Project Proposal

Project Title

Real-Time Surveillance ROV
(Server-Based Smart Robotic Vehicle)

Team Information

University: Patuakhali Science and Technology University
Course: CCE 321 – Computer Peripheral and Interfacing
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1. Introduction

Modern surveillance, environmental monitoring, and remote inspection systems require real-time data acquisition, intelligent sensing, and remote accessibility. Manual monitoring in hazardous or remote environments is often risky, inefficient, and time-consuming. Inspired by planetary rover systems such as the Mars Rover, this project proposes the design and development of a **Real-Time Surveillance ROV** using Raspberry Pi and peripheral interfacing techniques.

The proposed system is a server-controlled robotic vehicle capable of monitoring environmental parameters, detecting obstacles, and performing thermal surveillance. The system is remotely operated through a mobile application using a **Server ↔ Vehicle ↔ App** communication architecture.

2. Objectives of the Project

The main objectives of this project are: - To design a server-based remotely operated robotic vehicle - To implement real-time control using a mobile application - To monitor environmental parameters such as soil moisture, temperature, humidity, and water presence - To detect obstacles using LIDAR and ultrasonic sensors - To perform thermal-based visual surveillance - To demonstrate peripheral interfacing using Raspberry Pi - To develop a scalable and energy-efficient robotic system

3. Scope of the Project

This project focuses on integrating multiple sensors and peripherals with Raspberry Pi to build a smart surveillance platform. The system can be applied in agriculture monitoring, disaster management, environmental research, and security surveillance. The design also allows future enhancements such as autonomous navigation and AI-based analysis.

4. System Architecture

The system consists of three main layers:

4.1 User Layer

- Mobile application for vehicle control and data visualization

4.2 Server Layer

- Acts as a communication bridge between app and vehicle
- Processes sensor data
- Stores data in a database
- Performs prediction and analysis

4.3 Vehicle Layer

- Raspberry Pi-based robotic platform
- Sensors, motors, and power system

Communication Flow:
App → Server → Vehicle
Vehicle → Server → App

5. Hardware Components

- Raspberry Pi
- Thermal Camera Module
- LIDAR Sensor
- Ultrasonic Sensor
- Soil Moisture Sensor
- Temperature Sensor
- Humidity Sensor
- Water Level Sensor
- DC Gear Motors
- Motor Driver Module
- Robot Chassis

- Battery System
- Solar Panel
- Solar Charge Controller
- Voltage Regulator
- Communication Module (Wi-Fi / GSM)

6. Software Components

- Python (Vehicle control and sensor interfacing)
- Mobile Application Interface
- Server API
- Database Management System
- Real-time Communication Protocols
- Data Prediction Algorithms

7. Methodology / Working Principle

1. The user sends movement and control commands through the mobile application.
2. Commands are transmitted to the server via the internet.
3. The server forwards commands to the Raspberry Pi installed on the vehicle.
4. Raspberry Pi controls the motors using the motor driver module.
5. Environmental sensors collect real-time data.
6. LIDAR and ultrasonic sensors continuously scan for obstacles.
7. The thermal camera captures heat-based visual data.
8. All sensor data and visual information are sent back to the server.
9. The server processes, stores, and forwards data to the mobile application.

8. Key Features

- Real-time remote control
- Server-based communication
- Thermal vision surveillance
- Intelligent obstacle detection
- Environmental monitoring and prediction
- Solar-powered energy support
- Modular and scalable design

9. Applications

- Smart agriculture monitoring

- Disaster and rescue operations
- Environmental research
- Security and surveillance
- Industrial inspection
- Remote area exploration

10. Future Enhancements

- Autonomous navigation system
- AI-based obstacle avoidance
- Machine learning-based prediction models
- Cloud-based analytics
- GPS-based navigation
- Multi-robot coordination

11. Conclusion

The **Real-Time Surveillance ROV** project demonstrates the practical implementation of computer peripheral interfacing using Raspberry Pi. By integrating multiple sensors, communication modules, and a server-based control architecture, the system provides a reliable and efficient solution for real-time monitoring and surveillance. This project successfully bridges hardware and software to address real-world challenges in monitoring and exploration.

12. Acknowledgement

We would like to express our sincere gratitude to **Sarna Das**, course instructor of **CCE 321 – Computer Peripheral and Interfacing**, Patuakhali Science and Technology University, for her valuable guidance, encouragement, and continuous support throughout the completion of this project.