free from any technical issues. The extremely simple design makes the circuit easy to implement and maintain.
- Alterations in the system can be done easily if the process of working changes in the future.

Chapter 4

CONCLUSION AND FUTURE SCOPE

4.1 Future Scope

The greatest scope is in agricultural lands, where farmers are assisted greatly by this. There is no need for the farmer to be present during the operation.
Gardens that need to be monitored in the absence of homeowners require systems like APIS. Home gardens that are maintained with a large effort by homeowners require proper observation and maintenance. It can be provided by APIS.
Irrigation in parks needs to be done even when people are not there to maintain the grass or trees.
In the future according to the user's requirement, it can be updated to meet the user requirements.
Smart Wi-Fi Irrigation Controllers are next-generation controllers that can adjust irrigation system automatically using real-time weather information. Moreover, it can be controlled from anywhere, anytime.

4.2 Limitations

- When we'll implement it in large fields, industrial supply can be used to run the motor. In small gardens, this may seem like a large waste.
- Needs a large amount of sensing equipment for very large irrigation areas.
- The system is not completely reliable. Unexpected factors can cause errors, and they may in some cases cause loss. Despite being good, it needs to be manually checked and maintained regularly.

4.3 Conclusion

Irrigation becomes easy, accurate, and practical with the idea above shared and can be implemented in agricultural fields in the future to promote agriculture to the next level. The output from the moisture sensor and level system plays a major role in producing the output. Thus the "Automatic Plant Irrigation System" has been designed and tested successfully. It has been developed by integrating all the features of all the hardware components used. The presence of every module has been reasoned above and placed carefully to contribute to the best working of the unit. The system has been tested to function automatically and to the best of its ability. 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 555 Timer which triggers the DC Motor pump to turn ON and supply the water to the respective field area. When the desired moisture level is reached, the system halts on its own and the DC Motor pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

References

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