

Unique Identification for Monitoring of COVID-19 Using the Internet of Things (IoT)

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Abstract— In this paper, a unique identification system is proposed for monitoring the most recently discovered coronavirus (COVID-19). This infectious disease took a large number of lives in a different country. This proposed system can monitor the users from COVID-19 by using the Internet of Things(IoT). A system is designed where thermal scanning of the human body by a sensor and daily the record of the same user is being stored in the database. For identification of each user, there is a development of QR code which is a one-time generation process. If a person having a normal GSM phone then there will be a unique identification number is generated and shared with the operator who registers them to the system so that they can also take benefits. If any person or user having some symptoms and while scanning via a thermal scanner if their body temperature will be 100F or more then a pop-up message will generate and via the audio system will ask him or she is suffering from fever, sore throat, and difficulty in breathing. If a person having all these symptoms then our system will send a message to their mobile for consulting the doctor or for a test. Our proposed system is untouched and operates automatically.

Keywords— Thermal scanning, COVID-19, Monitoring, IoT.

I. INTRODUCTION

Coronavirus disease (COVID-19) is a novel infectious disease and most people who get infected with this virus will encounter mild to moderate respiratory illness and recover without requiring special treatment. Older people and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses [1]. This disease having multiple symptoms for identification and people gets confused about whether they are suffering from this disease or not. WHO ensures about the symptoms and on that basis we can identify this disease. Coronavirus disease is now affecting the lives of everybody and its history is varying all the time. On 31 December 2019, the World Health Organization (WHO) was formally notified about a cluster of cases of pneumonia in Wuhan City, home to 11 million people, and the cultural and economic hub of central China. By 5 January, 59 cases were known and none had been fatal [2][3]. Ten days later, WHO was aware of 282 confirmed cases, of which four were in Japan, South Korea, and Thailand [4]. There had been six deaths in Wuhan, 51 people were severely ill and 12 were in a critical condition. The virus responsible was isolated on 7 January and its genome shared on 12 January [5]. The cause of the severe acute respiratory syndrome that became known as COVID-19 was a novel coronavirus, SARS-CoV-2. The rest is history, albeit a history that is constantly being rewritten: as of 12 May,

82,591 new cases of COVID-19 worldwide were being confirmed daily and the death rate was over 4200 per day [6]. The phylogenetic analysis defines that SARS-CoV-2 generated in animals, probably bats, and was transmitted to other animals before crossing into humans at Wuhan City [7] [8]. With the increase in the number of COVID19 cases along with the globe, the major concern is identifying those individuals infected from the virus. Since now not any concrete symptoms have been recognized which confirm the COVID infection inside the body we are only left with thermal monitoring and assessment of early symptoms of a viral infection inside the body. The symptoms recognized by the WHO are in the following Table 1. With the emerging number of COVID19 cases along the globe causing loss of life of around 6 lakh people. The devices used for monitoring temperature now a day are non-contact thermometer. But unfortunately while screening infected various cases have been reported where it gets transmitted that individual.

TABLE I. Symptoms of COVID-19 [1]

Most Common Symptoms	
Fever	87.9%
Dry Cough	67.7%
Fatigue	38.1%
Sputum Production	33.4%
Less Common Symptoms	
Shortness of Breath	18.6%
Myalgia/Arthralgia	14.8%
Sore Throat	13.9%
Headache	13.6%
Chills	11.4%
Rare Symptoms	
Nausea	5.0%
Nasal Congestion	4.8%
Diarrhea	3.7%
Hemoptysis (Coughing up blood)	0.9%
Conjunctival Congestion	0.8%

In this paper, we propose a monitoring system for COVID-19 which is applicable at multiple zones such as Railway station, Airport, Hospitals, Schools, Colleges, Residential premises, Offices, Shopping mall, and so on. The one reason behind increasing this number of CORONA infected people and death trolls is the irregular monitoring of the person infected from this virus. This may be overcome by implementing a device that can provide the unique identification to every person which can be used to create a database of the various parameters related to the early symptoms of this virus. We are providing a QR (Quick Response) code identification technique to create a database of various users with or without having access to

smartphones. The camera will scan the QR code of the individual and simultaneously the thermal sensor will assess their temperature and update it to the database associated with that person. As the most common symptoms were fever (43.8% on admission and 88.7% during hospitalization) and cough (67.8%). The median incubation period was 4 days (interquartile range, 2 to 7).

II. SYSTEM MODEL

Coronavirus disease is growing at a high rate in India as well as in different countries. The government is taking the number of steps by forming a contaminated zone, distributing states in the red zone, orange zone, and green based on the number of the infected person. Also, impose locked down in whole countries for many days. The growth of the economy stuck at some point due to the locked down. When the process of unlocking begins many people restart their jobs and for this, they have to move from one place to another. In these pandemic situations, people cannot understand whether they affected by the virus or not. By looking at the current situation of COVID-19 we design a model for monitoring the users daily. Our system composed of a thermal sensor which is used for sensing the body temperature of human or users. High zoomed camera for recognizing the human by scanning the QR code. LED screen for showing the measured result of temperature or if the temperature reaches the threshold value or more, then a recorded voice message will be delivered by using the speaker. If any symptom occurs and if the user raises their hand the proximity sensor will identify the movement of arms and a message will blink on the screen for check-up or test of COVID-19. The proposed system is shown in fig.1.

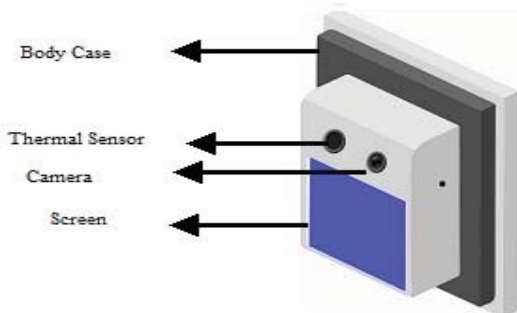


Fig.1. A prototype of the proposed module

The designed module consists of multiple hardware components and its internal circuitry is shown in fig.2. The use of raspberry pie is for operating multiple sensors such as

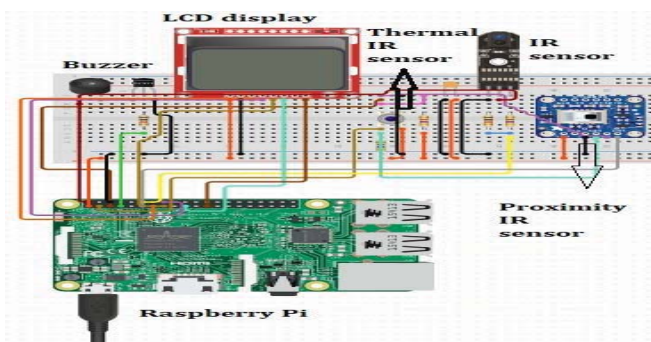


Fig.2. Internal Circuitry of the system

IR obstacle sensor and IR thermal sensor. This system module is operated by IoT and this raspberry pie plays an important role. The data is transmitted and received via GSM module and the generation of QR code for smartphone and UID code for a non-smartphone is done by IoT. The whole operation is controlled by the raspberry pie. The component description with their usage is described in Table II.

TABLE II. COMPONENT DESCRIPTION

Equipment Details	Description	Usage
Thermal sensor- MLX90614	Non-contact thermal infrared sensor with high sensitivity	For thermal scanning
IR obstacle sensor- TCRT500L	IR sensor works at 3.3V to 5V.	To take input response by the users.
Camera Shield	Resolution is 424×3136, Lens is stock lens and camera interface with 2 lane MPI	To scan the QR code and taking a snap of the individuals
Raspberry Pi screen	Capacitive 800×480 touch screen portable	To feed the details of the individual not having a smartphone
Raspberry Pi	Single-board computers, ARM cortex, CPU: 1.5GHz 64/32 bit quad-core.	To automate the entire process of monitoring

III. WORKING OF PROPOSED SYSTEM

Mainly our designed system works on three conditions and these conditions are defined based on the users having a smartphone or not. We describe each condition based on the working principle with block diagrams. If we discuss our first condition in which users having a smartphone. In this condition, the prototype has a camera and it captures the image of the person at the range of 1 meter and by using open source QR code will generate. While generating QR code person must fill the data about himself like his name, age, contact number, and gender. That QR code is displayed on the screen of the prototype and the same QR code is sent to the user's mobile phone.

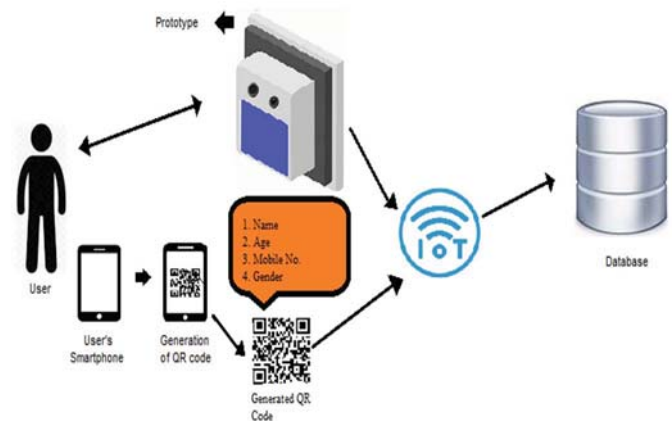


Fig.3. Block diagram with the smartphone

The QR code is stored in the database through the IoT, it means every person having unique identification on which their data will process and monitored accordingly. After that,

a sound is generated by buzzer which shows the indication for thermal scanning. Then the person will move forward towards the IR sensor for temperature measurement and their data will be stored in the database through the IoT. There is also an inbuilt GPS module for getting the user's current location and being updated for determining the QR code generation's location. Then the same process will repeat for another person. The block diagram of this operation is shown in fig. 3. If a person or user does not have the smartphone then the way of operation has been changed according to the defined condition. In this case, if a user is not equipped with a smartphone and carrying a simple GSM phone then the mode of QR code generation will change only. A Unique Identity (UID) number is generated through the IoT and being stored at the database manually for the first time also and a unique identification number is generated and by SMS it will send to the user's phone by using GSM module. By using UID number he will get a print of QR code. They can use it and move for thermal scanning and respective temperature data will store in the database. In QR code the location of the generation of QR code is also mentioned and the same process will repeat for the next user. If a user is unable to get UID number based on his or her mobile number a QR code will generate and they collect it from the nearest control unit. In case he lost the print of QR code then they can also obtain the same QR code from any control unit by using their UID code or mobile number. The block diagram is shown in fig.4.

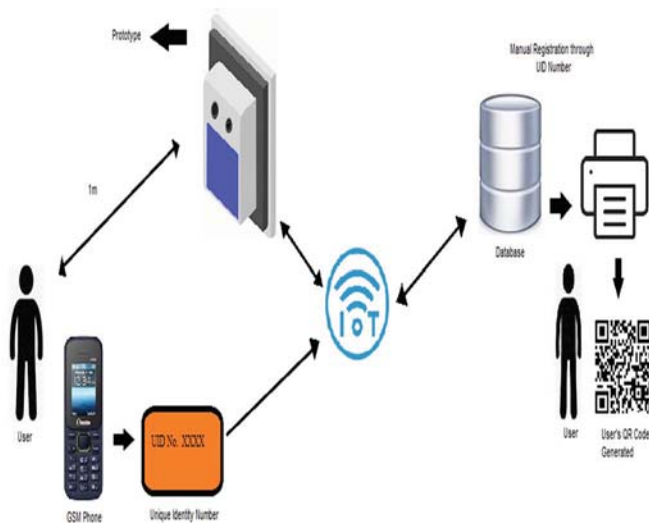


Fig.4. Users with the non-smartphone

Now in another case, we discuss how our system will find the person having symptoms or not. We put some condition if body temperature rises then in this condition how our system works. This case is defined after the thermal scanning if the user's temperature value is equal to or greater than 100° F. Then the details of the user with QR code are displayed on the screen and three questions will be asked after a warning buzzer. These questions will be asked via a recorded voice through a speaker and a person has to raise their hand if "YES". If "NO" then they don't have to raise a hand. By proximity sensor, the movement of hand will be recognized and if any symptom of a user is in YES format then an SMS is received for the alert. If he has temperature

and not facing any symptom then he can also be notified via SMS and regarding this whole information is saved in the database. The location of thermal scanning is also updated and recorded in the database through a GPS module. Like if he went to the mall and proceed for thermal scanning his data will be updated with his current location body temperature at a particular location is updated, if he moves to another location and again he proceeds for thermal scanning his location will update with his body temperature. This process is only applicable to the users having a smartphone. Those who not having smartphones will not be able to get an update about their current location. Their location is fixed and defined only at the time of generation of QR code, if they can update their QR code from the control unit in the case of loss of their QR code or having any reason then their location is identified by the control unit. The schematic operation for this condition is shown in fig.5.

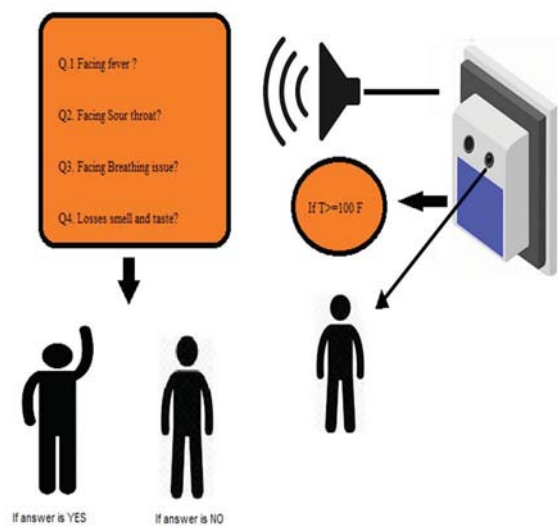


Fig.5. Block diagram for identification of COVID-19

The whole operation is observed and monitored via the Internet of Things, by using the IoT we design a network in which we can easily connect with each user via smartphone or nonsmart phone. COVID-19 is still growing at a fast rate and due to this, the people are unidentified from this infectious disease. To overcome the situation our prototype device may able to identify the symptoms of the corona.

IV. FLOWCHART

In this section we discuss how our prototype works, we can implement it in any zone such as school. So on assuming on this condition we define the whole process of our proposed system. If we consider a college then we categories the users in different sections such as students, professors, academic staff, and non-academic staff, and accordingly we implement the devices for better response and safety. If any user will move towards the system the camera will capture the image and ask him to fill the basic details such as Name, Age, Gender, and Mobile number. After this, a QR code is generated and sends it to the user's phone with the current

location. This QR code is valid for 1 month and it will reissue after filling the details again. All the data is being stored in the database and for security reasons at every month data of users must be updated. After getting the QR code whenever they move through the system has to show the QR code so that the machine can identify easily and then buzzer sound will come from the system which notices them put their forehead in front of the IR thermal sensor for thermal scanning. If the user body's temperature is less than 100F, then that data is updated to the user's database and correspondingly daily, this system works. If the user body's temperature moves beyond the threshold value then their buzzer again sounds three times and asks him to move for self-assessment. While processing the assessment the proposed module is equipped or programmed with the audio message and it will ask about the symptoms of COVID-19 and users have to raise their hand if he is facing the said difficulties. Based on the movement of arm proximity sensor will sense and on that basis a programmed message will be generated and it will reflect on the screen as well as send to the user's phone also and inform them to consult a doctor. Accordingly, all the data is being stored in the user's database by using the Internet of things. The schematic representation of the flowchart is shown in fig.6.

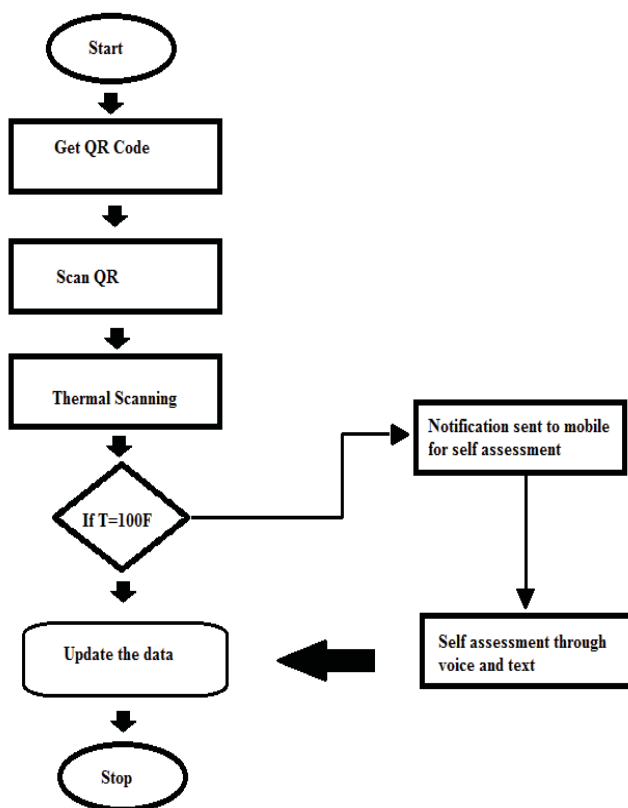


Fig.6 Schematic representation system's working

CONCLUSION

We are proposing a new, novel, innovative, and smart microcontroller based temperature monitoring system idea with the generation of unique QR codes. As we all familiar with the fact that Covid-19 is not only an epidemic in India

but in worldwide. We are now in lockdown but when the lockdown will be removed then we have to manage ourselves with the Coronavirus. In context with a fight against corona, we must need a systematic, advanced monitoring and surveillance system. Our proposed idea completely fits that we are going for thermal scanning as the temperature is the only common symptom for most of the COVID-19 cases worldwide that why we opted for thermal scanning as our main attribute. As discussed in the working principle section we are using an IR sensor for thermal scanning and creating a unique QR code. These generated codes exist lifetime and we can have their basic information like Name, Age, Mobile number, etc, so that in future we can trace him/her if anything goes wrong. Our proposed system is having a pre-recorded voice questions which come in a picture once a person is having a higher temperature value. These questions will enhance the accuracy of the prediction and we can ask him/her to go for self-quarantine and if the things do not change we will suggest him/her to go for further medication. By this, we can find a suspected person and we can break the chain. As mentioned earlier we are providing the unique code so we can trace out the places where that person visited a few days before and we can lock and sanitize that places once the case is confirmed. In this way, our proposed system will be directly useful to the mass of the people. We are providing QR code for not only Smartphone users but also for non-Smartphone users so that this system can be applicable for every common person. We can connect this monitoring system at colleges, schools, Shopping malls, railway stations, bus stand, Offices, banks, etc and as our system is having IoT connection we can have a strong database for the future better prediction using machine learning, AI or big data analysis. We think this system will be a huge success as no such monitoring system with IoT and QR code generator is existing to date. Its easily operate, it is cost-effective, its having small and compact size, it is using Raspberry-pi so in future we can add many more features in it. We can have a huge database same as Aarogya Setu Application and we can compare and share our data for more accurate and precise prediction system generation to fight against COVID-19.

FUTURE WORK

Covid-19 is increasing at a high rate and to detect this disease some other parameters come into the picture. Firstly there was a symptom of body temperature, sore throat, and difficulties in breathing which are major symptoms, and considering breathing issues there must be the detection of oxygen level in human beings. Many people lose their life just because of improper treatment and lack of proper knowledge. In many hospitals, medical staff s are also unable to identify the symptoms properly. In our system, we try to put an oxygen level detection system so that the data of oxygen level will be identified and regularly it will be monitored. The database of a user having some symptoms are also provided to the nearest health center so that they could also reach for the test of the corona. Many people do not understand how it is dangerous. They don't visit to doctor when they were suffering from minor symptoms.

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