

Department of Information Technology

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A.P. Shah Institute of Technology

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UNIVERSITY OF MUMBAI

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A Project Report on

IOT Enabled Traffic Diversion System for Emergency Services

Submitted in partial fulfillment of the degree of Bachelor of Engineering(Sem-8)

INFORMATION TECHNOLOGY

By

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1. Project Conception and Initiation

1.1 Abstract

- One of the most profound aftermaths of evolving technologies in this modern era is rapidly increasing vehicular counts, which has become grave in the wake of staggering rise in world population. As a result, traffic congestion has become a serious problem in most countries around the world. We are developing a system with the help of IOT to make emergency system like ambulance to reach destination to its earliest. We would be providing the driver of ambulance with the option to choose source and destination location. That selected lane will be displayed on digital screens present near signals. The message being displayed on screen will be seen by other drivers on highway and they will be able to sideline themselves before arrival of ambulance.

1.2 Objectives

- To make ambulances services faster and efficient by using Google API for finding the shortest route to destination.
- To guide the traffic controller to manage traffic during peak hours as well as normal hours and make way for ambulance.
- To help the traffic controller to move traffic in a systematic order by displaying the lane chosen by the him.
- To provide an efficient service to driver by opting for our user-friendly application using Flutter.
- To get the feedback from the driver of the ambulance about assistance provided through system using grading scale, emoticons or stars.

1.3 Literature Review

S.No.	Paper Name	Findings
1	IoT Based Traffic Management System for Ambulances Preprint · April 2020 By Mohammad Moazum Wani Central University of Kashmir	The ambulance driver uses the web application for choosing the route and navigating the ambulance. Communication between the ambulance and traffic signal is established using the cloud server. Arduino UNO is interfaced with Wi-Fi module and the Wi-Fi module is used as a traffic signal in this system.
2	IoT Based Intelligent Ambulance Monitoring and Traffic Control System Chapter · February 2021 by Santhosh Krishna B V New Horizon College of Engineering	In ambulance section, whenever, the accident takes place, ambulance has to come to the accident spot and pick the injured person, IR sensor is used to detect the patient on stretcher, once detected heart rate sensor is used to monitor patient's pulse rate. Through serial monitor the Nurse has to input the type of injury, so that request is continuously send to the near by hospitals
3	Ambulance Assistance for Emergency Services Using GPS Navigation by Shantanu Sarkar School of Computer Science, VIT University, Vellore Issue: 09 Sep-2016	The output of this system will be the location of the Ambulance which will be displayed in the Google maps based on which the hospital management can redirect the ambulance to the location of the nearest patient. Hospital can use GSM technology to send the message to the ambulance regarding the location of patient.

1.4 Problem Definition

When the ambulance at emergency comes and the ambulance has to face traffic, this costs a whole life sometimes. Increased traffic in modern urban areas is increased to uncertain level. The road accidents in modern urban areas are increased to uncertain level. The loss of human life due to traffic is to be avoided. Traffic congestion and tidal flow are major facts that cause delay to ambulance. The loss of human life due to mis-managed traffic and delay in ambulance reaching destination is terrifying and heart wrenching. Traffic congestion and tidal flow are major facts that cause delay to ambulance.

Solution Proposed:

To develop a system with help of IOT to manage the routing of emergency services like ambulance for faster and systematic travelling.

1.5 Scope

- We will be finding the shortest route to destination for ambulances.
- Managing the heavy traffic hours with ease.
- Gives society a better outlook with efficient working of immediate services as a whole lane will be dedicated to them.
- Alert message will be displayed using LED moving message display board.

1.6 Technology stack

SOFTWARE REQUIREMENTS

- Flutter 3.3.2
- Python 3.9/3.10
- Firebase
- Tinkercad
- Arduino IDE

HARDWARE REQUIREMENTS

- nodeMCU
- LCD
- Power Supply
- Jumper wires

1.7 Benefits for environment & Society

- The system aims to reduce the response time of emergency services by enabling ambulances to navigate congested roads and intersections more quickly and safely.
- The system would consist of various sensors and devices placed throughout the city, including buzzers, traffic sensors, and GPS trackers. These devices would be connected to a central control system that would collect data and analyze it in real-time.
- When a person is experiencing a medical emergency, every second counts, and the faster that emergency services can arrive on the scene, the better the outcome is likely to be. By enabling ambulances to move more quickly through traffic, the system could help improve the chances of survival for patients.
- The system could also help reduce congestion on city streets by enabling emergency vehicles to move more quickly and efficiently through traffic. This could have a ripple effect on the rest of the transportation network, as reduced congestion would lead to fewer delays for other vehicles as well.

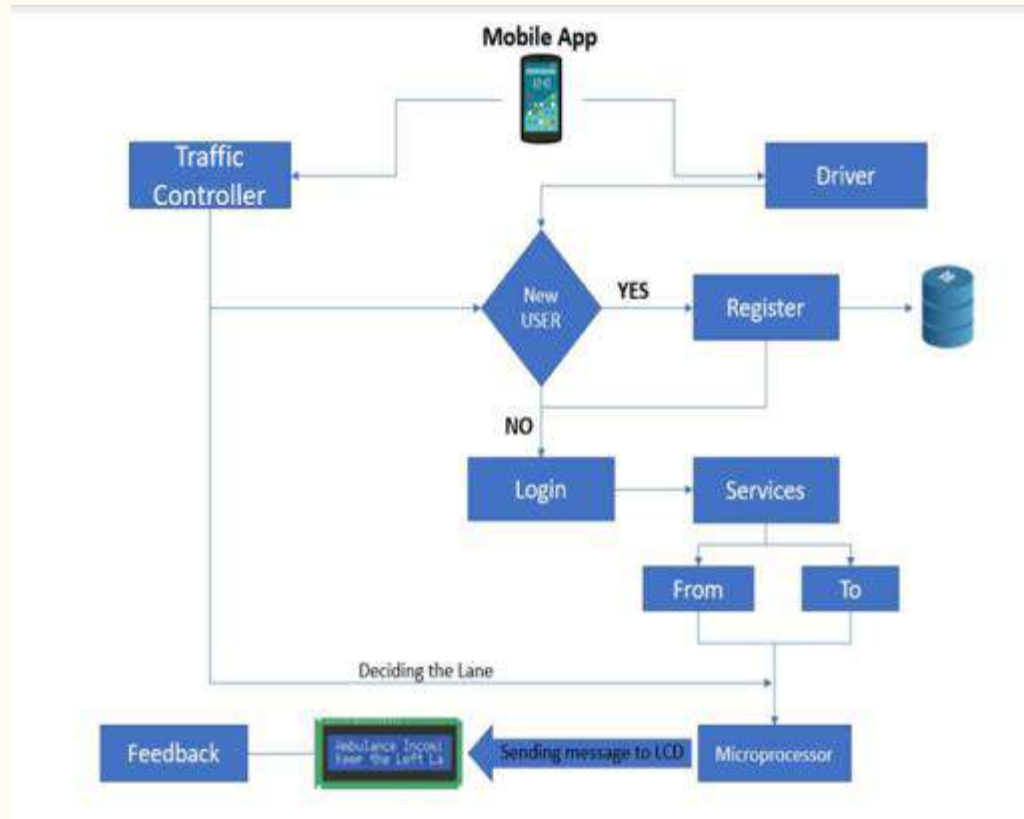
1.7 Benefits for environment & Society

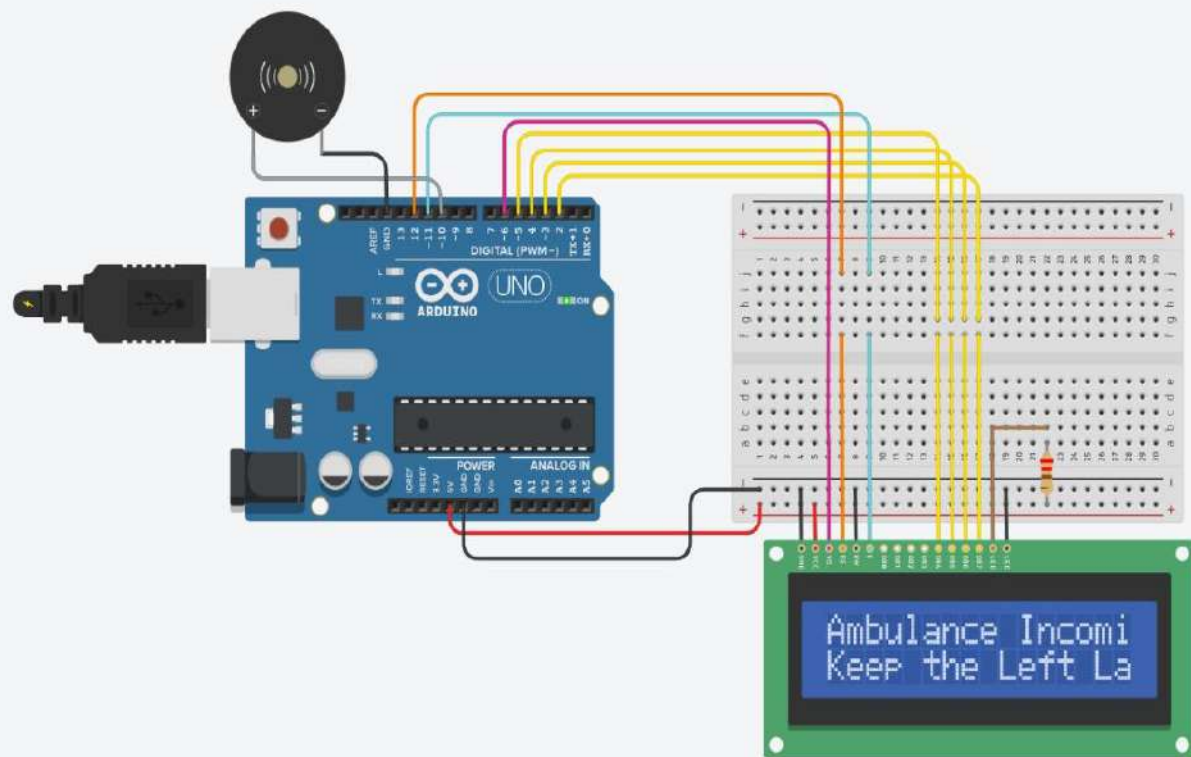
2. Project Design

2.1 Proposed System

- Mobile Application which is user friendly for the driver of ambulance so that he can input source and destination location and also select a lane for his entire journey.
- Display of message like, "Ambulance Incoming, vacate lane ___" on Digital boards near traffic signal using microcontrollers.
- Giving driver the option to submit his review on our services based on his ease and serviceability of the system.

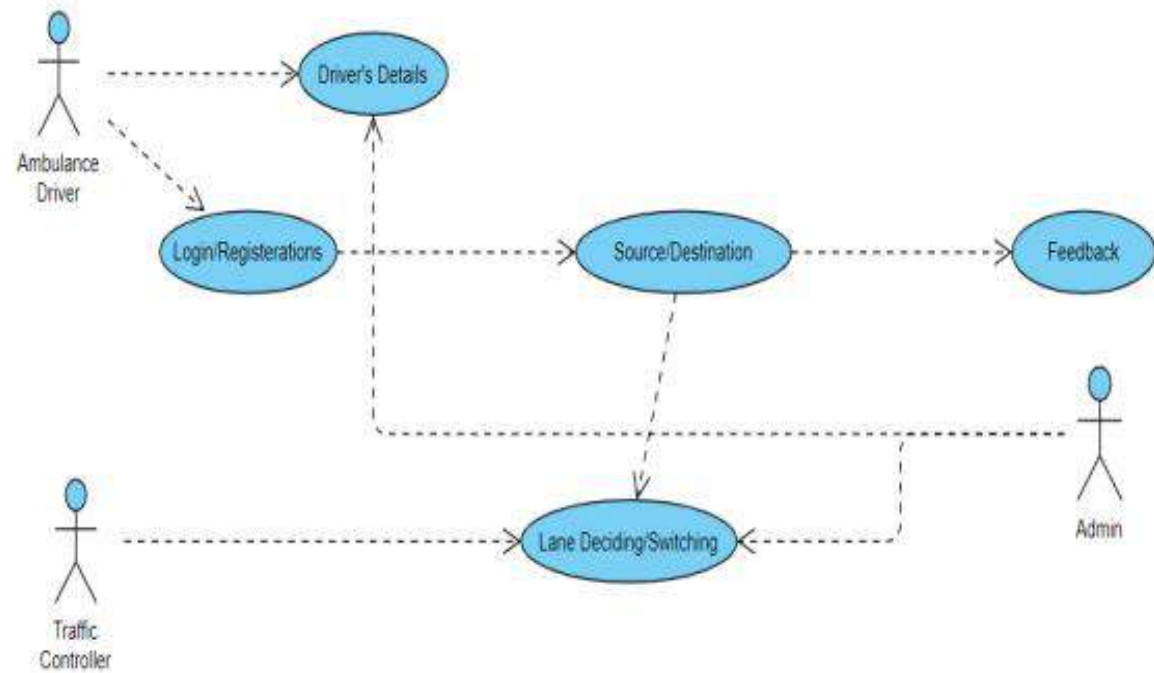
2.2 Design(Flow Of Modules)





2.3 Description Of Use Case

The Use Case Diagram below shows different actors as Driver and Traffic Controller. The relation between actors and what they can do with the system. The Traffic Controller will manage the traffic using smart screens with the help of IOT. Ambulance driver will be provided with the shortest path according to the source and destination entered earlier. The location co-ordinates will be provided as inputs for the traffic controller to manage the traffic. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design related requirements.



3. Implementation

1. Login Page

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2 import package-humanitarian_icons/humanitarian_icons.dart;
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2. Driver Page

```
import 'package:cloud_firestore/cloud_firestore.dart';
import 'package:flutter/cupertino.dart';
import 'package:flutter/material.dart';
import 'package:firebase_auth/firebase_auth.dart';
import 'package:google_maps_flutter/google_maps_flutter.dart';

import '../components/my_textfield.dart';
import 'feedback.dart';

class DriverPage extends StatefulWidget {
  @override
  State<DriverPage> createState() => _DriverPageState();
}

class _DriverPageState extends State<DriverPage> {
  final user = FirebaseAuth.instance.currentUser!;
  final _srcController = TextEditingController();
  final _destController = TextEditingController();
  GeoPoint? _src;
  GeoPoint? _dst;
  bool _tripStart=false;
  late GoogleMapController mapController;

  final LatLng _center = const LatLng(19.268255, 72.967336);

  void _onMapCreated(GoogleMapController controller) {
    mapController = controller;
  }

  @override
  Widget build(BuildContext context) {
    var isLoggedIn=false;
    return Scaffold(
      appBar: AppBar(centerTitle: true,
        title: Text('AmbWay'),
        backgroundColor: Colors.red[400],
      ), // AppBar
      body: SingleChildScrollView(
        child: Column(
          children: [
            SizedBox(height: MediaQuery.of(context).size.height*0.05,)
```

3. Traffic

```
import 'package:cloud_firestore/cloud_firestore.dart';
import 'package:flutter/cupertino.dart';
import 'package:flutter/material.dart';
import 'package:firebase_auth/firebase_auth.dart';
import 'package:google_maps_flutter/google_maps_flutter.dart';
import 'package:major/pages/feedback.dart';
import 'package:major/pages/message.dart';

import '../components/my_textfield.dart';

class TrafficControllerPage extends StatefulWidget {
  @override
  State<TrafficControllerPage> createState() => _TrafficControllerPageState();
}

class _TrafficControllerPageState extends State<TrafficControllerPage> {
  String? dropdownValue;
  String? _source;
  String? _destination;
  bool changed=false;
  late GoogleMapController mapController;

  final LatLng _center = const LatLng(19.268255, 72.967838);

  void _onMapCreated(GoogleMapController controller) {
    mapController = controller;
  }

  final user = FirebaseAuth.instance.currentUser!;
  @override
  Widget build(BuildContext context) {
    var isLoggedIn=false;
    return Scaffold(
      appBar: AppBar(centerTitle: true,
        title: Text('Ambway'),
        backgroundColor: Colors.red[400],
      ), // AppBar
      body: SingleChildScrollView(
        child: Column(
          children: [
            SizedBox(height: MediaQuery.of(context).size.height*0.05,)
```

4. Feedback Page

```
import 'package:flutter_rating_bar/flutter_rating_bar.dart';

class FeedbackPage extends StatefulWidget {
  @override
  _FeedbackPageState createState() => _FeedbackPageState();
}

class _FeedbackPageState extends State<FeedbackPage> {
  double _rating = 0;

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(centerTitle: true,
        title: Text('AmWay'),
        backgroundColor: Colors.red[400],
      ), // AppBar

      body: Center(
        child: Column(
          mainAxisAlignment: MainAxisAlignment.center,
          children: [
            SizedBox(
              height: MediaQuery.of(context).size.height*0.10,
              child: Card(
                color: Colors.blueGrey,
                child: Text(
                  'Feedback',
                  style: TextStyle(fontSize: 20),
                ), // Text
              ), // Card
            ), // SizedBox

            RatingBar.builder(
              initialRating: 0,
              minRating: 1,
              direction: Axis.horizontal,
              allowHalfRating: true,
              itemCount: 5,
              itemPadding: EdgeInsets.symmetric(horizontal: 4.0),
              itemBuilder: (context, _) => Icon(
                Icons.star,
                color: Colors.amber,
              ), // Icon
            ),
          ],
        ),
      ),
    );
  }
}
```

5. IoT Code for Prototype

```
#include <ESP8266WiFi.h>

#include <ESPAsyncTCP.h>

#include <ESPAsyncWebServer.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);

AsyncWebServer server(80);

//replace ssid and password with your wifi network credentials

const char* ssid = "redmi"; // your SSID

const char* password = "12345678"; //your WIFI Password

const char* PARAM_INPUT_1 = "input1";

const char index_html[] PROGMEM = R"=====(
<!DOCTYPE HTML><html><head>

  <title>Smart Notice Board</title>

  <meta name="viewport" content="width=device-width, initial-scale=1">

  <p> <font size="3" face="sans-serif"> <marquee> IoT Wireless Smart Notice Board </marquee> </font> </p>

```

```
void setup() {  
  
  Serial.begin(115200);  
  
  lcd.init();           // initialize the lcd  
  
  // Print a message to the LCD.  
  
  lcd.backlight();  
  
  lcd.begin(16, 2);  
  
  lcd.clear();  
  
  lcd.setCursor(0, 0);  
  
  lcd.print("Ambulance Incoming");  
  
  WiFi.mode(WIFI_STA);  
  
  WiFi.begin(ssid, password);  
  
  if (WiFi.waitForConnectResult() != WL_CONNECTED) {  
  
    Serial.println("WiFi Failed!");  
  
    return;  
  
  }  
  
  Serial.println();  
  
  Serial.print("IP Address: ");  
  
  Serial.println(WiFi.localIP());  
}
```



```

server.on("/", HTTP_GET, [] (AsyncWebServerRequest *request) {

    request->send_P(200, "text/html", index_html);

});

server.on("/get", HTTP_GET, [] (AsyncWebServerRequest *request) {
    String message;
    String inputParam;
    if (request->hasParam(PARAM_INPUT_1)) {
        message = request->getParam(PARAM_INPUT_1)->value();
        inputParam = PARAM_INPUT_1;

        //    lcd.clear();
        lcd.setCursor(0,1);
        lcd.print(message);
    }
    else {
        message = "No message sent";
        inputParam = "none";
    }
    Serial.println(message);
    request->send(200, "text/html", index_html);
});
server.onNotFound(notFound);
server.begin();
}

void loop() {
    for (int positionCounter = 0; positionCounter < 29; positionCounter++) {
        lcd.scrollDisplayLeft();
        delay(500);
    }
}

```

4. Testing

- **Functional Testing**

1. Unit Testing

Unit testing is the first level of testing, which is typically performed by the developers themselves. At the code level, it is the process of ensuring that individual components of software are functional and work as intended. Unit testing can be done manually, however automating the process will reduce delivery times and boost test coverage. Because flaws will be detected earlier in the testing process and will take less time to fix than if they were discovered later, debugging will be easier as a result of unit testing. It helped us in finding the shortest route on the basis of algorithm that Google API has implemented. Google API will help us to generate the possible shortest path after entering the source and destination locations for the driver side application. The main objective of unit testing is to isolate written code to test and determine if it works as intended. Also make the changes to improve the efficiency.

2. Prototype Testing

Prototype testing is the process of testing your hardware prototype with proper connections and integration to validate design and feasibility decisions before development stage is initiated. The goal is to identify problems and areas of improvement early so you can make the necessary changes prior to development and build a product that meets users needs and expectations and also works properly with underlying hardware and software.


Test Case No.	Test Case Condition	Test Steps/Procedures	Expected Results	Actual Results	Pass/Fail
1.	Route Test	User enters the source and destination locations	The system should present the shortest path from source and destination location	The system succesfully provided the shortest route	Pass
2.	Duration Test	Record the time taken for completing one journey to the desired destination	The ambulance should take comparetively less time to reach the destination	The ambulance took somewhat same time to reach the destination	Fail(ambulan ce took same time as it took with earlier systems)
3.	Message Display Test	The controller would enter the display message in the field avaiable on the application	The exact same message should be displayed on all digital screens which was entered by controller	The same message was displayed on all screen	Pass

5. Result

- **Flutter Module**

1. Login Page

AmbWay




Welcome back you've been missed!

[Forgot Password?](#)

Sign In

Not a member? [Register now](#)

AmbWay

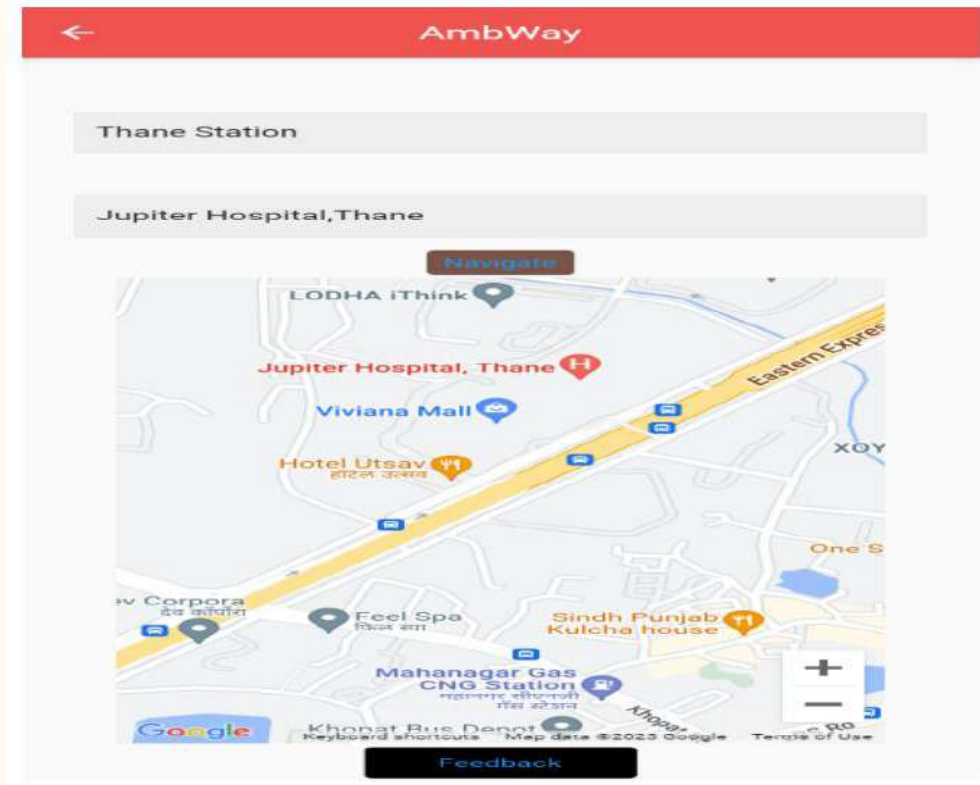


Let's create an account for you

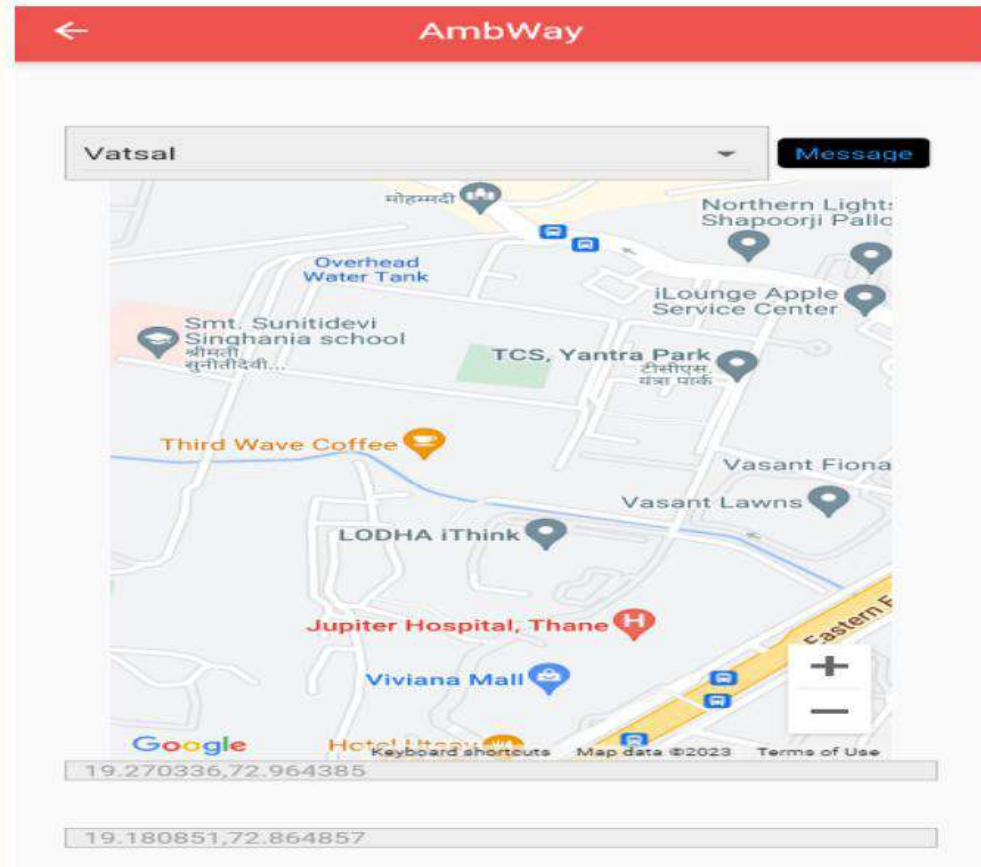
Sign In

Already a member [Login now](#)

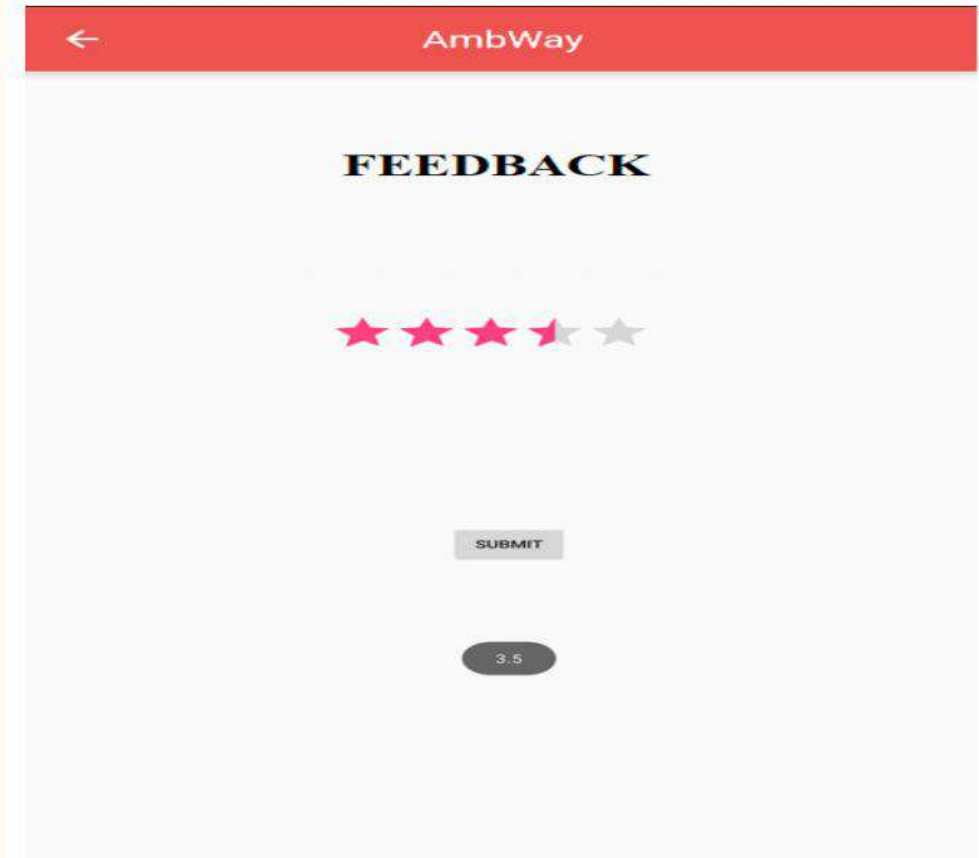
2. Driver Page



3. Traffic Controller Page



4. Feedback Page



A screenshot of a mobile application's feedback page. The page has a red header bar with a white back arrow on the left and the text "AmbWay" in the center. Below the header, the word "FEEDBACK" is displayed in a bold, black, serif font. Underneath the title, there are two rows of five stars each. The top row consists of five light gray stars. The bottom row consists of four red stars followed by one light gray star. Below the stars, there is a gray rectangular button with the word "SUBMIT" in black capital letters. At the bottom of the page, there is a dark gray oval button containing the text "3.5" in white.

← AmbWay

FEEDBACK


★★★★★

★★★★★

SUBMIT

3.5

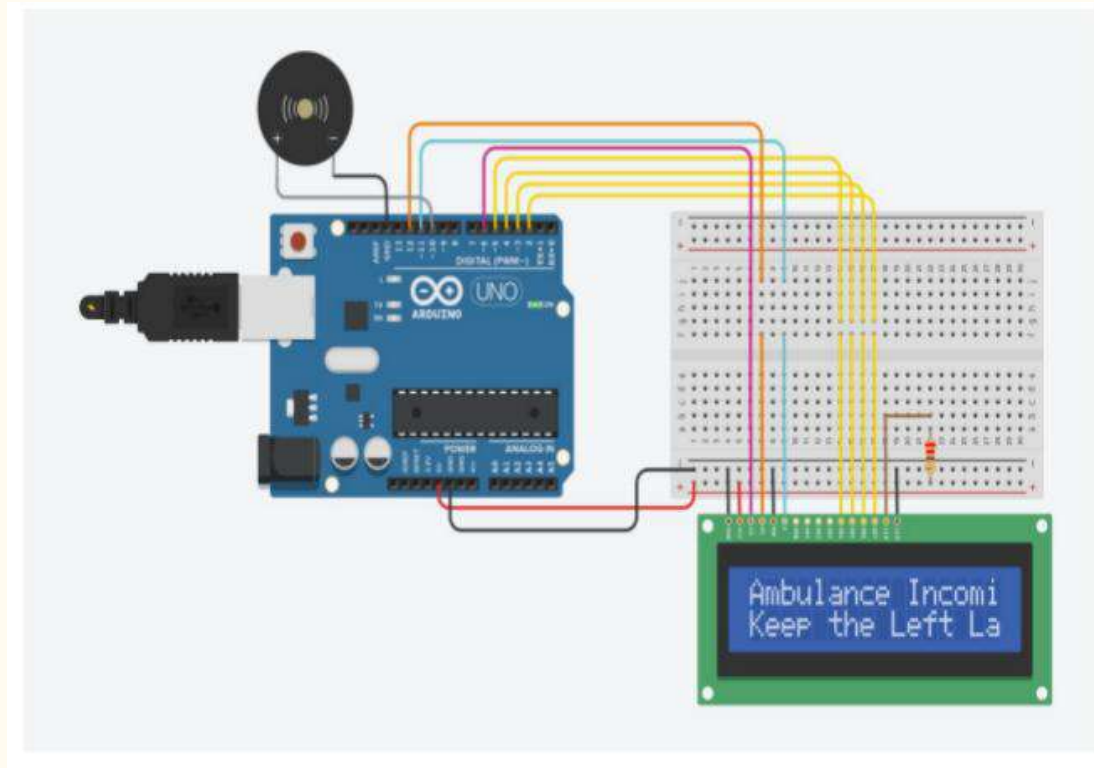
5. Smart Screen Input Page (For Traffic Controller)

 AmbWay

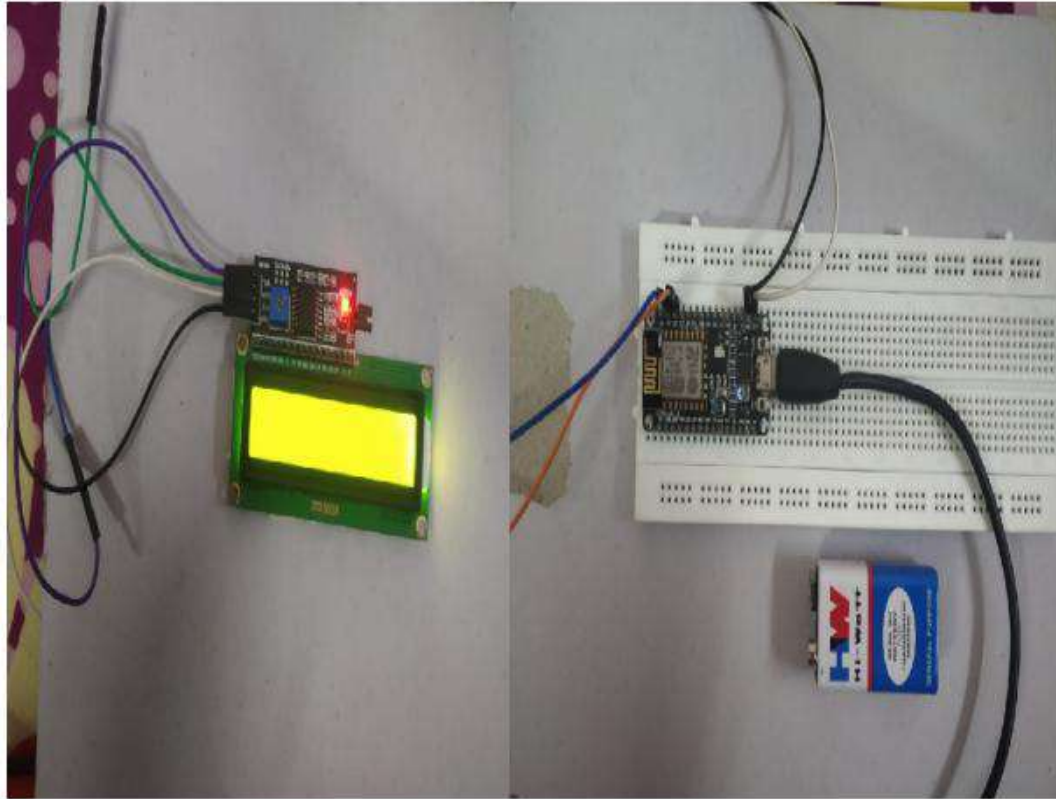
IOT Wireless Smart Screen

Enter Text to Display:

1. Tinkercad Simulation



2. IoT Prototype



6. Conclusion and Future Scope

- The work presents review of the existing research done in field and tries to develop a system suitable for developing countries. The project has two objectives, which are, first, finding the shortest route to hospital for ambulance and second for displaying the message of ambulance arrival on all digital screens present on the route of the ambulance. The micro-controller can be programmed easily which gives scope for deployment better algorithms in future. This system for emergency services will prove life changing for all citizens residing as it eases the work of traffic controllers and also saves precious lives.
- Right now the system is just focused towards helping the Ambulance reach its location faster and quicker. Hence it can be used in different emergency situations such as for fire brigade, police, bomb squad etc. The proposed system holds a vast area to grow in future. The smart board can be used in future for the purpose of certain different public awareness programs too. One of our future scope holds the usage of sensors, which would be enabled to collect real-time data of traffic around particular areas. This would help in making wise decision before starting the journey to destination.

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Thank You

