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Project
**Automatic Braking Emergency Device
(ABED)**

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Concept of Operations

For the Practicum project, our team has come up with a device named Automatic Braking Emergency Device. This Minimum Viable Product (MVP) has an ultrasonic sensor attached to a RaspberryPi. The sensor measures the distance by using ultrasonic waves. It emits an ultrasonic wave and receives the wave reflected back from a target. Therefore, it knows how close the object is in front of it. This product can be a part of any moving device since it can brake the device automatically when there's any obstacle in front of it. We believe that companies and even individuals can use this device to fulfill their needs that relate to automation.

Market Analysis

Intended customers:

Our product can be a part of other larger systems that require automation. We believe that any automotive companies that are seeking to incorporate additional safety features to their product are our primary customers such as Tesla. Additionally, any other companies that would like to use this safety feature to provide services or for other different purposes depending on the company's needs and wants are also our intended customers. For instance, a lot of companies have adapted using robots in their warehouses for transportation which would likely need our Automatic Braking Emergency Device in order for the robots to stop safely when approaching obstacles.

Competition:

As we already mentioned above, Tesla could be our intended customer if they are interested in our Automatic Braking Emergency Device since the company focuses on autopilot which is a suite of advanced driver-assistance system features. However, they could become one of our competitors for having their own automatic braking system. Other smaller companies that have a large scale fully automated or autonomous systems are likely to be our competitors as well.

Unique Features: simple, inexpensive, small, and useful.

This device is widely applicable, since almost any system with safety measures could benefit from it, and performs reliably at low cost and with off the shelf components. This device makes use of a common ATmega processor and easily attainable Ultrasonic sensor to implement an accurate braking

system that has the potential to save companies several thousand times more than the cost of the precaution device and its deployment/installation.

Price Point:

We believe that this device is for simpler purposes that do not require high precision readings nor have large amounts of money at stake. Therefore, the price point for the Automated Braking Emergency Device is approximately \$20. This ballpark price point is for the cost of all board materials and peripherals, engineering overhead/programming implementation, and for appropriate profit margin.

Requirements

Our microcontroller should have the ability to reliably stop within 5-10cm from any given obstacle based on input readings provided by the HC-SR04 Ultrasonic Sensor; the aversion algorithm/decision matrix programming will be written in the C language and will be deployed from ATmega328p processor. Ideally, this implementation should produce repeatable results with minimal resources for a large cost to benefit margin.

System Architecture

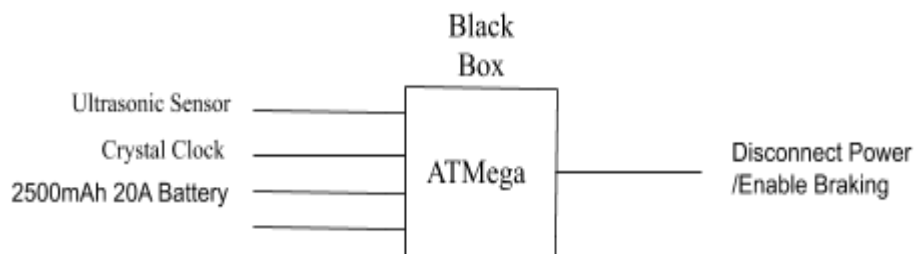


Figure 1: Level 0 Schematic

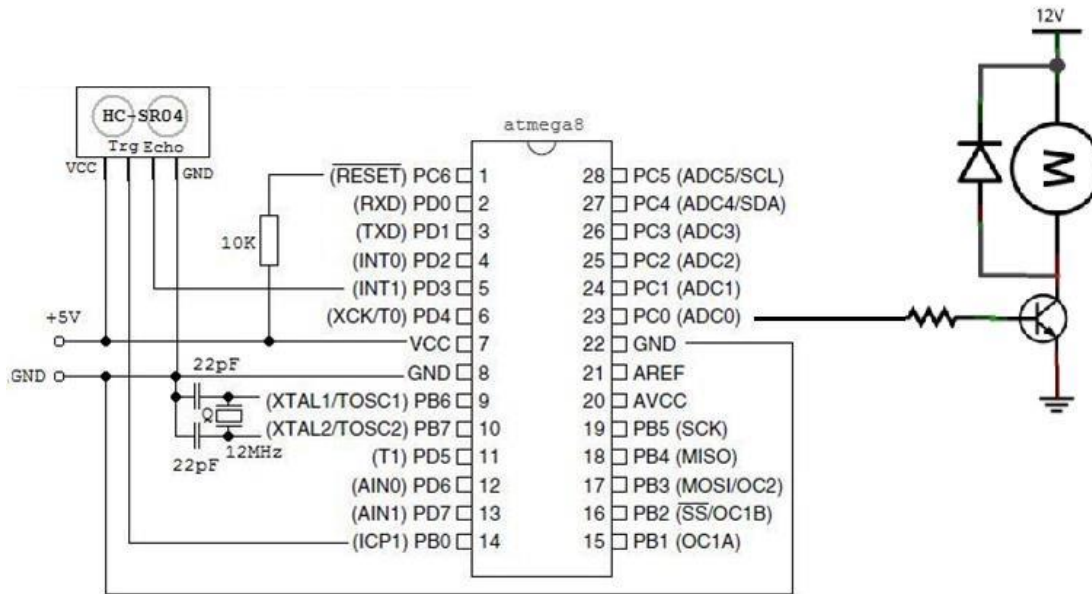


Figure 2: Level 1 Schematic

Design Specification

- Sensor: Ultrasonic sensor HC-SR04
- Processor: ATmega328p
- Actuator: LCD1602
- Power: 2500mAh 20A Batteries
- Arduino: No
- Development environment: Arduino IDE