NYU TANDON SCHOOL OF ENGINEERING

NYU TANDON

# Mechatronics and Robotics Engineering

(Department of Mechanical and Aerospace Engineering)

Advanced Mechatronics

ROB-GY-6103

Project Proposal

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# MORPHOBOT

(Project Proposal)


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## Introduction:

Our project aims to create a highly adaptable hybrid rover (Morhpobot) that smoothly transitions between land-based and aerial functionalities. To achieve this, we will utilize Raspberry Pi as the main controller for land operations and Arduino for aerial maneuvers. With the inclusion of RF and Bluetooth technologies, users will be able to remotely control the drone and rover.

## Objectives:

1. Design and construct a hybrid rover capable of land-based movement (4-wheeled motion) and aerial flight (drone capability).
2. Integrate Raspberry Pi for controlling land-based operations, including navigation, obstacle detection, and data processing.
3. Utilize Arduino for flight control, implementing advanced algorithms for stability, maneuverability, and responsiveness.
4. Develop RF communication for drone control and Bluetooth technology for rover control, enabling seamless transitions between land and aerial modes.

## Components and Functionality:

- **Rover Module**:
    - Raspberry Pi: Acts as the main controller for land-based operations, executing navigation algorithms, obstacle avoidance, and sensor data processing.
    - Bluetooth Module: Enables wireless control of the rover, allowing operators to send commands for movement, turning, and other functions.
    - Ultrasonic Sensors: Used for obstacle detection and avoidance during rover movement on the ground.
    - Motor Control: Four-wheeled motion controlled by motor drivers, responding to commands from the Raspberry Pi via Bluetooth.
- **Drone Module**:
    - Arduino: Functions as the flight controller for aerial maneuvers, implementing sophisticated control algorithms for stability and responsiveness.
    - RF Transmitter-Receiver System: Facilitates long-range communication for drone control, including flight direction, altitude, and maneuvers.
    - MPU-6050 Gyroscope and Accelerometer: Provides crucial data on orientation, acceleration, and flight conditions for precise control and stability.
    - ESCs (Electronic Speed Controllers): Regulate motor speeds based on Arduino commands, ensuring dynamic stability and control during flight.

## Conclusion:

This innovative hybrid rover utilizes RF and Bluetooth communication technologies to combine the capabilities of the Raspberry Pi for ground-based operations and the Arduino for airborne maneuvers. This rover's ability to seamlessly switch between ground and aerial modes, along with its sensor, and motor control makes it perfect for remote data collection, exploration, and surveillance in difficult-to-access areas.

**References:**

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3. Sihite, E., Kalantari, A., Nemovi, R. *et al.* Multi-Modal Mobility Morphobot (M4) with appendage repurposing for locomotion plasticity enhancement. *Nat Commun* **14**, 3323 (2023). https://doi.org/10.1038/s41467-023-39018-y