The Battle Roach Robot

Carla J. Araile, New York City College of Technology Undergraduate Student

Anthony Francis, New York City College of Technology Undergraduate Student

Abstract

Robotics is becoming a leading technology in the modern world, encompassing integrated computer controlled systems that are capable of interacting with their environment in order to carry out specific tasks. The objective of the robot project was to create a fully autonomous battle robot able to adapt accordingly to a dynamic environment.

The robot’s mission was to navigate, take corrective courses of action in the presence of obstacles, locate, identify and extinguish the “enemy” territory’s target lights before the enemy robot extinguishes the Battle Roach’s home target lights.

Stevens Institute of Technology provided their custom-made PIC microcontroller and a pre-assembled chassis to serve as the foundation for the robot. The Battle Roach’s design and construction used a set of requirements and guidelines which allowed modifications on the Stevens equipment to comply with the physical needs required for a successful mission. Once completed, the Battle Roach must compete against a champion battle robot on the battlefield to test its effectiveness. Multiple disciplines, such as mechanical, electrical, and programming software were involved in the process of the creation of the fully autonomous battle robot.

Objectives

- Construct an autonomous robot able to navigate through an obstacle course shown above
- Construct an effective obstacle evasion bumper system
- Be able to determine friendly/enemy territories
- Be able to detect, identify, and extinguish enemy target lights
- Win a competition against a champion battle robot

Methodology

During the pre-construction process, a conceptual design matrix was evaluated in order to choose the best possible design for the Battle Roach Robot. The robot requires target light sensors, a floor color recognition sensor, a directional navigation sensor, and an effective bumper obstacle evasion system. Therefore, a prototype was constructed that employed three target light sensors, a Beacon light sensor, a Floor Sensor Module for floor color recognition and a three-part bumper design as part of the main design.

The Battle Roach Robot was able to:
- Navigate autonomously through the obstacle course
- Employ a successful bumper system for obstacle evasion; however, the radius must be reduced to avoid too much usage of the system
- Detect its location in the arena with an effective Floor Sensor Module (FSM) for color recognition through color reflectivity thresholds and a Beacon light sensor tower
- Detect targets; however, it still has trouble in extinguishing only enemy target lights
- The battle robot competition has not taken place

Data

Stevens Institute custom-designed PIC microcontroller board. It was programmed in C language through the compatible HI-TECH Integrated Development Environment. The board supports both analog and digital inputs for data acquisition, a voltage divider circuit for the analog light sensors channels and Analog to Digital (A/D) Converters for voltage sensing, as well as a motor driver circuit for the two motors used.

Results

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