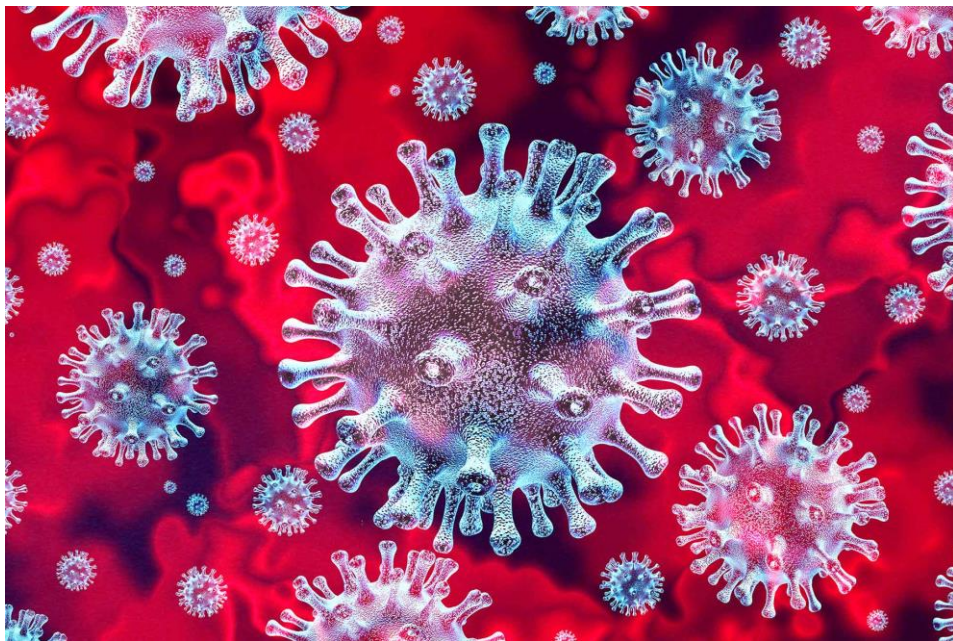# Review Open call 8 COVID: Containment of Outbreaks of Virulent Infectious Diseases

MRI LIMITED

CityLab (imec)

FEC8

Nov 20, 2020

The Concept

- ➢ The latest existential threat coming from Covid-19 pandemic has shaken the world.

- ➢ Covid-19 fallout is impacting every aspect of our lives — social, economic, and financial.

- ➢ Governments around the world are trying to come to terms with this crisis.

- ➢ There are other known pathogens out there with much higher infectivity.

- ➢ The existential threat to mankind from these nano-sized enemies lurking somewhere is real.

"World is always at a risk of such potential apocalyptic global event that could potentially pose existential threat to the mankind"

COVID

GDPR Compliant
Decentralized
Blockchain Security

Contact Proximity
(Anonymous)

Travel Advisory

Citizen Status
(Anonymous)
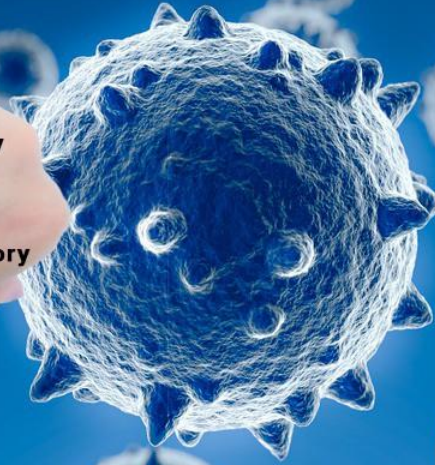
COVID

World's First Wearable Device to Shield Humanity from Any Potential Existential Threat from Deadly Pathogens

COVID Smartwatch

1. AI-powered and Blockchain secured smart watch design.
2. GDPR compliant.
3. 24/7 BLE5 mesh-networking connectivity for always-on real time. anonymous surveillance of several vital health parameters.
4. Integrated with sensors to monitor Covid-19 symptoms (body temperature, blood oxygen, blood pressure, pulse, sleep pattern etc. and also with high end sensors for monitoring ECG.
5. Autonomously / anonymously monitor and detect the earliest signs of an outbreak.
6. Privacy-preserving containment measures via screening, contact tracing, quarantine, social-distancing, mobility restrictions.
7. Autonomously and seamlessly screen citizenry for any morbidity risk at the entry point to spaces housing significant human congregation.
8. Ensures easy monitoring for concerned authorities.
9. Designed to alleviate future epidemic / pandemic possibilities along with the current COVID-19 pandemic..
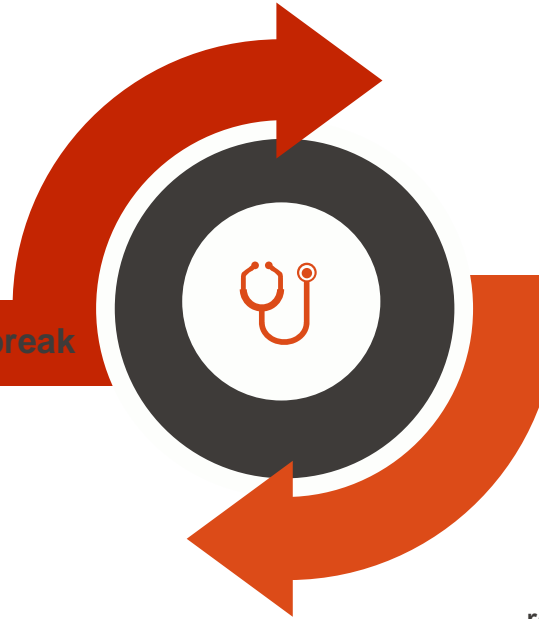
COVID: Functions

Deployment of big data analysis by AI-powered neural network that builds on a data input matrix and delivers alerts that can avert future epidemic breakdown

Deployment of BLE mesh networking modules capable of interacting with the adjacent peers in the most secured and anonymous way.

Early detection of potential epidemic outbreak

Disease containment measures

The input matrix takes feed from diverse sources such as climate forecasts, environmental observation, sentinel animals / health facilities, early cases, outbreak, on-going epidemic and even contact tracing in evolved pandemic

Feeding additional patient surveillance data to the network through real time monitoring of user's health status via optical sensor (SpO2), thermal sensors, Additional optical sensors for BP, pulse rate, ECG, etc. Also, GPS and G sensors for contact tracing, social distancing and enforcing quarantine

Primary Objectives of the Experiment

BLE5 Mesh-Network

➢ COVID, with an always on BLE-5mesh-networking connectivity, anonymously monitors user's proximity to any potential infectivity risk to the user or to the community at large.

➢ Its mobility advisory feature autonomously alerts the user of any morbidity risk in vicinity or in a destination location.

➢ COVID can be autonomously scanned at COVID Check Point (CCP) that act as gatekeeper to human mobility in areas of significant human congregation, like airports, malls, cinema halls, trains, buses, cross-border travel, etc. & are autonomously regulated by concerned authorities.

➢ The primary aim of the experiment was to test the BLE meshnetworking abilities of COVID smartwatch.

Experiment Set Up

The primary work plan of the experiment comprised of;

➢ Deploying and testing data connectivity / transmission in COVID devices (smart watch) in a simulated BLE-5 mesh-networking environment powered by a network of BLE-4 nodes of the City of Things testbed – CoT testbed.

➢ Select at least 1 of the CoT nodes as COVID Check Point (CCP) node simulating the real world check-in points/stations/walkthroughs to authorize passage to a high footfall surveillance areas.

➢ Simulating the CCP node to autonomously and seamlessly read the COVID device for health status (Red, Yellow or Green) and accordingly either authorize the passage or advise the user and concerned authorities regarding any infirmity detected.

➢ The recent restrictions imposed by COVID-19 compelled us to conduct the BLE meshnetworking experiment remotely under the supervision of the CoT testbed by simulating mobile phones to behave as a COVID smartwatch and installing our meshnetworking application over the devices to create a BLE5 mesh-network that propagates data across devices.

Experiment Set Up

To conduct the experiment in the simulated BLE meshnetworking environment we developed;

1. an algorithm that calculates users health status based on his/her vitals such as temperature, heart rate, blood oxygen and blood pressure.

2. an android mobile application with BLE meshnetworking protocol that enables sending and retrieving user health information in a private and secure manner when users come in Bluetooth vicinity of one another.

3. a mechanism that alerts the user as per the health status of the close contacts in the Bluetooth vicinity.

Experiment Results & Conclusion

➢ The protocol ensures the continuous data sharing between the peers using BLE meshnetworking as and when the devices come in close vicinity of one another.

➢ The BLE meshnetworking enabled mobile application also provided users with the information on his/her contact with the other peers which justifies and ensures the contact tracing of the person, if found to be in close vicinity with the person with suspected or infected health status.

➢ The experiment thus justifies the simulated case of BLE meshnetworking for data transmission in a secured manner without the use of any other means of communication in the controlled atmosphere using the BLE meshnetworking script installed over the mobile phone.

Business Impact
Initial Project Funding & Functionality Testing

➢ COVID-19 situuation posed an urgent need for a technology with the disease containment capabilities.

➢ Most of the solutions projected to tackle this COVID-19 situation were based on contact tracing using BLE proximity applications.

➢ Our solution goes beyond the state of the and utilizes BLE meshnetworking to ensure uninterrupted and secured data sharing between the peers.

➢ The novel concept required an initial funding push to be introduced to the market.

➢ Fed4fire not only offers novel testing facilities but also the initial funding and hence there could not be a better platform for us to proceed with project COVID.

➢ Secondly, COVID aims to ensure data sharing in a continuous manner and hence making the device robust enough to ensure the always-on connectivity with the peers is the most important aspect to achieve the intended goal.

➢ The successful integration and testing of Bluetooth Mesh-networking module in the current variant of COVID has enhanced the robustness of the system communication.

Business Impact:
Forming a base for other H2020 proposals

➢ Validation of core concept of COVID BLE meshnetworking has already culminated into massive support from other researchers and academic peers.

➢ Company has entered into several collaborative agreements with partner organizations for deploying variants of COVID device technology.

➢ Support from over 35+ EU cross industry partners.

➢ COVID concept that originated as a novel wearable device for COVID-19 containment, formed a solid base for our other H2020 projects:

    1. **MOONSHOT**: Future First Responder Operating System (FROS) technology

    2. **CLINTOS** : A prototype for EU's ambitious Trials@Home project defining the future of

        clinical trials as Remote Decentralized Clinical Trial (RDCT)

    3. **SMS**: A versatile, future-ready, user-centric, privacy-preserving wearable device that

        stops preventable Acute Coronary Syndrome (ACS) deaths

Business Impact:
A much required push for early market entry

➢ There's an urgency to introduce COVID to avoid restrictive lockdowns and enable safe human mobility within dense public spaces and hence the immediate plan of the company is to launch COVID smart watch in crowdfunding campaigns.

➢ Company plans to quickly launch a pre-sale crowdfunding campaign before starting a large-scale production.

➢ Once the significant numbers of pre orders are generated, company plans to launch the first iteration of the device on crowdfunding platforms like Kickstarter or Indiegogo.

➢ Successful testing & validation of the core functionality of the device has helped us getting a step closer in achieving this milestone.

Business Impact:
Getting a step closer in realising the ultimate goal

➢ COVID team believes that the aftermath of Covid-19 pandemic will create a new mobility standard for saving humanity from the impending existential threats from dangerous pathogens.

➢ The primary aim of the COVID project is to develop, test and introduce into the market a versatile wearable device that may eventually become a standard possession for every citizens.

➢ The company ultimately aims to project COVID as a new standard for cross border travel on the lines of health passport.

➢ The initial funding from fed4fire ensured the wider recognition of the technology not only in the EU domain but also among the other industry stakeholders and government authorities.

Feedback

- Fed4Fire+ affiliate facilities are state-of-the-art and a boon for SMEs that mostly don't have such infrastructure in-house to test and validate their research.

- The testbed resources available are really advanced and can be accessed 24*7.

- BLE meshnetworking, being the core functionality of the COVID device, needed to be tested on a regular basis before concluding on a final protocol.

- Fed4fire, offering these testing tools in a remotest possible way has turned out really beneficial for the project COVID.

- The current test protocol requires Bluetooth low energy (BLE4) or higher modules located at specific distance to determine the efficacy of BLE-5 mesh-networking and thus restricting the device movement to the marked vicinity depending on the health risk stratification protocol.

- We found City Of Things (Citylabs) to be the most appropriate for this purpose.

Feedback
Testbed

- City of Things testbed is located in the centre of the city and the static hardware housings entailing the WiFi and BLE modules are spread around an area of about 0.5km by 0.5km.

- Testbed has BLE4 modules located at static locations and also the WiFi nodes to optimise the location accuracy of the devices factored in during the triangulation process.

- The nodes were flexible enough to be programmed as per our BLE meshnetworking script.

- One of the CoT testbed nodes could simulate a COVID Check Point (CPP) station and monitor the mobility of the COVID devices.

- The best part of conducting experiment with Citylabs resources is that the testing facilities can be customised easily as per the need of the experiment.

Feedback
FED4fire

- We found Fed4Fire+ one of the most valuable programmes within the H2020 framework, particularly for SMEs working in the field of IoT and wireless networking.

- No sooner the preliminary test results were available for COVID experiments, we were able to attract leading research teams across Europe to build at least three consortia based on COVID BLE meshnetworking concept.

- The successful completion of stage 1 experiment has not only helped us gain the wider visibility in the EU domain but also helped us receive the initial funding necessary for any business to flourish.

- Company aims to extend this association with Fed4fire by submitting the COVID proposal for the upcoming stage 2 call and conducting a small scale field trial with the City Of Things testbed to ensure the smooth entry into the market.

THANKS FOR YOUR ATTENTION!

WWW.FED4FIRE.EU