# BANKING SURVEILLANCE USING IR SENSOR WATER LEAKAGE DETECTOR

**20EC5203 - ELECTRONIC DESIGN PROJECT I**

**A PROJECT REPORT**

***Submitted by***

**PRAVEENKUMAR A**

***in partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

***in***

**ELECTRONICS AND COMMUNICATION ENGINEERING**

**K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY**

(An Autonomous Institution, Affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

**SAMAYAPURAM – 621 112.**

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# K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY
# (AUTONOMOUS)
**SAMAYAPURAM - 621 112**

## BONAFIDE CERTIFICATE

Certified that this project report titled **"BANKING SURVEILLANCE USING IR SENSOR"**, **"WATER LEAKAGE DETECTOR"** is the bonafide work of **PRAVEENKUMAR A (811722106076)** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported here in does not from part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

**SIGNATURE**

**Dr. S. SYEDAKBAR, M.E., Ph.D.,**

**HEAD OF THE DEPARTMENT**

Assistant Professor
Department of Electronics and Communication Engineering
K.Ramakrishnan College of Technology (Autonomous)
Samayapuram – 621 112.

**SIGNATURE**

**Mrs. J. DEEPA, M.Tech., (Ph.D).,**

**SUPERVISOR**

Assistant Professor
Department of Electronics and Communication Engineering
K.Ramakrishnan College of Technology (Autonomous)
Samayapuram – 621 112

Submitted for the viva-voce examination held on ……

**INTERNAL EXAMINER** **EXTERNAL EXAMINER**

# DECLARATION

We jointly declare that the project report on **"BANKING SURVEILLANCE USING IR SENSOR"**, **"WATER LEAKAGE DETECTOR"** is the result of original work done by us and best of our knowledge, similar work has not been submitted to "**ANNA UNIVERSITY CHENNAI**" for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfillment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

**Signature**

PRAVEENKUMAR A

Place:Samayapuram

Date:

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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| BC547 | - | BIPOLAR JUNCTION TRANSISTOR |
| IC | - | INTEGRATED CIRCUIT |
| IR | - | INTEGRATED CIRCUIT INFRARED |
| LED | - | LIGHT EMITTING DIODE |
| NE 555 | - | TIMER |
| RX | - | RECEIVER |
| TX | - | TRANSMITTER |
| VR | - | VARIABLE RESISTOR |

# CHAPTER-1
# COMPONENTS

## 1.1 BREAD BOARD

A breadboard serves as an indispensable tool in the realm of electronics, providing a versatile platform for the assembly and testing of electronic components. Comprising a rectangular board with a grid of interconnected holes, the breadboard is designed to offer a user-friendly environment that facilitates the creation of electronic circuits without the need for soldering. The grid arrangement follows rows and columns, and within each row, multiple holes are electrically connected. Beneath the surface of the board, metal clips establish electrical connections, allowing for the creation of intricate circuits without the permanency associated with soldered connections.

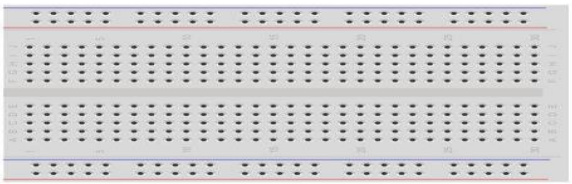

Figure 1.1 Bread board

In addition to its grid structure, breadboards typically feature power rails along the sides, commonly coloured in red and blue. These power rails provide accessible points for connecting power sources, whether they be batteries or external power supplies. The ease of access to power facilitates the testing and experimentation of circuits.

## 1.2 LIGHT EMITTING DIODE

Light Emitting Diodes (LEDs) represent a groundbreaking technology with wide ranging applications across diverse industries. Functioning on the principle of electroluminescence, LEDs emit light as a result of electrons moving within a semiconductor material. The advantages of LEDs are manifold. They excel in energy efficiency by converting a significant portion of electrical energy into visible light, surpassing traditional incandescent bulbs that dissipate a substantial amount as heat. This not only contributes to lower electricity bills but also aligns with global efforts towards energy conservation. The durability of LEDs is a key asset, attributed to their solid-state construction, lacking delicate components like filaments or glass bulbs.

Figure 1.2 LED

Beyond their use in indicators and displays, LEDs play a pivotal role in driving technological advancements. Their low power consumption makes them ideal for battery-operated devices, while their contribution to energy efficiency aligns with sustainability goals. In the automotive industry, LEDs are extensively used in headlights and taillights, improving visibility and safety. The continual evolution of LED technology underscores its importance in shaping a more sustainable and technologically advanced future.

## 1.3 POWER SUPPLY

A battery stands as a fundamental component in the realm of portable electronics, operating as a versatile electrochemical device designed to store and deliver electrical energy through a controlled chemical reaction. Typically composed of one or more electrochemical cells, a battery consists of positive (cathode) and negative (anode) electrodes immersed in an electrolyte solution. The chemical interaction between these components, when a circuit is closed, triggers a reaction that results in the flow of electrons, generating electrical energy. Alkaline batteries, for instance, are ubiquitous in everyday devices due to their reliability and cost-effectiveness. Lithium-ion batteries, renowned for their high energy density and rechargeable nature, are prevalent in various applications, including smartphones and electric vehicles. Nickel-cadmium batteries, also rechargeable, find their niche in portable electronics, offering a balance between efficiency and longevity. Alkaline batteries are ideal for low-drain devices, while lithium-ion batteries shine in applications demanding compactness and high energy storage.

Figure 1.3 Battery

Rechargeable batteries, a notable category, contribute significantly to sustainability efforts by minimizing waste and promoting resource efficiency. Particularly economical for devices with frequent usage patterns, rechargeable batteries not only reduce environmental impact but also prove cost-effective over time. Batteries serve as omnipresent power sources, indispensable for a broad spectrum of electronic devices. Their role extends from powering small everyday gadgets to being the driving force behind electric vehicles. In an era where electronic devices are integral to daily life.

## 1.4 RESISTOR

A resistor is a fundamental electronic component that opposes the flow of electric current. It is a passive two-terminal device with the primary function of controlling or limiting the amount of current passing through a circuit. Resistors are crucial in electronics for adjusting voltage levels, protecting components from excessive currents, and defining time constants in various applications. Resistors come in various types, including fixed resistors with specific resistance values and variable resistors like potentiometers and rheostats that allow manual adjustment. The resistance of a resistor is measured in ohms (Ω) and is governed by Ohm's Law, which relates the voltage (V), current (I), and resistance (R) in a circuit through the equation $V = I \times R$. In electronic circuits, resistors play essential roles in voltage dividers, signal conditioning, and setting bias points for active devices like transistors.

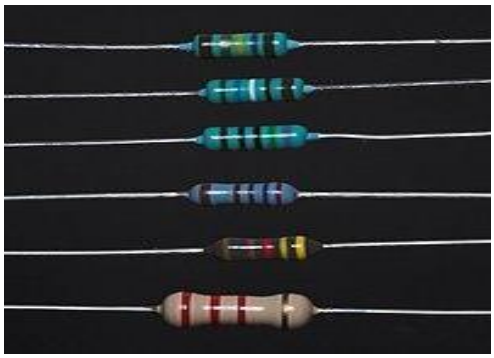

Figure 1.4 Resistor

Moreover, in setting bias points for active devices like transistors, resistors contribute to stabilizing and controlling the operation of these components. They are also employed in filters, oscillators, and numerous other applications where precise control of electrical parameters is necessary. Resistors are foundational components in circuit design, offering control and stability in the flow of electric current, contributing to the overall functionality and performance of electronic systems. In summary, resistors are foundational components in circuit design, offering control and stability in the flow of electric current.

## 1.5 CAPACITOR

A capacitor is a fundamental electronic component that stores and releases electrical energy in a circuit. It consists of two conductive plates separated by an insulating material called a dielectric. When a voltage is applied across the plates, an electric field is established, causing the accumulation of positive and negative charges on the respective plates. Capacitors are versatile components with various applications in electronics. They play a crucial role in smoothing voltage fluctuations, filtering signals, and providing energy storage in circuits. The ability to store electrical energy temporarily makes capacitors valuable in timing circuits, coupling AC and DC signals, and decoupling power supplies. Capacitors come in different types, including electrolytic capacitors, ceramic capacitors, and tantalum capacitors, each with specific properties suited to different applications. The capacitance of a capacitor, measured in farads (F), indicates its ability to store charge.

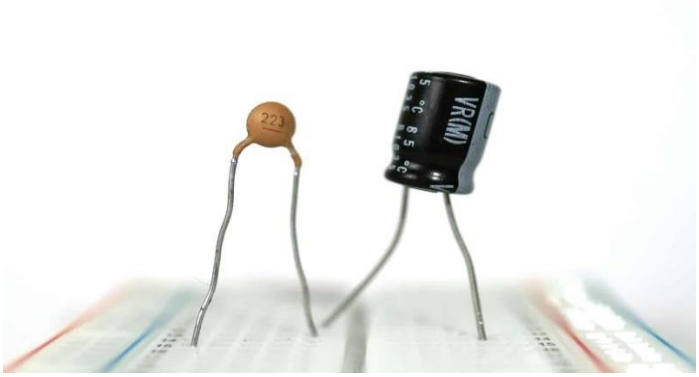


Figure 1.5 Capacitor

In electronic circuits, capacitors are essential for stabilizing power supplies, eliminating noise, and facilitating the proper functioning of various electronic components. They play integral roles in audio systems, power amplifiers, filters, and numerous other electronic devices, contributing significantly to the efficiency and performance of electrical systems.

## 1.6 INTEGRATED CIRCUIT

An Integrated Circuit (IC) is a compact arrangement of interconnected electronic components, such as transistors, resistors, capacitors, and diodes, fabricated on a semiconductor material. The miniaturized design of an IC allows for the integration of multiple functions and electronic circuits into a single chip, providing a significant advancement in electronic technology. Digital ICs, such as microprocessors and memory chips, process binary information, enabling the operation of computers and digital devices. Analog ICs, like operational amplifiers (op-amps) and voltage regulators, are designed for continuous signal processing, common in audio amplifiers and power supplies. The 555 timer IC and the 741 op-amp are notable examples.

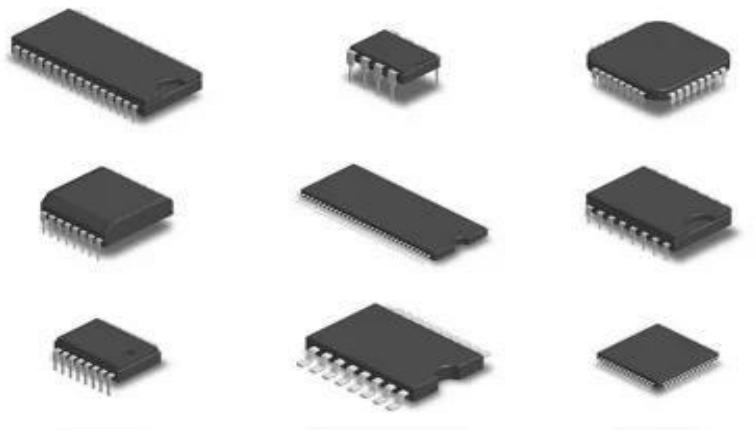

Figure 1.6 Integrated circuit

The 555 timer is widely used for generating time delays, pulse-width modulation, and oscillations. The 741 op-amp, on the other hand, is versatile and commonly used in amplifiers and signal processing applications. The compact nature of ICs enables the creation of complex electronic systems while minimizing space requirements, power consumption, and manufacturing costs. Integrated Circuits have revolutionized the field of electronics, contributing to the development of countless electronic devices, from computers and smartphones to medical equipment and communication devices.

## 1.7 BUZZER

A buzzer, a straightforward yet essential component in electronics, functions as an audio signalling device designed to produce sound when an electrical current is applied. Operating as a transducer, the buzzer converts electrical energy into audible sound waves, making it a valuable component for providing alerts and notifications in various electronic devices. The basic construction of buzzers typically involves a vibrating element, which could be a diaphragm or a piezoelectric crystal, and an electromagnetic coil. When an electric current flows through the coil, it generates a magnetic field. This magnetic field interacts with the vibrating element, causing it to vibrate and produce sound waves. The vibration frequency determines the pitch or tone of the sound emitted by the buzzer. Buzzers serve a wide range of applications, finding use in alarms, timers, notification systems, and any scenario where an audible alert is necessary.


Figure 1.7 Buzzer

In electronic circuits, the operation of buzzers is often controlled by oscillators or timer circuits. These circuits dictate the frequency at which the buzzer vibrates, resulting in distinct tones for different purposes. For instance, in an alarm system, a buzzer might be designed to emit a continuous, attention-grabbing tone, while in a timer application, it may produce intermittent sounds to indicate specific intervals or events. Different buzzer designs and types cater to specific needs, allowing engineers and designers to choose the most suitable option for their intended purpose.

## 1.8 TRANSISTOR

A transistor, a pivotal semiconductor device, stands as a cornerstone in the world of electronics due to its remarkable ability to amplify signals and act as a switch. Representing a fundamental building block in electronic circuits, transistors offer versatility and are integral to a broad spectrum of applications, ranging from amplifiers and oscillators to digital logic circuits. The two primary types of transistors are bipolar junction transistors (BJTs) and field-effect transistors (FETs), each with its own variations. BJTs, categorized as NPN (negative-positive-negative) and PNP (positive-negative-positive), involve the movement of charge carriers between two semiconductor materials. On the other hand, FETs encompass types like MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) and JFETs (Junction Field-Effect Transistors), relying on the modulation of conductivity within a channel. This ability to amplify signals is harnessed in various devices, including audio amplifiers that drive speakers, radio-frequency amplifiers in communication systems, and operational amplifiers in instrumentation.

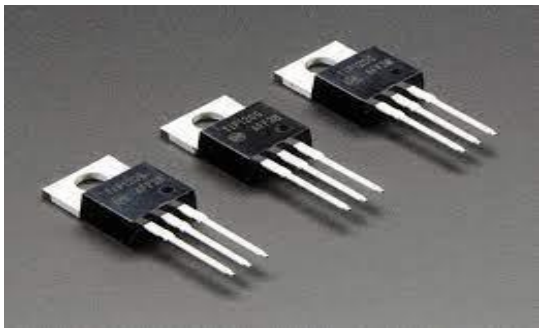

Figure 1.8 Transistor

The compact size, low power consumption, and reliability of transistors have been instrumental in the miniaturization and advancement of electronic technology. Transistors have played a transformative role in the evolution of electronic devices, contributing significantly to the development of computers, communication devices, and various electronic systems. The continued refinement and integration of transistors into electronic circuits underscore their enduring importance in shaping the landscape of modern technology.

## 1.9 CONNECTING WIRES

Connecting wires form the indispensable infrastructure of electronic circuits, serving as the vital conduits that establish electrical pathways and facilitate the seamless flow of electric current. These wires, typically composed of conductive materials like copper or aluminium, play a fundamental role in ensuring the proper functioning of circuits, both on breadboards and within complex electronic systems. The primary function of connecting wires is to link various components within a circuit, creating the necessary electrical connections for the circuit to operate as intended. Their conductivity allows for the transmission of electrical signals between different elements, forming the essential links that enable communication and cooperation among circuit components. Beyond their basic role in establishing electrical connections, connecting wires contribute significantly to the organization and structure of circuit layouts.

Figure 1.9 Connecting wires

Different lengths accommodate diverse circuit layouts, while distinct colours aid in visually distinguishing between various connections. This visual clarity becomes particularly crucial during the prototyping and experimentation stages of electronic system development, where designers and engineers need to troubleshoot and optimize circuit configurations. In essence, connecting wires are not just functional components; they are integral to the design, organization, and functionality of electronic circuits. As technology advances, the importance of well-designed and well-organized connecting wires remains paramount in the pursuit of innovation and progress in the field of electronics.

## 1.10 VARIABLE RESISTOR

A variable resistor, exemplified by components like potentiometers, stands out as a specialized and versatile device in electronics, offering a dynamic approach to controlling resistance within a circuit. Unlike fixed resistors, which maintain a constant resistance value, variable resistors enable users to manually adjust resistance, providing a means to control the flow of electric current. Potentiometers, a common type of variable resistor, often feature a rotary or linear mechanism that allows users to modify resistance by turning a knob or sliding a lever. This adjustability makes variable resistors highly valuable in electronic devices and systems where the fine-tuning of voltage or current levels is essential for optimal performance. One of the key applications of variable resistors is in volume controls for audio equipment. Tuning circuits in radios and other communication devices represent another significant application of variable resistors.

Figure 1.10 Variable Resistor

In electronic designs, variable resistors contribute to the adaptability and functionality of systems. The ability to manually adjust resistance allows for real time customization, providing users with control over the behaviour of circuits. In summary, variable resistors, particularly exemplified by potentiometers, play a key role in electronic systems by offering a means for users to adjust resistance. This adjustability provides versatility and control, allowing for precise customization of electronic devices and contributing to their adaptability and functionality.

## 1.11 IR TRANSMITTER RECEIVER

transmitter (IR Tx) and IR receiver (IR Rx) are key components used for transmitting and detecting infrared light, commonly employed in remote control and sensing applications. The IR transmitter is typically an infrared LED that emits light in the infrared spectrum, which is invisible to the human eye but detectable by the IR receiver. The IR receiver is usually a photodiode or a phototransistor designed to sense the IR light emitted by the transmitter. Together, these components facilitate wireless communication by encoding and decoding data as modulated IR signals. They are highly directional and efficient, minimizing interference from ambient light. IR Tx and Rx pairs are widely used in devices like TVs, robotics, obstacle detection systems, and proximity sensors. They are compact, energy- efficient, and offer reliable performance in various environments. Their ability to work seamlessly together makes them essential for applications requiring non- contact data transfer or object detection.


Figure 1.11 IR Transmitter Receiver

# CHAPTER-2

# BANKING SURVEILLANCE USING IR SENSOR

## 2.1 ABSTRACT

Banking Surveillance Using IR Sensor is a modernized and efficient security solution that has been specially designed for financial institutions, especially banks. At present, unauthorized access and theft have emerged as major risks, so the project uses an infrared sensor system with an LM358 operational amplifier to detect movement or interference in a particular secured area. This circuit is cost-effective, simple, and reliable for security surveillance. The circuit consists of a 9V battery that powers an IR transmitter and receiver. The infrared light from the IR transmitter will be monitored continuously by the IR receiver. Any interference in the beam will be sensed and then processed by the LM358 operational amplifier, which works as a comparator. Once the movement or obstacle is detected, the system automatically activates a buzzer and an LED, both of which give audible and visual alarms that alert security personnel of the intrusion. The design also has 10k variable resistor VR to make it sensitive adjustable. This makes it flexible, allowing the system to adjust to different environments and needs. Further, being compact in design and less in power consumption, it's lightweight to be installed even in secluded regions of the bank, including its usage on ATM or vaults. In general, this project highlights the concept that simple electronic components can integrate and generate a reliable surveillance system, therefore this project is a stepping stone for developing more advanced solutions. By focusing on efficiency, cost-effectiveness, and practicality, the Banking Surveillance Using IR Sensor project shows its potential to greatly improve security in high-risk areas.

## 2.2 INTRODUCTION

Security systems are essential in securing sensitive locations, especially in the banking industry. As threats of theft and unauthorized access continue to rise, innovative surveillance solutions are necessary to ensure asset and personnel safety. The Banking Surveillance Using IR Sensor project caters to these needs by utilizing a compact and efficient system for the detection of movement or interference in a secured area. The key technology that is being used in this project is the infrared (IR) sensor, consisting of an IR transmitter and receiver pair. This sensor system creates an invisible detection line that is constantly monitored for disruptions. This circuit is also equipped with an LM358 operational amplifier, which analyzes the signal from the IR receiver. When the IR beam breaks, the amplifier gets triggered, and it further activates a buzzer and an LED. The security guards are alerted in case of any intrusion through these warnings. The system is driven by a standard 9V battery, which makes the device easy to deploy and transport. One of the main features of this design is the incorporation of a 10k variable resistor. This enables the user to vary the sensitivity of the system. This flexibility will make the system versatile enough to be used in any type of environment, from entry points to high-security areas such as bank vaults. The benefits of this project are simplicity, cost-effectiveness, and reliability. Unlike other complex security systems, this IR sensor-based circuit is designed with easily available components so that it can be used all over. Furthermore, the combination of both audio (buzzer) and visual (LED) alarms makes it much more effective in alerting security personnel in time.This project indicates the potential for using basic electronic principles to design robust solutions for practical problems. It is designed as a standalone but can be improved further with features like remote monitoring, wireless alerts, or even smart surveillance system integration.

## 2.3 COMPONENTS USED

- Variable resistor -10K ohms (1)
- Resistors - 100ohms, 220ohms, 10ohms (1, 1, 1)
- Integrated circuit - LM 358 (1)
- IR Transmitter Receiver Pair - 1
- Light Emitting Diode - 1
- Buzzer - 1
- Bread board - 1
- Battery - 9v (1)
- Connecting Wires - As required

## 2.4 CIRCUIT DIAGRAM

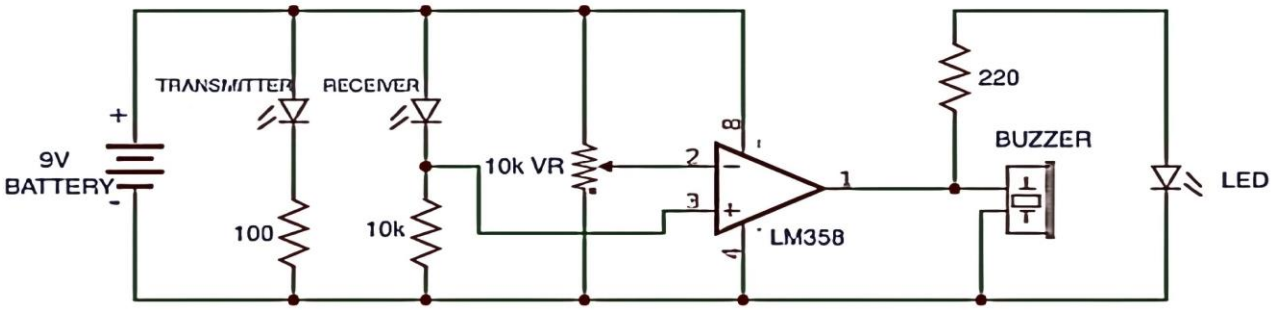


Figure 2.1 Circuit Diagram of banking surveillance using IR sensor

## 2.5 WORKING MODEL

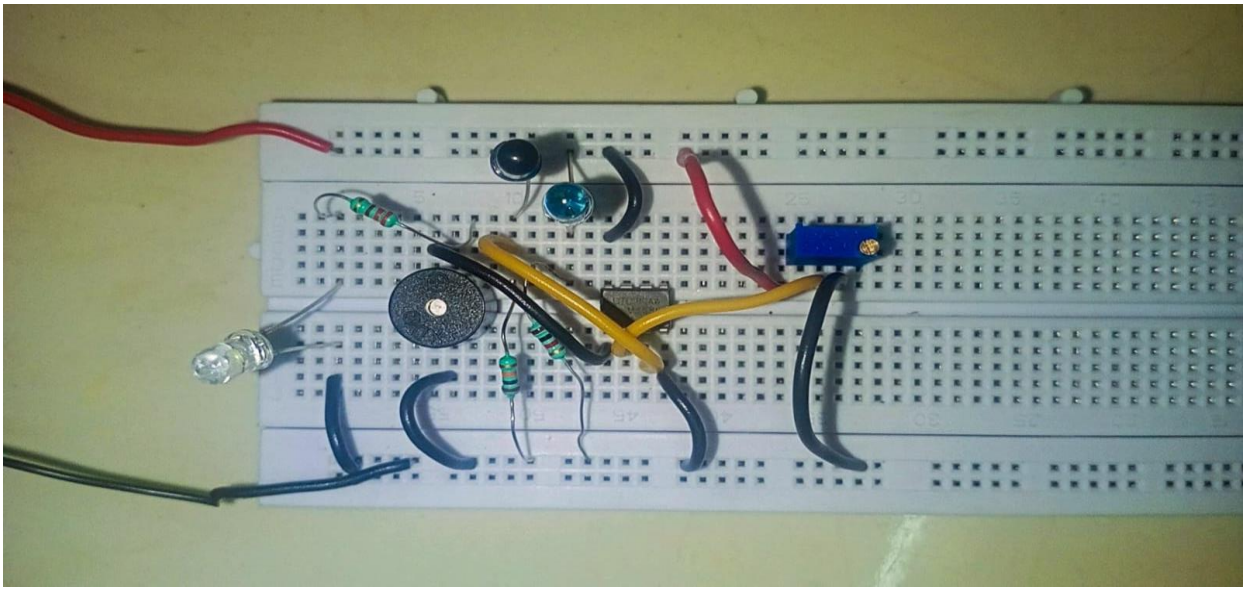

Figure 2.2 Working Model of banking surveillance using IR sensor

By referring to Figure 2.1 (Circuit Diagram), the model was constructed as illustrated in Figure 2.2. The working procedure of the "banking surveillance using IR sensor" module is designed as an IR-based proximity sensor system for object sensing or movement detection. It will work with an IR transmitter and receiver in combination with an operational amplifier, LM358, and will be powered through a 9V battery. The transmitter emits light continuously in the form of infrared, which, as an object approaches, sends it back to the receiver. The IR receiver captures the reflected signals and then produces a low voltage representing the amplitude of the captured signal. This is taken as input to the LM358 which amplifies and processes this signal so as to supply the output devices. Two inputs in LM358 have been presented as non-inverting (+) and an inverting (-). A 10k variable resistor (VR) connected to the non-inverting input enables sensitivity adjustment by setting the reference voltage. When the voltage from the receiver exceeds the reference voltage set by the VR, the LM358 output switches to a high state. This high output activates the buzzer and LED connected to it, giving audible and visual warnings that an object is nearing the sensor. The stabilizing of the circuit of resistors 100 and 10k ohms is made to

ensure there is a proper flow of current in the IR transmitter and receiver. A resistor of 220 ohm connects the buzzer and LED limiting the current thus not causing damage to it. The circuit design ensures that this system works reliably and efficiently. It can also be sensitive according to need, depending upon environmental conditions or applications.

The simplicity and efficiency of the system make it useful for several practical applications such as automatic doors, security alarms, and touchless locker systems. This can be taken to another level with added features such as microcontrollers, where more advanced functionality can be achieved in the form of user authentication and IoT connectivity for remote monitoring. In this design, basic electronic components have been effectively utilized to form a workable and scalable proximity detection system.

## 2.6 BLOCK DIAGRAM


Figure 2.3 Block Diagram of banking surveillance using IR sensor

### 2.6.1 LM 358 IC

The LM358 is a dual operational amplifier (op-amp) integrated circuit (IC), commonly used in analog signal processing applications. It has two independent, high-gain, internally frequency-compensated op-amps that can operate with a single power supply, making it versatile for low-voltage circuits. The LM358 is widely used for amplifying signals, filtering, and voltage comparison. It has low power consumption, making it suitable for battery-operated systems. The IC features a high input impedance and low output impedance to ensure proper signal processing. Its common applications include amplifiers, filters, voltage followers, and signal conditioning in various electronic circuits.

### 2.6.2 RESISTORS

Resistors are strategically employed in this module to limit the current flow within the circuit. By doing so, they act as a protective barrier, preventing excessive current from flowing during normal operation. This contributes to the overall stability and safety of the system. Without resistors, the other components in the circuit, such as the relay and LEDs, could be subjected to currents higher than they can safely handle, which could lead to component failure.

### 2.6.3 LEDs (Light-Emitting Diodes)

LEDs serve as visual indicators in this module, offering real-time feedback on the status of the circuit. One LED illuminates to signify the normal connection of the power supply, while another activates in the presence of a short circuit. This dual-LED system enhances user awareness, allowing for quick identification of potential issues. LEDs, therefore, play a crucial role in providing user feedback and enhancing the usability of the module.

### 2.6.4 Variable resistor

A variable resistor is another name for a potentiometer or rheostat, which is an electrical component whose resistance can be manually varied. It consists of a resistive material and a wiper that moves along the material to change the resistance between two terminals. In a potentiometer, the third terminal is used to tap the variable resistance value, commonly used in voltage dividers, audio control systems, and signal adjustments. A rheostat, generally, is a two-terminal device that is mainly used to vary current flow in circuits. Variable resistors allow for fine control over electrical parameters, making them flexible in many applications in electronics.

### 2.6.5 Power Supply

The power supply provides the necessary electrical energy to drive the entire circuit. It is a foundational component that ensures the continuous operation of the system. Without a power supply, the circuit would not function, as the components would have no source of energy to draw from. The power supply, therefore, is a critical component of the module.

## 2.7 ADVANTAGES

- **Better Security**

  The system has guaranteed detection against unauthorized access or intruders using IR sensors which continuously watch over areas of special interest within banks and ATMs, thereby significantly enhancing security in general to send an immediate response whenever access is compromised.

- **More Energy Savings**

  Powered by a 9V battery, the system uses low power, and thus can work for extended periods of time. It is cost-effective and ensures long-term usage without frequent battery replacements.

- **Minimal Maintenance**

  The circuit has been built with simple and rugged components that do not require much maintenance. It reduces the maintenance cost and ensures consistent performance for extended periods of time.

- **Fast Response Time**

  The IR sensor and LM358 operational amplifier ensure instant detection and alert activation. The rapid response time of the system helps security personnel to react quickly to potential threats.

## 2.8 APPLICATION

- **Banking System**

  This system is suitable to monitor bank entry points and the teller areas, detect the unauthorized access during off-time. Its fast response triggers immediate alerts, which increases the safety for customers and assets.

- **Vault Security**

  The IR sensor system offers additional security for bank vaults by detecting access and raising alarms during movement. It helps prevent valuable items from being smuggled out and limits illegal access.

- **School File Management Room**

  This surveillance system helps in protecting sensitive documents stored in school file rooms from theft or tampering. The system is compact and can be easily installed without disturbing the workspace.

- **Office Recorder Room**

  This system helps in ensuring that sensitive information or records, stored in office recorder rooms, are safe from access. Unauthorized access to this room triggers immediate alerts for safeguarding confidential company data.

- **Night Time Security**

  This system enhances the night-time surveillance by indicating any movement in the monitored area. Its energy-efficient design ensures constant operation during low-light or unmonitored hours.

# CHAPTER – 3

# WATER LEAKAGE DETECTOR

## 3.1 ABSTRACT

This water leakage detector circuit is simple yet quite effective, electronic design intended for identifying the leakage of water and alerting the users in real-time. Operating with the NE555 timer IC as the core of the circuit's operation, this water sensor includes a transistor switch in the BC547 and integrates a speaker for producing audible alerts each time the water leaks. The 555 timer operates in an astable mode, thus generating an oscillating signal to drive the speaker upon activation by the water sensor. The compact and cost-effective solution is ideal for applications in residential, commercial, and industrial settings, where early detection of water leakage can prevent costly damage, save water, and ensure safety. The integration of basic components ensures that the circuit is easy to construct and maintain; thus, it is suitable both for hobbyists and professional use. The water sensor is the first input device which detects the existence of water by conductivity when water bridges the sensor terminals. It then activates the BC547 transistor which, further activates the 555 timer circuit. The timer generates an audio frequency signal that drives the speaker, producing a sound alert. The circuit's simplicity, reliability, and adaptability make it a versatile solution for water leakage monitoring in various environments. This water leakage detector project is designed to emphasize practicality and ease of use. It caters to the growing need for low-cost yet efficient leakage detection systems. The circuit achieves robust performance with a minimal complexity by including widely available components and using the multifunctional capability of the 555 timer IC. This is a very good design especially when unattended monitoring is called for, such as in rooms storing things, under sinks or near water pipes.

## 3.2 INTRODUCTION

Leakages involving water can be a general cause of considerable property destruction and excessive waste of the precious commodity of water; however, leakage detection within sufficient time is quite challenging and poses additional expenses in repairing the lost quantity. An effective circuit designed for leakages in pipes leading to timely repair in minimizing damages to the costly possessions developed on an effective, affordable basis in less implementing process was much required. The water leakage detector uses simple electronic components such as a 555 timer IC, a BC547 transistor, resistors, capacitors, and a speaker to create an efficient system that alerts the user to the presence of water in unintended areas. The heart of the circuit is the 555 timer IC, one of the most versatile and widely used components in electronic design. Operating in an astable mode, the 555 timer produces a continuous square wave signal when it is triggered. This signal drives a speaker, making an audible alarm. The circuit is designed to activate the timer when the water sensor detects the presence of water. The water sensor itself works based on the conductive nature of water, closing an electrical circuit to allow current flow and detection. The BC547 transistor acts as a switch in this setup, amplifying the weak signal from the water sensor to a level sufficient to activate the 555 timer. This ensures that the circuit is sensitive enough to detect even small amounts of water leakage. The design also integrates a simple resistor-capacitor network to stabilize the 555 timer's operation and hence ensure reliable performance. This project is not only very practical but also educational, providing an excellent introduction to basic electronic principles such as switching, signal generation, and amplification. It demonstrates how simple components can be combined to create a functional and impactful device. This is highly suitable for domestic and commercial and industrial areas and hence gives a scalable solution for monitoring water leakage. It allows users to be involved with a much deeper understanding of the electronics circuits that might have practical applications in solving everyday problems. It, further brings forward a pro action approach toward water conservation and protecting one's properties along the lines of sustainable globalization, with resource optimization.

## 3.3 COMPONENTS USED

- Bread board - 1
- Resistor - 100K ohms, 470 ohms, 1K ohms (2,1,1)
- Integrated Circuit - NE 555 Timer (1)
- Transistor -BC-547 (1)
- Buzzer - 1
- Rain Sensor - 1
- Capacitor - 10uF (1)
- Battery - 9v
- Connecting Wires - As required.

## 3.4 CIRCUIT DIAGRAM

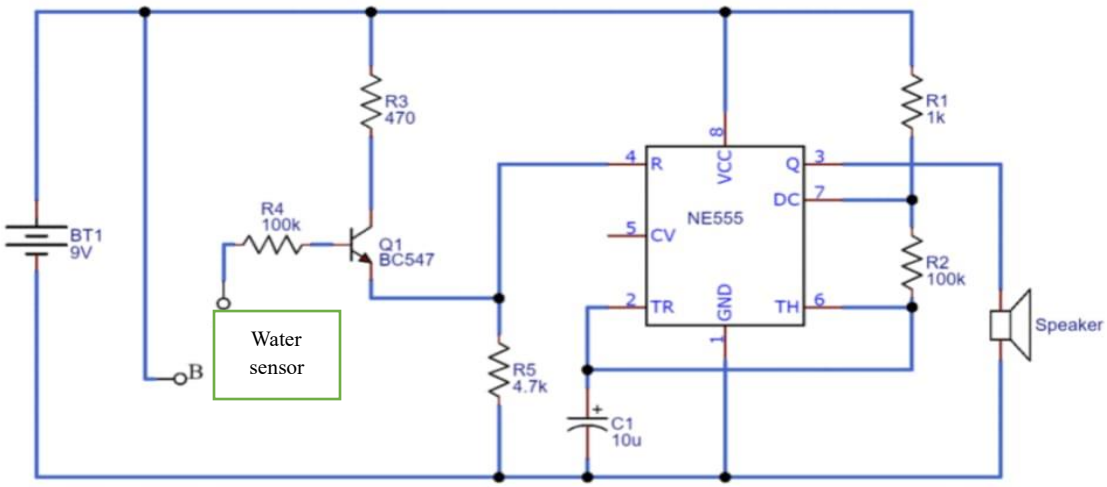


Figure 3.1 Circuit Diagram of water leakage detector

## 3.5 WORKING MODEL

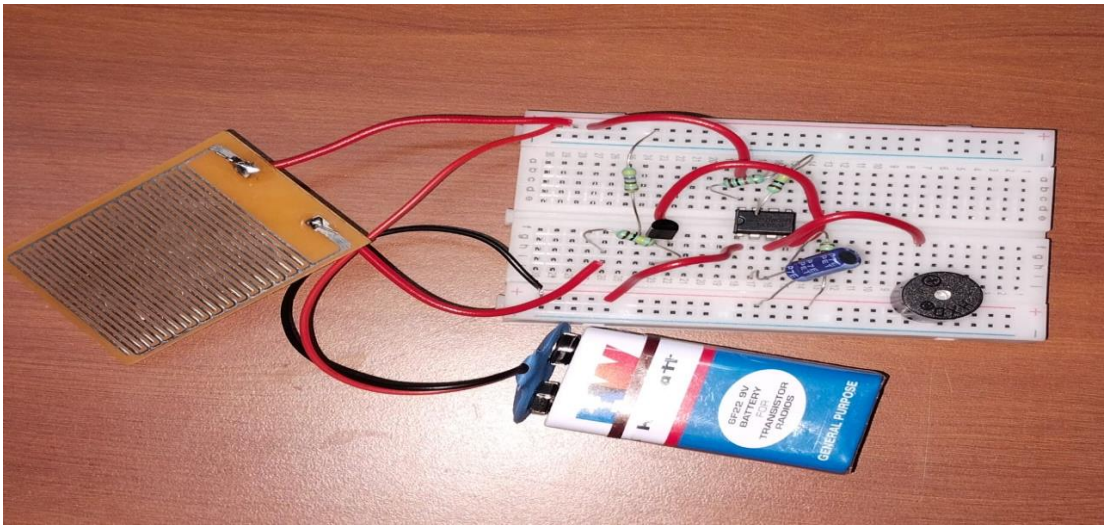


Figure 3.2 Working Model of water leakage detector

By referring to Figure 3.1 (Circuit Diagram), the model was constructed as illustrated in Figure 3.2. The working procedure of the "water leakage detector" It works with the power from a 9V battery. BC547 transistor acts as the control device. Now when any signal is given at the two control points, A and B, then the transistor conducts that lets the NE555 timer circuit work on. If in astable mode, then NE555 timer sends a square wave signal in the circuit. The frequency of this signal is dependent on the values of resistors R2 and R5, and capacitor C1. Charging and discharging through these resistors, it generates a pulse wave at the output pin (pin 3) of the timer IC. This output drives a speaker through resistor R1, and hence there will be an audible sound. The frequency of the square wave is the parameter on which the pitch of the sound is determined. This can be modified by altering the values of R2, R5, or C1. The BC547 transistor inclusion makes it suitable for the application where sound has to be triggered on demand. Electrical pulses produced convert into sound waves when sent through the speaker; therefore, a clear tone is produced. This is a simple but effective circuit demonstrating the principles of timing and oscillation while serving as a

functional sound generator. It can be adapted to any purpose such as alarm or educational demonstrations by altering the component values to achieve different frequencies and tones.

## 3.6 BLOCK DIAGRAM


Figure 3.3 Block Diagram of water leakage detector

### 3.6.1 RAIN SENSOR

It is basically a circuit that can simply detect whether water is present in it or measure its level. It is built up by probes or plates which detect the presence of water; a transistor or an operational amplifier for the signal to be processed and finally by an outputting device such as an LED or buzzer to indicate its detection. This water bridges the conductive probes and completes the circuit, thus sending a signal to the processing unit. This system is applied in applications like water level indicators, flood alarms, and irrigation systems, which ensure efficient water management and timely notifications of water presence.

### 3.6.2 TRANSISTOR

The transistor, often a bipolar junction transistor (BJT), acts as a pivotal switch in the circuit. When the LDR signals a change in light conditions by altering its resistance, the transistor amplifies this signal. It modulates the current flow through the LED, functioning as an electronic switch that can either permit or restrict the flow of current. By acting as an amplifier, the transistor ensures that the LED receives sufficient power to illuminate when activated.

### 3.6.3 IC 555 TIMER

IC 555 timer is one of the most versatile and widely used integrated circuits in electronics. It can work as a timer, oscillator, or even flip-flop in its applications. The IC 555 works in three main modes  monostable or one pulse generation, astable or continuous pulse generation, and bistable or on/off switch. Its internal configuration consists of a comparator, flip-flop, discharge transistor, and a voltage divider. Users may adjust the external resistors and capacitors to determine the timing intervals or oscillation frequency. The IC 555 finds application in pulse generation, PWM control, time delay circuits, and signal modulation. Its reliability and simplicity make it essential for hobbyists and professionals.

### 3.6.4 BUZZER

A buzzer is an electronic device used to create sound signals, widely used in alarms, indicators, and electronic devices. It operates by converting electrical energy into mechanical vibrations through a piezoelectric element or electromagnetic coil. Once the circuit is energized, it produces an audible tone or beep. Buzzers are of two types  active or self-contained with an internal oscillator and passive, requiring an external driving circuit. They are compact, energy-efficient, and versatile and thus suitable for applications like warning systems, timers, and notification devices in industrial and consumer electronics. Their simplicity ensures reliable sound production.

### 3.6.5 POWER SOURCE (9V BATTERY)

The 9V battery functions as the essential power source for the entire circuit. It supplies the required voltage and current to ensure proper functioning of the components. The stability and reliability of the power source are crucial for consistent and predictable circuit

behaviour. The battery's role extends to sustaining the circuit's functionality over time, making it a fundamental element in the overall design.

## 3.7 ADVANTAGES

- **Early Detection of Water Leaks**

  The circuit senses water leakage immediately when it happens and allows users to respond promptly with corrective measures. This minimizes unnecessary exposure to leaks that can eventually cause major damage.

- **Prevents Water Wastage and Damage**

  This system quickly detects leaks, hence reducing wastage of water and potential damage to walls, floors, and equipment through water exposure.

- **Cost-Effective and Energy-Efficient**

  It is an affordable circuit made by easily accessible components and requires much less power while operating. Thus it becomes a long-term viable method.

- **Automation Saves Manual Checkups**

  The circuit autonomously functions without requiring regular visual checkup. This reduces lots of time and efforts more specifically where the area is too hard to reach or carries higher risk factors.

- **Help to Decrease Maintenance Costs**

  Early detection minimizes severe water damage, thus minimizing costly repair and restoration costs. It also prolongs the life of plumbing systems and all related infrastructure.

## 3.8 APPLICATION

- **Residential Water Leak Detection**

  The system can be installed in sinks, near washing machines, or in basements for leak detection in homes. It helps homeowners prevent water damage, thus saving on utility bills by attending to leaks promptly.

- **Commercial Building Water Management**

  This circuit is suitable for detecting water leakage in offices, hotels, and shopping complexes. It is used to ensure timely maintenance before costly damage to infrastructure and equipment.

- **Industrial Water Pipeline Leakage Monitoring**

  It can be applied to monitor leaks in complex industrial pipelines, ensuring smooth running. Early detection helps avoid production downtime and costly repairs.

- **Water Tank Leakage Detection**

  By positioning the sensor near water tanks, it can immediately detect any leaks or overflows. It avoids unnecessary use of water and damage caused to the structure due to a leakage.

- **Smart Home Water Conservation Systems**

  This circuit can be integrated into smart home systems for automated monitoring and control of water. It aids in sustainable living through efficient utilization of water as well as increased safety.

# CHAPTER - 4
# CONCLUSION

The IR sensor-based banking surveillance system and water leakage detector demonstrate how simple yet effective technologies can improve safety, security, and convenience in everyday life. The banking surveillance system uses infrared sensors to provide safe and reliable access, providing an extra layer of protection in sensitive areas. This innovative locker system is a great example of how basic electronics can be combined with programming to create practical, user-friendly solutions to real-world problems. Water leakage detectors offer a similar method to combat one of the most critical issues in property maintenance. The early alerts to water leaks result in saving from potentially costly repairs, structural damages, and potential health risks from mold development. These two systems indicate the pioneering possibilities of sensor technologies that integrate low costs and easy implementation with functionality. They pave the way for smarter, safer, and more resilient environments, demonstrating how accessible innovations can create meaningful impact.

An essential innovation in property maintenance is a water leakage detector, aimed to deliver prompt leaks and allow for fast action, which would have prevented more expensive repairs and avoided possible damages. Through the early correction of problems regarding water, this can significantly lower the risks that could compromise structural integrity, water losses, and health dangers such as bold growths, contaminating indoor air and negatively affecting the quality of health inside. This device is an example of sensor technology being integrated into realistic, practical, user-friendly applications that are reliable for any kind of user. They are affordable and simple tools for homeowners, businesses, and facility managers. Beyond that, it helps in sustainable activities by saving water and keeping waste at bay. By enhancing safety, efficiency, and resilience in living and working environments, the water leakage detector indicates how accessible technology can build smart, secure, and environmentally responsible spaces.

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