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Intelligent Traffic Information System based on Internet of Things

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Abstract - *In recent years, the popularity of personal vehicles is a major issue in big cities which causes traffic congestion, environmental pollution, waste of time and much more. Mostly, traffic congestion causes accidents. Hence, traffic management is a vital issue in big cities. Manual traffic control by policemen as well as the predefined set time for the signal at all circumstances has not proved to be efficient. The model makes use of cloud for delivering different services such as servers to address the above-mentioned issues, this paper proposes an internet-of-things (IoT) based model which also gives priority to avoiding dumping areas. This model makes use of cloud storage to deliver services such as real time data which gives continuous updates so that it can handle the traffic smoothly. A real time traffic information collection and monitoring system is proposed which solves the problem of real time monitoring and controlling road traffic. This system employs key technologies: Internet of Things, Android Application to, manage and supervise traffic information. Advantages of this model are cost effectiveness, fuel efficiency and reduced travelling time.*

Key Words: Traffic Information System, IoT, Sensor, Android Application, Traffic Monitoring, Node MCU, Gas Sensor, Load cell.

1. INTRODUCTION

IoT is nothing but the network of interconnected things/devices embedded with sensors, software, and network connectivity. Such an interconnection makes it possible for sensors to be responsive by collecting and exchanging data. A sensor plays an important role when used in an IoT system. A sensor measures physical phenomenon in the environment such as temperature, gas concentration and transforms it into electronic signals. Various types of sensors are required for a variety of applications.

Modern transport systems fail to provide smooth transportation to citizens in the world of continuous and fast paced development. This eventually leads to excessive traffic jams which result in delays to professional and personal spots. In addition to this various other problems also arise such as mental frustration causing road rages, fuel wastage, and wear and tear of vehicles. Nowadays, traffic issues are eventually faced by everyone due to an increase in the number of vehicles. IoT can be used to resolve the problem of traffic congestion. Many types of sensors can also be used. The density of the traffic can be analysed and accordingly the driver or individuals can be alerted. Also other sensors can be used to detect the dumping areas so that the user can avoid that area.

2. LITERATURE SURVEY

Pallavi Belokar and Prof. Kavita Joshi, in their paper "Intelligent Traffic Management Control Systems" design a model integrated with GPS-GSM in which the traffic information is imparted to the drivers via SMS which can help them to choose traffic avoiding routes to the destination. Here, the driver receives real time traffic information from the server after manually enquiring for it through GSM. The real-time traffic information is collected through IR sensors. The proposed model software is deployed in the keil micro vision compiler environment using programming language "Embedded C". [1]

"IoT based Intelligent Traffic Control System" by Harshini Vijetha H and Nataraj K R, proposed a new approach of Controlling Traffic System which makes use of Pi-Camera and Ir sensor for detecting traffic density. This model uses RFID for confirming zero traffic region for emergency vehicles and also for tracking stolen mobile phones. It uses a dual mode control system, automatic mode and manual mode. The automatic mode does not involve human intervention whereas manual does involve human intervention to manually search and find the route. [2]

"Intelligent Traffic Information System Based on Integration of Internet of Things and Agent Technology" by Hasan Omar Al-Sakran put forward an architecture that integrates IoT with agent technology into a single platform where the agent technology handles effective communication and interfaces among a large number of heterogeneous highly distributed and decentralized devices within the IoT. It presents a framework distributed traffic simulation model within NetLogo, an agent-based environment for IoT traffic monitoring systems using mobile agent technology. [3]

I. Made Oka Widyantara and Nyoman Putra Sastra, in their research paper, "Internet of Things for Intelligent Traffic Monitoring System: A Case Study in Denpasar", intended to determine the design of the implementation of the IoT for Intelligent Traffic Monitoring System (ITMS) in Denpasar city, Bali, Indonesia. The main goal of this research was to visualize the traffic on Web-based

GPS/GPRS. Their implementation mainly focuses on acquisition of traffic by leveraging the capabilities of GPS as a sensor, GPRS based data transport, and the design of a Web/GIS based traffic monitoring software. [4]

This paper highlights the optimization of traffic data collection in a city using sensors and microcontrollers. The paper provides configuration to minimize the possibilities of traffic jams problems. It is observed due to this proposed system of Intelligent Traffic data collection is more efficient and convenient.[1] Identification of heavy traffic areas is done successfully and fast. Hence, many precious lives would be saved.[2] The proposed system can provide a new way of monitoring traffic flow that helps to improve traffic conditions and resource utilization.

3. PROPOSED METHODOLOGY

Nowadays there is an increase in vehicles and due to our busy life, we prefer to travel by our private vehicle rather than traveling by public transport and due to this there is an increase in traffic problems. In our proposed system we have provided solutions for traffic congestion and monitoring systems. In this we are providing an android application for the user where he can detect his live location first then he can search for the shortest path as well as alternative path where he can avoid traffic jams. Also the user will also be able to see the nearby hospitals for emergency times. We are also using sensors for detecting the dumping areas which will also be included in the application so that the user can avoid this zone.

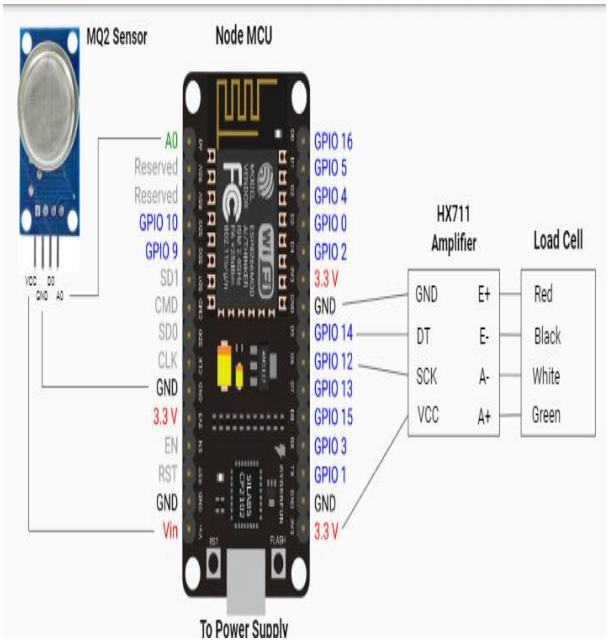

Fig -1: Circuit Diagram

4. IMPLEMENTATION

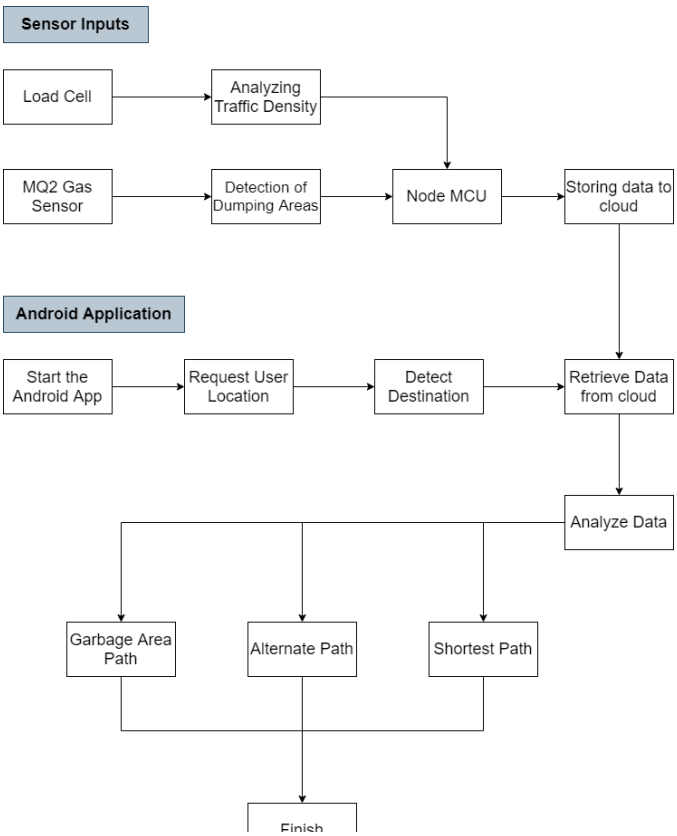

Fig -2: Working of Intelligent Traffic Information System (ITIS)

The load cell, which will fit in the road, will analyze the traffic passing over it. Predefined threshold values and range of weight categories will differentiate the type of traffic in the region. The data collected will be uploaded to the cloud storage. Here we are using Google Firebase as our cloud storage.

Further, the MQ2 sensor placed at the dumping areas will detect the methane gas emitted from the garbage. More methane gas will indicate that the garbage containers are completely filled and there is a possibility that the garbage is spilled out on the road. Hence this data is collected and uploaded to the Firebase cloud realtime database.

Fig -3: Load Cell and MQ2 Sensor Firebase Data

All this data is analyzed and fetched in an android application.

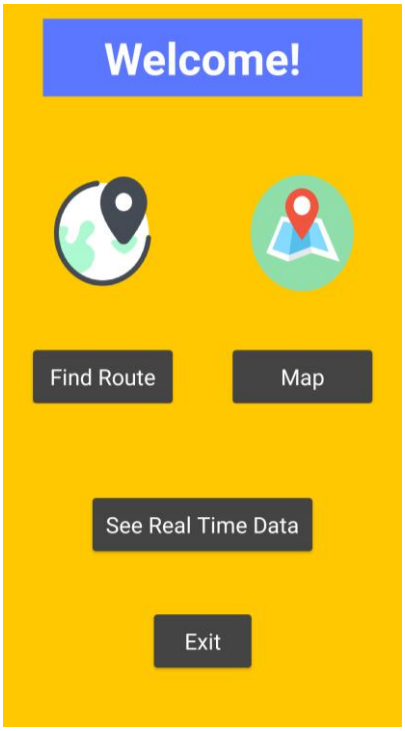

Fig -4: Landing Page of the Android Application

This is the Android Application of our project showcasing various options on the landing page

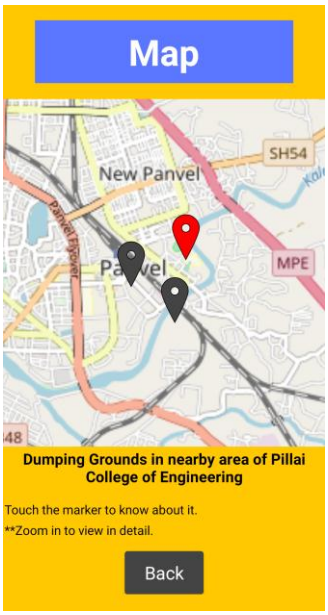

Fig -5: User location detected in Red Marker

In this Android application, the user will be able to find his/her current location, in the "Map" option.

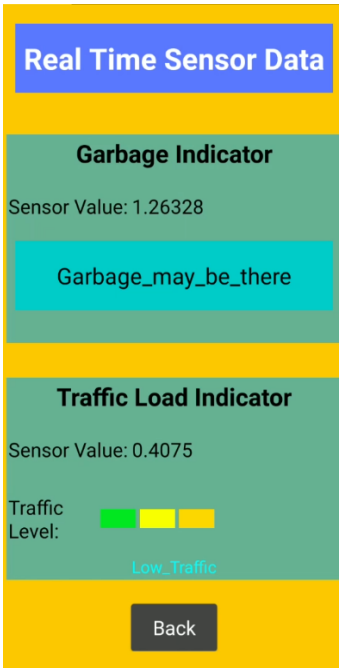

Fig -6: Real time sensor data from Google Firebase

Real time sensor values can be viewed in the "See Real Time Data" option. The sensor values are uploaded to the Firebase Storage using Real Time Database and immediately retrieved in the Android Application. The data of both the sensors Load Cell and MQ2 Sensor, have been displayed in the above screen.

Fig -7: Finding Route

This is the finding route screen where the user can find his desired and convenient route to his destination which can be viewed in the "Find Route" option. Here, the source and destination are predefined.

Fig -8: Route without traffic

Here the user, after mentioning the source and destination, can view all the routes, shortest route, alternative path (both displayed in green arrows) and route through the garbage area (displayed in yellow arrows).

Fig -9: Route with low traffic

Here the user can view all the routes, shortest route (with low traffic, displayed in green arrows), alternative path (displayed in green arrows) and route through the garbage area (displayed in yellow arrows). As the traffic level increases, it is reflected in the traffic level indicator as shown.

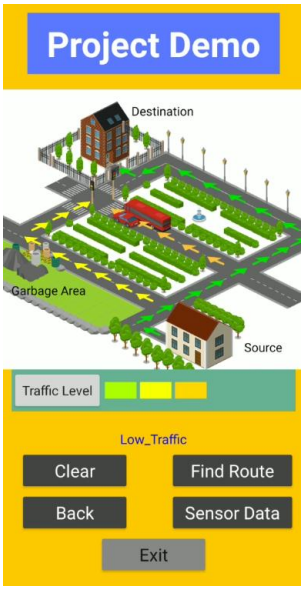

Fig -10: Route with moderate traffic

Here the user can view all the routes, shortest route (with moderate traffic, displayed in orange arrows), alternative path (displayed in green arrows) and route through the garbage area (displayed in yellow arrows). As the traffic level increases, it is reflected in the traffic level indicator as shown.

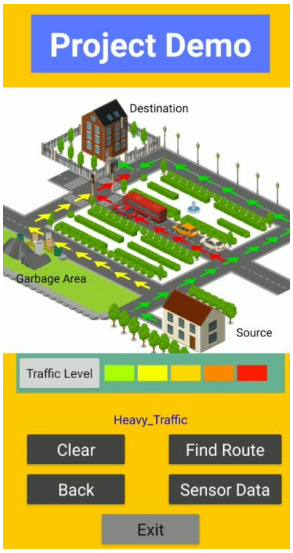

Fig -11: Route with heavy traffic

Here the user can view all the routes, shortest route (with heavy traffic, displayed in red arrows), alternative path (displayed in green arrows) and route through the garbage area (displayed in yellow arrows). As the traffic level increases, it is reflected in the traffic level indicator as shown.

The user can find the shortest path to the destination in the "Find Route" option. To suggest the shortest path we will be using Dijkstra's algorithm. Dijkstra's algorithm (or Dijkstra's Shortest Path First algorithm, SPF algorithm) is an algorithm for finding the shortest paths between nodes in a graph, which may represent road networks. While suggesting the shortest path, heavy traffic areas and garbage dumping areas are considered and mostly avoided for smooth and hassle free journeys from the user location to the destination.

5. FUTURE SCOPE

5.1 Dynamic Traffic Light Sequence

RFID for dynamic traffic light sequences circumvents or avoids problems that usually arise with systems that use image processing and beam interruption techniques. RFID technology with appropriate algorithms and databases can be applied to a multi-vehicle, multi-lane and multi-road junction area to provide an efficient time management scheme. A dynamic time schedule can be worked out for the passage of each column. The simulation showing the dynamic sequence algorithm can adjust itself even with the presence of some extreme cases. This system will be able to emulate the judgment of a traffic police officer on duty, by considering the number of vehicles in each column and the routing properties.

5.2 Avoiding Accidents

The proposed system can provide a new way of monitoring traffic flow that helps to improve traffic conditions and resource utilization. In addition, the transport administration department, using real-time traffic monitoring information, can in time detect potentially dangerous situations and take necessary actions to prevent traffic congestion and minimize the number of accidents thus ensuring the safety of road traffic.

6. CONCLUSION

The continuous growth of population all over the world creates great challenges to the transport management system. Due to an increase in the number of vehicles, it is necessary to take effective steps in order to control the traffic and hence avoid all types of losses that are caused due to traffic. The study aimed at understanding the traffic issue and recommending improvements to facilities smoother traffic flows. The development of the monitoring system to deal with traffic congestion in urban areas is a critical issue. Not only this but our project highlights the problem as well as the solution, for example, we specify whether there is traffic congestion or not, but we also provide alternate paths for the same destination.

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BIOGRAPHIES

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Kulkarni Sourabh Rajendra is an aspiring and tech savvy individual pursuing a Graduation Degree in IT Engineering from Mumbai University. Having interest in IoT and web optimization, he has a specialization certification in Search Engine Optimization.

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