

Product Design Specification

Social Distancing Device

Version 1.01

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1 - Executive Summary

The social distancing device is a system to monitor and notify the user if they are in close vicinity with another person who doesn't meet the CDC regulated 6' of distance (or about two arm lengths) between others and themselves. The CDC advises that it is important to stay at least 6 feet away from other people when going out in public and wear a mask to slow the spread of COVID-19. Therefore, this device is designed to be used by the general public when running errands or at work. The main purpose of this device is to prevent the potential spread of COVID-19 by keeping people aware of their surroundings.

The social distancing device will be worn around a person's waist or as an attachment to their shirt. This device will constantly monitor when another person enters a 6' radius to the users. Once this condition has been met, it'll initially notify the user through a flashing LED sequence. However, if a person comes within close-quarters contact of 2', then the social distancing belt will send an auditory alert to the user that they have failed CDC social distancing regulations. There will be only two inputs that the user has to control for the functionality of this device. There will be an on/off pushbutton press to start or stop the device and a dial (potentiometer) to control the auditory alert volume.

2 - Market Analysis

Intended Customers: The general population, especially for people with active lifestyles. The current COVID-19 pandemic has drastically altered how the general population conducts and lives their daily lives. Therefore, it's imperative that our device allows the people an opportunity to regain some of their normalcy, while being socially responsible when running errands or at work.

Market Research:

After conducting research on similar devices available on the market, there are several devices available to purchase currently on the market or are still patent pending. However, the biggest difference is that these devices are designed for employers to disseminate the product amongst their workforce. These devices are linked by proprietary ultra wideband (UWB) technology to conduct contact tracing to determine the distance between workers. This setup can be viewed from devices like Safe Spacer by IK Multimedia and eqWave by Equivital Limited. Most of these devices are around \$100 per wearable unit to purchase.

However, we want to build a simple solution to the current pandemic by constructing a wearable device that measures the distance of another person without the need for these devices to be linked to another. This allows the freedom for everyone to buy one of their own choosing that will operate regardless of another device.

Estimated Cost: While the prospective cost of the social distancing device is subject to change as requirements and design specifications change throughout the design process. Currently, the prospective cost will be around \$35 to cover the cost of components, assembly, and potential profitability of the product.

3 - Requirements

Must:

- Must accurately detect objects within a 6' distance at a waist height of the use.
- Must notify the user if they're not meeting regulated social distancing standards
- Must be wearable and portable on the user.
- Must have some protective shell/casing for the circuitry of the device.

Should:

- Should have circuitry soldered to perfboard (PCB preferably).
- Should have a decent battery life.
- Should have an on/off switch for the system.
- Should have some sort of LED indicator.
- Should have volume control if using auditory alerts.
- Should be detachable from either the belt or from the user's shirt.

May:

- May be water-proof.
- May be resistant to impact.
- May have WiFi/Bluetooth capabilities.
- May have some form of contact tracing.

4 - System Architecture

Level 1 Block Diagram for Social Distancing Device

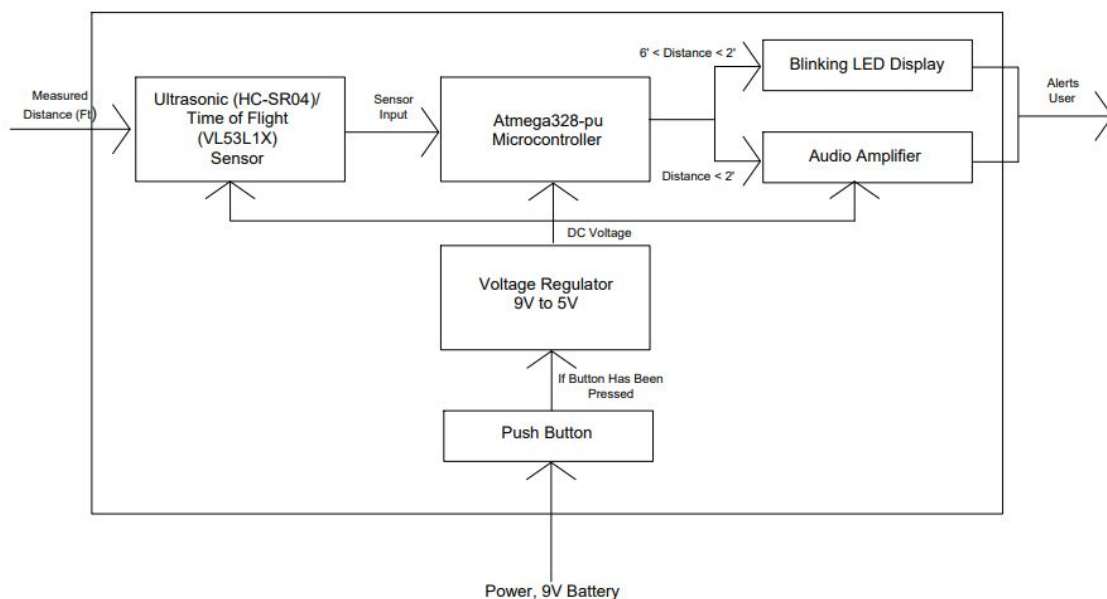


Figure 1: Proposed Block Diagram for System (Version 1.01)

Note: The contactless temperature sensor (MLX90614) wasn't added to the block diagram, because of the uncertainty with feasibility in our design. This diagram will be revised through sensor testing.

5 - Design Specification

Functionality: The Social Distancing Device will measure the distance of another person entering an enclosed distance of 6' to the user. This condition will be determined by several sensors. We're projecting to utilize either an ultrasonic or Time of Flight (ToF) sensor to accurately measure and check the distance from the user to the object, while having a contactless temperature sensor to measure the ambient temperature to determine whether this object is either a person or an inanimate object. If both conditions are met then the device will either have a flashing LED pattern to alert the user if the person is less than 6' away from the user. If the distance reaches less than 2' the social distancing device will send an auditory alert stating that the user is in dangerous contact with another person. This device will constantly monitor and verify these conditions, while the user runs errands or conduct business throughout their day.

Processor: Atmega328-pu

Sensors: Time of Flight (ToF) or Ultrasonic sensors to monitor the distance between the user and another object. Contactless Temperature Sensor (MLX90614) to measure the ambient temperature from another person to distinguish a person within the 6' radius rather than an inanimate object. Currently the contactless temperature sensor wasn't provided into the Block 1 diagram, because feasibility testing is still occurring before finalizing it into the design.

Actuators: LED Sequence and LM386 Audio Amplifier.

Power Supply: A battery (preferably 9V).

- The design will have a belt as the foundation with sensors strategically placed around the belt. The belt will have enclosures where the processor and sensors reside. This enclosure may be detachable
- The firmware will be the Arduino bootloader.
- The IDE used will be the Arduino IDE aka "processing"