Production Model Design Report

F2019 – ECE 298

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| --- | --- | --- | --- |
| Lab Section: | 6 | Group: | 2 |

[For your project, your group will complete one Production Model Design Report. The audience is your manager and the manager of the Production Engineering team, so the document should be of high quality. Inside this report, you will each individually select two issues that must be addressed when bringing a project to production scale (one STEM and one non-STEM issues – choose different topics than your partner). Delete all the instructions in brackets before submitting this document. Use IEEE format to note any relevant references or links [1]. You do this in Word by going to References 🡪 Citations & Bibliography 🡪 Manage Sources to add a source, and then to Insert Citation to use it.]

# Team Members

|  |  |  |
| --- | --- | --- |
| # | Name | Role |
| 1 | Waleed Ahmed | Primary Software Developer |
| 2 | Muhammad Shah | *Primary Hardware Designer* |

# Design Overview

## Problem Statement

Bicyclists sometimes have trouble navigating on roads for obstacles whether it be fellow cyclists, or pedestrians, vehicles on the road. This could be due to several conditions, such a low visibility conditions such as fog or low light hours like dawn or dusk, or perhaps the objects are in a blind spot or the cyclist has simply missed them. In these cases, a warning system is needed to alert the cyclist of objects or people in their vicinity for safety reasons. Design a system that includes two sensors; one front and one rear that can alert the cyclist to the oncoming danger.

## Design Scope

This project solves this problem by having 2 ultrasonic sensors that will be used to find objects at a certain distance from the cyclist. There are two different kinds of indicators that will warn the cyclist for either of their direction; buzzer indicator for forward direction that will have different frequencies depending on the objects distance and level sensitive coloured LED indicators for the rear direction.

It was assumed that the sensors could be mounted onto the front and back of the bicycle at locations where they would be able to safely detect nearby objects without obstructing the bicycle itself and that the sensors would only need to sense objects in the forward and backwards direction. It was also assumed that the cyclist could look at the ultrasonic sensor readings on the LCD at a safe location that wouldn’t cause any distractions for the cyclist.

## Project Design Requirements

1. The project must display the output of the one of the ultrasonic sensor readings, converting the sensor digital readings to a distance value to be displayed on the LCD.
2. The project must turn on a certain coloured LED corresponding to a distance value found from the front sensor value.
3. The project must also create 2 different sounds based upon the distance calculated from the back facing sensor value.
4. The project must also take in push button values that then correspond to setting up and configuring the MCU in either user mode or setup mode and the other push button should be able to set user threshold values.

## System-Level Design (High-Level)

[Include the updated/corrected figures from your Template for Feasibility Model Design document and add appropriate figure captions to explain what each one is.]

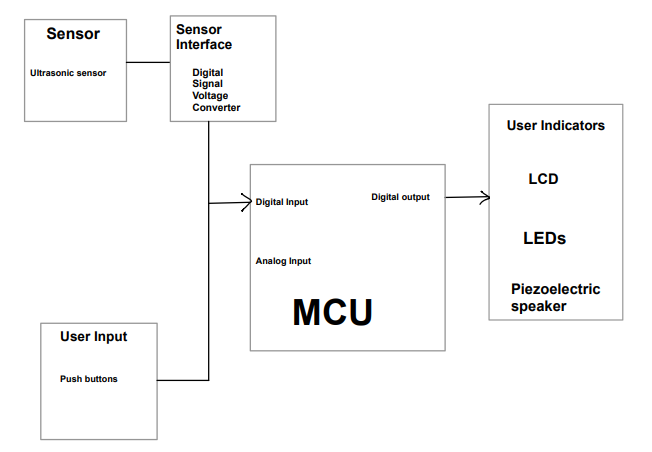


Figure 1 System-Level Design shown with a high -level block diagram

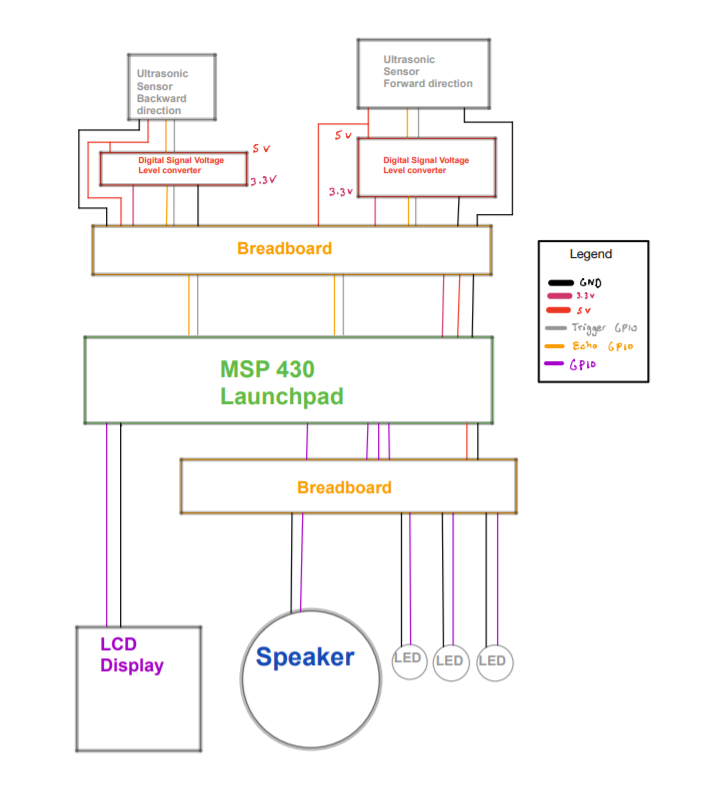


Figure 2 Feasibility Model Diagram

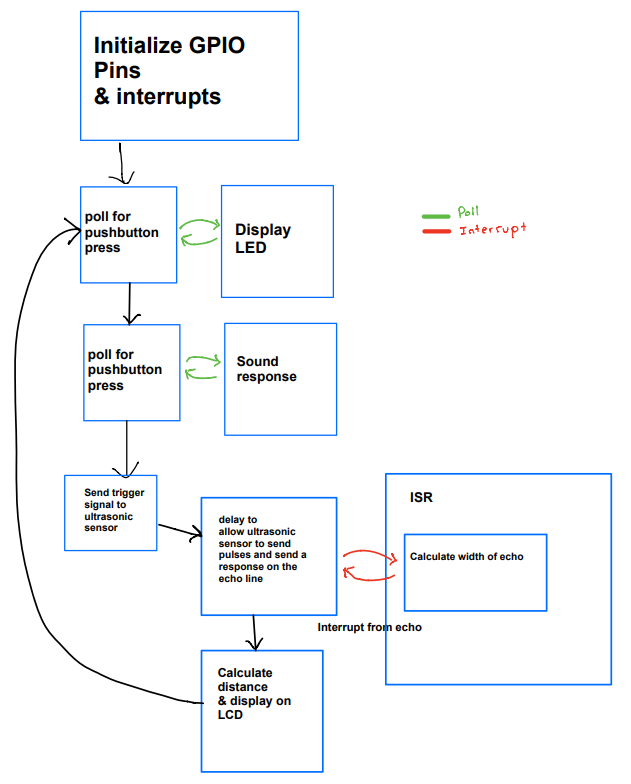


Figure 3 High-Level Software Flowchart

## Completed Prototype

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| Figure 4 Completed prototype with PCB on top of MCU |  | Figure 5 Rear proximity sensor reading for red LED showing object is in the nearest threshold value |
| Figure 6 Rear proximity sensor reading for red Green showing object is in the furthest threshold value |  | Figure 7 Buzzer used for indication that object is near in forward direction |

## Preliminary Production Design Changes

One major issue that needs to be tended to a future revision of the product is to have the product have the correct pin arrangement for the ultrasonic sensor on the PCB. This can be easily be done by fabricating a new PCB design with the correct pin arrangements for the backwards facing ultrasonic sensor.

An enhancement that we could make to our Production Design is that we could add push buttons onto the PCB to allow for easier access for the user. We could also improve our project by using more powerful sensors as the ones we currently use are weak and cannot detect objects that are further away. Another enhancement that we would like to add is to have the sensors be attacked with jumper cables to the PCB so that the PCB can be between the bicycle handles for cyclist and the sensors could be located at appropriate locations on the bike. We would also like to manufacture the board so that it is smaller, so it doesn’t obstruct the cyclist.

# Member 1 Production Details

[Muhammad Shah] – ID# [20725801]

## [STEM Issue]

[Replace heading with one of these topics: Design for Test (DfT), Design for Manufacturability (DfM), Design for Reliability (DfR), Cables and Connectors, Mechanical Enclosure, Further Integration.]

[Write one paragraph explaining the topic.]

[Write one paragraph explaining how the topic relates to your project.]

[Propose a high-level set of next steps and state any thoughts or issues that should remain top-of-mind for the production engineer who will take your prototype through to a production-ready product. Refer to any codes, standards, or parts that should be noted by the engineer.]

## [Non-STEM Issue]

[Replace heading with one of these topics: Energy Efficiency, Sustainability, Supply Chain Management, Cost Analysis at Volume, RoHS / Environmental Safety, Ethical Considerations, Safety Considerations.]

[Write one paragraph explaining the topic.]

[Write one paragraph explaining how the topic relates to your project.]

[Propose a high-level set of next steps and state any thoughts or issues that should remain top-of-mind for the production engineer who will take your prototype through to a production-ready product. Refer to any codes, standards, or parts that should be noted by the engineer.]

# Member 2 Production Details

[Member 2 Name] – ID# [Member 2 ID#]

## [STEM Issue]

[Replace heading with one of these topics: Design for Test (DfT), Design for Manufacturability (DfM), Design for Reliability (DfR), Cables and Connectors, Mechanical Enclosure, Further Integration.]

[Write one paragraph explaining the topic.]

[Write one paragraph explaining how the topic relates to your project.]

[Propose a high-level set of next steps and state any thoughts or issues that should remain top-of-mind for the production engineer who will take your prototype through to a production-ready product. Refer to any codes, standards, or parts that should be noted by the engineer.]

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# References

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| [1] | "IEEE Style," 2019. [Online]. Available: https://pitt.libguides.com/citationhelp/ieee. |

# Appendix – Detailed Design

*[Include design documentation here. The idea is for this document to be a fully detailed snapshot of the prototype. Include the four tables from your Template for Prototype Design document, schematics, layouts, code or a link to a repository, mechanical drawings, etc. I put a Section Break before this part, so you can put the pages landscape if that works better and it won’t affect those pages up front.]*