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# A Smart Wearable Platform for COVID Monitoring

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***Abstract*— The world is currently underprepared to deal with viral pandemics such as COVID-19 in many aspects, but we are improving. The use of face masks and other wearable devices has become the new normal to reduce spread of the coronavirus, with the help of technology we open a new world of improving prevention and health monitoring. Our platform focuses on temperature detection and monitoring with low power, compact-ness, at a small cost to mass produce. This device is designed with its own custom PCB, with capabilities to be easily manipulated, changed, and improved. Lastly the addition of a motion data acquisition device was installed for person to person contact tracing via Bluetooth Low Energy Communication system. In this paper, we developed an affordable platform that allows for smart contact tracing that can be used for multipurpose data collection. This data will be used for contact tracing, temperature logs, and many more applications that break into this new field and allows for future improvements.**

## I. Temperature Logging Hardware Design

Patients' temperature sensing is a key in our wearable platform design with the thermopile we selected in terms of power but accuracy too. Calibration steps were performed to validate the direct comparison between measured voltage and actual temperature to calculate the error to further improve using our software error compensation for final stages of the thermopile for improvements.

In addition to the thermopile on our sensor ZTP-148SR, we have a thermistor connected that we can use for the ambient temperature sensing for data collection [1]. Final circuit design is shown in Fig 1. in the PCB design.

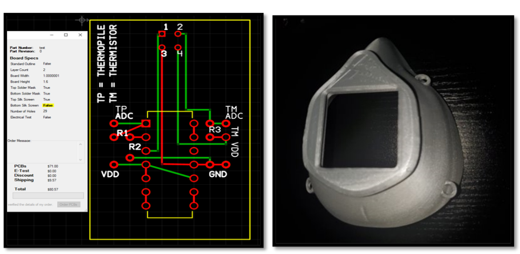


Figure 1. Printed Circuit Board (PCB) design and Casing Mockup

## II. Bluetooth Motion Data Collection

We built sensor tile that is split into two pieces a cradle and the sensor tile for transmitting motion data to IoT routers with time stamping. The data acquisition via Bluetooth communication to an external device that can further be used for monitoring or other uses of the location data received. Specifically, we collected acceleration data in units of milli-g for better map the person's indoor locations. Using this data for example, contact tracing on campus, offices or in hospitals, IoT type system [2][3].

We integrated all parts into a prototype face mask casing for our device. We found that the best way to approach this was to start with 3D printing as the base. The prototype in Fig. 2 is cheap and the 3D printer made the whole mask with less than 3 dollars of PLA type of filament [5].

The price estimated above includes the prices of both microcontrollers used to start and to finish, alongside thermistor/thermopile, resistors, capacitors, the op amp, 3D printed mask and lastly the battery.

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## III. Contact Tracing System Design

We designed an automatic contact tracing system while preserving users' privacy on University campus setting. First of all, we took a decentralized approach for contact tracing similar to DP-3T [4]. Infected users can communicate with IoT routers available on campus by sharing their pseudonym. Campus users can check there to see if they had encountered them by checking the published pseudonym list. We took this approach to process the automatic contact tracing due to the privacy concerns. The local IoT servers cannot backtrack published names against infected users on the list.

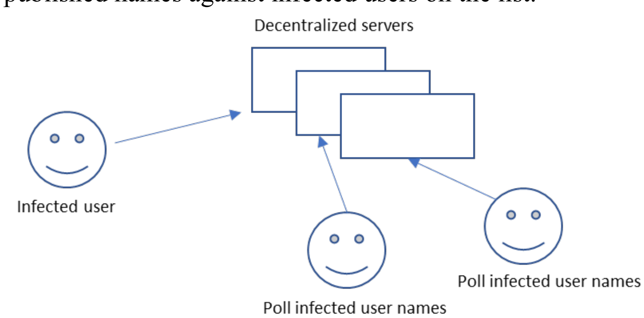


Figure 2. Overall system

## References

[1] Thermopile datasheet, https://www.mouser.com/catalog/specsheets/Amphenol_Specification%20sheet%20of%20ZTP-148SRC1_REV0.pdf, 2021
[2] "Apple: Privacy-Preserving Contact Tracing."
[3] "Google Exposure Notifications: Using technology to help public health
[4] C. Troncoso et al., "Decentralized Privacy-Preserving Proximity Tracing," 2020, accessed: 02. December 2020. [Online]. Available: www.github.com/DP-3T/documents
[5] https://www.dynamism.com/