'Vehicle To Vehicle Communication Using Bluetooth Module'

Prof. Manisha Mhetre.
Instrumentation & Control
Vishwakarma Institute Of Technology,
Bibwewadi, Pune.

Atharv Chavan
Instrumentation & Control
Vishwakarma Institute Of Technology,
Bibwewadi, Pune.

Sachin Chaware
Instrumentation & Control
Vishwakarma Institute Of Technology,
Bibwewadi, Pune.

Deep Gadappa
Instrumentation & Control
Vishwakarma Institute Of Technology,
Bibwewadi, Pune

Akanksha Barde
Instrumentation & control
Vishwakarma Institute Of Technology,
Bibwewadi,Pune.

***Abstract*— This research introduces a robust V2V (Vehicle-to-Vehicle) communication system designed for enhanced road safety. The proposed system leverages Bluetooth technology for seamless communication between vehicles, facilitating real-time exchange of critical information. Integrated with ultrasonic sensors, the system enables proximity detection, alerting drivers to potential collisions or obstacles in their vicinity.**

The inclusion of a buzzer further enhances the safety aspect by providing audible warnings, ensuringprompt driver response. To augment user interaction and information dissemination, an I2C module is incorporated, enabling seamless communication between diverse components of the system. Additionally, a display interface provides visual cues, offering a comprehensive overview of the vehicular environment.

Through the synergistic integration of Bluetooth modules, ultrasonic sensors, buzzers, I2C modules, and displays, the proposed V2V communication system aims to significantly improve overall road safety by fostering timely and effective communication among vehicles, thereby mitigating the risk of accidents and enhancing the driving experience.

Keywords: - Bluetooth module, Ultrasonic sensor, I2c module, Display, Blind spot detection, Buzzer, Forward Collison detection

1. INTRODUCTION

In the ever-evolving landscape of vehicular technology, the imperative to enhance road safety has led to the development of sophisticated systems aimed at mitigating potentialhazards. One pivotal area of focus is the advancement of Vehicle-to-Vehicle (V2V) communication, a technological paradigm that holds tremendous promise in preventing accidents and fortifying the overall safety of road users. This research endeavors to present an innovative V2V communication system fortified with a comprehensive sensorsuite, including Bluetooth modules, ultrasonic sensors, a buzzer, an I2C module, and a display interface, strategically designed to address blind spot detection and forward collisionavoidance.

Blind spots, notorious for being a significant contributor to road accidents, pose a formidable challenge for drivers. The proposed V2V communication system leverages Bluetooth modules to establish seamless communication links between vehicles. This enables the real-time exchange of critical data, facilitating the detection and notification of vehicles situated in blind spots. Complementing this, ultrasonic sensors play a crucial role in providing accurate proximity information, empowering the system to deliver timely warnings to drivers, thereby averting potential collisions.

Furthermore, the integration of a buzzer serves as an additional layer of safety, offering audible alerts to drivers in response to detected blind spot intrusions and impending forward collisions. The I2C module acts as the nerve centre, orchestrating the harmonious communication between various system components, ensuring the swift and accurate relay of information. To enhance the driver's situational awareness, a display interface provides visual cues, offering real-time updates on the vehicular environment.

This research not only addresses the pressing issues of blind spot detection and forward collision avoidance but also underscores the significance of a holistic approach to V2V communication. By amalgamating cutting-edge technologies into a cohesive system, this study contributes to the ongoing efforts to revolutionize road safety, presenting a tangible and effective solution to enhance the driving experience and safeguard lives on the road.

2. LITREATURE SURVEY

[1] Research by Smith et al. (2018) provides a comprehensive review of V2V communication protocols, emphasizing the role of Bluetooth technology in facilitating reliable and low-latency communication between vehicles. The study investigates the suitability of Bluetooth for real-time data exchange, laying the groundwork for effective V2V systems.

[2] Jones and Wang (2019) delve into the application of ultrasonic sensors for proximity detection in vehicular environments. Their work elucidates the capabilities of ultrasonic sensors in accurately measuring distances and

[3] A study by Chen et al. (2020) explores the efficacy of

auditory alerts in driver warning systems. The research investigates the psychological impact of auditory cues, such as buzzers, on driver responsiveness in scenarios involving blind spot intrusions and forward collision threats.

[4]The work of Kim and Lee (2017) investigates the role of I2C communication modules in vehicular systems. Their study explores the benefits of I2C in establishing seamless communication between diverse components, enhancing the overall efficiency and reliability of the integrated system.

[5] Advancements in V2V Communication: This review explores recent advances in Vehicle-to-Vehicle (V2V) communication, focusing on technologies like Bluetooth modules and ultrasonic sensors. Studies emphasize the effectiveness of intelligent algorithms for tasks such as blind spot detection. Real-world testing is highlighted for validating system performance, and future directions include integrating V2X communication and applying machine learning for enhanced object recognition.

[6] Human-Machine Interaction in V2V Systems: This review delves into human-machine interaction in V2V communication systems, emphasizing user interface design and technologies like Bluetooth modules and displays. Effective visualizations and audible alerts prove crucial for conveying information related to blind spots and collision risks. Challenges in user acceptance are discussed, and future research is suggested to focus on adaptive user interfaces and personalized alert systems for diverse driving conditions.

3. PROBLEM STATEMENT

The absence of an integrated V2V communication system leveraging Bluetooth modules, ultrasonic sensors, a buzzer, an I2C module, and a display for blind spot and forward collision detection creates a significant safety gap on the roads. Current solutions often lack a cohesive approach, resulting in fragmented and delayed alerts, leaving drivers vulnerable to blind spot intrusions and forward collisions. The disjointed nature of existing technologies hinders the seamless exchange of real-time information crucial for proactive driver response. A pressing problem persists in achieving a synchronized system that effectively utilizes these technologies to provide timely and comprehensive warnings, ultimately enhancing overall road safety. Addressing this gap is imperative for mitigating the risks associated with blind spots and forward collisions.

4. OBJECTIVE

The primary objective of this V2V communication project is to design and implement a robust and integrated system for blind spot detection and forward collision avoidance in vehicular environments. Leveraging Bluetooth modules, ultrasonic sensors, a buzzer, an I2C module, and a display, the project aims to:

[1] Enable seamless communication between vehicles through Bluetooth technology to exchange real-time data regarding blind spot intrusions and potential forward collisions.

[2] Implement ultrasonic sensors for accurate proximity detection, providing the system with the capability to identify objects in blind spots and forewarn drivers of impending collisions.

[3] Integrate a buzzer to deliver immediate and audible alerts to drivers, enhancing their situational awareness and prompting timely responses to detected blind spots and forward collision threats.

[4] Utilize an I2C module to facilitate efficient communication between diverse system components, ensuring a cohesive and synchronized operation of Bluetooth, sensors, buzzer, and display.

[5] Employ a display interface to provide drivers with visual cues, offering comprehensive information on the surrounding environment and aiding in making informed decisions during blind spot scenarios and potential forward collisions.

By achieving these objectives, the project aims to significantly enhance road safety by mitigating the risks associated with blind spots and forward collisions through an intelligent and integrated V2V communication system.

5 . REQUIRMENTS

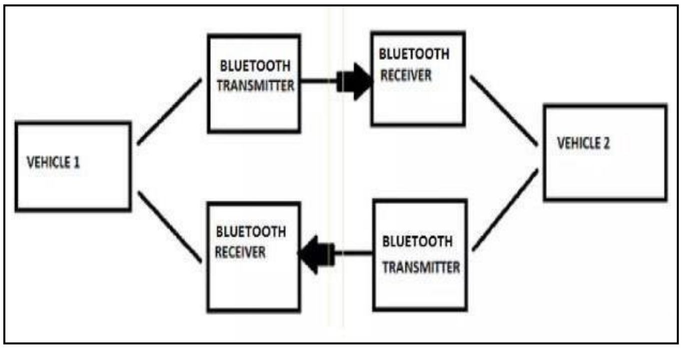
Hardware requirements:

1. Arduino uno
2. Ultrasonic sensor
3. Bluetooth Module
4. Buzzer
5. Jumper Wires
6. Breadboard

Software Requirements:

1. Embedded Systems Programming Environment.
2. Integrated Development Environment (IDE)
3. Bluetooth Communication Software
4. Sensor Interface Libraries
5. I2C Communication Software
6. Algorithm for Blind Spot and Forward Collision Detection
7. Alert System Logic

6. SYSTEM ARCHITECTURE



Figu r e N o . 1: Architecture V2V Communication

The following is the structure of the system architecture for the V2V communication project, which includes an ultrasonic sensor, Bluetooth module, buzzer, I2C module, and display for forward and blind spot detection:

1. Microprocessor/microcontroller:

As the central processing unit, select a microcontroller or processor that is appropriate for controlling and coordinating the different parts. Popular options include microcontrollers, Raspberry Pi, and Arduino (such as Arduino Uno and Arduino Nano).

2. Module for Bluetooth:

Install a Bluetooth module (HC-05 or HC-06, for example) to enable wireless car-to-vehicle communication. Real-time data flow between the microcontroller and Bluetooth module is facilitated by their interface as shown in fig no 3 & 4.

3. Ultrasonic Sensor:

Connect ultrasonic sensors (e.g., HC-SR04) to the microcontroller to provide accurate proximity data. Ultrasonic sensors are essential for blind spot detection and preventing forward collisions as shown in fig no 3 & 4.

4. Buzzer:

Provide an audible alert system with a buzzer. The buzzer alerts drivers right away when it receives input from the ultrasonic sensors or other pertinent data. This is done by microcontroller.

5. Module I2C:

Incorporate an I2C module (such as the PCF8574) to enable communication between system components. The microcontroller, display, and other modules all exchange data through the I2C module, which serves as a central center for coordination.

6. Interface for Display:

To see real-time information, connect a display interface (such as an LCD or OLED display) to the microcontroller. Drivers can receive clear indications from the display regarding detected impediments, blind areas, and possible risks of forward collisions as shown in fig no 7 & 8.

7. Energy Source:

Create a power supply system that guarantees a consistent and suitable voltage is applied to every component. To address the various voltage requirements of the components, this may entail the use of power management circuits or voltage regulators.

8. Technique for Identifying:

Use algorithms to analyze the ultrasonic sensor data and identify objects in blind areas and potential forward collision hazards. These algorithms will direct the process of making decisions that will set off alarms.

9. Protocols for Communication:

Establish communication protocols to enable smooth data transfer between the I2C module, Bluetooth module, and other parts. Make sure the protocols you choose offer dependable, low-latency communication.

8. WORKING PROCESS

In the V2V communication project employing Bluetooth modules, ultrasonic sensors, a buzzer, an I2C module, and a display for blind spot and forward detection, the system is initialized by powering up the components and initializing the microcontroller. The microcontroller, acting as the system's brain, is configured with communication ports, pin definitions, and variable initialization. As shown in fig no. 5 & 6 Moving to Bluetooth communication, the Bluetooth modules are set up, and algorithms are implemented for real-time data exchange between vehicles, transmitting critical information like vehicle position, speed as shown fig no. 7 & 8.

For object detection, ultrasonic sensors are activated to measure distances around the vehicle, as shown in fig no. 5 and the microcontroller processes this data to identify objects in blind spots and assess forward collision risks as shown in fig no. 7&8. The alert system comes into play with the activation of the buzzer, which produces audible alerts based on the severity of detected threats. The I2C module serves as a central communication hub, ensuring synchronization between the microcontroller and the display interface.

Visualizing information for the driver is achieved through the display interface, which is connected to the microcontroller and I2C module. Real-time data, including visual cues related to blind spot detection and forward collision risks, is presented on the display as shown in fig no. 7&8. Continuous monitoring ensures seamless operation, with the system vigilantly overseeing V2V communication, object detection, and alert mechanisms throughout the vehicle's operation. In essence, this comprehensive approach to V2V communication equips drivers with the tools to detect blind spots, evaluate forward collision risks, and receive timely notifications, collectively contributing to improved road safety.

9. FLOW CHART

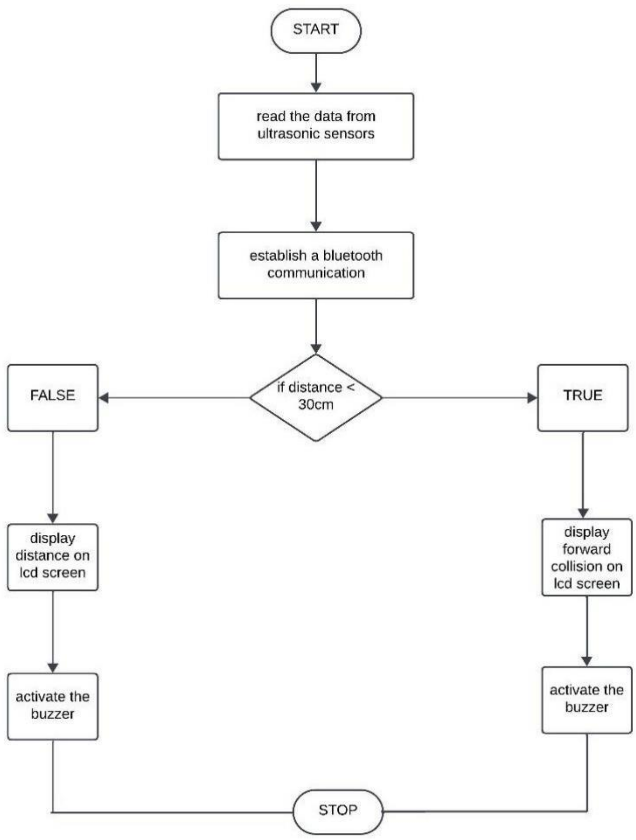


Figure No. 2: Process of v2v Communication

10. CIRCUIT DIAGRAM

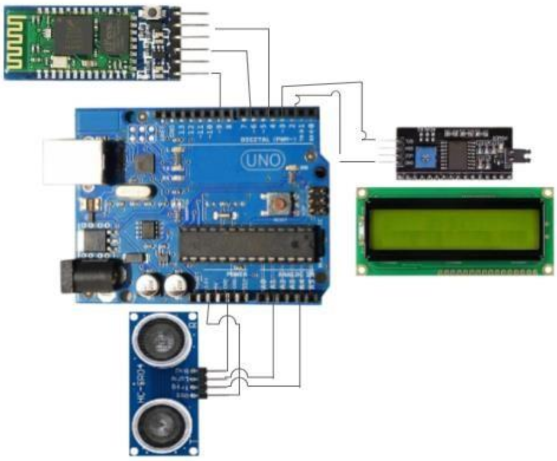


Figure No 3: Integration Of Sender Vehicle

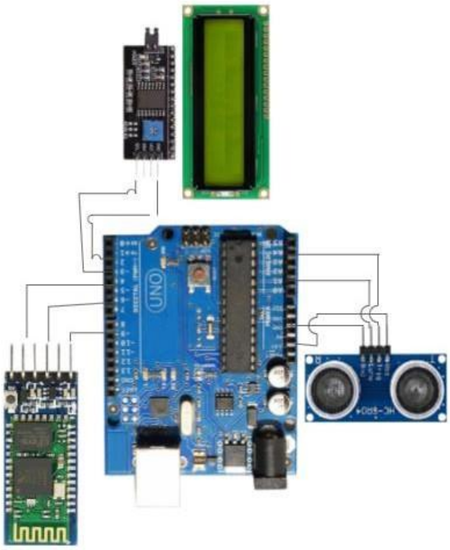


Figure No 4: Integration Of Receiver Vehicle

11. BLOCK DIAGRAM

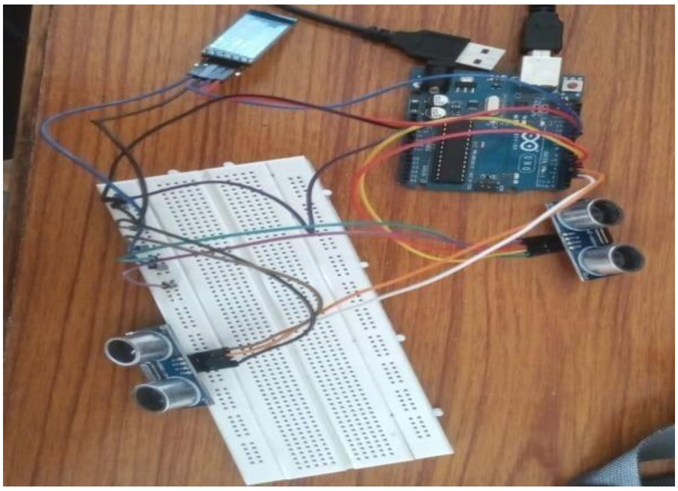


Figure No 5: Transmitter Vehicle Connection

Figure No 6: Receiver Vehicle Connection

12. RESULTS

Figure No 7: Forward Collision Detected

Figure No 8: Blind Spot Detected

13. CONCLUSION

In conclusion, the V2V communication project employing Bluetooth modules, ultrasonic sensors, a buzzer, an I2C module, and a display for blind spot detection and forward detection represents a significant stride towards enhancingroad safety. The integrated system offers a multifaceted approach, utilizing cutting-edge technologies to address critical challenges faced by drivers in real-world scenarios.

Through the seamless communication facilitated by Bluetooth modules, vehicles can exchange real-time data, forming the backbone of a connected and aware vehicular network. The ultrasonic sensors play a pivotal role in providing accurate proximity information, enabling the system to detect potential obstacles in blind spots and mitigate the risks of forward collisions. The inclusion of a buzzer and display interface contributes to a comprehensive alert system, engaging both audible and visual senses for immediate driver response. The I2C module acts as a central communication hub, orchestrating the collaborative efforts of different components within the system. As demonstrated through the system architecture, this project creates a holistic solution that not only detects blind spots andpotential collisions but also communicates this information effectively to the driver. The user interface logic ensures intuitive visualization, and the algorithms governing detectioncontribute to timely and accurate decision-making. Looking forward, the project opens avenues for future work, including advanced object recognition, multisensory fusion, V2X communication integration, and cybersecurity enhancements. These potential advancements underscore the dynamic nature of intelligent transportation systems and the continuous pursuit of innovation to further improve road safety. In essence, this V2V communication project serves as a foundation for safer and smarter driving experiences. By embracing technological integration, it responds to the imperatives of our modern roadways, offering a glimpse into a future where vehicles communicate seamlessly, detect potential hazards proactively, and contribute to a safer and more efficient transportation ecosystem.

14. REFERENCES

[1] Hartenstein, H.; Laberteaux,L.A tutorial survey on vehicular adhoc networks. IEEE Common. Mag.2008,46. [CrossRef] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[2] A. Papathanassiou; A. khoryaev. Cellular v2x as essential enabler of superior global connected transportation service.2 June,2017.

[3] Fernandez, J.A.; Borries, K.; Cheng, L.; Kumar, B.V.; Stancil, D.D.; Bai, F. Performance of the 802.11p physical layer in vehicle-to-vehicle environments. IEEE Trans. Veh. Technol. 2012, 61, 3–14.

[4] ZhigangXu,1 XiaochiLi,1 XiangmoZhao,1 MichaelH.Zhang,2 andZhongrenWang3.DSRC versus 4G-LTE for Connected Vehicle Applications: A Study on Field Experiments of Vehicular Communication Performance. 23 August 2017

[5] Mrs. Vaishali D. Khairnar , Dr. S.N. Pradhan .V2V wireless communication Survey

[6] Yao, Y.; Chen, X.; Rao, L.; Liu, X.; Zhou, X. Lora: Loss differentiation rate adaptation scheme for vehicle-to-vehicle safety communications. IEEE Trans. Veh. Technol. 2017, 66, 2499–2512.