

2014 Angry Engineers Competition

Sponsored by the BYU Department of Electrical and Computer Engineering

Rules Committee: Dr. Brian Mazzeo, Dr. Daniel Smalley, Dr. Neal Bangerter

Overview

The purpose of this competition is to give you an extracurricular experience with microcontrollers and some simple electronics in a fun and exciting competition. In many situations it is often necessary to acquire the position of some object of interest using radar or other sensing techniques. Then, a decision is made about the objects and often a projectile is launched to destroy the object. In this competition, an ultrasonic ranging system will be used to find targets and plastic projectiles will be launched towards the targets. The strategy and competition will be open-ended.

Important Dates

20 February 2014 – Competition during Engineering Week – times will be announced

17 January 2014 – Team Sign-ups close – kits will be distributed as parts arrive

13 January 2014 – Team sign-ups begin in the ECEn Office

Teams will consist of 2-3 students. It is important to note that if you sign up, you are *committed* to entering the competition on the 20th of February.

Prizes

First Prize - \$100 (*but really, this is about bragging rights*)

Second Prize - \$50

Third Prize - \$25

Parts List

Teensy 3.1

USB micro-B cable

Wall adapter USB power supply

Pan/tilt mount

HC-SR04 ultrasonic sensor

V398 firing mechanism

6 plastic projectiles for the V398 launcher

In addition to the above parts, you can use up to five dollars of supplies from the ECEn Shop. One of the best parts of this project is that you will be able to keep all of the hardware!

Rules Updates

Note that rule updates will be posted on the competition website which will be found at <http://www.et.byu.edu/~bmazzeo/LTR/2014/>. Be sure to check in every now and then for updates.

Rules

The tournament will be elimination style where teams will advance after successfully completing a round. The key to this competition is accuracy, with a secondary consideration being the amount of time it takes to determine the position of the target.

The playing field will be constructed as shown on the following page. Basically, your device will sit in the box on a table and have to search the field in front of it for the target, then fire your projectiles towards the target, trying to hit it.

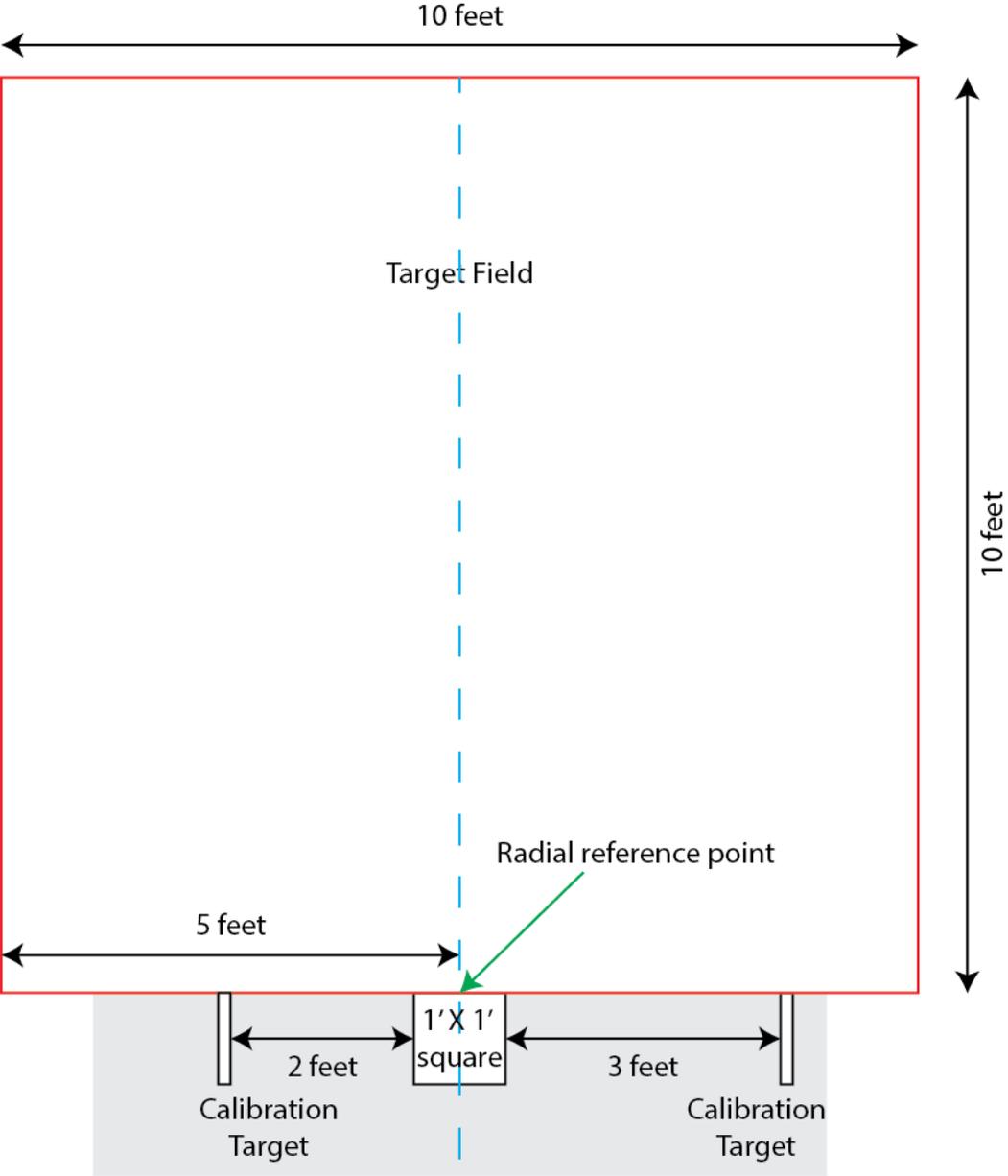
The target will consist of a 1' X 1' board that will be placed such that it faces perpendicular to the launching square as to give a good ultrasonic return signal. The height of the center of the target can be between -1.5 to 1.5 feet above the level of the table where the devices will be placed.

In round 1, the target will be placed at a 1 foot distance from the radial reference point. In round 2, the target will be placed at a 2 foot distance. Rounds will take place until a team can no longer strike the target.

For each turn, the device will be placed in the 1' X 1' square. The ultrasonic sensor unit and projectile launching component must be pointed directly towards one of the calibration boards on either side of the square at beginning. This is to help you but also to ensure that there is no advantage to any particular position on the field.

You will plug in your USB power supply into a power strip that will be provide on the table. That is the only cord or part of your device that may leave the square at the beginning of your turn. A turn will consist of placing your device within the square within 1 minute. Then, when the judge indicates, you will press a button on your device that activates your device (make sure you have such a button). The time will be measured until you strike the target or exhaust the six projectiles allocated to you for each turn. A turn will not exceed two minutes in length. You cannot change your code between rounds.

You will be given a single turn in any round for which you are eligible to compete in. For round 1, all the teams are eligible. In round 2, only the teams that successfully hit the target during round 1 will be eligible. In round 3, only the teams that successfully hit the target during round 2 will be eligible. The winner of the competition will be the team that passes the most rounds in the competition. If there are two or more teams that tie, then the team that hit the target in the shortest amount of time will be declared the winner. For example, if two teams are eligible for the eight foot distance and both successfully hit the target in that round, but both do not hit the target at the nine foot distance, the team that hit the target at a distance of eight feet in less time will be declared the winner.



Competition Platform Table ~4 feet above ground

The following are some notes for you to consider as you plan your competition entry.

Projectile firing mechanism

<http://www.xheli.com/28p-wlv398-20.html>

Teensy 3.1

This is the microcontroller module. Be careful, not all the pins on this device are 5 V tolerant. The website for this device is found at <https://www.pjrc.com/teensy/index.html>.

Ultrasonic sensor

The HC-SR04 ultrasonic sensor has a range from about 2 cm to 400 cm. A datasheet is found at the following site:

https://docs.google.com/document/d/1Y-yZnNhMYy7rwhAgyL_pfa39RsB-x2qR4vP8saG73rE/edit

Dual servo control for pan/tilt operation

The pan/tilt servo pair was obtained from the following site:

<http://www.ebay.com/itm/PT-Pan-Tilt-Camera-Platform-Anti-Vibration-Camera-Mount-w-2-Servos-Aircraft-FPV-/380721594149>

You should be able to control the servos using a PWM signal from your microcontroller. Here are some links to other sites that will help you:

<http://extremeelectronics.co.in/avr-tutorials/servo-motor-control-by-using-avr-atmega32-microcontroller/>

SG90 specifications

Red = battery (+)

Brown = battery (-)

Orange = Signal

Operating voltage should be 4.0 to 7.2 volts

Operating speed = 0.12 sec/60 degrees

Stall torque at 4.8 volts = 16.7 oz/in