

Smart Cap for Prevention of Contagious Diseases and Social Distancing Using Arduino

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Abstract: During the outbreak of contagious diseases like Corona & Nipah, Social distancing and regular check-up of body temperature is very essential. Smart Cap is designed to overcome the problems faced by people who has to go outside homes during the outbreak. The cap senses any human that comes in one-meter radius and can alert them to maintain social distancing. The cap can be used for measurement of body temperature regularly and gives an alert if body temperature is higher than normal. It is also possible to check the body temperature of the people that we come in contact. It stores the live location of wherever the person has gone. If tested positive, the authorities can easily trace the places he went. A transparent face shield is also attached in the cap for prevention of risk of spread.

Keywords – Contagious diseases, Face Shield, location tracking, Pandemic, PIR Sensor, SIM808, Social Distancing, Temperature detection,

I. INTRODUCTION

An infectious disease that spreads across multiple countries is referred as a pandemic. There are many pandemics that have occurred at different times throughout history. Some of the pandemics that have occurred in the past are the 1918 influenza pandemic. Near to 50 Million people died in the pandemic. The next one is the Asian flu in 1957 with a cost of 1.1 million lives, During 2005 there had been an outbreak of HIV/AIDS with an approximate death of 25 million people. Currently there is the outbreak of covid-19 during December 2019 affecting almost all countries in the world.

Nipah and Corona virus diseases were some of life-threatening diseases caused by the recently found deadly viruses which have no vaccination. The source of Corona virus is not yet confirmed by the researchers and the source of Nipah virus was found to be from animals and mainly bat

[11]. The symptoms of Nipah virus included fever, headaches, myalgia vomiting and soar throat. People affected by Corona virus was found to experience moderate and severe respiratory illness. To date, there is no medicine or treatment methods available for such diseases as per the World Health Organization [11,13]. These viruses spread through contact, droplets of saliva, coughs and sneeze of the infected person. Older people with health issues are more likely to be affected and it leads to severe illness. Since there are no vaccination or medicine available, the only way to prevent the spread of the virus is to protect ourselves and others from being affected by the pandemic by taking care of preventive measures. Hence avoiding frequent contact with others and our face and having a good health is very important. Reducing contact rate by social distancing can thereby reduce the transmission rate of the virus [7].

Due to the outbreak of the deadly diseases caused by these viruses, many engineers and researchers around the world had done several research and project works for prevention, tracing and protection of ourselves from being affected and to prevent the spread of these viruses. Some of the research works includes (i)Contact tracing phone app for Covid-19. The app can trace close contacts of those infected with Covid-19 and is of best use for large population [12]. (ii)Contact area detector using cross view projection consistency. As a Covid-19 transmission occurs from touching contaminated objects, the project aims at finding the contacted area on the surface of a static object to help people to better understand the Covid-19 spread [8]. But according to the recent studies of WHO, the possibility of getting affected through objects is very low. Several researches and studies in the medical field were also conducted. Some of the closely related projects includes (i)Social distancing cap. The cap uses an ultrasonic sensor

are used in three sides of the cap and is aimed at ensuring a proper distance in public [2,5]. (ii)Safe distance protection badge. It is a wearable badge. It warns the user if they encroach another user safe distance badge. But the project is effective only when everyone in the society starts using the badge [4]. (iii)IR IoT based contactless temperature sensor. The project is mostly useful in places of public gathering where a person has to manually check and note the temperature of every person who enters. It reduces the effort by placing an IR contactless temperature sensor at the entrance and the temperature of every person is detected and it is stored to the internet cloud [1].

Previous works similar to our project includes Social distancing cap which uses ultrasonic sensor in the front side of the cap [2,5]. An ultrasonic sensor will detect any obstacle in the radius which might not be necessarily human. Hence even a static object will be detected and the alert will be given. Our project overcome these disadvantages by using PIR sensor in the back side of the cap. Where's the PIR sensor particularly detects only humans and animals because it detects by the heat signatures emitted by humans and animals by using Infrared Rays. Also, the ultrasonic sensor placed in the front side of the cap is irrelevant and it is visible for us normally and we can maintain social distancing. Since anyone can see the people in the front side, the sensor is actually required in the backside as it is not possible to look back and forth all the time. This limitation is being overcome in our project by placing the PIR sensor in the back side of the cap so that if a person comes close to us, we get an alert. Another similar project was Safe distance protection badge [4]. The badge is to be worn by every person and it warns the user when another person's badge is encountered within a given range. The limitation of the project is that this badge is effective only if every person in the society uses the badge as if a person without the badge comes nearer to us, it cannot be detected. It is not necessary that everyone in the society uses the badge. The smart cap detects any human presence irrespective of whether the person nearby has a smart cap or not. IR IoT based contactless temperature sensor is a project that has a function of our project [1]. It is a static device and measures the temperature of every person in a public gathering and stores the data in cloud. It is not portable and it measures the temperatures only if the person goes near the meter. It does not collect and store the data of people who doesn't go near it. Smart Cap is portable and we can keep a track of our temperature as well as the temperatures of the people coming near us. Additionally, the smart cap uses a GPS - GSM module to track and store our locations which will be helpful if the person is found to be a carrier of the disease at a later stage. The smart cap is a multipurpose project which is portable and can be used easily.

During such pandemics it is important to keep social distancing among people to prevent the spread of such deadly virus, but many of the jobs cannot be done from home

and the job requires us to go out of the house. The people also will have to go out of their homes to buy supplies for their homes. The smart cap is a device designed for people going out during this period.

The cap contains a PIR sensor, GPS-GSM module, a transparent face shield and temperature sensor. For a person who has to go out during a lockdown during a pandemic, the location history of that person should be stored for future reference [3]. If it is confirmed that person was a carrier of that disease, it would be easier to track the places where the person has gone and the possible spread across the places [6]. People should avoid frequent self-touching and make sure that our temperature and that of the surrounding people are normal. The temperature sensor is used for the regular checking of the body temperature [9,14]. If the body temperature goes beyond the normal body temperature, the buzzer gives an alert to the person wearing the cap. This sensor can also be used to check the body temperature of any person that we come in contact. The PIR sensor is used for sensing any motion in one-meter radius around the person wearing the cap [15]. It helps in social distancing [10]. Since the hands are most exposed part of the human body, self-touching of the face such as touching nose, eyes and mouth frequently must be avoided. The cap has a transparent face shield placed in the front which can be a replacement for masks. Since many people have irritations using a mask, the face shield overcomes that problem since it is not in direct contact with the body.

II. IMPLEMENTATION & METHODOLOGY

The main method for preventing the spread and avoiding infection from the virus is by covering the face, the project was implemented in a cap attached to a face shield. This gives a primary protection with the shield and gives the person a choice to wear mask if necessary. The sensors were attached to a cap for easier use. The block diagram of the circuit used is shown in figure 1.

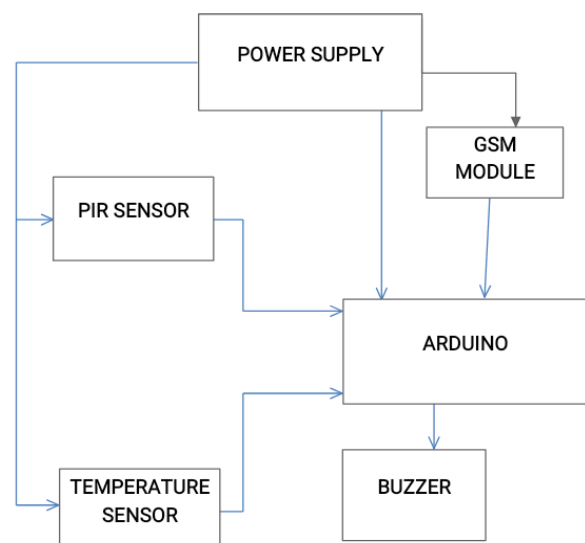


FIG 1: BLOCK DIAGRAM

The flowchart of the methodology used is given in figure 2.

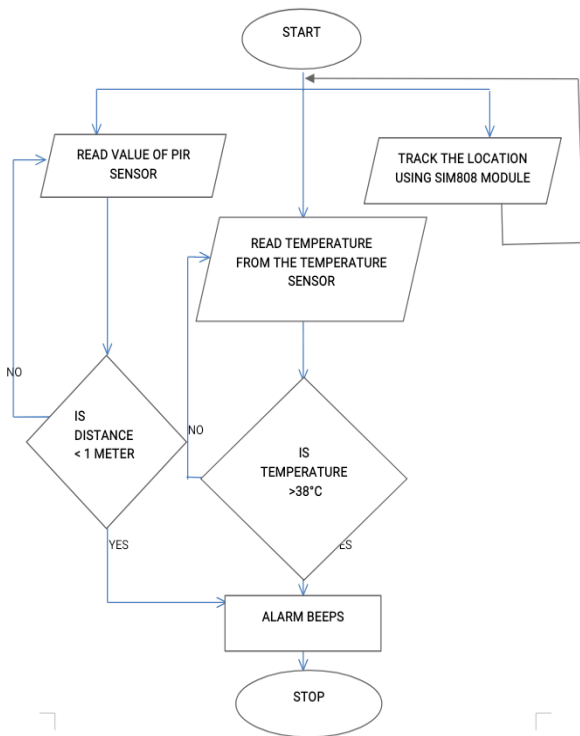


FIG 2: FLOWCHART

The main parts of the smart cap are:

A. POWER SUPPLY

The power supply used is a 9V DC battery. The operating voltage of the Arduino board is 5V DC. Even though the operating voltage is 5V, the input voltage can vary from 7V to 12V DC since the Arduino has an inbuilt voltage regulator which regulates the input voltage to 5V DC.

B. ARDUINO

The development board used in the cap is Arduino. It is a development board that has a microcontroller chip which can be programmed to get the desired outputs. It is an open source microcontroller board. The microcontroller chip used is an Atmega328P. The Arduino board has a set of digital and analog pins which can be programmed.

The Arduino Uno has a flash memory of 32KB, SRAM of 2KB and EEPROM of 1KB. The input voltage can range from 7V DC to 12 V DC. Its operating voltage is 5V DC and has a clock speed of 16 MHz. Arduino Uno is the controlling part of the project. It takes all the inputs such as temperature, location, distances and gives desired output signal after processing.

C. SIM 808

SIM 808 is the GPS-GSM module used in the cap. It is manufactured by SIMCom and contains integrated GSM/GPRS, GPS and Bluetooth engines. The main use of the module is to store the location of the person using it

wherever he goes. The sim card in the GSM module helps us keep track of the location of all the places that the person has gone while wearing the smart cap. Diseases such as Corona can spread through contact even when there are no symptoms shown by the affected. If the person is found to be a carrier of the disease or is tested positive later, the authorities can track the places where the person has gone and get to know the possible people that the patient has come in contact with and possible spread through the air. The GSM engine in the module can also be used to send SMS alerts. SMS alert is given when the body temperature of the person is beyond the normal body temperature

D. TRANSPARENT FACE SHIELD

A transparent face shield is attached to the Smart Cap which protects our face from possible infection of the virus and communal spread through air. It prevents the spreading of airborne diseases to a great extent. The main advantage of the shield is that unlike masks, it can be reused after sanitizing and gives a protection to the whole face. It can be cleaned and washed. The transparency of the shield gives us a proper vision and the visibility of facial expressions and lip movement in a conversation. The shield gives an option for wearing masks. There might be times when people have to pull down the mask. The shield gives protection in such scenario. The shield gives protection to the people even if there is no mask used. The mask makes irritation and allergies for some people. This can also be overcome by using the shield. The shield is not in direct contact with the face and is at a small distance in the front of the cap

E. PIR SENSOR

PIR sensor is used to detect human motion. The sensor in the cap is used to detect any humans in a radius of one meter and alert us if anyone is inside the one-meter range. This can help in maintaining social distancing when the person wearing the cap has to go out of their house. This can prevent the spreading of many air borne diseases and diseases that spread through contact. The PIR sensor uses infrared rays to detect the heat signature of a body and detect the motion of the object based on the thermal values.

F. TEMPERATURE SENSOR

The temperature sensor is used to detect the temperature of the body whenever required. This can be used whenever the person using the cap needs to check the body temperature of himself. It can also be used whenever the person has to check the body temperature of a person near him/her. During an outbreak of any contagious diseases like nipah or Corona, regular check-up of body temperature will be very helpful for anyone using the cap during the outbreak.

G. BUZZER

A buzzer is added to the circuit for the alarm system. To alert the person wearing the cap if something goes wrong. The buzzer has two functions in the smart cap. The buzzer gives alarm while using the temperature sensor, if the body temperature is higher than the normal. It also gives alarm when there is any person in the one-meter radius. This alarm would help recognise the situation and take necessary

actions.

The Smart Cap works when the power supply is turned on. A switch is used for turning the power on and off. The sensors are connected to the Arduino board and the program code is saved in the microcontroller memory. Once the power supply is turned on, the sim card in the SIM808 Module becomes active and starts storing the location until the power is off. The powering of Arduino triggers the turning on of sensors like PIR and temperature sensor and they work continuously

III. RESULT

The smart cap was successfully made and was working. When the person wearing the cap goes out during a lockdown, the person will need to maintain a social distancing of one meter. The person will be able to see only the front side and will not be able to see whether anyone is there behind him. The PIR Sensor attached behind the cap detects any human presence behind the person using infrared rays. The buzzer is used as the alert system. It buzzes when there is anyone in the one-meter distance. Diseases like Nipah and covid can spread through air. This is prevented by the face shield attached in the front side of the cap. The SIM808 Module stores the live location of the cap. The regular check-up of body temperature is also important during an outbreak. The temperature sensor attached to the cap helps to check the body temperature. Since the cap uses a wired sensor, this can also be used to check the body temperature of anyone near us.

IV. CONCLUSION AND FUTURE SCOPE

The smart cap was very useful for the people going out during a pandemic. It helped in social distancing and helped protecting the face when they were not using a mask. It was used to maintain a distance of one meter from other people and helped checking the body temperature of the person on a regular basis.

There are many advantages for using the smart cap. It is easy to use and very cheap. It helps prevent the infection and spread of contagious diseases. It can be reused for a long period of time. Cleaning of the cap is also possible. The shield in the cap also helps replace the mask and gave clear visibility to the facial expressions and lip movement to increase the effectiveness of the conversations and understand emotions clearer.

There are few disadvantages for the cap. The cap is heavier than an ordinary cap due to the hardware circuit. People should wear it all the time to be effective. Wearing the cap for a long time might cause irritation to some people. People who doesn't want to disclose the location of the places where they have gone would not wear the cap while going to those places. If the person is tested positive in the future, the authorities wouldn't get the exact locations of the places where the person has gone. The temperature sensor is contact sensor and hence must be sanitized after each use

The cap has a scope of further improvements in the future. The temperature sensor can be changed to an infrared temperature sensor which will give a more accurate measurement of the temperature. But the infrared temperature sensor will make the cap costly. Using a camera will make the circuit smaller. Camera vision can be used to detect any humans and find their body temperature using thermal imaging. The cap can be improved in many ways which will help overcome the disadvantages and be made a light multipurpose and highly efficient preventive measure during a contagious disease outbreak or pandemic in the future.

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