ARDUINO-BASED SMART WATER MANAGEMENT SYSYTEM FOR
PREVENTING WATER LEAKAGE IN FARM FIELDS

Submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Electronics & Communication Engineering.

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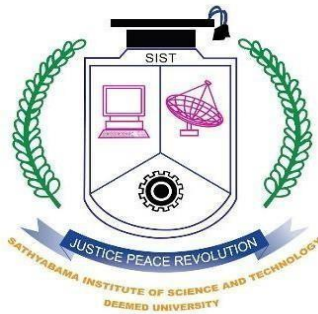
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SCHOOL OF ELECTRICAL AND ELECTRONICS

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report submitted for EPICS(ENGINEERING PROJECT IN COMMUNITY SERVICE)project is the bonafide work of who carried out the project entitled **"ARDUINO-BASED SMART WATER MANAGEMENT FOR PREVENTING WATER LEAKAGE IN FARM FIELDS"** under our supervision from JULY 2023 to NOV 2023.

Internal Guide

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Submitted for Viva voce examination held on_____

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DECLARATION

WE **AMBATI.KAVYADEVI (41130020), ATTLURI.PRASANNA (41130044), A.HARSITHA(41130045),K.BALA SUBINGA(41130048)** hereby declare that the Project Report entitled "**ARDUINO BASED SMART WATER MANAGEMENT SYSTEM FOR PREVENTING WATER LEAKAGE IN FARM FIELDS**" done by us under the guidance of **DR**. **M. SUMATHI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and communication Engineering.

DATE: **SIGNATURE OF CANDIDATES**

PLACE:

ACKNOWLEDGMENT

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We convey our thanks to **Dr.N. M. NANDHITHA, M.E, Ph.D.,** Dean, school of electrical and electronics and **Dr. T. RAVI M.E Ph.D.,** head of the department, dept. of electronics and communication engineering for providing us necessary support and details at the right time during the progressive reviews.

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ABSTRACT

Water is the most important natural resource that every living creature needs. The amount of water is pretty less than required. Some people are not able to get the sufficient amount of water. This is because of leakages in the water supply pipelines. This project mainly focuses on the domestic supply of water. In this project, the system consists of water sensors to detect leakage in the pipelines and these sensors will be kept at all the possible leak occurring places; when there is a leakage in a spot, it will automatically stop the flow of the water through that region by blocking the water with the help of a solenoid valve. Since, the aim is to use it for domestic purposes, it is possible to monitor the amount of water in the storage tank with the help of an ultrasonic sensor, also it is possible to turn the water pump on automatically.Water Leakage detection is an important problem in TWAD board especially in city site. In the existing system the opening and closing of water tanks at each location was done manually.

Also, leakage cannot be detected accurately. Due to this factor, there is no efficient water supply. Also, it results in water scarcity problem. In order to reduce the leakage of water through pipelines and to develop an efficient water supply system this project provides the solution using microcontroller and with water flow control technology. The proposed system consists of an Arduino UNO, water flow sensor, Relay, solenoid valve, pH sensor and power supply unit. This proposed methodology can monitor the flow rate, identifies the leakage and then controls the operation of the total system. The methodology was first tested through Proteus simulation and it was implemented in the hardware. The ultrasonic sensor and flow sensor senses the water level and the water leakage respectively.Once the flaw is identified, it is informed to control room through the interne(Email, twitter, SMS) and also nearby people can be informed intime. By placing this system, we will be able to collect and analyze the water usage patterns of the residents and save a lotof water in small as well largescale in future.In order to give a solution, we put forward a system that monitors the water level, water quality and water leakage using various sensors.

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CHAPTER -1

INTRODUCTION

1.1 WHAT IS WATER MANAGEMENT

The water supply management in the world has always brought challenges. Water is the primary resource that supports human survival; however, for adequate water distribution, some important factors must be considered to guarantee the supply. The major causes of water loss are technical failures in the distribution process and leaks. Water Loss is one of the biggest problems that we are facing, the advent of summer season accompanies severe drought and loss of ground-level water on a high scale. People will be unaware of how much they waste precious treasure and in the future, they run out of water. It is necessary to manage as well as supervise the amount of water that we are using every day. The need for a water management system is mandatory. Every house needs a rainwater management system and a water loss detection system to utilize the available water efficiently. Thus a smart water management system that detects water loss through the pipelines and gives an alert message is the need for the current era.

Thus an IoT based system connected with the GSM module helps in tabulating the water flow readings.Water is an essential need for human survival but due to rapid pace of industrialization and greater emphasis on agricultural growth combined with latest advancements, agricultural fertilizers and no enforcement of laws have led to water pollution to a large extent. The availability of good quality water is paramount in preventing outbreaks of water-borne diseases as well as improving the quality of life. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. Water quality refers to the chemical, physical, biological, and radiological characteristics of water. In this work Water quality is calculated by considering waters physical (temperature. Water pollution monitoring system can help to detect the water pollution that means temperature of the water.The pipe leakage detection is also the important thing to avoid the wastage of water. A lack of appropriate leakage analysis and monitoring can result in repairs that are ineffective in controlling or reducing leakage

CHAPTER 2
LITERATURE SURVEY

This is not a novel concept; IoT-based trash cans have been deployed and used in the past. Some writers described systems in which sensors in the bin checked whether the bin was full or not. If it was full, an automatic message was delivered to the system's server end through the Arduino SIM module, which used the Arduino board's application. When the server got the message, it transmitted it to the worker in charge, who, if available, would announce his or her presence by accepting the assignment and arriving at the specified location. The task would be shifted to another worker if the worker was unavailable. The information of all smart dustbins may be viewed by the concerned individual at any time and from anywhere, allowing him or her to make an informed decision. The cost reduction, resource optimization, and effective use of smart dustbins were all accomplished by adopting this proposed method. The city's traffic was decreased indirectly as a result of this method. In big cities, the waste collection van came twice or three times a day, depending on the population of the region. The system provided real-time information on the state of each and every dust bin, allowing the responsible authority to dispatch the rubbish collection truck only when the dustbin is full. Some proposed smart garbage management system using IR sensor, microcontroller and Wi-Fi module. This system assured the cleaning of dustbins soon when the garbage level reached its maximum. If the dustbin was not cleaned in specific time, then the records were sent to the higher authority who took appropriate action against the concerned contractor.

This system also helped to monitor the fake reports and hence helped to reduce the corruption in the overall management system. It ultimately helped to keep cleanliness in the society. The Dustbin with a Wi-Fi Router was gradually launched. A Passive Infrared Sensor was installed in the Dustbin. The temporary connection code was programmed into the Wi-Fi router. The PIR sensor detected garbage in the trashcan and delivered signals to the microcontroller when the user threw it in. The signals were detected by the microcontroller, which transmitted them to the router device. The router checked the signals and created random codes before sending them back to the microcontroller. The signals were read by the microcontroller and transmitted to the LCD Display. The LCD Display displayed it. The user entered the random code generated by the router on the PHP interface which was hosted on the server. The server then responded to the request and displayed the Master Wi- Fi password to the user. The user then used the Master Wi-Fi password to connect to the

internet. The user got the internet access for 10 minutes and automatically got disconnected. In their work proposed an IoT-based unbelievable waste clean association structure where sensor frameworks are utilized to steadily checking the waste component of the garbage.when the waste estimation over the dustbins is recognized, the framework along these lines cautionsthe embraced individual by strategies for GSM/GPRS. They structure works by utilizing microcontroller which gives interface between the sensor and the GSM/GPRS framework. Also, an Android application is utilized to screen and join the important data identifying with the unmistakable component of waste found in various zones. With this framework, another client can basically chooseon the structure and not simply the manager . Regardless, anybody can make a record and theframework likewise surrender access to clients not expected for. This framework can be improvedby setting two holders to self-rulingly collect dry and wet squanders. For this situation, the wet wastecan be moreover masterminded and be utilized for the period of biogas, made intense by making itinsignificant and fiscally astute. built up a sharp reject watching framework which is utilized in the estimation of deny level ceaselessly and cautions the fitting expert through SMS writings. Theframework is wanted to screen the waste holder and send the messages as alerts when perceivedto be full or in every way that really matters full to help its evacuation .

To accomplish this point ofconfinement, the framework utilizes a camera which is set at each position where rubbish isamassed close to a stack cell sensor orchestrated at the base of the waste holder. For this situation,the camera will constantly takes surveys of the reject holder while the stack cell sensor takes the weight to pick whether full or not. Besides, an edge level is set which is utilized to separate the result of the camera and weight sensor. Exactly when the edge is practiced, the controller transmita message by strategies for the GSM module to the suitable master urging them that the junk holderis full and ought to be engineered. Reasonably, the waste archive total vehicle is dispatched to gather the deny utilizing a robot instrument. In any case, catch is that the camera takes pictures allthrough disregarding the manner in which that its purpose of constrainment is come to in any case. .

. Theframework is wanted to screen the waste holder and send the messages as alerts when perceivedto be full or in every way that really matters full to help its evacuation of the compartment on time.The centrality of the structure is to improve the ability of strong waste trade the executivesdependably. In any case, the downside is that the notice of the storehouses' status avoids the zoneof the holder or its orientation, making it badly arranged to find and amass the waste canisters in abrief moment. proposed a garbage storing up framework that is adjusted having data gatheringstructure subject to the arranging of pictures taken and GSM module. To accomplish this point ofconfinement, the framework utilizes a camera which is set at each position where rubbish isamassed close to a stack cell sensor orchestrated at the base of the waste holder. For this situation,the camera will constantly takes surveys of the reject holder while the stack cell sensor takes theweight to pick whether full or not. Besides, an edge level is set which is utilized to separate the result of the camera and weight sensor. Exactly when the edge is practiced, the controller transmita message by strategies for the GSM module to the suitable master urging them that the junk holderis full and ought to be engineered. Reasonably, the waste archive total vehicle is dispatched to gather the deny utilizing a robot instrument. In any case, catch is that the camera takes pictures allthrough disregarding the manner in which that its purpose of constrainment is come to in any casejust contemplates the latest to pick gathering. As requirements be, the use of camera is senselessor unessential. Chaware proposed a waste get-together structure considered imaginative to helpwith keeping urban domains clean. The structure works by watching rubbish stores and tell theexperts and the waste collection vehicles about the part of garbage set away or contained in thereject holder through a web application. Regardless, the framework utilizes ultrasonic sensors inwhich their distinctive precision can be affected by changes in temperature. In addition, it utilizesWiFi which is inherently a short range alliance. From this time forward, these disadvantages sway the ideal execution of the structure.

Kalpana, proposed a sharp canister the authorities framework which stores the majority of the bits of information concerning the dustbins and their district on the server. In this framework, the clients are responsible for checking the segment of the misfortune in the holder correspondingly as sending such data to the server. The subtleties are gotten to by the proper experts at the not actually charming end by techniques for the Internet and quick reaction can be started to arrange the vault of the waste. In this structure the canister must be washed down when a client sends the status of the holder to the server through an adaptable application. Thusly, the damage is that concerned masters can't screen the waste estimation unendingly yet rather need to monitor things for messages. In like way, if a client is unfit to send the message it proposes that nature will be verified with waste when the holder is full. have proposed the likelihood of a "Talented Recycle Bin" that utilizes RFID imprints to recognize the character of the individual flinging the deny. RFID based (or any ID card based) structures are implausible to finish on a city wide condition as it is unreasonable to think each individual will pass on his RFID card dependably at whatever point he needs to engineer a type of waste into a trash holder. Besides, their framework has no game-plan for sending the information to the cloud C.K.M. Lee and Trevor Wu have endeavored to understand a waste association structure in Hong Kong . Their framework utilizes GPRS to send the sensor information to a flexible application over the cloud. This is again not attainable as fitting GSM modules to the majority of the dustbins of a city and guaranteeing that GPRS information is accessible to the majority of the canisters is preposterous. Reviewing the weaknesses of the above frameworks, we are proposing an "IoT based strong waste association structure" with an assistant game-plan giving a hard and fast review of the framework level arrangement, square estimation building, and a convention stack, which can be executed and scaled on a city wide estimation missing much hindrances.

CHAPTER – 3

3.1 AIM OF PROJECT :

Automation in the pumping system for filling up the water tank. A sensor is placed on the top of the tank which constantly monitors the level of the water being supplied to the tank. As the water reaches the limiting level the water pump is automatically turned off. It also calculates the running time and the power consumed by the motor. The data is thereafter stored in the cloud. The data can be easily fetched to have budget estimation per month. It also notifies the weather conditions, if the weather is predicted to be bad the notification about filling up the tank would come which in response helps up in filling up the tank when there is a power supply.

3.2 SCOPE:

Water is one of the most important basic needs for living beings. But with the modernization and development of human lifestyles, consumption of water has been at the peak. The shortage of water has been thus increasing at a very rapid rate. States like Kerala and Chennai which had once ample of water is now running out of it. Wastage of water has been proven to be one of its major cause. Water overflow over an hour and careless draining of freshwater from residential, hospitals, and municipal tanks adds flavor to the shortage of drinking water.It becomes quite hectic for the conventional tanks to fill up the water judiciously without any wastage of it or nearly impossible to keep a check on it.So thereby we switch to the i.o.t project to nearly solve the above-mentioned problems and keep a check on the overflowing of the tank and also keep an eye on the prevention of wastage of electricity on the excess working of the pumps. Water management is a global issue and it is the prime duty of all the people to save and conserve water so that it can be passed on safely to the future generation. Viewers please watch the ppt and leave your likes and comments. It becomes quite hectic for the conventional tanks to fill up the water judiciously without any wastage of it or nearly impossible to keep a check on it.So thereby we switch to the i.o.t project to nearly solve the above-mentioned problems and keep a check on the overflowing of the tank and also keep an eye on the prevention of wastage of electricity on the excess working of the pumps. It is widely acknowledged that there are fundamental flaws in the nation's water and wastewater management infrastructure (pipe systems, facilities, and equipment) that result in environmental damage and the loss of millions of gallons of water every year. Labor-intensive meter reading and the lack of visibility into distribution, collection, and consumption patterns result in time-consuming, costly, and reactive services. To minimize these losses, and to address mounting concerns about drought,

flooding, and water quality, the water industry is now adopting advanced sensor and communications solutions designed specifically for "smart" Internet of Things (IoT) water management. In large part, the move toward implementing smart water solutions is being driven by stricter government compliance requirements, the evolution of smart cities, and the need for water conservation in agriculture and other heavy water use markets. Smart Water Utilities Improving Service Levels and Promoting Water Conservation Smart Municipalities Reducing Pollution and Enhancing City Services Water management is considered the heart of many smart city initiatives across North America. Local and rural areas and municipalities require people to come up with plans for management and distribution of water resources, flood control strategies, harvesting rainwater according to the plan of the town, and more.The proposed system can be made more advance in future, as here we are using mobile for notification purpose to the user, and in future a mobile application can be used. Also in our system we are notifying to one or two users only but in future with the help of satellite we can give preference of number many user and notify only that user which is within the specified area range and near our system also in quality detection, we are detecting pH only but in future we can detect many other quality factors like chlorine, salinity, turbidity etc. The field of leak management continues to evolve with innovations in materials, technologies, and methodologies to make leak detection and prevention more efficient and cost-effective. Overall, the scope of water leakage management is expansive, driven by environmental concerns, economic considerations, and technological advancements. It plays a crucial role in ensuring sustainable and efficient water resource management. Reducing water leakages is essential for conserving water resources and minimizing environmental damage. Leak management aligns with sustainability goals. For utilities and homeowners alike, reducing water losses through effective leak management can lead to significant cost savings in terms of water bills and infrastructure maintenance. Governments and regulatory bodies are likely to introduce stricter standards and regulations for leak management to promote water conservation. Educating and involving consumers in leak detection and management through smartphone apps and smart meters can contribute to reducing water wastage. Developing advanced technologies and systems to prevent water leaks in infrastructure, residential, and industrial settings is a primary focus. This includes better materials, construction techniques, and early warning systems. Advancements in leak detection technologies, such as acoustic sensors, data analytics, and artificial intelligence, are expanding the ability to identify leaks quickly and accurately. Utilizing big data and machine learning, water utilities and organizations can analyze consumption patterns, detect anomalies, and predict potential leaks, allowing for proactive maintenance.

CHAPTER – 4
EXPERIMENTAL OR MATERIALS AND METHODS

4.1 CIRCUIT DESIGN

A circuit is actually any loop through which matter is carried. For an electronic circuit, the matter carried is the charge by electronics and the source of these electrons is thepositive terminal of the voltage source. When this charge flows from the positive terminal, throughout the loop and reaches the negative terminal, the circuit is said to be completed. However this circuit consists of a number of components which affectsthe flow of charge in many ways. Some may provide hindrance to the flow of charge, some simple store or dissipate charge. Some require external source of energy, somesupply energy.
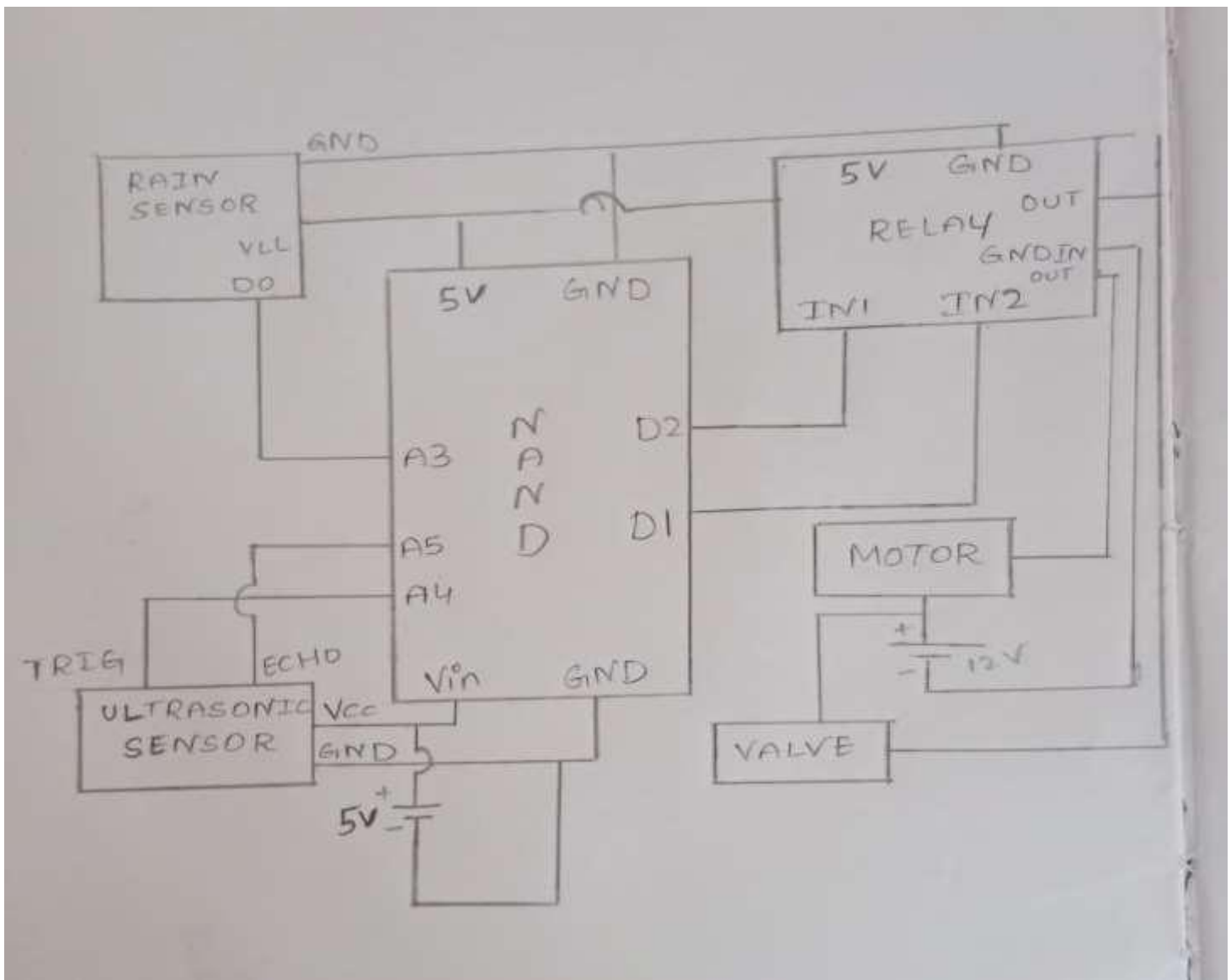
4.2 TOOLS

- Arduino IDE (Integrated Development Environment)

- Tinkercad Circuits, Blynk

- Circuit Digest Capacitor Calculator

- Express Resistor Color Code Calculator
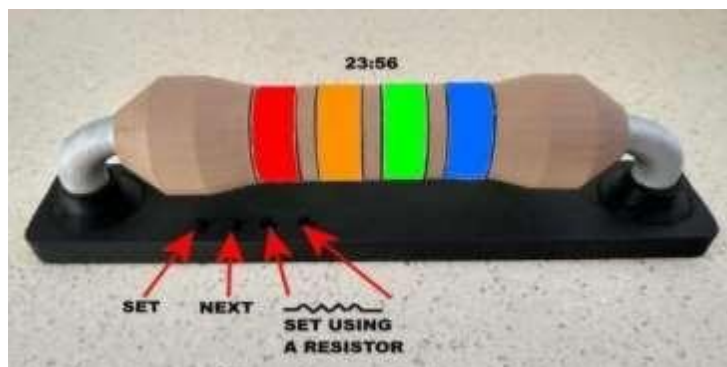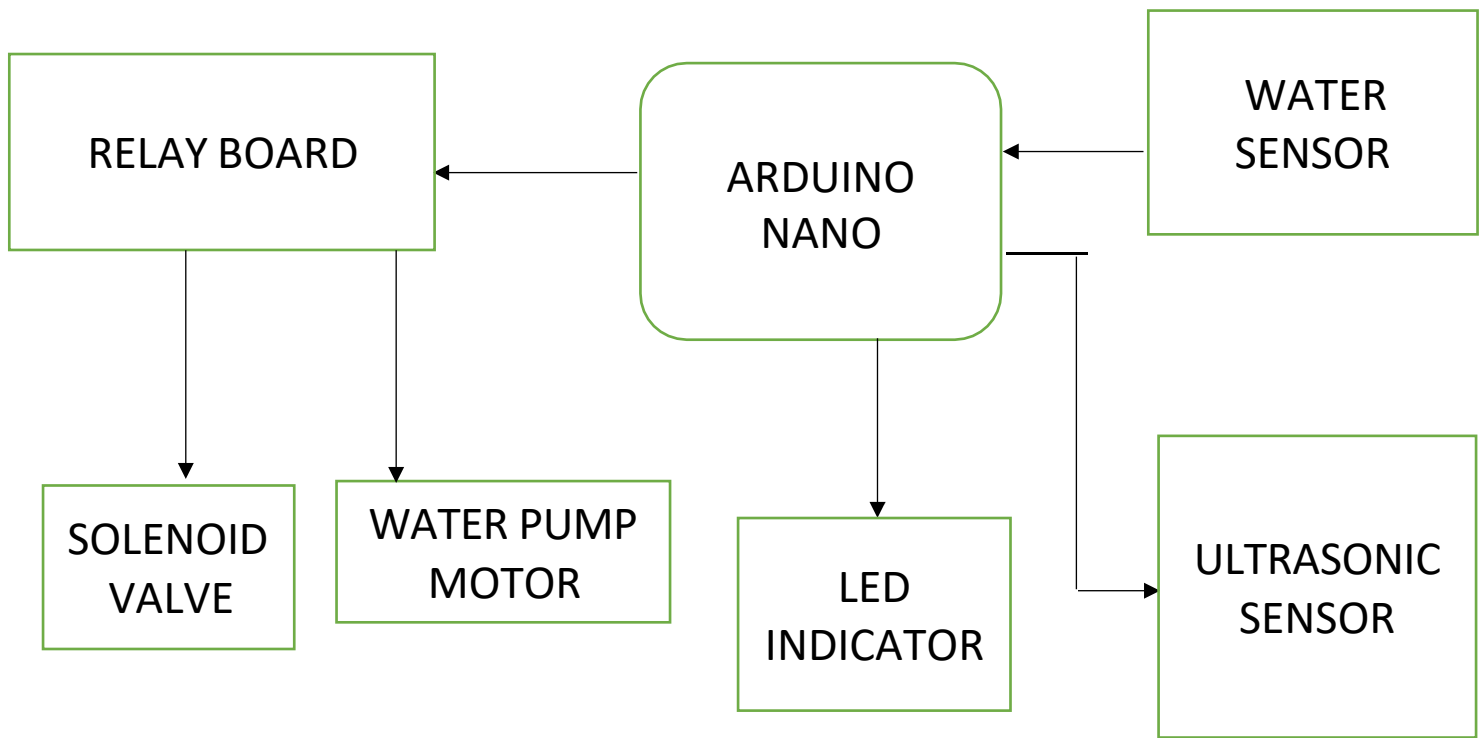

Fig 4.2 Blynk and Arduino ide

Fig 4.3 Resistor Colour Code calculator

4.2 BLOCK DIAGRAM

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┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│              │◄─────│  ARDUINO     │◄─────│   WATER      │
│ RELAY BOARD  │      │  NANO        │      │   SENSOR     │
│              │      │              │      │              │
└──────────────┘      └──────────────┘      └──────────────┘
    │        │              │      │
    ▼        ▼              ▼      └──────►┌──────────────┐
┌───────┐ ┌──────────┐ ┌──────────┐       │  ULTRASONIC  │
│SOLENOID│ │WATER PUMP│ │   LED    │       │   SENSOR     │
│ VALVE  │ │  MOTOR   │ │INDICATOR │       │              │
└───────┘ └──────────┘ └──────────┘       └──────────────┘
```

RELAY BOARD   :   It is connected in two connections of solenoid valve and water pump motor.

SOLENOID VALVE   : which is used to turn on and off the water flow when the leakage is detected.

WATER PUMP
 MOTOR   : it is used to continuous water flow.

LED INDICTOR   : it is used to know the information of water level present in the tank.

ULTRASONIC
SENSOR   : used to detect the level of water.

4.3 HARDWARE AND SOFTWARE REQUIREMENTS

1. NodeMCU

2. LUA based firmware developed for ESP8266 Wi-Fi chip

3. ESP8266 Development board/kit

4. Solenoid Valve

5. Relay Board

6. Capacitors

7. Transistors

8. Cables and connectors

9. Diodes

10. PCB and Breadboards

11. LCD

12. Buzzer

13. Adaptor

4.4 BASIC ELECTRONIC COMPONENTS

1. Ultrasonic Sensor
2. Arduino Nano
3. Solenoid valve
4. Relay Board
5. Water Sensor
6. Servo Motor
7. IR Sensor
8. Microcontrollers and Development Boards
9. Transformers and Powersupply
10. PCB boards
11. Resistors and Capacitors

4.5.1 Ultrasonic Sensor

An ultrasonic sensor is a device that uses high-frequency sound waves (ultrasonic waves) to measure distances and detect objects. It works by emitting a short burst of ultrasonic waves and then measuring the time it takes for the waves to bounce back after hitting an object. By knowing the speed of sound, the sensor can calculate the distance to the object. These sensors are commonly used in various applications, such as robotics, automotive parking assistance, and industrial automation, to detect obstacles or measure distances accurately.

Fig 4.5 Ultrasonic Sensor

4.5.2 Arduino Nano

The Arduino Nano is a highly popular microcontroller board known for its compact size and versatility. At its core, it utilizes the ATmega328P microcontroller chip, providing the processing power for a multitude of projects. Despite its diminutive form factor, it boasts a generous array of digital and analog input/output pins, enabling connections to an assortment of sensors, actuators, and electronic components. With USB connectivity, the Nano can be easily programmed and powered directly from a computer, though it also supports external power sources. Thanks to its compatibility with the Arduino IDE, beginners and experts alike can effortlessly code and create electronic applications. Operating primarily at 5 volts, though 3.3-volt variants are available, the Arduino Nano finds applications in robotics, home automation, sensor monitoring, and countless other DIY electronics projects. Its small size and adaptability make it a favored choice among hobbyists and professionals for crafting innovative electronic solutions in constrained spaces.

Fig 4.6 Arduino Nano

4.5.3 Solenoid Valve

A solenoid valve is a fundamental component in fluid control systems, known for its ability to regulate the flow of liquids or gases. At its core, it consists of a coil of wire (the solenoid) that, when energized with an electrical current, generates a magnetic field. This magnetic field exerts a force on a movable plunger or armature, which is typically sealed to prevent fluid leakage. When the solenoid is activated, it either opens or closes the valve, allowing or obstructing the flow of the fluid through a passage. Solenoid valves are widely used in various applications, including controlling the flow of water in irrigation systems, managing gas flow in heating appliances, and even in industrial automation to regulate the movement of liquids or gases in manufacturing processes. Their rapid response time, reliability, and ability to function automatically based on electrical signals make them crucial in many industries. Solenoid valves come in various sizes and configurations to suit specific needs, making them versatile and indispensable components in fluid control systems.

Fig 4.7 Solenoid Valve

4.5.4 Relay Board

A relay board is an electrical device used to control high-power circuits with low-power signals. It typically consists of multiple electromechanical relays mounted on a single board. Each relay has two main components: an electromagnetic coil and a set of switch contacts. When a low-voltage signal is applied to the coil, it generates a magnetic field that activates the switch contacts, allowing or interrupting the flow of electricity through the high-power circuit connected to the relay. Relay boards are widely used in automation, home automation, and industrial applications to interface between microcontrollers, sensors, and high-power devices, enabling remote or automated control of lights, appliances, motors, and more. They provide a safe and reliable way to isolate and control electrical loads, making them an essential component in various electronic and electrical systems.

Fig 4.8 Relay Module

4.5.5 Water Sensor

A water sensor is a specialized electronic device designed to detect the presence or absence of water in its vicinity. These sensors typically work on the principle of conductivity or capacitance. When water comes into contact with the sensor, it changes the electrical properties of the material, which the sensor can detect. Water sensors are commonly used in a variety of applications, including leak detection in homes and buildings, water level monitoring in tanks and reservoirs, and flood detection in areas prone to flooding. They play a crucial role in preventing water damage by alerting users to potential leaks or flooding, allowing for prompt action to mitigate water-related problems. Water sensors are cost-effective and dependable devices that provide an extra layer of security and peace of mind in environments where water-related issues can be a concern.
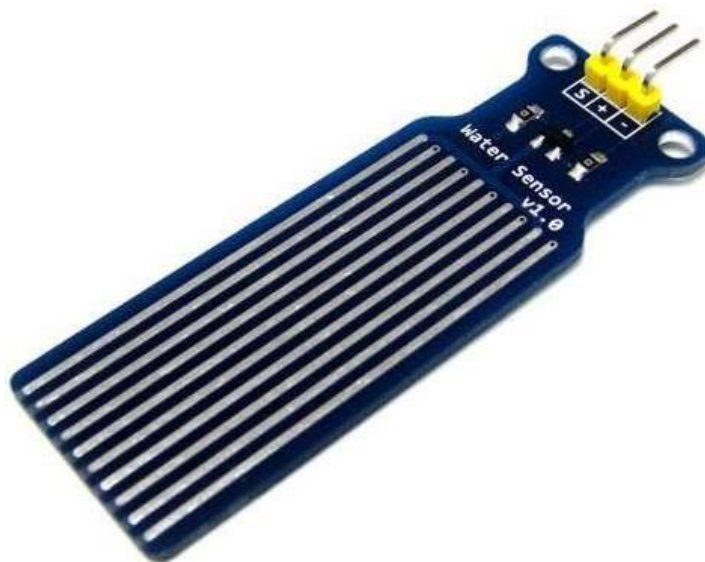

Fig 4.9 Water Sensor

A servo motor is a precise and highly controllable electric motor that operates based on feedback from an integrated sensor. It's designed to provide accurate and controlled angular or linear motion in response to a specific input signal. Servo motors are commonly used in various applications where precision and reliability are essential, such as robotics, CNC machines, remote-controlled vehicles, and automation systems. These motors contain internal feedback mechanisms, such as encoders or potentiometers, which continuously monitor the motor's position and adjust it as needed to maintain the desired position or speed. This closed-loop control system makes servo motors exceptionally accurate and capable of precise movements, making them a fundamental component in numerous industries and technologies requiring precise motion control.

Fig 4.8 Servo Motor

4.5.6 Infrared Sensor

An IR (Infrared) sensor is a device that detects and responds to infrared radiation in its environment. These sensors work on the principle of detecting changes in the infrared light spectrum, which is emitted or reflected by objects. Infrared sensors are commonly used for various applications, including proximity sensing, motion detection, and remote control systems. They consist of an IR emitter, which emits infrared light, and an IR receiver, which detects the reflected or emitted light. When an object enters the sensor's field of view, it alters the amount of received infrared radiation, triggering a response. IR sensors are widely used in devices like motion-activated lights, TV remote controls, and even in industrial settings for object detection and automation, owing to their reliability and cost-effectiveness in detecting changes in the environment without physical contact.
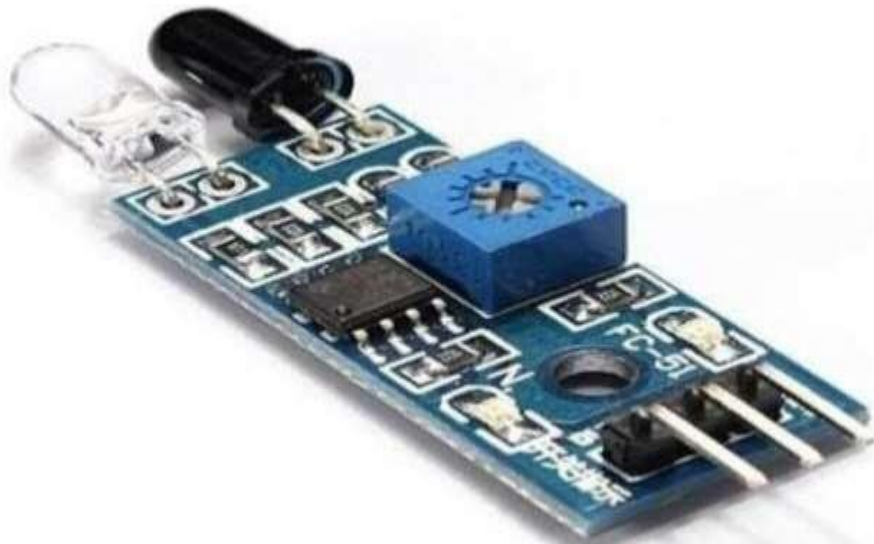

Fig 4.9 Infrared Sensor

4.5.7 MICROCONTROLLERS AND DEVELOPMENT BOARDS

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. A development board is a printed circuit board with circuitry and hardware designed to facilitate experimentation with a certain microcontroller. Al so there are certain hardware circuits that greatly aid testing and debugging such as pushbuttons and LEDs.
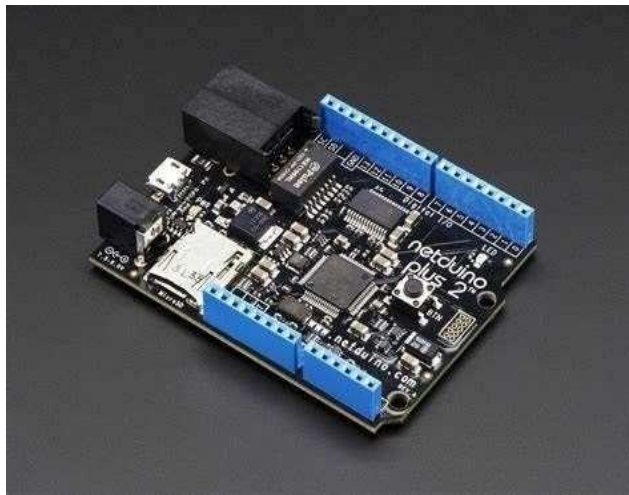

Fig 4.8 Microcontrollers

4.5.8 TRANSFORMERS AND POWER SUPPLY

A power supply is an electrical device that supplies electric power toan electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. A transformer is passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits . A varying current in any coilof the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force (EMF) across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits.

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Faraday's Law of Induction,discovered in 1831, describes the induced voltage effect in any coil due to a changingmagnetic flux encircled by the coil.

FIG 4.9 Power supply

4.5.9 PCB and Breadboards

A Printed Circuit Board is a laminated sand witch structure of conductive andinsulating layers. *Meta worlds* was an attempt by CDC to establish a BBS-like environment on the Internet, basically a closed mailbox in HTML format online. Access to the content was only possible for registered users who had to authenticatethemselves with username and password to access the system. Meta worlds supported the parallel operation with the standard ANSI based PC Board BBS software and used Microsoft SQL Server as underlying database. A runtime-versionof Microsoft SQL Server came with the Meta worlds software. CDC went out of business before Meta worlds was finished. Meta worlds was developed by CDC to make the transition to the Internet when the decline of the BBS became apparent.
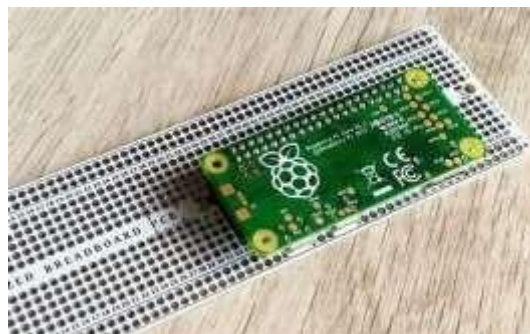

Fig 4.9 PCB

4.5.10 Resistors and Capacitors

A resistor is a passive two-terminal electrical component that implies electrical resistance as a circuit element. In electronic circuits,resistors are used to reduce current flow, adjust signal levels, to divide voltages bias active elements, and terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as avolume control or a lamp dimmer), or as sensing devices for electrical networks and electronic circuits and are ubiquitous in electronic. Practical resistors asdiscrete components can be composed of various compounds and forms. Resistors are also implemented within integrated *circuits* .The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine .orders of magnitude The nominal value of the resistance falls within the manufacturing tolerance indicated on the components.


Fig 4.10 Resistors and Capacitors

CHAPTER – 5
PRINCIPLE ADVANTAGES AND DISADVANTAGES

5.1 WORKING PRINCIPLE

Water leakage management using Arduino relies on a network of sensors strategically placed in areas prone to leaks. These sensors detect the presence of water and promptly relay this information to an Arduino board. The Arduino processes the data and initiates a response, which can include sounding alarms, sending notifications to the user, or even taking direct action, such as closing a water valve to halt the leak. Data about the incident, including timestamps and location, may be logged for future reference. Some systems incorporate user-friendly interfaces, like LCD screens or mobile apps, for real-time monitoring and control. For added convenience and remote access, certain setups connect to the internet, allowing users to receive alerts and manage their water leakage system from anywhere. In essence, Arduino serves as the core controller, orchestrating the detection and management of water leaks, safeguarding against potential damage and wastage . Water leakage management systems powered by Arduino offer an efficient and customizable solution to safeguard properties against water damage. These systems rely on an array of sensors strategically placed in areas prone to leaks, ensuring early detection. When water is detected, Arduino's processing capabilities come into play, triggering a range of responses, from sounding alarms to shutting off water valves. Communication protocols like Wi-Fi and Bluetooth enable remote monitoring and control, allowing users to receive instant alerts and make adjustments via their smartphones or computers. These systems can integrate with smart home setups for seamless automation and provide data analysis for long-term water management insights. Arduino's adaptability and cost-effectiveness make it an appealing choice for homeowners and small businesses seeking reliable protection against water-related disasters while maintaining flexibility and affordability .
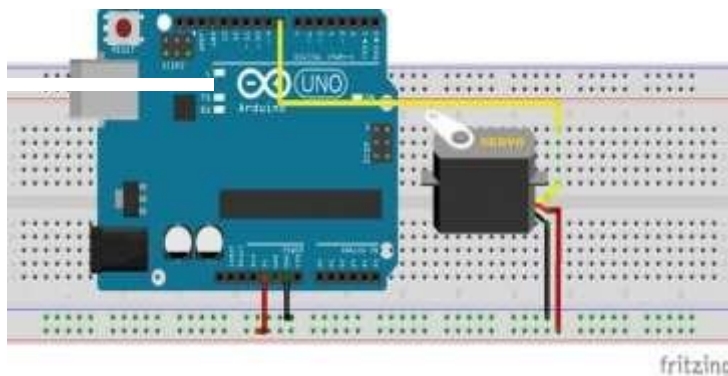
5.2 ADVANTAGES AND DISADVANTAGES

5.2.1 ADVANTAGES

- Water damage is the most common cause of home insurance claims. This is because water can easily leak through the roof, escape the plumbing system, or come from other sources like faulty appliances. Moreover, even a small amount of water can damage walls, ceilings, floors or other contents in a home given enough time.

- Smart leak detection systems include several small moisture/leak sensors. These devices run on batteries and can be placed near areas that are more prone to water damage. Such areas include: on sump pumps, near water-bearing fixtures, and behind or beneath pipes.

- More advanced leak detectors come with an option to set a minimum amount of water before an alert is triggered. This helps property owners learn only about water incidents that can potentially cause damage, excluding small spills. An additional feature of smart leak detectors is monitoring the temperature variations in a home — if there's an unexpected change in temperature, the device will send alerts.

- Most smart leak detectors on the market are integrated into smart home systems. Such systems include a central hub that connects to the Internet, an app, as well as a variety of smart devices that can be added, such as leak detectors, carbon monoxide (CO) detectors, thermostats and motion sensors. The hub communicates with all connected products and can be monitored and controlled from the app.

- Installing independent leak detectors is easy and doesn't require special tools. However, installing a smart home system with leak detection gadgets may require the services of a specialist. Furthermore, to make sure the detectors work properly throughout the year, the batteries and power sources regularly.

- More tips on how to prevent water damage in homes and properties can be found here. If water damage has already occurred, here are essential guidelines to eliminate musty odours from water-damaged contents. PuroClean stands ready to provide professional restoration services to any property affected by fire, water or mould damage.
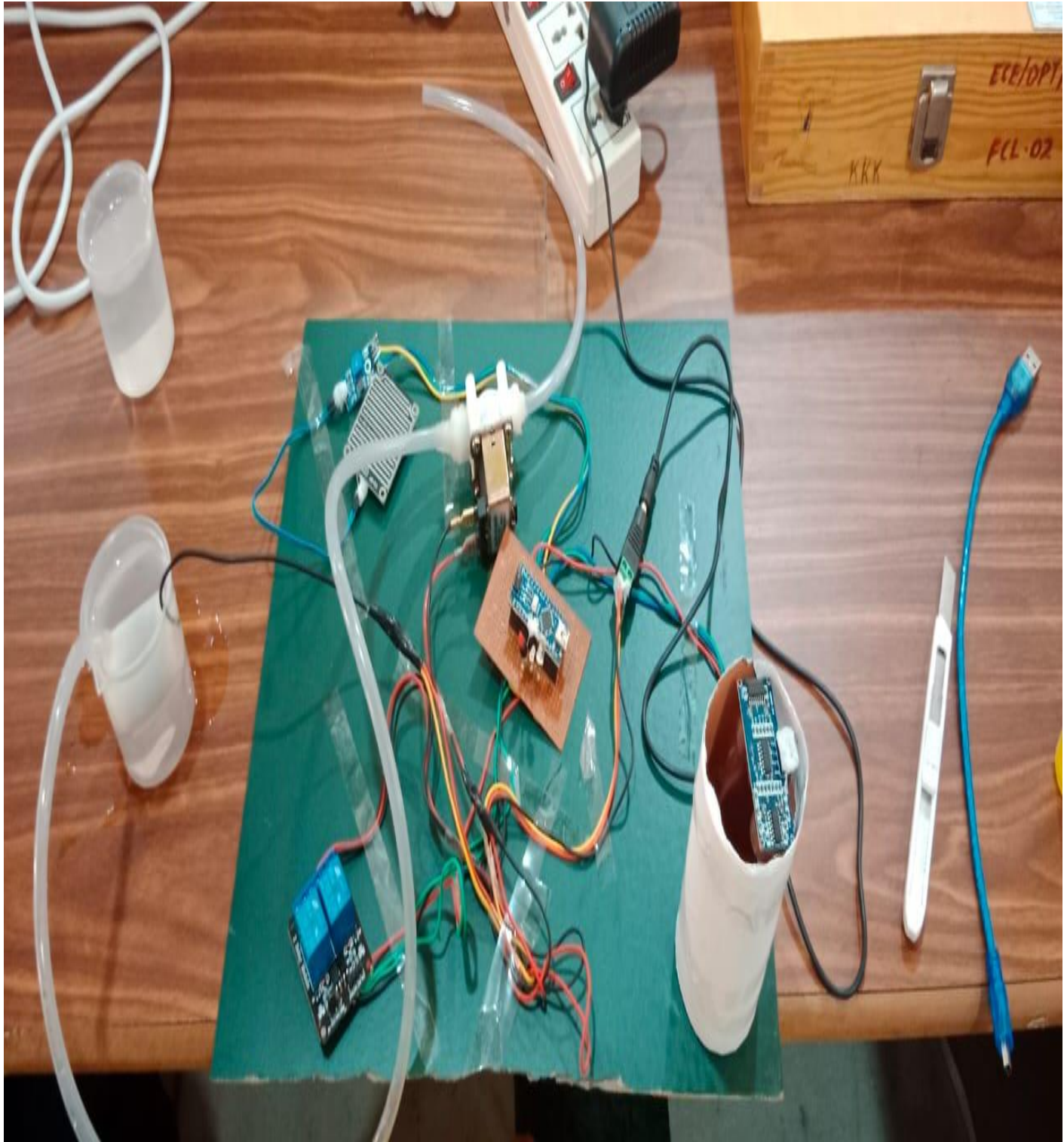
5.2.2 DISADVANTAGES

- One time usable, if the cable detects a leak or comes into contact with spilt oil, it becomes inoperable and must be changed before the system can detect a second leak.

- Expensive maintenance, each time oil comes into contact with the cable, it needs to be changed.

- Slow operating timeThe disadvantages of this system are that it only detected leaks if a sudden decrease in the water flow occured and that it cannot identify where the leakage occurred, only that it occurred. Also, the system was not tested on a real environment, so the accuracy of the concept is not available.

- The biggest downside to these is that you must place them strategically so any water leaking will reach their probes. This may mean that a leak has already caused significant water damage before reaching the sensing probe.

- Smart leak detection systems provide the ability to stop leak-caused water damage before it happens. They can also be controlled and programmed remotely, allowing for easy access no matter where you are. Below, you can find more information on how a smart leak detection system can benefit homes and properties.

- Smart water leakage management systems based on Arduino technology offer many advantages, yet they do come with some notable disadvantages. First and foremost, there's the issue of cost, as setting up these systems can be relatively expensive, making them less accessible to budget-conscious individuals or small businesses. Additionally, the complexity of configuring Arduino boards and sensors, especially for those without technical expertise, can pose a challenge. These systems are also dependent on a continuous power supply, making them vulnerable to outages.

- Regular maintenance is crucial to keep sensors and components functioning correctly, and there are security concerns related to internet connectivity. False alarms, compatibility issues, and the need for precise sensor placement add to the list of drawbacks. Lastly, there's the potential risk of neglecting routine plumbing inspections due to overreliance on technology. In assessing the adoption of such systems, it's vital to consider these disadvantages alongside their benefits

CHAPTER 6
RESULTS AND DISCUSSION

When there is no water in the tank, all the LEDs are off as an indication that the tank is completely empty. When water level increases and touches the sensor, the Red LED will glow indicating that there is water within the tank. As the water level continues to rise and reaches half the tank, Yellow LED will glow .In future scarcity of water is going to become a major problem to mankind therefore there is an urgent requirement of a system for the management of fresh water. Further providing live track of data and warning the user through android application whenever there is a wastage of water will be a good solution to the problem. In future we look for better improved methodologies, more automation and more user-friendly application on this system and we hope that this system will be applied to dams, farms and every other possible water resources.

Smart water leakage management systems based on Arduino technology offer many advantages, yet they do come with some notable disadvantages. First and foremost, there's the issue of cost, as setting up these systems can be relatively expensive, making them less accessible to budget-conscious individuals or small businesses. Additionally, the complexity of configuring Arduino boards and sensors, especially for those without technical expertise, can pose a challenge. These systems are also dependent on a continuous power supply, making them vulnerable to outages. Regular maintenance is crucial to keep sensors and components functioning correctly, and there are security concerns related to internet connectivity. False alarms, compatibility issues, and the need for precise sensor placement add to the list of drawbacks.Lastly, there's the potential risk of neglecting routine plumbing inspections due to overreliance ontechnology. In assessing the adoption of such systems, it's vital to consider these disadvantagesalongside their benefits

CHAPTER 7

7.1 SUMMARY

In summary, smart water management using Arduino technology represents a forward-thinking approach to efficiently and sustainably manage water resources. This system leverages sensors, data analytics, and automation to detect leaks, monitor water quality, and optimize water distribution. While it offers numerous advantages, such as early leak detection, remote monitoring, and potential cost savings, it also presents challenges, including installation costs, complexity, and maintenance requirements. Overall, it plays a crucial role in addressing water scarcity, improving water quality, and promoting responsible water use in an increasingly urbanized world, but its implementation should be carefully considered in light of specific needs and resources. In summary, smart water management using Arduino technology represents a forward-thinking approach to efficiently and sustainably manage water resources. This system leverages sensors, data analytics, and automation to detect leaks, monitor water quality, and optimize water distribution. While it offers numerous advantages, such as early leak detection, remote monitoring, and potential cost savings, it also presents challenges, including installation costs, complexity, and maintenance requirements. Overall, it plays a crucial role in addressing water scarcity, improving water quality, and promoting responsible water use in an increasingly urbanized world, but its implementation should be carefully considered in light of specific needs and resources

7.2 CONCLUSION

Thus the proposed system enhances with quick detection of water leakage and blocks the flow of water in the pipeline where leakage occurred. It also provides the rate of flow of water in a particular pipe line. By using this methodology man power work can be reduced. Leakage can be detected quickly. It also displays the pH value of the water, hence through this the quality of water can be monitored. One future extension of this work can be implemented with GSM module in order to locate the area of leakage occurred. Secondly it can extend to IOT basis ofmodification in order to send SMS to the authorized person of water control board

CHAPTER 7

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