IEEE Southeast Con Hardware Challenge 2017

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TEAM

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SCHEDULE

PROJECT DESCRIPTION

- 2017 IEEE Southeast Con Hardware Challenge
 - March 30

• Objective: Success



• Oct. 9, 2016 Rules

Autonomous robot

4 STAGES

Star Wars Themed

- "Uncovering the Unknown"
- "Lightsaber Duel"
- "Bring Down the Shields"
- "Launch a Proton Torpedo"





BOT CHASSIS DESIGN

- Starting size must not exceed 12"x12"x12" (as per official Rules)
- Preliminary Research has resulted in the following design aspects
 - Material: Water-Jetted Aluminum, 3D Printing
 - Bot Size 10"x10"x10" to allow for possible expansion if needed
 - Perforated to reduce weight



*Not to scale

MICROCONTROLLER

PLATFORM

NAVIGATION







VEX ROBOTICS TANK TREAD KIT

- Climb stairs
- Complete Kit
 - Chassis
 - Motors
 - Axles
- 32.75 inches per track
- Tensioner
- Affordable



MOTOR

- Vex Robotics 2-Wire Motor 393 Vex
 - At 7.2 V, 100 RPM
 - 160 RPM

- Vex Robotics Motor Controller
 - I 2-Wire Motor
 - Speed and direction







STAGE I – DESCRIPTION

- Rotational dimensions for copper pads are:
 - I 0°
 - 2 72°
 - 3 144°
 - 4 216°
 - 5- 288°
- Center pad is common ground
- Capacitor is non polarized
- Diode can be forward or reversed



Code Component type		Component value		
1	Wire	N/A		
2	Resistor	10K, 10% tolerance		
3	Capacitor	0.1uF, non polarized		
4	Inductor	500mH		
5	Diode	IN4001–cathode/anode can be oriented in either direction		

STAGE I – SCHEMATIC

• 5 digital pins

• I analog pin

ground



STAGE I – SCHEMATIC

• 5 digital pins

• I analog pin





STAGE I – PSUEDO CODE

Int Stage I (int pin)

Set pin to output

Read voltage

Wait I sec

Read voltage2

Return component

- If(voltage > voltage2)
 - Capacitor "3"
- Else If(voltage < voltage2)
 - Inductor "4"
- Else if(voltage = 5)
 - Wire"I"
- Else if (voltage = 2.5)
 - Resistor "2"
- Else
 - Diode "5"

CODE OUTPUT

.99	
1.99	
fire	
2.52	
2.51	
Resistor	
4.57	
0.00	
Capacitor	
4.45	
4.44	
Diode	
1.28	
4.69	
Inductor	
4.77	

STAGE 2 – "LIGHTSABER DUEL"

- Detect Electromagnetic Field induced
 - I amp supplied to a 40 turns of #20 copper wire wound around a 0.5" bobbin
 - Active for 2 seconds randomly during a 30 second round interval
 - Started by robot contact
 - 4 active periods during the round with the final activation at 28 seconds



Figure 1: Arena Stage 2 with Lightsaber

STAGE 2 – THE LIGHTSABER



• Lightsabers!

- 3" tall Field attached lightsaber
- Adafruit Medium Vibration Sensor Switch to detect contact made
- Adafruit LED array to visually indicate contact
 - Red for Points Deducted, Blue for Points Awarded

Figure 2: Lightsaber and Bobbin

STAGE 2 - "THE FORCE IS STRONG WITH THIS ONCE' – OBI WAN"



STAGE 2 - "'THE FORCE IS STRONG WITH THIS ONCE' – OBI WAN"





STAGE 3 – "BRING DOWN THE SHIELDS"

- Implement Stage | Code
- Quadrature Encoder
- 360° represents a value of one
- Number of turns =
 Digit
- Direction changes = Next Digit
- Five Digits

Component	Wire	Resistor	Capacitor	Inductor	Diode
Code	I	2	3	4	5

STAGE 3 – APPROACH



SERVOS

- Components
 - DC motor
 - Potentiometer,
 - Control circuit.
- Controlled through pulse width modulation (PWM)
- PWM signal-> Motor
 - Determines position



- Standard
 - 0 to 180°
- Continuous Rotational Servo
 - 0 to 360°

STAGE 3 – SERVO

- Rotates 360°
- Voltage: 4.8-6.0 Volts
- Torque: 27.8/30.6 oz-in. (4.8/6.0V)
- Speed: 0.9/0.84 sec/360° (4.8/6.0V)





STAGE 3 – PSEUDO CODE

- INCLUDE Servo.h library
- CREATE servo object
- ATTACH servo to PWM pin 9
- READ in integer code values
- Forward Function
 - Rotate servo clockwise
 - Delay: Full rotation * digit
- Reverse Function
 - Rotate servo counterclockwise
 - Delay: Full rotation * digit

- Forward(codel)
- Reverse(code2)
- Forward(code3)
- Reverse(code4)
- Forward(code5)

CR SERVO SPEED AND DIRECTION CONTROL

myservo.write(θ)

 $90^{\circ} < \theta \le 180^{\circ}$ Clockwise rotation $0 \le \theta < 90^{\circ}$ Counterclockwise rotation

Greater distance from 90° = Faster rotation

90°

Stop

STAGE 3 – FUTURE

- Chassis design
 - Arm
- Gripper added
- Testing with stage I
 - Defined integers



STAGE 4 – DESCRIPTION

- 6"x 6", 3.5" above the top step
- The target area is roughly 7" from the starting arena area
- Launching Position



STAGE 4 – APPROACH

- I.5"-2" pipe for pressure vessel
- 0.5" PVC barrel or converted nerf barrel
- Bicycle Pump
- Solenoid valve



NAVIGATION

Long Range



Short Range



GP2Y0A41SK0F 4-30cm

GP2Y0A02YK0F 20-150cm

LAYOUT



NAVIGATION CODING METHOD

- Basic algorithm for making complex decisions
- Starts with breaking down inputs from sensors into manageable information
- Information is then put into a rule matrix to determine output

BUDGET UPDATE

- Current Spent: \$301.11
- Budget Left: \$448.89
 - Materials for chassis \$50
 - Batteries \$100
 - Materials for stage 1 \$50
 - Materials for stage 2 \$50
 - Materials for stage 3 \$30
 - Materials for stage 4 \$50
- Total Left to be spent \$330
- Budget Left For Emergencies \$118.89

FUTURE

- Research Update (Overall Bot) November 3rd
- Research Update (Stages)– November 10th
- Parts Ordered November 18th
- Stages Complete December 9th