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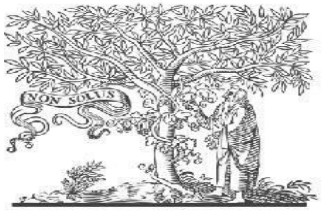

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TITLE: Personal and Public Safety Monitoring Devices For COVID19 Using IoT and Sensor Technology

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Personal and Public Safety Monitoring Devices For COVID19 Using IoT and Sensor Technology

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Abstract
There are constraints to provide the effective treatment for COVID19 patients in Hospitals due to infectious nature of the disease. Quality treatment and continuity in the healthcare of patient is difficult in case of patients of diseases of infectious nature. In the process of treatment many patients are not been properly monitored to their clinical events for better diagnosis. Patients are uncomfortable for the delay in medical attention as cost of such treatments is too high as various devices are to be included in the care. Therefore, it is required to provide the unrestricted medical advice and support to avoid further spread of the disease and better cure of the patient. In this manuscript, we proposed four (04) ICT enabled centralized patient monitoring and public safety devices along with usage of other IoT based systems which are to be used for COVID19 Hospitals to help the Paramedic's staff to monitor the body temperature of the COVID19 patients in emergency medical situations for serious patients with the aim of stabilizing them without moving to their place. In addition we proposed some more personal and public devices used in wake of COVID19.

1. Introduction

Pathogens are not certainly responsible for a disease. When bacteria, viruses, or any other microbes enter into the human body and start replicating them then infection occurs. This infection starts damaging body cells and symptoms of the illness appear in an individual. The intensity of the infection depends on the type and strength of the pathogen, also the degree of immunity of an individual. Once the infectious disease captured a living being then it make that living being a carrier of that infectious disease. Therefore, identification and cure for the infected living being is compulsory. Medicines play its own roles in the cure but care of the patient is another aspect which is crucial in the care of infectious diseases like COVID19. Therefore, specific devices are to be used for the extensive care of the patients. Present devices for this purpose are either too costly or very inconvenient in use. Hence, we put an effort to provide a low-cost, mass-produced, portable hand-held device having features including an integrated screen, user-friendly controls, and a serial port. Clinicians can take this light, easily usable and portable instrumentation device to a remote location very easily.

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It is an ICT enabled centralized patient monitoring device for COVID19 Hospitals which helps the Paramedics hospital staff to routine monitor the body temperature of the COVID19 patients with the aim of stabilizing them without moving to their place except for un-avoidable condition. This invention relates to monitoring of person safety requirements during this COVID19 situation. More particularly, the proposed invention is similar to an IoT-based Smart device for monitoring of personal parameters so that to avoid for infection of possibility of COVID19.

2. COVID19: A Case Study

An understanding about the behaviour about the diseases has to be identified before proposing a solution and therefore, we have considered the COVID19. It is a pandemic in today's world and all related research communities are fighting against it. Therefore, let us consider the following different parameters used to understand the behaviour of COVID19 to counter it.

1.1.Test Cases or Total Number of Sample Tested

It is one of our most important tools/process in the fight with COVID19 to sluggish and diminishes the impact of the virus spread. Different types of cases like Non-vulnerable Cases, Susceptible Cases, Positive Cases or Vulnerable Cases are identified by the tests after clinical identification [5-6].

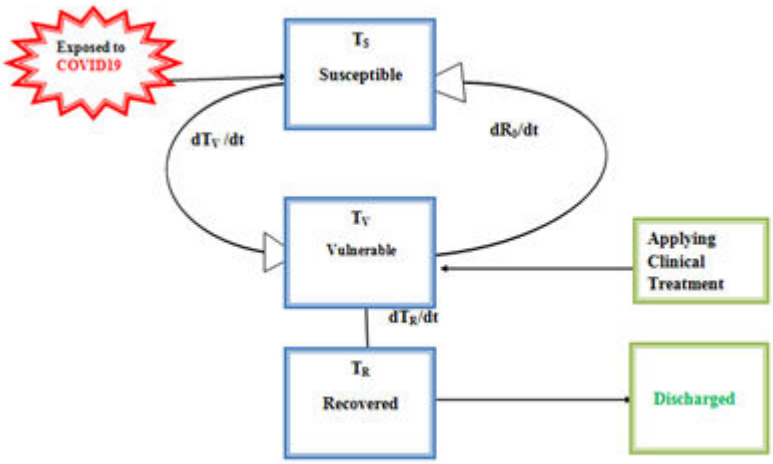

Figure-1: Susceptible-Vulnerable-Recovery cases

1.2.Non-vulnerable Cases

These are the accumulation of the negative test cases and the recovered cases after clinical treatment from the vulnerable category and having no symptom of COVID19 infections.

1.3.Susceptible or vulnerable Cases

The susceptible cases are the cases that exposed to COVID19 and don't help in transmission of infection after infection. Some susceptible cases which are exposed to infection of COVID19 and affected by the infection and carried out transmission is called vulnerable cases and some are exposed but still they cannot help in transmission of infection are susceptible cases. Some cases are the recovered and discharged after successful clinical treatment as shown in Figure-1[5].

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1.4.Positive cases or Active cases

The positive cases are the the infected by virus and they are identified by the appropriate laboratory testing. They are supposed to be reported by different countries as per their standard protocols. Some of the Active cases may be recovered and some may not so, we can calculate total active case as given below-

The total Active Cases = Total cases–*Total* ***recovered Cases - Total deaths cases [6]***

1.5.Transmission Rate

The *attack rate or transmissibility* tells how rapidly the disease spreads. Reproductive number represented by R_0 provides the information that how many persons are infected by a single person.

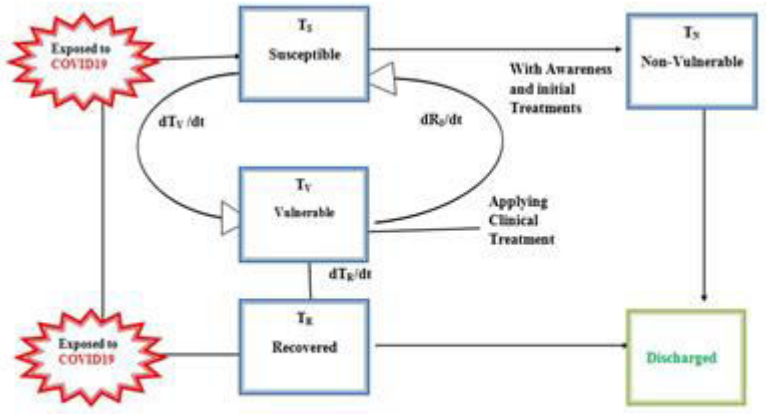

Figure-2: Susceptible-Vulnerable-Recovery-Susceptible cases

1.6.Recovered cases

These are the Recovered and Discharged cases after successful clinical treatment.This statistic is highly important for COVID19 treatment. They are represented by [6, 7] as given below-

The total recovered Cases = Total cases - Active Cases - total deaths.

The recover cases are the subset of vulnerable cases. After successful recovery from the COVID19 infection it is recommended to check the symptoms are resolved successfully and two negative tests are there within 24 hours and additional 14 days isolations is directed [6]. But after the recovery, if again, the recovered case is exposed to COVID19 then the case can be susceptible case and may help in transmission of infection as shown in Figure-2

1.7.Infection outbreak

If an infection is spreading at an unexpected high rate then it is known as outbreak of a disease. It is due to the huge size contact with a spreading agent including a person, animal, an environmental factor, or another media. Once it occurs then it will take days or even years to come at an end [6] [8].

1.8.Rate of positive cases

Rate of positive cases R_0 is the ratio between the total number of affected positive cases or vulnerable cases to the underlying cases that are susceptible to infection and can be

made per cases with transmission rate R_0. This is the rate which gives the number of newly infected people from a single case. The average positive rate is the difference of total susceptible case to total negative cases in a day. A number of groups have estimated the positive rate for Covid-19 to be somewhere approximately between 1.5 and 5.5 [6].

1.9. Rate of Negative Cases

Rate of Negative Cases is the ratio of total negative test cases to total number of test conducted. In the best case it should be approaching to total number of tests conducted.

1.10. Rate of Recover Cases

The rate of Recovery is ratio between the total recovery cases in cumulative to total number of affected positive cases [6]. It is represented as below-

The total recovered Cases = Total cases - Active Cases - total deaths.

1.11. Rate of Death Cases

Total Deaths cases are the cumulative number of deaths among detected positive cases [6].

The values of above discussed parameters present the current intensity of the pandemic. On the basis of the values of these parameters we conclude that what type of remedy has to be followed to counter the pandemic. To control these parameters defiantly the medication plays an important role but it is not available then using masks, keep distance, curfews at public places etc. help to restrict the infection.

On the other side of the coin, patients are to be handled in a very conscious manner so that a very limited or no infection spreads. Generally, these patients are to be kept in isolation and Hospital Staff has to take care of them with a minimal contact. This is only possible by using the technological devices. The availability of such devices at a minimal cost has to be ensured. Therefore, we have made an effort by proposing such devices at minimal cost to provide quality treatment and continuity of patient care particularly for COVID19 hospitals.

We proposed four (04) ICT enabled centralized patient monitoring and public safety devices which are to be used for COVID19 hospitals and help to the paramedic's hospital staff to monitor the body temperature of the Paramedics patients in emergency medical situations for those who are seriously ill with the aim of stabilizing them without moving to their place.

3. Literature Survey

Detection of more patients in an advanced stage and keeping them for medication is a significant part of the hospital management. It also leads to a financial burden to the healthcare system of that nation as there are different infrastructures which are involved for the patients including "ADML-Covid19 Protected Room", "IFQCK-Covid19 Kit", "CMSP-Suit", and "COVID19 killer". Contamination in a room or surface is disinfected and sterilized by the use of an apparatus like "ADML-Covid19" Protected Room. In case of rough surfaces, "IFQCK-Covid19 Kit" is used to non-destructive advanced testing. "CMSP-Suit" is used as a structural material for protection cloths for COVID19. In all such kind of infrastructures automatic data collection of patients is missing.

Method for medications to the infectious diseases are also proposed in the literature including SARS-CoV2 (COVID19) method and treatment based on ACE2 M-RNA Inhibitor

Desoxycorticosterone Acetate, method and treatment for **SARS-CoV2 (COVID19) based on** Angiotensin-I-Converting Enzyme 2 (ACE2) Inhibitor in Pharmaceutical Compositions Against SARS CoV2 (COVID19) Infection, and method and treatment for **SARS-CoV2 (COVID19) based on** ACE2 Inhibitor.

On the basis of literature review about COVID19 we infer that none of the work is suggesting or claiming about the "ICT Enabled Centralized Patient Monitoring Device" in the treatment of an infectious disease.

Due to this above backdrop it is desired to have a device which can operate automatically to providing data related to the patient's diagnosis and medical advice in quick, efficient and accurate way. This proposed system and device will better configure the patient health and provide the data for analysis with elementary medical diagnosis along with different modules including patient's data module, conversion module for generating an output file representing the health of patient, and a display module to display output.

4. IoT for COVID19

IoT plays a significant role during the COVID19 pandemic for healthcare systems to monitor the patients with intertwined devices. IoT industry helps a lot during these days to protect the people from infection and spread of the pandemic. IoT network is a collection of interconnected devices to collect data and communicate it to a device for analysis on wireless network without human intervention. Once the data is gathered at a common platform with a common language, it can be analyzed by a distributed environment. The analysis helps to take the proper countermeasures against the pandemic. IoT devices are integrated in many systems used to sluggish the impact of COVID19 pandemic and contributes to the COVID19 safety norms.

The architecture of the IoT varied from solutions to solutions and also depends on the functional area. But the major Technology consists of four major components including sensors/ Devices, Gateways, networks/cloud, and application Layers.

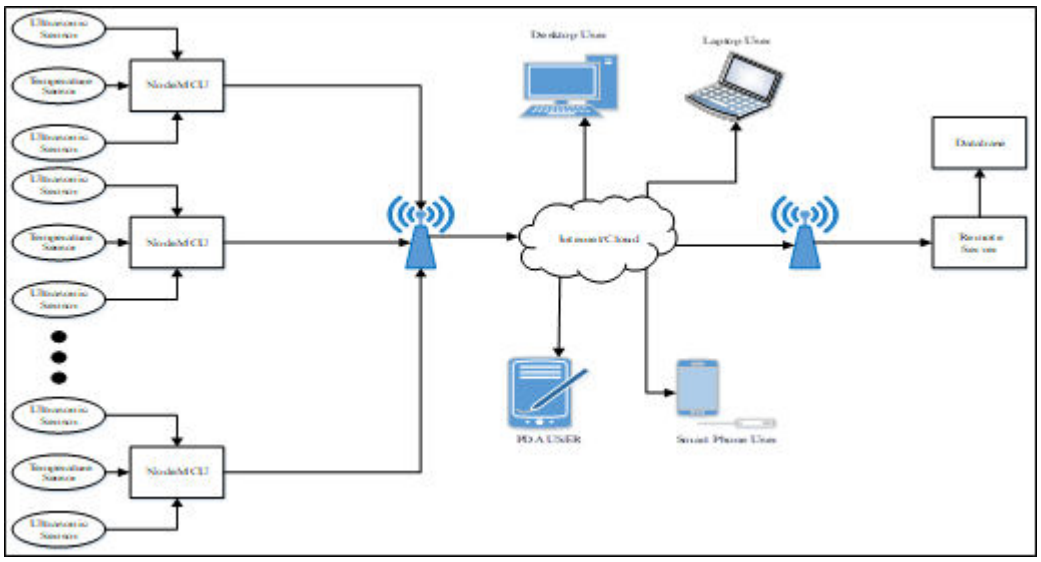

Figure-3: Block Diagram

There are different layers of IoT which is shown in the Figure 3. Sensors and actuators are the

first stage in the IoT architecture. Sensors are the electronics devices which are used to sensors the environmental parameters and the actuators are the transducers which converts the electrical signals into the motion. They are connected to the node devices through wired or wireless medium and send – receive corresponding data over the network. The second stage is the Gateways through which data are transferred in a very high speed. These may be the WiFi, Ethernet, GSM, 5G etc. After that the third stage is the cloud where the information through analytics, management of devices and security controls are done. The last stage is the cloud transfers the information or data to end users applications.

In case of COVID19, healthcare systems devices/sensors including temperature sensor, heartbeat sensor, blood pressure sensor etc. are responsible to sense the data. Through the gateway, this collected information goes the cloud where it is analyzed by different required modules and the resultant has to be provided to the medical attendant using APIs of application layer.

5. IOT Enabling Technology

5.1 Sensors

5.1.1 SRF10 ultrasonic sensor

Ultrasonic rangefinder is a small electronic sensor that has the capability to interpret distance into equivalent electrical signals. The communication takes place using the I^2C protocol with a specific address defined by the user. The I^2C protocols employs two hard lines i.e. SDA, SCL. These lines must be connected to +5V through 1.8 KΩ pull up resistor for better performance. There are different commands to initiate to get the output in the form on inches, centimeters, micro-seconds. After writing the commands to the command register the output is obtained after 65mS in the appropriate format defined by the command. The sensor has a maximum range up to 6 meters.

5.1.2Thermistor Temperature sensor

Thermistor is a variable resistance element; whose resistance varies with change in temperature. It is the short form of Thermal Resistor. Thermistors are classified as PTC (Positive Temperature Coefficient) or NTC (Negative Temperature Coefficient) type. They are used as current limiters, temperature sensors, overcurrent protectors and many other applications. These sensors are inexpensive, rugged, dependable and responsive. Because of these qualities' thermistors are widely used for simple low temperature measurement applications. Most common application is the digital thermometers and home appliances such as refrigerator, ovens, etc. They are available in different shapes like rod, disc, bead, washer, etc. typically the thermistors are suitable for temperature ranges -100 °C to 300 °C. There are two types of Thermistor Temperature Sensor are Positive Temperature coefficient Thermistor (PTC) and Negative Temperature Coefficient Thermistor (NTC).In positive temperature coefficient thermistor, resistance of thermistor increases with increase in temperature.PTC thermistor are divided into two groups based on:

- Material used- Silistors, which use silicon as the semiconductive material. They are used as PTC temperature sensors for their linear characteristic.
- Their structure and manufacturing process- It is the switching type PTC thermistor. This type of PTC thermistor is widely used in PTC heaters, sensors etc.

PTC thermistors are mostly used as self-regulating heaters, for over current protection, etc. In negative temperature coefficient thermistor, resistance decreases with increase in temperature. NTC thermistor is made from semiconductor material (such as metal oxide and ceramic). Most NTC thermistor sensors are typically suitable for temperature range between -55°C to +150°C. Generally, NTC thermistors are used for temperature measurement. Mechanism behind the measurement of temperature is evaluated based on the Figure 4.

Rx is the equivalent resistance of the NTC thermistor at 25°C. The voltage drop across the thermistor is fed to the ADC. Using the simple voltage divider network formula, the resistance is obtained through:

The equivalent temperature can be determined through thermistor resistance using the Steinhart-Hart equation.

$$R_{th} + R_x = \frac{5 * R_x}{V_{out}} \quad \text{---------- (1)}$$

Rth is the resistance of thermistor

$$V_{out} = 5 * \frac{R_x}{R_x + R_{th}} \quad \text{---------- (2)}$$

Vout is the voltage measured by the ADC

$$V_{out} = \frac{5 * ADC_{val}}{1023} \quad \text{---------- (3)}$$

$$Temp(^{\circ}K) = \frac{1}{\left(A + B\left[\ln(Rth)\right] + C\left[\ln(Rth)\right]^3\right)} \quad \text{---------- (4)}$$

where:

$$A = 0.001129148, B = 0.000234125, C = 8.76741 * 10^{-8}$$

And R_{th} is the thermistor resistance.

- A, B and C are the Steinhart-Hart coefficients that vary depending on the type and model of thermistor.
- Steinhart-Hart formula accuracy is around ±0.15°C, over the range of -50°C to +150°C which is useful for most applications.
- For lower temperature ranges i.e. 0°C to 100°C we will get better accuracy, around ±0.01°C.

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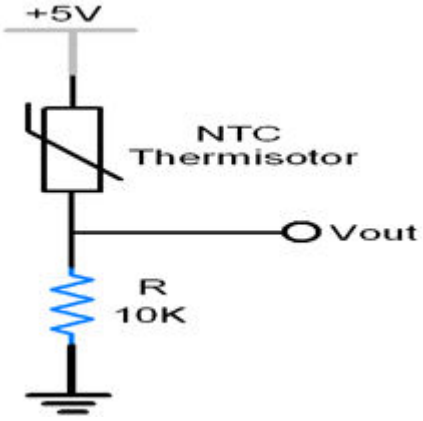

Figure 4: Voltage Divider Connection to Determine Temperature

The V_{out} is connected to the ACD to obtain equivalent digital value for the analog voltage difference observed. This change in voltage is result of the change in thermistor resistance due to the change in temperature, which can be obtained through the equation given as:

$$R_{th} = \left(\frac{1023 * R_{series}}{Value_{ADC}} \right) - R_{series} \quad \text{---------- (5)}$$

where :

$Value_{ADC}$ = Value obtained from the ADC in the range of 0 to1023

R_{Series} = Value of the resistance connected in series with the thermisto r accross which the output is drawn

5.1.3 Contactless Temperature Sensor:

Contactless Temperature Sensor Module GY-906 (MLX90614) is a Small low power industrial sensor operating at 5 Volts. It has a temperature detection range of -70°C to +380°C with an accuracy of about 0.5°C and resolution of 0.02°C. It is compatible with I2C communication protocol. It's model is depicted in figure 5.

Figure 5: Contactless Temperature Sensor Module

5.1.4 IR Sensor Module:

It is an in-expensive and accurate module used to trigger the dispensing mechanism of sanitizer. It's very much power efficient and responsive. It communicates through logic levels of the sensors directly to the processor, rather than the stream of data to get processed. It has a sensitivity range of 2 cm to 80 cm. It's model is depicted in figure 6.

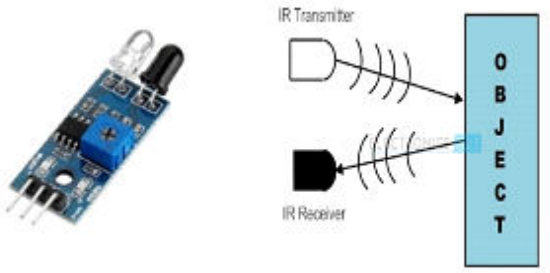

Figure 6: IR Sensor Module

5.2 Microcontroller Units

5.2.1 ESP8266EX (again 4)

The "D1 Mini" MCU is an ESP8266EX based Internet of Things development board equipped with on-board Wi-Fi, 4 Mega Bytes of flash and 11 Digital I/O's. All the I/O are multiplexed to support SPI, UART and I2C communication Protocols Except the D0 which is capable of taking Analog input up to 3.3V. This development board is dedicated for IoT application and is easily ready for the application after it is connected to a network. It can be used through other network members like the Computer and the Smart phones.

5.2.2 Raspberry Pi Zero W

It is a smaller and low-cost version of the "Raspberry Pi" the credit card sized computer. Its cost is about a 3rd of the actual Raspberry Pi. It is equipped with Broadcom BCM2835 SOC has only one core with 512 MB internal memory and works at a frequency of 1GHz. It supports SPI, I2C and UART Embedded Protocols for data communication. It also supports wireless communication technologies through built-in 802.11n Wi-Fi Module and Bluetooth v4.1. Its ultra-Low Power and Compact that makes it compact and suitable for many low-cost applications.

5.3 Actuators

5.3.1 Buzzer for Notification:

It is an inexpensive and rugged device primarily made up of piezoelectric material. When electrical pulses are applied it vibrates at a very high frequency to generate high pitch sound suitable for warning signal.

5.3.2 Pumping Mechanism of Dispenser:

It is a low cost 5VDC operated pump suitable for pumping low amount of fluid to short distance with acceptable amount of pressure. It consumes about 0.5 to 0.7 Amp of current at 5 volts. Its self-priming and precise. It's model is depicted in figure 7.

Figure 7: Sanitizer Dispensing Pump

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5.3.3 Character LCD for Display:

There are variety of LCD available in the market but the one which is suitable for the work is a low cost and low power 5 V operated Display capable of displaying alpha numeric characters only. Its I2C communication enabled to minimise the wiring complexity along with a high contrast display, perfect for use in brightly lighted area. It displays the message using 64 Characters in 4 rows.

6. Personal Safety Methodology and Equipment

4.1. ICT enabled Wrist band

The proposed device is a ICT enabled centralized patient monitoring device which can be used for COVID19 hospitals and will help the hospital staff(Paramedics) to monitor the body temperature of the COVID19 patients in emergency medical situations who are seriously ill with the aim of stabilizing them without moving to their place. It will also monitor the patient's movement activity with respect to other persons and give warning to maintain social distancing.

By using the ICT enabled wrist band one can do the centralized patient monitoring from a remote distance. It will help the Paramedics hospital staff to monitor the body temperature of the COVID19 patients in emergency medical situations who are seriously ill with the aim of stabilizing them without moving to their place. It can also be used for the Hospital staffs to monitor their body temperature in frequent basis and helps in social distance maintaining. It will also monitor the patient's movement activity with respect to other persons and give warning to maintain social distancing. As it is a low cost wearable device so it can be also used for quarantine peoples or for personal use. As list of Wearable devices are connected to a centralized database so it will help the Paramedics to analysis the statistics of temperature monitoring of the total patients so in time and accurate clinical and medical treatments can be provided at the earliest. An Initial Diagram for ICT enabled wrist band is depicted in figure 8.

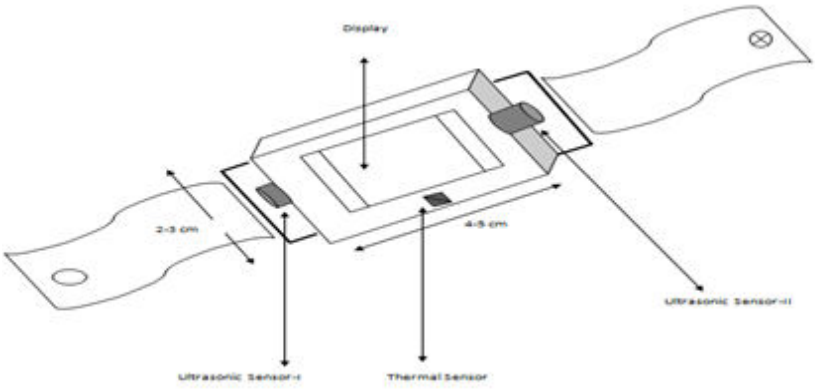

Figure-8: Initial Diagram for ICT enabled wrist band

Figure 9 is representing the possible usage description of ICT enabled wrist band and figure 10 depicts the complete on board design of this device

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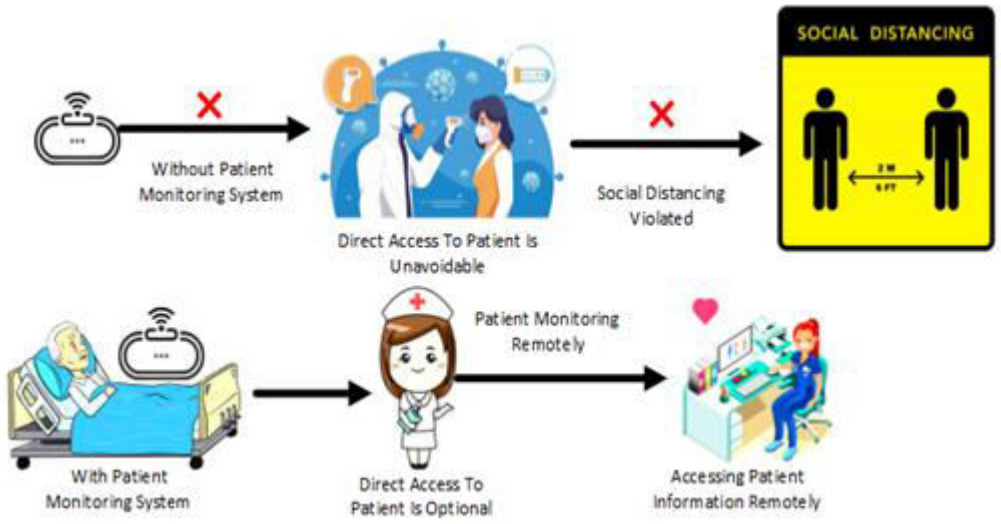
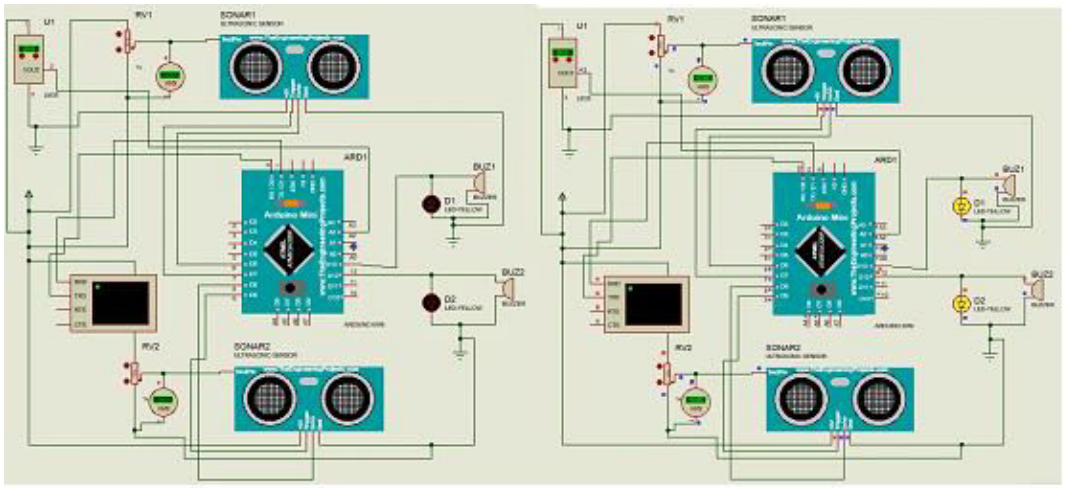
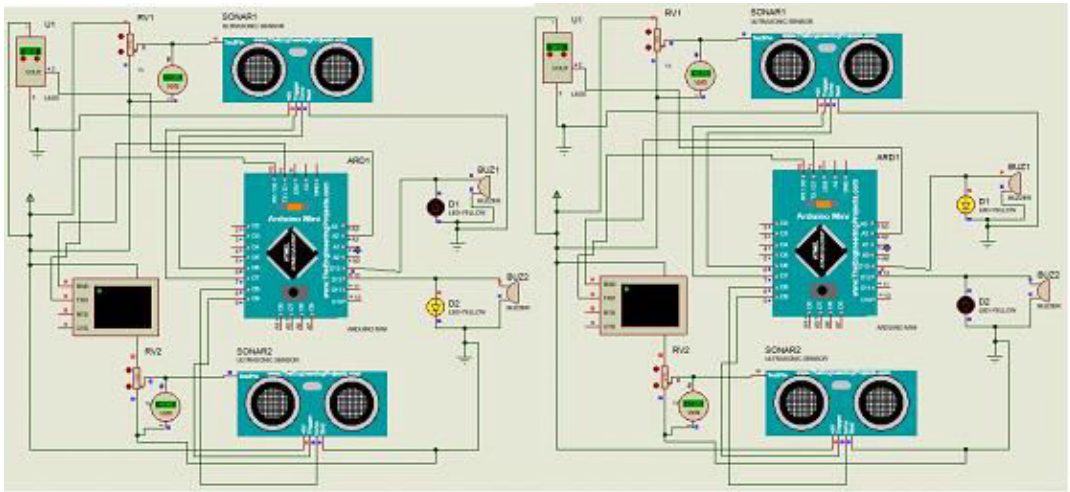


Figure 9: Description for ICT enabled wrist band



(a) (b)



(c) (d)

Figure 10: On Board diagram for ICT enabled wrist band

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The foregoing detailed description of the device implemented is better understood when read in conjunction with the attached drawings. For better understanding, each component is represented by labelled which is further illustrated for the components used with the figure. The simulation is done through a virtual simulator software. The software consists of virtual devices in which ultrasonic sensor, MCU unit, Buzzer. The ultrasonic senor is used to sense the distance between the user and the public around. The alert is given up as a glowing led and the corresponding buzzers. When the sensor placed in the topdetects a presence in the proximity it gives up a signal to the left buzzer and the led. The bottom sensor also operates in the same manner. When both the sensor detect proximity together both leds and the buzzers turns on giving alert. When there is no alert it is cleared that no proximity presence is detected.

4.2 ICT enabled Face Shield

The proposed the proposed research is a battery operated ICT enabled smart face shield structure which can be used as a personal safety monitoring equipment as shown in figure 11. It can help to monitor the body temperature of a person and intimate about not maintaining the social distance. This smart face shield is to provide an extra layer of protection and to protect the eyes when in close contact with someone that has or is suspected to have COVID-19.

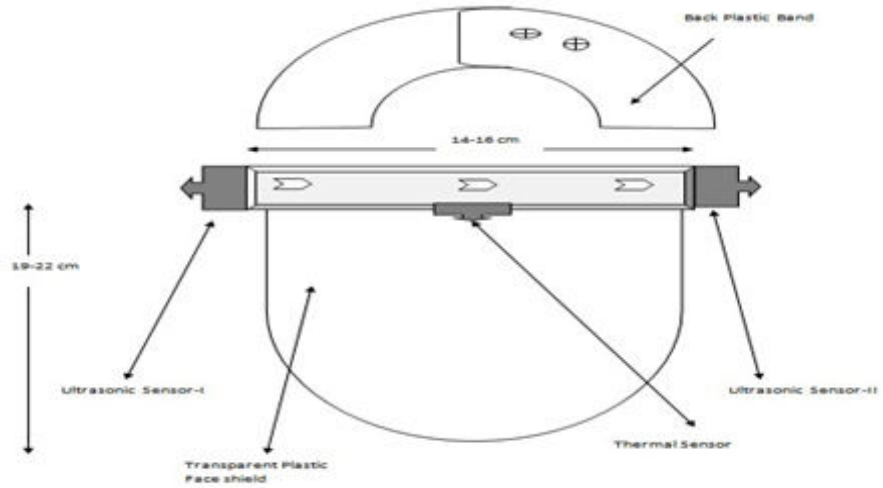


Figure-11: Initial Diagram for ICT enabled Face Shield

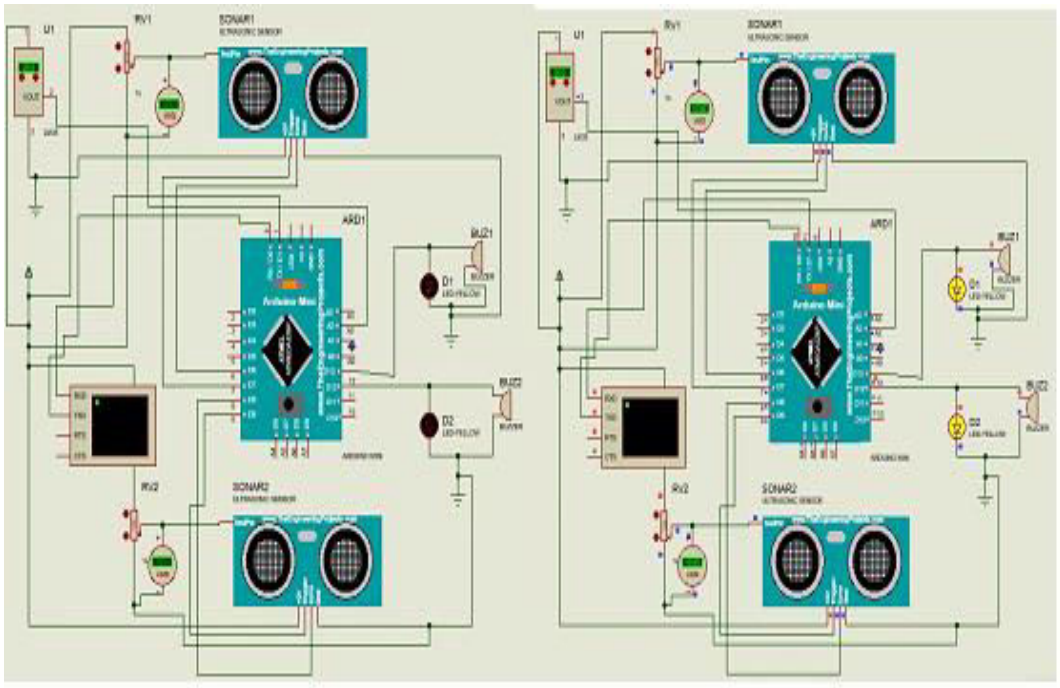
There are many possible utilizations of the ICT enabled Face Shield, some of them are given as below-

- This smart face shield structure can be used as a personal safety monitoring equipment.
- It can help to monitor the body temperature of a person and intimate about not maintaining the social distance.
- It can be also used for the Hospital staffs to monitor their body temperature in frequent basis and helps in social distance maintaining.
- As it is a low cost wearable device so it can be also used for quarantine peoples or for personal use.

- This smart face shield is to provide an extra layer of protection and to protect the eyes when in close contact with someone that has or is suspected to have COVID19
- It is also a reminder to maintain social distancing, and at the same time it allows visibility of facial expressions and lip movements for speech perception.
- It is also suggested that if wearing face shields in a regular basic it could also help to reduce the number of COVID19 infections.

Figure 12 is representing the possible Prototype model of ICT enabled Face Shield and figure 13 depicts the complete on board design of this device.

Figure: 12 Prototype model



(a) (b)

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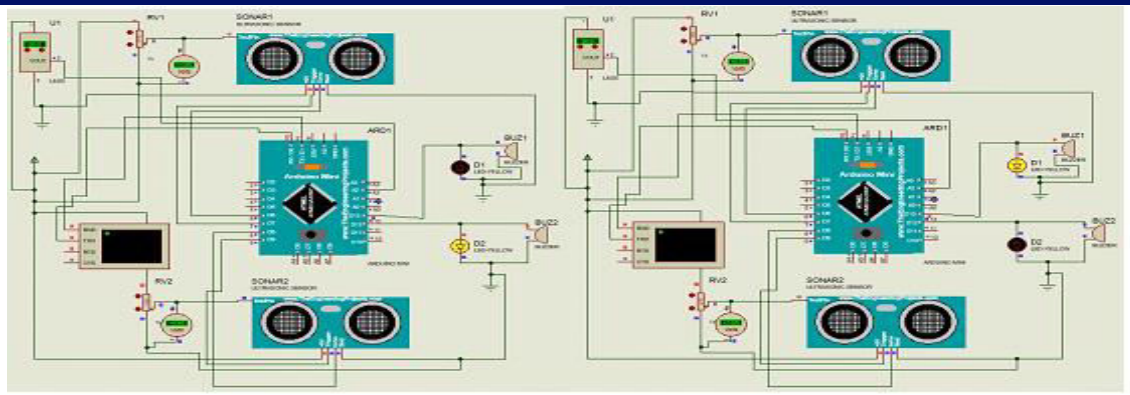

Figure 13: On Board diagram for ICT enabled Face Shield

The detailed description of the device is depicted by figure 11. The drawings are well labelled to each component for it's better understanding. The simulation is done through simulation software where electronics devices can be automated without the use of the real hardware. This is the software best suited for the PCB design. From the figure 13, it is clear that when the sensor detects any obstacles within the range specified in the program then automatically a signal will go to the microcontroller. Based on the signal received by the MCU the actuation will be taken place in the form of sound. This in turn notifies the patients who are wearing the device that it's essential to maintain the social distancing.

6. Public Safety Methodology & Equipment

6.1. Automated Contactless Attendance record system

The proposed invented device is related to a Contactless attendance system cum personal healthcare monitoring equipment for organization safety Since the device is a common accessible device so it can alert regarding the temperature of a person which is a necessary parameter for suspect of COVID19, as first point of contact for every environment starts with spread of the virus at the doorstep of any organization.

This model is generally designed to be deployed at the entrance point of different Educational Institutions like School, College, and Training etc. for implementing some of the basic guidelines of COVID19 to restrict the spread of the virus in this pandemic. In this model, when a person comes closer to the Mirror for seeing the face, the presence of him/her is detected by the Ultrasonic sensor. Once the human being is detected by the system, the temperature sensor is activated automatically to capture the body temperature of the person. If the sensed temperature value is in predefined normal range, the system will run the face detection module and capture photo of the face of that particular person. Then, the system will run the face recognition module. Once the face is detected, the attendance of that person will be captured. Along with this, the system also generates a predefined message through display and audio module for use of sanitization kit before entering into the organization. But, if the obtained temperature is not in normal range or the captured face does not match with the existing database, then the system alarms and passes the message to the receptionist. Eventually, entry of that particular person is restricted at the entrance and initial security measures are initiated. In addition to it, if temperature is not in the range, the system will pass a predefined message through the display unit to the person that contains all the details of

COVID19 guidelines to be followed along with the toll free number and in case of mismatch of the face, it displays a message to contact the system admin. Initial Diagram for Automated Contactless Attendance record system is depicted by figure 14.

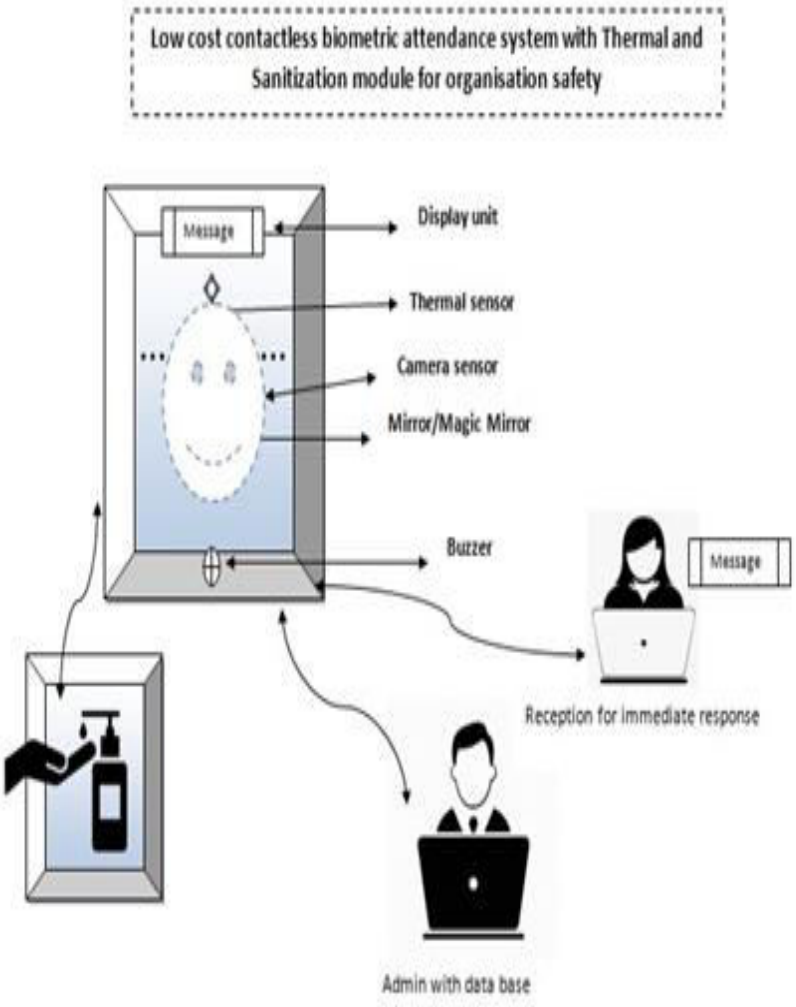

Figure-14: Initial Diagram for Automated Contactless Attendance record system

The proposed device can be used specifically to a biometric system cum personal healthcare monitoring equipment for organization safety. This device relates to monitoring of public safety requirements during this COVID19 situation. More particularly, the invented device is related to the IOT based Smart common device for monitoring of personal parameters so that to avoid for infection of possibility of COVID19 at the doorstep of any organization and also helps in sanitizing. As it is a low cost device so it can be also used for common uses in shopping malls. It contains a smart mirror so the COVID19 instructions and organization notices can also be displayed for information. Since the device is a common accessible device so it can alert regarding the temperature of a person, as first point of contact for every environment starts with spread of the virus at the doorstep of any organization. Detailed flow diagram of the device is depicted by figure 15 and block diagram for automated contactless attendance record system is represented by figure 16.

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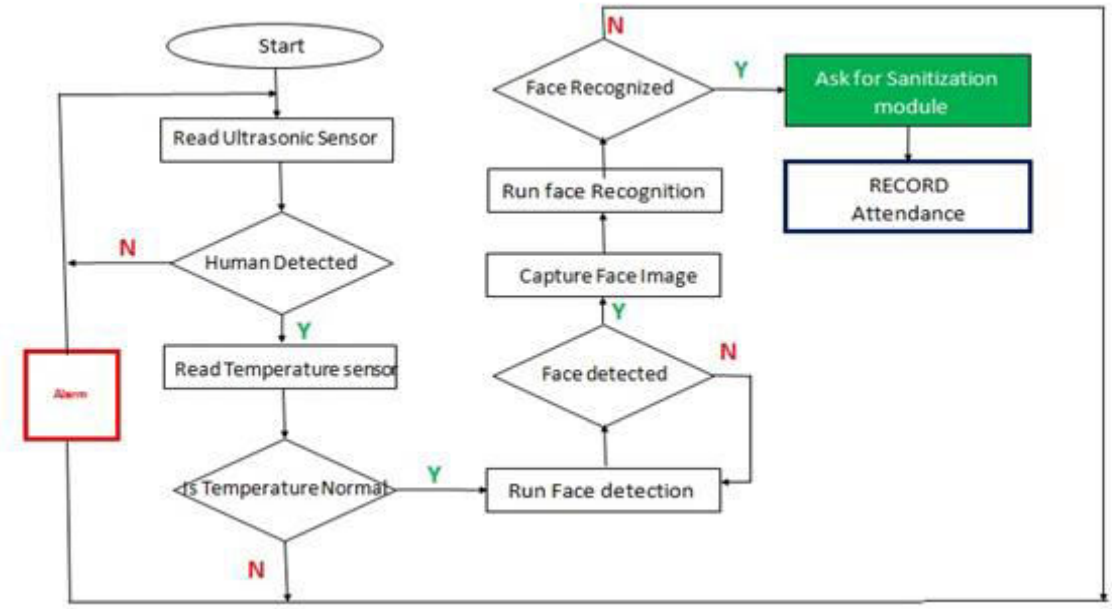

Figure 15: Flow diagram for Automated Contactless Attendance record system

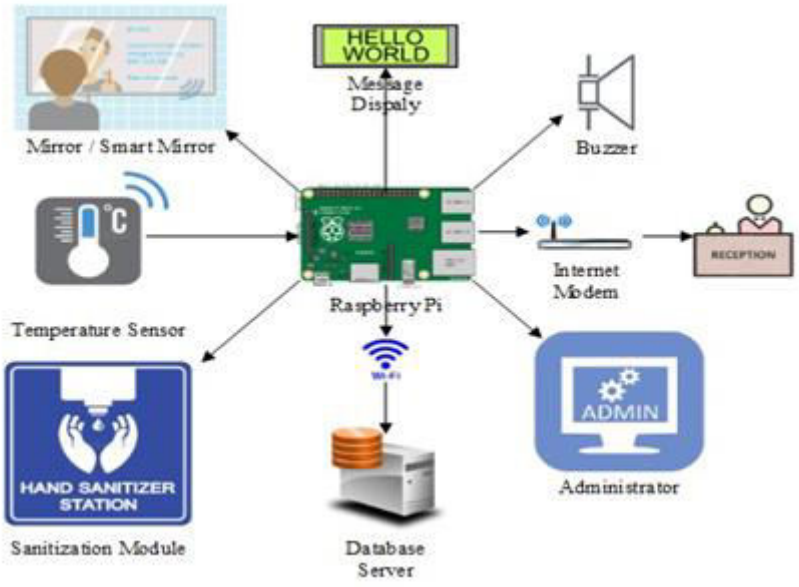

Figure 16: Block Diagram for Automated Contactless Attendance record system

6.2 CONTACTLESS SMART DEVICE FOR PUBLIC SAFETY

This model is generally designed to be deployed at the entrance point of different organizations like School, College, Bank, Public transport, and Temple etc. for implementing some of the basic guidelines of COVID19 to restrict the spread of the virus in this pandemic. Since the device is a common accessible device so it can alert regarding the temperature of a person, as first point of contact for every environment starts with spread of the virus at the doorstep of any organization .So the proposed invented device is related to a automated Contactless health care system for public safety. Since the device is a common accessible device so it can alert regarding the temperature of a person, as first point of contact for every

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environment starts with spread of the virus at the doorstep of any organization. The device will automatically conducts thermal screening to detect the body temperature. If a person is found to have a very high temperature, then the system will display a message in the magic mirror and not allow to entry and will automatically notify that person to take a COVID19 test or to take necessary actions and If the temperature is recorded between the required normal temperature slot then the entry is allowed only after proper hand sanitization using the device.Apart from this, the system also passes a predefined message through the display unit to the person that contains all the details of COVID19 guidelines to be followed along with the toll free number. Generic diagram for the contactless smart device for public safety is depicted by figure 17 and figure 18 shows the flow diagram for contactless smart device for public safety.

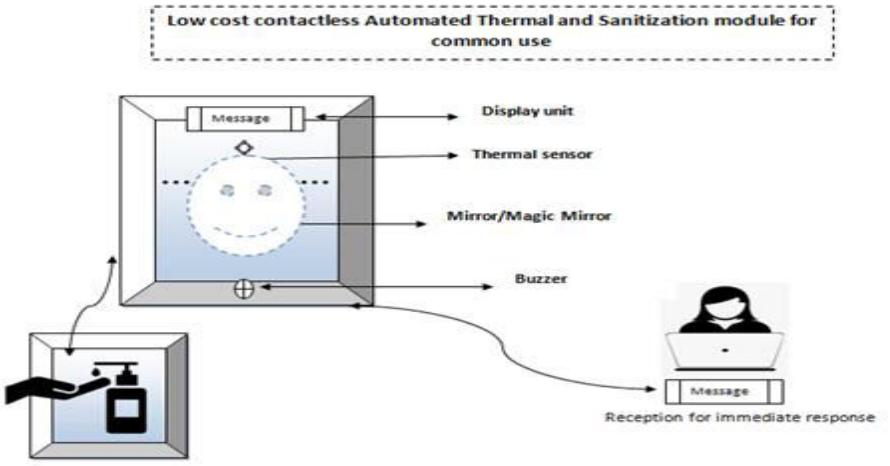

Figure 17: Initial diagram for contactless smart device for public safety

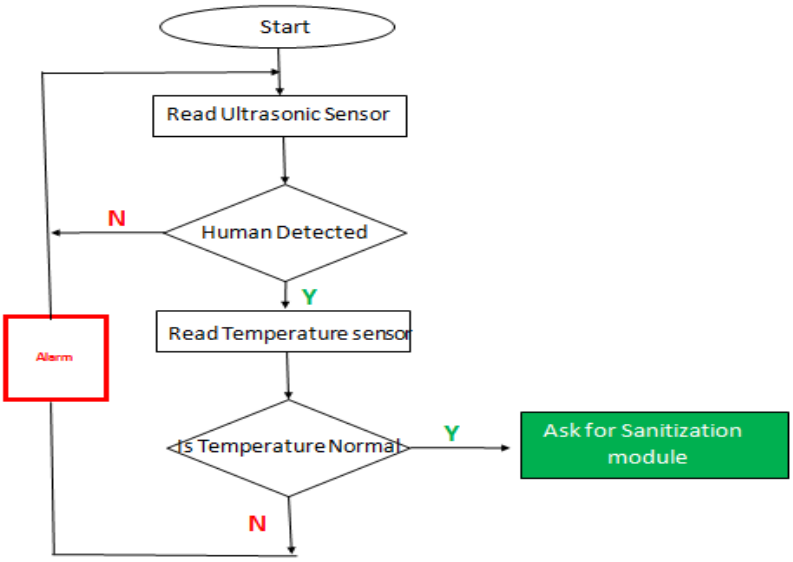

Figure 18: Flow diagram for contactless smart device for public safety

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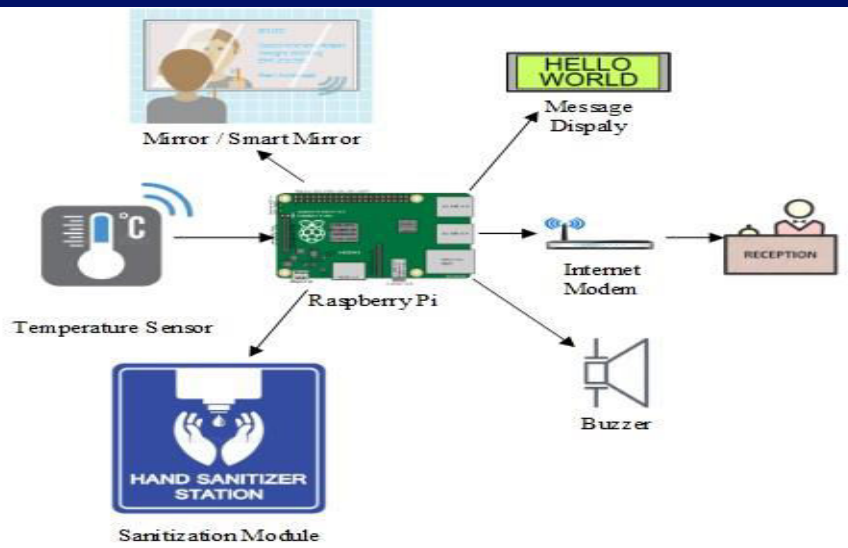

Figure- 19: Block Diagram for contactless smart device for public safety

The proposed device can be used specifically to a personal healthcare monitoring equipment in a public place like school, public transports, market place, Spiritual places, shopping malls, hospital etc. This invention relates to monitoring of public safety requirements during this COVID19 situation. More particularly, the present invention is related to the IOT based Smart common device for monitoring of personal parameters so that to avoid for infection of possibility of COVID19 and also helps in sanitizing. It can be also used for the Hospital staffs to monitor their body temperature in frequent basis and helps in sanitizing. As it is a low-cost device so it can be also used for common uses. This device can be also be used by small retail shops. As it contains a smart mirror so the COVID19 instructions can also be displayed for information. Since, the device is a common accessible device so it can alert regarding the temperature of a person, as first point of contact for every environment starts with spread of the virus at the doorstep of any organization. Figure 19 shows the Block Diagram for contactless smart device for public safety and figure 20 depicts the Prototype model for contactless smart device for public safety.

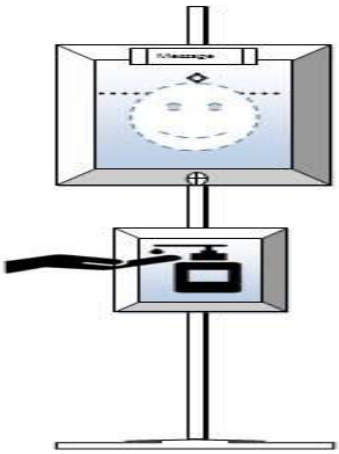

Figure 20: Prototype model for contactless smart device for public safety

7. Conclusion

In this manuscript we have proposed Personal and Public Safety Monitoring Devices in Wake of COVID19 by Application of IoT and Sensor Technology. In the process of treatment many patients are not been properly monitored to their clinical events for better diagnosis. Patients are uncomfortable for the delay in medical attention as cost of such treatments is too high as various devices are to be included in the care. As there are constraints to provide the effective treatment for COVID19 patients in Hospitals due to infectious nature of the disease, we proposed the devices to maintain the quality treatment and it's continuity in the healthcare. Before proposing our inventions we studied different parameters helpful to understand the behaviour of COVID19. Later the role of IoT enabling technology is described how it will be helpful for the purpose. the manuscript provide the detailed description about our inventions including ICT enabled wrist band, ICT enabled face shield, automated contactless attendance record system, and contactless smart device for public safety. we have also provided the detaild working environment and process to use these devices. We hope that in this pandemic time these devices will be helpful to sluggish the impact of pandemic.

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