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Vehicle-To-Vehicle (V2v) Communication using Lora

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ABSTRACT: The Vehicle-to-Vehicle (V2V) Communication System Using LoRa with Arduino is designed to improve road safety through long-range, low-power communication. Utilizing Arduino Uno and Nano, the system integrates LoRa TX/RX modules, ultrasonic sensors, GPS, and an LCD. Vehicles exchange real-time data, such as location, speed, and distance, via LoRa, enabling them to monitor their surroundings and maintain safe distances. The ultrasonic sensors and GPS provide crucial information to prevent collisions. This system enhances traffic management and safety by facilitating timely data sharing between vehicles, making it ideal for both urban and rural environments.

I. INTRODUCTION

Through low-power, long-distance communication, the Vehicle-to-Vehicle (V2V) Communication System Using LoRa with Arduino aims to enhance road safety. Using Arduino Uno and Nano, the framework coordinates LoRa TX/RX modules, ultrasonic sensors, GPS, and a LCD. Through LoRa, vehicles exchange real-time data like location, speed, and distance to keep safe distances and monitor their surroundings. GPS and ultrasonic sensors provide crucial collision prevention data. By facilitating timely data sharing between vehicles, this system improves traffic management and safety, making it suitable for both urban and rural settings.

Arduino microcontrollers, which act as each vehicle's central processing units, are the building blocks of the system. Displays, ultrasonic sensors, GPS modules, LoRa transceivers, and other sensors and modules are all connected to these microcontrollers. The GPS module provides precise location data, while the ultrasonic sensor is used to measure the distance between vehicles. The LoRa handset works with correspondence among vehicles, and the showcase is utilized to give visual alarms to the driver.

II. LITRATURE SURVEY

[1] "Evaluation of LoRaWAN for V2V communication"by L.Cerqueira et al. (2019) This paper evaluates the performance of LoRaWAN (LoRa Wide Area Network) for V2V communication using a testbed of connected vehicles. The study examines the impact of vehicle density, network congestion, and transmission power on the reliability and latency of V2V communication. The results show that LoRaWAN can achieve reliable V2V communication at a low transmission power, making it a suitable technology for V2V applications.

[2] "LoRaWAN-based V2V communication for intersection collision avoidance" by Z. Zhang et al. (2020) This paper proposes a LoRaWAN-based V2V communication system for intersection collision avoidance. The system uses a pre-crash algorithm to detect potential collisions between vehicles approaching an intersection and sends a warning message to the affected vehicles via LoRaWAN. The study shows that the proposed system can effectively reduce the number of intersection collisions, making it a promising technology for improving road safety.

III.EXISTING SYSTEM

Several technologies have been developed and implemented in the current landscape of Vehicle-to-Vehicle (V2V) communication with varying degrees of success. Dedicated Short-Range Communications (DSRC) and cellular networks, such as 4G LTE and the upcoming 5G, are the most well-known of these. These systems allow vehicles to share real-time data like speed, location, and traffic conditions to enhance road safety and traffic management.

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Limitations of Existing Systems

- Range
- Infrastructure
- Cost
- Scalability
- Security

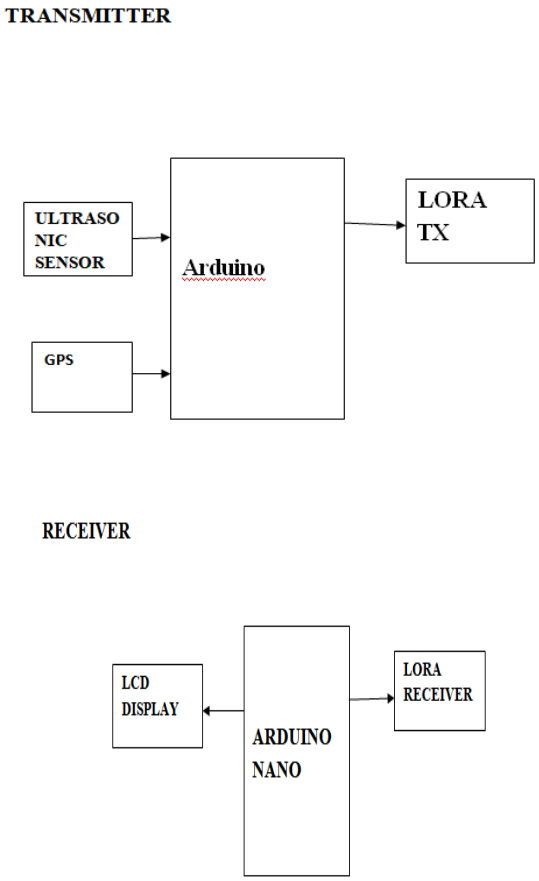
IV. PROPOSED SYSTEM

To circumvent the limitations of the existing V2V communication systems, the proposed system makes use of LoRa (Long Range) technology. LoRa is a remote correspondence convention intended for long-range, low-power, and low-information rate applications, making it especially reasonable for V2V correspondence in both metropolitan and country settings. The proposed framework incorporates Arduino microcontrollers, ultrasonic sensors, GPS modules, LoRa handsets, ESP8266, and showcases to make a powerful and dependable V2V correspondence organization.

Advantages of the Proposed System

- Longer Range
- Interference Resistance
- Ease of Integration
- Flexibility and Modularity

V. BLOCK DIAGRAM



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VI. HARDWARE COMPONENTS REQUIRED

- Arduino
- Arduino nano
- Lora tx
- Lora rx
- Ultrasonic sensor
- Gps
- Lcd

VII. SOFTWARE REQUIRED

Arduino ide

VIII. HARDWARE DESCRIPTION

Arduino

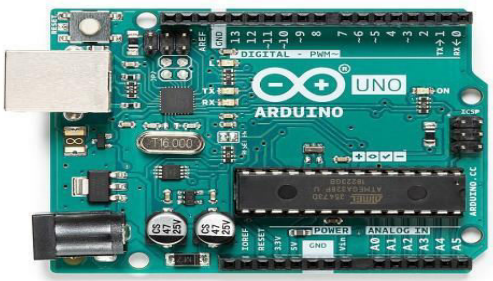

Fig:1 ARDUINO UNO

The Arduino Uno is an open-sourcemicrocontroller board in light of the MicrochipATmega328P microcontroller and created by Arduino.cc. Sets of digital and analog input/output (I/O) pins are provided on the board, allowing it to interface with various expansion boards (shields) and other circuits. The board is programmable using the Arduino IDE (Integrated Development Environment) via a type B USB cable and has 14 digital and 6 analog pins.

Full similarity with Safeguard sheets (Adaptation 2 is the main Arduino board that isn't viable with Safeguard sheets because of tall parts and a mistaken ICSP header position);

- AVcc LP channel to bring down the degree of commotion in the ADC;
- auto-reset empower/handicap jumper to forestall inadvertent resets;
- pin that is appropriate for the Arduino Diecimila;
- pin 13 of the installed drove, with a resistor to restrict current;
- Locally available TX and RX leds;
- power drove with fitting current limiter resistor (less 20mA of comsumption);
- jumper to handicap successive correspondence and to enable RX outside pull down resistor, to avoid "RX floating bumble". This part allows to use mechanized pin0 and pin1 as a regular pin, when consecutive correspondence isn't needed;
- "Every comparable part (diodes, semiconductors, leds, capacitors) have a similar direction on the board, simplifying mounting and lessening the probability of mistakes,"
- no wires between pads, more space between wires, greater wires, greater pads (better for cutting, restricting and entering, with no shortcircuits, securing expansions or open wires in utilization);

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Arduino nano

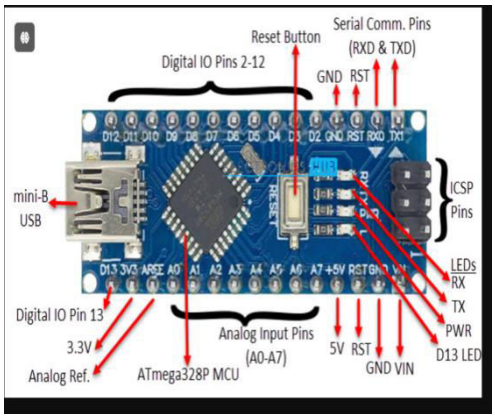

Fig:2 ARDUINO NANO

The ATmega328P microcontroller is the foundation for the small, open-source Arduino Nano board, which was created by Arduino.cc. With a smaller size factor, it functions similarly to the Arduino Uno. A collection of digital and analog input/output (I/O) pins on the Nano board allow it to be interfaced with other circuits and expansion boards. It has eight analog and fourteen digital pins, and a Mini-B USB connector that may be used to program it using the Arduino IDE. The board may be powered by an external 7–12V power source connected by the VIN pin, or it can be powered via the USB connection. It requires voltages between 7 and 12 volts to function.

Digital Pin Usage: - The digital pins (D0 to D13) are used in digital input/output activities.
- If necessary, analog input pins can also be set up to operate as digital pins.

Analyzing Digital Signals: - To determine a digital pin's current state, use {digitalRead(pinNumber)}. Either {LOW~ (0V) or {HIGH~ (5V) is returned.

Writing Digital Signals: - To set a digital pin's state to either `LOW` (0V) or `HIGH` (5V), use `digital Write (pin Number, value)}.

Signal States: - There are just two potential states for digital pins: {LOW} (0V) and {HIGH~ 5V

ultrasonic sensor

Fig:3 ULTRASONIC SENSOR

Using ultrasonic waves, ultrasonic sensors calculate distance. The ultrasonic wave is sent out by the sensor head, and it is reflected back by the target. Ultrasonic sensors track the duration between an emission and a reception to determine the target's distance.

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HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

GPS

Fig:4 GPS

The Worldwide Situating Framework (GPS) is a satellite-based route framework comprised of no less than 24 satellites. GPS works in any weather patterns, anyplace on the planet, 24 hours every day, with no membership expenses or arrangement charges.

Specifications:

- **Receiver Type:** 50 channels, GPS L1 (1575.42 MHz)
- **Horizontal Position Accuracy:** 2.5 meters
- **Navigation Update Rate:** 1 Hz (5 Hz maximum)
- **Capture Time:**
  - Cool start: 27 seconds
  - Hot start: 1 second
- **Navigation Sensitivity:** -161 dBm
- **Communication Protocol:** NMEA, UBX Binary, RTCM
- **Serial Baud Rate:** 4800 to 230400 (default 9600)
- **Operating Temperature:** -40°C to 85°C
- **Operating Voltage:** 2.7V to 3.6V

LORA (LONG RANGE)

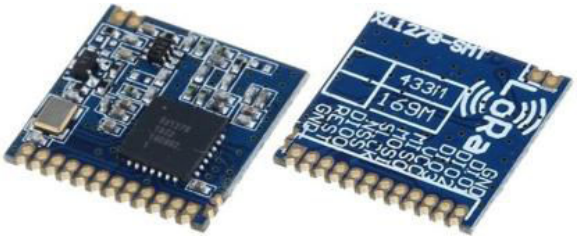

Fig:5 LORA MODULE

LoRa (Long Range) is a low-power, long-range wireless platform used for IoT networks, introduced by Semtech. It uses spread spectrum modulation based on chirp spread spectrum (CSS) technology. Common frequencies include

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433MHz, 915MHz, and 868MHz, enabling bi-directional communication over distances of 15-20km with minimal power consumption. LoRa supports public, private, and hybrid networks, offering greater range than cellular networks and facilitating low-cost, battery-operated IoT applications.
In LoRa technology, messages from devices are received by gateways and forwarded to a central network for processing. The LoRa Alliance, a non-profit organization, standardizes and advances this LP-WAN technology, driven by IoT demands.

Features:

- LoRaTM spread spectrum communication
- +20dBm - 10mW. Stable RF output power when input voltage changed
- Half-duplex SPI communication
- Programmable bit rate can reach to 300KBPS

Lcd

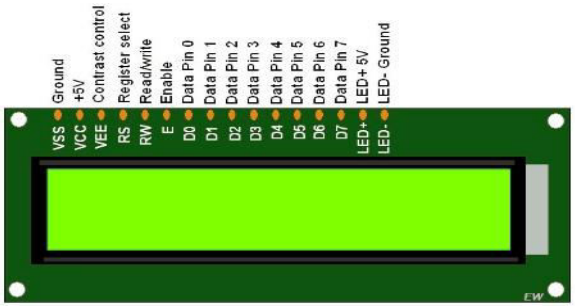

Fig:6 LCD

An electronic display module known as an LCD (Liquid Crystal Display) screen is utilized in numerous contexts. A very fundamental module, a 162 LCD display is utilized frequently in numerous circuits and devices. These modules are liked north of seven portions and other multi section LEDs. These are the reasons: LCDs are prudent; effectively programmable; have no constraint of showing extraordinary and even custom characters (in contrast to in seven portions), activitys, etc.A 16*2 LCD has two such lines and can display 16 characters per line. In this LCD each character is shown in 5×7 pixel lattice. The Command and Data registers on this LCD are its two registers.

Features of 16×2 LCD module

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers

IX. SOFTWARE DESCRIPTION

ArduinoSoftware(IDE)

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Arduino is an open source, PC equipment and programming organization, task, and client local area that plans and makes microcontroller units for building computerized gadgets and intuitive items that can detect and control objects in the actual world. The venture's items are dispersed as open-source equipment and programming, which are authorized under the GNU Lesser Overall population Permit (LGPL) or the GNU Overall population Permit (GPL), allowing the production of Arduino sheets and programming conveyance by anybody. Pre-assembled Arduino boards can be purchased commercially or as DIY kits. The designs of Arduino boards make use of a variety of controllers and microprocessors.

The sheets are furnished with sets of advanced and simple information/yield (I/O) sticks that might be communicated to different development sheets (safeguards) and different circuits.

X. CONCLUSION

The proposed Vehicle-to-Vehicle (V2V) correspondence system involving LoRa development offers a promising choice as opposed to existing particular procedures. By using LoRa's long-range capacities, low power use, and pragmatic nature, this system watches out for the essential furthest reaches of current V2V propels like DSRC, cell associations, and Wi-Fi. The combination of ultrasonic sensors, GPS modules, Arduino microcontrollers, and ARDUINO NANO provides a comprehensive solution for improved street security, impact evasion, and continuous information trade.

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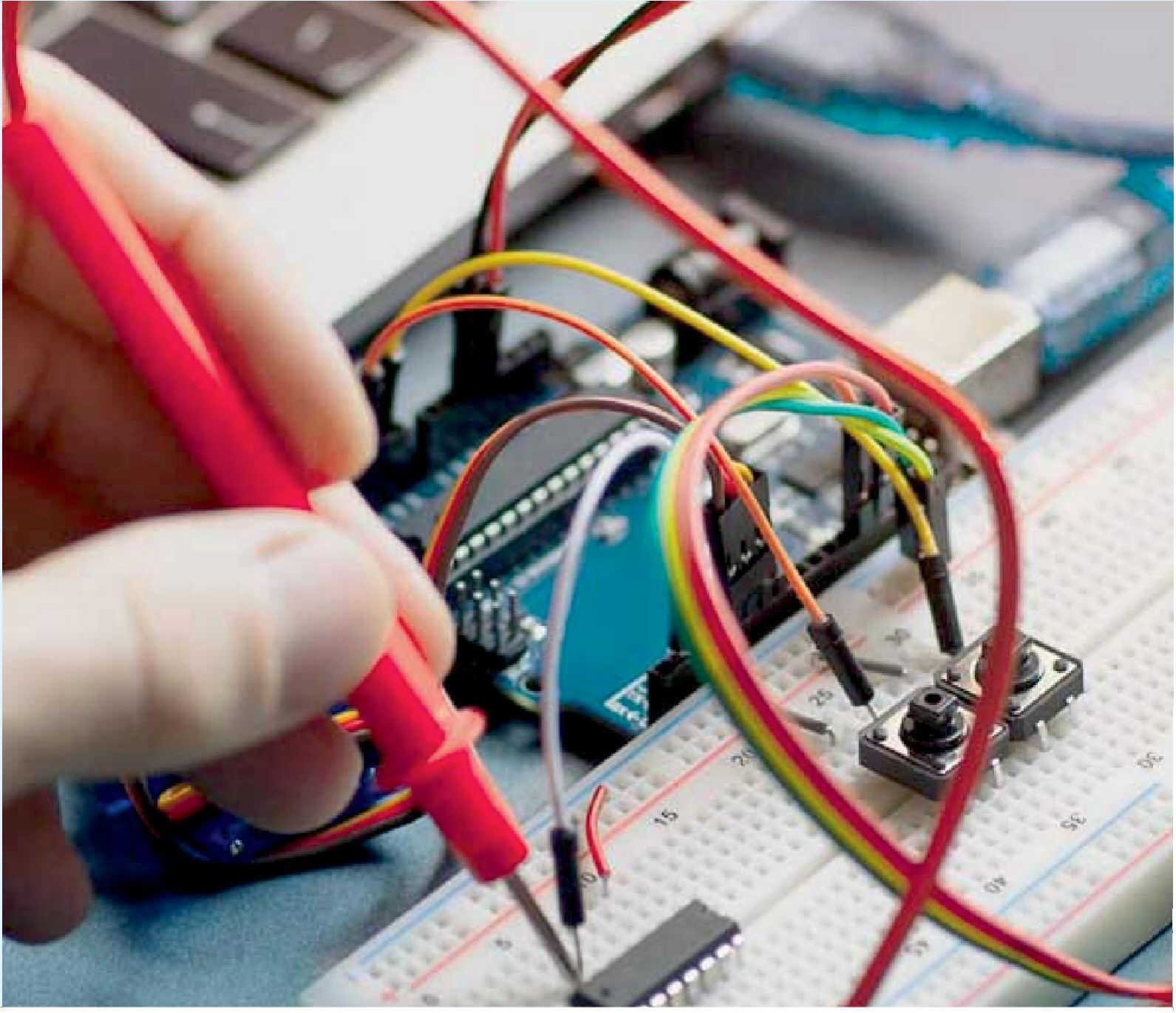

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