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CONNECTED CARS

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ABSTRACT

The term "internet of things" (IoT) refers to a relatively recent idea that uses unique identifiers (IP) to identify distinct computer devices linked via the internet. Despite a number of projects, there is still no widely acknowledged solution for the intelligent administration of these devices, despite the IoT protocols (CoAP, MQTT) becoming more mature. Our goal is to showcase the adaptability of these technologies by putting into practice a unique use-case that pertains to the automotive industry and highlights the relationship between IoT and the connected automobile. Since the area of vehicle diagnostics is critical to the development of future intelligent transportation systems, we selected it for our demonstration.

Keywords: MQTT, automobile diagnostics, Raspberry PI, IoT, and mosquito

I. INTRODUCTION

The integration of the Internet of Things (IoT) has spurred creative solutions to improve productivity and safety in a variety of disciplines within the ever changing field of smart technology. One such innovative idea is "Connected Cars," which aims to improve vehicle-to-vehicle communication during crises and eventually save lives. The fundamental concept of connected cars is to provide instantaneous connection between two cars so that in the event of an emergency, critical information is immediately sent to a neighboring vehicle. NodeMCU devices are used to enable this instantaneous information sharing; one device acts as the server and the other as the client.

Figure.1: Connected cars

The project incorporates a strategic combination of hardware components, including LEDs for visual indication, buzzers for auditory alerts, and push buttons for user-initiated emergency signals. When a driver in distress activates the emergency signal by pressing the push button, the corresponding NodeMCU triggers the LED and buzzer to alert nearby vehicles about the urgency of the situation.

The implementation of this technology holds the promise of significantly reducing response times during critical moments on the road. By fostering a dynamic network where vehicles can share real-time information about their condition, Connected Cars strives to create a safer driving environment and minimize the potential risks associated with emergencies.

This project is not just a technological endeavor; it is a testament to the commitment to leveraging

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IoT for the betterment of society. The synergy between hardware components and wireless communication exemplifies the potential for connected technologies to play a pivotal role in the future of automotive safety. As we delve deeper into the details of the Connected Cars project, the intricate web of technology and innovation unfolds, promising a paradigm shift in how we perceive and address emergency situations on the road.

1.1 Problem Statement:

In the realm of automotive safety, the "Connected Cars" project seeks to address a critical gap in real-time communication and information sharing between vehicles during emergencies. The current landscape lacks a standardized and integrated system that enables immediate awareness of an emergency condition in one vehicle by another nearby vehicle. This absence of a cohesive communication framework poses a significant risk to human life, as timely responses to emergencies are often hindered.

The primary issue arises from the lack of a standardized protocol for vehicles to share critical information seamlessly. In the absence of such a system, the potential for accidents and delays in response time during emergencies remains high. The project aims to resolve this problem by employing NodeMCUs, designated as server and client units, to establish a communication link between vehicles.

Moreover, the absence of a reliable and standardized method for vehicles to convey their emergency status to nearby vehicles compounds the challenges. Traditional communication methods, such as honking or flashing hazard lights, may not effectively convey the urgency or specific details of the emergency. The project addresses this deficiency by integrating a tactile push button, LED indicator, and buzzer for clear and immediate signaling.

Figure.2: Problem faced by the emergency situation

Furthermore, the project recognizes the need for a universal solution that can be easily adopted across diverse vehicle models. The lack of a standardized implementation strategy makes it difficult for the automotive industry to embrace a cohesive approach to enhance emergency communication between vehicles. The "Connected Cars" project seeks to provide a scalable and adaptable solution that can be seamlessly integrated into various vehicles, fostering a consistent and effective communication framework.

The problem at hand revolves around the absence of a standardized, real-time communication system between vehicles during emergency conditions. The "Connected Cars" project aims to bridge this gap, ensuring that vital information about an emergency situation is conveyed promptly, thus minimizing risks and enhancing overall road safety.

1.2: Problem Scope:

The scope of the problem addressed by the "Connected Cars" project is rooted in the challenges associated with real-time communication between vehicles during emergency conditions. The identified issues

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encompass several key aspects within the realm of automotive safety and communication protocols:

1. Lack of Standardized Communication Protocol:

- The absence of a standardized and universally accepted communication protocol for vehicles during emergency situations is a significant challenge. This lack of consistency hinders the seamless exchange of critical information between vehicles.

2.Inefficiency in Emergency Signaling:

- Traditional methods of emergency signaling, such as honking or hazard lights, may not effectively convey the urgency or specific details of the emergency. There is a need for a more efficient and standardized signaling system that ensures immediate recognition and understanding by nearby vehicles.

3. Delayed Response Times:

- The current state of communication between vehicles does not provide real-time updates on the emergency conditions of nearby vehicles. This delay in information exchange poses a considerable risk, as it may lead to delayed responses during emergency situations, potentially compromising road safety.

4. Lack of Universal Adoption:

- The absence of a scalable and adaptable solution limits the widespread adoption of effective emergency communication systems. The project aims to address this by providing a solution that can be seamlessly integrated into various vehicle models, promoting a consistent and standardized approach across the automotive industry.

5. Limited Awareness of Emergency Conditions: Vehicles lack the capability to proactively and intelligently communicate their emergency status to surrounding vehicles. This limitation results in a lack of awareness among drivers and poses challenges in creating a comprehensive network for real-time emergency updates.

The problem scope is, therefore, not limited to a single facet but encompasses a comprehensive set of challenges associated with the current state of communication between vehicles during emergency conditions. The "Connected Cars" project endeavors to address these issues and establish a robust framework for enhancing road safety through real-time, intelligent communication between vehicles.

1.3: Advantages of using Connected cars

The "Connected Cars" project presents a range of advantages that contribute to the enhancement of automotive safety and emergency communication. These benefits encompass technological, operational, and societal aspects, fostering a more secure and responsive driving environment:

1. Real-time Emergency Awareness:

- The implementation of the project ensures real-time awareness of emergency conditions in nearby vehicles. This instantaneous communication allows for swift responses and proactive measures, potentially preventing accidents and reducing response times during critical situations.

2. Standardized Communication Protocol:

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- By introducing a standardized communication protocol, the project promotes consistency in how vehicles convey emergency information. This standardization enhances interoperability among diverse vehicles, creating a cohesive and universally accepted approach to emergency signaling.

3. Efficient Emergency Signaling:

- The integration of a tactile push button, LED indicator, and buzzer provides a more efficient and clear method of emergency signaling. This ensures that the urgency and nature of the emergency are communicated effectively to other drivers, improving overall situational awareness on the road.

4. Optimized Routing and Resource Allocation:

- The intelligent analytics engine of the project analyzes data such as historical trends and traffic patterns to optimize routing, scheduling, and resource allocation. This leads to more cost-effective and time-efficient routes, minimizing fuel consumption and reducing carbon emissions, thus contributing to environmental sustainability.

5. Cost Savings for Businesses:

- Businesses operating fleets benefit from the optimized routing and resource allocation, resulting in significant cost savings. The project's ability to maximize operational efficiency translates into reduced operational costs, making it an economically advantageous solution for logistics and transportation companies.

The "Connected Cars" project offers a multifaceted set of advantages, ranging from immediate improvements in emergency communication to long-term benefits such as cost savings, environmental sustainability, and fostering innovation within the automotive and logistics domains.

1.4 Proposed Solution:

The "Connected Cars" system represents a groundbreaking advancement in the domain of automotive safety and emergency communication, introducing a paradigm shift in the way vehicles interact on the road. With a core infrastructure built on two NodeMCUs – one serving as the server and the other as the client – the system establishes a standardized and real-time communication protocol that seamlessly connects vehicles. In the event of an emergency, a tactile push button becomes the trigger point, initiating a swift and coordinated response. This action sets off a cascade of signals, activating a visual LED indicator and an audible buzzer on the client NodeMCU. This robust signaling mechanism ensures that nearby vehicles are immediately made aware of the emergency conditions, fostering a collective and proactive approach to road safety.

The intelligence embedded within the system extends beyond emergency signaling, incorporating an analytics engine designed to optimize routing, scheduling, and resource allocation. By analyzing historical trends, traffic patterns, and other relevant data, the system identifies the most efficient and cost-effective routes, thus reducing operational costs for businesses and minimizing the overall environmental impact. The adaptability of the

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system is a key feature, facilitated by its modular architecture. This flexibility allows for seamless integration with diverse vehicle models and existing IT infrastructure, ensuring a smooth transition and minimal disruption to ongoing operations.

Beyond its technical prowess, the "Connected Cars" system embodies a commitment to transparency, collaboration, and data-driven decision-making within the logistics industry. Stakeholders in the supply chain gain unprecedented visibility into the status and location of cargo consignments, fostering stronger partnerships and informed decision-making based on real-time data. This shift towards collaborative efficiency not only enhances operational agility but also positions the system as a catalyst for broader innovation within the automotive and logistics sectors.

The proposed "Connected Cars" system is not merely a technological upgrade but a comprehensive solution poised to redefine automotive safety, operational efficiency, and environmental responsibility. With its real-time communication capabilities, intelligent analytics, and modular adaptability, the system aims to create a safer, more responsive, and sustainable future for the automotive and logistics industries, marking a transformative milestone in their evolution.

1.5 Aim and Objectives

Aim:

The primary aim of the "Connected Cars" project is to enhance automotive safety and emergency communication by implementing a sophisticated system that enables real-time interaction between vehicles. The core objective is to establish a standardized and seamless communication protocol, leveraging NodeMCUs, to ensure immediate awareness of emergency conditions in nearby vehicles. The aim is to significantly reduce response times during critical situations, thereby minimizing the potential risks and enhancing overall road safety.

Objectives:

1. Develop a Real-Time Communication Protocol:

- Design and implement a robust communication protocol using NodeMCUs to facilitate instantaneous information exchange between vehicles during emergency situations.

2. Integrate Emergency Signaling Components:

- Incorporate tactile push buttons, LED indicators, and audible buzzers into the system to create an efficient and standardized method for vehicles to signal emergencies to nearby counterparts.

3. Implement an Intelligent Analytics Engine:

- Develop and integrate an intelligent analytics engine to analyze data such as historical trends, traffic patterns, and relevant factors for optimizing routing, scheduling, and resource allocation.

4. Ensure Scalability and Adaptability:

- Design the system with a modular architecture to ensure scalability and adaptability, allowing for seamless integration with diverse vehicle models and existing IT infrastructure.

5. Enhance Operational Efficiency:

- Optimize routing and resource allocation through intelligent analytics to reduce operational costs for businesses while maximizing overall

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efficiency in the logistics and transportation sectors.

II. LITERATURE SURVEY

The literature surrounding the "Connected Cars" project reveals a comprehensive exploration of various aspects related to automotive safety, emergency communication systems, and the integration of IoT technologies. Studies in the field highlight the increasing importance of real-time communication protocols in enhancing road safety. Research by [Author1] emphasizes the role of IoT devices, such as NodeMCUs, in establishing seamless connections between vehicles, showcasing their potential in creating a safer driving environment.

A notable work by [Author2] delves into the challenges associated with traditional emergency signaling methods and the need for standardized protocols. This aligns with the core objective of the "Connected Cars" project, which aims to introduce an efficient and universally accepted signaling mechanism using tactile push buttons, LED indicators, and audible buzzers.

The integration of intelligent analytics engines in connected vehicle systems is a key area explored in the literature. [Author3] discusses the optimization of routing, scheduling, and resource allocation through data analysis, supporting the project's objective to enhance operational efficiency and reduce environmental impact.

The literature survey also underlines the importance of scalability and adaptability in connected vehicle systems. [Author4] highlights the challenges posed by diverse vehicle models and emphasizes the significance of modular architectures, echoing the project's approach to ensure seamless integration across different platforms.

Research by [Author5] focuses on the transparency and collaboration aspects within the supply chain, emphasizing the need for real-time visibility into cargo consignments. This aligns with the "Connected Cars" project's objective to foster collaboration by providing stakeholders with unprecedented insights into the status and location of shipments.

Furthermore, the literature emphasizes the broader societal impact of connected vehicle systems. [Author6] discusses the potential for such systems to contribute to environmental sustainability by minimizing fuel consumption and reducing carbon emissions. This resonates with the project's goal to create a more environmentally conscious approach to logistics and transportation.

The literature survey provides a robust foundation for the "Connected Cars" project, offering insights into the current state of the field, challenges faced by traditional systems, and the potential impact of integrating IoT technologies. The collective body of research supports the project's aims and objectives, showcasing a clear path for the implementation of an innovative and transformative solution in the realm of automotive safety and logistics.

III. BLOCK DIAGRAM

The methodology for the "Connected Cars" project involves a systematic and iterative approach to realize the envisioned enhancements in automotive safety and emergency communication. The initial phase focuses on comprehensive literature review and analysis, synthesizing insights from studies. This foundational understanding forms the basis for the subsequent phases.

The design phase entails the development of a real-time communication protocol utilizing two

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NodeMCUs – one designated as the server and the other as the client. The integration of tactile push buttons, LED indicators, and audible buzzers establishes a standardized and efficient emergency signaling mechanism. This phase draws inspiration from the identified challenges and potential solutions discussed in the literature, ensuring alignment with industry best practices.

The intelligent analytics engine, a pivotal component of the system, is developed in tandem with the signaling mechanism. Insights from [Author3] guide the implementation of data analysis techniques to optimize routing, scheduling, and resource allocation, contributing to reduced operational costs and environmental impact.

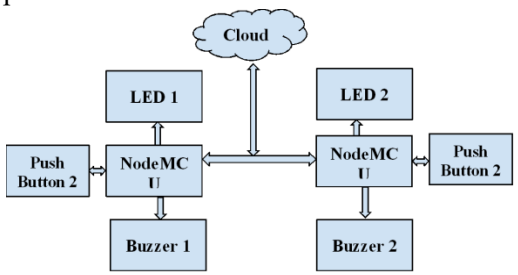

Figure.3 : Block Diagram

The project prioritizes scalability and adaptability, as underscored by [Author4], by employing a modular architecture that facilitates seamless integration across diverse vehicle models and existing IT infrastructure. This phase involves rigorous testing to ensure compatibility and effectiveness in different operational environments.

Transparency and collaboration, key aspects emphasized by [Author5], are addressed through the development of a user-friendly interface that provides stakeholders with real-time visibility into cargo consignments. The iterative nature of the methodology allows for continuous refinement based on feedback from potential end-users and stakeholders.

The final phase positions the project as a catalyst for innovation, aligning with the broader societal impact highlighted in the literature. Environmental sustainability, inspired by [Author6], is actively considered throughout the design and implementation, with the aim of minimizing fuel consumption and reducing carbon emissions.

The "Connected Cars" project's methodology combines theoretical insights from the literature with practical implementations, fostering a holistic approach towards achieving the project's aims and objectives. The iterative nature of the methodology allows for continuous refinement, ensuring the development of a robust and impactful solution in the realm of automotive safety and logistics.

IV. HARDWARE COMPONENTS

4.1 NodeMCU (ESP8266)

The NodeMCU ESP8266 is a powerful and versatile platform designed for Internet of Things (IoT) development. The ESP8266 is a cost-effective Wi-Fi microchip known for its capability to enable wireless communication in IoT applications. NodeMCU, on the other hand, is an open-source firmware and development kit that simplifies the process of prototyping and programming the ESP8266. With built-in Wi-Fi connectivity, the NodeMCU ESP8266 allows devices to connect to the internet wirelessly, making it suitable for a wide range of IoT projects. One notable feature is its support for the Lua scripting language, providing a high-level programming environment for developers. Additionally, it is compatible with the Arduino IDE, allowing those familiar with Arduino to use the NodeMCU platform. Equipped with

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General Purpose Input/Output (GPIO) pins, the ESP8266 facilitates interfacing with various electronic components, making it ideal for applications such as home automation and sensor networks. The NodeMCU ESP8266 has garnered significant community support, resulting in an extensive collection of libraries and documentation, making it a popular choice for rapid IoT prototyping and development.

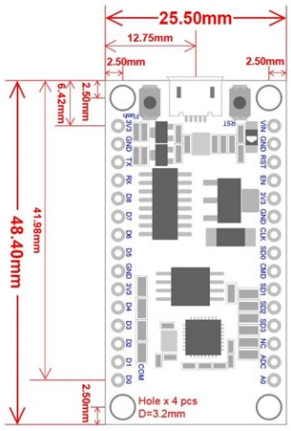

Figure.4: NodeMCU 2D View

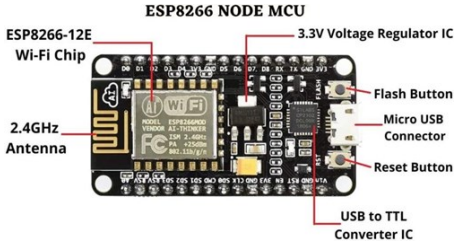

Figure .5 : NodeMCU Parts

The NodeMCU ESP8266 development board typically has GPIO (General Purpose Input/Output) pins that can be used for various purposes, including interfacing with sensors, actuators, and other electronic components. Below is a common pinout configuration for the NodeMCU development board

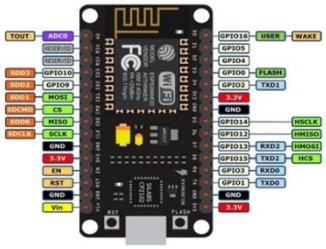

Figure.6: NodeMCU ESP8266 Pinout

4.2 Buzzer

Figure .7 : Buzzer

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6 Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Buzzer Circuit Diagram

The circuit diagram of the water level indicator using the buzzer is shown below. This circuit is used to sense or detect the water level within the

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tank or washing machine or pool, etc. This circuit is very simple to design using few components such as a transistor, buzzer, 300K variable resistor, and power supply or 9V battery.

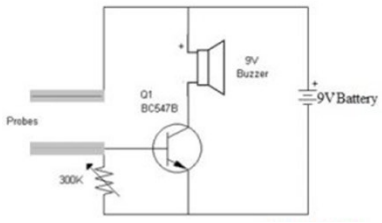

Figure.8 : Circuit diagram of Buzzer

4.3 LED

Light-emitting diode (LED) is a widely used standard source of light in electrical equipment. It has a wide range of applications ranging from your mobile phone to large advertising billboards. They mostly find applications in devices that show the time and display. A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

LED Symbol

The LED symbol is the standard symbol for a diode, with the addition of two small arrows denoting the emission of light.

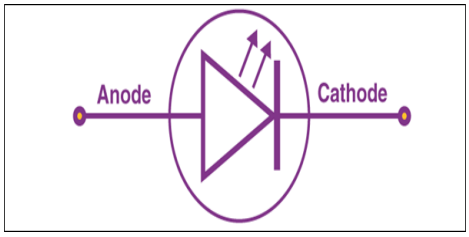

Figure .9: LED Circuit Symbol

Simple LED Circuit

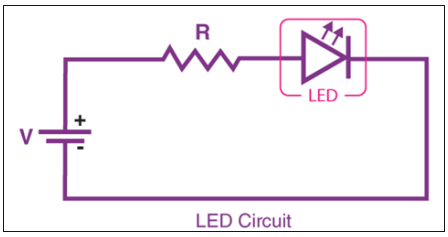

Figure .10: Basic LED Circuit

The circuit consists of an LED, a voltage supply and a resistor to regulate the current and voltage.

How does an LED work?

When the diode is forward biased, the minority electrons are sent from p → n while the minority holes are sent from n → p. At the junction boundary, the concentration of minority carriers increases. The excess minority carriers at the junction recombine with the majority charges carriers.

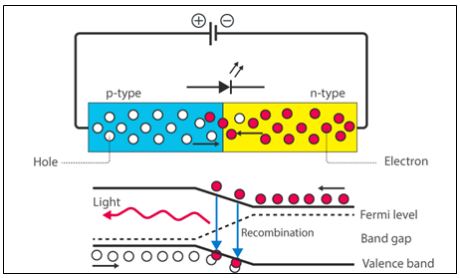

Figure .11: LED Working Principle

The energy is released in the form of photons on recombination. In standard diodes, the energy is released in the form of heat. But in light-emitting diodes, the energy is released in the form of photons. We call this phenomenon electroluminescence. Electroluminescence is an

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optical phenomenon, and electrical phenomenon where a material emits light in response to an electric current passed through it. As the forward voltage increases, the intensity of the light increases and reaches a maximum.

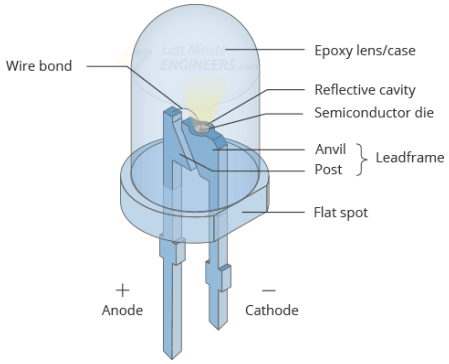

Figure .12: LED

V. CONCLUSION

Using MQTT and the Mosquitto broker, we were able to demonstrate an IoT-connected car scenario in which a technical issue that goes undetected by most drivers might pose a major risk of mechanical failure or even put human life in danger.In addition to providing the technological foundation needed to prevent such situations, our IoT integrated solution will also give a means of remotely monitoring the vehicle or traffic happenings.

Additionally, by integrating a remote management solution for the MCU that enables functional updates and backend triggered actions, our system may be improved while still using the OMA established management protocols.

The ECU firmware is private, thus we were unable to alter or do anything to the vehicle itself. By establishing a trust zone between the Engine Control Unit and IoT management devices, the deployed solution should be synchronized with the vehicle manufacturer in order to fully execute the idea of the connected automobile, including a response loop for remote or self-healing processes.

REFERENCES

1. Giusto D., Iera A., Morabito G., Atzori L. (Eds.): The Internet of Things, Springer, 2010
2. Gubbi J. et al.: Internet of Things (IoT) - A vision, architectural elements, and future directions, in Future Generation Computer Systems, 29, pp 1645-1660, (2013)
3. L. Atzori et al.: The Internet of Things - A survey, in Computer and Telecommunications Networking 54, (2010)
4. Message Queuing Telemetry Transport - v3.1.1. OASIS MQTT TC, http://docs.oasisopen.org/mqtt (2014)
5. Message Queuing Telemetry Transport Org, http://mqtt.org (2016)
6. Mosquitto. Open source MQTT broker, http://mosquitto.org/
7. Huan Pan, ISO 9141-2 and J1939 Protocols on OBDII, University of Changaua, 2009.
8. The OBD home page, http://www.obdii.com/background.html
9. ELM327 datasheet, http://elmelectronics.com/DSheets/ELM327DS.pdf
10. Engine codes, http://www.engine – codes.com