

# **SIGN WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY**

**NALAIYA THIRAN PROJECT BASED LEARNING**

**ON**

**PROFESSIONAL READINESS FOR INNOVATION,  
EMPLOYABILITY AND ENTREPRENEURSHIP**

***Project Report Submitted By***

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**NOVEMBER -2022**

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## **1.INTRODUCTION**

### **1.1 PROJECT OVERVIEW**

The goal of this project is to replace the static signboards with smart connected sign boards to get the speed limitations from a web app using weather API and update it automatically based on the weather conditions, set diversions through API and warn drivers for school zones and hospital zones.

### **1.2 PURPOSE**

This project has designed a system to alert the driver about the speed limits in specific areas by reducing the speed of the vehicles in sensitive public zones without any interference of the drivers where controls are taken automatically by the use of a wireless local area network. The main objective of the proposed system is to operate the vehicles in a safe speed at critical zones minimizing the possible risk of unwitting accidents and casualties. Besides, the system is capable of detecting the accidents and give notification to the control room. The system operates in such way that the accident information is passed to the vehicles entering the same zone to take diversion to avoid traffic congestion.

## **2.LITERATURE SURVEY**

### **2.1 EXISTING PROBLEM**

- Rain makes brakes inefficient and leads to accidents
- Fog reduces visibility and increases the probability of accidents
- Traffic diversion requires human intervention

### **2.2 REFERENCE**

1. Aalaei, A., & Davoudpour, H. (2016). Revised multi-choice goal programming for incorporated dynamic virtual cellular manufacturing into supply chain management: A case study. *Engineering Applications of Artificial Intelligence*, 47, 3–15.
2. Abdoa, J., & Demerjianb, J. (2017). Evaluation of mobile cloud architectures. *Pervasive and Mobile Computing*, 39, 284–303.

3. Aburaia, M., Markl, E., & Stuje, K. (2015). New concept for design and control of 4 axis robot using the additive manufacturing technology. *Procedia Engineering*,100, 1364–1369.

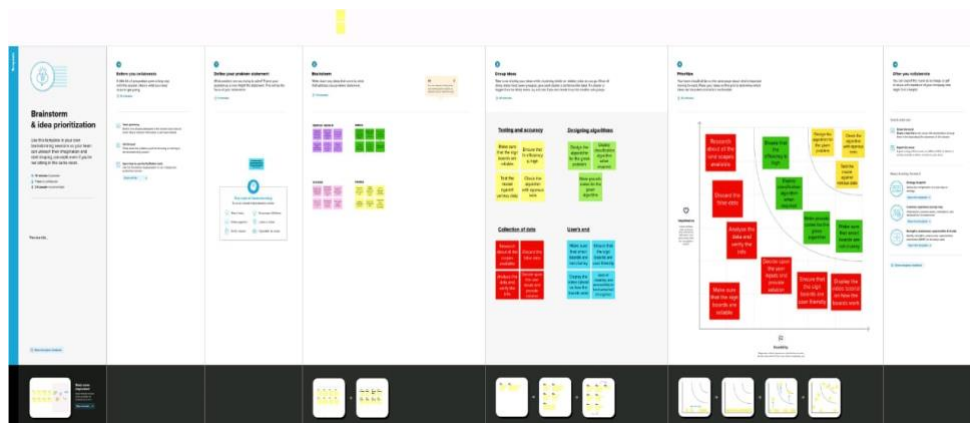
4. Ahmed, E., & Kohno, R. (2017). Error control coding and decoding with medical QoS constraints for Wban end to end connection via

## 2.2 PROBLEM STATEMENT DEFINITION

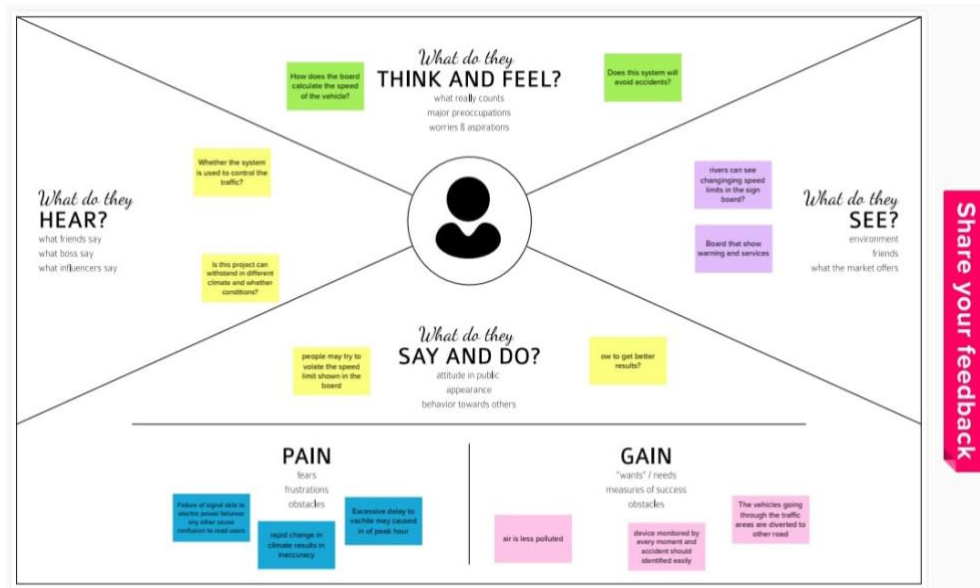
The early effects to prevent road accidents and to ensure road safety includes the use of speed detection devices,CCTVs,speed limiters and emergency accident units.Old approaches emphasize the concept of problem-solving in Road safety, but it is more correct to recognize that Road safety activities doesn't solve problems. For instance, when a safer road design is implemented,hopefully the number of crashes, or their seriousness, will go down, but they will not disappear. It is more correct to say the implementation of correct policies, programs and measures will reduce numbers or consequences of crashes, but they will no be solved.This realization is important,because it changes the focus from a problem that will go away if we devote enough resources to it, to a situation requiring on-going management. This management in turn requires thedevelopment of scientifically based techniques, witch will enable us to predict with confidencethat safety resources are well-spent and likely to be effective.The standard measures used in assessing road safety interventions are fatalities and killed or seriously injured (KSI) rates, usually per billion (109) passenger kilometres.Vehicle speed within the human tolerances for avoiding serious injury and death is a key goal of modern road design because impact speed affects the severity of injury to both occupants and pedestrians.

## 3.IDEATION & PROPOSED SOLUTION

### 3.1 EMPATH MAP CANVAS



### 3.2 IDEATION & BRAINSTORMING



### 3.3 PROPOSED SOLUTION

S.No	Parameters	Description
1	Problem Statement	<p>To replace the static signboards, smart connected sign boards are used.</p> <p>These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.</p> <p>Based on the weather changes the speed may increase or decrease</p> <p>Based on the traffic and fatal situations the diversion signs are displayed.</p> <p>Guide(Schools), Warning and Service(Hospitals, Restaurant) signs are also displayed accordingly.</p>

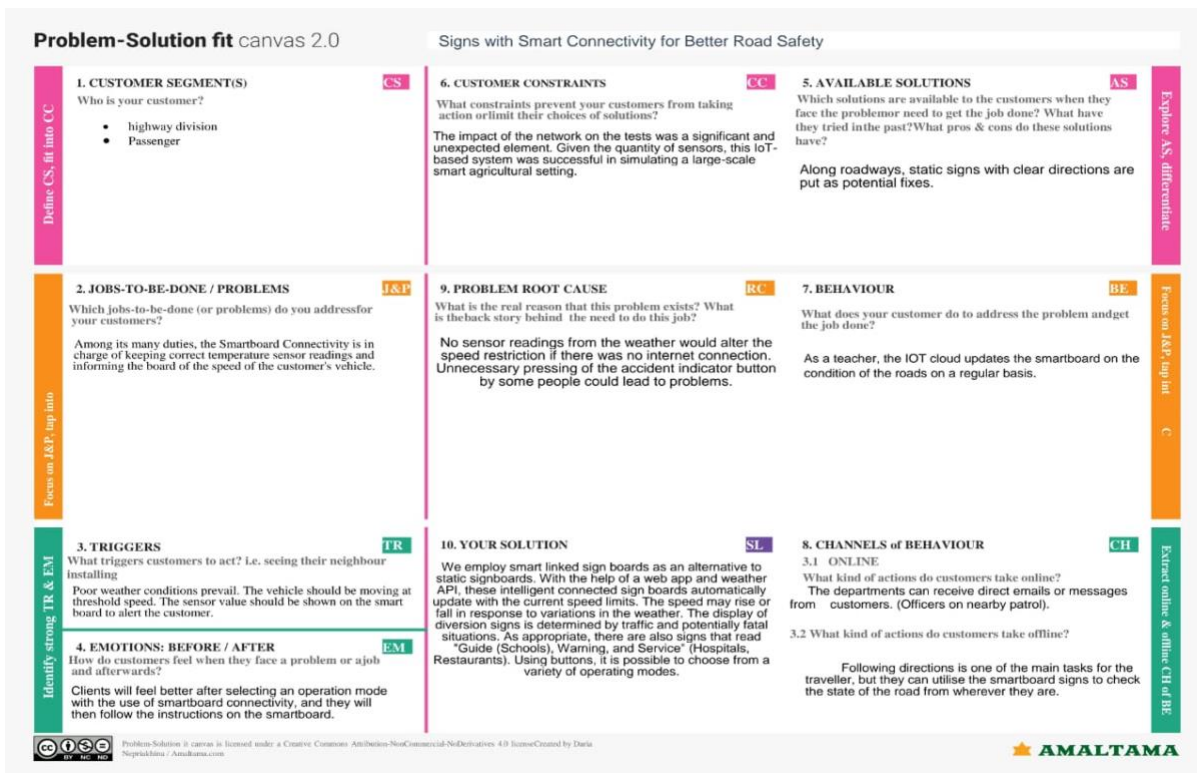
		Different modes of operations can be selected with the help of buttons.
2	Idea Description	<p>The weather and temperature details are obtained from the OpenWeatherMap API. Using these details, the speed limit will be updated automatically in accordance with the weather conditions. Also, the details regarding any accidents and traffic congestion faced on the particular road are obtained .Based on this,the traffic is diverted followed by a change in map path and the traffic is cleared. So in the traffic sign board , some buttons will be placed which will be used to make it generic; where each button will be given a functionality such as changing the warning signs, which are predefined and separate signs will be present for both school andhospital zones.By activating this button, either through the web application or the physical buttons, sign of the board can be changed accordingly, and the speed limit will also be set depending upon the zones. Also, the pedestrians are given an option to change the traffic signs if they want to cross the road. If the pedestrian presses the button that is present on the post at the end of the road, then the traffic will be analyzed immediately. Accordingly, the sign of the traffic signal will be</p>

		<p>changed. This inturn reduces the frequent changing of the traffic signs even if the pedestrians are not present.</p>
3	Novelty	<p>Generic Sign board for all applications that uses both buttons and web service for updation</p> <p>Pedestrians are given the access to request the sign change of the signal to cross the road</p>
4	Customer satisfaction	<p>Diversion reasons will be displayed</p> <p>If there is no traffic, pedestrians can cross the street without waiting.</p> <p>Customer can reach the destination before the expected time</p>
5	Business Model	<p>Since APIs are used to actively monitor the customer's environment, this project employs a business strategy in which revenue will be generated on the basis of the length of time in which the customers actively interact with the product.</p> <p>This product is aimed to be free of cost to the public, but the revenue will be generated by selling this product to the government at a low cost, so there will be less accidents and the public will be aware of the discrepancies or accidents in the particular road. The public will</p>

		<p>also gain all the information about the road, even if they are checking for an alternate path because of some mishaps that happen on the roads and these functionalities will increase the value of the product in the global market.</p>
6	Scalability of the solution	<p>In the future, if any update is required either on the hardware or software side, it can be easily implemented. The hardware components can be directly interfaced with the microcontroller and small modifications can be made in the programming of the existing product. In case of the software, the website application has to be updated with the additional functionality by creating a new section for the updated hardware. So this will not affect the existing functionality of the product and new functionality can be easily integrated. In addition, a separate circuit will be kept along with the hardware to detect any problem which informs the web application. Also a notification will be sent to the product service department.</p>



### 3.4 PROBLEM SOLUTION FIT



### 4. REQUIREMENT ANALYSIS

#### 4.1 FUNCTIONAL REQUIREMENT

FR No	Functional requirement (Epic)	Sub requirement (Story/sub-task)
FR-1	User registration	Sign Boards should be made of bright coloured LED'S enable of attractive driver's attention not too distracting to cause accidents
FR-2	User confirmation	Should display information through means like images/illustrations with text so that the user can understand the signs correctly
FR-3	User convenience	Display should be big enough to display all the signs correctly so that it is visible even to far away drivers

Following are the functional requirements of the proposed solution.

## 4.2 NON-FICTIONAL REQUIREMENTS

Following are the non-functional requirements of the proposed solution

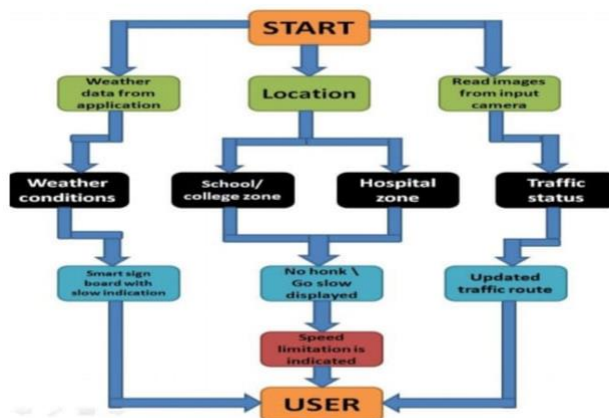
FR.NO	Non-fictional requirements	Description
NFR-1	Usability	Should be able to dynamically update with respect to time.
NFR-2	Security	Should be secure enough that only the intended messages are displayed in the display.
NFR-3	Reliability	Should convey the traffic information correctly.
NFR-4	Performance	Display should update dynamically

		whenever the weather or traffic values are updated.
NFR-5	Availability	Should be on service 24/7
NFR-6	Scalability	should be modular and hence able to scale on servers horizontally.

## 5.PROJECT DESIGN

### 5.1 DATA FLOW DIAGRAM

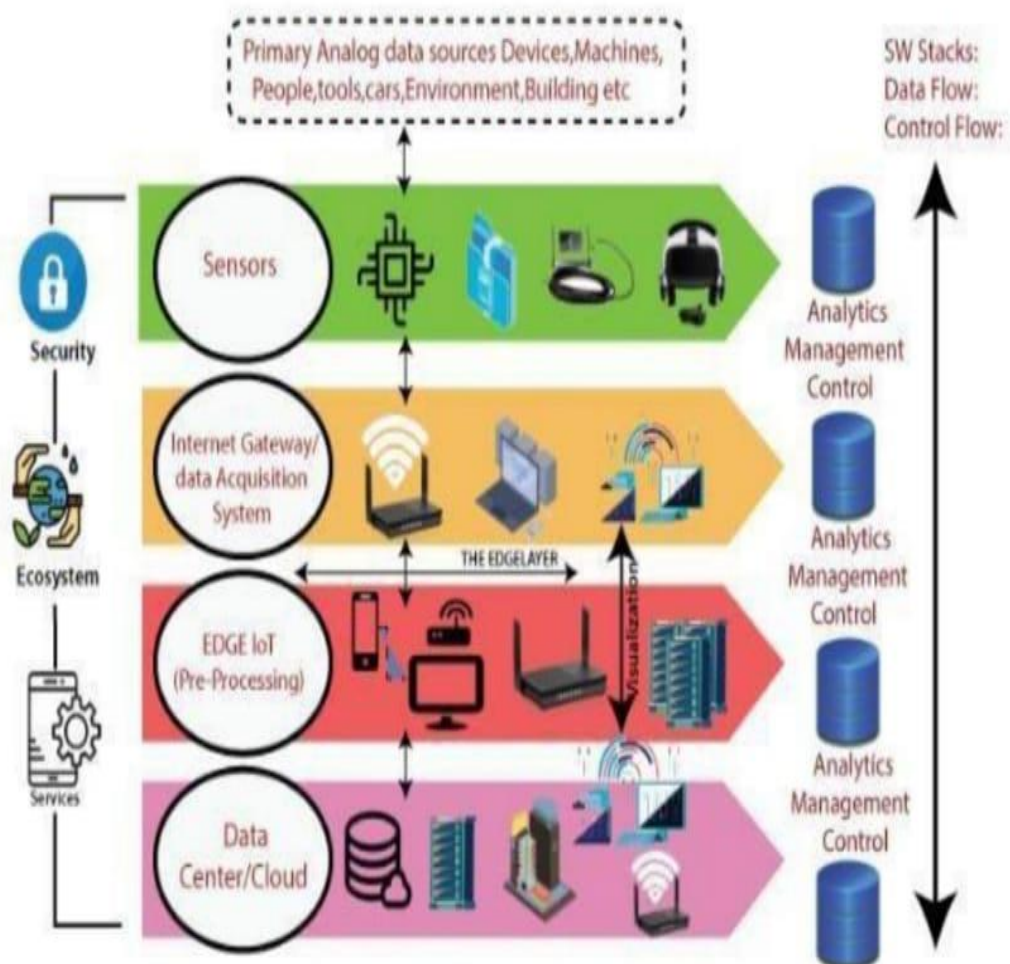
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored



## 5.2 SOLUTION & TECHNICAL ARCHITECTURE

Solution Architecture: To replace the static signboards, smart connected sign boards are used.

- These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.
- Based on the weather changes the speed may increase or decrease.
- Based on the traffic and fatal situations the diversion signs are displayed.
- Guide (Schools), Warning and Service (Hospitals, Restaurant) signs are also displayed according



## 6.PROJECT PLANNING AND SCHEDULING

### 6.1 Sprint planning & Estimation

Product backlog, sprint schedule and estimation (4m)

Sprint	Functional requirements (epic)	User story/Task	Story points	Priority	Team members
Sprint-1	Resources initialisation	Create and initialize accounts in various public APIs like OpenWeather API.	1	LOW	ISSATHU NISHA, SANAA, SUHAINA, FAHIMA
Sprint-1	Local Server/Software Run	Write a Python program that outputs results given the inputs like weather and location	1	MEDIUM	ISSATHU NISHA, SANAA, SUHAINA, FAHIMA
Sprint-2	Push the server/software to cloud	Push the code from Sprint 1 to cloud so it can be accessed from anywhere	2	MEDIUM	ISSATHU NISHA, SANAA, SUHAINA, FAHIMA
Sprint-3	Hardware initialization	Integrate the hardware to be able to access the cloud functions and provide inputs to the same.	2	HIGH	ISSATHU NISHA, SANAA, SUHAINA,

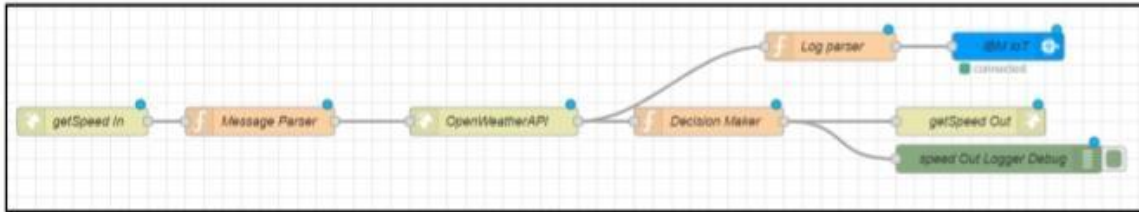
					FAHIMA
Sprint-4	UI/UX Optimization & Debugging	Optimize all the shortcomings and provide better user experience	2	LOW	ISSATHU NISHA,  SANAA,  SUHAINA,  FAHIMA

#### Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total story points	Duration	Sprint start date	Sprint end date(planned)	Story points completed (as on planned end date)	Sprint release date(actual)
Sprint-1	20	6 Days	24 oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	07 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

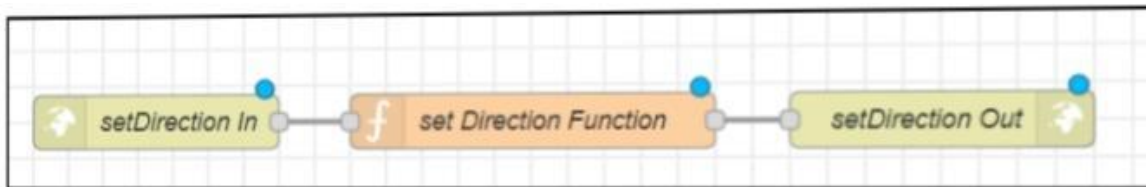
## 7.CODING & SOLUTIONING

### 7.1 FEATURE 1 - GET SPEED FOR GIVEN LOCATION & CLIMATE



This part of Node RED flow accepts an http GET end point at `"/getSpeed"` from which the location, uid, hospital/school zone info are passed. Message parser sets the required APIKEY for OpenWeatherAPI for the next block. This data is then passed out Decision Maker which makes all the decisions regarding the message to be output at the display and sends it as a http response. This data is displayed at the micro controller. Thus a lot of battery is saved due to lesser processing time.

## 7.2 FEATURE 2 - SET DIRECTION REMOTELY FOR A GIVEN SIGN BOARD



This part of Node RED flow accepts an http GET end point at `"/setDirection"` from which the uid and direction information are passed by the respective authorities. Set Direction Function block adds the direction information to the database and returns the same as an http response. This data is sent to the microcontroller along with the `"/getSpeed"` path and the microcontroller displays it.

## 8.TESTING

### 8.1 TEST CASE

#### ● TEST CASE 1

Clear weather - Usual Speed Limit.

#### ● TEST CASE 2

Foggy Weather - Reduced Speed Limit.

#### ● TEST CASE 3

Rainy Weather - Further Reduced Speed Limit.

#### ● TEST CASE 4

School/Hospital Zone - Do not Honk sign is displayed.

## 8.2 USER ACCEPTANCE TESTING

Dynamic speed & diversion variations based on the weather and traffic helps user to avoid traffic and have a safe journey home. The users would welcome this idea to be implemented everywhere.

## 9. RESULT

### 9.1 PERFORMANCE MATRICS

Based on the IBM pack we chose, the performance of the website varies. Built upon NodeJS, a light and high performance engine, NodeRED is capable of handling upto 10,000 requests per second. Moreover, since the system is horizontally scalable, a even higher demand of customers can be served.

## 10. ADVANTAGES & DISADVANTAGES

### ADVANTAGES

- Lower battery consumption since processing is done mostly by Node RED servers in the cloud.
- Cheaper and low requirement micro controllers can be used since processing requirements are reduced.
- Longer lasting systems.
- Dynamic Sign updation.
- School/Hospital Zone alerts

### DISADVANTAGE

- The size of the display determines the requirement of the micro controller
- Dependent on OpenWeatherAPI and hence the speed reduction is same for a large area in the scale of cities.

## 12. CONCLUSION



Our project is capable of serving as a replacement for static signs for a comparatively lower cost and can be implemented in the very near future. This will help reduce a lot of accidents and maintain a more peaceful traffic atmosphere in the country.

### 13.FEATURE SCOPES

Introduction of intelligent road sign groups in real life scenarios could have great impact on increasing the driving safety by providing the end-user (car driver) with the most accurate information regarding the current road and traffic conditions. Even displaying the information of a suggested driving speed and road surface condition(temperature, icy, wet or dry surface) .could result in smoother traffic flows and, what is more important, in increasing a driver's awareness of the road situation.

### 14. APPENDIX

SOURCE CODE:

<https://docs.google.com/document/d/16iVvYMj3DGt84SLFtqCjrxGizNI52Tv-/edit?usp=drivesdk&ouid=100462285406671611329&rtpof=true&sd=true>

GITHUB LINK: <https://github.com/IBM-EPBL/IBM-Project-10726-1659199588>

DEMO LINK :

<https://drive.google.com/file/d/14RgCKG5BiKivj8QVOnV2qRbJsoc64htx/view?usp=drivesdk>