Vehicle Fever Detection System

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Introduction:

Objective:

A problem that is frequently encountered due to the COVID 19 pandemic is that of spread through rideshare services such as Uber as well as Taxis. Our solution to this problem is to implement a system that can be mounted on the interior door of vehicles that extends an IR thermometer out the window to check riders temperatures before they enter the vehicle. The system will then alert the driver via a digital display as to whether the current passenger has a fever or not 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 or not to accept riders that are sick in general based on whether or not they have a fever, a common flu symptom.

Background:

The primary issue with covid being transmitted through rideshare and taxi services is pressing due to the fact that rideshare/taxi driver and patrons are put at a high risk of transmitting COVID 19 by being in close proximity to others in an enclosed space as well as by touching 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 this study by the Norweigan Institute of Public Health 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.

Physical Design:

The physical design of our system will consist of an IR thermometer mounted to an external fixture on the rear window opposite the driver in rideshare and taxi vehicles that is connected through wiring to the ATMEGA microcontroller as well as a display that will be positioned towards the driver near where navigational information is generally displayed. The wiring will run along the sides of the seats of the vehicle and will be easily hidden and will be implemented in a way such that the cars other functionalities are not hampered to any significant degree. The display will notify the driver if the passenger's temperature is abnormal.

High Level Requirements:

- The thermometer must be able to accurately measure the temperature of the passenger without any obstruction regardless of the weather conditions and the thermometer must be positioned in a location that is both easy to access for the passenger and shielded from weather conditions such as snow and rain.
- The readings must be accurate on a single reading and provide accurate info to the driver on the display on whether the passenger is at a dangerous temperature or not. 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 must be integrated into the car without any loss of the functionality of the car itself such as seat adjustments, doors and windows opening and/or closing, or navigation attachments. The external attachments should also be non extrusive to the point where it will not result in accidental collisions with walls and other objects while driving.

Design:

Block Diagram:

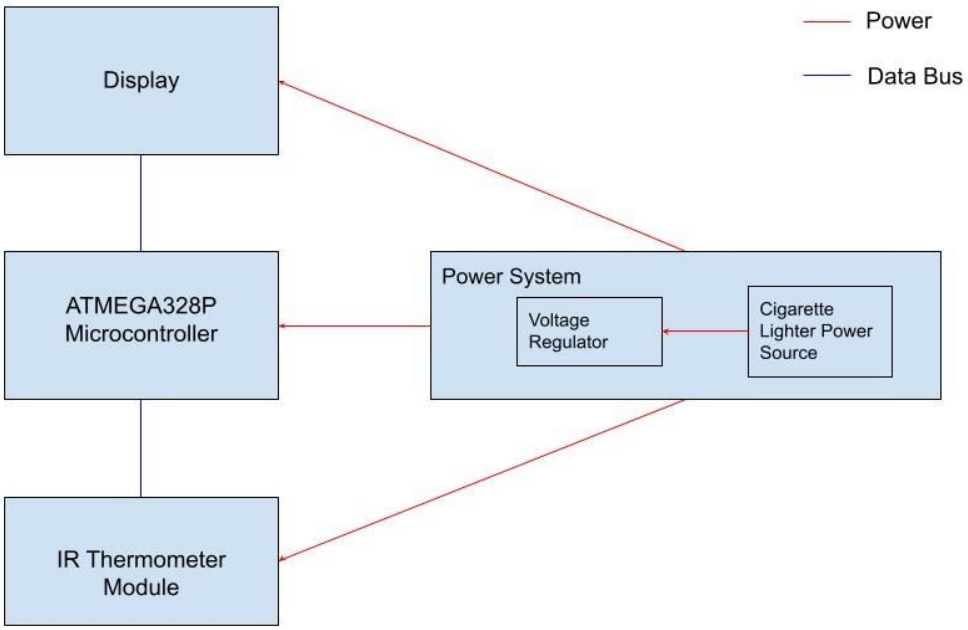

Figure 1 : Overall System Block Diagram

Functional Overview:

Power System :

The power system of our project consists of two components, the cigarette lighter power source from the car, and the voltage regulator. The power source will be 12V DC, and this power will be delivered to the voltage regulator. The voltage regulator will bring this output voltage down to a manageable level and will route the power to the other components of our system. That is, it will power the display, microcontroller module, and IT thermometer module.

Requirement 1 : Must be able to deliver a stable and safe voltage to all three components.

Requirement 2 : Must maintain a safe and isolated temperature in delivery of power in order to keep driver and passenger safe.

Display Unit :

The overall system must be able to deliver accurate results from the microcontroller module to the driver. These results must be delivered in the form of LEDs which represent the suggested course of action for the driver. The display unit will be somewhat minimal but will still convey the necessary information to the driver.

Requirement : Must be able to accurately inform the driver with necessary information such as the temperature of the potential passenger, and the recommended course of action via LEDs.

IR Thermometer Module :

The thermometer module will contain one IR thermometer that will read the potential passenger's temperature and send that data to the microcontroller.

Requirement : The thermometer must accurately measure the passenger's temperature.

Requirement : The thermometer module must accurately send the temperature data to the microcontroller module for processing.

Microcontroller Module :

This module will house the ATMEGA328P microcontroller that will process the data from the thermometer and produce results to be displayed on the display unit for the driver. The microcontroller module overall servers as a middle man, as well as the core processing unit for the overall system. It links all three main components of the system.

Requirement 1 : Must determine if the temperature received from the thermometer is out of range and/or valid.

Requirement 2 : Must communicate results with display unit to inform driver.

Risk 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 Naive Bayes 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, 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.