POWER PROTECTION SYSTEM FOR HOUSE HOLD APPLICATIONS

LONG RANGE OBSTACLE DETECTOR FOR HANDICAPPED

A PROJECT REPORT

Submitted by

HARITHA DIVYASRI K S

SUDHARSANA R

THARSHITHA S S

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SAMAYAPURAM - 621 112

BONAFIDE CERTIFICATE

Certified that this project report titled **"POWER PROTECTION SYSTEM FOR HOUSEHOLD APPLICATION"**, **"LONG RANGE OBSTACLE DETECTOR FOR HANDICAPPED"** is the bonafide work of **HARITHA DIVYASRI K S (811722106031), SUDHARSANA R (811722106113), THARSHITHA S S (811722106120)** 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	**SIGNATURE**
Dr. S. SYEDAKBAR, M.E., Ph.D.,	Mr.A.PARTHIBARAJ,M.E.,(Ph.D)
HEAD OF THE DEPARTMENT	**SUPERVISOR**
Assistant Professor	Assistant Professor
Department of Electronics and Communication Engineering	Department of Electronics and Communication Engineering
K Ramakrishnan College of Technology (Autonomous)	K Ramakrishnan College of Technology (Autonomous)
Samayapuram – 621 112	Samayapuram – 621 112

Submitted for the viva-voce examination held on ………………

INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

We jointly declare that the project report on **"POWER PROTECTION SYSTEM FOR HOUSEHOLD APPLICATION", "LONG RANGE OBSTACLE DETECTOR FOR HANDICAPPED**" 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

HARITHADIVYASRI K S

SUDHARSANA R

THARSHITHA S S

Place: Samayapuram

Date:

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LIST OF FIGURES

LIST OF ABBREVATIONS

LED	Light Emitting Diode
DC	Direct Current
IR	Infrared
BJT	Bipolar Junction Transistor
NPN	Negative - Positive - Negative(BJT)
PNP	Positive - Negative - Positive(BJT)
FET	Field Effect Transistor
MOSFET	Metal – Oxide – Semiconductor Field Effect Transistor

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.

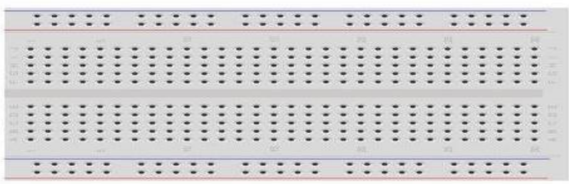

Figure :1.1 Bread board

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. Connecting wires play a crucial role in establishing electrical connections between various components on the breadboard. These are shown in fig. 1.

1.2 DIODE:

A diode, a fundamental semiconductor device with two terminals known as the anode and cathode, plays a pivotal role in electronic circuits due to its unique electrical properties. The primary function of a diode is to control the flow of electric current by allowing it in one direction while blocking it in the opposite direction. This property is vital in rectification processes, especially in power supply circuits, where diodes are instrumental in converting alternating current (AC) to direct current (DC). The behaviour of a diode is characterized by its voltage-current relationship, described by the Shockley diode equation, which exhibits an exponential relationship between the voltage across the diode and the current flowing through it. When the diode is forward-biased, meaning a positive voltage is applied to the anode with respect to the cathode, it conducts current, allowing the flow of electrons. In contrast, when the diode is reverse-biased (negative voltage applied to the anode), it blocks current, essentially acting as a one-way valve for electric current are represented in figure 1.2.

Figure: 1.2 Diode

1.3 LED:

Light Emitting Diodes (LEDs) represent a ground breaking technology with wide-ranging applications across diverse industries. Functioning on the principle of electroluminescence, LEDs(as shown in figure 1.3) 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:1.3 LED

1.4 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(figure 1.4) , 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. Nickelcadmium 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:1.4 Battery

1.5 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. Resistors are shown in figure 1.5.

Figure:1.5 Resistor

1.6 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(figure 1.6) 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.

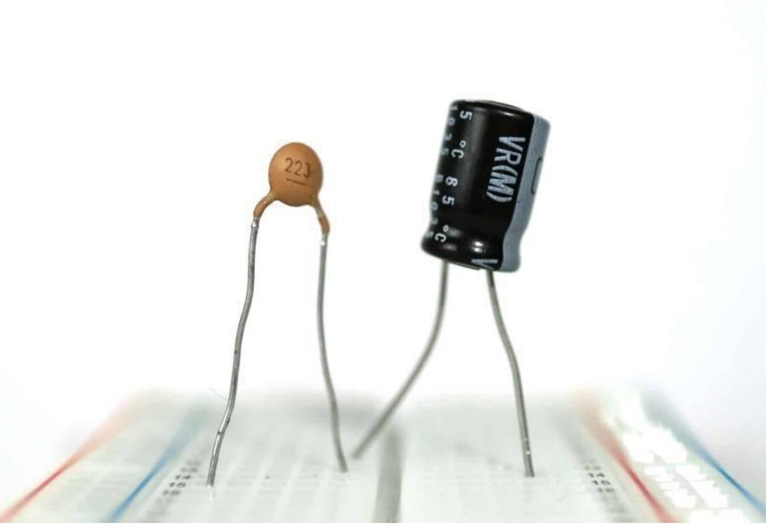

Figure:1.6 Capacitor

1.7 IR RECEIVER :

An IR (Infrared) Receiver is an electronic component designed to detect and receive infrared light signals, typically emitted by an IR LED (Light Emitting Diode) or IR transmitter. These signals are often used in communication systems, such as remote controls, sensing devices, and security systems. The IR receiver converts the modulated IR signal into a form that can be processed by electronic circuits (usually into an electrical signal that represents the data)

Figure:1.7 IR Receiver

IR detection is used in IR sensors, proximity sensors, and remote-control receivers. Object detection and motion sensing in phototransistor-based IR detectors are often used to detect the presence of objects (as in robotic navigation) or in security systems. Remote control systems, the emitter can be used in devices like TV remote controls, where it emits infrared light, and the phototransistor receives it on the target device (e.g., TV or air conditioner).

1.8 IR TRANSMITTER:

Figure: 1.8 IR Transmitter

An IR Transistor is a type of transistor used specifically in IR communication or detection applications. These transistors are typically designed to detect infrared light, or in some cases, to emit infrared light (though emitting infrared light is more commonly associated with IR LEDs).IR detection are used in IR sensors, proximity sensors, and remote control receivers. Object detection and motion sensing are phototransistor-based IR detectors are often used to detect the presence of objects (as in robotic navigation) or in security systems. Remote control systems, the emitter can be used in devices like TV remote controls, where it emits infrared light, and the phototransistor receives it on the target device (e.g., TV or air conditioner).

1.9 BUZZER

Figure: 1.9 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.

1.10 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.

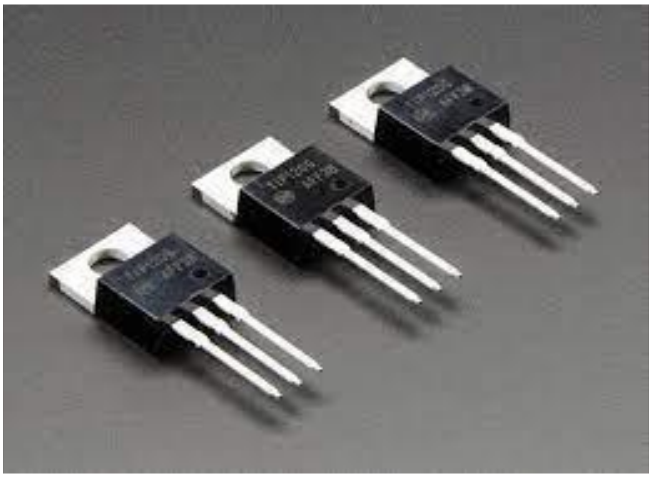

Figure:1.10 Transistor

1.11 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 aluminum, 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.

Figure:1.11 Connecting wires

Different lengths accommodate diverse circuit layouts, while distinct colors 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.

1.12 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 :1.12 Variable Resistor

In electronic designs, variable resistors contribute to the adaptability and functionality of systems.

CHAPTER-2 POWER PROTECTION SYSTEM FOR HOUSEHOLD APPLICATION

2.1 ABSTRACT:

The Power Protection System for Household Applications aims to protect household electrical appliances from voltage fluctuations by employing a simple yet effective circuit design. Voltage instability can lead to inefficiencies, damage to sensitive devices, or safety hazards in residential environments. This project demonstrates a compact protection system using a Zener diode for voltage regulation and a 2N2222 NPN transistor for load control.

The Zener diode's role in this system is crucial, as it ensures a stable output voltage of 9.1V regardless of fluctuations in the input supply. The transistor acts as an amplifier or switch to control current flow through the load. An LED indicator adds a visual layer of feedback, helping users monitor the circuit's operational status in real time. This power protection circuit is suitable for low-power devices in homes, such as routers, small appliances, and lighting systems.

This system's simplicity makes it ideal for educational purposes, where students can learn fundamental concepts like voltage regulation, current amplification, and practical circuit design. It is also highly practical in reallife situations, offering a low-cost, reliable solution to protect essential household appliances, particularly in areas prone to voltage surges or brownouts. Its scalability makes it a candidate for adaptation to higher power systems by incorporating larger transistors or alternative components.

2.2 INTRODUCTION:

In today’s world, the reliability of household electrical systems is vital due to the increasing dependence on electronic devices. Voltage fluctuations—caused by issues such as power surges, brownouts, or poor grid infrastructure—can result in irreversible damage to sensitive appliances like televisions, computers, and kitchen devices. The Power Protection System for Household Applications addresses these challenges by regulating voltage and providing protection.

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The inclusion of passive components, such as resistors, ensures current control and protection for both the LED and transistor. This project underscores the importance of voltage regulation in household environments and demonstrates how even a basic circuit can provide effective protection

2.3 COMPONENTS USED:

COMPONENTS	RANGE
Resistor	1k
Transistor	2N2222
Zener diode	9.1V
LED	1
Power supply	9V,9V
Connecting wires	As required
Bread board	1

2.4 CIRCUIT DIAGRAM:

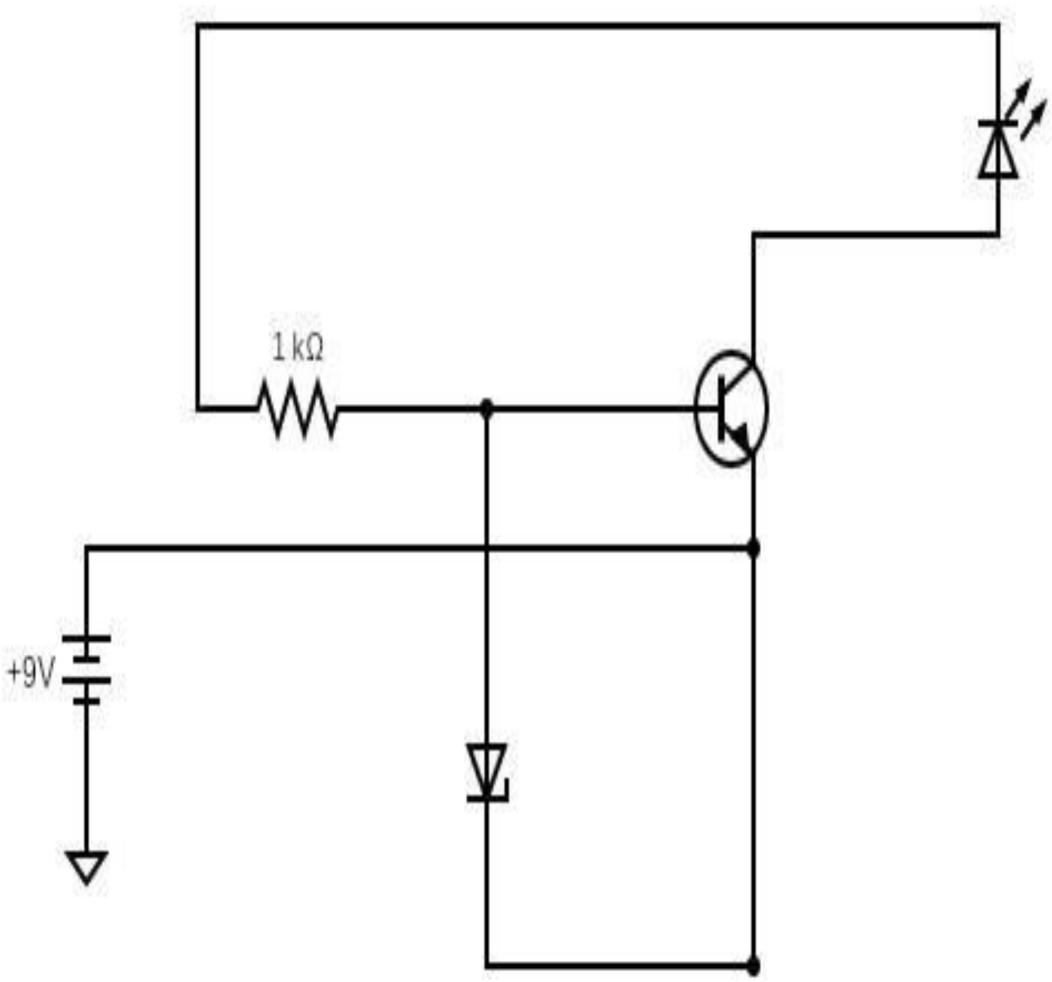


Figure: 2.4 Circuit Diagram of Power protection system for household protection

2.5 WORKING MODEL:

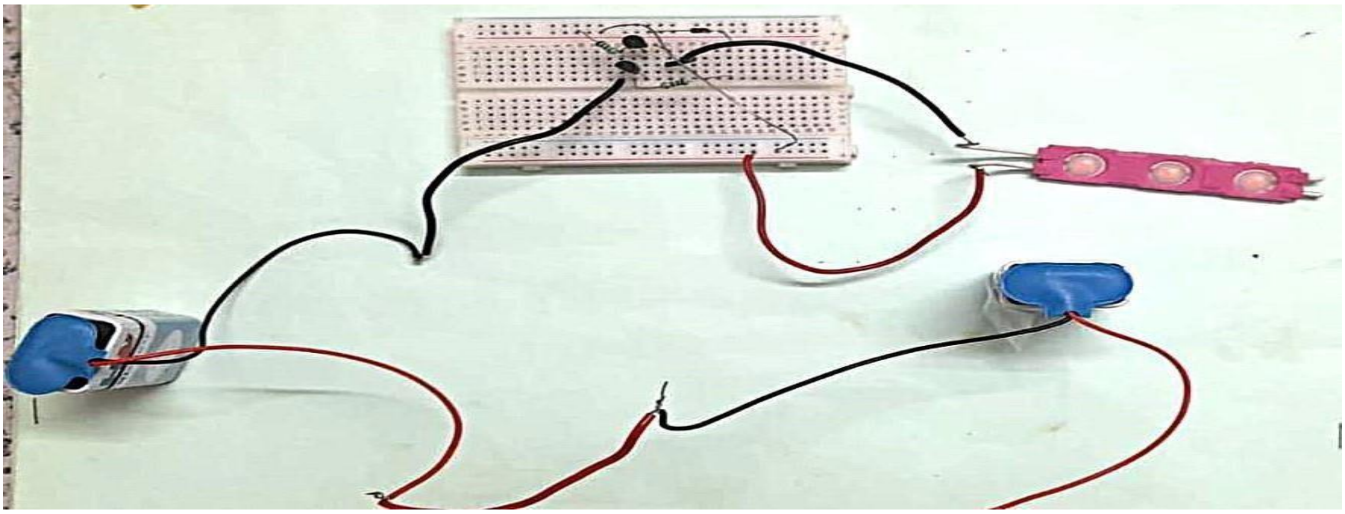


Figure:2.5 Working Model

The operation of the Power Protection System for Household Applications revolves around the collaborative functioning of the Zener diode, NPN transistor, resistors, and LED. This section provides a detailed explanation of each component's role and the overall working principle. The circuit is powered by a 9V DC source, which may experience fluctuations. The Zener diode, connected in reverse bias mode, plays a crucial role in stabilizing the voltage. When the input voltage exceeds the Zener breakdown voltage of 9.1V, the diode maintains this voltage level across its terminals. This property ensures that any connected appliance receives a steady voltage, protecting it from surges. A resistor is placed in series with the Zener diode to limit the current flowing through it. This prevents overheating or damage to the diode during high input voltages. The same resistor is connected to the base of the 2N2222 transistor, limiting the base current to ensure safe operation of the transistor. The 2N2222 transistor functions as a switch or current amplifier. When the Zener diode stabilizes the voltage, the base of the transistor receives sufficient current to turn it on. This allows the transistor to conduct between its collector and emitter, powering the connected load. An LED is connected to the collector of the transistor with a current-limiting resistor.

When the transistor conducts, the LED lights up, indicating that the system is operating normally. If the input voltage drops below the Zener breakdown voltage, the transistor stops conducting, turning off the LED and disconnecting the load. This acts as a safeguard against undervoltage conditions. The circuit design includes inherent protections, such as current-limiting resistors and the transistor’s cut off characteristics. These ensure that neither the components nor the connected load are subjected to harmful conditions.

2.6 BLOCK DIAGRAM:

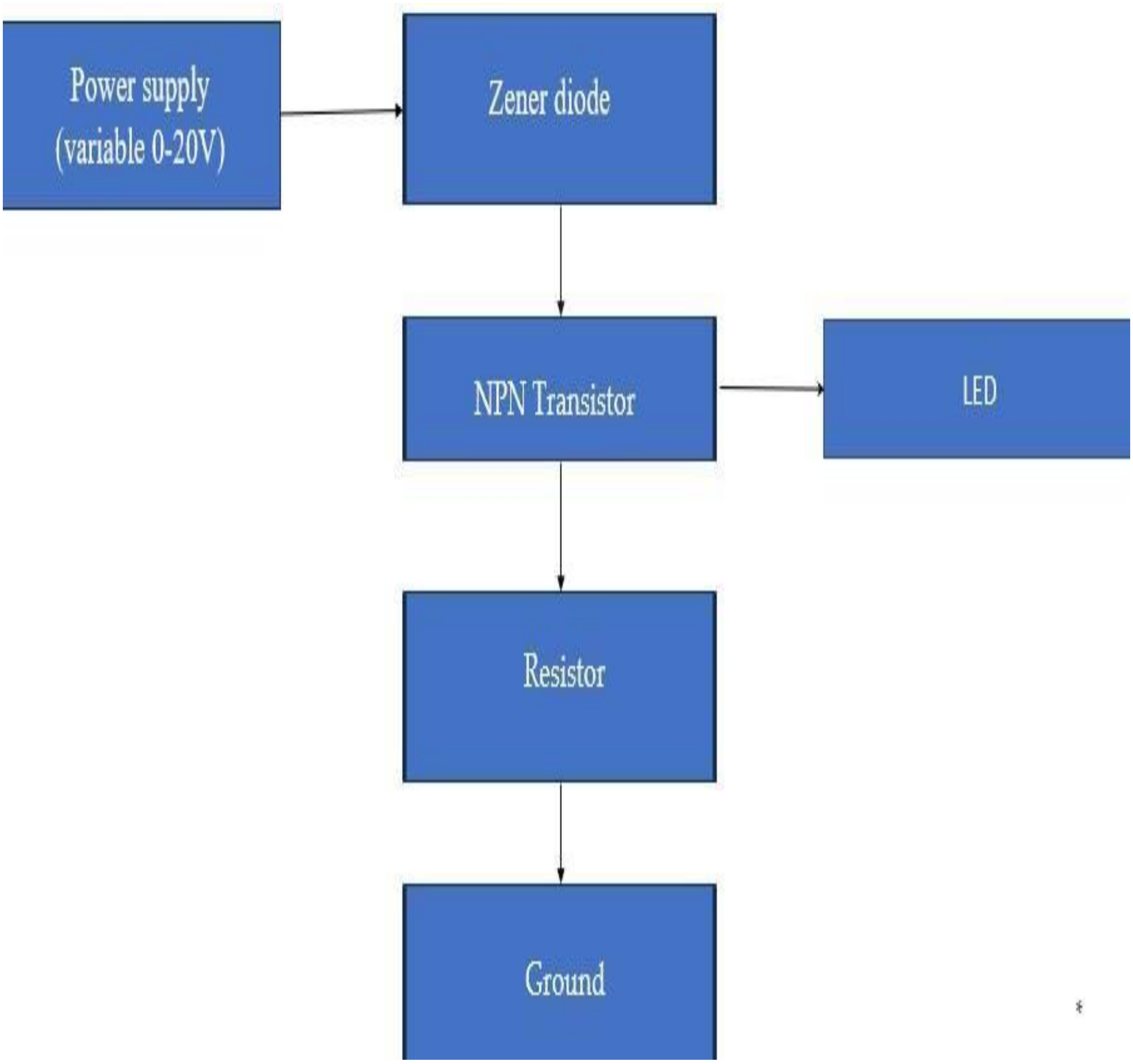


Figure:2.6 Block Diagram

2.7 ADVANTAGES:

- **Cost Effective**: Provides an affordable solution for protection without compromising on quality.
- **Simple Design**: Easy to integrate and maintain, reducing complexity in design and installation.
- **Reliable Protection**: Ensures consistent and dependable safety by preventing damage due to overcurrent situations.
- **Adjustable**: Allows for customization of protection settings to suit specific application needs.

2.8 APPLICATION:

- **Home Appliances**: Used in household electrical devices to prevent overcurrent and damage to sensitive components.
- **Power Distribution Units (PDUs)**: Ensures safe power distribution in data centers or server rooms by protecting against overcurrent.
- **Automotive Electronics**: Protects circuits in vehicles from excessive current, safeguarding components like ECUs, sensors, and wiring.
- **Battery-Powered Devices**: Provides overcurrent protection to batterypowered devices, extending their life and preventing failure.
- **Industrial Equipment**: Used in heavy-duty machinery and equipment to ensure safe operation and prevent damage from power surges or overloads.

CHAPTER – 3

LONG RANGE OBSTACLE DETECTOR FOR HANDICAPPED

3.1 ABSTRACT:

The Long-Range Obstacle Detector is a cost-effective and efficient system designed to detect obstacles over extended distances using infrared (IR) technology. The system utilizes an IR transmitter, an IR receiver, a BC547 transistor, and supporting passive components to identify objects in its path. When an obstacle is detected, the circuit activates a buzzer and an LED indicator, providing both auditory and visual feedback. This project can be applied to multiple fields, including robotics, vehicle navigation systems, and automated safety features.

The core of the system is the IR transmitter and receiver pair. The transmitter emits IR radiation continuously, which reflects back to the receiver when an obstacle enters its range. The signal received by the IR receiver is processed using a BC547 transistor, which acts as a switch to activate the alert mechanisms. This design ensures a quick response and reliable operation.

3.2 INTRODUCTION:

Obstacle detection is a critical feature in various modern technologies, such as autonomous vehicles, robotic systems, and automated security systems. The Long-Range Obstacle Detector addresses the need for a reliable and affordable solution for detecting objects or obstacles in a given range. This project utilizes the principles of infrared light reflection and electronic switching to achieve this goal.

The system's primary components include an IR transmitter and receiver, which form the detection mechanism. The IR transmitter emits infrared rays in a straight path, and when these rays encounter an obstacle, they are reflected back to the IR receiver. The receiver converts this reflected signal into an electrical signal, which is then processed by the circuit to trigger an output. The BC547 transistor plays a crucial role as an amplifier or switch, ensuring that the detected signal is sufficient to activate the output devices.

This project finds applications in areas like obstacle-avoiding robots, parking assistance systems, and automatic doors. It also serves as a foundation for developing more complex systems, such as LiDAR-based sensors or ultrasonic distance measurement devices. The compact design and low power consumption of this system make it ideal for use in battery-operated devices.

Additionally, the project introduces learners to essential electronics concepts, such as photodiode operation, transistor switching, and the behaviour of resistors in current control. The circuit's modular nature allows for easy customization, making it a versatile solution for both educational and practical applications.

3.3 COMPONENTS USED:

COMPONENTS	RANGE/QUANTITY
Resistor	100 ohm,47k ohm,200k ohm
IR Transistor	1
IR Receiver	1
Transistor	BC547
Battery	5V
LED	1
Buzzer	1

3.4 CIRCUIT DIAGRAM:

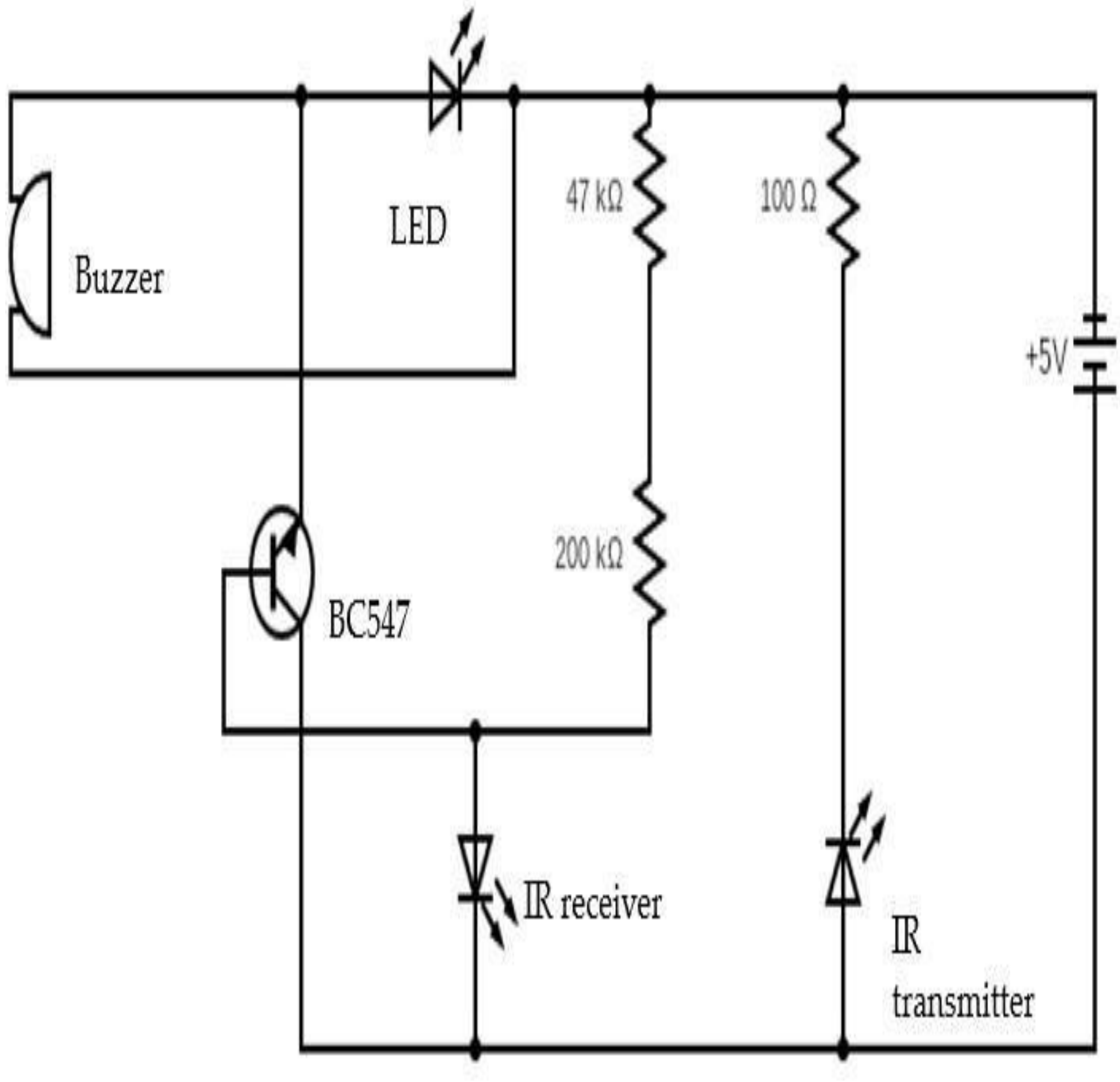


Figure:3.4 Circuit Diagram

3.5 WORKING MODEL:

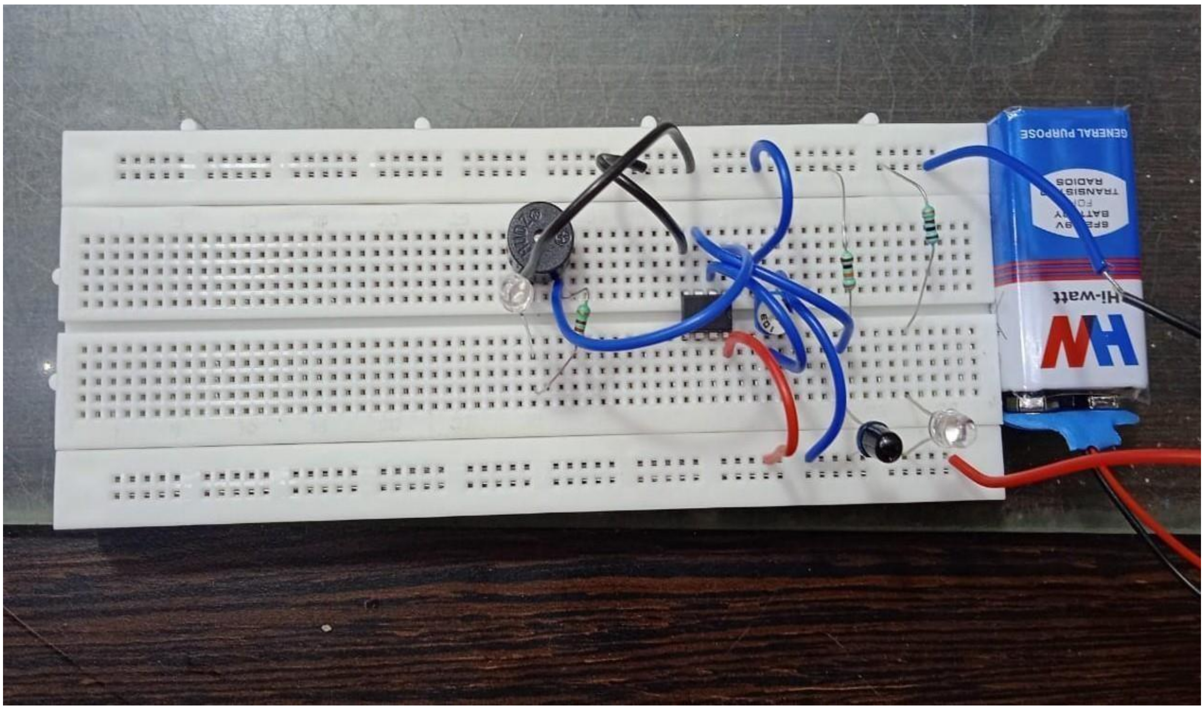


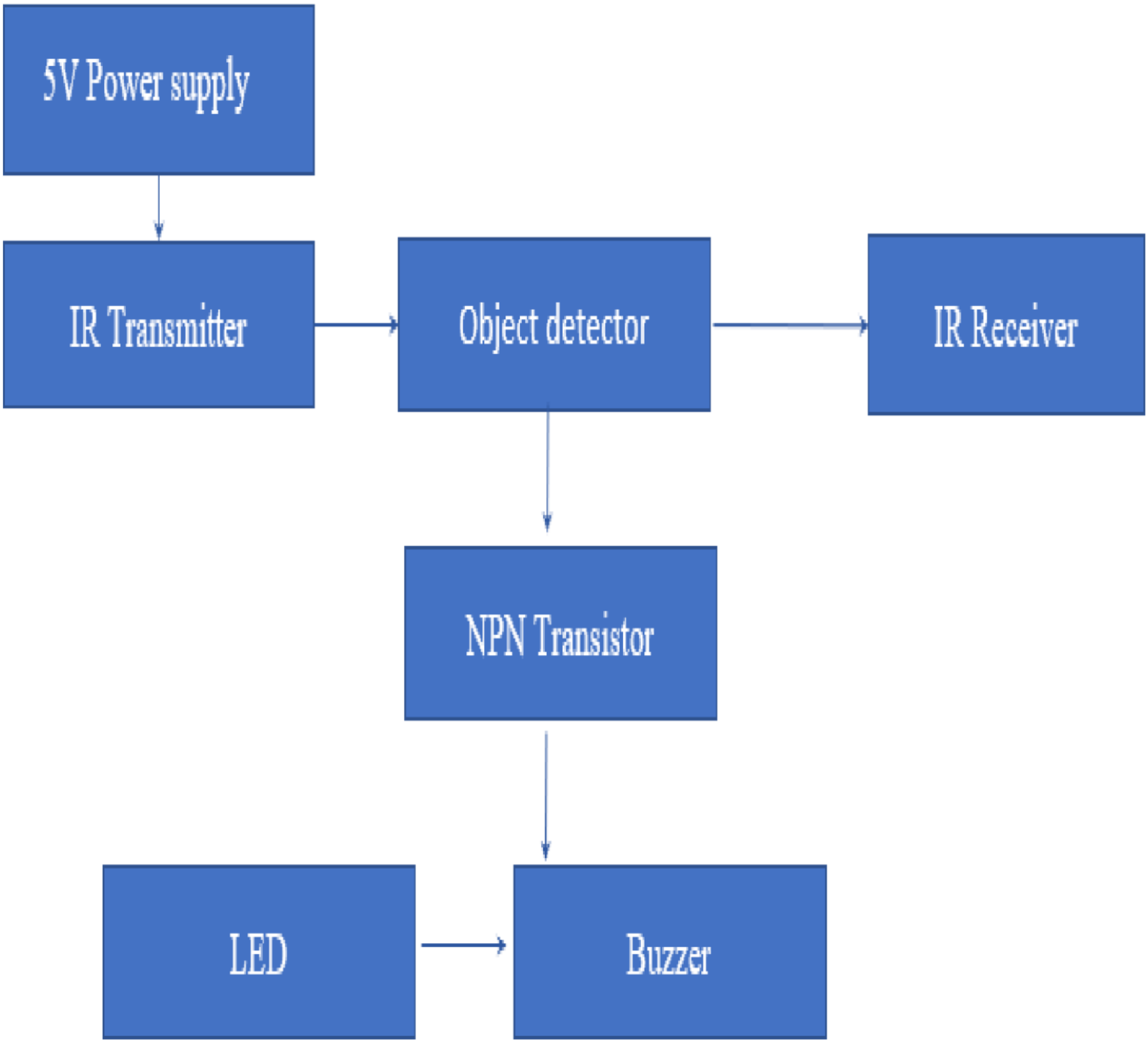
Figure:3.5 Working Model

The IR transmitter consists of an IR LED that continuously emits infrared radiation. These rays are invisible to the human eye but are effective for detecting objects. The IR receiver is a photodiode that detects the infrared rays reflected back when an obstacle enters the detection range. This reflection is stronger if the object is closer or highly reflective. When the IR receiver detects reflected rays, it generates a small electrical signal. This signal is weak and cannot directly drive output devices like a buzzer or LED. To amplify the signal, the BC547 NPN transistor is used. The base of the transistor is connected to the IR receiver through a resistor. This resistor limits the current to the base, ensuring safe operation of the transistor. Once the signal from the

IR receiver is strong enough, it triggers the transistor to turn on. This allows current to flow from the collector to the emitter, activating the connected buzzer and LED. The buzzer emits a sound to alert the user, while the LED provides a visual indication of obstacle detection. Resistors are strategically placed in the circuit to control the current flowing through the IR LED, IR receiver, and the transistor. This prevents damage to the components and ensures stable operation. The circuit operates on a 5V DC power source, making it compatible with standard USB power supplies or batteries. This low voltage requirement enhances the system's p0ortability and energy efficiency. The range of obstacle detection can be adjusted by varying the sensitivity of the IR receiver or the intensity of the IR transmitter. This is typically achieved by changing the resistance values or using a potentiometer.

3.6 BLOCK DIAGRAM:

Figure:3.6 Block Diagram



3.7 ADVANTAGES:

- **Ease of Integration**: Can be easily integrated into existing systems and devices, reducing the time and cost of deployment.
- **Enhanced Safety**: Contributes to safer operation by preventing accidents, errors, or system malfunctions through reliable functionality.
- **Improved Navigation**: Provides better accuracy and control, ensuring smoother operation, particularly in dynamic environments.
- **Cost-Effective**: Offers a budget-friendly solution while maintaining high performance and reliability.
- **Low Power Consumption**: Operates efficiently with minimal energy usage, extending battery life and reducing operating costs.

3.8 APPLICATION:

- **Autonomous Vehicles**: Enhances vehicle navigation, object detection, and decision-making for self-driving cars, improving both safety and efficiency.
- **Drones**: Facilitates precise control and navigation in drones, contributing to better flight stability and mission execution.
- **Industrial Automation**: Used in automated manufacturing processes to improve the reliability, precision, and safety of machines and robots.
- **Security Systems**: Provides enhanced situational awareness in surveillance systems, aiding in the detection and monitoring of security threats.

CHAPTER 4

CONCLUSION:

The Power Protection System achieves its goal of safeguarding household electrical appliances from voltage fluctuations and power surges. By utilizing a Zener diode for voltage regulation, a transistor switch (2N2222), and an LED indicator, the system effectively demonstrates how cost-effective components can enhance appliance safety. This project emphasizes reliability, simplicity, and the critical role of protective circuits in modern electrical systems.

While the system is highly efficient for its intended purpose, its functionality can be expanded by incorporating features like automatic cutoff for overvoltage or undervoltage conditions, a microcontroller for realtime monitoring, or IoT capabilities for remote operation.

The Long-Range Obstacle Detector, on the other hand, demonstrates the application of infrared technology for real-time object detection. With an IR transmitter and receiver, a BC547 transistor for signal amplification, and alert mechanisms like a buzzer and LED, the project provides a foundation for understanding proximity sensing. Its design is robust, portable, and energy-efficient, making it ideal for integration into robotics, navigation systems, and security applications.

Future enhancements can include replacing the IR system with ultrasonic sensors for better accuracy or integrating with a microcontroller for intelligent distance measurement and obstacle avoidance algorithms.

CHAPTER 5

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