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Designing Covid Risk Monitor

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Project Description

The idea of this project is to design an IoT device that monitors a user's covid risk level based on their daily activities and interactions. This device will make it easier for users to abide by the Public Health covid-19 guidelines and prevent rapid growth of covid-19 cases. The device will detect other humans through their emitted energy (electromagnetic radiation) and read their temperature. We also keep track of their distance (at least two meters) with our user. This device will also keep track of the user's location,which will allow the user to see who they might have been in contact with. This way if one user tests positive, we can alert other users who were at the same location about a potential exposure to covid-19. Taking into account all the data gathered through the day, the user will be notified of their risk level or get an exposure warning.

Goal/purpose of the design

This device is designed to help everyone affected by covid in the workplace, especially those with a higher risk of severe symptoms and higher risk of exposure such as frontline workers.

Sensors

The Covid Risk monitoring device will be wearable and include three sensors. These sensors are a proximity sensor, temperature sensor and location sensor.

Proximity sensor

A proximity sensor is a non-contact sensor that detects objects when it enters the sensor's field of range. Although there are many different types of proximity sensors, the two most commonly used ones are an inductive proximity sensor and capacitive proximity sensor. Inductive proximity sensors detect the proximity of metal targets to an inductive coil sensor, whereas capacitive proximity sensors detect the change in capacitance between a sensor and an electrode (detect disruption to electrical field).

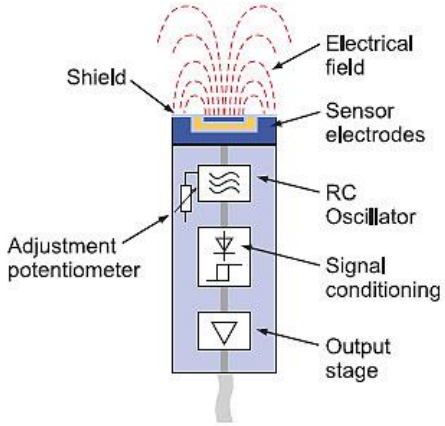

Figure 1. Internal construction of a capacitive proximity sensor

Since our covid risk monitor will be used to monitor humans, it only makes sense for us to use a capacitive proximity sensor as humans carry an electric charge that would disrupt the electrical field emitted from the sensor. For our covid risk monitor, the capacitive proximity sensor will be used to detect the position of a person. If the user is too close to another person, the sensor will warn them.

Figure 2. Capacitive proximity sensor

Temperature sensor (PIR)

Since our Covid risk monitoring device will detect other humans through their emitted energy (electromagnetic radiation), the type of temperature sensor we need to use is a Passive Infrared (PIR) sensor. A PIR sensor measures infrared (IR) light radiating from objects in its field of view.

Figure 3. PIR sensor detecting objects in its field of view

The term passive refers to the fact that PIR devices do not radiate energy themselves for detection purposes. Thus, when another person enters the PIR sensor's field of view, they will be detected.

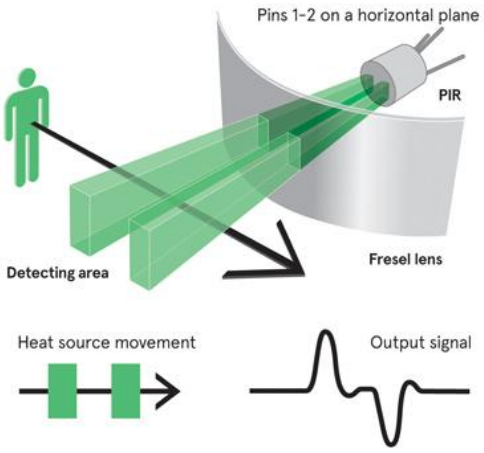

Figure 4. How a PIR sensor works

Location sensor (GPS)

In order for our Covid risk monitoring device to keep track of the user's location and allow us to see who they might have been in contact with, a GPS sensor is required. GPS sensors are receivers with antennas that use a satellite-based navigation system with a network of satellites in orbit all around the earth. These satellites send signals to the GPS sensors (receivers) to provide position.

Figure 5. GPS sensor module

Block Diagram of the System

For this product we are using raspberry pi and reading the data through Microsoft Azure Cloud platform.

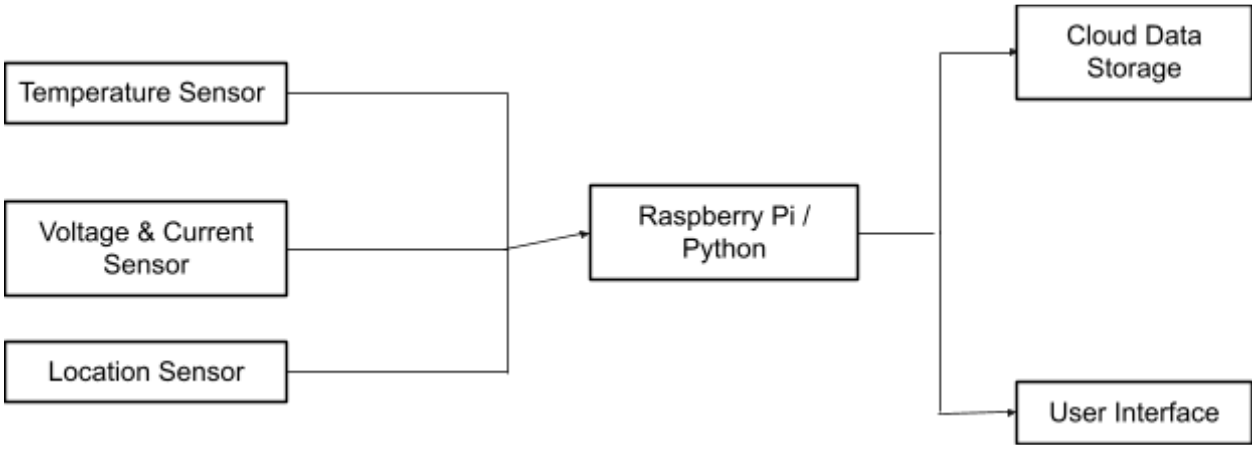

Figure 6. Block diagram of the covid risk monitoring device

Raspberry Pi

Once the sensors have collected the data, it is sent to the cloud through the Raspberry Pi. Raspberry Pi acts as a gateway and sends the collected data to Event Hub. Azure Event Hub is the big data streaming service of Azure. It is designed for high throughput data streaming scenarios where customers may send billions of requests per day. Once the data has entered the Event Hub, the Event Grid is then triggered which will perform a function to let us know that

there is new data available. Azure Stream analytics is used to read the data live and potentially store it in a Blob Storage. We then use Power BI which is a data visualization software to display the data for users. If we have enough time we will use a web socket to build a web application. The web application will use .NET core as it's back-end framework and AngularJs as it's front-end framework. The front-end and back-end will communicate through REST Api.

Uploading Data to the Cloud

While IoT devices can generate significant amounts of data per second, cloud computing paves the way for this data to travel. The data that is uploaded to the cloud is stored and can be accessed remotely at any time. When it comes to data our IoT device will upload to the cloud using the Microsoft Azure portal, it is vital that this information can be stored and accessed at any time so that if somebody in our database has covid we can utilize our device's features. If somebody were to test positive for covid and they're data was already stored in the cloud, it would be easy to access it and determine their last location. In turn, this would allow us to notify other people that may have come in contact with that specific person through a web application.