SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"V2V Communication in EV Using LORA Technology"

submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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CERTIFICATE

Certified that the project work entitled "V2V Communication in EV Using LORA Technology" is a bonafide work carried out by Apoorva H(1SI20EE006) Bhavana S(1SI20EE007), Shravana R(1SI20EE036) and Swetha patil(1SI20EE038) in partial fulfillment for award of degree of of Bachelor of Engineering in Electrical & Electronics Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2023-24.It is certified that all corrections/suggestions indicated for internal assessment have been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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Course Outcomes

After successful completion of major project, graduates will be able to

CO1: To identify a problem through literature survey and knowledge of contemporary engineering technology.

CO2: To consolidate the literature search to identify issues/gaps and formulate the engineering problem

CO3: To prepare project schedule for the identified design methodology and engage in budget analysis, and share responsibility for every member in the team

CO4: To provide sustainable engineering solution considering health, safety, legal, cultural issues and also demonstrate concern for environment

CO5: To identify and apply the mathematical concepts, science concepts, engineering and management concepts necessary to implement the identified engineering problem

CO6: To select the engineering tools/components required to implement the proposed solution for the identified engineering problem

CO7: To analyze, design, and implement optimal design solution, interpret results of experiments and draw valid conclusion

CO8: To demonstrate effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE/Springer/ paper format of the work

CO9: To engage in effective oral communication through power point presentation and demonstration of the project work.

CO10: To demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics.

CO11: To perform in the team, contribute to the team and mentor/lead the team

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1												3		
CO-2	3													
CO-3											3			
CO-4						3	3							
CO-5	3	3												
CO-6					3									
CO-7			3	3										
CO-8										3				
CO-9										3				
CO-10								3						
CO-11									3					
Average	3	3	3	3	3	3	3	3	3	3	3	3		

Attainment level: - 1: Slight (low) 2: Moderate (medium) 3: Substantial (high)

POs: PO1: Engineering Knowledge, PO2: Problem analysis, PO3: Design/Development of solutions, PO4: Conduct investigations of complex problems, PO5: Modern tool usage, PO6: Engineer and society, PO7: Environment and sustainability, PO8: Ethics, PO9: Individual and team work, PO10: Communication, PO11: Project management and finance, PO12: Lifelong learning

Abstract

There's huge increment of utilization of vehicles in past decade. The reason for such endless utilization is due to the advancement of Mechanical Transformation. As the number of clients on road increments, there's a require for secure versatility. It is the prime concern when moving from 5G to 6G innovation. Independent activity framework and independent driving are a few of the measures for secure driving.

Communication between vehicle, called vehicle to vehicle communication (V2V) is expected to upgrade street security, because it permits cars to communicate with each other and share data like GPS position, speed data to assist drivers in dodging mischances, path alter and numerous more. By remaining associated, vehicles can respond to each other and more proficiently communicate with each other. For case, one vehicle can send caution to other vehicle almost antagonistic climate looming, road hazards, or activity stick ahead. V2V communication ensures about motor vehicle security additionally has capacity to be a substitute strategy to extend the on-road web benefit.

Thus, it is imperative for the communication between vehicles to be solid and continuous neighboring vehicles, and the wireless association data. For the reason of dependable and ceaseless communication, we are employing a long extend (LORA) plot for V2V security communications in a interstate environment. i

Contents

List of Figures

List of Tables

Chapter 1

Introduction

Vehicle-to-vehicle (V2V) communication utilizing LoRa (Long Run) innovation includes vehicles trading data wirelessly over long separations. LoRa may be a low-power, long-range remote communication innovation that's appropriate for IoT and M2M applications. Location and collision evasion can be accomplished between vehicles utilizing frameworks that works on any one of the two noticeable strategies specifically, LoRa an Ultrasonic run sensor. None of the innovations beneath improvement for this application has come to a palatable organize be accepted to as authoritative. For each vehicle, LORA extricates the activity thickness, the separations from neighboring vehicles, and the remote association data. It includes a considerable range, open-source, basic, vigorous, and low-cost equipment, tremendous setup conceivable outcomes, and applications, extending from medication to agribusiness, don't utilize authorized groups. The tests demonstrated to have great reach indeed in a thick urban environment. An effective strategy to communicate between two vehicles is through LoRa. It guarantees secure driving and anticipate mischances. In this proposed method, a framework that comprise of an ultrasonic sensor is utilized to identify the protest along the way of the vehicle. We will too utilize sensors for more application such as an alarm flag is sent to the other Beat sensor which faculties the pulse of the driver and liquor sensor that identify the utilization of alcohol is also embedded in framework. vehicle in the event that the protest can't move. Temperature sensor sense the warm produced interior the car and an alarm flag is sent to the driver at the raise see when its esteem surpasses certain edge. This makes a difference to anticipate mishaps as the vehicle behind can alter the course. LoRa (Long Extend) innovation in V2V (Vehicle-to-Vehicle) communication frameworks empowers long-range, low-power communication between vehicles. It works within the unlicensed radio recurrence groups, using spread range tweak to attain long-range network.!!

1.1 Motivation

Every year, approximately 1.6 lakh people dies on Indian roads. As the number of users on road increases, there is need for safe mobility,and it is needed to enhance road safety and crash avoidance.This can be achieved using LORA Technology, for the purpose of reliable and continuous communication.With this technology, vehicles can share information of speed, location and braking.

1.2 Objective of the project

The project aims to develop a vehicle to vehicle Communication using LORA Technonology for crash avoidance in Electric vehicle. The primary objective of the project is,

1. To provide long range communication.
2. High speed data transmission.
3. A LORA scheme for V2V safety communications, to adapt rapidly and appropriately the data rate with respect to environment dynamics.
4. Develop warning system, to notify the drivers of potential risk. Thereby reducing number of accidents on roads and increasing road safety.

1.3 Problem Statement

1. An overview of the wireless access technologies used in V2V communication.
2. Technical challenges faced by V2V.
3. one-to-one security
4. Low power consumption

1.4 Organisation of the report

The chapter I presented in the introduction to LORA, highlights the project's motivation, and outlines primary objectives of the project. Further, Chapter II discusses the literature survey carried out to formulate the objectives. Chapter III briefly explains the flow of design and Methodology. Chapters IV presents about the system software which includes flowchart and algorithm along with code. Chapter V presents results and conclusion of the project. Chapter VI represents future scope.

Chapter 2

Literature Survey

This chapter presents the literature review carried out to formulate the primary objectives of the project work.

Vehicle to Vehicle (V2V) Communication is a developing technology which helps make our transportation system intelligent. The system can also avoid accidents and traffic congestion. In this paper, we employ Light Fidelity (Li-Fi) for data communication among vehicles. Li-Fi falls under the category of Visible Light Communication (VLC). Li-Fi involves the use of visible light spectrum as a medium of communication. The technology provides high speed and is an eco-friendly method. The use of Li-Fi in V2V Communication is considered promising. In this paper, we propose a framework for V2V Communication using Li-Fi Technology.[1]. Visible Light Communication (VLC) it's a cheap communication system which uses electromagnetic frequencies from the visible spectrum to fulfil optical communications. It's an active research topic, being used in many research laboratories because of its potential of development. The main contribution of this paper is the development of an adaptive MIMO (Multiple-Input-Multiple-Output) system for VLC using frequency diversity. In this way, a VLC system can use more than one transmitting-receiving frequency, increasing in this way the data rate and the amount of information transmitted. The system is used for ITS (Intelligent Transportation System), where the car headlights can communicate with other LED (Light Emitting Diode) light sources across the road, increasing in this way the road safety. In the last part of the research is related a new approach for a hybrid communication system, integrating VLC with LoRa technology.[2]. To realize reliable vehicle-to-vehicle (V2V) communications, a measurement-based spectrum database (MSD) has been attracted. In this demo, we will explain the construction procedure of the MSD for V2V communications and an overview of the measurement campaign with exhibiting a video. The measurement campaign was performed in two different test courses, and radio environment maps and packet delivery rate maps were generated in each transmission position. The results show that the proposed database can accurately estimate the structure-dependent radio environment in V2V communications.[3]. There is tremendous increase of usage of vehicles in past decade. The reason for such vast utilization is due to the development of Industrial Revolution. As the number of users on road increases, there is a need for safe mobility. It is the prime concern when moving from 5G to 6G technology. Communication between vehicle, called vehicle to vehicle communication (V2X) handles safe communication. Autonomous traffic system and autonomous driving are some of the measures for safe driving.Detection and collision avoidance can be achieved between vehicles using systems that operates on any one of the two prominent techniques namely, LoRa an Ultrasonic range sensor. An efficient method to communicate between two vehicles is through LoRa. It ensures safe driving and prevent accidents. In this proposed method, a system that consist of an ultrasonic sensor is used to detect the object along the path of the vehicle. An alert signal is sent to the other Pulse sensor which senses the heartbeat of the driver and alcohol sensor that detect the consumption of liquor is also embedded in system. vehicle if the object can't move. Temperature sensor sense the heat generated inside the car and an alert signal is sent o the driver at the rear view when its value exceeds certain threshold. This helps to prevent accidents as the vehicle behind can change the direction.[4].Mobile communication technology has been developed rapidly and extensively. For 5G technology, various applications used by one device have been integrated largely into the same approach. Vehicle-to-Vehicle (V2V) communication is one candidate technology which is developed along with other 5G techniques. Applications for the vehicle communication require the high accuracy, such as safety warning. In this paper, the improvement of time remaining before getting in the dangerous area is proposed by using the GPS detection of moving direction. This GPS technology has been already registered in 5G technology in which all devices have to include it inside the hardware platform. The simulation results show that the remaining time in various situations is improved. This method expects to decrease road accident and traffic jam in urban.[5]. An autonomous vehicles use various kinds of sensors to communication to other vehicles with the aim to manage traffic in road intersection. Autonomous vehicles are installed with sensors and modern technologies for self-management communication. Autonomous vehicles are used communication to manage the traffic in highways and urban roads. To reduce the communication delay, we have proposed V2V communication based MIMO technology.[6].The present era is leading us to the peak of wireless communication. Taking wireless communication into account, cellular network technologies like Wi-Fi and Bluetooth strike out first. But ecosystem is getting worse day-by-day with the use of these technologies. Hence a greener, faster and more efficient technology is the need of the hour. This is where Li-Fi (i.e., Light Fidelity) comes into play. Li-Fi is a VLC (i.e., Visible Light Communication) Technology that uses light as a medium for communication. Obviously, it is the fastest medium of communication and is eco-friendly one. Combining the V2V and Li-Fi Technologies will drive the future of smart cars to a higher altitude. This project briefs the use of Vehicle to Vehicle (V2V) Communication using Light Fidelity (Li-Fi) to pass data among vehicles in order to prevent traffic jam, accidents, etc. This research work has used Gyro sensor, Ultrasonic sensor, LCD display, LDR sensor, Transmitter and a Receiver of Li-Fi. LEDs as light source.[7].As the evolution of future wireless technologies, vehicle-to-vehicle (V2V) communications become a critical paradigm via densely connect a lot of vehicles to improve the performance in vehicle ad hoc networks (VANETs). In this paper, we investigate the spectrum reuse optimization of V2V communications for maximizing the average throughput (AT) in VANETs. Specifically, on the basis of stochastic geometry, the homogeneous Poisson point process (PPP) is used to characterize the random distribution of V2V transmitters (V2V TXs). Then, we derive the closed form probabilities of successful transmission for both V2V pair transmission and V2V broadcasting, where the AT of V2V communications is obtained and the maximizing AT problem is analyzed with outage constraints of vehicle-to-infrastructure (V2I) communications. Further, we prove that the maximum AT exist the upper and lower bounds which are strongly correlated with V2V TX density. Finally, the optimal V2V TX density for spectrum reuse is derived in a closed form, where the AT can be maximized. Simulation analysis indicates that the maximum AT of V2V communications can be not only impacted by interference of different V2V TXs when spectrum reusing, but also lowered down by high constraints of V2I communications.[8].This paper introduces visible light communication (VLC) for inexpensive vehicle-to-vehicle messaging (V2V) using off the shelf LEDs and photo diodes. VLC is a cost effective method to integrate with intelligent transport systems (ITS) for road safety applications. Light from the brake lamps of a vehicle can be used to transmit messages for emergency hard brake, so that the following vehicle can take precautionary measures to avoid accidents. A prototype V2V communication system is designed that has low complexity and high reliability. Experimental evaluation of the prototype shows that the system can detect hard brakes from a distance of 20m and can provide early warning to drivers following at the speeds upto 80 km/h, reducing the chances of road accidents.[9]. Among the profound changes that will come with the Internet of Things is vehicular communication. Shortly the vehicles will be connected between themselves (V2V) and their infrastructure. For the full achievement of these objectives, the challenges of new technologies are enormous due to the requirement of high reliability, high speed, and low latency. None of the technologies under development for this application has reached a satisfactory stage be assumed to as definitive. The LoRa technology, operating at frequencies below 1 GHz, presents a good signal spread and penetration in obstacles. It has a considerable range, open-source, simple, robust, and low-cost hardware, vast configuration possibilities, and applications, ranging from medicine to agriculture, do not use licensed bands. The tests proved to have good reach even in a dense urban environment. They can become a viable alternative in applications that require short message transmissions with few characters that do not require the constant sending of information packages. The purpose of this work is to evaluate the communication between V2I, V2V, and stationary vehicles using LoRa technology in field tests with measurements of signal strength, reception ratio, and signal-to-noise ratio. It will be using different SF (scattering factors) inherent to LoRa (SF7 and SF12) and evaluate the influence of the Doppler effect on communication.[10]. TPID5201253. Today, UAVs are used in different situations, for example on emergency conditions for locating people after an earthquake or transporting medicines to not accessible places. A major drawback of drone's communications is the short distance that can be reached. In this paper, the perform of LoRa (Long-Range) protocol is studied with the purpose of implementing it in these kinds of communications. Also, a system is proposed with the goal of increasing coverage area in UAVs communications. Furthermore, some tests were developed equipping two UAVs with the necessary hardware and transmitting information between two far points to analyze the performance of the system developed. Some of these values were the distance, power of transmission, the Signal to Noise ratio (SNR) and the Received Signal Strength Indicator (RSSI). Finally, the developed system was tested and gave a successful result for a distance of 10 km.[11].V2V communication is always combined with cellular network and device-to-device (D2D) communication. The vehicles transmitting with a cellular base station (BS) can realize the vehicle-to-infrastructure (V2I) based on the uplink channels and infrastructure-to-vehicle (I2V) communication based on the downlink channels. The clustering methods are widely applicated on V2V communication to improve spectrum utilization. Meanwhile, the information transmission of vehicles needs enough capacity. And V2V links are vulnerable to the outage case caused by the high mobility of vehicles. To guarantee the capacity of all links and V2V stability for transmission requirements, we propose a heuristic Graph-Coloring Based Spectrum Sharing (GCSS) scheme based on both traceable slow-varying large scale fading information. The GCSS algorithm is divided into two sub-problems, including the power control considering the V2V outage probability and the graph-coloring clustering algorithm. Importantly, the allocated optimal power is calculated by V2I and I2V spectrum reusing formulation. The graph-coloring clustering method includes the available color channel building of each V2V link, the interference graph of the V2V links and the improved heuristic clustering algorithm. The simulation results show that the GCSS scheme improves the system capacity, the cellular capacity, and the V2V clusters capacity compared with the heuristic clustering algorithm.[12]. In a vehicular platoon operation, it is possible to minimize the energy consumption by reducing the intervehicular spacing, which reduces the aerodynamic drag force acting on the vehicle. By virtue of this, in electric truck platoons, it is possible to extend the range of vehicle operation through close platoon formations. However, in a Vehicle to Vehicle (V2V) communicated autonomous platoon, the extent to which the intervehicular spacing could be reduced depends upon the communication latency while considering the aspect of platoon stability. This paper analyzes the effect of Dedicated Short Range Communication (DSRC) and the Fifth-Generation (5G) cellular communication on energy consumption and stability of electric truck platoon formations. It is observed that for a chosen drive cycle, by establishing lower time-headway magnitudes between individual trucks, 5G-based platoon formations could establish platoon stability and could lower the energy consumption per kilometer by 10 percent, resulting in a range extension of 12.5 percent in dry and 9.5 percent in wet road conditions, respectively.[13]. This paper presents a compact 8×8 C Slot-based based MIMO antenna for CR application. This antenna is proposed for safety and non-safety applications among connected vehicles with the support of V2I networks based on CR frequency bands. Multiband operation is achieved through a C slot on 8 antenna elements with the substrate material as FR4. The obtained wireless frequency band will be used as the CR band among the connected vehicles with the support of V2I networks that covers the 2.4 GHz band, WIMAX band (3.1 - 3.3 GHz), lower 6 GHz Wi-Fi band, and (6.2-6.4, GHz). Rectangular DGS slots are introduced among the antenna elements for good isolation. The proposed antenna is presented with the simulation results such as return loss, VSWR, Gain, Directivity, Efficiency, Radiation pattern (E plane and H Plane), surface current distribution, and ECC as well as diversity gain performances. This design holds good results and it is suitable for the automotive industry. This antenna provides enough information through the available CR bands among the onboard connected vehicles in keywords networks.[14]. Vehicle-to-vehicle (V2V) communication is one of the key technologies for autonomous driving. When multiple vehicles request contents like road conditions successively, separate content delivery by V2V communication makes the traffic volume increase rapidly, which may lead to congestion in the wireless channel. Applying the Content-Centric Network (CCN) technology to V2V communication helps improve the communication efficiency, by exploiting contents cached at vehicles. However, in previous methods, it is possible that (i) vehicles cannot use contents stored in nearby vehicles not on the communication path, and (ii) nearby vehicles may store the same contents as caches redundantly. To solve these problems, this paper proposes a collaborative caching method, which divides vehicles into clusters, and the cluster head manages caches of all vehicles in its cluster unitarily. In this way, vehicles can use the contents cached at adjacent vehicles not on the communication path, and the redundancy of duplicate cache can be avoid to store more diverse contents. The simulation results confirm that the proposed method helps to reduce the packet latency and improve the success rate of fetching requested contents.[15]. C-V2X (Cellular-Vehicle-to-Everything) is a radio communication system, standardized in 3GPP, for connecting vehicles. In particular, V2X using 5G New Radio (NR), standardized since Release 16, is examined to set up multiple Base Stations (BSs) for securing a wide communication area. However, practical and cost issues are associated with installing many BSs for V2X. Sidelink communication, which is a direct V2V (Vehicle-to-Vehicle) communication between the user equipment (UEs) aids in further expanding the communication area without increasing the BSs, and configures a relay route between the UEs via the BS and roadside unit (RSU). However, as no relay route construction method using the 5G NR control data exists, there is no evaluation of V2V communication's transmission characteristics using the relay routing method. This study proposes a new relay routing scheme for 5G NR V2V wherein an effective distance based on the quality of communication among the BSs, RSUs, and terminals is provided. Moreover, a relay node for realizing a path with minimal number of frames required for end-to-end (E2E) communication from the source to the destination node is selected. The transmission characteristics of the proposed method were evaluated and verified in the 3GPP environment, where a packet reception ratio of 0.9 was achieved even when the number of BS to be installed was reduced by 1/6.[16]. In cellular networks that support Vehicle-to-Vehicle (V2V) direct communication, a new resource allocation algorithm based on hypergraph partitioning is proposed to solve the resource allocation problem of Vehicle-to-Infrastructure (V2I) uplink multiplexing, in order to obtain the best resource allocation and robust channel change. Under the interference of V2V, the large scale fading information of wireless channels that changes slowly is used to combine communication reliability and power control, and the optimization model of maximizing the channel capacity of V2I is established to meet the heterogeneous requirements of vehicle network services, and then the minimum capacity maximization is considered to provide more uniform capacity performance. Simulation results show that the proposed algorithm improves the channel capacity of V2V and the channel is more robust on the premise of ensuring the reliability of V2V communication.[17].The applications related to cooperative automated driving need to share periodic safety information with neighboring vehicles in a reliable and low-latency manner. However, the performance of vehicular ad-hoc technologies degrades substantially when the channel becomes congested. Therefore, this paper presents a channel congestion evaluation method for V2V safety communication for the IEEE 802.11p protocol. The evaluation addresses multiplatooning applications, in which the vehicles' density is a defining element. To illustrate the negative effects of the channel load level, a number of relevant performance metrics were analyzed, such as Channel Busy Ratio (CBR), Packet Loss Rate (PLR), and Inter-Packet Delay (IPD).[18].Vehicle-to-Vehicle (V2V) communication requires highly reliable wireless links to deliver safety messages effectively. Signal interference or blockages caused by big vehicles like buses and trucks can deteriorate communication quality, causing loss of packets containing safety information transmitted among vehicles. Hence big vehicle shadowing critically influences V2V communication quality. This paper investigates the impact of big vehicle shadowing on V2V communications, considering cellular network coverage of vehicles. Under big vehicle shadowing, we analyse and derive the reuse distance and outage probability of V2V communications. To mitigate the negative of big vehicle shadowing, beamforming-based reception and transmission along with relay approaches are shown. Simulation results show that the proposed approaches significantly improve the performance of V2V communications in the presence of big vehicles.[19]. With the increasing volume of passenger transport, the Hong Kong International Airport (HKIA) authority has undertaken a 10-year project to construct the Skycity, satisfying the needs of tourists and passengers. Developing a new intelligent public road transport system is imperative to support this initiative. This research presents a novel traveling time estimation model incorporating realistic transport volume data, focusing on the station-to-station travel time while considering vehicle-to-vehicle (V2V) communication for headway calibration. In this paper, the accuracy of the proposed model is validated using PTV Vissim 11.00-14, taking into account traveling time, headway, and the number of trips made by connected vehicles. The simulation results demonstrate that the autonomous transport system can efficiently transport thousands of passengers per hour, ensuring safety and optimizing headway through V2V communication. Moreover, the model has the potential to provide estimated arrival times for upcoming buses at bus stations, thus offering valuable information to passengers.[20]. Vehicle-to-vehicle (V2V) communication has been considered as a key technology of the intelligent transportation system because it has emerged with significant benefits such as improving driver safety and reducing traffic congestion and accidents. Although the V2V technology has provided some key advantages, the challenge still exists. Since V2V communication enables the transceiver pairs to exchange emergency information in the same cellular frequency band, the interferences of V2V links and vehicle-to-cellular (V2C) links should occur. Therefore, in our study, we tackle the interference problem by optimizing the transmit powers of the V2V users and the cellular users. The problem-solving process begins with formulating the optimization problem with linear constraints, where the objective function is the sum of data rates, and the transmit powers of all transmitters are the control variables. Then, we design a proper deep neural network (DNN) to solve the optimization problem. DNN obtains the optimal solution via training the neural networks in a way to minimize the loss function. The simulation results show that the proposed DNN algorithm is better than those of weighted minimum mean squared error (WMMSE), fixed transmit power, and Dinkelbach's methods, and particularly achieves near-global optimum with lower computation complexity than the exhaustive search (ES).[21]. This paper proposes a novel three-dimensional (3D) geometry-based channel model for vehicle-to-vehicle (V2V) communication systems aided by intelligent reflecting surface (IRS) in urban traffic merging areas. Firstly, to accurately describe the scenario, the channel model consisting of a multiple truncated confocal ellipsoid and a truncated ellipsoid is established, and the corresponding closed-form expressions of channel impulse responses (CIRs) are derived under spherical wavefront assumption. Meanwhile, three different phase reflection configurations of IRS are considered when channel modeling. Then, the impacts of vehicle speed, the number of IRS cells, and different IRS phase shift assumptions on the proposed model channel are intensively investigated via key statistical properties, e.g., the temporal auto-correlation function (ACF) and spatial cross-correlation function (CCF). Finally, simulation results show that our proposed channel model can capture the IRS-aided V2V channel characteristics in urban traffic merging areas, and prove that the additional IRS makes the channel more controllable and stable, which results in a promising prospect in V2V communication systems.[22].Due to its extensive use in intelligent transportation systems, the topic of traffic accident detection is quickly becoming one of the most fascinating ones. The absence of inexperienced drivers, driving while intoxicated, driving too fast, and driving while sleepy are the main contributors to these traffic accidents. Numerous measures have been used to stop these traffic accidents. However, the majority of them failed to stop this. We demonstrate an upgraded Li-Fi accident detection method in this study. The proposed model offers an intelligent system for the identification and avoid of accidents for the protection of human life. Sensors like mems sensors and ultrasonic sensors are used in that preventative component. When a sensor determines there is not enough space between two vehicles, it notifies the vehicle in front of it.[23]. The current V2V communication architecture presents a significant challenge in achieving seamless and reliable connectivity for vehicular communication. This paper proposes a novel adaptive resource allocation scheme for drones to support QoS in V2X. By leveraging the strengths of this technology, this approach aims to enhance the connectivity and coverage of V2V communication, especially in non-line-of-sight (NLOS) scenarios or out of coverage zone. The use of UAV in the V2V communication system provides a viable solution for addressing coverage gaps and signal degradation caused by obstacles or distance. This paper provides a conceptual framework of the proposed architecture and discusses the potential benefits associated with this approach. Simulation results show that the proposed approach significantly improves the reliability and performance of V2V communication, demonstrating its potential as a promising solution for the next-generation V2V communication architecture.[24].Vehicle to Vehicle Communication is the kind of communication that allows for communication between neighboring cars to enhance and lessen traffic. Despite the fact that traffic is growing every day, we still cannot survive it. We can go closer to minimizing traffic by utilizing this technology. Vehicle-to-Vehicle Communication is the name given to the technology because it allows one vehicle to communicate with another or, more precisely, convey information to another vehicle. In order to communicate, RF communication is used. A quick overview of the various communication methods and characteristics utilized in vehicle-to-vehicle communication is provided in this document. The suggested system seeks to create and construct a suitable system employing rf protocols for automotive applications. The primary issues with the current technology include inaccurate accident and obstacle detection, sluggish response times, and other issues.[25]. The deep learning techniques on the base of YOLOv5 architecture have been shown to make a traffic objects detection system for V2V communications to ensure traffic safety and traffic flows prediction. According to the detection data the detector allows to estimate the traffic object speed and the coordinates of movement. To improve the accuracy of calculations, the distortion correction algorithm (in geometric optics), the Chang method and the Kalman filter are used. To set the detector to work in online operation mode, an algorithm has been developed that receives video stream from open city surveillance cameras with the processing of a m3u8 playlist. The developed detector can be used on "connected" vehicles to assess the situation on the roads and ensure safety traffic.[26]. Vehicle to Vehicle (V2V) correspondence is achieved by sending information with the nearby vehicles to prevent mishaps. This is achieved by the communication of vehicle information on travel to each other with smart techniques. In this study, intellectual cognitive radio technology is used to prevent information crashes and channel destruction. The vehicle operator may receive a warning to reduce the risk of an accident depending on how the framework is designed. In order to obtain vehicle information, each vehicle can identify the closest vehicle among all the directions. The prototype communicates other vehicle by

Cognitive radio (CR) and this technique offers betterrecognition intellectually to separate each vehicle to keep away from interference so that the exact data is sent between vehicles without noise and false information. The information like speed, temperature, and vehicle braking ability is collaborative between each other vehicles are achieved in this work. The working is examined with MATLAB simulation to analyze the spectral range and data transfer range between the vehicles. The working performance and simulation results are verified with the hardware results.[27].The paper discusses the utilization of wireless communication in a particular field, which is referred to as Vehicle-to-Vehicle Communication or Automotive Wireless Communication. It provides an overview of this technology and its applications in the automotive industry. V2V communication refers to the exchange of real-time data between vehicles wirelessly. The primary objective V2V correspondence is to forestall mishaps by enabling vehicles to share their speed and position information with each other. In case of any potential danger, the driver may receive a warning or on the other hand the actual vehicle might go to prudent lengths, for example, applying the brakes to dial back.[28]. In the framework of the fifth generation (5G) wireless network, vehicle-to-vehicle(V2V) communication in tunnel scenarios has received more and more interests. In the article, a three-dimension (3D) geometry-based channel model (GBSM) is proposed. By considering the scattering of tunnel walls and other vehicles, a semicylinder and two cylinders centered on the transmitter (Tx) and receiver (Rx) are applied to simulate thecommunication environment of the tunnel scenario. We derive and explore the corresponding statistical properties including temporal auto-correlation function (ACF), space cross-correlation function (SCCF) as well as frequency correlation function (FCF). The conclusions indicate that the velocity of Tx and distance between Tx and Rx both have impacts on the statistical properties.[29].Every year, traffic accidents involving vehicles result in hundreds of fatalities, serious injuries, and significant material losses. The primary causes of vehicular traffic accidents are infractions of traffic laws. Hence, having a reliable method of identifying violations will result in a decrease in traffic accidents and a reliable traffic control system. The vehicle environment has become one of the hottest study topics for the communications sector as a result of recent developments in telecommunications, computing, and sensor technologies. Computer networking researchers have proposed a new wireless networking concept called Vehicular Ad hoc Network (VANET), which can increase passenger safety and provide “efficient” road and policy monitoring. This concept aims to reduce the high number of vehicular traffic accidents, improve safety, and manage traffic control systems with high and reliable efficiency. Future VANET-based vehicle applications will include everything from transport automation systems to entertainment and comfort-based ones, making roads saferand better structured.[30].

Chapter 3

Methodology

This chapter presents Block diagram along with the detailed description of hardware components required for the project.

3.1 Block Diagram

Vehicle-to-Vehicle (V2V) communication utilizing Moo Run (LoRa) innovation includes the trade of data between vehicles over a remote communication arrange. LoRa, which stands for Long Extend, could be a remote communication innovation known for its long-range capabilities, moo control utilization, and reasonableness for Web of Things (IoT) applications.The flow diagram for vehicle to vehicle Communication using LORA is shown in Figure 3.1.

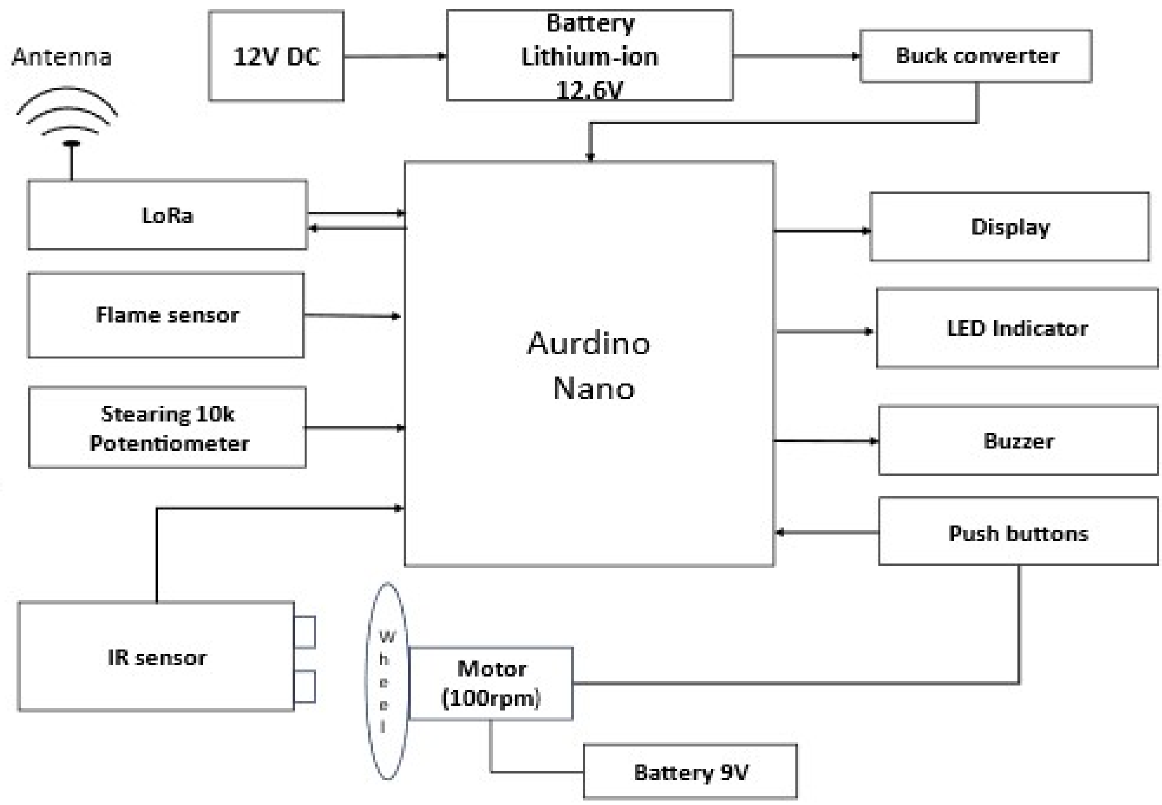

Figure 3.1: Representation of V2V communication using LORA technology.

LoRa operates in the sub-GHz frequency bands, typically in the Industrial, Scientific, and Medical (ISM) bands:

LoRa Technology: LoRa operates within the sub-GHz recurrence groups, regularly within the Mechanical, Logical, and Therapeutic (ISM) groups. It employments a chirp spread range modu- lation strategy, permitting for long-range communication and way better entrance through deterrents.

V2V Communication Components: Lora Handsets: Each vehicle is prepared with a LoRa handset competent of both transmitting and accepting information. Recieving wires: Vehicles have recieving wires to encourage the remote communication between them.

Information Transmission: Vehicles can transmit and get little bundles of information containing data such as position, speed, speeding up, and other pertinent information. LoRa's long- range capability empowers vehicles to communicate over significant separations, making it appropriate for V2V communication in numerous traffic scenarios.

Communication convention: A communication convention is required to encourage the trade of data between vehicles. Conventions just like the IEEE 802.11p standard (Remote Get to in Vehicular Situations - WAVE) are commonly utilized for V2V communication.

Safety Applications:V2V communication utilizing LoRa is regularly utilized for safety applications, such as collision shirking and cooperative mindfulness. Vehicles can share real-time data around their current state and environment, permitting for more in- formed and convenient decision-making by the onboard frameworks.

Work Organizing: LoRa underpins work organizing, where vehicles can act as both transmitters and transfers. This capability improves the unwavering quality and extend of communication, as messages can be transferred through different vehicles.

Security and Protection: Security measures, such as encryption and authentication, are implemented to ensure the integrity and confidentiality of the transmitted data.Protection concerns are also addressed to protect the identity and sensitive information of the vehicle occupants.

Integration with other Frameworks: V2V communication frameworks utilizing LoRa can be in- tegrated with other progressed driver help frameworks (ADAS) and autonomous vehicle advances to upgrade by and large street security.

3.2 Hardware Components

- Arduino NANO
- LCD display
- Buzzer
- IR sensor
- LoRa module
- Buck converter
- LED indicator
- Flame sensor

Arduino NANO:

Figure 3.2: Represents 'Arduino nano'.

Figure-3.2: Represents 'Arduino nano', Arduino nano could be a micro-controller board that In this venture, we are working to create an IoT Based Discuss Contamination Checking Framework in which we are going watch the Discuss Quality done on portable using the web and will start an alert when the air quality goes past a certain level. When there's a adequate amount of unsafe gasses exist within the discuss like CO2, smoke, temperature, rain.It will appear the discuss esteem in Parts per Million (PPM) on the LCD so that able to show it exceptionally effectively. The Arduino nano board incorporates 14 advanced input/output pins 6 analog inputs, a USB Association, a control jack, a reset button. The client community that plans and makes single-board micro-controllers and micro-controller units for building progressed gadgets and naturally objects . . The Arduino miniaturized scale controller isn't as it were for specialized people but is expecting for architects and specialists moreover since of its center to ease of use based on its arrange which makes a difference to attain the aiming objective.

LCD Display:

Figure 3.3: Represents 'LCD Display'.

Figure-3.3 Represents LCD Display. LCD(Liquid Crystal Display)an electronic display module. Typically a basic(16x2)16 character by 2 line show. Black text on Green background. It is used to show the Air and Humidity. A (16x2) LCD is a very plain module and is very normally used in different types of devices and circuits .A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840x2160 or 4096x2160 pixels.A pixel is made up of three sub pixels; a ruddy, blue and green—commonly called RGB.

Buzzer:

Figure 3.4: Represents 'Buzzer'.

Figure-3.4 Represents Buzzer.A Buzzer or beeper is an electronic audio signaling device. Whenever the air pollution or the toxic level in the air goes beyond the threshold level the Buzzer makes sound starts beeping indicating Danger .The beep is run on background without blocking other Arduino code. When a beep is ended, The function will set the state of buzzer to BUZZERIDLE. Beep Time: unsigned long - the time buzzer beeps (in milliseconds). delay: unsigned long - the time delay before beeping (in milliseconds).

IR Sensor:

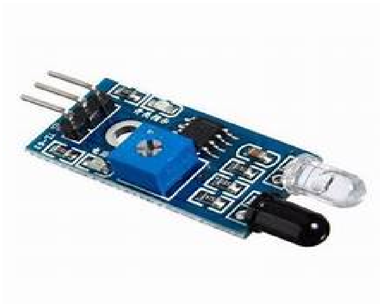

Figure 3.5: Represents 'IR Sensor'.

Figure-3.5 Represents IR sensor.They are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people.

Buck converter:

Figure 3.6: Represents 'Buck converter'.

Figure-3.6 Represents Buck converter.A buck converter is utilized to step down voltage of the given input in arrange to attain required yield. Buck converters are for the most part utilized for USB on the go, point of stack converters for PCs and portable workstations, Battery Chargers, Quad Copters, Sun powered Chargers, and control sound enhancers. A buck-boost converter produces a DC yield voltage that can be either greater or littler in greatness than its DC input voltage. As its title recommends, it combines the capacities of a buck converter(used for DC voltage step-down) and a boost converter (utilized for DC voltage step-up).

LED Indicator:

Figure 3.7: Represents 'LED Indicator'.

Figure-3.7 Represents LED Indicator.Driven, in gadgets, a semiconductor gadget that emanates infrared or unmistakable light when charged with an electric current.Visible LEDs are utilized in numerous electronic gadgets as pointer lights, in automobiles as rear-window and brake lights, and on bulletins and signs as alphanumeric shows.

Flame Sensor:

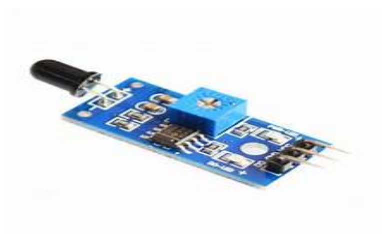

Figure 3.8: Represents 'Flame Sensor'.

Figure-3.8 Represents Flame sensor.sensor which is most touchy to a ordinary light is known as a fire sensor. That's why this sensor module is utilized in fire alerts. This sensor recognizes fire something else wavelength inside the extend of 760 nm – 1100 nm from the light source. This sensor can be effortlessly harmed to tall temperature. So this sensor can be put at a certain remove from the fire. The fire discovery can be done from a 100cm remove and the location point will be 600. The yield of this sensor is an analog flag or computerized flag. These sensors are utilized in fire battling robots like as a fire alert.

3.3 Working principle of LoRa Technology

LoRa (Long Range) technology in V2V (Vehicle-to-Vehicle) communication systems enables long-range, low-power communication between vehicles. It operates in the unlicensed radio frequency bands, using spread spectrum modulation to achieve long-range connectivity. Figure-3.9 Represents ‘LoRa Module Ra- 02 433MHZ Wireless’.

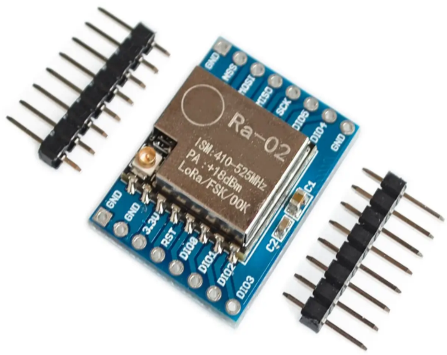

Figure 3.9: Represents ’LoRa Module’.

In V2V communication, LoRa technology facilitates the exchange of information between vehicles, such as location, speed, and other relevant data. LoRa’s key features for V2V include:

Long Range: LoRa can cover distances of several kilometers, making it suitable for V2V communication where vehicles may be spread out over a wide area.Low Power: LoRa devices consume minimal power, extending the battery life of devices in Fig V2V systems, a crucial factor for vehicles.

Low Data Rate: V2V communication often involves sending small packets of data, such as position updates and safety information. LoRa’s low data rate capability is well-suited for such applications.

Chapter 4

System Software

4.1 Flowchart

Figure-4.1: Represents Flowchart,Flowchart is a diagram that shows an overview of an program and it is also called as step by step solution to a program.Here oval shape represents start and end of program, diamond shape represents decision making and rectangular shape represents process.

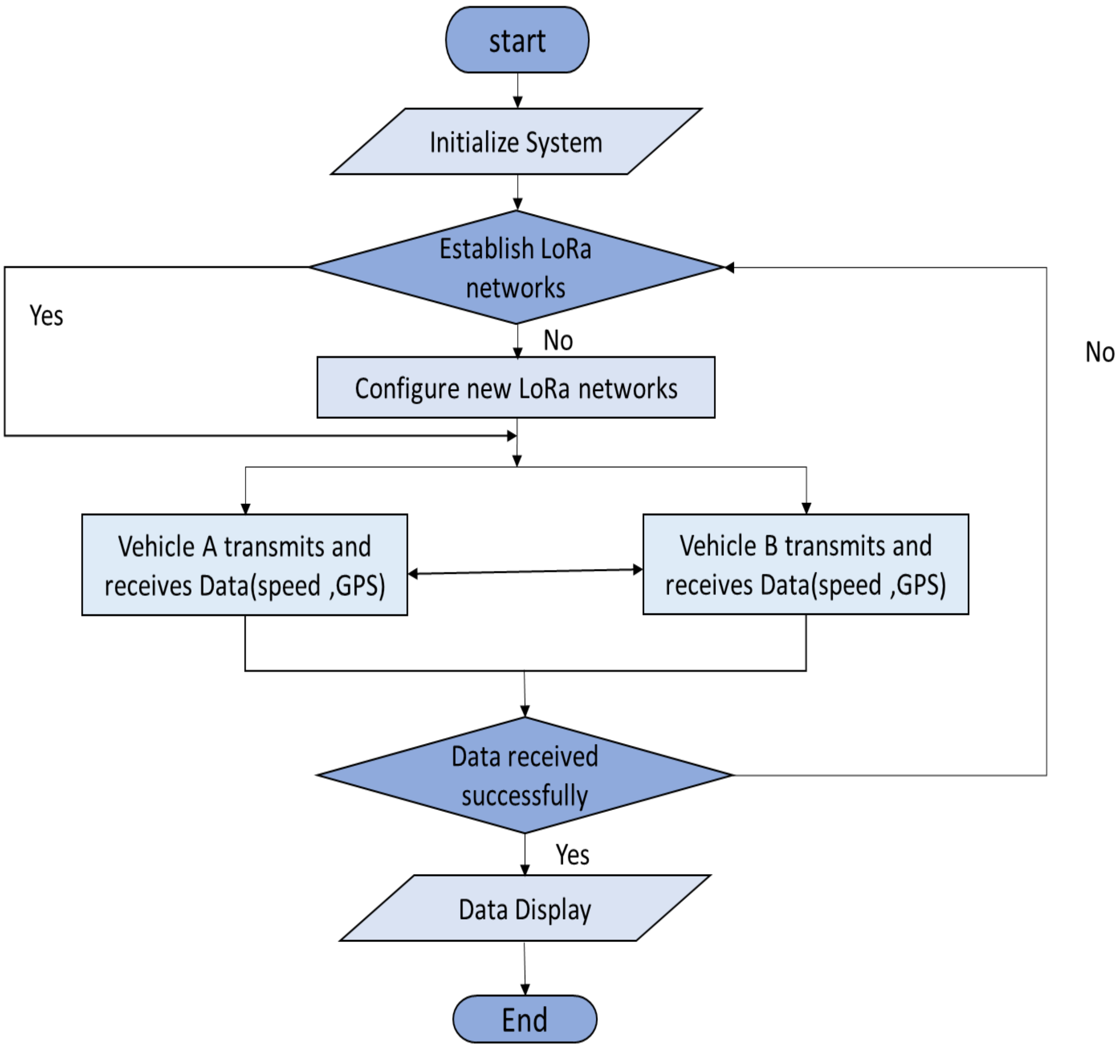

Figure 4.1: Represents 'Flowchart'.

4.2 Algorithm

Figure-4.2: Represents Algorithm, Algorithm is a list set of instructions used to solve problems or perform task based on the understanding of available alternatives and it is also called as problem solving operation.

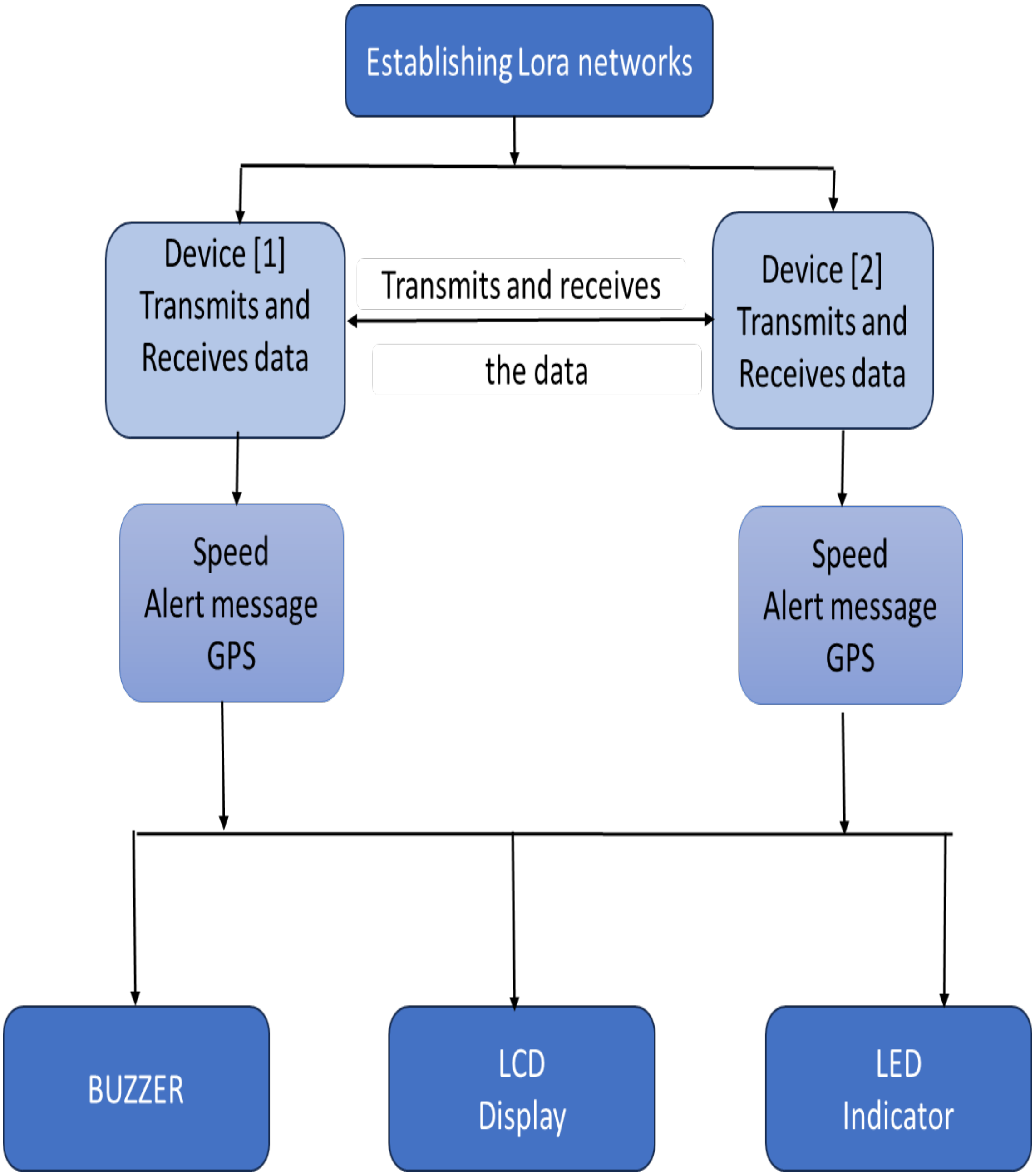

Figure 4.2: Represents 'Algorithm'.

4.3 Code

```
#include <lora.h>
#include <master.h>
#include <slave.h>
#include <SPI.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal_I2C.h>

const byte numChars = 200;
char receivedChars[numChars];

LiquidCrystal_I2C lcd(0x27, 16, 2);

boolean newData = false;

SoftwareSerial MySerial(12, 11);

#define BUZZER 7
#define LED1 8
#define LED2 9
#define LED3 10

#define BUT1 4
#define BUT2 5
#define BUT3 6
#define IR 2
#define FLAME 3

unsigned long int lastTime = -1;

void setup() {
```

```
  Serial.begin(115200);
  MySerial.begin(19200);

  lcd.init();
  lcd.clear();
  lcd.backlight();
  lcd.setCursor(5, 0);
  lcd.print("V 2 V");
  lcd.setCursor(1, 1);
  lcd.print("COMMUNICATION");
  delay(3000);

  pinMode(LED1, OUTPUT);
  pinMode(LED2, OUTPUT);
  pinMode(LED3, OUTPUT);
  pinMode(BUZZER, OUTPUT);

  pinMode(BUT1, INPUT);
  pinMode(BUT2, INPUT);
  pinMode(BUT3, INPUT);

  pinMode(IR, INPUT);
  pinMode(FLAME, INPUT);
}

unsigned long int lastIR = -100000;

void loop() {
  String b1 = digitalRead(BUT1) ? "P" : "-";
  String b2 = digitalRead(BUT2) ? "B" : "-";
  String b3 = digitalRead(BUT3) ? "S" : "-";
```

```
String fl = digitalRead(FLAME) ? "-" : "F";
if (!digitalRead(IR)) {
  lastIR = millis();
}

String ir = (millis() - lastIR) > 5000 ? "" : "M";

int value = analogRead(A0);
String dir = "R";
if (value <= 340) {
  dir = "L";
} else if (value <= 680) {
  dir = "F";
}

recvWithStartEndMarkers();

if ((millis() - lastTime) > 500) {
  lastTime = millis();
  if (ir != "M") {
    MySerial.write("<CAR NOT MOVING>");
  } else {
    String str = "<" + b1 + b2 + b3 + fl + ir + dir + ">";
    MySerial.write(str.c_str());
  }
}

if (newData) {
  newData = false;
  lcd.clear();
  lcd.setCursor(0, 0);
```

```
if (String(receivedChars).startsWith("CAR NOT MOVING") == 1) {
  lcd.print("CAR NOT MOVING");
  digitalWrite(LED1, LOW);
  digitalWrite(LED2, LOW);
  digitalWrite(LED3, LOW);
} else {
  char dir = receivedChars[5];
  String dirs = "";
  if (dir == 'F') {
    dirs = "FRONT";
  }
  if (dir == 'L') {
    dirs = "LEFT";
  }
  if (dir == 'R') {
    dirs = "RIGHT";
  }
  lcd.print(String("CAR MOVING:" + dirs).c_str());
  lcd.setCursor(0, 1);
  if (receivedChars[3] != '-') {
    lcd.print("FLAME");
  } else if (receivedChars[0] != '-') {
    lcd.print("PANIC");
  } else if (receivedChars[1] != '-') {
    lcd.print("BREAK DOWN");
  } else if (receivedChars[2] != '-') {
    lcd.print("SLOW DOWN");
  }

  digitalWrite(LED1, receivedChars[0] != '-' || receivedChars[3] != '-');
  digitalWrite(LED2, receivedChars[1] != '-' || receivedChars[3] != '-');
  digitalWrite(LED3, receivedChars[2] != '-' || receivedChars[3] != '-');
```

```
      if (receivedChars[0] != '-' && receivedChars[1] != '-' && receivedChars[2] !=
        digitalWrite(BUZZER, HIGH);
        delay(500);
        digitalWrite(BUZZER, LOW);
      }
    }
  }
}

void recvWithStartEndMarkers() {
  static boolean recvInProgress = false;
  static byte ndx = 0;
  char startMarker = '<';
  char endMarker = '>';
  char rc;

  while (MySerial.available() > 0 && newData == false) {
    rc = MySerial.read();

    if (recvInProgress == true) {
      if (rc != endMarker) {
        receivedChars[ndx] = rc;
        ndx++;
        if (ndx >= numChars) {
          ndx = numChars - 1;
        }
      } else {
        receivedChars[ndx] = '\0';  // terminate the string
        recvInProgress = false;
        ndx = 0;
        newData = true;
```

```
      }
    } else if (rc == startMarker) {
      recvInProgress = true;
    }
  }
}
```

Chapter 5

Result and Conclusion

In this chapter Results of the project are discussed.

Vehicle-to-vehicle communication using LoRa (Long Range) technology can result in improved road safety, efficient traffic management, and enhanced driving experiences. It enables vehicles to exchange information such as panic button , speed breaker and emergency alert , break down , flame indication , road turning indications ,road conditions wirelessly over long distances, facilitating real-time communication between vehicles and enabling advanced driver assistance systems driving functionalities.

We have two vehicles implemented with LoRa Module, where the vehicle model operated at first acts as 'master' and model operated later acts as 'slave'. whenever the switch is pressed in master, vehicle starts moving and this will be indicated as 'car moving' in LCD display at slave vehicle.

When master vehicle starts moving , steering direction status of master will also be displayed at slave LCD display such as "Right" , "Left" and "Front" .

whenever master's steering direction is right , LCD display shows "Right" in slave.Figure-5.1: Represents direction right.

Figure 5.1: Represents 'direction right'.

whenever master's steering direction is left , LCD display shows "Left" in slave.Figure-5.2: Represents direction left.

Figure 5.2: Represents 'direction left'.

whenever master's steering direction is front , LCD display shows "Front" in slave.Figure-5.3: Represents direction front.

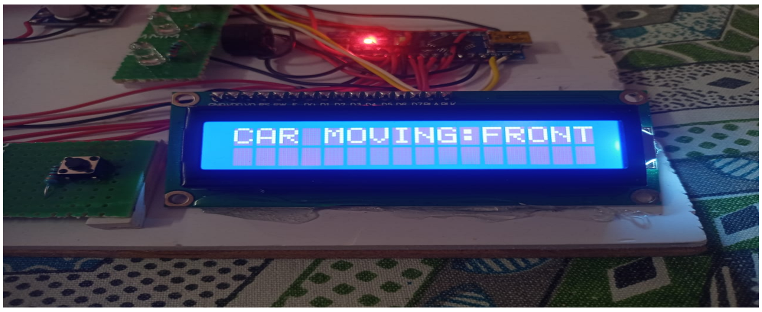

Figure 5.3: Represents 'direction front'.

There are three pushbuttons placed in both vehicles , one pushbutton indicates panic button, second pushbutton indicate breakdown button and last indicates slowdown. Whenever panic button is clicked at master, Slave vehicle gets notified about this through Buzzer beep, Correspond LED blink along with LCD display showing "Panic" .Figure-5.4: Represents panic.

Figure 5.4: Represents 'panic'.

Whenever break down(engine failure or when car don't get started) at master Slave vehicle gets notified about this through Buzzer beep, Correspond LED blink along with LCD display showing "break down" .Figure-5.5: Represents break down.

Figure 5.5: Represents 'breakdown'.

Whenever master slow downs the vehicle , panic button is clicked at master, Slave vehicle gets notified about this through Buzzer beep, Correspond LED blink along with LCD display showing "slow down" .Figure-5.6: Represents slow down.

Figure 5.6: Represents 'slow down'.

Apart from all this, there we also have flame sensor which senses the flame at master and notifies slave vehicle through buzzer beep, all the three LED Blink and LCD display showing "Flame".Figure-5.7: Represents flame.

Figure 5.7: Represents 'flame'.

Chapter 6

Future Scope

The execution assessment and execution of Crisis vehicle location conspire utilizing LoRa innovation was done. Execution assessment of a reenacted environment was moreover done where the two diverse scenarios were compared: one with run assessment and another with portability situation of the vehicle. Parameters of LORA innovation such as remove spreading figure (SF) and speed levels which are analyzed in both the situation. Comparative investigation based on the RSSI level and PDR factors for the collected information was done. The affect of both tall speeds, engendering models for diverse zones will be explored for the execution of the given plot within the coming future work.

1.Vitality Productivity: V2V communication can optimize vitality utilization in EVs by permitting vehicles to trade information on battery status, charging station accessibility, and vitality utilization designs. This data can offer assistance EVs arrange their courses more effectively, diminishing vitality wastage and amplifying driving extend.
2. Energetic Charging: V2V communication combined with LoRa innovation can encourage energetic charging, where EVs wirelessly charge whereas in movement. By sharing data approximately vitality request and accessibility, vehicles can powerfully alter their charging rates and optimize vitality exchange, minimizing charging times and maximizing driving extend.
3. Armada Administration: V2V communication empowers productive armada administration for electric vehicle armadas. Armada administrators can remotely screen the status of each vehicle, track their areas in real-time, and optimize directing to play down downtime and maximize operational effectiveness. This leads to taken a toll reserve funds, moved forward armada utilization, and superior by and large benefit conveyance.
4. Vehicle-to-Grid (V2G) Integration: V2V communication can encourage V2G integration, permitting EVs to serve as portable energy storage units. Vehicles can communicate with the lattice to supply or get power based on request changes, subsequently stabilizing

the network and empowering more noteworthy integration of renewable vitality sources.
5.Improved Client Involvement: V2V communication upgrades the client encounter for EV drivers by giving real-time data on adjacent charging stations, activity conditions, and stopping accessibility. This makes a difference drivers make educated choices, decreases extend uneasiness, and improves generally comfort.
6.Collaborative Vitality Administration: V2V communication empowers collaborative vitality administration among EVs inside a arrange. Vehicles can frame ad-hoc systems to share overflow vitality, prioritize charging based on person needs, and collectively optimize vitality utilization to advantage the whole organize.
7.Integration with Keen Cities: V2V communication in EVs can be consistently coordinates with keen city framework, enabling efficient traffic administration, crisis reaction coordination, and natural checking. This integration cultivates a more associated and feasible urban transportation biological system. In general, long-standing time scope of V2V communication in electric vehicles utilizing LoRa innovation is extensive, advertising openings for vitality optimization, armada administration, lattice integration, client comfort, and keen city advancement. By leveraging the control of V2V communication, EVs can ended up fundamentally components of a economical and interconnected transportation biological system.

Plan of Action

This chapter describes the detailed project implementation plan is as shown in the Table 7.2.

Events	2023			2024			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Literature survey for problem	✓	✓					
Problem formulation		✓					
Literature survey for possible methods to address the problem		✓	✓				
Design solution			✓				
Identification of platforms/ tools			✓	✓	✓		
Validate the design, analyze and interpret the results						✓	✓
Preparation of the report							✓
Demonstration							✓

Table 6.1: Plan of Action

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