Planetary Rover Remote Control Using Two-Way RF Communication

YASİN ARSLAN, MEHMET ENES BİLGİN, ENES BÜYÜKGÜN, KEMAL ALPTÜRK ERESEN

SUPERVISORS

Dr. GÜRHAN BULU, Electrical and Electronics Engineering, Hacettepe University
AYLİN HATİP İPEK, FERDİ EMRE TANIR, HÜSEYİN GÖKTAŞ, ROKETSAN Inc.

Introduction

❖ This project aims to develop a mobile system with obstacle avoidance algorithms in collaboration with ROKETSAN Inc. It consists of two main components: the Rover and the Control Station.

❖ The Rover gathers data on the climate, atmosphere, and potential habitability of inhospitable terrains and transmits this information to the Control Station to facilitate data transfer.

❖ The Control Station processes the data received from the Rover, presents it to the user via an interface, and sends directional commands to the Rover.

Specifications and Design Requirements

❖ The Rover has a movement range of 360 degrees horizontally.

❖ While the Rover is in autonomous mode, it cannot approach any obstacle closer than a safety distance of 45cm (approximately twice its own height).

❖ The Rover can be operated in manual mode, receiving direct commands from the user with almost instantaneous response (Latency $\cong 0$)

Solution Methodology
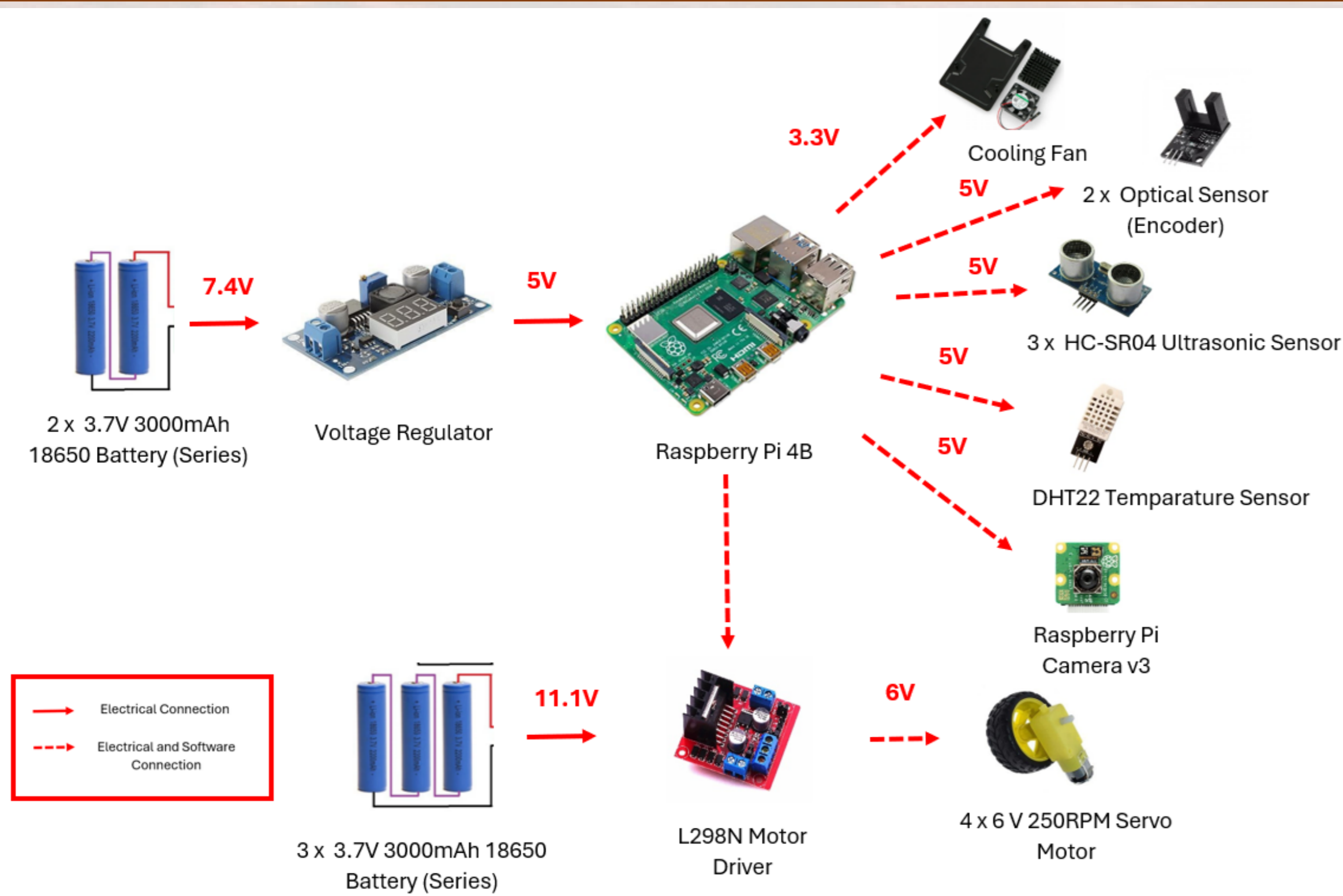
❖ Control Station GUI is programmed with C#
❖ Raspberry Pi 4B is used to Rovers the electromechanical system.
❖ The Raspberry Pi 4B has a built-in Wi-Fi module, allowing it to wireless communication with the control station.
❖ Raspberry Pi Camera v3 is used to transmit the live video.
❖ L298N motor driver and Servo motors are used to Rovers movement
❖ 3 * 3000 mAh 3.7V Li-Po battery is used to supply the required power to the motor driver system.
❖ 2 * 3000 mAh 3.7V Li-Po battery is used with voltage regulator to supply the required power to the Raspberry Pi 4B.
❖ HC-SR04 ultrasonic sensors provide distance information about obstacles in front of the rover.
❖ Encoder counters provide information about the rover's turning angle and the distance traveled by the vehicle.
❖ Temperature measurements are taken at regular intervals using the DHT22 temperature sensor.
❖ The regulator keeps the current and voltage constant from the power source.
❖ The cooling fan used for prevent to Raspberry Pi from overheating.

Application Areas

❖ Planetary rovers serve multiple purposes, from exploring planetary surfaces and conducting geological studies to collecting samples and facilitating communication with spacecraft. They also excel in exploring challenging Earth environments, like caves, where human access is limited. These versatile applications significantly contribute to exploration, scientific research, and technological advancement.

Rover and User Interface
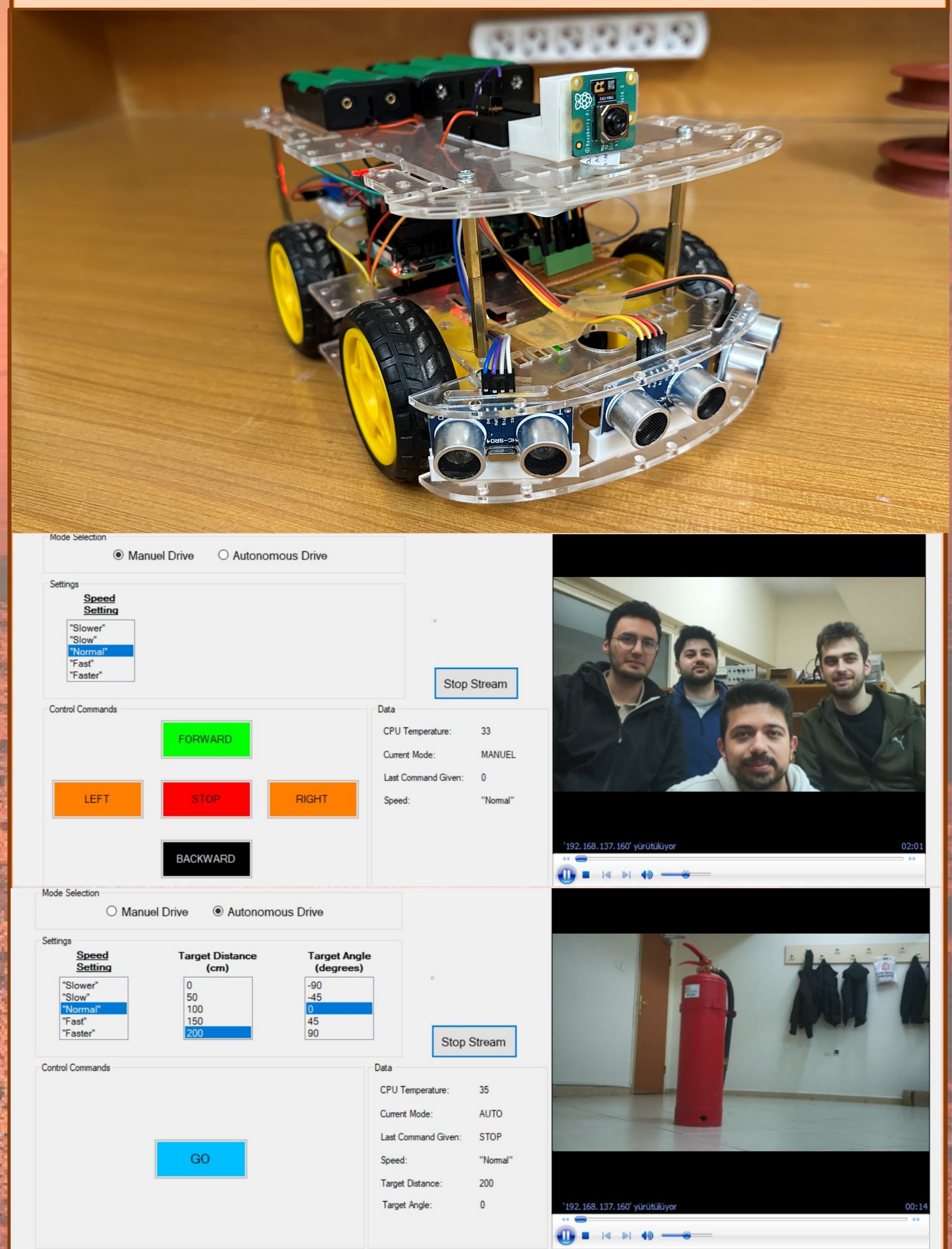
Results and Discussion

❖ This study consists of two main components: the rover and the control station. Successful wireless communication has been established between them using Wi-Fi. In this wireless communication, the transmission of real-time video along with various sensor data has been successfully accomplished.

❖ This project is not only valuable for exploring other planets but also highly useful for navigating inhospitable areas on Earth.

Acknowledgment