DEPARTMENT OF COMPUTER ENGINEERING
BAHAUDDIN ZAKARIYA UNIVERSITY, MULTAN

LAB PROJECT PROPOSAL

COURSE NAME:	Applied Physics
COURSE CODE:	NAS-114P
COURSE INSTRUCTOR:	Dr. Mudassir Khalil
PROJECT ADVISOR:	Engr. Tooba Rani
SESSION:	2025-2029
SEMESTER:	Semester-1

PRESENTED BY:

Ghania Khawaja	2025-CPE-31
Madiha Liaquat	2025-CPE-33
Ali Hamza	2025-CPE-11
Samiullah	2025-CPE-37
Nizalia Areen	2025-CPE-24

FireSense Unit

Autonomous Fire-Fighting Robot

Introduction:

Fire hazards pose a significant threat to life, property, and infrastructure, especially in environments where human response time is critical. Traditional fire-fighting methods often rely on manual intervention, which can be delayed or dangerous in high-risk zones. To address this challenge, FireSense Unit is designed as an autonomous fire-fighting robot capable of detecting and suppressing fires in their early stages. Unlike conventional systems that depend heavily on microcontroller-based programming (e.g., Arduino), this project emphasizes a mechanical and sensor-driven approach , ensuring reliability, simplicity, and cost-effectiveness. Designed for safety, efficiency, and operational reliability, the robot minimizes human exposure to hazardous environments and makes it suitable for educational use, laboratory testing, and small-scale real-world applications.

Objective:

- Detect fire using basic flame sensors.
- Move toward the fire source autonomously.
- Deploy extinguishing agents (e.g., water or fire retardant) effectively.
- Minimize human risk in hazardous fire-prone zones.
- Support emergency response in labs, homes, and industrial settings.

Theory:

The FireSense Unit operates through a coordinated system of mechanical components and sensors designed to detect, approach, and suppress fire outbreaks autonomously. Unlike microcontroller-based robots, this unit relies on direct sensor integration and mechanical logic to perform its tasks, ensuring simplicity and robustness.

- **Photodiode (IR Receiver):**

- **Function:** Detects infrared radiation emitted by flames, serving as the primary fire sensor.
- **Theory:** Operates on the photoelectric effect, generating current when exposed to IR light, allowing accurate fire localization.

- **BC547 Transistor:**

- **Function:** Acts as a switch and signal amplifier, controlling current flow to motors, LEDs, or relays.
- **Theory:** A bipolar junction transistor (BJT) amplifies or switches low-current signals to control higher-current devices.

- **Resistors:**

- **Function:** Limit current and protect sensitive components like LEDs and transistors.
- **Theory:** Follow Ohm's Law (V = IR) to regulate voltage and current, ensuring circuit stability.

- **LED:**

- **Function:** Provides visual feedback for system power status or fire detection.
- **Theory:** Converts electrical energy into light through electroluminescence, offering simple indication.

- **1N4007 Diode:**

- **Function:** Protects circuits from reverse voltage and prevents component damage.
- **Theory:** Allows current to flow in one direction, functioning as a rectifier and protective element.

- **5 V Relay:**

- **Function:** Electrically isolates the low-power control circuit from motors or the extinguishing mechanism.
- **Theory:** An electromagnetic switch that opens or closes circuits when energized, enabling safe operation of high-current devices.

- **3.7 V Li-ion Batteries (×2):**

- **Function:** Provide portable, rechargeable power to sensors and motors.
- **Theory:** Store energy chemically and release it as electrical energy, offering high energy density and efficiency.

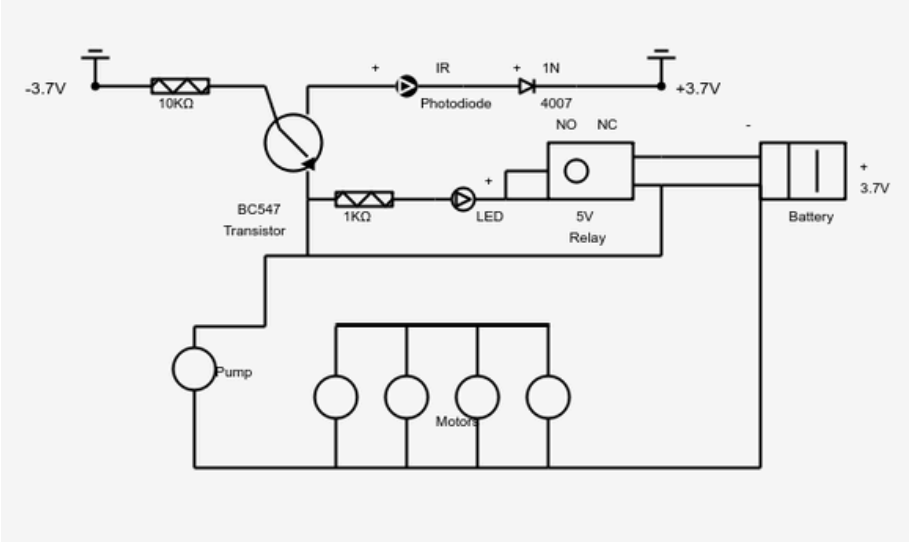
- **Gear Motors (×4):**

- **Function:** Drive the robot's wheels for movement and navigation.
- **Theory:** Convert electrical energy into rotational mechanical motion; gears provide torque and speed control for smooth mobility.

- **Switch:**

- **Function:** Manually powers the robot ON or OFF.
- **Theory:** Opens or closes the electrical circuit, controlling the flow of current safely.

Circuit Diagram:



Equipment's List:

- IR Flame Sensor
- BC547 Transistors
- Resistors
- LED's
- Diodes
- Relay Module
- Li-ion Batteries
- Gear Motors
- Mini Water Pump
- Water Pipe + Tank
- Connecting Wires / Jumpers
- Breadboard
- Mounting Screws & Tools

Project Plan:

Work Plan	Weeks
Searching and submission of proposal	1st week(18 November - 25 November)
Buying Equipment	2nd week(26 December - 2 December)
Stimulation & Completion of Project	3rd week(3 December - 9 December)
Submission of Project	5th week(17 December - 23 December)

Applications:

- In **industrial zones**, automated fire units suppress blazes in chemical plants and refineries without risking human lives.
- In **smart buildings**, intelligent systems provide autonomous fire detection and rapid response in residential and commercial spaces.
- In **emergency rescue**, mobile fire-fighting machines assist crews by locating and extinguishing flames in confined or smoke-filled areas.
- In **wildfire control**, ground vehicles and aerial platforms detect and contain forest fires in remote terrain.
- In **transport safety**, automated extinguishers prevent and suppress vehicle fires in tunnels, parking lots, and transit hubs.
- In **defense and labs**, specialized fire-control devices operate safely in explosive or research environments to mitigate hazards.

References:

- https://github.com/aryan-kundu/AutoSensingFireExtinguisher
- https://www.youtube.com/watch?v=CfzwXfDvARA
- https://www.youtube.com/watch?v=2TKjNfS6QwE
- https://www.linkedin.com/posts/sri-krishna-teja-nagam-ba5303286_automatic-fire-extinguisher-system-without-activity-7395347318058917888-NsaZ