

# WIRELESS COMMUNICATION SYSTEM INTEGRATING VEHICLES AND ROAD TRAFFIC UNITS FOR INTELLIGENT TRANSPORT SYSTEM

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## Abstract

The project presents a design to a next generation of wireless communication between vehicular system by adding significant enhancements and modernizing the existing features. There is a long list of features implemented in this project which is described below. New communication technologies into modern vehicles to offer an opportunity for better assistance to people injured in traffic accidents. The main objective of the proposed project is to develop a vehicle communication system using adhoc wireless network to improve inter vehicle communication. To design an intelligent system which is able to automatically detect road accidents, green light optimal, speed advisory and notify them through vehicular network. The parameters were chosen for the project is Collision warning, Road speed limits warning, departing the highway, Obstacle discovery are used to detect the purpose of safety.

**Index terms:** MEMS sensor, LPC130, LPCXpresso IDE (Eclipse based).

## 1. Introduction

Embedded systems are computing systems with tightly coupled hardware and computer code integration that are designed to perform a fanatical function. During the last decades, the whole type of vehicles in our roads has full-fledged a stimulating growth, making traffic density higher and increasing the drivers 'attention desires. The immediate results of this situation is that the dramatic increase of traffic accidents on the road, representing a major draw back in most countries.

To reduce the amount of road fatalities, vehicular networks can play Associate in nursing increasing role within the Intelligent Transportation Systems (ITS) space [1]. Most ITS applications, such as road safety, fleet management, and navigation, will rely on knowledge changed between the vehicle and also the road-side infrastructure (V2I), or maybe directly between vehicles (V2V) [2]. The mixing of sensing capabilities on-board of vehicles, at the side of peer-to-peer mobile communication among vehicles, forecast vital enhancements in terms of safety within the close to future. Before inward to the zero accident objective on the long term, a quick and economical operation throughout the hour following a traffic accident [3] significantly will increase the chance of survival of the injured, and reduces the injury severity. Hence, to maximize the advantages of mistreatment communication systems between vehicles, the infrastructure ought to be supported by intelligent systems capable of estimating the severity of accidents and mechanically

deploying the actions needed, thereby reducing the time required to help bruised passengers. Many of the manual choices taken these days by emergency services area unit supported incomplete or inaccurate information which may get replaced by automatic systems that adapt to the specific characteristics of every accident.

A preliminary assessment of the severity of the accident can facilitate emergency services to adapt the human and material resources to the conditions of the accident, with the ensuing assistance quality improvement [4]. In this paper, we tend to make the most of the utilization of vehicular networks to gather precise data concerning road accidents that's then accustomed estimate the severity of the collision.

In the existing system accident and traffic in-timations are updated to other vehicles by manual process. In the existing system it was implemented by the arm cortex 7 processor. The existing system was theoretically proven by the KDD algorithm [5] process and uses on board unit which is responsible for de-tecting and reporting accident situation to an external control. The drawbacks of existing system is there is no vehicle adhoc network, cannot locate excat loca-tion. Operation speed is very low. No driver assis-tance system. Less safety and no Speed limit warn-ing.

## 2. OUR PROPOSAL

Our approach collects information on market once a traffic accident happens, that is captured by sensors put in on-board the vehicles

Based on the information our system develops a vehicle communication system using adhoc wireless network to improve inter vehicle communication using mems sensor. The proposed approach presents a collision warning, road speed limit warning, departing the highway, obstacle discovery which makes it suitable for real time applications Due to increasing prices of groceries and staple crops, we plan to introduce a autonomous system where swarm robots will solve the major problem of unavailability of work-force, reduce waste wastage, increase production of crops and constantly monitor the crops throughout its growth period.

The system has been designed such that it can intimate status of the road to the entire vehicle in its vicinity through wireless technology. Any vehicle come to the coverage range it receives the message. This is very helpful for driver to choose alternate path without intersecting the congestion. This message will sent to the other vehicle through mems sensor device using ad-hoc method. So the monitoring section will get to all these details automatically without any delay. The advantage of proposed system is safety, traffic management and driver assistance system. The increase in human-machine interaction in our daily lives has

made user interface technology progressively more important. Vehicle to vehicle communication have attracted increasing concerns in recent intelligent transportation. For drivers, real time communication can provide valuable traffic information to support enroute choice decisions. Other useful applications in intelligent transportation system and in transportation generally include safety assistance for land vehicle drivers, unmanned surveillance system. Design an integrated system that is safe, cost effective, efficient and secure. The vehicle to vehicle communication technologies using adhoc network was implemented by the mems sensor. It has been commonly used for land vehicle navigation to provide reliable position, velocity and attitude. It act as the driver assistance system

## 2.1. ARCHITECTURE OVERVIEW

### A. FORWARD HAZARD WARNING

If a vehicle detects an event like emergency braking, accident, traffic congestion, slippery road, or construction zone, it adds accident data [6] [7] to its sporadically broadcasted Cooperative Awareness Message that that's shipped to all or any or any vehicles at intervals the shut neighborhood. Different cars or motorcycles receives the data and choose either to warn the motive force if the dangerous location is on the route ahead or simply to broadcast the data to warn different vehicles.

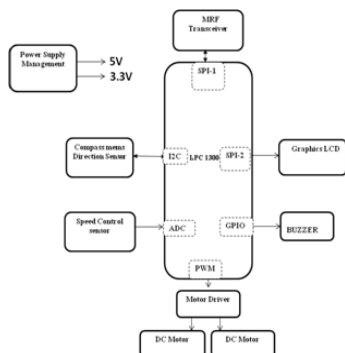


Fig.1. Processing unit -1

### B. INTERSECTION COLLISION WARNING

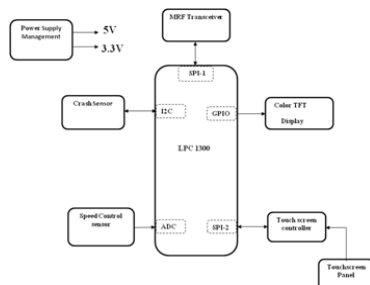


Fig.2. Processing unit - 2

Whereas the bike is riding on the most roads, an automobile is approaching the intersection from the right-hand facet. Owing to road obstruction the automobile driver

is in approaching the bike. once driving onto intersection, the automobile driver receives warning of approaching bike. The rider additionally receives a warning on its HMI.

### C. EMERGENCY VEHICLE WARNING

Once vehicles square measure driving on the road, an emergency vehicle approaches from behind. This technique uses data from energy unit to assist the motive force on the way to clear the road for the emergency vehicle even once siren and lightweight bar might not nevertheless be audible or visible. The driver/rider of the opposite vehicle are going to be suggested to prevent at the road facet to let the energy unit go past. If the motive force doesn't slow the vehicle [6] once this warning, the vehicle details are going to be mechanically transferred to the control unit.

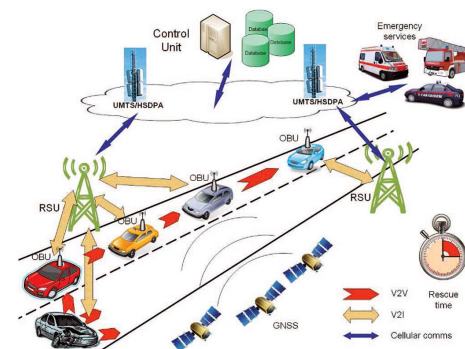


Fig.3. Overview of system

### D. GREEN LIGHT WEIGHT BEST ADVISORY

The vehicle [6] calculates associate in nurs-ing approaching speed of say, 45 km/h, at that the vehicle would reach apart. The light at the start of future is inexperienced part. This information is given to the motive force UN agency will avoid the spare stop. If the vehicle is somehow required to prevent, then light would mechanically switches off automotive engine and later turn ON the ignition once it shows inexperienced.

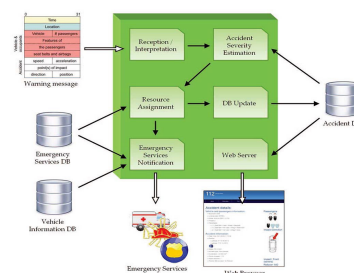


Fig.4. Controller structure.

### E. ROAD REGULATION WARNING

The road regulation warning application permits connected vehicles to receive data that it's approaching a road along side the suggested speed for the curve. This capability permits the vehicle to produce a warning to motive force concerning the road and suggested speed. The vehicle will communicate and informs this to the traffic control unit [6], where ever the vehicle variety are displayed. If the motive force drives the vehicle quicker than

the regulation ignoring the warning, the vehicle unit would inform the vehicle details to the control unit.

### 3. DEVICE CONTROLLING UNIT

#### A. ARM CORTEX-M3

The ARM Cortex-M3 processor is the industry-leading 32-bit processor for extremely deterministic real-time period and has been specifically developed to enable partners to develop high-performance low-cost platforms for a broad range of devices as well as microcontrollers, automotive body systems, industrial management systems and wireless networking [7] and sensors. The processor delivers outstanding procedure performance and exceptional system response to events whereas meeting the challenges of low dynamic and static power constraints. The processor very configurable facultative a large vary of implementations from those requiring memory protection and powerful trace technology through to extremely price sensitive devices requiring stripped-down space

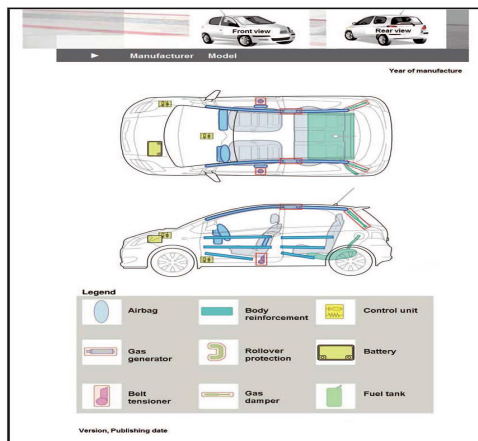


Fig.5. Example of car rescue sheet.

### 3. HIGH LEVEL DESIGN

In fig. 6, shows the swarmbots dispersed in the agricultural field and the co-ordination between them by wireless communication.

#### B. LPC 1300 AREA UNIT

The LPC1300 square measure ARM Cortex-M3 based mostly microcontrollers. The ARM Cortex-M3 could be a next genera-tion core that provides system enhancements like increased rectify options and a better level of sup-port block integration. The LPC1300 operate at computer hardware frequencies of up to seventy two megahertz. The ARM Cortex-M3 computer hardware [4] incorporates a 3-stage pipeline and uses Har-vard design with separate na-tive instruction and knowledge buses still as a 3rd bus for peripherals. The ARM Cortex-M3 computer hardware conjointly includes an indoor pre-fetch unit that supports speculative branching. The peripheral complement of the LPC1300 includes up to thirty two KB of non-volatile storage, up to eight KB of information memory, USB Device (LPC1342/43 only), one Fast-mode and I2C-bus interface, one UART, four general purpose timers, and up to forty two general purpose I/O pins.

#### C. MEMS ACCELEROMETER

An measuring instrument may be a device for mensuration acceleration and gravity iatrogenic reaction forces. Single- and multi-axis models ar out there to observe magnitude and direction of the acce-leration as a vec-tor amount. Accelerometers will be wont to sense inclination, vibration, and shock. they're increa-singly gift in moveable electronic de-vices. The trendy accelerometers [8] are typically tiny small electro-mechanical systems (MEMS), so the best MEMS devices potential, consisting of very little quite a cantilever beam with a symptom mass (also referred to as seismal mass). Automatically the measuring instrument behaves as a mass-damper-spring system; the damping results from the residual gas sealed within the device. As long because the Q-factor isn't too low, damping doesn't lead to a lower sensitivity.

The most ordinarily the capacitance between a group of mounted beams and a group of beams connected to the proof mass is measured. This methodology is easy and reliable; it conjointly doesn't need further method steps creating it cheap. The desegregation piezoresistors within the springs to notice spring deformation and therefore deflection, could be a sensible different, though some a lot of method is required. For terribly high sensitivities quantum tunneling is additionally used; this needs specific fabrication steps creating it dearer. Optical measuring has been incontestable on laboratory scale. Another, so much less common, kind of MEMS-based measuring system [3] contains tiny|alittle|atiny low} heater at very cheap of a awfully small dome, that heats the air within the dome to cause it to rise. A thermometer on the dome determines wherever the heated air reaches the dome and also the deflection off the middle could be a live of the acceleration applied to the sensing element. Most micromechanical accelerometers oper-ate in-plane, that is, they're designed to be sensitive solely to a direction within the plane of the die. By integrat-ing 2 devices sheer on one die a two-axis measuring system is created. By adding an extra out-of-plane device 3 axes is measured. Such a mix invariably features a abundant lower arrangement error than 3 distinct models combined when packaging. Micromechanical accelerometers are availa-ble in a very big variety of mensuration ranges, reaching up to thousands of g's. The designer should build a compromise between sensitivity and also the peak acceleration which will be measured.

#### D. DC ELECTRIC MOTOR

In any motor, operation is predicated on easy electromagnetism. A cur-rent-carrying conduc-tor generates a magnetic flux and strengthens of the external magnetic flux. The interior configuration of a DC motor is meant to harness the magnetic interaction between a current-carrying conductor associate degreed an external magnetic flux to get motion. The other hardware description are follows:

- **Buzzer:** used to provide warning sound to the driver
- **Battery:** used to power all the electronics and motors in the project

- **MEMS Compass:** used to find the direction of the moving vehicle.

#### 4. OVERVIEW OF PROTOCOLS

##### A. IC INTERFACE

The entire measure chain consists by a low-noise electrical phenomenon electronic equipment that converts into Associate in Nursing analog voltage the electrical phenomenon unbalancing of the MEMS device and by analog-to-digital converters. The acceleration knowledge is also accessed through Associate in Nursing I2C/SPI interface [4] therefore creating the device particularly appropriate for direct interfacing with a microcontroller.

The LIS302DL options a Data-Ready signal (RDY) that indicates once a replacement set of measured acceleration knowledge is on the market therefore simplifying knowledge synchronization in digital system using the de-vice itself.

The LIS302DL can also be designed to get Associate in Nursing mechanical phenomenon Wake-Up and Free-Fall interrupt signal consequently to a programmed acceleration event on the enabled axes. each Free-Fall and Wake-Up are often offered at the same time on 2 totally different pins.

##### B. I2C BUS PROTOCOL

The I2C bus physically consists of two active wires and a ground affiliation. The active wires, re-ferred to as SDA and SCL, are each bi-directional. SDA is that the Serial knowledge line, and SCL is that the Serial CLock line. useful blocks on the diagram correspond with the particular ICs [3]; styles proceed ra-pidly from diagram to final schematic. No have to be compelled to style bus interfaces as a result of the I2C-bus interface is already integrated on-chip. Integrated addressing and data-transfer protocol enable systems to be utterly software-defined. an equivalent IC varieties will typically be utilized in many various applications. Design-time reduces as designers quickly become accustomed to the often used purposeful blocks described by I2C-bus compatible ICs. The ICs will be superimposed to or aloof from a system while not touching the other circuits on the bus.

##### C. MIWI P2P WIRELESS PROTOCOL

The silicon chip MiWi™ P2P Wireless Pro-tocol may be a variation of IEEE 802.15.4 [5] ,victimisation Micro-chip's. The microchip's MRF24J40MA two.4 gigahertz transceiver and any microchip eight, sixteen or 32-bit microcontroller with a lay to rest computer circuit (I2C). The protocol provides relia-ble direct wireless communication [7] via AN easy-to-use programming interface. it's a fashionable feature set which will be compiled in and out of the stack to fulfill a large vary of client wants – whereas minimizing the stack footprint. The MiWi P2P protocol modifies the IEEE 802.15.4 specification's Media Access management (MAC) layer by adding commands that modify the handclasp method. It simplifies link disconnection and channel hopping by providing supplementary macintosh commands. However, application-specific de-cisions, like once to perform AN energy notice scan or once to leap chan-nels, aren't outlined within the protocol. Those prob-blems area unit left to the appliance developer.

##### 5. EMBEDDED PROTOCOL

##### A. SERIAL PERIPHERAL INTERFACE

Serial Peripheral Interface may well be a simple interface that allows to talk microcontroller and peripheral chips or intercommunicate between 2 or a lot of microcontrollers. Serial Peripheral Interface bus generally known as four wire interfaces could also be accustomed interface such chips or devices like: digital display, sensors, memories, ADC, RTC. The vary of usage is big.

SPI Bus uses synchronous protocol, wherever transmittal and receiving is target-hunting by clock signal generated by master microcontroller. SPI interface permits connecting many SPI devices whereas master selects every of them with metallic element (Chip Select) signal – (Underline means active is LOW).

##### B. Analog-to-Digital (A/D) Converter

The module has 5 inputs for the 28-pin devices and eight for the 40/44-pin devices. The conversion of AN analog signaling ends up in a corresponding 10-bit digital variety. The A/D module has high and low-tension reference input that's packages electable to some combination of VDD, VSS, RA2 or RA3. The A/D convertor contains a distinctive feature of having the ability to work whereas the device is in Sleep mode. To operate in Sleep, the A/D clock should be derived from the A/D's internal RC generator.

##### C. UART

UART stands for the Universal Asynchron-ous Receiver/Transmitter. In asynchronous transmit-ting, teletype-style UARTs send a "start" bit, 5 to eight information bits, least-significant-bit 1st, Associate in Nursing nonmandatory "parity" bit, so one, one and a [\*fr1], or 2 "stop" bits. the beginning bit is that the opposite polarity of the data-line's idle state. The stop bit is that the data-line's idle state, and provides a delay before consecutive character will begin. (This is named asynchronous start-stop transmission). In mechanical teletypes, the "stop" bit was usually

stretched to 2 bit times to allow the mechanism long-er to complete printing a personality. A stretched "stop" bit additionally helps resynchronization. The parity will either build the quantity of "one" bits be-tween any start/stop combine odd, or even, or it will be omitted. Odd parity is additional reliable as a re-sult of it assures that there'll perpetually be a mini-mum of one information transition, and this allows several UARTs to resyn-chronize.

##### 6. SOFTWARE LIBRARIES

###### A.GRAPHICS LCD

Used to show the vehicle status and other info to the driver. Uses PCD8544 low power, CMOS LCD controller. The interfaced via SPI\_Protocol and it has 48 rows and 84 columns.





Fig.6. Graphics LCD

### B. QVGA TFT COLOUR DISPLAY

A color touchscreen TFT display with QVGA resolution is used as the main HMI for the project demonstration.

## 7. SOFTWARE SPECIFICATION

### A. Proteus 8

Proteus 8 is a single application with many service modules offering different functionality (schematic capture,PCBlayout). The wrapper that enables all of the various tools to communicate with each other. It uses QT version 4.8.4.It is a c++ tool kit for cross platform application development. It provides single source portability access across ms windows and embedded devices

## 8. DEVELOPMENTAL TOOL

### B. LPCXpresso

LPCXpresso is a complete toolchain for LPC1000 series of Cortex-M microcontrollers. It has Eclipse based IDE, GNU Compiler, Linker and Libraries. It has Enhanced GDB Debugger and supports LPC-Link Programmer and Debugger. It is developed by NXP Semiconductors and CodeRedTechnologies

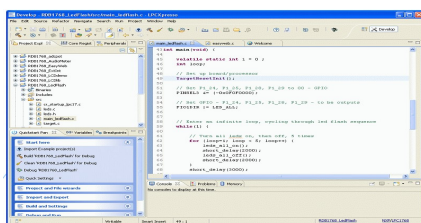


Fig.7. Implementation of LPCXPRESSO

## 9. PROGRAMMING LANGUAGE

C may be a all-purpose, block structured, procedural, imperative computer programming language developed in 1972 by Dennis Ritchie at the Bell phonephone Laboratories to be used with the UNIX software system.

C has proved to be a strong and versatile language that may be used for a range of applications, from business programs to engineering. C may be a significantly fashionable language for private pc programmers as a result of it's comparatively little -- it re-quires less memory than different languages. though it's a problem-oriented language, C is way

nearer to programing language than area unit most different high-level languages. This closeness to the underlying machine language permits C programmers to put in writing terribly economical code.

## 10. EXPERIMENTAL PERFORMANCE

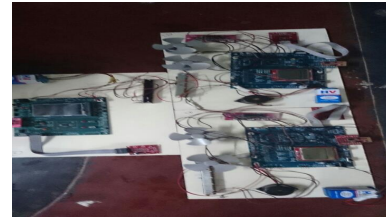


Fig.8. Module of proposed system



Fig.9. Working state of proposed system

## 11. CONCLUSION

The new communication technologies integrated into the automotive sector provide a chance for higher help to individuals disjointed in traffic accidents, reducing the response time of emergency services, and increasing the knowledge they have concerning the incident simply before beginning the rescue process to the present finish, we have a tendency to designed and enforced a image for automatic accident notification and help based on V2V and V2I communications. This project provides new driver help system in today's world between the conveyance communication networks. It additionally prevents and intimate the accident and injury on vehicles to the near area unit which offer minimum time however in existing system accident and traffic intimations are updated to different vehicles by manual method and therefore the operation system is incredibly slow with less safety. In projected system the software package is quick with high safety. Advanced driver help increasing road safety by reducing the quantity of accidents additionally as reducing the impact just in case of non-avoidable accidents. Increasing traffic potency with traffic congestion management leading to reduced transport time, fuel consumption and therefore contributory to improving the surroundings. User communications and knowledge services giving comfort and business applications to driver and passengers. This project are going to be terribly helpful and effective as all the units area unit power-driven by a thirty two bit arm cortex-m3 microcontroller that is low value, low

power and provides superior performance compared to the obtainable eight,16,32 bit.

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