

CONTACT TRACING AND SOCIAL DISTANCING DEVICE

Technical Field

The present invention relates to a device and methods thereof for searching, sensing, discovering, screening, enabling awareness, alerting, sharing, sending, receiving, and transmitting information amongst known and/or unknown devices in a communication network, especially when used as part of a disease control strategy.

Background

Contact tracing is an effective disease control strategy that involves firstly, identifying cases and their contacts and then working with them to interrupt the transmission of the disease. This includes asking cases to isolate and contacts to be quarantined. Contact tracing is a key strategy to prevent the further spread of infectious diseases, including the coronavirus disease of 2019 (COVID-19).

Case investigation is the identification and investigation of patients with confirmed and/or the probable diagnoses of infectious diseases. Contact tracing, also termed "contact investigation", is the identification, monitoring, and support of the individuals (contacts) who have been exposed to the patient and possibly infected themselves. This process prevents further transmission of disease by strategically separating people who have (or may have) an infectious disease from people who do not. Further to this, social distancing rules (voluntary or involuntary in form) may be employed or encouraged to the general public at large, or to contacts to stay home and/or maintain a social distance from others (e.g. 1m or more) until 14 days

after their last exposure to the infected patient, in case they too become ill.

Prompt identification, voluntary isolation or quarantine,
5 and monitoring of a person or persons diagnosed with an infectious disease and their contacts can effectively break the chain of disease transmission and prevent further spread of the disease. In essence, case investigation with
10 contact tracing are core disease control measures that have been adopted by state and local health departments for decades to slow or stop the spread of infectious diseases, including COVID-19.

The extent to which case investigation with contact tracing
15 may be successfully implemented however meets with multiple social, economic and technological challenges. First and foremost, the target individual must be willing or possesses sufficient social-consciousness to cooperate with workers tasked with carrying out contact investigation
20 and contact tracing, since personal details related to one's lifestyle has to be made available. Furthermore, such personal details, after being made available, should be subject to a robust data protection framework to ensure the privacy of the target individuals. On the other hand,
25 contact tracing requires staff with adequate training, tactful interpersonal skills, cultural sensitivity, and language and skilled interviewing abilities that will allow them to build and maintain trust with clients and individual contacts. Generally, effort should be made to
30 interview a patient and contacts by telephone, text, or video conference instead of in person. However, this may not be as practical with the less technology-savvy population. Overall, contact tracing is a labour-intensive and onerous process that requires a highly-trained team of

effective communicators who can approach individuals with compassion and build trust.

During the COVID-19 pandemic, health authorities in some countries, including China and Singapore have turned to the adoption and evaluation of digital tools to manage cases or effect contact tracing. Such tools, while deemed able to make the traditional contact tracing process faster and more efficient, inadvertently pose other privacy or technology issues. For instance, the use of electronic device based geolocation tracking can provide an authority with private information relating to the locations where the individual had been to. This occurs regardless of whether an individual is infected, posing an extra cost to privacy. In another example, where public transportation is concerned, an individual should first scan a quick response (QR) code (made available by the public transport provider) to log the details of the journey. However, the use of such QR codes requires an individual to make an actual effort to execute the fundamental step of scanning such a QR code, in addition to the pre-requirement that the individual possesses sufficiently proper access (for instance, in terms of the compatibility of software and/or hardware) to a mobile computing device (e.g. a tablet computer or a mobile phone). In the event that any of these basic requirements are not met, the intended use of such QR codes are then rendered ineffective.

Another digital management scheme which is available involves the issuance of a separate token, a physical device which logs interactive signals (for instance Bluetooth signals originating from between mobile devices) between users of close proximity. Such intended use of the token however, as a pre-requisite also requires one to have

access or sufficient access to a compatible mobile device. Furthermore, the token has to be carried on the individual in addition to an already carried mobile device. This may be considered cumbersome by some people, or may result in
5 a lost token which needs to be replaced.

The device and methods in the current application provide a solution to the difficulties encountered in the use of presently available tools for managing contact tracing.
10 Furthermore, the device and methods in the current application also enable social distancing to be carried out in a seamlessly interactive manner.

In view of the above, the presently disclosed technology
15 is put forth.

Summary

In the first aspect, there is provided a device for use in
20 social distancing and contact tracing, comprising the following components: a protective shield, a chipset, a memory storage module, an indication light module and a source of power. Advantageously, such a device not only acts as personal protective equipment, but also serves the
25 purpose of enabling social distancing and contact tracing to be carried out as part of a disease control strategy.

The indication light module of the device mentioned in the first aspect may be positioned on the chipset.
30 Advantageously, this allows for the possibility of a simpler electronic circuit design for the device.

The memory storage module mentioned in the device of the first aspect may be positioned on the chipset. Advantageously, this discourages a user of the device to easily remove the memory storage module, therefore preventing a potential loss of the memory storage module.

The chipset mentioned in the device of the first aspect may be a microchip. Advantageously, such a microchip can consist of a printed circuit board (PCB) that can be designed and manufactured in an efficient manner. Further advantageously, such a microchip is of a smaller manufactured chipset form and therefore may require lesser design space when integrated with the protective shield in the manufacturing phase to form the device.

The indication light module in the device of the first aspect may comprise of one or more light emitting diodes. Advantageously, such light emitting diodes can each be in the form of a single colour to visually indicate the proximal distance between devices (and generally, also the users of the device).

The source of power in the device of the first aspect may be a battery. Advantageously, such a source of power allows the provision of power to the device in a manner which is safe to the user of the device, for instance, should the device come into contact with an electrically conductive medium such as water.

The chipset in the device of the first aspect and its related variations abovementioned may be reversibly attached to the protective shield of the device.

Advantageously, this allows one to replace the protective shield of the device as it is exposed to wear and tear. Further advantageously, the chipset may be reused.

5 The protective shield in the device of the first aspect and its related variations abovementioned may be a face mask. Advantageously, such a face mask as part of the device can be suited to be worn in an everyday situation in a convenient manner to effect social distancing and contact
10 tracing. Further advantageously, the indication light module as positioned on the face mask provides a clear, and unobstructed view of the indication light module (e.g. LED lights) which serves to provide a visual warning and/or indication of the proximal distances (social distance)
15 between persons during an outbreak of disease.

In a second aspect, there is provided a method of carrying out social distancing and contact tracing comprising the following steps: (i) establishing a network of at least two
20 devices selectable from any of the devices of the first aspect and its variations abovementioned, (ii) initiating signaled contact and recording such a contact between any two devices within the network of the at least two devices mentioned in step (i), and (iii) displaying a
25 representation of the proximal closeness of the any two devices using the indication light modules of the any two devices. Advantageously, the method does not require social distancing ambassadors (i.e., enforcement workers) to ensure that social distancing is observed. Further
30 advantageously, the method of the second aspect allows for the seamless interaction between any of the devices or their variations mentioned under the first aspect, not only resulting in an effective manner of enabling social distancing but further, also providing basic contact

tracing in regard of the interaction of the users of the device.

The method of the second aspect may also further comprise
5 another step:(iv) analyzing the memory storage module of
at least one of the any two devices to retrieve information
relating to the historical proximal closeness between them.
Advantageously, this allows for an authority to procure
data stored on a memory storage module to carry out an
10 analysis of the information found within the data. Further
advantageously, the analyzed data can be used in a manner
which enables the authority to carry out contact tracing.
Yet further advantageously, an individual's virtual
footprint is only known if he or she is infected and has
15 handed over the device to an authority.

In a third aspect, there is provided a method of carrying
out social distancing and contact tracing comprising the
following steps:(i)establishing a first network of at least
20 two devices selectable from any of the devices of the first
aspect and its variations abovementioned, (ii) establishing
a second network of at least a device selectable from any
of the devices of the first aspect and its variations
abovementioned, with at least one nodal sensor, (iii)
25 initiating signaled contact and the recording of such
contact between the devices of the first network, (iv)
initiating signaled contact and the recording of such
contact between the device (or devices) and the nodal
sensor of the second network, (v) displaying a
30 representation of the proximal closeness of any two devices
of the first network using the indication light modules of
these two devices. Advantageously, the method does not
require social distancing ambassadors (i.e., enforcement
workers) to ensure that social distancing is observed.

Further advantageously, the method of the third aspect allows for the seamless interaction between any of the devices or their variations mentioned under the first aspect, not only resulting in an effective manner of enabling social distancing but further, also providing basic contact tracing in regard of the interaction of the users of the device. Yet further, advantageously, the method allows for the logging of information relating to the proximal interaction between a device and a nodal sensor.

The method of the third aspect may further comprise the step of (vi) analyzing the memory storage module of at least one of the devices in the first network and/or the nodal sensor of the second network to retrieve information. Advantageously, this allows for an authority to procure data stored on a memory storage module and/or the nodal sensor to carry out an analysis of the information found within the logged data. Further advantageously, the analyzed data can be used in a manner which enables the authority to carry out contact tracing. Yet further advantageously, an individual's virtual footprint is only known if he or she is infected and has handed over the device to an authority.

Definitions

The following words and terms used herein shall have the meaning indicated:

The term "signaled contact" refers to an interaction of an electronic and/or digital kind involving electronically and/or digitally emitted signals between any of the devices of the present application.

The terms "distance between devices" or "distance between users of the device" or "distance between users" or their equivalent, refer, in the general sense, to the same distance which is detectable by the range of available wireless technologies (e.g. Bluetooth, Wi-Fi or Radio Frequency Identification, RFID) as used in any of the devices of the present application. In the same manner, the use of the adjective "proximal", for instance in the phrase "proximal closeness/distances between devices" or its equivalent are intended to refer to the same detectable distance mentioned above.

The words "essentially" and "substantially" do not exclude "completely" e.g. a composition which is "substantially free" from Y may be completely free from Y. Where necessary, the word "substantially" may be omitted from the definition of the invention.

Unless specified otherwise, the terms "comprising" and "comprise", and grammatical variants thereof, are intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, unrecited elements.

As used herein, the term "about", typically means +/- 10% of the stated value, more typically +/- 9% of the stated value, more typically +/- 8% of the stated value, more typically +/- 7% of the stated value, more typically +/- 6% of the stated value, more typically +/- 5% of the stated value, more typically +/- 4% of the stated value, more typically +/- 3% of the stated value, more typically +/- 2% of the stated value, more typically +/- 1% of the stated value, and even more typically +/- 0.5% of the stated value.

The term "slightly", in the context of any value described in the specification means typically +/- 10% of the stated value, more typically +/- 9% of the stated value, more typically +/- 8% of the stated value, more typically +/- 7% of the stated value, more typically +/- 6% of the stated value, more typically +/- 5% of the stated value, more typically +/- 4% of the stated value, more typically +/- 3% of the stated value, more typically, +/- 2% of the stated value, more typically +/- 1% of the stated value, and even more typically +/- 0.5% of the stated value.

The word "similar" is to be inferred as "comparable with" with the intention to neglect any non-major and/or minor features present.

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Throughout this disclosure, certain embodiments may be disclosed in a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the disclosed ranges.

Accordingly, the description of a range should be considered to have specifically disclosed all the possible sub-ranges as well as individual numerical values within that range. For example, the description of a range such as from 1 to 6 should be considered to have specifically disclosed sub-ranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

Disclosure of Optional Embodiments

Exemplary, non-limiting embodiments according to the first, second and third aspects will now be disclosed.

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In an embodiment of the first aspect, the memory storage module, the indication light module and the source of power are all found on the chipset.

10 In another embodiment, the memory storage module, the indication light module and the source of power are all found on the chipset. In addition, the chipset is in turn positioned on the outward facing side of the protective shield when normally worn by a user.

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In another embodiment, the chipset is either waterproof or is able to resist water.

In an embodiment, the indication light module is able to
20 indicate any two different colours of light from the following colours: green, red or yellow. In another embodiment, the indication light module is able to indicate three different colours of light: green, yellow and red. In another embodiment, the different coloured light or
25 lights of the indication light module may flash either in a continuous or discontinuous state.

In an embodiment, the source of power is a battery which is of a rechargeable type (for instance, which can be
30 charged through the use of a micro-USB charging module). In another embodiment, the battery is a lithium type battery. In another embodiment the lithium type battery may be selected from one of the following types of batteries: CR927, CR1025, CR1130, CR1216, CR1220, CR1225, CR1616,

CR1620, CR1632, CR2012, CR2016, CR2020, CR2025, CR2032, CR2040, CR2050, CR2320, CR2325, CR2330, CR2354, CR2412, CR2430, CR2450, CR2477, CR3032, CR11108. In another embodiment, the battery is a lithium polymer battery. In yet another embodiment, the battery is enclosed in a sealed box. In a further embodiment, the box may be constructed of a plastic material, for example, polyethylene (PE), high-density polyethylene (HDPE), polytetrafluoroethylene (PTFE), polyethylene terephthalate (PET or PETE), polypropylene (PP), polycarbonate (PC), poly(methyl methacrylate) (PMMA), polyoxymethylene (POM) and acrylonitrile butadiene styrene (ABS).

In an embodiment, the chipset in any of the devices as mentioned above in the first aspect and its variations can be reversibly attached to the protective shield. In an embodiment, the chipset is reversibly attachable to the protective shield using a snap-lock type attachment. In another embodiment, the snap-lock type attachment is indirectly mounted on the protective shield using an adhesive means (e.g. tape, Velcro fasteners or adhesive glue). In another embodiment, the reversible attachment may be constructed of a plastic material, for example, polyethylene (PE), high-density polyethylene (HDPE), polytetrafluoroethylene (PTFE), polyethylene terephthalate (PET or PETE), polypropylene (PP), polycarbonate (PC), poly(methyl methacrylate) (PMMA), polyoxymethylene (POM) and acrylonitrile butadiene styrene (ABS). In another embodiment, the chipset contains one of the following: HC-05 Bluetooth module, ESP32 microcontroller or nRF52840.

In an embodiment, the protective shield in any of the devices as mentioned above in the first aspect and its variations is a face mask. In another embodiment, the face

mask can be one of the following types: basic cloth face mask, surgical face mask, N95 respirator, filtering facepiece respirator, P100 respirator/gas mask, self-contained breathing apparatus, full face respirator, full length face shield or KN95 respirator.

In an embodiment of the second aspect, the network is established based on Bluetooth, a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using Ultra High Frequency (UHF) radio waves from 2.402 GHz to 2.480 GHz. In another embodiment, the network as established is made up of 2 to 10 devices, more than 10 devices, more than 20 devices, more than 30 devices, more than 40 devices, more than 50 devices, more than 60 devices, more than 70 devices, more than 80 devices, more than 90 devices or more than 100 devices. In another embodiment, the recording of the signaled contact between devices is carried out on the memory storage modules of the devices. In another embodiment, the indication light modules which display a representation of the proximal closeness of the any two devices consist of three different colours to represent the different distances of: more than 2 metres, 1 metre to 2 metres and less than 1 metre.

In an embodiment of the second aspect, there is further provided the step of analyzing the memory storage module of at least one of the any two devices to retrieve information relating to the proximal closeness between them; the analysis may be carried out by a government health authority; the information which is retrieved consists of one or more of the following: unique identity numbers (UINs) of the devices, the proximal distances of the devices in the established network, the times and dates of the

signaled contact between devices, the corresponding light colours corresponding to defined range of distances and/or distances, and the manufacturer or manufacturers of the chipsets and/or memory storage modules of the devices.

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In an embodiment of the third aspect, the first and/or second network is established based on Bluetooth, a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using
10 Ultra High Frequency (UHF) radio waves from 2.402 GHz to 2.480 GHz. In another embodiment, the first network as established is made up of 2 to 10 devices, more than 10 devices, more than 20 devices, more than 30 devices, more than 40 devices, more than 50 devices, more than 60 devices,
15 more than 70 devices, more than 80 devices, more than 90 devices or more than 100 devices. In another embodiment, the second network as established is made of up 1 device and 1 nodal sensor, more than 1 device and 1 nodal sensor or more than 1 device and more than 1 nodal sensor. In
20 another embodiment, the recording of the signaled contact between devices of the first network is carried out on the memory storage modules of the devices. In another embodiment, the recording of the signaled contact between the device or devices of the second network is carried out
25 on the memory storage modules of the device (or devices) and nodal sensor (or nodal sensors). In another embodiment, the indication light modules which display a representation of the proximal closeness of the any two devices of the first network consist of three different colours to
30 represent the different distances of: more than 2 metres, 1 metre to 2 metres and less than 1 metre.

The method of the second aspect may be further provided with the step of analyzing the memory storage module of at

least one of the devices in the first network and/or the nodal sensor of the second network to retrieve information; the analysis may be carried out by a government health authority; the information which is retrieved consists of one or more of the following: unique identity numbers (UINs) of devices, the proximal distances between devices and/or between device(s) and the nodal sensor(s) in the established networks, the times and dates of the signaled contact between devices and/or the nodal sensor, the corresponding light colours corresponding to defined range of distances and/or distances, and the manufacturer or manufacturers of the chipsets and/or memory storage modules of devices and/or nodal sensors.

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Brief Description Of Drawings

The accompanying drawings illustrate disclosed embodiments and serve to explain the principles of the disclosed embodiments. It is to be understood, however, that the drawings are designed for purposes of illustration only, and not as a definition of the limits of the invention.

Fig. 1 shows an exploded view of an embodiment of the device's chipset (1a), snap-lock attachment leg (1b), battery box seal (2), battery (3), battery box (4), holder (5a) and adhesive tape layer (5b).

Fig. 2 shows an embodiment of an integrated chipset suitable to be implemented on the claimed device, containing the components of a memory card (1c), an antenna (1d), time/date module (1e), Radio Frequency Identification Chip (RFID) chip (1f), Light Emitting Diode (LED) (1g) and Bluetooth chip (1h).

Fig. 3 illustrates an exemplary scenario where a network is established between devices.

Examples

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Non-limiting examples of the invention will be further described in greater detail by reference to specific Examples. These examples should not be construed as in any way limiting the scope of the invention.

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Example 1: Dimensions of the assembled hardware which can be exemplarily used in the device

In this example, the hardware components of the device containing a microchip set, battery, tri-colour LED light, plastic housing and an affixed attachment to the protective shield are assembled to the overall dimensions of approximately 4cm x 3cm by 1cm and weighs approximately 10g.

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20 Example 2 (Comparative example): Difference in dimensions and weight between an N95 face mask's air vent and the assembled hardware components of Example 1

In this example, an N95 face mask's air vent is approximately 4.4cm x 4.4cm x 1.8cm and weighs approximately 19g. In comparison, the assembled hardware of Example 1 is dimensionally smaller and weighs less.

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Example 3: Use of the device in enabling social distancing and contact tracing

30 Over a period of time during the COVID-19 pandemic, a shopping mall contains 157 persons distributed on a 5-storey building. A shop on the second level has a sale for clothing apparel, and 19 persons are in relatively close

proximity to each other. These 19 persons at the sale are users of the device of the current application. If the device of any of these 19 persons are within less than a distance of 1m from another person, the LED light on the device will be red in colour to serve as a visual reminder and warning for the need to maintain a social distance of more than 1m as a strategy to effectively control disease transmission. Once these users of the device move apart to maintain a distance of between 1m to 2m, the LED light then turns yellow to indicate the presence of moderate risk in the potential for disease transmission. Furthermore, once these users of the device move even further apart (for instance, more than 2m), the LED light on the devices will turn green to indicate the presence of merely a low risk of disease transmission.

In another area of the mall, two users (A and B) of the device are in a proximal distance of less than 1m from each other. One of these users of the device (A) is later found to have been an infectious COVID-19 case at that point in time of being in the mall. The chipset of the device belonging to the infectious user A is retrieved for analysis by the health authority, upon which it is found that B's device was in close contact at less than 1m to A's device. B is subsequently identified (through the identification of the UIN of B's device's chipset) as part of the contact tracing strategy to control the transmission of COVID-19. Subsequently, both A and B are advised to stay in isolation for 14 days.

Example 4: Administrative and system processes indicated by LED lights on the device

The LED lights flash green to show that the read-write state between the interface of the memory storage module

and the chipset is buffering or that the software regulating the workings of the chipset is loading.

The LED lights flash yellow to indicate a hardware and/or software error in the device.

- 5 The LED lights flash red to indicate that the power level of the battery is low.

Example 5a: Use of a microcontroller within the device

- 10 In this example, an ESP32 microcontroller-based chipset, which among other components, consists of a microprocessor, a battery, a Bluetooth module and tri-colour LED lights, is used to facilitate the workings of the device. The chipset also has a micro-USB interface to allow the battery to be charged. Furthermore, such a micro-USB interface (in
15 addition to the Bluetooth module) not only allows for the uninterrupted transfer (for instance, if the power level of the battery is drained) of data (e.g. additional programming code) from an external source to the microcontroller, it also allows for the transfer of logged
20 data from the memory storage module (e.g. Read-Only Memory or, ROM in the form of a memory chip) of the device to an external source for further investigative purposes and to carry out contact tracing.

25 Example 5b: Use of Arduino hardware/software

- In this example, an Arduino board is used as the microcontroller. The open-sourced Arduino software (an integrated development environment, or IDE) can be used to establish the program required to operate the
30 microcontroller.

Example 6: Normal workings of the battery in the device

On a full charge cycle of the battery in the device, the device is able to sustain normal usage (e.g. transfer of

data using Bluetooth on an established network of devices, logging of data including proximal distances between devices and the use of LED lights to visually indicate proximal distances) over a period of 3-5 days. The battery could thereafter be subject to charging using the method mentioned in Example 5. Alternatively, the drained battery can be removed from the said device and a new battery inserted as a replacement.

10 Example 7: Availability of switch or power-saving mode on the device

A variation of the device is provided with a switch to power the chipset on/off. Another variation of the device includes the provision of a power saving mode, whereby if the device does not detect the presence of another nearby device for a sustained period of time (e.g. 1 hour), the chipset goes into "sleep" mode, thus conserving battery power.

20 Example 8: Ensuring privacy of users of the device

Each device emits Bluetooth signals which may be picked up and stored as information by nearby devices. These emitted signals can only be picked up, as programmed, within a certain range of distances, thus eliminating the unnecessary logging of e.g. proximal distances which are too far off of a social distancing range (e.g. a larger distance of 5m). The emitted signals also contain obfuscated and deciphered code (collectively which may be termed the Unique Identity Number or UIN) which can uniquely identify the emitter device. The UIN is uniquely linked with the emitter device and advantageously does not contain sensitive information (e.g. geolocation, name, residential address or national registration identity card number) regarding the user of the device.

Example 9: Coloured representation of proximal distances

The representation of proximal distances between devices can be effected using any colour of light available (e.g. red, blue, green, yellow, white, etc. for LED light colours). By default, the following distances and colours can be used: more than 2m (green), 1m to 2m (yellow), less than 1m (red). However, the stipulated range of distances can be redefined: e.g. less than 6 feet (equivalent of 1.83m) to show a continuous red or quick-flashing red light.

Example 10a: COVID-19 Risk Management Software (CRMS) associated with the device's chipset enabling risk management procedures of social distancing and contact tracing

In this example, the exemplarily workings of an associated COVID-19 Risk Management Software (CRMS) are described. In essence, the CRMS goes through the data in an identified COVID-19 patient's device through the following steps: -

(a) It identifies the UINs of all the other devices that have come into contact with the COVID-19 positive patient within the last 14 days;

(b) CRMS ranks each contact based on three criteria. Each of the criterion below holds equal weightage: -

(i) the proximal distance to which the COVID-19 positive patient was from the other individual. Closer distances are deemed to involve an exposure of higher risk.

(ii) the duration for which the COVID-19 positive patient and the other individual were in proximity. Longer durations are deemed to involve an exposure of higher risk.

(iii) the frequency by which the COVID-19 positive patient interacted with (or came across) the other individual.

5 (c) Based on the criteria, the data is ranked from high-risk contacts to low-risk contacts. Advantageously, this will enable contact tracers to find individuals at highest risk of being infected with COVID-19 by the COVID-19 positive patient. This is opposed to the contact tracing
10 methods currently used, whereby the individuals are contacted in chronological order.

Example 10b: COVID-19 Extended Risk Management Software (ERMS) associated with the device's chipset enabling risk
15 management procedures of social distancing and contact tracing

Another software, the COVID-19 Extended Risk Management Software (ERMS) is associated with the device's chipset
20 enabling risk management procedures of social distancing and contact tracing. ERMS can work in tandem with the CRMS described in Example 10a.

The principal function of ERMS is to further develop the
25 risk model built by the RMS; the focus of the ERMS is the group of individuals who were in contact with the identified and confirmed COVID-19 patient. These individuals may also have been in contact with other confirmed COVID-19 patients. Based on the distance,
30 duration and frequency of contact each individual had with all confirmed COVID-19 patients, as well as individuals who have been in contact with confirmed COVID-19 patients, an extended risk model is further built. The CRMS thus builds

a risk model centered on a confirmed COVID-19 patient while the ERMS is the aggregate of all exposure risk from all confirmed COVID-19 patients. This takes into account that an individual may have come into contact with more than one confirmed COVID-19 patient due to the following reasons:

- (a) the nature of his/her job - e.g., as a waiter or waitress at a restaurant which necessarily requires interaction with customers;
- (b) visiting of public places - such as a crowded public transport terminal during peak hours.

Example 10c: Establishing CRMS and ERMS using various programming languages

CRMS and ERMS may be established using one of the following programming languages: R, MATLAB, GNU Octave, Python, C or Java.

Example 11: Analysis of data logged on memory storage module

Logged data can be stored on the memory storage module of the claimed device for up to 25 days. When a user of the device is tested positive for COVID-19, all 25 days of the logged data is analyzed accordingly by an authority or authorities.

Example 12: Use of the device and its associated methods in disease outbreaks

The claimed device and its associated methods can be used in the occurrence of an infectious disease that is respiratory or airborne in nature, including the following: Avian Influenza (including all variants), Ebola Virus Disease (EVD), and novel/mutated strains of Middle Eastern

Respiratory Syndrome (MERS) or Severe Acute Respiratory Syndrome (SARS).

Example 13a: Seamless experience for the user of the device

5 at public places

Public places including shops, shopping centres and public transport terminals whereby a congregation of people may be present, can also serve as a nodal point for users of the device and its associated method. At any of such places, 10 a nodal sensor may be positioned, for instance at the entrances. Such a nodal sensor can interact with the claimed devices in its vicinity to provide a record of devices which have been present. Advantageously, users no longer are required to have in their possession a mobile 15 device (e.g. smart phone) to carry out a physical scanning of any QR code which may be in place to serve that purpose of record. Further advantageously, the nodal sensor when used in tandem with the claimed device(s) and associated methods, prevents the congregation of individuals in having 20 to pause and attempt to scan such a QR code.

Example 13b: Location gap fill-in to provide a record of potential indirect transmission of disease

The nodal sensor described in Example 13a is also an 25 important tool which may be used to investigate and establish any indirect transmission of a disease. For instance, a patient may contaminate an area surrounding himself or herself (e.g. street furniture or public infrastructure) when he or she sneezes while still in 30 possession of the device. By positioning a nodal sensor at suitable locations (e.g. on street furniture), the virtual footprint of the patient can be traced since the device would have interacted with the nodal sensor digitally. Personnel tasked with disinfecting such visited places can

accordingly follow such a digital trail and effectively carry out their task more accurately.

In another instance, the placement of such nodal sensors to work in tandem with the claimed device also allows information regarding the traffic volume (as aggregated) of people (device users) whom have been in the proximity of a nodal sensor to be derived. Better resource allocation can thus be carried out to disinfect places (considering both essential, or non-essential facilities or areas) which have had a larger number of people. Such workings of the abovementioned nodal sensors can also be integrated within the ERMS described in Example 10b.

Example 13c: Nodal sensor

The nodal sensor as described in Examples 13a and 13b is a statically positioned item which can digitally interact with any of the devices described in the first aspect and its variations. The components of a nodal sensor include, among other things, a wireless communication module, a chipset and a memory storage module. The memory storage module can be a hard disk which may be positioned in a remote location, or a memory card which is positioned within the nodal sensor itself. The wireless communication module is of compatible technology with the wireless technology implementable on any of the devices of the first aspect and its variations thereof, e.g. Bluetooth, Wi-Fi or RFID.

Applications

The potential applications of the presently disclosed technology are wide-ranging and are described below:

The device currently claimed and the methods associated with the likes of such a device overall enable social distancing and contact tracing to be carried out with a seamless user experience, and an efficient and effective manner to contact trace when meeting the requirements of a national-level disease control strategy.

The technology as claimed, in the form of the device and its associated methods, redefines the traditional method of contact tracing, i.e. whereby laborious interviews are conducted between suspected diseased cases and the people they had interacted with, with a highly manageable system, in the form of the CRMS and ERMS software. Time is of essence in the conduct of contact tracing, and any potential delay can result in a further and wider spread of a disease which is the target of control. The present technology as put forth herein in the present application not only does not require laborious (or even preemptive) efforts to curb a disease in its footsteps, but advantageously can then allow a reallocation of resources to other areas to combat the disease (e.g. the procurement of medical supplies).

The technology as claimed, in the form of the device and its associated methods, can also be implemented across borders with proper intervening governmental efforts. This can therefore form a larger strategy to effect social distancing and contact tracing in a cross-border manner.

The technology as claimed, in the form of the device and its associated methods, respects one's privacy since no sensitive information is procured in the social distancing and contact tracing procedures carried out with the claimed

device and its associated methods. This will encourage the general public to partake in efforts to combat disease spread through observing social distancing and providing only essential data during contact tracing, thus
5 potentially allowing effective disease control to reach a successful extent. Such a successful extent of disease control also means that a country, can, post pandemic, move on to the next phase of focusing on economic recovery.

10 It will be apparent that various other modifications and adaptations of the invention will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the invention and it is intended that all such modifications
15 and adaptations come within the scope of the appended claims.

Claims

1. A device for use in social distancing and contact tracing, comprising the following components: a protective shield, a chipset, a memory storage module, an indication light module and a source of power.

2. The device of Claim 1, wherein the indication light module is positioned on the chipset.

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3. The device of Claim 1, wherein the memory storage module is positioned on the chipset.

4. The device of Claim 1, further wherein the chipset is a microchip.

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5. The device of Claim 1, wherein the indication light module comprises of one or more light emitting diodes.

6. The device of Claim 1, wherein the source of power is a battery.

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7. The device of any one of Claims 1-6, wherein the chipset can be reversibly attached to the protective shield.

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8. The device of any one of Claims 1-7, wherein the protective shield is a face mask.

9. A method of carrying out social distancing and contact tracing comprising the following steps:

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(i) Establishing a network of at least two devices selectable from any of the devices of Claims 1-8;

5 (ii) Initiating signaled contact and the recording of such contact between any two devices within the network of the at least two devices mentioned in step (i), and

(iii) Displaying a representation of the proximal closeness of the any two devices using the indication light modules
10 of the any two devices.

10. The method of Claim 9, further comprising the following step:

15 (iv) Analyzing the memory storage module of at least one of the any two devices to retrieve information relating to the historical proximal closeness between them.

20 11. A method of carrying out social distancing and contact tracing comprising the following steps:

(i) Establishing a first network of at least two devices selectable from any of the devices of Claims 1-8,

25 (ii) Establishing a second network of at least a device selectable from any of the devices of Claims 1-8, with at least one nodal sensor.

(iii) Initiating signaled contact and the recording of such
30 contact between the devices of the first network,

(iv) Initiating signaled contact and the recording of such contact between the device or devices and the nodal sensor of the second network,

(v) Displaying a representation of the proximal closeness of any two devices of the first network using the indication light modules of these two devices.

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12. The method of Claim 11, further comprising the following step:

(vi) Analyzing the memory storage module of at least one
10 of the devices in the first network and/or the nodal sensor of the second network to retrieve information.