Vehicle Fever Detection System

ECE 445 Design Document

Team 67 - Rahul Rajkumar, Vinayak Dhanawade, Vishnu Rathnam

ECE 445 Project Proposal - Spring 2021

TA: Dean Biskup

Introduction:

Objective:

A problem that is frequently encountered due to the COVID 19 pandemic is that of spread through rideshare services such as Uber and Taxis. Our solution to this problem is to implement a system that can be mounted on the interior door of vehicles that extends an MLX90614 IR thermometer [7] out the window to check riders temperatures before they enter the vehicle. The arm to extend the thermometer will be activated by an ultrasonic sensor which will detect when the window has rolled down enough to safely extend the thermometer. The system will then alert the driver via a digital display as to whether the current passenger has a fever and give the specific temperature. The driver can then decide on a plan of action with this information in order to effectively limit the spread of COVID 19 and ensure both their safety and that of future passengers. This system also has applications in the future after the pandemic in that drivers can choose whether to accept riders that are sick in general based on if they have a fever, a common flu symptom.

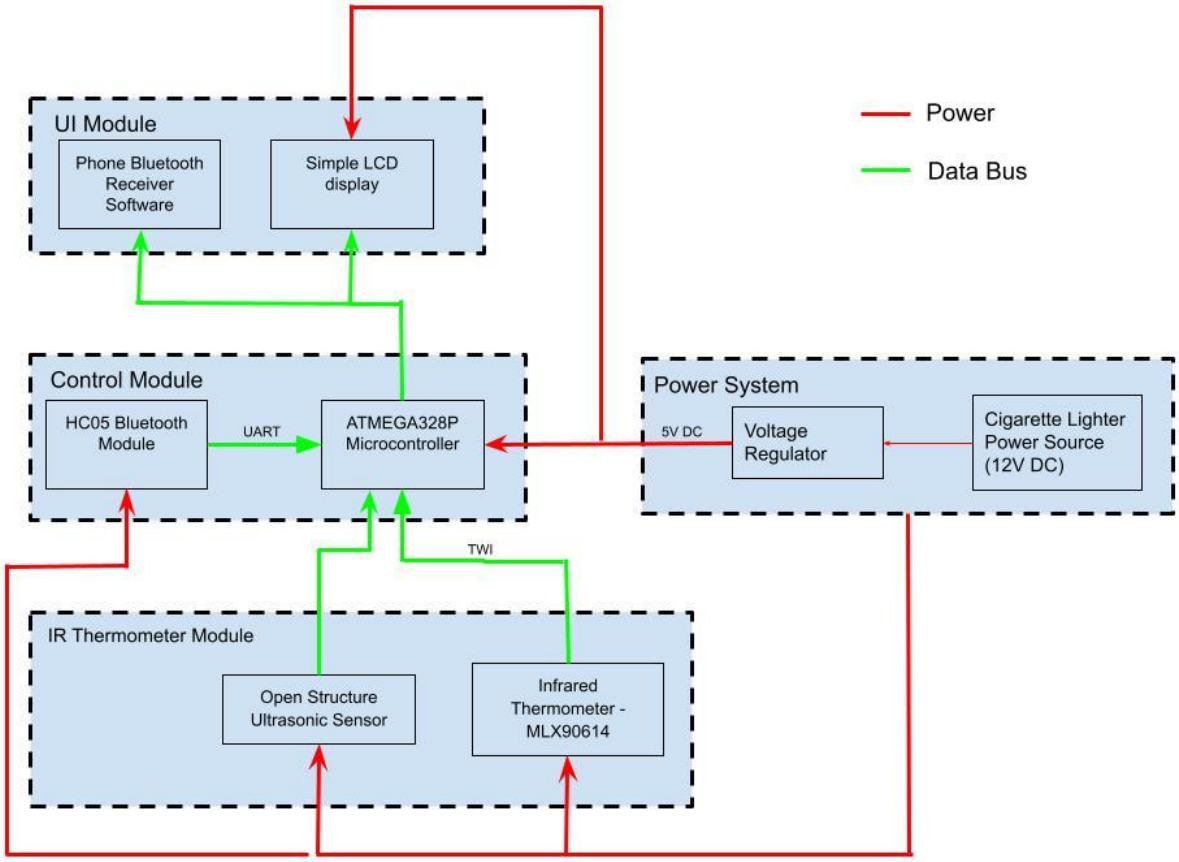
Background:

The issue of COVID 19 being transmitted through rideshare and taxi services is pressing due to the fact that the drivers and patrons are put at a high risk of transmitting COVID 19 by being in close proximity to others in an enclosed space. This is exacerbated by the users having to touch surfaces that are frequently used and touched by many others. While masks suffice to prevent spread in open spaces, their effectiveness is severely limited in an enclosed space with limited ventilation like a car. According to a study by the Norweigan Institute of Public Health [1], Taxi and Rideshare drivers are among the highest risk groups for getting COVID 19 due to their constant proximity to many different people every day. Since this risk is so high we hope our solution will provide both those drivers and the passengers that interact with them a higher level of safety than that of simply wearing a mask.

High Level Requirements:

- The ultrasonic sensor operating the arm that will reach out will detect when the window has fully rolled down and trigger the activation of the arm to reach out the thermometer
- The readings must be at least 90% accurate with a +/- .5 degree celsius variance and provide info to the driver on the display on whether the passenger is at a dangerous temperature (above 37.5° C as defined by the national institute for health research [2]) for various infrared thermometers. The display must be positioned in a way that it is not obstructive to the driver while driving but still easy to see so that the driver can take a quick and effective plan of action
- The entire system should be able to function on the cars internal 12 Volt DC power supply through a 5 Volt usb converter

Block Diagram :



RV Tables:

Requirement	Verification
1. Ultrasonic sensor detects when a window is rolled down.	1. Roll down a window in front of the sensor and measure reading to check if the window being rolled down is detected.

Requirement	Verification
2. Can measure temperature with at least 90% accuracy with +/- 2 degree celsius variance	2a. Take various temperature measurements with both IR thermometer and traditional armpit thermometer 2b. Measure temperatures and compare variance

Requirement	Verification
3. System should output no more than 5V	3. Measure output voltage to make sure it is below 5V

Tolerance Analysis:

The biggest risk is accuracy of the thermometer. If the thermometer we use is not accurate, we will not be able to judge the validity of whether or not someone has COVID-19. We will need to pick a thermometer that is not only accurate but also also extremely durable since it has to travel at high speeds and withstand multiple weather conditions due to it being attached to the outside of the car. In order to further reduce the risk of a false negative reading, we will use a classifier to determine a temperature limit that will be the best to reduce risk of COVID-19.

Ethics and Safety:

In order to follow all of the Code of Ethics as determined by the IEEE [3], we will not identify a specific individual with their temperature results and will not store any temperature data. Also, we will disclose to the patient that their temperature results will be shared with the driver but not stored or shared with anyone else. All our wiring will be enclosed in insulation and routed safely throughout the vehicle, preventing any entanglement, static hazards, or loose/hazardous electrical connections. Our unit will also be stress tested for durability and will be able to withstand travelling at high speeds without detaching from the car door and being a potential debris hazard. All this combined ensures that we will be following all ethical and safety guidelines set by OSHA [4].

References:

[1] Norweigan Institute of Public Health, 'More COVID-19 in some occupational groups' 2020 [Online]. Available: https://www.fhi.no/en/news/2020/more-covid-19-in-some-occupational-groups/

[2] National Institute for Health Research, 'Non-contact infrared thermometers' 2013 [Online]. Available: https://www.community.healthcare.mic.nihr.ac.uk/reports-and-resources/horizon-scanning-reports/hs-report-0025#:~:text=Two%20studies%20defined%20fever%20as,%2Dglass%20thermometer%20(17).

[3] IEEE code of ethics. (n.d.). 2021 [Online] Available: https://www.ieee.org/about/corporate/governance/p7-8.html

[4] Department of Labor logo United Statesdepartment of labor. (n.d.).2021 [Online] Available: https://www.osha.gov/laws-regs

[5] Murata, ‘Basic knowledge about ultrasonic sensors: Features of each type of ultrasonic sensor’ 2014 [Online]. Available: https://www.murata.com/en-us/products/sensor/ultrasonic/library/basic/feature

[6] EDGEFX, ‘How Bluetooth Module Interfacing with Microcontrollers’ 2017 [Online]. Available: https://www.edgefxkits.com/blog/interfacing-hc-05-bluetooth-module-with-microcontroller/#:~:text=The%20microcontroller%20can%20communicate%20with,information%20to%20other%20Bluetooth%20devices.

[7] Sparkfun, ‘Infrared Thermometer - MLX90614’ 2015 [Online]. Available: https://www.sparkfun.com/products/9570