PROJECT PROPOSAL - TEAM 19

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This document is to propose a solution for the RT Embedded Challenge 2018. The challenge is to navigate a vehicle through a minefield by using audio beacons of fixed frequencies located throughout the field.

For this scenario, we design an autonomous vehicle, in such a way that it satisfies all the given constraints. We first choose the components to be used for the project. The controller that is to be used to control the vehicle is chosen to be Teensy 3.2 Real Time processor. The vehicle consists of an aluminum chassis with two rear wheels and one front center wheel. Each rear wheel has a dedicated DC motor used to motivate each wheel independently. Both DC motors are connected to a PWM motor driver unit that controls the RPM of each motor independently based on a 2 PWM signals.

The microcontroller will interface the PWM motor drivers to the vehicle and all the other sensors that are to be included.

The sensors that are to be included are a microphone (Electret Microphone Amplifier - MAX4466 with Adjustable Gain) and a couple of Ultrasonic sensors. The purpose of each sensor is discussed below.

The main challenge of this project is to find the direction of the signal. The microphone can detect the signal information and the FFT function can return an array of numbers to represent the intensity of the signal based on the frequency and the distance of signal source. The main idea of how to find the direction of the source of signal is to make the cart rotate at one spot. If the return value of FFT function keeps increasing, the cart will keep rotating. If the return value starts to decrease, then the cart should stop rotation and go to the direction at which it detects the maximum intensity of sound of the desired frequency.

The ultrasonic sensors detect the distance between the cart and the objects to avoid collision. We define the distance between any obstacle in the field and the vehicle. The vehicle cannot go beyond that fixed distance, to avoid collision with the beacon or any other object in the minefield.

There are several signal sources. After reaching one signal source, the cart should stop and repeat the previous step to find the next signal source till it finds the exit beacon of the minefield.