# SoutheastCon Robotics Team ECE Senior Design Team #1

## Aim: To develop an autonomous robot that can complete the tasks described in the 2017 SoutheastCon Robotics competition rules

## Introduction

This project involves designing and constructing a fully autonomous robot capable of completing four stages. Each stage requires various tasks for the robot to complete and are outlined in rules given for the competition. The robot competed in the Star Wars inspired 2017 IEEE SoutheastCon Hardware Challenge held in Charlotte, NC from March 30<sup>th</sup> to April 2<sup>nd</sup>. Each stage was awarded different points for successful completion. The robot designed is named F2-P2.

## Designs

### Chassis

- 1/8" Aluminum
- Two levels

### Microcontroller

- Arduino Mega
- Ample amount of pins to accommodate all components

## **Battery**

- NiMH
- 7.2 V, 3000 mAh

## Navigation

- Long and short range infrared (IR) sensors
- Long range used for distances between 20 150 cm
- Short range used for distanced between 4 30 cm

## Platform

- Vex Robotics tank tread kit, DC motors, and motor controller
- Allows for the robot to easily travel on stairs if needed

## Acknowledgements

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Figure 4: Robot Back View



Figure 5: Robot Side View



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Figure 6: Navigation Sensor Layout





Figure 1: Arena

#### **Stage 1 – Uncover the Unknown**

- Test 5 different circuits in an unknown configuration to determine what the hidden component is
- Components have a numeric value between one and five. (Table 1)
- Displayed on an LCD
- Solution (Figure 3) Send voltage through each pad and compare to output voltage Each component has a different output voltage



Figure 6: Stage 1 Layout

Table 1: C	omponent Code
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Code	Component
1	Wire
2	Resistor
3	Capacitor
4	Inductor
5	Diode

### **Stage 3 – Bring down the shield**

- Implement Stage 1 code on a quadrature encoder
- Turn encoder 360° for each code value
- Direction change = next digit
- Input all 5 digits
- Solution (Figure 10)

Use 2 steeper motors to turn a conveyor that touches the encoder Steeper motor allows for precise steps



Figure 9: Stage 3 Layout



Figure 10: Stage 3 Solution





Figure 2: Robot Front View

## **Stage 2 – Lightsaber Duel**



Figure 7: Stage 2 Layout



Figure 8: Stage 2 Solution

Figure 3: Stage 1 Solution

#### • Detect an electromagnetic field

- Robot must make contact with a "Lightsaber" when field is active
- Solution (Figure 8)
  - Uses a Hall Effect sensor that detects a change in the magnetic field
  - A servo is used to strike the "lightsaber"

### **Stage 4 – Launch a Proton Torpedo**



Figure 11: Stage 4 Layout



Figure 12: Stage 4 Solution

- Fire 3 nerf darts through a 6" x 6" target
- Shoot after Stage 2 is complete

#### Solution (Figure 12)

- Use a modified electrical nerf gun
- The nerf gun is able to shoot from the farthest point on the arena making stair climbing obsolete.