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An Efficient Accident AvoidanceSystem Using Wireless Technology in Instrument Cluster

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Abstract: Wireless technology has completely transformed the way we livein today's world almost every automobile vehicle operates hard functions in a wire connection. Replacing a wired connection with wireless connection could prove to be productive in economic senses as it will have an effect on the weight, cost and performance. In this project I propose a wireless network to which will control accelerating, braking, control steering and other functions in the vehicle. The Display unit is in front of the driver, Functionality interface on the dashboard at first included the steering wheel and the instrument cluster. The instrument cluster contains gauges speedometer, tachometer, odometer, fuel gauge, and other telltale. The main objective of the proposed system to design a wireless instrument cluster to operate the vehicle in safe speed at critical zones using ultrasonic sensor and 1EEE 802.15.4 standard. Wireless communication between the vehicle body control unit and instrument cluster unit for indicate the vehicle functionality of the vehicle, sensor unit used for safe distance measurement For Simulation purpose the Vehicle unit consider as ARM controller unit and the instrument cluster hardware is designed with ARM controller for interfacing and design a functional process of the vehicle, this propose system provide efficient vehicle speed control.

Index Terms: ARM-LPC2148, LCD Display, LED'S, Meters, buzzer, IEE 802.15.4 Standard .Ultrasonic sensor.

I. INTRODUCTION

The instrument cluster contains gauges such as a speedometer, tachometer, odometer and fuel gauge, and indicators such as gearshift position, seat belt warning light, parking-brake-engagement warning lightand an engine-malfunction light. There may also be indicators for low fuel, low oil pressure, low tire pressure and faults in the airbag system. Heating and ventilation controls and vents, lighting controls, audio equipment and automotive navigation systems are also mounted on the dashboard. The top of a dashboard may contain vents for the heating and air conditioning system and speakers for an audio system. A glove compartment is commonly located on the passenger's side. There may also be an ashtray and a cigarette lighter which can provide a power outlet for other low-voltage appliances.

American car manufacturers and their imitators designed unusually-shaped instruments on a dashboard laden with chrome and transparent plastic, which could be less readable, but was often thought to be more stylish. Sunlight could cause a bright glare on the chrome, particularly for a convertible. With the coming of the LED in consumer electronics, some manufacturers used instruments with digital readouts to make their cars appear more up to date, but this has faded from practice. Some cars use a head-up display to project the speed of the car onto the windscreen in imitation of fighter aircraft, but in a far less complex display.

In recent years, spurred on by the growing aftermarket use of dash kits, many automakers have taken the initiative to add more stylistic elements to their dashboards. One prominent example of this is the Chevrolet Sonic which offers both exterior (e.g., a custom graphics package) and interior cosmetic upgrades. Manufacturers such as Honda, Toyota and Mercedes-Benz have included fuel-economy gauges in some instrument clusters, showing fuel mileage in real time. The ammeter was the gauge of choice for monitoring the state of the charging system until the 1970s. Later it was replaced by the voltmeter. Today most family vehicles have warning lights instead of voltmeters or oil pressure gauges in their dashboard instrument clusters, though sports cars often have proper gauges for performance purposes and driver appeasement.

The ZigBee network layer natively supports both star and tree networks, and generic Mesh networking. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allow the use of ZigBee routers to extend communication at the network level. ZigBee builds on the physical layer and media access control defined in IEEE standard 802.15.4 for low-rate. The specification includes four additional key components: network layer, application layer, ZigBee device objects (ZDOs) and manufacturer-defined application objects which allow for customization and favor total integration. ZDOs are responsible for a number of tasks, including keeping

Track of device roles, managing requests to join a network, as well as device discovery and security. The

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MAC sublayer is capable of single-hop reliable communications. As a rule, the security level it is to use is specified by the upper layers. The network layer manages routing, processing received messages and being capable of broadcasting requests. Outgoing frames will use the adequate link key according to the routing, if it is available; otherwise, the network key will be used to protect the payload from external devices.

II. LITERATURE REVIEW

In Md. Abdus Samad Kamal*et al*[1] this paper presents a vehicle driving system in a model predictive control framework that effectively improves traffic flow. The vehicle driving system regulates safe intervehicle distance under the bounded driving torque condition by predicting the preceding traffic. It also focuses on alleviating the effect of breaking on the vehicles that follow, which helps jamming waves attenuate to in the traffic.It is observed that the system alleviates congestion-forming phenomena from the traffic and improves the traffic flow by only controlling a single vehicle. Since the smart vehicle significantly attenuates the jamming waves, the flow of vehicles in the following traffic becomes smooth, so need some string stability.

In Rubini.R, *et al* [2] proposed a system has an alerting,recording and reporting system for over speed violationmanagement. The Zigbee transmitter sends the speed limitedof the particular lane entered by the vehicle and also givesalerts like “road works”, “steep slopes”, “school zone” inthe form of acoustical messages and also in LCD. Thereceiver unit placed in the vehicle receives the messagesand sends to the microcontroller. When speed of the vehiclenears the speed limit it displays the warning and if exceedsthe limit, the microcontroller records the violated speed andtime. The LCD displays the lane speed limit and shows thenumber of times, speed was violated. A GSM module sendsmessage to the nearest traffic personnel immediately after aviolation occurs. An authenticated device is also provided,which can be operated only by the traffic police in whom hecan retrieve the data stored at any time. Increase in thecount of violation increases the penalty amount which canbe collected in toll gates located nearby.

In F.Parvez Ahmed *et al* [3] this paper focus on unifying the Global Positioning system with embedded wireless system is the new approaches in intelligent vehicle control for critical remote location application using ARM. In conventional system they are designed to control the speed of vehicles in all days. The main objective of the proposed system is to operate the vehicle in safe speed at critical zones. The base station having the transmitter which is designed for Frequency Modulation (FM), the receiver part is implemented in Vehicle. The ARM processor is implemented at receiver side, which receives the critical frequency,and then it is activated in critical mode. Speed Control Driver (SCD) can be custom designed to fit into a vehicle’s dashboard, and displays information on the vehicle. Once the information is received, it automatically alerts the driver, to reduce the speed according to the time and zone. The novel system is implemented with the support of embedded processor and the simulation is achieved through Keil C software and results are discussed.

In Gummarekula Sattibabu [3] *et al* this paper describes the advancement in the processor technology and microcontrollers has opened a new system designed to prevent the accidents caused due to negligence of drivers in seeing traffic signals alongside the road and other anomalies on the roads. So to intimate the driver about the zones and to automatically maintain the speed is accomplished by means RF technology. The main objective is to design an Electronic Display controller meant for vehicle’s speed control and monitors the zones, which runs on an embedded system and can be custom designed to fit into a vehicle’s dashboard to display information on the vehicle. This system if adopted by some state can effectively reduce the number of road accidents caused by speeding vehicles losing control of the vehicle at speed breakers or by driver’s negligence towards traffic signals. This paper presents a new design to control the speed of the automobiles at remote places for fixed time.

In Sunil R. Kewate *et al* [5]Road accidents can be prevented by adopting measures such as Traffic management, improving quality of road infrastructure and safer vehicles. The existing techniques still doesn’t able to reduce the number of accidents. Hence there is a need to implement Intelligent Speed Adaptation (ISA) in which vehicles speed can be automatically controlled by various limit techniques which are based on zones, highway, traffic density etc. In this research work, it proposes automatic speed control system based on color strips for highway road and the roads where the speed control within limit is required. Many color sensors are able to detect more than one color for multiple color sorting applications. Depending on the sophistication of the sensor, it can be programmed to recognize only one color, or multiple color types or shades for sorting operations.

The methodology explains that a various color strips are marked on highway road or the roads where the speed control within limit is required and vehicle will have a colorsensor attached which will recognize the color marked on the highway road and accordingly maintain the vehicles speed in that particular limit. In this developed system, the color detecting sensor of specific intensity is used to activate/deactivate the system of speed control within the color strips marked on the road. In actual practice, the system works that when vehicle enter in speed limiting roads like express–high way, high way and any other roads where the speed limit is required etc., the vehicle sensor detect the color to activate the system and send the signals to programmable ECU/MCU and the programmable ECU /MCU controls the position of throttle valve/fuel pump/motor which result in controlling the speed of engine at given limit. When the system activated

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then our vehicle is controlled at given limited speed or below that limiting speed and cannot exceed beyond that limit till the next color strip crossed. This reduces the road accidents and gets driving comfort for the driver, after implementation of this automatic speed control system.

III. PROPOSED SYSTEM

Wireless communication is transfer the data between two or more points that are not connected by an electrical conductor. Wireless communication will play a major role in efficient vehicle control systems, different type of wireless communication method are given below that are vehicle to vehicle communication, vehicle to infrastructure communication, intravehicle communication For transmitting a data between the vehicle with the help of different protocol for controlling the data loss.

In my proposed system provide the design of wireless instrument cluster; IEEE 802.15.4 standard is used for data transmission, Frames are the basic unit of data transport, of which there are four fundamental types (data, acknowledgment, beacon and MAC command frames), which provide a reasonable tradeoff between simplicity and robustness. Additionally, a superframe structure, defined by the coordinator, may be used, in which case two beacons act as its limits and provide synchronization to other devices as well as configuration information. A superframe consists of sixteen equal-length slots, which can be further divided into an active part and an inactive part, during which the coordinator may enter power saving mode, not needing to control its network. Within superframes contention occurs between their limits, and is resolved by CSMA/CA. Every transmission must end before the arrival of the second beacon.

IV. BLOCK DIAGRAM

The block diagram of the proposed system has two important units that are vehicle body unit, Instrument cluster unit these are the two units involve in the wireless communication. Instrument cluster unit has following block for speed indication:Zigbee unit: for transmitting the data between the pc and instrument cluster unit,Power supply: provide the power supply to the controller for process control,LCD Display: Display the transmitted data by the PC unit, Motors, Speedometer, RPM meter: speed variation shown in the meter.Personal Computer unit has following blocks:Zigbee unit: for transmitting the data from the vehicle body unit transmitting the data.

The instrument cluster unit is a receiving unit , that the receiving unit arehas controller for process controlling, lcd display for display the receiving data from the transmitter, motors are running with the desire receiving data speed and the speedometer and odometer are used to provide the variation in the speed and RPM rate. The proposed system will provide the wireless instrument cluster .Each block of the instrument cluster unit are given below sections.As mentioned before, applications with well-defined bandwidth needs can use up to seven domains of one or more contention less guaranteed time slots, trailing at the end of the superframe.

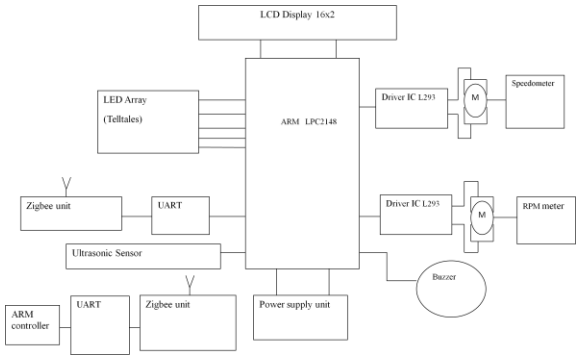

Fig.1 Block Diagram of Speed Control System

4.1Power Supply Unit

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. Examples of the latter include power supplies in desktop computers and consumer electronics devices. Every power supply must obtain the energy it supplies to its load, as well as any energy it consumes while performing that task, from an energy source.

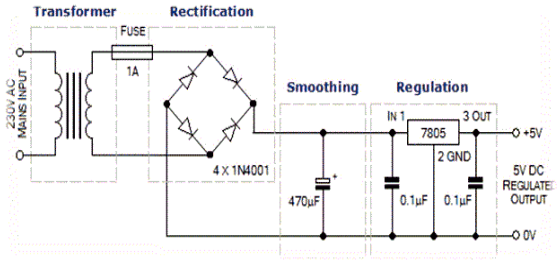

Fig.2 Power Supply Unit

4.2 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical;

Easily programmable; have no limitation of displaying special and even (unlike in seven segments), animations and so on.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like

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initializing it, clearing its screen, setting the cursor position, controlling display etc.

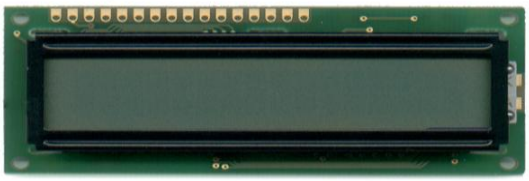

Fig.316x2 LCD Display

The LCD display units data pins D4 to D7 are interface to the port are p0.16 to p0.19 of the controller for data receiving and controlling process. The interfacing ports are getting the data and display to the LCD display. RS-Reset pin interface to the port of p1.16 and EN-Enable pin interface to the port of p1.17.the read and write pin are connecting to the ground. Using the reset enable pin is used to display the receiving data.

4.3 LPC2148 Controller

LPC 2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kb to 512 kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 percentageswith minimal performance penalty.In-System Programming/In-Application Programming via on-chip boot Loader software. Single flash sector or full chip erase in 400 ms and programming of 256 B in 1 ms. Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.USB 2.0 Full-speed compliant device controller with 2 kb of endpoint RAM.

In addition, the LPC2148 provides 8 kb of on-chip Random Access Memory accessible to USB by Direct Memory Access.One or two 10-bit ADCs provide a total of 6/14Analog inputs, with conversion times as low as 2.44 ms per channel. Single 10-bit DAC provides variable analog output.Two 32-bit timers/external event counters (with four capture and four compareChannels each), Pulse Width Modulation unit (six outputs) and watchdog.Low power Real-Time Clock with the

Independent power and 32 kHz clock input.The LPC 2148 incorporate a 32 kb, 64 kb, 128 kb, 256 kb and 512 kb flash memory system respectively. This memory may be used for both code and data storage. Programming of the flash memory may be accomplished in several ways. It may be programmed In System via the serial port. The application program may also erase and/or program the flash while the application is running, allowing a great degree of flexibility for data storage field firmware upgrades, etc. Due to the architectural solution chosen for an on-chip boot loader, flash memory available for user's code on LPC 2148 is 32 kb, 64 kb, 128 kb, 256 kb and 500 kb respectively.

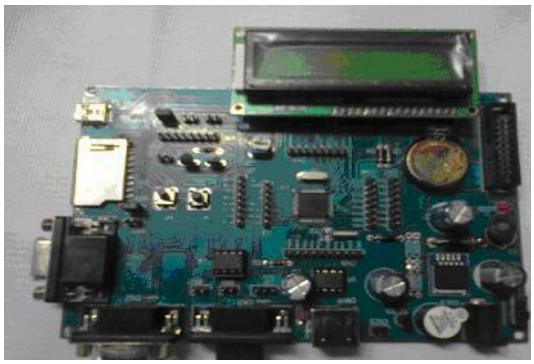

Fig.4LPC2148 Controller

4.4 Interfacing Pulse Width Modulation with LPC2148

Generate a Pulse width modulation in LPC2148 Primer Board at a particular frequency. Pulse Width Modulation is a technique for getting analog results with digital means. Digital control is used to create a square wave, a signal switched between on and off. This on-off pattern can simulate voltages in between full on (5 Volts) and off (0 Volts) by changing the portion of the time the signal spends on versus the time that the signal spends off. The duration of "on time" is called the pulse width. To get varying analog values, you change, or modulate, that pulse width.

Table.1 Pin assignment with LPC2148

	PWMs	**LPC2148 Lines**
OUTPUTS	PWM1	P0.0
	PWM3	P0.1

4.5 Ultrasonic Interfacing With LPC2148

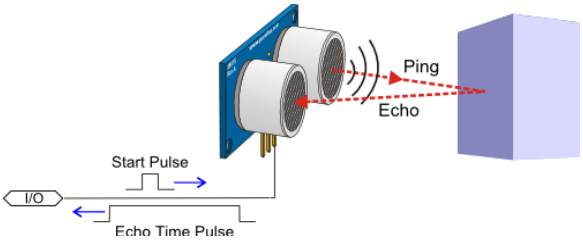

Fig.5 Ultrasonic Interfacing with LPC2148

The PING))) Ultrasonic works by sending sound waves and then the sensor signal emits a PWM that needs to be timed to detect the distance. The PWM width depends on the time it takes for the sound waves to bounce back from an object.Connect to your CPU Pin, such as P0.X, Configure P0.

X as output, and give a 20uS Pulse of HIGH then LOW ,Immediately configure P0.X as input,Take a snapshot of a hardware timer or start a hardware timer, Enable P0.X as falling edge interrupt, P0.X will go HIGH, and then LOW and the width of this HIGH wave corresponds to the object distance

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4.6 Vehicle Control Unit

For simulation purpose lpc2148 controller consider as a vehicle control unit. The personal computer unit is a receiving unit, that the receiving unit is user to transmitting the data with the help of IEEE 802.15.4 standard. The controller act as a transmitter with the help of the zigbee unit. In my phase 1 work of vehicle body is the personal computer build with .NET program that will generating the box for each data, what are the data want to be transmitted are created as a box unit. .NET Frameworkisdeveloped by Microsoft that runs primarily on Microsoft Windows. It is open source and Microsoft with .NET is extending it to run on Mac OS platforms and Linux. It includes a large class libraryknown as Framework Class Library and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment, an application virtual machine that provides services such as security, memory management, and exception handling. Programmers produce software by combining their own source code with .NET Framework and other libraries. .NET Framework is intended to be used by most new applications created for Windows platform.

Microsoft also produces an integrated development environment largely for .NET software called Studio. Framework Class Library:Framework Class Library is a library of functionality available to all languages using .NET Framework. Framework Class Library provides classes that encapsulate a number functions, including file reading writing, rendering, database interaction. It consists of classes, interfaces of reusable types that integrate Common Language Runtime.

V. WORKING MODEL

The working model of the system is presented here to transmitting the data theunit builds with LPC2148 controller for data transmission. The value of baud rate and the port for data transmission will be getting with help of the keyboard interfaced with the controller and keil c program of controller. The entered values are transmitted with the desire baud rate value to the receiver unit. The data will be transmitting to the receiving unit with the help of IEEE 802.15.4. So the lpc2148 controller interfacing with the keyboard, lcd display and connected with the zigbee unit .The serial communication converter used to convert the data between controller unit and the zigbee unit.

5.1 Instrument Cluster Unit:

The receiver unit is an instrument cluster unit; the instrument cluster unit is designed with LPC2148 Controller, motors, meters (speedometer, odometer), power supply unit, LCD display, and zigbee unit. The transmitter unit transmits the data to the receiver unit. The receiver zigbee unit pick up the transmitting data, that the received data given to the controller unit. The controller units scripting with the keil-c software .using the 'c' coding the receiving data will be get processing. The controller runs the motor at the receiving speed value and display the speed in the LCD display. The result will provide the wireless communication between the personal computer and the instrument cluster unit. Ultrasonic Sensor unit will sensing the safe distance between the vehicle if the distance excide the safe distance mean the controller provide the indication using buzzer at the time the speed get limited automatically. The transmitter unit program with keil c program for data transmitting. .that supports the exchange of types and object instances between libraries and applications written using any conformin c language. The wireless communication between the vehicle body control and instrument cluster unit for vehicle control with the help of keil.

Fig.6 working model of Wireless Instrument Cluster

VI. CONCLUSION

This project explored the design of a prototype model for wireless driving controls of instrument cluster in a vehicle. Wireless communication is transfer the data between two or more points that are not connected by an electrical conductor. Wireless communication will play a major role in efficient vehicle control systems; this project explores the wireless communication between transmitter and receiver unit. The transmitter unit is personal computer build with c Programs written for 'c' Framework execute in a software environment, receiver unit designed with controller unit with keil-c. This project has an advantageous nature of cutting down the present cost of the vehicle. It also helps in the reduction of the vehicle weight.

If this project idea isimplemented in present vehicular system then the detection of mechanical problems in vehicles will also become easy. Since in present system if there is a problem with broken wire then it's considered somewhat difficult for the mechanic man to find the correct wire and fix.

So to avoid these conditions this project seems to have some advantages to be noticed. Hence if the wired connection of the present vehicular system is replaced by wireless network communication then it will be a boon to the automobile industry as well as to mankind.

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