

ARM 7 Embedded Controllers for Vehicle Obstacle Detection and Safety System

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ABSTRACT: Technological approaches for detecting and monitoring fatigue levels of driver continue to emerge and many are now in the development, validation testing, or early implementation stages. Previous studies have reviewed available fatigue detection and prediction technologies and methodologies. As the name indicates this project is about advanced technologies in cars for making it more intelligent and interactive for avoiding accidents on roads. By using ARM7 this system becomes more efficient, reliable & effective. There are very less number of systems implemented on human behavior detection in or with cars. In this paper, we describe a real-time online safety prototype that controls the vehicle speed under driver fatigue. The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents. The main components of the system consist of number of real time sensors like eye blink, alcohol, Temperature, Vibration sensors, ultrasonic range finder sensor with software interface.

KEYWORDS: Embedded System, Sensors, Vehicle Tracking, Locking, Microcontroller, GPS, GSM

I. INTRODUCTION

Vehicle is the first place where safety starts. Hence we must try to equip it with the latest technologies and measures to make it a safe machine and also to keep ourself and our loved ones safe. Always remember that safety starts and ends with the person who drives the vehicle. The cars and trucks found today have high range of inbuilt safety accessories to protect their passengers. Before it used to be just seatbelts, but now more features have been included which are more advanced and efficient than seatbelts. Warning alerts and alarms are other security systems way here an embedded system has been designed to make the journey of the passengers inside a vehicle safe and secure with various recently found safety and security measures. When you think of work-related safety hazards, you probably think about what goes on inside the workplace. But one of the greatest threats to your safety is not in the workplace, but rather on the road. Someone is injured every 18 seconds. Over 2 million of those injuries turn out to be disabling. A person dies in a crash on U.S. Roads Every 11 minutes. In fact, motor vehicle accidents are the most common cause of death in the United States more than cancer or heart attacks. When we think about the serious accident, it could change your life- and not for the better. As of now most of the research and implementation on with mechanical behaviour of the car, its safety and passengers, but what if the driver misbehaviors what can be done? Each year, car enthusiasts salivate at the prospect of seeing what bleeding-edge designs automakers will unveil on the car show circuit. Those same enthusiasts are often disappointed when the amazing concepts still haven't made it to the auto dealer's showroom floor several years later. But before any new car model can ever go on sale to the public, it must first undergo a battery of testing to make sure it'll be safe, reliable and reasonably in tune with the demands of the motoring public. The government demands some of this testing, while other major components of it are devised by the car companies themselves in an effort to ensure they meet specific standards for performance, fuel economy, comfort and other measures, but those which don't are axed.

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(An ISO 3297: 2007 Certified Organization)

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II. RELATED WORK

1. W. SCHNEIDER AND R. M. SHIFFRIN, "CONTROLLED AND AUTOMATIC HUMAN INFORMATION PROCESSING: I. DETECTION SEARCH AND ATTENTION," *PSYCHOL., REV.*, VOL. 84, NO. 1, PP. 1–66, JAN. 1977.

FROM THIS PAPER WE REFER

A two-process theory of human information processing is proposed and applied to detection, search, and attention phenomena. Automatic processing is activation of a learned sequence of elements in long-term memory that is initiated by appropriate inputs and then proceeds automatically—without subject control, without stressing the capacity limitations of the system, and without necessarily demanding attention. Controlled processing is a temporary activation of a sequence of elements that can be set up quickly and easily but requires attention, is capacity-limited (usually serial in nature), and is controlled by the subject. A series of studies using both reaction time and accuracy measures is presented, which traces these concepts in the form of *automatic detection* and *controlled, search* through the areas of detection, search, and attention. Results in these areas are shown to arise from common mechanisms. Automatic detection is

shown to develop following consistent mapping of stimuli to responses over trials. Controlled search is utilized in varied-mapping paradigms, and in our studies, it takes the form of serial, terminating search. The approach resolves a number of apparent conflicts in the literature.

2. H. J. DAMVELD AND R. HAPPEE, "IDENTIFYING DRIVER BEHAVIOUR IN STEERING: EFFECTS OF PREVIEW DISTANCE," PRESENTED AT THE MEASURING BEHAVIOUR, UTRECHT, THE NETHERLANDS, 2012

FROM THIS PAPER WE REFER

In this paper, the first steps are taken to bring identification in driver steering tasks up to the same level as identification in aircraft piloting tasks. A study was performed to provide measurement data, to allow identification of the driving behavior in a curve negotiation task. The study aimed to separate two essential driver control components, being: 1. preview (feed forward) control using visual information regarding the upcoming road curvature, and 2. compensatory (feedback) control to minimize lateral position and heading error. Figure 1 shows a model adapted from [6] which shows two compensatory control loops, responding to a heading error (ϕ) and a lateral error (Y). Also a feed forward loop is shown, responding directly to the commanded heading ϕ_C . In a fixed base driving simulator, drivers were instructed to drive as they would normally do over a winding road. Two separate stimuli, commonly called forcing functions, were simultaneously applied being 1) the commanded road heading ϕ_C , and 2) a steering wheel disturbance δ_{SD} , representing disturbances due to wind and road irregularities.

3. N. OVCHAROVA, M. FAUSTEN, AND F. GAUTERIN, "EFFECTIVENESS OF FORWARD COLLISION WARNINGS FOR DIFFERENT DRIVER ATTENTION STATES," IN *PROC. IEEE IV SYMP.*, 2012, PP. 944–949.

FROM THIS PAPER WE REFER

In recent years various collision warning systems for rear-end crash situations have been introduced into the market. Their goal is to reduce the number of fatalities and to mitigate collision consequences. The challenge in the design for such functions is to achieve a high effectiveness for both attentive and inattentive drivers. A possible approach could be an adaptation of the human-machine interface (HMI) to driver attentiveness levels. This paper presents a preliminary study of different visual-acoustical HMI concepts performed in a driving simulator. The participants completed two drives with each warning signal. In the first drive they were distracted by a secondary task and in the second one they were in an attentive state. The statistical analysis of the inattentive drivers' data showed a significant reaction time reduction by employing an acoustical speech warning. A visual alert for inattentive subjects did not result in an

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additional reduction. Only a simple and intuitive visual display showed a significant reduction of response time for attentive participants. The results of this study show that for varying driver attentiveness levels a warning intensity adaptation is needed in order to increase the benefit and acceptance of the collision warning.

4. WAKAMATSU, KITAKYUSHU, HIBIKINOETEL [1] FROM THIS PAPER WE REFER

It proposed a new approach on Accident prevention system based on semantic network, here they used the web mining technique to analyse the web information by means of searching, recommending, surfing and visualizing the web. The objective of this paper is to build an accident prevention system by means of the semantic network. The system is built from a number of ranking algorithms based on generality and novelty measures extracted from an accident database.

5. P L NEEDHAM ET EL [2] FROM THIS PAPER WE REFER

It has used Accident Data Recorders (ADR's) in the area of commercial and public fleets have proved to have a considerable accident preventative effect and as a result have significantly reduced consequential costs. Apart from offering effective relief to professional drivers from the risk of erroneous liability the ADR has served well as a management tool to reduce collisions, damages and repair costs in an unexpected way.

6. HSIU FEN TSAI, AND JIAN- -- -JRLIN JRLINET EL [3]

FROM THIS PAPER WE REFER

made study to explore how to realize high performance collision warning system (CWS), providing the precaution against traffic crash in transit. An embedded hybrid adaptive network-based fuzzy inference system (ANFIS) plus quantum-tuned back-propagation neural network (QTBPNN) built anthem platform with Davinci+XScale-NAV270 was employed to realize collision warning system and they also installed motor vehicle event data recorder (MVEDR).

III. PRAPOSED BLOCK DIAGRAM

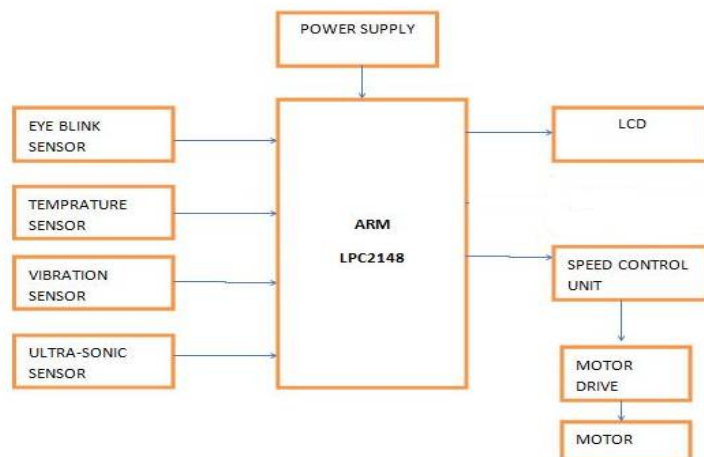


Figure No 01 System Architecture

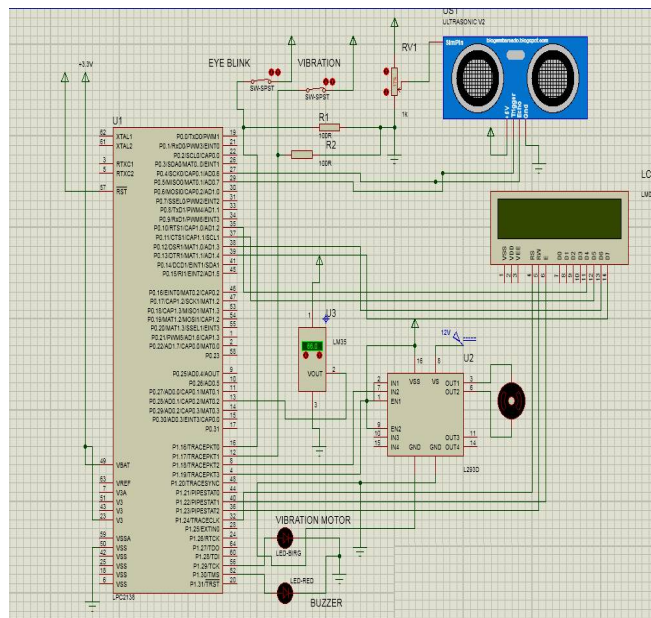
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EXPLANATION-

The proposed system makes use of latest technologies in monitoring driver fatigue and safety. Here we are using ARM 7 LPC 2148 real time sensor part for monitoring different parameter like eye blinking sensor, temperature and vibration and front and back distances. In this proposed system user directly interact with automotive. If there is change in sensor parameter sensor due to driver eye blink, temperature of vehicle and vibration then sensor sense these parameter and given to the ARM controller. The LPC 2148 controller generates control signal to the steering control and speed control of motor. The steering control unit is control wheel speed and control part connected to motor drive by using this system we can avoid accident mostly happening at midnight. Following flowchart explain the working operation of proposed system.



IV. ACTUAL WORKING OF THE SYSTEM

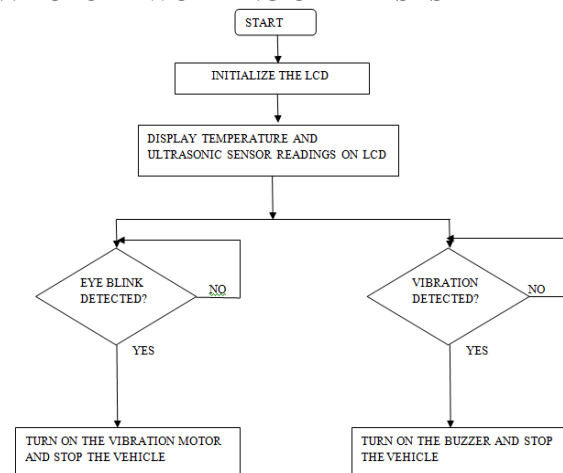


Figure No 02 Actual Working of the System

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V. COMPONENT USED

1. LLER : LPC2148

The LPC2148 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 a 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 % with minimal performance penalty.

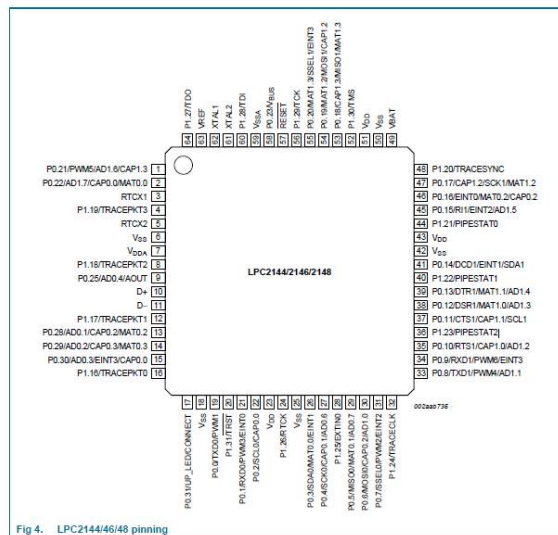


Figure No 03: Pin Diagram of LPC 2148

2. ULTRASONIC SENSOR HC-SR04

The ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1” to 13 feet. Its operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module.

Features:

- Power Supply :+5V DC
- Quiescent Current : <2mA
- Working Current: 15mA
- Effectual Angle: <15°
- Ranging Distance : 2cm – 400 cm/1" - 13ft
- Resolution : 0.3 cm
- Measuring Angle: 30 degree
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

3. EYE BLINK SENSOR

This project involves measure and control of the eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the reflected infrared rays of eye. If the eye is closed it

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indicates that the output of IR receiver is high otherwise the IR receiver output is low. This to know whether the eye is closed or open This output is give to the microcontroller which then turns on the vibration motor if the eye blinks.

4. LM 35/35

Temperature is the most-measured process variable in industrial automation. Most commonly, a temperature sensor is used to convert temperature value to an electrical value. Temperature Sensors are the key to read temperatures correctly and to control temperature in industrials applications.

5. Vibration Sensor

The piezoelectric sensor is used for flex, touch, vibration and shock measurement. Its basic principal, at the risk of oversimplification, is as follows: whenever a structure moves, it experiences acceleration. A piezoelectric shock sensor, in turn, can generate a charge when physically accelerated. This combination of properties is then used to modify response or reduce noise and vibration. vibration sensors are important because vibration and shock can shorten the life of any electronic and electromechanical system. Vibration or shock sensors are commonly used in alarm systems to activate an alarm whenever the devices to which they are attached are touched, moved, or otherwise vibrated. Commercial vibration sensors use a piezoelectric ceramic strain transducer attached to a metallic proof mass in order to respond to an externally imposed acceleration. Piezoelectric vibration sensors used for detecting vibration from various vibration sources are generally classified into two large types, resonant type and no resonant type. Vibration sensors are very useful in detecting collisions or accidents.

6. Power supply Design

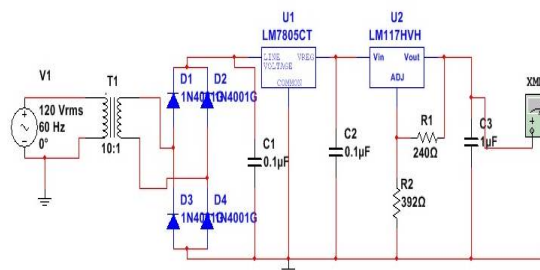


Figure No 04 Power supply Design

7. TRANSFORMER.

Once you have calculated the total current (I_t) choose one that fits the requirement. For example a 1Amp one for the 600mA power supplies. Now the rms secondary voltage (primary is whatever is consistent with your area) for our power transformer T must be our desired output V_o PLUS the voltage drops across diodes (two diodes). V_{o1} must be enough to feed the minimum operational input requirements for the LM7805 at all moments (min 7.3v to max 25v). For a 24vac secondary output like the O.P.'s one, I suppose it has a central tap (12vac from each terminal to central tap, 24vac across terminals), so here the secondary output is taken from central tap to one of the terminals. If it doesn't have a central tap and all you have is the 24vac output, it is recommended to use a different one due to the high V_p for this particular case

8. ABOUT C1 CAPACITOR

We saw in the previous section that the single phase half-wave rectifier produces an output wave every half cycle and that it was not practical to use this type of circuit to produce a steady DC supply. The full-wave bridge rectifier however, gives us a greater mean DC value ($0.637 V_{max}$) with less superimposed ripple while the output waveform is

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twice that of the frequency of the input supply frequency. We can therefore increase its average DC output level even higher by connecting a suitable smoothing capacitor across the output of the bridge circuit as shown below.

9. LM7805 (3Terminal regulator)

This is used to make the stable voltage of +5V for circuits. The LM7805 is three terminal positive regulators are available in the TO-220 - package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, More information refer Data sheet Of LM7805.

10. LCD Modules

HD44780 based LCD displays are very popular among hobbyists because they are cheap and they can display characters. Besides they are very easy to interface with microcontrollers and most of the present day high-level compilers have in-built library routines for them. The interface requires 6 I/O lines of the microcontroller: 4 data lines and 2 control lines.

VI. FLOW OF THE SYSTEM

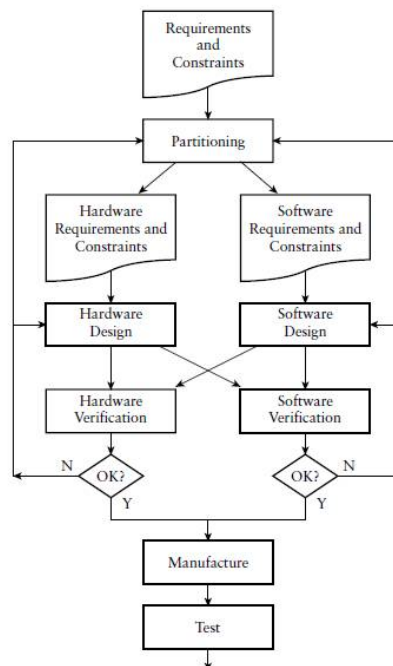


Figure No 05 Flow of the System

Explanation

We introduced the idea of an embedded system, a digital system in which one or more computers are used as components. Each embedded computer comprises a processor core, memory and interfaces with other parts of the system. Since the computers must be programmed to implement part of the system's functionality, we must augment our design methodology to include embedded software design. The initial inputs to the design methodology are the functional requirements and constraints for the system. As part of our architectural design considerations, we can choose which aspects of functionality can be implemented by embedded software on a processor core, and which parts can be implemented as digital sub circuits, that is, by hardware. Designing the hardware and software for a system

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together is called hardware/software cod design. Deciding which parts to put in hardware and which in software is called partitioning. There are numerous trade-offs to consider. Functionality that involves testing many conditions and taking alternative actions can be hard to implement in hardware, but is relatively straightforward in software. On the other hand, functionality that involves performing rapid computations on large amounts of data or data that arrives at a high rate may need a very high performance (and hence costly and power hungry) processor core, and so may more readily be performed by customized hardware. A further consideration is that embedded software may be stored in memory circuits that may be reprogrammed after the system is manufactured or deployed. Thus, the software may be upgraded to correct design errors or add functionality without revising the hardware design or replacing deployed systems. Once functionality has been partitioned between hardware and software, development of the two can proceed concurrently. For those aspects of the embedded software that depend on hardware, the abstract behavioral models from the hardware design task can be used to verify the software design. This can be done using an instruction-set simulator for the processor core working in tandem with a simulator for the hardware model. A similar approach can be used to verify parts of the hardware that interface directly with a processor core. Test programs can be run using the processor simulator running in tandem with the hardware simulator. The benefits of developing hardware and software concurrently include avoiding the extra time involved in developing one after the other, and early detection of errors in the interplay of software and hardware.

ADVANTAGES

- Maintenance is less
- It's safe
- Reduce the accident
- Steering control performance is high

APPLICATION

- Automotive application
- Modern cars and trucks

VII. CONCLUSION AND FUTURE SCOPE

It is due to the driver's fatigue, traffic accidents keep with a yearly increasing of a high rate. This paper shows the new fatigue detection algorithms & techniques using eye blink, alcohol, ultrasonic sensor etc. Sensors. In this technique the fatigue will be detected immediately and regular traps the events driver and third party. Through research presented in this paper, we propose an intelligent car system for accident prevention and making the world a much better and safe place to live. The automotive system consists of a number of subsystems. These subsystems are used to monitor the various controls of the vehicle. Data which is obtained through sensor, is used to monitor the various parameters in the vehicle. Every system which includes computer processing unit and carryout actions based on these inputs are referred to as an embedded system. Some of these applications are engine control, antilock brake system, temperature control, adaptive cruise control, collision avoidance, brake or throttle control, electronic stability control etc. The future scope of this research includes acquiring the information from sensors and then implementing the same using the above concept. In this field many research is going on to develop a full automatic system for future vehicle.

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