Welsh Jehnoy, Genther Derrick, Huynh Khoa, Arch Ryan, Yogi Saputra
Team 20
ECE 411
10/25/2020

Homework 2 PDS

Executive Summary / Concept of Operations

Mask to Actively Shield from COVID (M.A.S.C.)

The MASC is an automated COVID facemask to optimize the users mask experience during COVID, and future, pandemics. Using cutting edge technology, this smart mask is capable to determining when the wearer is at the most risk of exposure to other persons due to proximity and automatically moves a barrier over the wearers face. When the risk has been determined to be mitigated by sufficient distance, the mask moves away from the wearers face.

As an additional precaution to protect the user in a chaotic world, the mask defaults to a closed position when the user walks for more than a few steps so that acute exposure can be prevented by quick moving persons during motion.

Brief Market Analysis

The MASC is designed to attract customers who want to only wear a mask when needed to avoid exposure to covid-19, or other airborne diseases. Certain persons such as nurses, and doctors will also be an intended target audience for the product as they will need it to make sure that they have worn a mask at the times when needed.

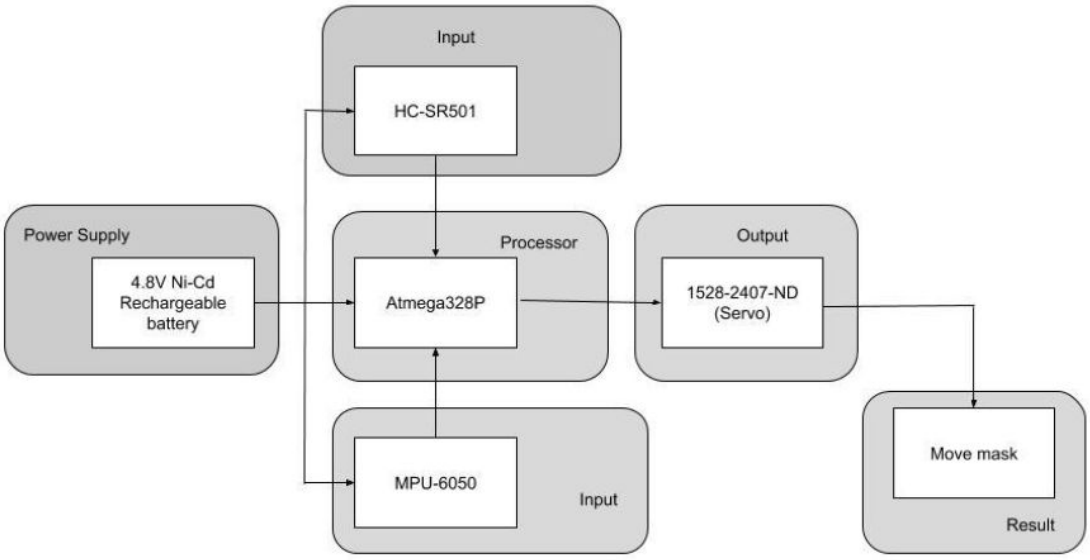
The competition is any products that help prevent exposure to covid-19. In particular, and the most common competition is any mask products as they are the most common item used to avoid exposure to covid-19 and other airborne illness. The mask product that will be produced has it's advantage of automatically closing and opening based on it's detection of possible airborne diseases nearby. This advantage will be used to take consumers who dislike wearing a mask when it's not necessary to do so.

The price for this product will depend on the price of the parts needed to create the product. A strong price to keep the product competitive is $20. This will ensure that customers won't be lured away from purchasing the product because of a large price tag, and it'll be cheap enough to make a decent profit.

Requirements

The mask must be able to detect when it needs to close to prevent the user contracting any airborne diseases. The mask will be able to detect it based on the distance of the user to another human, in which the mask will close upon close proximity to someone else. The mask must close when the user is walking. The mask must open when nobody is near them. The mask must be a portable device that can fit on the user's face. The mask must be as lightweight as possible and comfortable on the wearer's head. The mask must allow the user to breathe.

System Architecture



Design Specification

The unit will operate off of a Atmega328P that has been pre-loaded with the Arduino bootloader, which will be the IDE in the development.

This controller will utilize passive infrared detectors (HC-SR501) to tell if a person moves into proximity of the unit and an accelerometer (MPU-6050) to determine whether or not the wearer is in motion.

The sensors and microcontroller will be powered through a single 4.8V Ni-Cd rechargeable battery bank.

The motion of the shield itself is done through a continuous rotation servo (Adafruit PRODUCT ID: 3614) that is controlled via pulse-width modulation from the Atmega328P through an H-bridge circuit to be powered through a multi-cell battery pack (AA or C).

Prototyping will be done to determine the best means of motion for the mask. Types under consideration:

- O Split mask than opens/closes in both directions
- O Above-the-head mask that lowers/rises