

TOPIC NAME-Intelligent Post-Lock Down Management System for Public Transportation

PROJECT ID:SPS_PRO_230

TEAM MEMBERS- Anjali Kalwar (anjaliwebwork@gmail.com)

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HACKATHON TOPIC-

INTELLIGENT POST-LOCKDOWN MANAGEMENT SYSTEM FOR PUBLIC TRANSPORTATION

BY-

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UNDER-Smart internz

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Introduction:

1. Problem Statement-

As the number of patients are rising due to corona and as this virus has created problems in our daily life, our very first step after the lockdown should be focused on managing the crowd to control the virus effects.

Hence, the topic of our project is "Intelligent post-lockdown management system for public transportation" as a high amount of crowd is observed in transportation systems and the highest risk and the contact between people is majorly possible here.

Now lets look t the calculation of crowd that needs to be managed-
Data regarding trains:

Railway Lines	No. of stations	Total trains
Western	36	2813
Central	51	
Harbor	28	

Local trains running in Mumbai- 2342

No. of commuters per day- 7.5 million/75 crore

Total no. of trains running in Mumbai per day- 3000

Frequency on one train per day- 25

We consider total number of travelers be 8 million/80 crore

$$[800000000/(25*3000)] = 10800$$

Actual capacity of trains is 3500 to 5000 people. Assume 5000 people to be the capacity of one train. 10800 is the actual crowd in one train.

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Hence, the actual total no. of people in a train is twice it's actual capacity. So how do we manage this?

Hence, the main aim of the project is to assure that the public transport services are safe to use for the passengers without making a lot of changes to the already existing system. Lot of technical changes will generate costs and require a certain amount of time and manpower to be set up appropriately. Therefore the solution suggested by us allows the services to be used with minimum changes reducing the costs and any updates which would take time to install.

2. Solution review-

The solution to the problem statement has been designed to mainly avoid crowding at all whilst working out a well devised crowd reduction and sanitation plan. The peak hours are distributed to avoid crowding by changing the office hours and keeping them in different ranges. The sanitation system in public transport systems will serve the purpose of killing of any possible virus to prevent further spread due to the travelling. To avoid furthermore crowding at general public places, private vehicles have not been allowed to operate. The devices installed in every bus and train compartment helps to check the body temperature of the passengers, sanitize everyone who boards the transportation system and report if anyone with a high fever gets onboard. We have developed this using Node-RED where the IR sensor will detect the human temperature and the app will send a notification if a person with temperature greater than 99.5 enters the bus or train. The IR sensor will also be sending a notification to the policeman in the compartment, after sensing a person, to switch on the sprinkler.

Theoretical Solution:

1. Managing the crowd-

The crowd management plan is minimalistic in nature. With the private vehicles off the road, public commute will be running very smoothly. This also ensures that lesser people would be roaming around in public places in their leisure time and will travel only in their local area for buying essentials or for work.

The frequency of taxis, buses, trains, rickshaws could remain constant. With more commuters looking to travel to work by public transport, more number of people would be interested in driving taxis and rickshaws which will in turn help them earn their income. Only the frontline works will be allowed to use their personal vehicles to travel unhindered in case of emergencies.

The office workers would have their work hours changed, where a group of employees have a different in and out time than another groups. This would not only help improve work efficiency but also considerably reduce the crowding we normally notice at public places from where people commute to and fro from work places.

2. Distribution of crowd-

Instead of all the offices keeping their reporting time 9:00am and around, we plan to redistribute the peak hours by changing the office hours in the following way-

7am-3pm

8am-4pm

9am-5pm

10am-6pm

11am-7pm

12pm-8pm

As the reporting hours are different, the rush at the public transport places will be reduced. This will help to contain the spread of the virus as the size of crowd would be reduced by a significant amount by changing the office reporting hours and helps the commuters to follow the rules of social distancing. The commuters will advised to use the UTS app to book tickets online or can also use the ATVM machine. Those who do not have a smartphone can use the railway ticket counter or ask the railways employee at the ATVM machine to issue them a ticket.

Technological Solution:

1. Hardware solution-

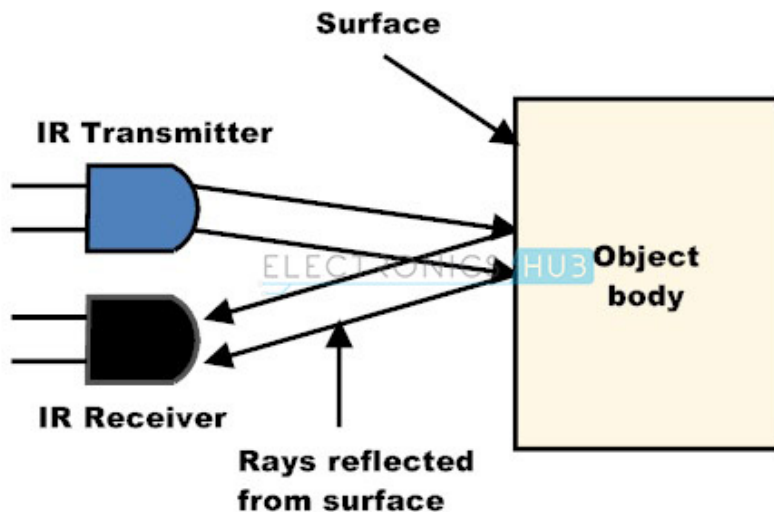
To maintain the hygiene of the people crowding we need to keep sanitizing them to kill the virus and to block the chain. Therefore, we need a sprinkler to sprinkle sanitize all over the people entering the train or bus. We also need an IR sensor to sense the temperature of human body to check the health of the person and be very sure that no human enters with a high temp or with any symptoms of corona. We will need a switch to control the sprinkler and the sensors.

Detailed information about IR sensors-

a) Principle of working of IR sensor:

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto – Coupler.

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.



b) Sprinklers:

We use an Impact Sprinkler. It is a type of irrigation sprinkler in which the sprinkler head, driven in a circular motion by the force of the outgoing water, pivots on a bearing on top of its threaded attachment nut. The head is driven in a circular motion by the force of the

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outgoing water, and at least one arm extends from the head.

By adjusting the position of the limiting collars, water flow can be directed from a full-circle pattern to one of less coverage. The impact sprinkler's long spray radius and uniform water distribution re-creates the effect of natural rainfall.

2. Software solution-

ABOUT NODE-RED

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using wide range of nodes in the pallet that can be deployed to its runtime in a single click.

The platform of Node-RED is Node.js and is written in JavaScript.

HOW TO INSTALL NODE-RED?

a) Install Node.js

Download the latest 10.x LTS version of Node.js from the official Node.js home page. It will offer you the best version for your system.

Once installed, open a command prompt and run the following command to ensure Node.js and npm are installed correctly.

Using Powershell: `node --version; npm --version`

Using cmd: `node --version && npm --version`

b) Install Node-RED

Installing Node-RED as a global module adds the command node-red to your system path. Execute the following at the command prompt:

`npm install -g --unsafe-perm node-red`

c) Run Node-RED

Once installed, you are ready to run Node-RED.

Installing the required nodes from Node-RED

The required nodes are IBM nodes, Dashboard nodes and random nodes

Steps to install required nodes-

a) Go to manage palette

b) Click on install

c) Type in the search bar and install

About the Node-RED flow

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About the nodes-

- **Random node**-Generates a random number between a low and high value.
(Here it will generate human body temperatures)

Edit random node

Delete Cancel Done

Properties

msg. payload

Generate a real number - floating point

From 98

To 104

Name Name

- **input node(time-stamp)**-Injects a message into a flow either manually or at regular intervals. The message payload can be a variety of types, including strings, JavaScript objects or the current time.

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- **Date node**-Adds a date picker widget to the user interface.

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Edit date picker node

Delete Cancel Done

Properties

Group [Home] Train

Size auto

Label date

→ If msg arrives on input, pass through to output: ☒

☒ When changed, send:

Payload Current value

Topic

Name

- **Button node**-Adds a button to the user interface.

Clicking the button generates a message with msg.payload set to the Payload field. If no payload is specified, the node id is used.

(Here door is a button node)

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Edit button node

Delete Cancel Done

Properties

Group [Home] Train

Size auto

Icon optional icon

Label DOOR

Tooltip optional tooltip

Colour optional text/icon color

Background optional background color

☒ When clicked, send:

Payload timestamp

Topic

☐ Enabled

- **Switch node**-Route messages based on their property values or sequence position.

Here the switch node directs the flow according to the given conditions.

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Edit switch node

Delete Cancel Done

Properties

Name

Property ▼ msg.payload

is between ▼ 98 → 1

99.5

is between ▼ 99.5 → 2

200

+ add

checking all rules ▼

☐ recreate message sequences

☐ Enabled

- **Function node**-A JavaScript function block to run against the messages being received by the node.

The messages are passed in as a JavaScript object called **msg**.

By convention it will have a **msg.payload** property containing the body of the message.

The function is expected to return a message object (or multiple message objects), but can choose to return nothing in order to halt a flow.

Here there are 2 function nodes. They are as follows

1)normal named function node

2)fever named function node

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Edit function node

Delete Cancel Done

Properties

Name Normal

Function

```
1 msg.payload="SPRINKLER ON";
2 return msg;
```

Outputs 1

☐ Enabled

Edit function node

Delete Cancel Done

Properties

Name Fever

Function

```
1 msg.payload="SPRINKLER ON & ALERT!";
2 return msg;
```

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- **Debug node**-Displays selected message properties in the debug sidebar tab and optionally the runtime log. By default it displays **msg.payload**, but can be configured to display any property, the full message or the result of a JSONata expression.

Edit debug node

Delete Cancel Done

Properties

Output ▼ msg.payload

To ☒ debug window
☐ system console
☐ node status (32 characters)

Name Name

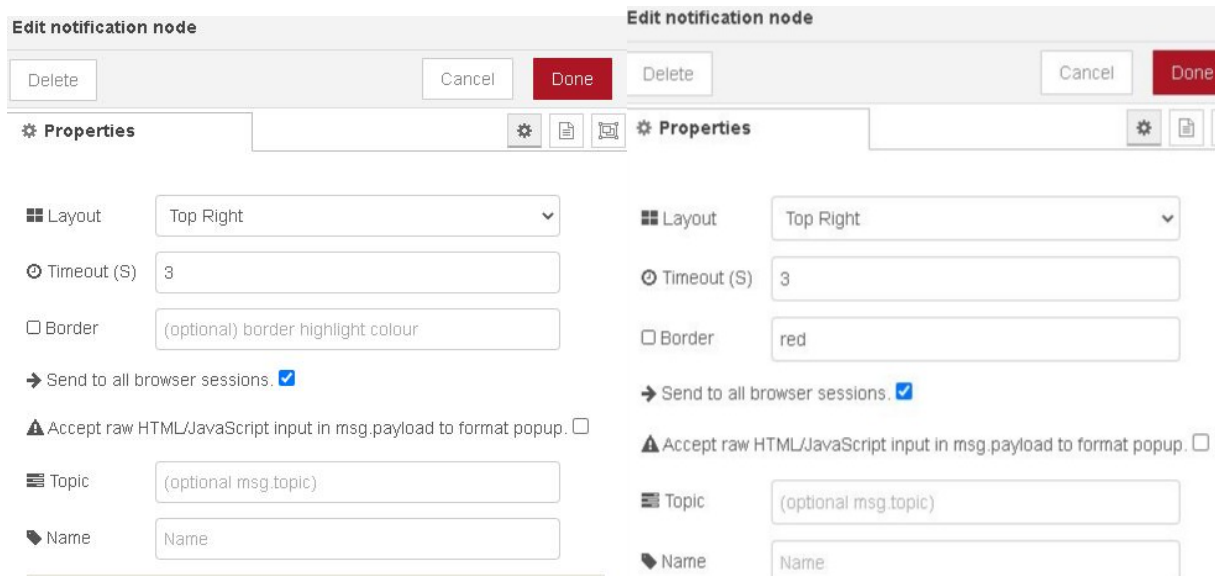
- **Notification node**-There are 2 notification nodes used here. Th notification nodes are availabe in dashboard nodes.

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Edit notification node

Delete Cancel Done

Properties

Layout: Top Right

Timeout (S): 3

Border: (optional) border highlight colour

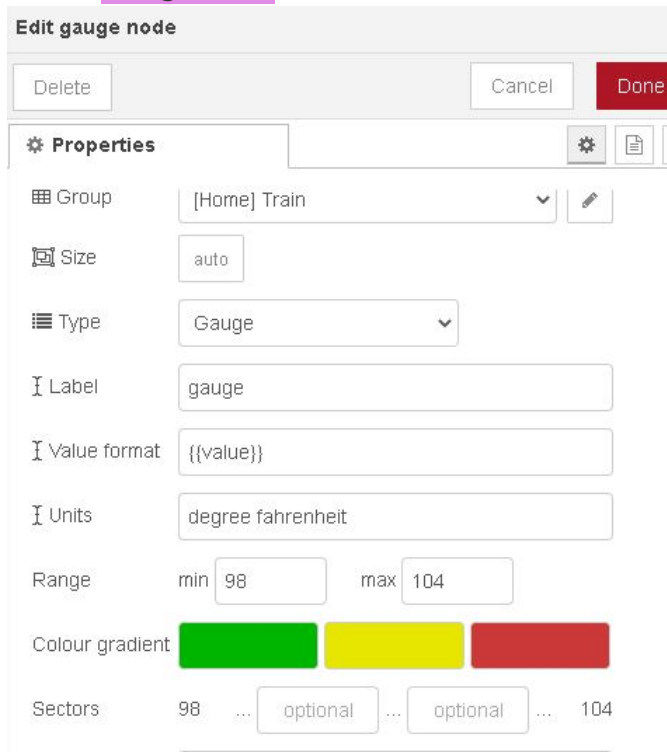
Send to all browser sessions: ☒

Accept raw HTML/JavaScript input in msg.payload to format popup: ☐

Topic: (optional msg.topic)

Name: Name

- **Gauge node**- This is also available in dashboard nodes.



Edit gauge node

Delete Cancel Done

Properties

Group: [Home] Train

Size: auto


Type: Gauge

Label: gauge

Value format: {{value}}

Units: degree fahrenheit

Range: min 98 max 104

Colour gradient: 

Sectors: 98 ... optional ... optional ... 104

- **File node**-Writes `msg.payload` to a file, either adding to the end or replacing the existing content. Alternatively, it can delete the file.

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Here the file stores all the human body temperatures entering through an entrance.

Advantages:

Crowding at peak hours will decrease as office reporting timings are distributed.

Minimum technologies are used to bring changes. Hence, updates will be done easily and transport will be safe for use very soon.

These changes help the poor people to travel to work feasibly.

Since the majority of people travelling are laborers public transport will help them go to work and earn for their basic needs.

Since changes made to the transport system are minimum, the cost of updating will not be high which will be favourable to our current economic situation.

As private vehicles are banned more number of people will be traveling by public transport which will help the government to generate revenue. This will also avoid flocking of people at public places.

Disadvantages:

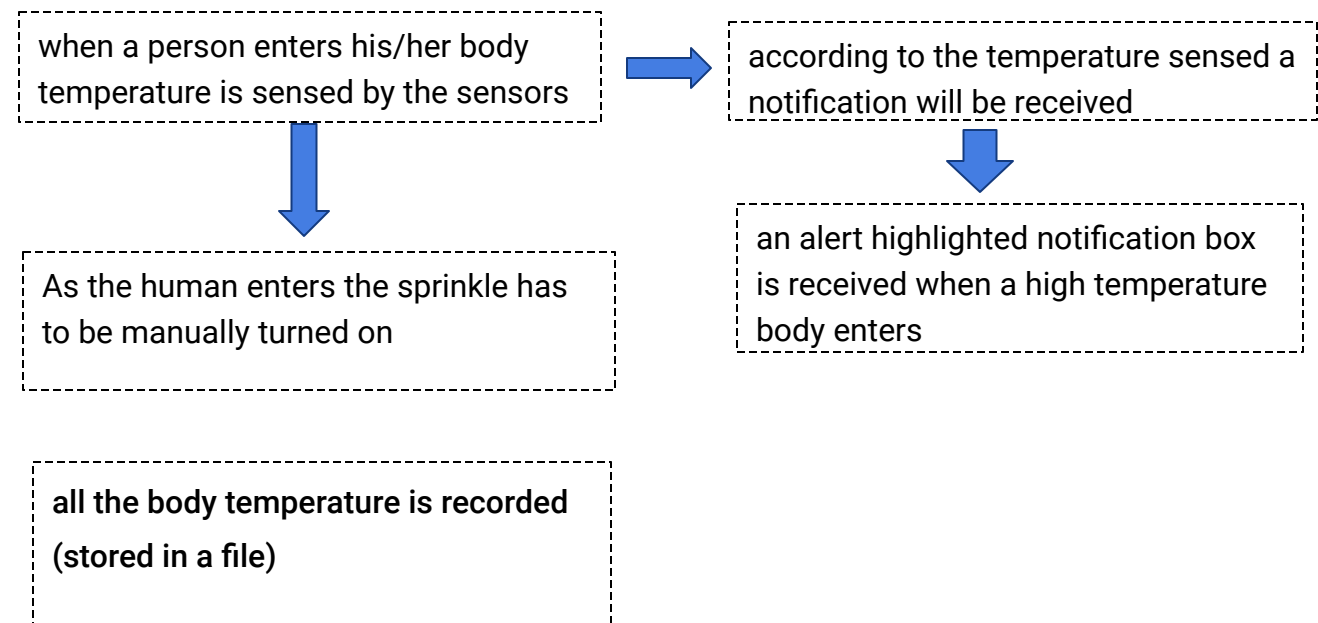
The design of the app is less interactive and it shows simple alerts as notifications.

The app is required to be downloaded in a smartphone only. This also makes having to know how to use a smartphone a necessary skill. There should be compatibility between the phone and the app for the app to run smoothly.

The user has to do the work manually (has to use the switch to on and off). This brings a possibility of contact and transfer of virus. The app should be 00000..made user-friendly by adding more automatic features.

Flowchart:

flowchart on how the system works-



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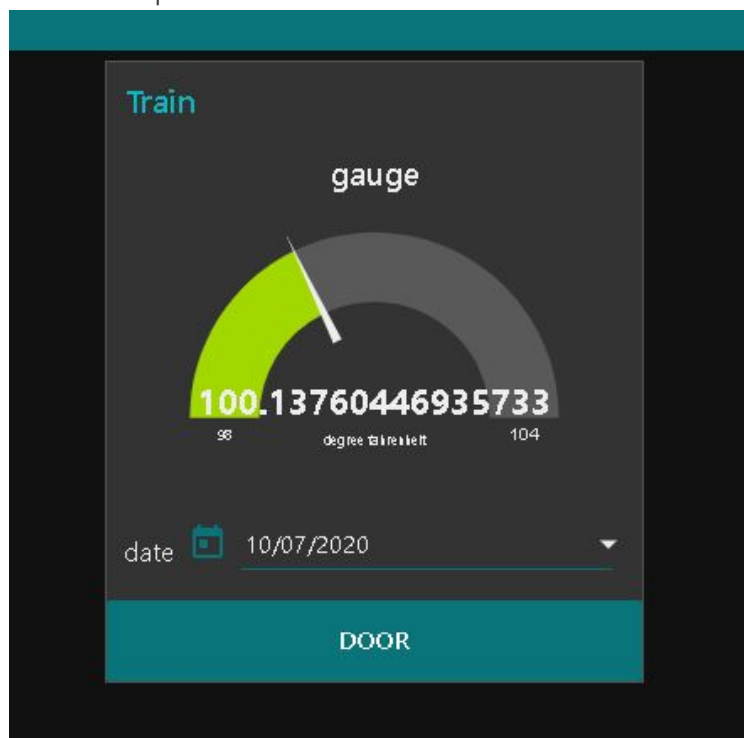
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Results:

The UI output-

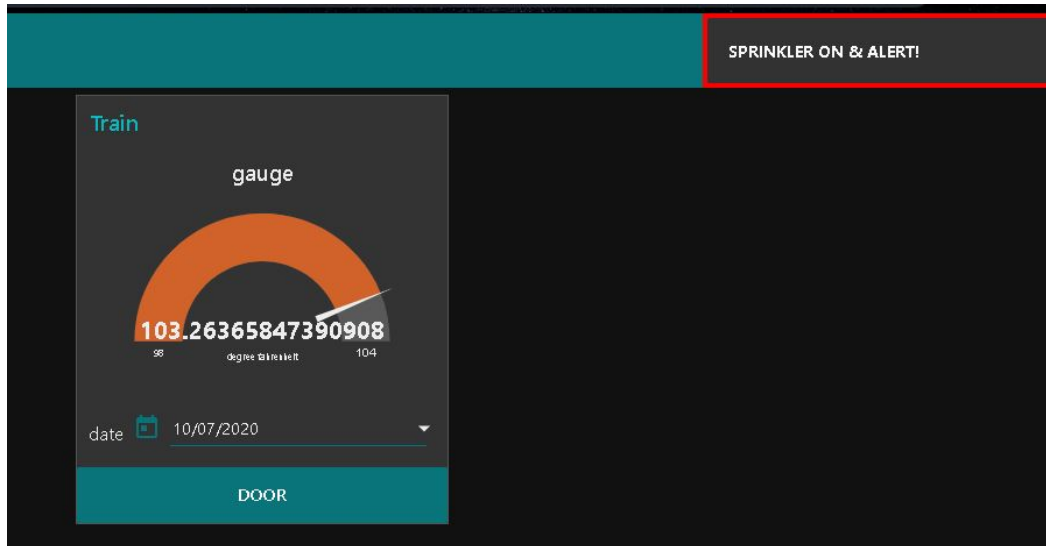


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Conclusion:

After implementing this in public transport systems, it will help people to travel safely and enable offices to function. The overall design is economically friendly and aims to provide safety and security to the public while travelling with only minimum upgrades. It also aids to restrain the spread of the virus and the number of victims will be reduced. This would enable people to start their normal life where they are also following some precautions and rules to keep their health safe.

The app provides to monitor the health of people around you as you travel in public transportations.

Hence, the main aim of the project is to assure that the public transport services are safe to use for the passengers without making a lot of changes to the already existing system. A lot of technical changes will generate costs and require a certain amount of time and labourers to be set up appropriately. Therefore the solution suggested by us allows the services to be used with minimum changes reducing the costs and any updates which would take time to install.

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Application:

This app can be used not only in trains and buses but also in many crowding areas.

The app can be implemented in shopping malls, schools, colleges,society, hospitals and other public crowding places.

It will store the temperature of human body entering and send notifications about what should be done and can also send a warning signal on the app if a covid symptom patient enters the environmental surroundings.

All this information can be received by person sitting anywhere and can know about what is exactly happening at the gates .

Scope of work:

People can use online apps to book tickets.

People who don't prefer to use online apps can buy tickets from the ticket counter.

Officials at the ticket counters can take care about sanitization and social distancing there.

As changes are made in peak hours, the crowd gets divided with respect to time slots.

As the people enter through the doors of trains/buses, the IR sensor(radiation thermometer) gets activated. Hence, when a high temperature body will pass through the IR sensor which is put at the door, the LED radiates light i.e. LED will turn 'ON' which will be a warning signal to people about the danger.

Pendant type sprinkler also gets activated as people enter through the doors and the sprinkler sprinkles the sanitizer on people in all directions. The timer deactivates the sprinkler and the sprinkler stops sprinkling the sanitizer after 20 seconds.

These technologies will assure the safety of people.

As a policeman will be present in every compartment, discipline and smooth working of the process will be taken care of.

People should make sure that Aarogya Setu app is installed in their phones.

This is how minimum changes can make environment and surroundings a better place for people to live in.

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Future Scope:

The internet of things describes the network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. IoT applications are prebuilt software-as-a-service applications that can analyze and present captured IoT sensor data to business users via dashboards. The ability of IoT is to provide sensor information as well as enable device to device communication.

Our project when collaborated properly using IoT can be very advance and can bring modernization in our practical world.

The sensors and the sprinkler can be controlled using the app itself. This will decrease the problems of touch and make the system more safe and friendly to the person managing the crowd using the app and taking care of people in the compartment.

This app can be implemented in many crowding places like schools, colleges, shopping malls, etc and the alert information (msg/notification) can be received by the heads/care-takers of these places and the app can be made more friendly by having the contacts of the nearby hospitals and policeman which can be a help for people facing problems in managing the crowd or can be a help to people who are suffering from the covid disease to get the medical treatments easily.

The app should be made for communication like sending photo and the contact of the patient suffering from covid and also a counter should be implemented on the gates that counts the no of people entering the place and sends a msg as "stop the crowd" when a specific no is crossed. This can be a help to also manage the crowd using the app.