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IOT Based Smart Bus Transportation

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***Abstract*—The developed IoT-based smart bus health monitoring system is expected to bring back the neat service and safety of public transportation at the rate of modern technology that will keep the track of information regarding bus condition. ITS (Intelligent transport systems) are comprised of sensor technologies and communication systems that connect on-board terminal, the vehicular systems, and 'fixed location systems. This modus operandi of ICT (f information and communication technologies) also encompasses problems of rail, air, and water transport apart from road transport. IoT can be used to support the betterment of public transportation; hence, the transportation systems can become more receptive and more efficient. This entails the live tracking, amount analysis, and user friendly interfaces which helps the commuter to have trustworthy information along with a superior transportation experience.**

***Index Terms*—Telemetry, Emergency alarm,mpu6050,GPS sensor , Accelerometer, RFID card, Load sensor.**

I. INTRODUCTION

A Smart Transportation System (STS) is a present day approach that employments progressed innovations to progress transportation systems. In this extend, we are actualizing a telemetry-based framework. We will be introducing sensors in different zones of the transport to track it in real-time. From these sensors, the data assembled will be analyzed and shown on a site for the coordinations company. This permits them to have real-time bits of knowledge and make educated choices. The STS too joins versatile flag control and real-time checking to decrease clog on the streets. By leveraging associated vehicle innovations, communication between vehicles and foundation components is upgraded, driving to progressed security and activity stream. Shrewd foundation, counting sensors and information analytics, plays a significant part in making a

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comprehensive and interconnected transportation environment. Through telemetry, we can track distinctive parameters of the transport, which makes a difference increment proficiency and diminish working costs

II. RELATED WORK

Dr. SAB Vishal Pawar and Dr. Smita A Bhosale propose an IoT-powered "Smart Local Bus Transportation System" that enhances bus operations and passenger convenience. By integrating GPS trackers and sensors into buses, they enable real-time monitoring of bus locations and mechanical health. Additionally, the system features automated fare collection and real-time bus tracking for passengers. These IoT-driven advancements aim to optimize bus scheduling, streamline fare payments, and provide up-to-date bus information for improved passenger experience.One challenge is the potential cyber security threats that come with increased connectivity. Another challenge is the demand to a stable internet connec- tion for real-time data transmission. There may also be issues with making the system work with existing infrastructure. While collecting passenger data safety measures to be taken. Finally, implementing and maintaining the system requires a significant initial investment. [1]

Vehicle-to-vehicle communication enables cars to share crucial information instantly, enhancing road safety. It also streamlines traffic by optimizing routing and coordination. This connectivity also supports advanced driver-assist systems and self-driving technologies, directing it to a highly interconnected and automated transportation system. Advantage- It boosts road safety by enabling vehicles to share real-time updates. This information streamlines traffic flow, cutting down on congestion and delays. By exchanging data,vehicles can anticipate potential hazards and respond swiftly, potentially preventing accidents and making the roads safer. Limitations- Coordinating communication between different vehicle manufacturers and their communication systems poses a hurdle. Merging vehicle-to-vehicle connectivity into current IoT-connected vehicle setups can be challenging. It is impor- tant to address confidentiality. Implementing this system might necessitate infrastructure upgrades and increase costs. [2]

Bushra Rashid and Mubashir Husain Rehmani's investigate investigates the functions of remote sensor systems (WSNs) in urban situations. They highlight the potential of WSNs to upgrade city foundation, such as buildings and streets, by giving checking and natural detecting capabilities. Also, they examine the part of WSNs in advancing savvy city activities, empowering productive administration and progressed urban services. .

Advantages- This paper gives a comprehensive outline of the utilization of Remote Sensor Systems (WSNs) in urban situations. It offers a precise and open organization, making it to comprehend the multifaceted applications of WSNs in urban settings.

Limitations- The archive may ignore particular applications of Remote Sensor Systems (WSNs) in urban situations due to its accentuation on particular viewpoints of WSNs. As a result, its utility for tending to certain urban needs may be restricted. [3]

The study titled "Exploring Crowdsourcing Information to Forecast Traffic Impacts" investigates the potential of leveraging data from the general public to anticipate traffic-related events. It seeks to devise techniques for gathering and evaluating real-time data from individuals to comprehend traffic patterns and possible disruptions. By harnessing the collective knowledge of the public, this research endeavors to enhance transportation management.

Advantages- Harnessing the control of the community, this

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project leverages crowd sourcing to gather real-time traffic data. This approach not only decreases costs but increases the accuracy over conventional methods. It empowers citizens to contribute their insights, fostering a perceptibility of community involvement. By integrating local knowledge into traffic management, this project promotes more efficient and effective transportation solutions. Limitations- The project could encounter difficulties due to questionable or prejudiced data collected from the public, which might compromise its accuracy. It is crucial to consider privacy issues and guarantee data security. The seamless integration of crowd-sourced data into existing traffic management systems may pose technological and operational challenges. [4]

This study proposes an innovative approach to enhance the safety and comfort of public transportation using health monitoring systems and the Semantic Web of Things. It leverages sensors to gather data, enabling real-time tracking of passenger health and efficient emergency responses. The system seamlessly integrates with current transport infrastructure, prioritizing privacy to foster trust. This promising solution aims to elevate the public transportation experience and ensure the well-being of passengers. Advantages- This article introduces a novel concept that integrates health monitoring systems into public transportation through the Semantic Web of Things. By doing so, it aims to improve passenger safety. Through real-time monitoring, the system enables swift responses to medical emergencies, enhancing the comfort and safety of transportation. Additionally, it prioritizes passenger privacy by implementing measures to safeguard personal information, thereby fostering trust among travelers. Limitations- The report may overlook practical difficulties, such as the expenses and logistics of implementing the system widely. It may also face opposition or privacy and consent worries from travelers regarding the gathering of health information. Furthermore, it might not fully examine the ethical implications or broader social effects of keeping an eye on health in public settings. [5]

This IoT-based framework revolutionizes vehicle upkeep and mishap anticipation. It utilizes sensors to assemble real-time information, which is at that point analyzed by machine learning calculations to recognize potential issues, guar- anteeing vehicle security. Also, the framework consistently coordinating with driver help devices to cultivate capable driving practices. Advantages- With this framework, we have steady get to to real-time data almost our vehicle's condition, upgrading street security. By utilizing prescient analytics, it can prognosticate conceivable issues some time recently they heighten into major issues and deflect potential mishaps. Besides, its integration with driver help capacities makes strides our driving security, assist contributing to the generally security of our roadways. Limitations- The system's execution depends intensely on the dependability and exactness of the sensor data it secures. When joining with current vehicle frameworks, compatibility concerns may emerge. The system's scope may not envelop all natural factors or mechanical issues, constraining its mischance avoidance capabilities. Besides, it is vital to consider potential cybersecurity vulnerabilities that seem compromise the system's usefulness and the unwavering quality of collected information. [6]

This system uses GPS to identify specific zones, such as schools and hospitals, and automatically reduces the speed of the vehicle when approaching them. It also provides audible alerts to the driver. Additionally, when two buses come into close proximity, the system sends an alert to the drivers of both vehicles, helping to prevent collisions. [7]

This extend proposes a framework for vehicle collision location and avoidance coupled with contamination monitoring.The innovation utilized here is,GPS and GSM module with flex sensor,raspberry pi and MCU.MQ7. It points to upgrade street security by identifying potential collisions and alerting drivers, whereas too observing contamination levels to advance en- vironmental mindfulness. The framework likely includes sensors introduced in 6 vehicles and on roadways to collect information on nearness, speed, and pollu- tion levels, with real-time communication capabilities to give timely warnings and overhauls to drivers. Advantages: This coordinates framework offers numerous focal points. Firstly, it improves street security by identifying and avoiding potential collisions, thereby diminishing the chance of mishaps. Besides, it advances environ- mental mindfulness by checking contamination levels, supporting in the iden- tification and relief of hurtful emanations. In conclusion, by leveraging IoT innovation, it empowers real-time communication and cautions, pro- viding convenient data to drivers for proactive activity, ultimately contributing to more secure and cleaner roads. Disadvantages: The system's confinements incorporate potential inaccura- cies in collision location and contamination checking, which may result in untrue cautions or questionable information. Moreover, framework require- ments and appropriation obstacles may posture challenges in realizing the system's full viability and versatility [8]

In this paper discuss about the causes of the traffic accidents driver drowsiness comes at first place.This paper proposes a Real Time Driver Fatigue Detection Based on SVM Algorithm.It mainly focuses on drivers face expression and behavior. From this project we take this idea but we implemented using IOT technology.Monitor the driving time of the driver to prevent fatigue- related accidents. [9]

This paper focus on the blueprint and implementation of a smart and compact electronic control unit for management of a bus fleet.The ECU system have the ability to extract all vehicle data by the ODB.In this paper the author also discuss about the estimation of driver behavior by data mining k-means algorithm. Here author uses Data Mining and IOT mechanisms to get the data but their is a problems like Data Mining will

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give a complex data and security is less and algorithms are more. When we look at our project we use IOT technology.So,there is no complexity in data and security is more. [10]

III. METHODOLOGY

A. Objective

The aim of the telemetry system is to upgrading the performance of buses while cutting costs. It gathers and analyzes data on bus conditions, driver actions, and safety-related aspects to boost efficiency and lower operating expenses. We have also integrated the RFID mode of payment and the count of number of passengers on the user end.

B. Parameter Tracking

- Bus Payload: Utilize load sensors to manage the weight of the payload, mainly goods, to prevent overloading.
- Engine Health: Track engine vibrations using vibration sensors and monitor exhaust emissions using MQ9 and MQ4 sensors.
- Driver Behavior: Employ an accelerometer MPU6050 to monitor driver behavior, such as hard driving and braking.
- Emergency Alarm: Incorporate a GSM module to send emergency messages to nearby buses in case of breakdowns or accidents.
- Location and Speed: Track the location and velocity of the bus using GPS sensors. Calculate speed using accelerometer data. Driver Fatigue: Monitor the driving time of the driver to prevent fatigue-related accidents.
- Collision Detection: Install ultrasonic sensors to alert the driver in case of potential collisions.
- Fuel Monitoring: Utilize fuel gauge sensors to calculate the fuel level in the bus, detect any fuel leakage, and calculate real-time mileage.

C. Data Aggregation and processing

- Gathering data from all the sensors installed in the bus.
- Process the data to extract relevant information such as payload weight, engine health status, driver behavior, location, speed, driving time, fuel level, and potential collision risks.
- Implement algorithms to examine the data and generate actionable insights.

D. Alert Mechanism

Implement a monitoring system that will send immediate alerts to affected parties (stakeholders) via SMS, dashboard notifications, or other communication methods whenever there are problems or emergencies. This system will keep everyone informed and up to date on issues such as overloads, engine problems, risky driving behavior, emergencies, or imminent collisions.

E. Compliance and Privacy

- Make sure the telemetry system complies with laws and rules about keeping data secret and safe.
- Put in place safeguards to keep sensitive data processed by the telemetry system safe and protect passengers' privacy.

F. Training and Integration

- Equip bus operators and technicians with the skills to utilize and understand telemetry system information.
- Enhance collaboration between the telemetry system and current fleet management and monitoring systems to facilitate smooth operations and data sharing.

G. Evaluation and Feedback

- Regularly assess the telemetry system's performance and impact on its goals.
- Gather feedback from bus operators, drivers, and management to identify areas for improvement and future enhancements.

H. Implementation

The successful integration of a comprehensive bus tracking and management system involves a meticulous approach to several key components, ensuring a seamless operation for both the core of this system is the establishment of robust communication channels between tracking devices installed on buses and a centralized server. This integration is crucial to facilitate a continuous and fostering live tracking and control. Real that necessitates the execution of advanced technologies, primarily relying on GPS, load sensors, vibration sensors, mq9 sensors, accelerometer which keeps a check on engine health, driver behavior, exhaust systems and chances of accidents. Parameters will be tracked by: - bus payload : we will be using load sensor , to check for over loading in bus (mainy goods) - engine health : Tracking vibration of a engine using vibration sensor And monitoring exhaust using mq9 sensor and mq4 sensor Drivers behaviour is monitor using accelerometer mpu6050 Which we can check for hard driving hard braking We have used a gsm module to send emergency message to near by busses in cases of breakdown or accident The location and speed of bus are tracked using GPS sensor and speed is calculated by accelerometer. Also tracked the drive time of driver to avoid fatigue which can reduce accidents. Also the fuel level in the bus is calculated using fuel gauge sensor , to check of any leakage of fuel and calculate real time milage. Also we have used ultrasonic sensor to give a collision alarm to driver.

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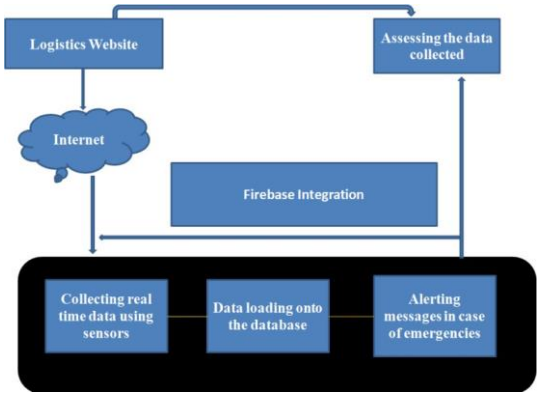

Fig. 1. IOT Based Smart Bus Transportation

RESULT

A smart public transit system adapting IoT is a best solution for improved traffic management, reduced congestion, and enhanced safety. Real-time data from IoT devices, such as sensors and cameras, which enables better traffic flow optimization and allows for timely responses to incidents.Also it enhance public transportation efficiency, reduce emissions, and provide users with accurate and updated information, contributing to a more renewable and user-friendly transportation infrastructure. and improved overall user experience. As this technology con- tinues to evolve, collaboration between stakeholders, including government bodies, technology developers, and the public is very important . Anyhow, the smart public transit system using IoT presents a transformative pathway towards creating more intelligent, sustainable, and user-centric urban transportation ecosystems.

CONCLUSION

In conclusion, by implementing a smart transportation system using IoT has the tremendous potential for revolutionizing urban mobility. By collecting real-time data and allowing the communication between vehicles and infrastructure, and intelligent analytics, such a system can significantly enhance efficiency, safety, and sustainability in transportation networks.The integration of IoT technologies in transportation facilitates dynamic traffic management, and optimized route planning. This, leads to reduced congestion, lower emissions,

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