Design and Development of GSM Based Automatic Irrigation Control System



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DECLARATION

We certify that the research/project based thesis titled, “Design and Development of GSM Based Automatic Irrigation Control System” is completely our group work. All sources and knowledge for this paper which were found by other researchers are acknowledged by reference. Materials of work such as images, figures, tables and citations in this paper are accepted by our Supervisor. We hereby declare that this thesis has not been previously submitted either in whole or in part, for any other degree or publication.

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Certification

This is to clarify that the following students worked on this research and project designated “Design and Development of GSM Based Automatic Irrigation Control System” under my direct supervision in the laboratories of the Department of Electrical and Electronic Engineering, Faculty of Science and Engineering, **Sonargaon University**, in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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Abstract

Irrigation is a source livelihood of majority of Bangladesh and has great impact on the economy of this country. The green house based modern agriculture industries are the recent requirement in every part of agriculture of Bangladesh. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric conditions sometimes may vary from place to place in large farmhouse, which makes very difficult to maintain the uniformity at all the places in the farmhouse manually. Appropriate environmental conditions are necessary for optimum plant growth, improved crop, and efficient use of water and other resources. Automating the data acquisition processes of the soil moisture allows plant growth with less labor requirement. The proposed system implemented GSM is used to report the detailed about irrigation. The report from the GSM is send through the android mobile. The Arduino software is used for simulation result and embedded hardware kit will be fabricated.

Acknowledgements

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Chapter 1
Introduction

1.1 Introduction

Agriculture uses 85% of available freshwater resources worldwide. To create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and communication improvements. Drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system. The user communicates with the centralized unit through SMS. The centralized unit communicates with the system through SMS which will be received by the GSM with the help of the SIM card. The GSM sends this data to ARM7which is also continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the LCD. Thus in short whenever the system receives the activation command from the subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another activation command to start the motor. The motor is controlled by a simple manipulation in the internal structure of the starter. The starter coil is indirectly activated by means of a transistorized relay circuit. When the motor is started, a constant monitoring on soil moisture and water level is done & once the soil moisture is reached to sufficient level the motor is automatically turned off &a massage is send to subscriber that the motor is turned off. The water level indicator indicates three levels low, medium, high and also empty tank.

A GSM-SMS remote measurement and control system for greenhouse based on PC-based database system connected with base station. Base station is developed by using a microcontroller, GSM module, sensors and actuators. In practical operation, the central station receives and sends messages through GSM module. Criterion value of parameters to be measured in every base station is set by central station, and then in base stations parameters including the air temperature, the air humidity.

Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth.

1.2 Purpose of the Study

The purpose of this study is to design, develop, and evaluate a GSM-based irrigation system, aiming to enhance the efficiency and sustainability of agricultural irrigation practices. The study seeks to address the limitations of traditional irrigation methods by incorporating modern communication and control technologies to optimize water usage, reduce labor-intensive tasks, and ensure timely and precise irrigation management.

The objectives of this study include:

Design and Development: To design and develop a robust and reliable irrigation system that utilizes GSM (Global System for Mobile Communications) technology for remote monitoring and control. The system will integrate sensors for measuring soil moisture levels, ambient temperature, and other relevant environmental parameters.

Remote Monitoring and Control: To establish a two-way communication link between the central control unit of the irrigation system and the user's mobile device through GSM networks. This will enable farmers and agricultural practitioners to remotely monitor real-time data and control irrigation schedules based on the prevailing conditions.

Water Conservation: To investigate the system's impact on water conservation by ensuring that irrigation is triggered only when soil moisture levels drop below a predefined threshold. By preventing over-irrigation, the study aims to contribute to sustainable water resource management and minimize water wastage.

Energy Efficiency: To assess the energy efficiency of the proposed system by optimizing power consumption during both normal operation and standby modes. The

study will explore strategies to prolong the system's battery life, ensuring uninterrupted operation even in areas with unreliable power supply.

Ease of Use and Accessibility: To evaluate the user-friendliness of the GSM-based irrigation system interface, ensuring that farmers of varying technological literacy can easily set up, configure, and manage the irrigation schedules using their mobile devices.

Performance Evaluation: To conduct field tests and collect data on the system's performance in terms of irrigation accuracy, response time, and overall effectiveness. The study will compare the system's irrigation outcomes with traditional manual methods to quantify its advantages.

Cost-Effectiveness: To analyze the economic feasibility of adopting the GSM-based irrigation system in comparison to conventional irrigation methods. This will include evaluating the initial setup costs, operational expenses, and potential long-term benefits.

Scalability and Adaptability: To explore the potential for scaling up the system and adapting it to different crop types, soil conditions, and geographic regions. The study will provide insights into the system's flexibility and its applicability in diverse agricultural scenarios.

By achieving these objectives, the study intends to contribute to the advancement of smart agricultural practices, fostering a more sustainable and efficient approach to irrigation management through the integration of GSM technology. Ultimately, the research aims to provide valuable insights and practical recommendations for the adoption of GSM-based irrigation systems, helping to address water scarcity and improve crop yields in agricultural communities.

1.3 Statement of the Problem

We want to make a GSM Based Automatic Irrigation Control System For simplifying and digitizing agriculture.

1.4 State-of-the-art Solutions

As of my last knowledge update in September 2022, I can provide you with a general overview of state-of-the-art solutions for GSM-based irrigation systems. Please note that there might have been further advancements in this field since then. A GSM-based irrigation system involves using mobile network technology (like GSM or GPRS) to remotely control and monitor irrigation processes. Here's an outline of the components and features you might find in such systems:

IoT Platform Integration: Many modern GSM-based irrigation systems are designed to integrate with Internet of Things (IoT) platforms. These platforms provide a centralized dashboard to manage and monitor the irrigation process. They enable real-time data visualization, control, and analysis from anywhere with an internet connection.

Wireless Sensors: Advanced systems utilize various types of wireless sensors to collect data about soil moisture, weather conditions, temperature, and humidity. These sensors provide accurate information that can be used to optimize irrigation schedules.

Remote Control: One of the key features of a GSM-based irrigation system is the ability to remotely control irrigation operations through SMS commands or dedicated mobile applications. Users can turn the system on/off, adjust watering schedules, and modify settings from their smartphones.

Automated Scheduling: These systems often incorporate smart scheduling algorithms that take into account factors like soil moisture levels, weather forecasts, and plant types. This ensures that irrigation is performed only when necessary, reducing water wastage.

Water Flow Management: State-of-the-art systems might include flow meters that monitor the amount of water being used during each irrigation cycle. This data helps in managing water resources efficiently and detecting any leaks or anomalies.

Weather Integration: Integrating real-time weather data into the irrigation system allows for adaptive irrigation scheduling. If rain is forecasted, the system can automatically adjust its watering schedule to prevent overwatering.

Data Analytics and Insights: Some systems offer advanced analytics features that provide insights into water usage patterns, plant health, and system performance. This data can be used to make informed decisions about irrigation strategies.

Remember that the availability of specific features can vary based on the manufacturer and the intended use of the irrigation system. Always do thorough research and choose a solution that best fits your requirements and the environmental conditions of your irrigation area. It's also a good idea to check for any new developments or updates in the field of GSM-based irrigation systems since my last update.

1.5 Practical Implementation

We used Proteus 8 Professionalsoftware to design our project and from this design we prepared a PCB and using certain number of components we ran GSM Based Automatic Irrigation Control System successfully.

1.6 Design Goals

Remote Control and Monitoring: The primary goal of the GSM-based irrigation system is to allow users to remotely control and monitor the irrigation process. Users should be able to activate or deactivate the irrigation system, adjust watering schedules, and receive real-time updates on system status through SMS or mobile applications.

Water Efficiency: The system should focus on water conservation by efficiently delivering water to plants based on their actual needs. It should incorporate soil moisture sensors and weather data to determine optimal watering times and duration, thereby preventing over-watering and reducing water wastage.

Customizable Irrigation Schedules: The system should enable users to set up customizable irrigation schedules based on plant types, local climate conditions, and specific water requirements. This flexibility ensures that different areas of the garden receive appropriate levels of irrigation.

Emergency Alerts: In case of critical conditions such as pipe leaks, pump failures, or other system malfunctions, the GSM-based irrigation system should send immediate

alerts to users via SMS or notifications. This feature ensures prompt actions can be taken to prevent damage and water loss.

Energy Efficiency: The system should be designed to optimize energy usage by controlling the operation of pumps, valves, and other components. It should incorporate features like sleep modes for devices when not in use and efficient power management to reduce energy consumption.

Ease of Installation and Use: The system should be designed for easy installation and setup, even for users with limited technical expertise. Clear instructions, intuitive user interfaces, and straightforward configuration processes are essential to encourage adoption and use.

Data Logging and Analysis: Incorporate data logging capabilities to store historical irrigation data, including watering schedules, soil moisture levels, and weather conditions. This data can be used for analysis and adjustments, allowing users to fine-tune their irrigation strategies over time.

Compatibility and Integration: Ensure the system can integrate with other smart home or automation systems if desired. This might involve compatibility with popular smart home platforms, APIs for integration, or interoperability with other IoT devices.

Security and Privacy: Implement robust security measures to protect user data and prevent unauthorized access to the system. Encryption of communication, secure authentication methods, and regular software updates to address potential vulnerabilities are crucial aspects of system security.

Scalability and Modularity: Design the system in a way that allows for scalability. Users should be able to add more zones, sensors, or components as their irrigation needs evolve. A modular design also makes it easier to replace or upgrade individual components without overhauling the entire system.

Cost-Effectiveness: Strive to keep the overall system cost reasonable by using cost-effective components and technologies. However, ensure that cost-cutting measures do not compromise the system's performance, reliability, or longevity.

Reliability and Durability: Build the system with high-quality components that can withstand outdoor conditions, such as moisture, temperature variations, and dust. The

system should be reliable, minimizing the risk of downtime and ensuring consistent irrigation.

By prioritizing these design goals, a GSM-based irrigation system can provide efficient, convenient, and sustainable irrigation management for a variety of agricultural and gardening applications.

1.8 Outline

Chapter 1: Introduction, this chapter learn about our project information, Objectives and advantages.

Chapter 2: Literature Review this chapter learn about other rehearse about this topic.

Chapter 3: The Equipment Details this chapter describe about design component of our system.

Chapter 4: Design & Project Implementation this chapter describe about design of our system.

Chapter 5: Result &Discussion this chapter will observe speed direction control.

Chapter 6: Conclusion this chapter describe about **consultation.**

Chapter 2

Background and Motivation

2.1 Introduction

The chapter reports on the conducted literature study, presenting previous works aligned with our work. At present power,the shortage has become a common problem in our country. Load shedding is increasing day by day in almost every region of Bangladesh.We are taking various measures considering load shedding and we are working tirelessly to resolve that.Several systems have been proposed regarding this issue.

2.2 Literature Review

Muhammad et al (2010): A direct way to deal with Irrigation control concern utilizing Artificial Neural Network Operator. The suggested platform is actually distinguished and also ON/OFF controller and also it is actually seemed ON/OFF Controller based Device explosives hopelessly in view of its own constraints. However, ANN based methodology has actually brought about possible consumption of much better and progressively efficient management. These controllers don't demand an earlier discovering of structure as well as have all-natural capability to adjust to the modifying problems not like routine strategies. It is necessary that ANN based platforms can easily spare parcel of information (energy and watering) and can give innovative end results to all type of cultivating zones.

Kalyanetal (2011): The demand for platforms that produce farming simpler and considerably sustainable features grown inside the previous number of years. The capacity to monitor 2 of the best vital assets of an agriculturist, watering device as well as opportunity, has been actually the absolute most recent test. A structure that provides this capability - making use of reliable and dependable methods, as an example, distant sensor organizing, landscape sprinkler watering body, GSM, TEXT innovations as well as promptly accessible cellular phone gizmos-- makes sure to make it possible for the ranchers to strengthen turnout and on a bigger scale, aid the horticultural and monetary growth of the nation.

Prisillaetal (2012): Watering is actually a standout amongst nature's most critical benefits to humankind, because the development in people sustenance requirement for individual is furthermore extending. Throughout the final number of many years' utilization of watering system for watering unit has actually increased incredibly. Irrigation system is actually infected because of wastage and also impurities in the businesses. Saving watering system is actually progressively essential. This excessive factor can be accomplished by making use of the leaving behind ANN management platform. It is going to provide a method to extra flood watering device in the business for future watering system explanation

Cosmin (2012): This evaluation shows that there is actually a verifiable cultivating propensity in the allotment of synthetic reasoning in cultivation. Automated master structures deal with a large region of nurturing nonetheless their variety and also multifaceted attribute adjustment impressively coming from country to nation. Underdevelopment of the IT base in various countries is the primary block in utilizing them, simply around 30% of the total populace as of now approaching these brand new advancements

YETHIRAJ et al (2012): There is actually a developing lot of usages of relevant information mining devices in agriculture as well as an establishing measure of details that go to existing available from many assets. This is generally a novel research area and it is actually relied upon to develop in the future. There is actually a good deal of work to become done on this creating and intriguing exploration field. The multidisciplinary approach of integrating program design along with farming will definitely help in anticipating/overseeing horticultural returns viably.

Chetanaetal (2012): The Automated Wireless Irrigationing System is actually an understandable framework, which tells the customer regarding its status. The 2 procedures of tasks provide the customer the option of set as well as hands-on procedure. The platform additionally gives the log report of the affairs accomplished.

In M. Guerbaoui, leafed, a. ed-dahhak" GSM based automated drip irrigation system" we proposed a system contribution to the development of greenhouse production in Morocco. The proposed solution involves the development of an integrated system for automate the drip fertilizing irrigation in green house. The solution adopted involves a data acquisition card PCL-812PGcontrolled by PC. The irrigation is provided by a hydraulic circuit based on an electric pump. Water needs are evaluated by measuring soil water status by soil humidity sensor.

In Purnima, S.R.N Reddy, "Design of Remote Monitoring and Control System with Automatic Irrigation System using GSM-Bluetooth", proposed artificially supplying water to land where crops are cultivated. Traditionally hand pumps, canal water and rainfall were a major source of water supply for irrigation. This method hassled to severe drawbacks like under irrigation, over-irrigation which in turn causes leaching and loss of nutrient content of soil. Changing environmental conditions and shortage of water have led to the need for a system which efficiently manages irrigation of fields. Automated irrigation system is a machine based system, which automates the irrigation of land by combining various software and hardware approaches together for field irrigation.

Chapter 3

Methodology

3.1 Introduction

We have covered a variety of the parts that went into making our device in this chapter. Every part of this apparatus is crucial, and we employed it flawlessly.

The following is a diagrammatic illustration of some of the steps:

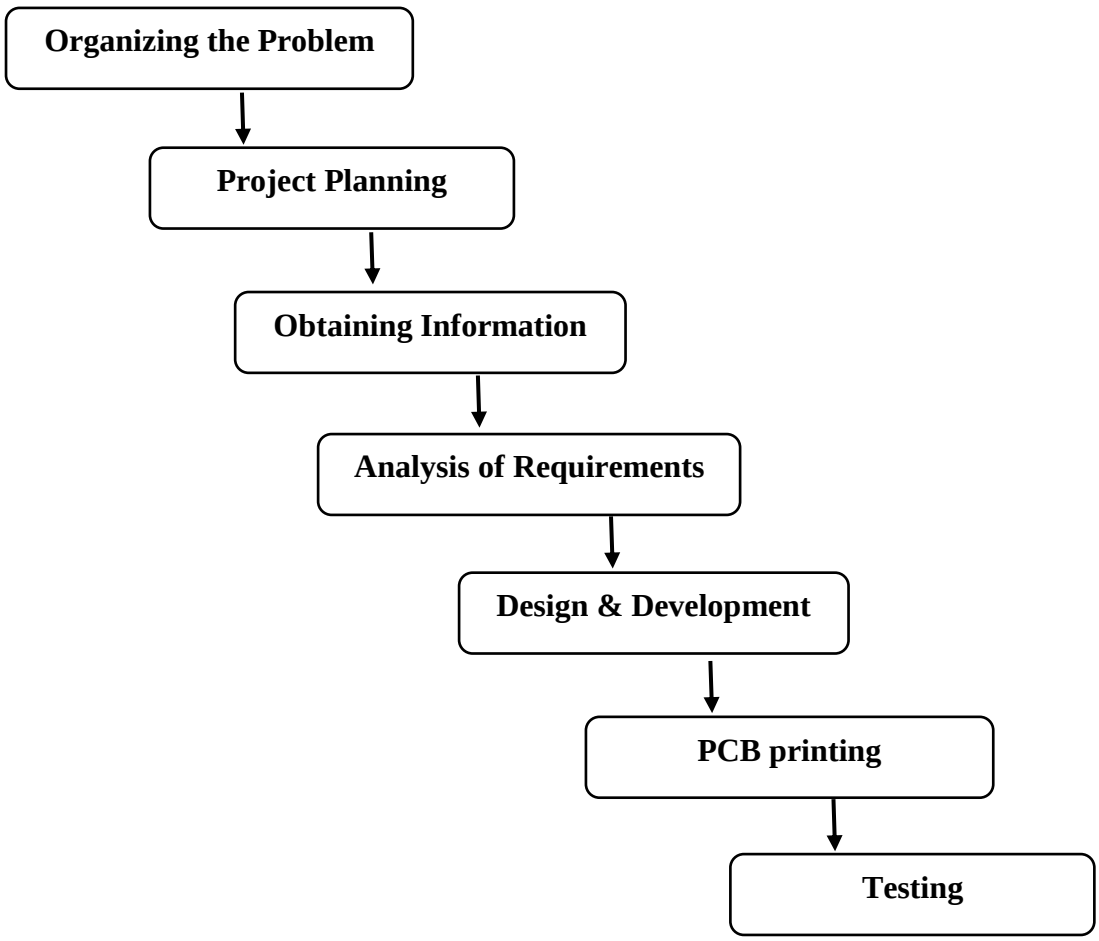


Figure 3.1.1: Proposed Methodology

3.2 Propositions and Hypothesis

The proposed work's entire process is broken down into several parts. Each step was carefully picked by the authors to ensure accuracy and efficiency in every phase of the procedure. The authors have meticulously specified all conceivable requirements for the proposed system to be developed. There are no unclear standards; they are all plain and specific. This proposed system has a lot of resources to back it up.

The following are the steps in order:

Organizing the Problem: At first, the authors have decided to search for a specific problem based on the current city of Bangladesh by which authors can design and developed a perfect solution for the problem. Thinking about power generation and its cost, we think about working with solar energy and we design our project and build an experimental prototype.

Planning a project: Project planning is a method for determining how to execute a project in a specific time frame and with clearly defined stages. This step involves deciding how to complete the project and which project will be completed. As a result, the authors have detailed the entire operation of the suggested system.

Obtaining Information: Problems can be identified and solved through obtaining information and knowledge. In this step, the authors do research and gather information from a variety of sources, including the internet, books, papers, and prior relevant works, as well as information from various people involved in the topic.

Analysis of Requirements: To create the project, the writers will need some hardware prerequisites. These can assist in the development of the proposed system by investigating the hardware. To create this proposed system, the authors will need Microcontroller, High-frequency Transformer, Capacitor, Buzzer, LCD Display, Mosfet, Resistor, Battery, Relay, mosture sensor, Rectifier, etc.

Development and Design: This step's major goal is to design and develop a hardware device. The writers created numerous diagrams in the design section, such as a flow

chart, system architecture, circuit diagram, block diagram, and so on. For hardware design, Proteus 8 Professional software has been utilized.

Coding & PCB printing: We used programming C and Arduino IDE to complete our project. We used laser printers and ferric chloride to print PCBs.

Testing: After we finish our work we do a load test and record some results. Next, we do data analysis and we do some calibration to increase the efficiency of our project.

Chapter 4

Result Analysis

4.1 Introduction

We built the system out of standard electronic components. The main processing unit is an ATmega328 microcontroller and SG3525 IC. Our output devices are solar, 1602 display, and our storage device is a 12-volt rechargeable battery.

4.2 Hardware Used in this Circuit

Table 4.2.1: Component List

01	Microcontroller	12	Resistor
02	IC 555Ttimer	13	Lipo Battery
03	GSM SIM800	14	Female Connector
04	Transistor-BC547	15	Soil Moisture Sensor
05	Transformer	16	Capacitor
06	LM2596 Buck Converter	17	Diode
07	Voltage Regulator	18	Soldering Wires
08	Water Pump	19	Capacitor
09	Relay		
10	Mini Water Level		
11	On off Switch		

4.2.1 Microcontroller-ATMEGA328P

ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno

Technical Specification:

Data Bus Width	8 b
Frequency	20 MHz
Interface	2-Wire, I2C, SPI, UART, USART
Max Frequency	20 MHz
Max Operating Temperature	85 °C
Max Supply Voltage	5.5 V
Memory Size	32 Kb
Memory Type	FLASH
Min Operating Temperature	-40 °C
Min Supply Voltage	1.8 V
Number of ADC Channels	6
Number of I/Os	23
Number of I2C Channels	1
Number of PWM Channels	6
Number of Programmable I/O	23
Number of SPI Channels	1
Number of Timers/Counters	3
Oscillator Type	Internal
Peripherals	Brown-out, POR, PWM,
RAM Size	2 Kb
Watchdog Timer	Yes

Application:

- Used in ARDUINO UNO, ARDUINO NANO and ARDUINO MICRO boards.
- Industrial control systems.
- SMPS and Power Regulation systems.
- Digital data processing.
- Analog signal measuring and manipulations.
- Embedded systems like coffee machine, vending machine.
- Motor control systems.
- Display units.
- Peripheral Interface system.

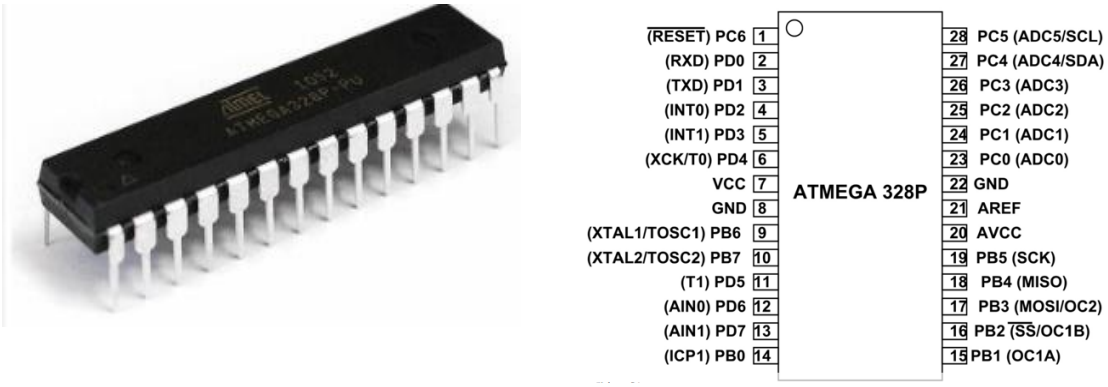


Figure 4.2.1.2: Microcontroller-ATMEGA328P

4.2.2 IC 555

Due to its potent and reliable characteristics, the IC 555 clock is one of the most frequently used ICs in hardware and is used in numerous electrical circuits. It performs as an oscillator, a square-wave structure generator with duty cycles ranging from 50% to 100%, and it may also delay time in circuits.

Features:

- It can withstand up to +18V but is typically operated at +5V.
- The result pin's source and sink currents are both close to 200mA.
- At +5V, the trigger voltage is 1.6.
- The ideal working temperature is close to or equal to 70 °C.
- It is available in 8-pin PDIP, SOIC, and VSSOP bundles, and the 555 clocks' duty cycle can be adjusted to meet client requirements.

Application:

- It is employed in the creation of square, waveform, and pulse waves as well as time delays, precise timing, and sequential timing.
- It has two different uses: as a mono-stable multi-vibrator and as an astable multi-vibrator.
- PWM (Pulse Width Modulation) and PPM are its primary applications (Pulse Position Modulation).
- Found in tachometers and thermometers.
- Are frequently found in DC Voltage Regulators.
- Used as a converter, such as a voltage to frequency converter.
- Frequency Divider also uses intuit is a component of the pulse detector.
- A Timer Switch can be created with it.

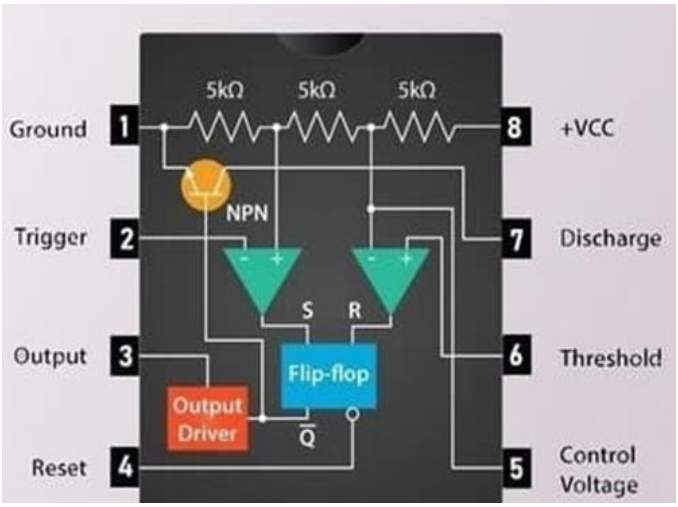


Figure 4.2.2: IC 555

4.2.3 GSM SIM800L

A smaller-than-normal cell module called SIM800L takes into account GPRS transmission, sending and receiving SMS, and deciding and receiving voice decisions. This module is the best option for any work that requires long reach availability due to its low cost, small footprint, and support for quad band recurrence. After connecting to power, the module starts up, searches for cell organization, and logs in as a result. Drove displays association express on board (no organization inclusion - quick flickering, signed in - slow squinting).The SIM800L GSM/GPRS Module by Sim Com is the main component of the breakout board. The working voltage of this device, as was mentioned in the pinout section above, ranges from 3.4V to 4.4V, meaning you may control this module directly from a lithium polymer battery. The rest of the pins are all separated out to 0.1" pin pitches, making this module very breadboard friendly. Additionally, it automatically detects the baud rate for usability. There are two radio wire options available on this board because the module needs an exterior receiving wire to interface with the organization. You will receive a helical radio wire in the package, which you can simply patch to the module's NET pin. However, there is a chance to interface the outside radio wire with the nearby UFL connection if you need to keep the radio wire far from the module board. This module is compatible with any 2G sim card.

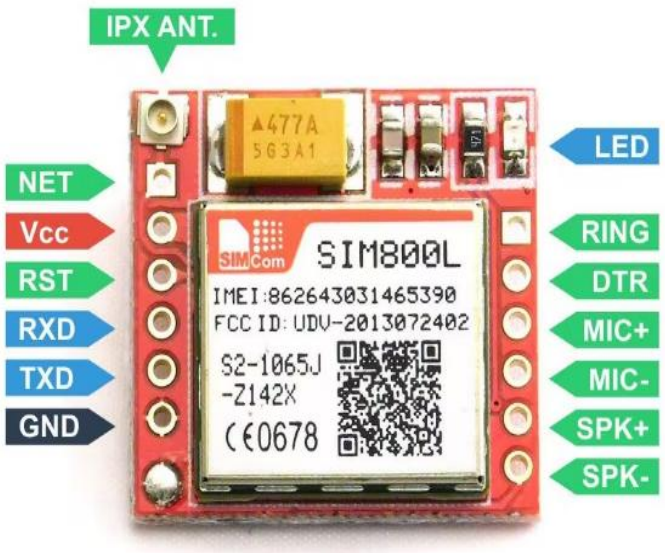


Figure 4.2.3: GSM SIM800L

4.2.4 12 Volt Battery

Inverter, UPS, and automobile systems frequently require 12-volt batteries. A battery, from a technical standpoint, consists of one or more cells that allow a chemical reaction to occur, resulting in the flow of electrons in a circuit. Batteries do not generate energy or electricity, Batteries are basically energy storage devices that allow us to utilize them when we need them. The battery is charged from 13.8 to 14 volts. Charging at extra volts can damage the battery. Different types of batteries are lead-acid Cell Battery, Tubular Cell Battery, Lithium-Ion Battery, and Lithium Polymer Battery. The direct current (DC) power we get from a battery is distinct from the alternating current (AC) power we get from our home's wall outlets. An inverter can be used to convert DC electricity to AC power if necessary. To acquire a higher voltage or larger storage capacity, we can connect numerous 12-volt batteries in series or parallel. If we connect two 12 volt batteries in series, for example, we'll have a 24-volt system. We'll still have a 12-volt system if we link these same 12-volt batteries in parallel, but it'll be able to power the same gadget for twice as long as a single 12-volt battery.

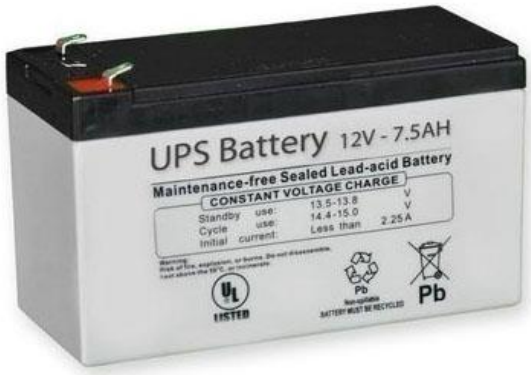


Figure 4.2.4: 12 Volt Battery

4.2.5BC547 Transistor

A transistor is an electrically controlled switch that is made up of semiconductor devices. The i/p, o/p, and control lines are the three terminals. The three elements are the emitter (E), collector (C), and base (B) (B). A transistor functions as a switch and

an amplifier to convert waves from auditory to electrical. Transistors are smaller, have a longer life span, and can work with low voltage sources. Germanium was used to create the first transistor. It is the basic building block in modern electronics and is employed in a variety of electrical and electronic devices.The transistor BC547 is an NPN transistor. A transistor is nothing more than a resistance transfer device that amplifies current. The enormous current of the emitter and base terminals will be controlled by a modest current at the transistor's base terminal. This transistor's primary job is to amplify as well as switch signals. This transistor's maximum gain current is 800A. BC548 and BC549 are two transistors that are comparable. The biasing of this transistor is when it operates at a fixed DC voltage in the preferred region of its properties. Furthermore, the BC547A, BC547B, and BC547C transistor series can be classified into three groups based on current gain.

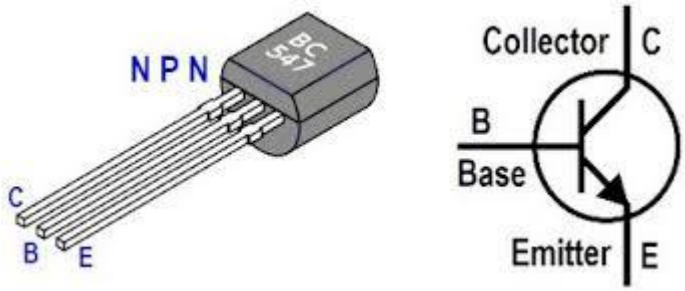


Figure 4.2.5: BC547 Transistor

4.2.6 Heat sink

A heat sink is an electronic component that is typically attached to an electronic device and is made of good thermal conducting material to remove excess heat. It is used to disperse excess heat from circuit components, minimizing overheating and premature failure while also enhancing component dependability and performance. The heat sink functions according to Fourier's law of heat. When a temperature disparity exists in a body, heat travels from high-to-low-temperature zones. The three different processes through which heat can be transmitted are radiation, convection, and conduction. Thermal conduction happens when two objects of different temperatures collide.Collisions occur between the hotter material's quicker molecules and the slower moving molecules of the colder substance. The energy is transferred

from the heated to the cooled object as a result. A heat sink transfers heat from a high-temperature component like a transistor to a low-temperature medium like air, oil, water, or any other suitable medium via conduction and subsequent convection.

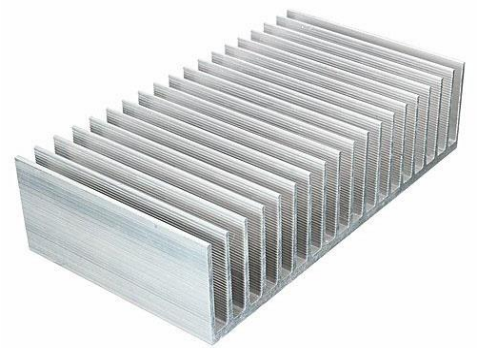


Figure 4.2.6: Heat sink

4.2.7Transformer-12V, 1000mA

Transformer 12 volts, 1000 mA 1Amp Input at 12 0 0 Output: AC 220V 12V Transformer Transforms one amp Take a bow 12 0 12 Volt Transformers Adapters For 12 0 12 Power Supply 1000mA. AC DC 12 V 1A to 240 V. This is a chassis mounting mains transformer for general use. Primary and secondary windings on the transformer are 240 V. The connection leads of the transformer are animatedly colored and insulated. 240 V AC is reduced to 12 V DC by the transformer, which also serves as a step-down transformer.Two outputs of 12V, 12V, and 0V are provided by the transformer. Below is a description of the Solid Core and Winding components used in the manufacturing of the transformer.

A static electrical device called a transformer uses inductive coupling between its winding circuits to transport energy. A changing attractive motion in the transformer's core is caused by a fluctuating current in the primary winding, and this shifting attractive motion then passes through the secondary winding. A varying electromotive force (E.M.F.) or voltage is caused by this different appealing transition in the optional winding. The transformer's centers are built of silicon steel with a high penetration rate. The center thus works to greatly reduce the polarizing current and bind the motion to a method that intensely binds the windings because the steel has a porousness that is typically that of open space.

Features:

- 100 percent Pristine
- Essential Voltage:220V
- Auxiliary Voltage:12V
- Current rating:1A
- Tapping :12V-0V-12V
- Focus tapped step-down transformer.
- This is a great item.



Figure 4.27: Transformer-12V, 1000mA

4.2.8Buck Converter- LM2596

The LM2596 series of controllers are reliable coordinated circuits that provide a stage down (buck) exchange controller with all of the dynamic characteristics needed to drive a 3-A heap with excellent line and burden guidance. A popular and widely used step-down exchange controller integrated circuit is the LM2596. The flexible version can accept input voltage ranging from 4.5V to 40V and convert it to variable voltage to obtain up to 3A of current flow. Due to its high current capacity, it is typically used in power modules to drive or regulate heavy loads.

The LM2596 series operates at an exchanging recurrence of 150 kHz, allowing for more modest measured channel parts than would be anticipated with exchanging controllers operating at lower recurrences. available in both a 5-pin TO-263 surface mount bundle and a normal 5-pin TO-220 bundle with a couple different lead twist options.

Features:

- Fixed output versions, such as the 3.3-V, 5-V, and 12-V ones;
- Voltage range: 1.2-V to 37-V, 4% maximum over load and line conditions;
- Customisable output version
- Available in TO-263 and TO-220 packaging, respectively.
- Is able to drive loads up to 3A.
- Four external components are required; the input voltage range is 40 V;
- The load and line regulations are remarkable.
- Internal oscillator with a set frequency of 150 kHz;
- TTL shutdown capability; low power standby mode with a typical 80 A draw;
- Highly effective and easily accessible
- Protection against thermal shutdown and current

Application:

- Used to step down voltage
- Can drive load under 3A
- Give momentous burden and line guideline

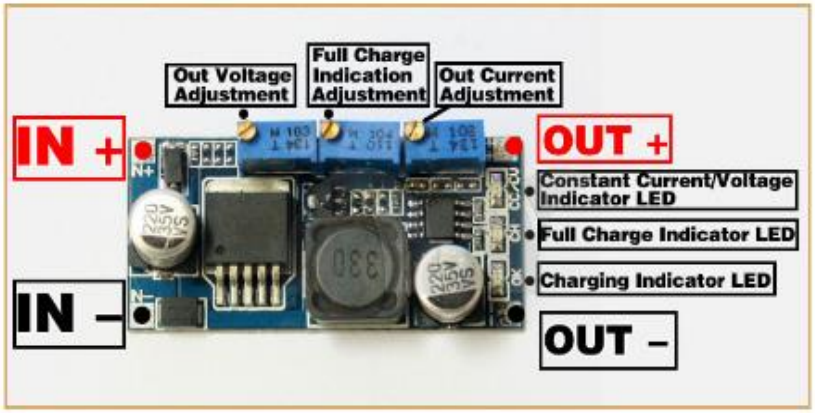


Figure 4.2.8: Buck Converter- LM2596

4.2.9 Diode (1n4007)

The 1N4007 is a 1 Amp general-purpose silicon rectifier diode that is often found in AC adapters for everyday household appliances. It's a low-speed rectifier diode that's

ineffective for square waves above 15 kHz. The 1N4007 diode has a molded plastic housing and is a basic recovery rectifier. It has a maximum current carrying capacity of 1 amp and can handle peak currents of up to 30 amps. As a result, we can use this diode in circuits that draw less than 1 amp. Although the reverse current is insignificant at 5uAmp, it can sustain a reverse voltage peak of up to 1000V.

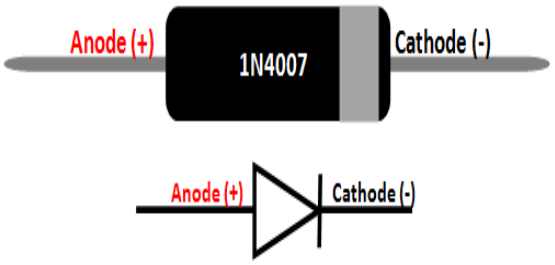


Figure 4.2.9: Diode (1n4007)

Specification:

- Reverse Voltage 1000 Volt.
- Forward Current 1 Amp.
- Type Standard Recovery Rectifiers.
- Forward Voltage 1 Volt.
- Max Surge Current 30 Amp.
- Reverse Current 5 uAmp.
- Minimum Operating Temperature, – 65 $C^{o.}$
- Maximum Operating Temperature, + 150 $C^{o.}$
- Surge Overload Rating to 30Amp Peak.

4.2.10 Resistor

A resistor is a two-terminal passive electrical component that implements electrical resistance to operate as a circuit element. Resistors are used in electronic circuits to reduce current flow, regulate signal levels, divide voltages, bias active devices, and terminate transmission lines. High-power resistors can be found in motor controllers,

power distribution systems, and generator test loads, and can dissipate hundreds of watts of electrical power as heat. Fixed resistors' resistance fluctuates only slightly with temperature, time, and operating voltage. Variable resistors can be used to change circuit elements like volume control or a lamp dimmer, as well as to detect heat, light, humidity, force, or chemical activity.



Figure 4.2.10: Resistor

4.2.11 Capacitor

A capacitor is a two-terminal electrical component that may store energy in the form of an electric charge. It is made up of two electrical wires separated by a certain distance. The space between the conductors can be filled with a vacuum or a dielectric, which is an insulating substance. Capacitance refers to the capacitor's ability to store charges. Capacitors store energy by separating opposing charge pairs. A parallel plate capacitor is the most basic form, consisting of two metal plates separated by a gap. Capacitors come in a variety of shapes, sizes, lengths, and girths, as well as a variety of materials.

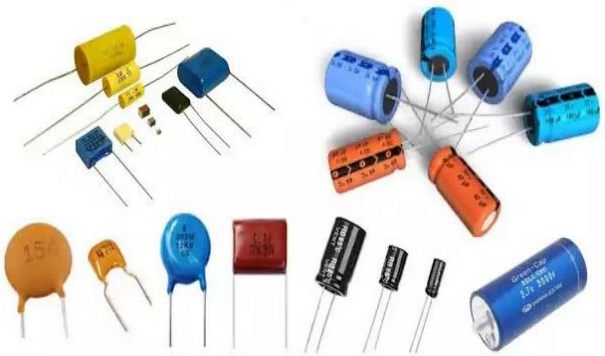


Figure 4.2.11: Capacitor

Different Types of Capacitors

- Electrolytic Capacitor.
- Mica Capacitor.
- Paper Capacitor.
- Film Capacitor.
- Non-Polarized Capacitor.
- Ceramic Capacitor.

4.2.12 Variable resistor

A variable resistor is a resistor that allows you to adjust the flow of current by providing a wide range of resistances. The current across the circuit drops as the resistance in the variable resistor increases, and vice versa. They can also be used to regulate the voltage across a circuit's gadgets.



Figure 4.2.12: Variable resistor

4.2.13Regulator IC 7805 & 7812

A positive voltage regulator, such as the 7805 and 7812, is used to provide a steady output voltage over a wide range of input voltage. The measure of voltage shift

between input and output is referred to as voltage regulation. When a variety of varying voltages is applied to the input terminal, it produces a constant output voltage. There are three terminals on this component: input, ground, and output. Because it generates positive voltage concerning the ground wire, it's termed a positive voltage regulator. Transistors and voltage regulator ICs such as the 7805 and 7812 function in a similar way to provide voltage regulation.

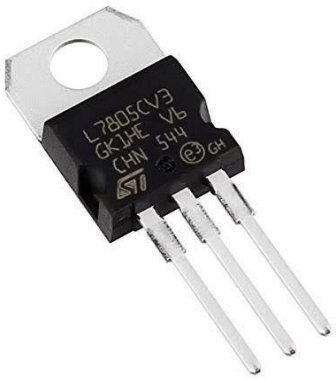


Figure 4.2.13: regulator IC

4.2.14Mini Water Pump

This DC 3-6 V Mini Micro Submersible Water Pump is a low-cost, small-size Submersible Pump Motor that can be operated from a 2.5 ~ 6V power supply. It can take up to 120 liters per hour with a very low current consumption of 220mA. Just connect the tube pipe to the motor outlet, submerge it in water, and power it.a mini water pump is a tiny or micro AC or DC water pump usually used to pressurize, circulate, or pump water for different uses. The DC type can have a rating of 3V, 5V, 6V, 12V, or 24V, and you can power it using a battery or solar.



Figure 4.2.14: Mini Water Pump

Specifications:

- DC Voltage: 2.5-6V
- Working current: 130-220mA
- Power: 0.4-1.5W
- Maximum lift: 40-110cm / 15.75"-43.4"
- Flow rate: 80-120L/H
- Outside diameter of water outlet: approx. 7.5mm / 0.3"
- Inside diameter of water outlet: approx. 4.7mm / 0.18"
- Diameter: approx. 24mm / 0.95"
- Length: approx. 45mm / 1.8"
- Height: approx. 33mm / 1.30"
- Wire length: about 15-20cm (red: " + ", black(white): " - ")
- Material: engineering plastic
- Driving mode: brushless DC design, magnetic driving
- Continuous working life of 500 hours

4.2.15Liquid Crystal Display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color or monochrome.



Figure 4.2.15: Liquid Crystal Display

4.2.16Moisture sensor

Soil moisture sensors measure or estimate the amount of water in the soil. These sensors can be stationary or portables such as handheld probes. Stationary sensors are placed at the predetermined locations and depths in the field, whereas portable soil moisture probes can measure soil moisture at several locations. This soil moisture sensor module is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.

Features & Specification:

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Output Digital - 0V to 5V, Adjustable trigger level from preset
- Output Analog - 0V to 5V based on infrared radiation from fire flame falling on the sensor
- LEDs indicating output and power
- PCB Size: 3.2cm x 1.4cm
- LM393 based design
- Easy to use with Microcontrollers or even with normal Digital/Analog IC
- Small, cheap and easily available

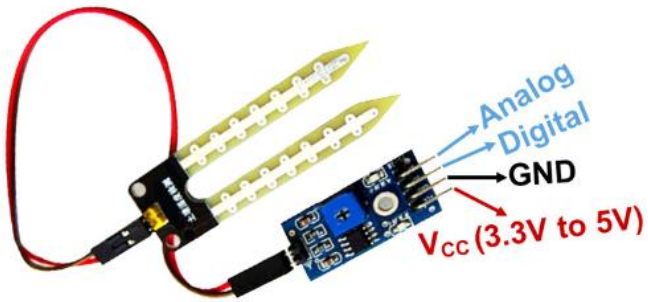


Figure 4. 2.16: Moisture sensor

4.3Design of the System

The proposed system has been designed in a variety of methods by the authors. The design is given below.

4.3.1Block Diagram

A block diagram is a representation of a system in which the main components are represented by blocks and connected by lines. All of the components are connected to the microcontroller and serve as input or output devices.

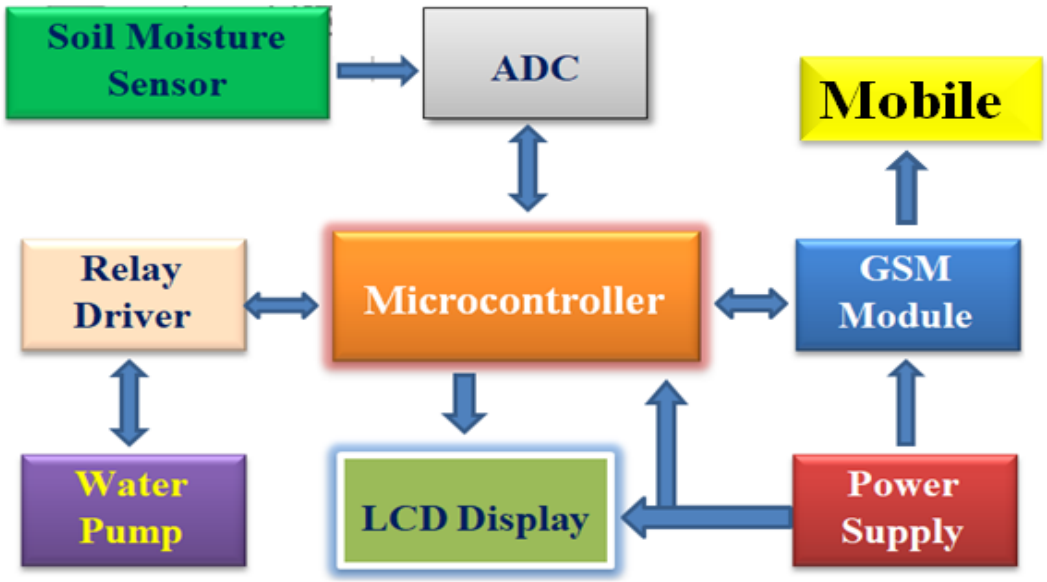


Figure 4.3.1: Block Diagram

4.3.2 Schematic Diagram

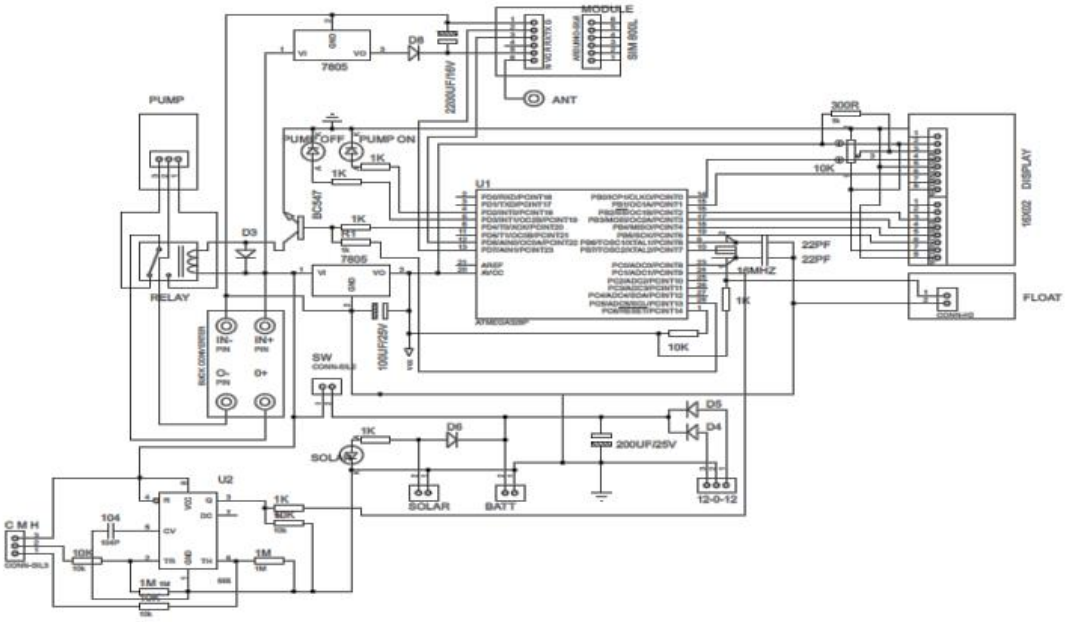


Figure 4.3.2.1: Irrigation Control System Circuit Diagram

4.3.3PCB Diagram

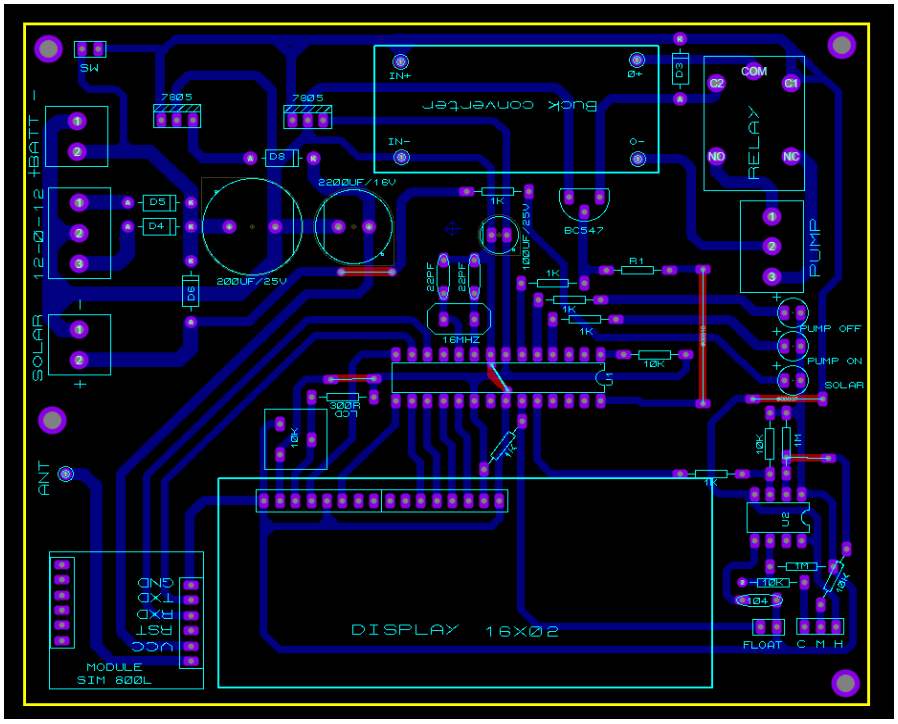


Figure 4.3.3.1: Irrigation Control System PCB Diagram

4.3.43D Visualizer

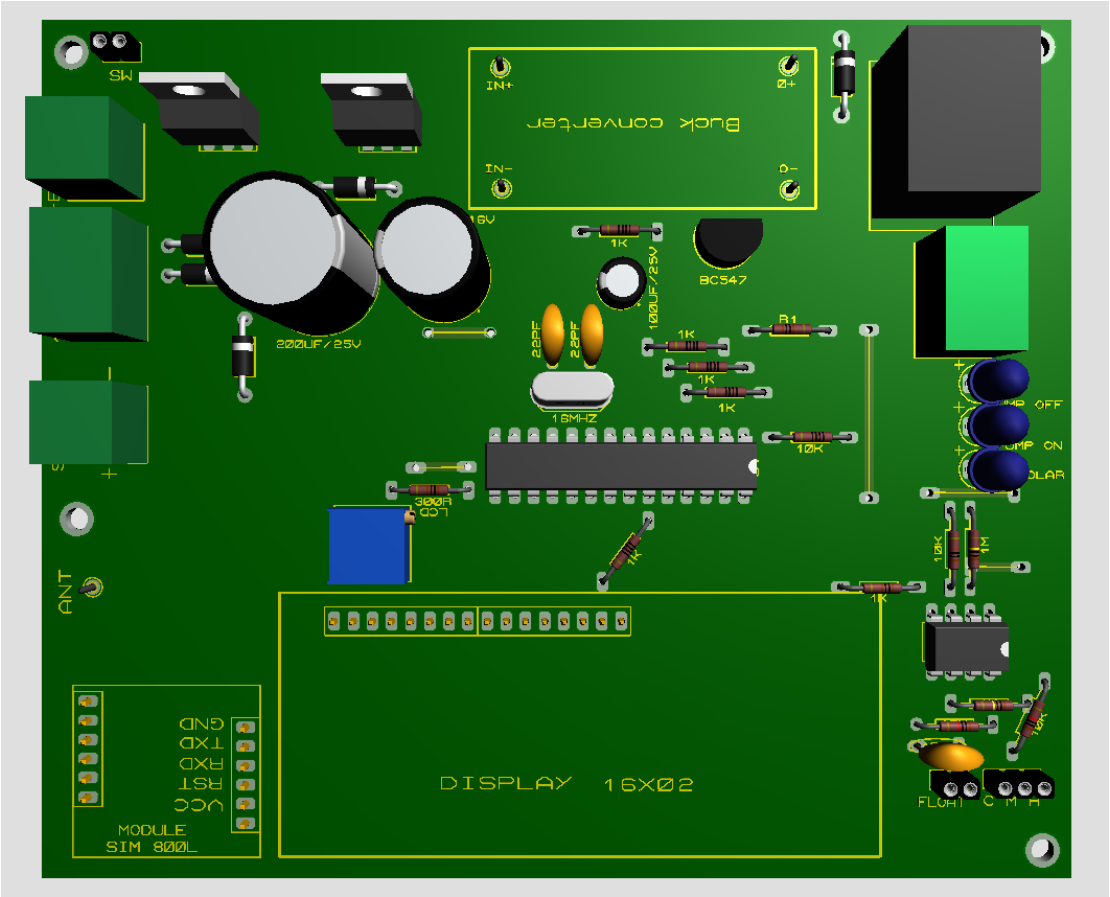


Figure 4.3.4.1: Irrigation Control System 3D Visualizer

Chapter 5

Conclusion

5.1 Device prototype

Irrigation Control System complete setup

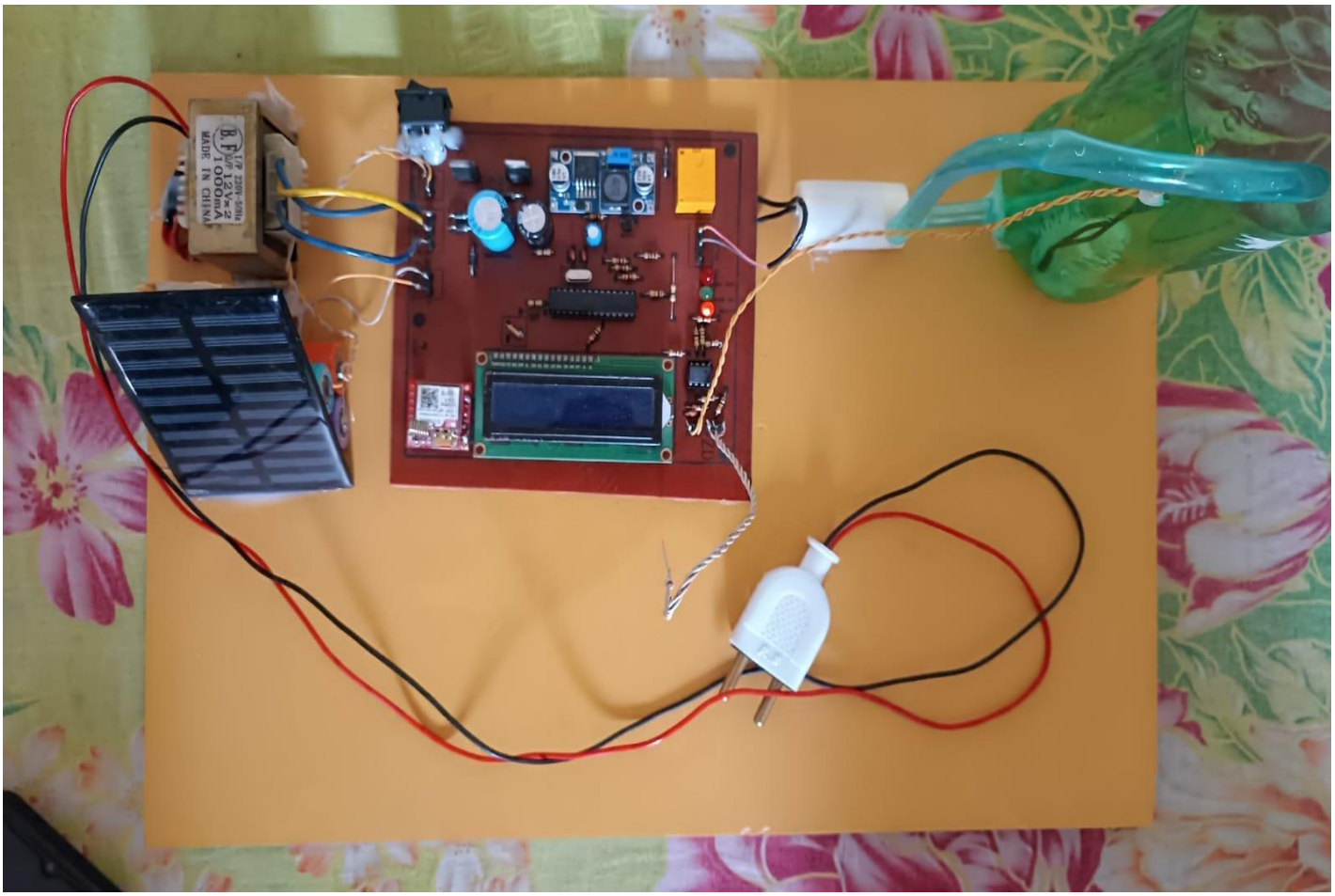


Figure 5.1.1: Irrigation Control System complete setup

5.2 Working principle

- Moisture sensor senses the low Moisture content of the soil.
- Gives a signal to the Microcontroller.
- Microcontroller then gives a signal to the called Mobile, by pressing call receiving button Microcontroller get signal to turn on the valve.
- When the Moisture content becomes sufficient, the sensor senses this and gives back the signal to the Microcontroller.
- Relay gets open and the Water Pump become turn off.

5.3Conclusion

This system supports aggressive water management for the agricultural land. This architecture is based on the capabilities of current and next-generation microcontrollers and their application requirements. Microcontroller used for the system is promising that it can increase system life by reducing the power consumption resulting from lower power consumption.

Since in earlier day's former forever supposed to go to their agricultural land and check the wet content of soil manually. To avoid additional human efforts we are able to use this technology. It permits user to watch and maintain the soil even supposing he's removed from his land no matter time. It's very effective and economic thanks to scale back human effort and water usage in agriculture land. Current issues in agriculture are reduced water level in land and handiness of human resource. Therefore as explained the Mobile Irrigation system will facilitate former in many ways. Aside from this use, this method is utilized in Cricket stadiums or Golf stadiums and conjointly publically gardens wherever no one is there to require care of plants. The system has many demand and future scope conjointly. It permits heap of development at intervals it and results in a typical and helpful system which may be used vary wide in agriculture field. The supply of the GSM network may be a

necessity for the system implementation. The system is very helpful for precise irrigation in farm fields and so chargeable for economical utilization of water resource and men power. This irrigation system is underneath budget. Construction, installation and maintenance are value effective. It's terribly helpful in rural areas and even in giant agricultural enterprises. It conjointly focuses on water saving. This circuit prevents over-irrigation that causes preventative in fields, a possible threat to farmers.

5.5Future Scope of the project

We can use some changed version of sensing element rather than Op-amp sensing element, we will able to attach some subtle sensing element in order that it can scan wet content of soil unceasingly (in totally different range). By receiving that values user will set some values to limit the WET condition and DRY condition. It'll be terribly benefits since user will set totally different values of wet of various crops. Developing code any, we are able to management pump victimization mobile. It conjointly helps to avoid recitation of motor. In future, project may be improved a lot of by adding Integration of weather data for dynamic irrigation scheduling based on precipitation forecasts. Multi-sensor implementation for comprehensive monitoring of soil nutrients, temperature, and other environmental factors etc.

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Appendix

The Code Used in Arduino Nano

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 10, 11, 12, 13);
#define float_switchPin A0
#define moisture_sensorPin A1
#define motorPin A5
#define soil_statusPin 3
#define tank_statusPin 2
#include<SoftwareSerial.h>
SoftwareSerial mySerial(7, 6); // (Rx,Tx  > Tx,Rx)
char incomingByte;
```

```
String inputString;
int relay1 = 4; // Output for Relay Control
const int avg_moisture = 800;
void setup()
{
 Serial.begin(9600);
 lcd.begin(16, 2);
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("    AUTOMATIC   ");
 lcd.setCursor(0, 1);
 lcd.print(" IRRIGATION SYS ");
 delay(3000);
 lcd.clear();

 lcd.setCursor(0, 0);
 lcd.print("Helped by ");
 lcd.setCursor(0, 1);
 lcd.print("Razibul Awal");
 delay(3000);
 pinMode(moisture_sensorPin, INPUT);
 pinMode(float_switchPin, INPUT);
 pinMode(motorPin, OUTPUT);
 pinMode(soil_statusPin, OUTPUT);
 pinMode(tank_statusPin, OUTPUT);
 digitalWrite(motorPin, LOW);
 digitalWrite(soil_statusPin, LOW);
 digitalWrite(tank_statusPin, LOW);
 pinMode(relay1, OUTPUT);
 digitalWrite(relay1, LOW); // Initial state of the relay
 Serial.begin(9600);
```

```
  mySerial.begin(9600);
  while (!mySerial.available()) {
    mySerial.println("AT");
    delay(1000);
    Serial.println("Connecting...");
  }
  Serial.println("Connected!");
  mySerial.println("AT+CMGF=1");
  delay(1000);
}
void loop()
{
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print(" MOISTURE -");
  if (analogRead(moisture_sensorPin) < avg_moisture) {
    lcd.print("HIGH ");
    digitalWrite(soil_statusPin, HIGH);
  }
  if (analogRead(moisture_sensorPin) > avg_moisture) {
    lcd.print(" LOW ");
    digitalWrite(soil_statusPin, LOW);
  }
  lcd.setCursor(0, 1);
  lcd.print("TANK LEVEL- ");
  if ( digitalRead(float_switchPin) == HIGH) {
    lcd.print("HIGH ");
    digitalWrite(tank_statusPin, LOW);
  }
  if ( digitalRead(float_switchPin) == LOW) {
    lcd.print(" LOW ");
```

```
   digitalWrite(tank_statusPin, HIGH);
  }
  digitalWrite(motorPin, LOW);
  if (analogRead(moisture_sensorPin) > avg_moisture && digitalRead(float_switchPin) ==
HIGH)
  {
   while (analogRead(moisture_sensorPin) > avg_moisture && digitalRead(float_switchPin)
== HIGH)
   {
    lcd.setCursor(0, 0);
    lcd.print(" MOISTURE - LOW  ");
    lcd.setCursor(0, 1);
    lcd.print(" MOTOR    - ON   ");
    digitalWrite(soil_statusPin, LOW);
    digitalWrite(tank_statusPin, HIGH);
    digitalWrite(motorPin, HIGH);
   }
   if (analogRead(moisture_sensorPin) < avg_moisture) {
    lcd.setCursor(0, 0);
    lcd.print(" MOISTURE - HIGH  ");
    lcd.setCursor(0, 1);
    lcd.print(" MOTOR    - OFF   ");
    digitalWrite(soil_statusPin, HIGH);
    digitalWrite(motorPin, LOW);
    delay(600);
   }
   if (digitalRead(float_switchPin) == LOW) {
    lcd.setCursor(0, 0);
    lcd.print(" TANK LEVEL- LOW  ");
    lcd.setCursor(0, 1);
    lcd.print(" MOTOR     - OFF  ");
    digitalWrite(soil_statusPin, HIGH);
```

```
   digitalWrite(motorPin, HIGH);
   delay(600);
  }
}
delay(500);
{
  if (mySerial.available()) {
   delay(100);
   while (mySerial.available()) {
    incomingByte = mySerial.read();
    inputString += incomingByte;
   }
   delay(10);
   Serial.println(inputString);
   inputString.toUpperCase(); // Uppercase the Received Message
   if (inputString.indexOf("ON") > -1) {
    digitalWrite(relay1, HIGH);
   }
   if (inputString.indexOf("OFF") > -1) {
    digitalWrite(relay1, LOW);
   }
   if (inputString.indexOf("ALL ON") > -1) {
    digitalWrite(relay1, HIGH);
   }
   if (inputString.indexOf("ALL OFF") > -1) {
    digitalWrite(relay1, LOW);
   }
   delay(50);
   }
   inputString = "";
  }
```

```
 }
}
```