Deployment of Traffic Control Management System using IoV

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Abstract: In the modern era of evolving technology, everybody wants to achieve their goals in the least time. Urban mobility supports the integration and balanced development of society with the cooperation of the Internet of Things (IoT). IoT is a system that forms a network of different objects which is connected through the internet that can collect and transfer the data over a wireless network without human intervention. When the connected object is restricted over vehicles only then the technology is referred to as the Internet of Vehicles (IoV). With the growth of the urban population and the addition of cities, vehicle ownership has been increasing drastically. Thus, the management of traffic has become a great problem in our day-to-day life.

A connected vehicle is equipped with Internet access and a wireless local area network that allows communication with other smart devices, whether inside the vehicle or outside in the environment. There are several ways that vehicles may be connected and with the environment as well as people such as drivers and those on the roads. These include vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-pedestrian, vehicle-to-cloud, and generally as vehicle-to-everything. The paper deals with traffic management, the cause of an accident, and ensure the safety and security of the person inside the vehicles with the help of few sensors.

Index Terms **- GPS, Location, IoT, Proximity Sensor, Vehicle Security, Vibration Sensor, Alcohol sensor.**

I. INTRODUCTION

The modern era is responsible for the unimaginable growth of the urban population due to which transportation becomes one of the important needs of humans. Though it has countless needs, we face a lot of problem in it due to which human life may suffer. Road accidents are one of the major causes of death on Indian roads. As per statistics of India measured by media in every four minutes one person is killed due to a road accident.

With the development of technology and the internet, every device is connected with the internet and provides great functionality in every field in which traffic control and management are one of the important aspects that tend to make human life easier and better. With the advanced technology, there is also an increase in the development of electric vehicles (EV), which are fully electric and automatic. Also, provide communication and interconnectivity between vehicle to vehicles or vehicle to other devices.

In the world of internet, most of the device is friendly with the internet which plays an important role in traffic management and control system and makes easier for the transportation. The increase in vehicle proprietorship leads to an increase in traffic-related issues. Earlier, it has been difficult to monitor the speed, details about the road accidents, vehicle tracking, pollution checking, alcohol detection, and emergency response. But with the ease of the internet and Internet of Vehicles (IoV), tries to make life simpler and easier.

The advanced traffic system makes use of Radio Frequency Identification (RFID), Internet of Things, and GPS (Global Positioning System) for locating the vehicles in case of emergency and providing all facilities quickly and safely. The main aim of IoT is to make the life of human Being better and innovative by creating a smart environment. IoT involves objects and entities that provide unique identifiers and automatic transfer of data over the network.

The proposed model is based on IoV (Internet of Vehicles) for implementing the smart traffic management system which makes use of an embedded system which are connected. As hardware component is used to collect the input data and sends it to the software and the Blynk app is used which provides Blynk server and blynk libraries for storing, analyzing, and visualizing the data collected from a hardware device. Blynk app will show all the notifications about the data collected and show the results computed.

II. LITERATURE REVIEW

Literature survey is a project report which represents the study carried out to gain knowledge and skill needed to complete the survey. The study is done to assist in the completion of a project. It is a survey on the previously existing material on the topic of our interest. It is very important to improve and to develop a successful project.

Information about few research papers or previously implemented projects that we have used as a reference is mentioned below:

[1] Tej Tharang Dandala, Vallidevi Krishnamurthy, Raj an Alwan, "Internet of Vehicles (IoV) for traffic management" in 2017. Identified the potential advantages of the Internet of Vehicles (IoV) over the traditional Internet of Things (IoT) in traffic management. Brings up better architectures and strategies for road traffic management.

[2] Mahesh Lakshminarasimhan, "Advanced Traffic Management System Using Internet of Things" in 2016 introduced a system for traffic management. The system is based on RFID techniques which introduce efficient traffic light control, smart parking system, and theft security mechanism. The system used supervised learning for the implementation of the desired system.

[3] Shraddha S. Kukade, Prof. U. W. Hore, "Intelligent Traffic Management System Based on Smart Internet of Vehicles: A Review",2017, implemented a system based on hardware and coding is done in python, proposed a system for handling the issues in case of a road accident and detecting the location of the vehicles and emergency spot. IoT based smart system finds an efficient way of vehicle safety and proper functioning of automatic vehicle transportation and communication between them and sending the data over the network. The main aim of the project to provide a smart traffic system and better safety on the road.

[4] H.V. Dadwani, R.B. Buktar, "Vehicle Tracking and Anti-Theft system using internet of things" in 2017. The proposed system is based on a combination of GPS+GSM Module that is used to get the location of the vehicle via GPS in case of vehicle theft. This system is mainly used for tracking vehicles in such cases. The system makes use of the embedded system for communication between all devices and sending of data over the network. The system is cheap, open-source, and also very compact. The system provides good security over the network, user-friendly, and sends notifications on the owner's registered number.

[5] Ang, Li-Minn, et al. "Deployment of IoV For Smart Cities: Applications, Architecture, And Challenges", 2018. The proposed paper is used to do a comparative study on the existing Internet of Vehicles (IoV) and seven-layer UIoV (Universal Internet of Vehicles) architecture based on multimedia and Big Data where different types of objects are connected with the internet and form inter-vehicles and intra-vehicles network. The different layer is used to identify different types of an object present in the network and provide a great advantage over IoV.

[6] Ali, Ahmed Sabeeh, Ali Hussein Hasan, and Hussein Atiyah Lafta. "Antitheft Vehicle Tracking and Control System Based IoT."(2020). They implemented a system that is cheap, effective, and reliable. The proposed system helps the police to track the stolen device in no time and shows the location on Google Maps through the web application. The web application will determine the nearest police station and emergency office and send the details, location coordinates, and other important information to them. So, that they can take quick action according to the situation. The proposed system is very helpful in detecting the stolen device.

III. ARCHITECTURE OF IOV

The architecture of IoV consists of three layers. They are:

3.1Perception Layer:

The perception layer is the physical layer of the IoV. The first layer is that in which all the sensor exits. Sensors are used for sensing and gather the input data and fetch the value of our area of interest and send it to the next layer for further process.

3.2 Network Layer

Network Layer is used for connecting all the devices and accept the data which is collected by different sensors present in the perception layer. This layer is also responsible for transmitting and processing sensor data. The network layer is the intermediate layer that is responsible for connecting the whole system.

3.3 Application Layer

The application Layer is the top-most layer of the IoV architecture which is responsible for storage, analysis, visualization of the data. The application layer provides delivering application-specific services to the user. It defines various application which is used for deployment of different devices connected to the Internet of vehicles.

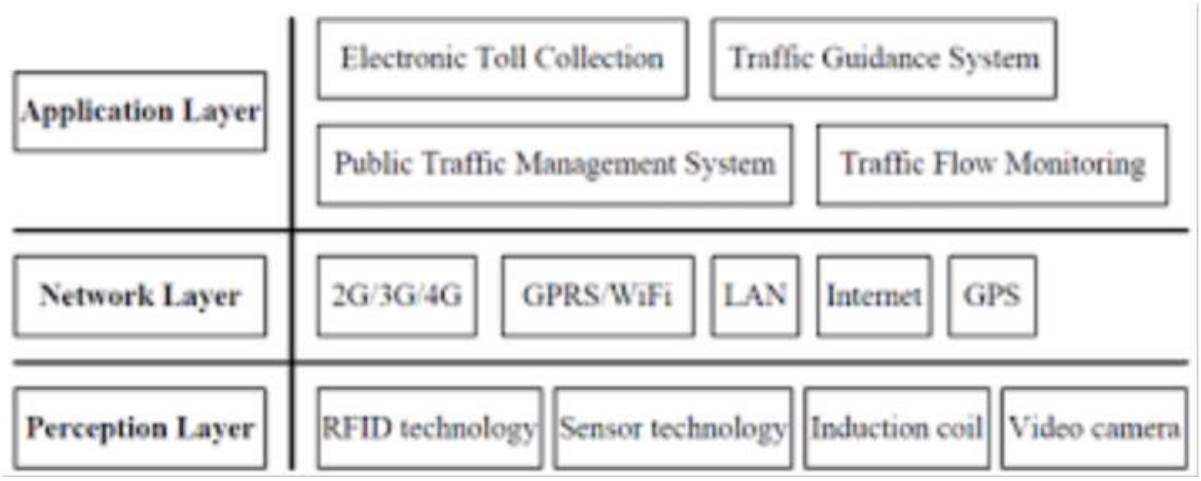

Figure 1. Architecture of IoV

IV. APPLICATION OF IOV

4.1 Safe driving

IoV technology is useful in providing a safe driving experience. Sensors are used by cooperative collision avoidance systems and detect a potential collision and the driver receives a warning notification. It is used to provide vehicle's performance and notification about the possible emergencies on the daily basis. The emergency notification about Traffic jams, dangerous road conditions, or accidents will trigger with the help of new connected roadways.

4.2 Traffic Control

IoV is an important factor for the development of urban management, transportation, logistics, urban traffic, and the lifestyle of lots of people living there.

4.3 Crash Response

IoV is responsible for proving communication between different vehicles, devices, and smart objects. If in case of any crash or accident reported, through the help of IoV the emergency teams can get through the vehicle location for help.

4.4 Convenience services

The service can access a car remotely and is used to make possible services like remote door unlock and stolen vehicle recovery. Improved real-time traffic, transit, and parking data are provided to the transportation agencies through connected car technology which makes it easier to manage the transportation system.

4.5 Infotainment

Connecting a car to the internet can provide entertainment options like streaming music, news, and information through the dashboard.

V. PROPOSED SYSTEM

The proposed model makes use of an embedded system which include hardware and software part. As the embedded system is a microprocessor-based hardware system with software programming. The system is based on IoV (Internet of Vehicles) for designing an advance and effective traffic management system. The system consists of different sensors for gathering the environment data and uploading it to further layer where the processing of the data is done and sends the result to blynk app, as proximity sensor is used to detect the presence of a nearby object, vibration sensor is used to detect the sudden shock, and alcohol sensor is used to detect the presence of alcohol or gas in the surrounding. Blynk platform is used in the system for visualization of the results of all sensors

VI. METHODOLOGY

With the advancement of technology, the Internet of Things is also developing day by day which also enhances another field to grow simultaneously. Internet of Things is a network that consists of various objects that are connected to form a network but IoV forms a network where objects are restricted to vehicles only. The system consists of an embedded system and electronic devices that interact, exchange, and share data. The system is divided into two parts. One is the hardware part and the other is the software part.

The embedded system is the prime controller of the system which includes NodeMCU as a Wi-Fi module. The main component of the system which is responsible to connect all the hardware component to the software part. The Wi-Fi module is used with a 3.3v/5v power supply. Here we are using a total of 3 sensors for capturing the relevant important data, like proximity sensor, alcohol sensor, and vibration sensor each of the sensor can operate on a 3.3v/5v power supply and input pin and ground pin which is connected to NodeMCU's ground pin and Analog pin. Then sensors after connecting start collecting the input data and send it for further visualization.

Arduino IDE is used for the coding of the sensors and NodeMCU by setting up the required board and ports. Coding is done in embedded C language which is easy to understand and use. The Blynk platform will be used for visualization of the results, as in the blynk app new project is created and setting of all the widgets is done according to the requirements and Blynk app will provide an API key which is used to connected the Blynk app to the NodeMCU. We just need to write the code in Arduino IDE for all the sensor and connect the code with the Blynk app by providing the API key in the codes and upload it. Blynk app will show the output as results which is collected by sensors as input data. Notification is sent through the blynk app when the sensor detects some changes in the surroundings.

VII. COMPONENT DESIGN

7.1 Proximity Sensor

The proximity sensor is a sensor that is used to detect the closer object with any direct contact. This sensor works on an electromagnetic field or a beam of electromagnetic radiation. The sensor operates on a 3.3V to 5v power supply and detects the nearby object at a range up to 7 centimeters depending on the obstructing object and surrounding environment and has a 3mm mounting hole for easy mounting. A proximity sensor can provide the output in either digital or analog. If the sensor detects some nearby object it will show output 1 else show 0 in the Blynk app after doing the desired coding for the sensor in Arduino IDE.

Figure 2. Proximity Sensor

7.2 Vibration Sensor

The vibration sensor is used to detect sudden shock or high intensity of movement in case if the vehicle came in contact with another vehicle or object which causes an accident. This sensor can also show the results in both analog and digital. The sensor operating voltage is 3.3V/5V and an SW-420 Vibration Sensor Module is used in the system and provides digital data, Logic low (0), logic High (1) with wide voltage LM393 comparator.

Figure 3. Vibration Sensor

7.3 Global Positioning System (GPS)

Global Positioning System (GPS) is used to get the latitude and longitude of a particular location. GPS is based on time and knowing the position based on a specific satellite. GPS is used in the vehicle so that the owner of the vehicle or other person can detect the location of the vehicle in case of vehicle theft or accident.

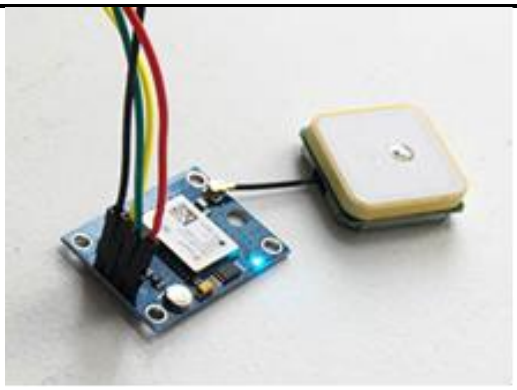

Figure 4. GPS

7.4 Alcohol/ Gas Sensor

The alcohol or gas sensor is used to detect the presence of alcohol or any gas in the environment. MQ-3 gas sensor is used in the system. It has a high sensitivity to alcohol and has a good power to distinguish between gasoline, smoke, and vapor. The system is used to detect different types of gas like methane etc, present inside the vehicle. This sensor is used to identify whether the driver drunken or not. The sensor's operating voltage is 3.3V/5V. The sensor detects the gas of range - 0.05 mg/L to 10 mg/L and operating temperature- 10-to-70-degree Celsius and Heater consumption: less than 750mw.

Figure 5. Alcohol Sensor

7.5 NodeMCU

Node Micro Controller Unit (NodeMCU) is open source IoT platform. NodeMCU runs on ESP8266 Wi-Fi SoC. It is a Wi-Fi module that is used to connecting all the sensors with the IoT. It is a hardware and software developing environment. Programming and coding of NodeMCU can be easily done in Arduino IDE by changing the required setting of boards and ports

Figure 6. NodeMCU

7.6 IoT

The Internet of Things (IoT) is a large network that connects different objects over the internet. It refers to a system of an interconnected object that is connected to collect and transfer data over the internet without human need. IoT can build a system which is automatic, efficient, effective and essential for all human being. IoT comprises lots of applications, it includes innovative shopping, system infrastructure management, remote health monitoring, emergency notification system**.**

Characteristics of IoT system:

1.The central object should have unique identification so that it can be distinguished from the various objectives of the network.

2.The most object should detect the presence of other objects present in the network.

3.The object of IoT (sensor) should be capable of automating data capture.

4.The object must be interoperable between different communication technologies.

5.There should be service-based interaction between objects. IoT systems should have low power operations and they should be secure.

Figure 7. Hardware Configuration

VIII. SOFTWARE DESIGN

8.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is multiple computing platforms and works for Windows, Mac OS, Linux. This platform is used to write and upload the program for all the sensors of the area of interest of the project. The Arduino IDE supports Embedded C for coding for all the hardware equipment and uses the special rule of code structuring. Arduino IDE supplies in-build program for different micro-controller and supplies software library from the wiring project, provide input and output procedures.

8.2 Blynk

Blynk is an application which can run on android and iOS platform and connect with Arduino and Raspberry Pi. This can be done by programming all the micro-controller in respective IDE and connecting with the BLYNK over the internet. It is a digital dashboard where one can build own application under BLYNK by just dragging and dropping the widgets. It is very simple to use and one can start in 5 minutes. It supports the hardware of our choice like Arduino, Raspberry Pi, NodeMCU, etc, and also provides different connection types such as Ethernet, Wi-Fi, USB, GSM, Bluetooth, etc. After logging into BLYNK and do the required setting then BLYNK will get you online over the internet of things. BLYNK is designed over the Internet of Things and also provides Blynk cloud for the storage and analysis of the data processed.

There are three major components in this platform:

Blynk app: Blynk provides the feature to create an application of your interest by dragging and dropping widgets after choosing the hardware and connection type and setting a pin according to the hardware used in the project.

Blynk server: Blynk provide cloud service and run a private blynk server locally. The main functionality of the Blynk server is to provide communication between the hardware and mobile. It is open-source, free, and easy to use, can easily handle over mobile phones.

Blynk libraries: It is responsible for communication between different hardware used in the project with the server and performs all the incoming and outgoing activities.

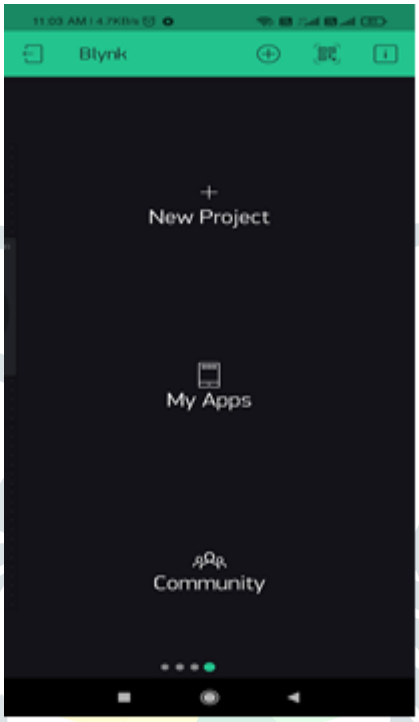

Figure 8. Blynk app

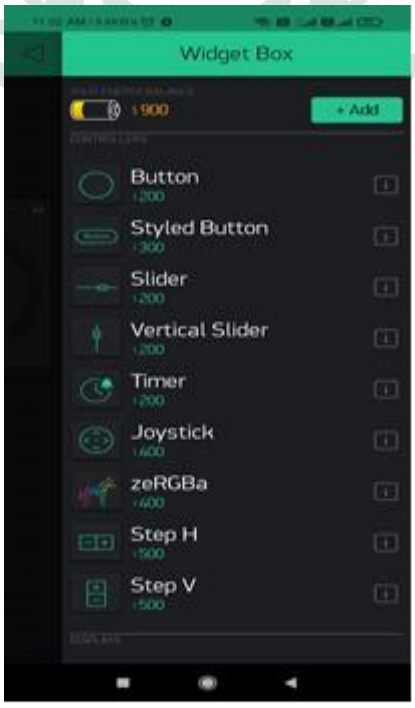

Figure 9. Blynk Widgets

IX. RESULTS

The proposed system is for smart traffic management which is made of software and hardware components. Software used like Arduino IDE for codding purposes and Blynk app is used for visualization of results. NodeMCU is used which is a Wi-fi module which is essential to connect all the sensor to Blynk server and different sensors are used for gathering relevant data from the environment and upload it into the Blynk cloud with the help of Wi-fi module. Blynk platform provides Blynk app for interfacing of the different sensor of our interest, Blynk server for connecting mobile phones with the hardware for the visualization purposes and also provide blynk libraries which are responsible for connecting all the hardware and also with the sensor. The results shown in the blynk app will be like, if the proximity sensor detects any nearby object, it will show logic 1 else remain o and send a message through blynk app like, "Be Careful". If the vibration sensor will detect any shock intensity, the gauge for it will display the results for the amount of intensity and send a message through blynk," Accident Detected", and the gauge for the gas sensor will display the amount of gas detected, if the gas sensor detects some amount of gas from the environment and send a message through blynk app like "Alcohol Detected "and GPS is used in the system which will detect the location of car and location is send through blynk app.

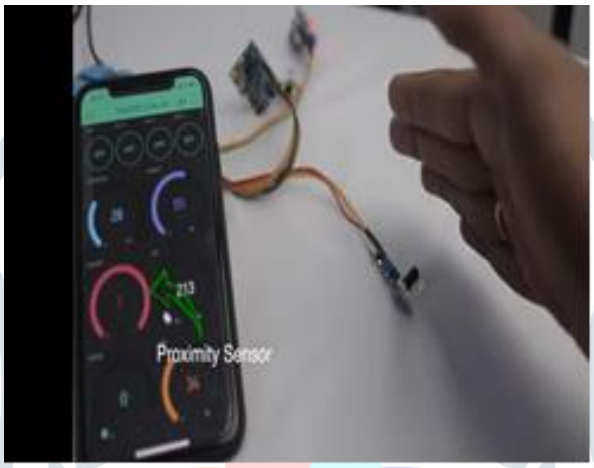

Figure 10. Output in Blynk

X. CONCLUSION

The system is developed to identify the advantages of the Internet of Vehicles over a large system called the" Internet of Things" when we deal only with vehicles. This paper mainly focused on the everyday problem faced by people in heavy traffic. This project is used to develop a system to connect the vehicle with other vehicles and objects and leads to an efficient traffic management system. It provides an application for all the connected devices in transportation. The proposed system is used to build a smart traffic management system by using different hardware and software components. So, that the driver of a vehicle can get the notification of the situation faced by him. The project is developed to bring better architecture and techniques for road traffic management and provide efficient monitoring and interaction between the vehicles on the road through the internet and a path to make traffic management fully automated without the intervention of humans. The concept of the Internet of Vehicle (IoV) can be extended to all modes of transportation for better communication between all the transport media.

XI. ACKNOWLEDGMENT

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