

A Summer Internship report on

Robotics

Submitted in partial fulfillment on

Diploma in Electronic Engineering



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Government Polytechnic Saharsa

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CERTIFICATE

I, Ankit Kumar Singh, hereby certify that the Summer Internship entitled "**Robotics**" which is being presented in the Diploma, submitted to the Department of Electronics Engineering of Government Polytechnic Saharsa, Saharsa, in partial fulfillment of the Diploma in Electronics Engineering, is an authentic record of my project carried out during the course under the guidance of **Dharmendra Sir**, Electronics Engineering Department, Government Polytechnic Saharsa.

Ankit Kumar Singh
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This is to certify that the above statement made by the student is correct to the best of my knowledge.

Government polytechnic Saharsa

PROF. **Dharmendra SIR**

Date:

Electronics Engineering Department

DECLARATION

I, **Ankit Kumar Singh**, hereby declare that this **Summer** Internship report, entitled "**Robotics**", is being submitted to the Department of Electronics Engineering in the Government Polytechnic Saharsa in partial fulfilment of the Diploma in Electronic Engineering and is the result of that project carried out by me under the guidance of **Dharmendra Sir**.

I further declare that to my knowledge, the structure and content of this report are original and have not been submitted for any purpose.

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Robotics:-

Introduction

- Robotics is an interdisciplinary field that combines **mechanical engineering**, **electronics**, **computer science**, and **artificial intelligence** to design, build, and operate robots. A robot is a programmable machine capable of performing tasks automatically or semi-autonomously, ranging from simple repetitive actions to highly complex operations that mimic human behavior.
- In today's world, robotics plays a vital role across various industries such as **manufacturing**, **healthcare**, **agriculture**, **defense**, **space exploration**, and **household automation**. With advancements in sensors, microcontrollers, and AI, modern robots are becoming more intelligent, efficient, and capable of interacting safely with humans.
- A robotics summer internship provides students with hands-on exposure to essential concepts like **robot design**, **embedded systems**, **motor control**, **coding (Arduino/Python)**, **sensor integration**, and **automation systems**. It helps develop practical engineering skills while encouraging innovation and problem-solving.
- Overall, robotics is shaping the future by transforming how machines assist humans, making processes faster, safer, and more precise.

Objective

The main objective of the robotics summer internship is to provide students with practical knowledge and hands-on experience in the design, development, and programming of robotic systems. The internship aims to help participants understand the fundamentals of robotics, including sensor integration, motor control, embedded systems, and automation techniques. Through real-world projects and guided training, students develop problem-solving skills, technical competency, teamwork, and creativity. Overall, the objective is to prepare learners for future careers in robotics, AI, and related engineering fields by strengthening both theoretical understanding and practical application.

Existing System

In the existing system, most tasks in robotics-related fields are performed manually or with limited automation. Traditional machines used in industries work on predefined mechanical operations and lack intelligent decision-making capabilities. These systems rely heavily on human supervision for controlling movement, monitoring performance, and responding to environmental changes.

Because of this, the existing process often becomes time-consuming, less accurate, and prone to human errors.

Furthermore, older automation systems do not have advanced sensors, microcontrollers, or artificial intelligence algorithms. As a result, they struggle with tasks that require precision, adaptability, and real-time feedback. These limitations highlight the need for modern robotics solutions that can operate autonomously, increase productivity, and ensure better safety.

System Requirements:-

1. Hardware Requirements

- **Microcontroller Board:** Arduino, Raspberry Pi, ESP32, or similar controller
 - **Sensors:** Ultrasonic sensor, IR sensor, temperature sensor, or any required sensors
 - **Motors:** DC motors, servo motors, or stepper motors depending on project
 - **Motor Driver:** L293D, L298N, or appropriate driver module
 - **Power Supply:** 5V–12V battery or AC adapter
 - **Breadboard & Wires:** For circuit building and connections
 - **Chassis/Robot Frame:** For assembling the robot structure
 - **Laptop/PC:** For coding and uploading programs
 - **Tools:** Screwdriver set, soldering iron, multimeter
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2. Software Requirements

- **Programming IDE:** Arduino IDE / Python / MATLAB / ROS (Robot Operating System)
 - **Simulation Tools:** Proteus, TinkerCAD, Gazebo (optional)
 - **Firmware Drivers:** USB drivers and board support packages
 - **Operating System:** Windows / Linux / macOS
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3. Functional Requirements

- The system should read sensor data accurately
 - The microcontroller must process input and give correct output
 - Motors should respond based on programmed logic
 - Robot should perform tasks like obstacle detection, movement, or automation
 - System should allow easy debugging and modification
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4. Non-Functional Requirements

- **Reliability:** System should perform consistently without failure
- **Efficiency:** Low power consumption and optimal performance
- **Safety:** No short circuits; proper insulation and safe handling
- **Scalability:** Should allow adding more sensors or modules

System Design & Architecture

The system architecture is divided into four main layers:

A. Input Layer (Sensors)

- Ultrasonic / IR sensors detect obstacles and measure distance
- Line sensors or motion sensors capture environmental data
- Sensor values act as the raw input for decision-making

B. Processing Layer (Microcontroller / Processor)

- Arduino / ESP32 / Raspberry Pi acts as the brain of the system
- Reads sensor values, processes data, and executes logic
- Runs pre-programmed algorithms for movement and control

C. Output Layer (Actuators & Motors)

- DC motors, servo motors, or stepper motors generate physical movement
- Motor drivers (L293D/L298N) control the power supplied to motors
- LEDs, buzzers, or displays give additional output signals

D. Power Supply Layer

- Battery pack (5V–12V) or adapter powers the entire system
- Voltage regulators ensure stable power to sensors and controller

2. Design Architecture

The design architecture outlines how the robot is constructed and how its internal modules interact.

A. Mechanical Design

- Robot chassis/frame holds all components
- Wheels, gears, and joints provide movement
- Placement of sensors ensures accurate detection

B. Electrical Design

- All sensors and motors are connected to the microcontroller
- The motor driver sits between motors and controller
- Power lines are distributed safely to all modules

C. Software Design

- Program is written in Arduino IDE/Python
- Follows a structured flow:
 1. **Initialize sensors and motors**
 2. **Read inputs**
 3. **Process data using logic/algorithm**
 4. **Control motors and movement**
 5. **Repeat continuously**

D. Data Flow Architecture

1. **Sensors detect environment**
2. Sensor data → microcontroller
3. Controller processes data using code
4. Output commands → motor driver
5. Motor driver controls motors
6. Robot performs movement/action
 - GET /api/restaurants/:id/menu: To get the specific menu for one restaurant.

Working Principle

The working principle of the robotic system is based on the interaction between **sensors**, **microcontroller**, and **actuators** to perform specific tasks automatically. The robot uses sensors to collect information from its surroundings, processes this information through a programmed controller, and then drives motors or actuators to produce the required movement or action.

1. Sensor Detection

The robot's sensors (such as ultrasonic, IR, or line sensors) continuously monitor the environment.

These sensors generate electrical signals based on distance, light, or obstacle detection.

2. Signal Processing

The microcontroller (Arduino/ESP32/Raspberry Pi) receives the sensor data and converts it into meaningful information.

Using the embedded program, the controller decides what action to take:

- Move forward
- Turn left/right
- Stop
- Avoid obstacles
- Follow a predefined path

3. Decision Making

The programmed logic or algorithm compares incoming sensor values with predefined conditions.

Based on the logic, the controller generates output commands.

Example:

If an obstacle is detected within 10 cm → Stop or turn the robot.

4. Actuator Control

The output commands are sent to the motor driver, which controls the motors based on the controller's instructions.

The motors then:

- Rotate wheels
- Move the robot
- Turn the chassis
- Operate attached mechanical parts

5. Continuous Feedback Loop

The entire process repeats continuously:

Detect → **Process** → **Decide** → **Act**

This loop enables the robot to perform real-time tasks and adapt to the environment.

Advantages

1. Increased Efficiency

Robots can perform tasks faster and more accurately than humans, reducing time and increasing productivity.

2. High Precision

Sensors and automated control systems allow robots to perform operations with high accuracy and minimal errors.

3. Continuous Operation

Robots can work 24/7 without fatigue, making them ideal for tasks that require constant movement or monitoring.

4. Improved Safety

Robotics reduces human involvement in dangerous environments, preventing accidents and ensuring safer operations.

5. Cost-Effective in the Long Run

Once installed, robots reduce labor costs and operational errors, leading to long-term savings.

6. Consistency and Reliability

Robots perform the same task with uniform quality every time, improving product reliability and output.

7. Flexibility and Adaptability

Robots can be reprogrammed or modified for different tasks, making them versatile for various applications.

8. Enhanced Monitoring and Control

Real-time sensor feedback helps in better decision-making and efficient automation.

Disadvantages / Limitations

1. High Initial Cost

Setting up a robotic system requires expensive hardware, sensors, controllers, and tools.

2. Requires Technical Skills

Designing, programming, and maintaining robots need trained personnel with specialized knowledge.

3. Limited Decision-Making

Robots can only perform tasks based on programmed instructions and cannot think or adapt like humans without advanced AI.

4. Maintenance Issues

Robots require regular maintenance, calibration, and component replacements to function smoothly.

5. Power Dependency

Most robots depend on batteries or external power sources, which can limit mobility and operating time.

6. Lack of Creativity

Robots cannot innovate or think creatively; they follow preset rules and logic.

7. System Failures

Sensor or motor failures can stop the entire robot, affecting performance and reliability.

Future Scope

1. Integration of Artificial Intelligence (AI)

Future robots can be enhanced with AI to make smarter decisions, learn from data, and adapt to different environments without manual programming.

2. Advanced Sensor Technology

Improved sensors such as LiDAR, thermal cameras, and advanced vision modules will allow robots to detect surroundings more accurately and work in complex situations.

3. Internet of Things (IoT) Connectivity

Robots can be connected to cloud systems and IoT networks for remote monitoring, data analysis, and real-time control from anywhere.

4. Increased Automation

Industries such as manufacturing, healthcare, agriculture, and logistics will rely more on robots for repetitive and hazardous tasks, reducing human effort.

5. Human–Robot Collaboration

Future robots will work more safely and efficiently alongside humans, improving productivity in factories, homes, and service sectors.

6. Improved Energy Efficiency

Better batteries, wireless charging, and low-power circuits will increase robot runtime and overall performance.

7. Customization and Scalability

Robots will become more modular, allowing users to upgrade or modify parts based on their needs without redesigning the entire system.

8. Expansion into New Fields

Robotics will grow into fields like disaster management, space exploration, medical surgery, education, and household automation.

Conclusion

The robotics summer internship provided valuable hands-on experience in understanding how robotic systems are designed, developed, and controlled. Through practical learning with sensors, microcontrollers, and programming, the internship helped build a strong foundation in automation and problem-solving. It also enhanced skills in teamwork, logical thinking, and technical creativity.

Robotics continues to grow rapidly across industries, and the knowledge gained during this internship prepares students for future opportunities in engineering, AI, and advanced automation. Overall, the internship successfully bridged the gap between theoretical concepts and real-world application, giving participants a clear understanding of how modern robotic systems work and how they can contribute to technological innovation.