

Driver Gaze Tracking And Eyes Off The Road Detection System

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ABSTRACT

Aim: The project is developed aiming to minimize accident occurrence in vehicle crashes and near-crashes due to driver's eyes off the road.

Existing System: Driver monitoring has been a long standing research problem in computer vision and automotive driver monitoring system applications. Broadly speaking, there are two approaches to estimate gaze direction: one is Techniques that only use the head pose and the second is those that use the driver's head pose and gaze. For systems that rely only on head pose estimation the processing complexity increases in regard to the software requirement and for those that rely on head pose and gaze estimation are grouped into hardware and software based approaches Active Appearance Models (AAMs) for facial feature tracking and head pose estimation and 3D eye-model was used for accurate gaze estimation, both of these rely on near-infrared (IR) illuminators to generate the bright pupil effect. This system is not person-independent and must be calibrated for every system configuration and driver. Besides their complexity of integration and implementation these systems are too expensive to be installed in mass-produced cars and they require periodic re-calibration because vibrations cause the system calibration to drift over time.

Proposed Design: To overcome the above constraints the current work proposes a new method of Eyes off Road (EOR) detection system that is much simpler compared to the previous designs and due to which they are greatly inexpensive and mass producible The proposed system does not require any driver-dependent calibration or manual initialization and works in real time, during the day and night. The system also provides the choice of localization and can result in an effective design which offers a prospect to develop a complete automotive driver monitoring systems that would be affordable to maximum number of automotive variants and easily accessible and modifiable according to various utility vehicles.

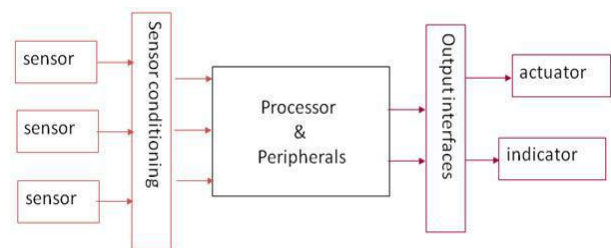
INTRODUCTION

Driver diversions are the main source of most vehicle crashes and close crashes. As indicated by an examination discharged by the National Highway Traffic Safety Administration (NHTSA) and the Virginia Tech Transportation Institute (VTTI) [16], 80% of accidents and 65% of close crashes include some type of driver diversion. What's more, diversions regularly happened inside three seconds previously the vehicle crash. Late reports have demonstrated that from 2011 to 2012, the quantity of individuals harmed in vehicle crashes identified with diverted driving has expanded 9%. In 2012 alone, 3328 individuals were slaughtered because of diverted driving accidents, which is a slight lessening

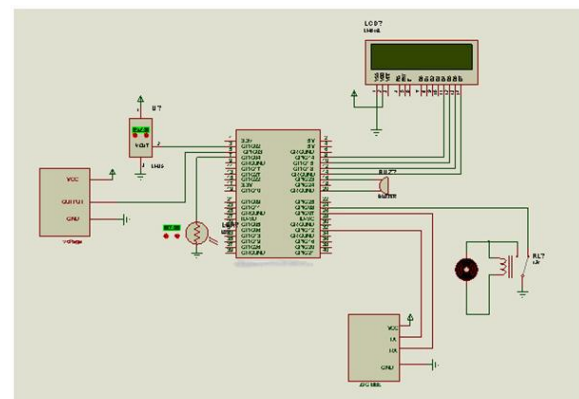
from the 3360 of every 2011. Occupied driving is characterized as any movement that could redirect a man's consideration far from the essential assignment of driving.

What is Embedded Technology

The embedded technology is a device or software that is hidden in a large device or structure. System embedded systems, in general, have computer inputs, processors, software, input sensors and outputs, controlling a particular device. The detailed specification of embedded systems is not easy. Unless otherwise indicated, general computer computers (monitor, keyboard, etc.) only have embedded systems. The system is one or several tasks that you organize or perform according to a set of rules, programs or plans. In other words, all units are assembled and grouped together according to a program or plan. An embedded system is a hardware-embedded software, application (s) or part of a specific application or part of a larger product or system. It processes a fixed set of pre-programmed instructions, which controls a greater system (computer, keyboard, display, etc.), which does not have an electromechanical device.



Schematic Diagram:



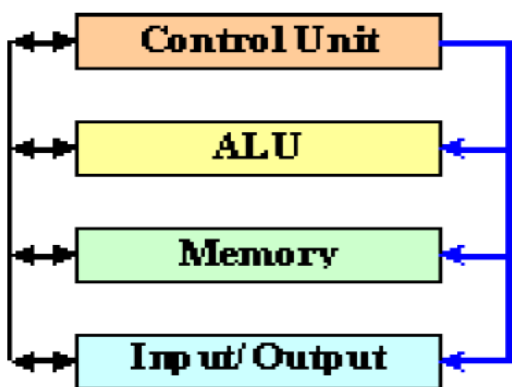
PROCESSORS FOR EMBEDDED SYSTEMS

General topics

This section should give a brief overview of many important topics related to the modern processor.

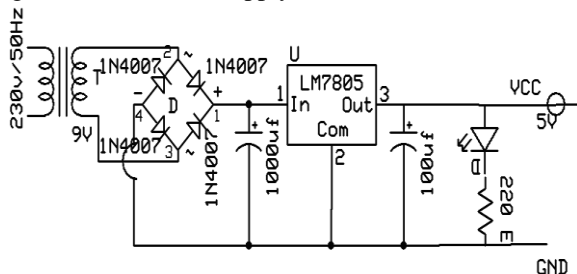
Infrastructure

A general purpose computer has four main sections: arithmetic and logic unit (ALU), control unit, memory and input and output device (I / O). These parts are interconnected. Control units, ALUs, registers, basic I / O and other closely related hardware are known as central processing units. Many different components were included in the initial CPU, but since the CPU has been built on an integrated circuit from the mid-1970s, which is called microprocessor



REGULATED POWER SUPPLY

The power equipment are designed to change high voltage AC mains electricity to a suitable short voltage supply for electronics circuits and other devices. A power supply can be conked out into a series of blocks, each of which performs a particular function. A DC power supply which maintains the output voltage constant irrespective of AC mains fluctuations or load variations is known as Regulated DC Power Supply.



Power supply section

Transformer

Rectifier

A circuit which is used to convert AC to DC is known as a rectifier. The process of conversion AC to DC is called rectification.

Filter

A filter is a gadget which evacuates the AC segment of a rectifier yield however enables the DC segment to achieve the heap.

Regulator

Voltage controller ICs are accessible with settled (normally 5, 12 and 15V) or variable yield voltages. The most extreme current they can pass additionally rates them. Negative voltage controllers are accessible, chiefly for use in double supplies. Most controllers incorporate some programmed security from intemperate current (overburden insurance) and overheating ('warm assurance'). A large number of the settled voltage controller IC's have 3 leads and look like power transistors, for example, the 7805 +5V 1A controller appeared on the privilege. The LM7805 is easy to utilize. You basically associate the positive lead of your unregulated DC control supply (anything from 9VDC to 24VDC) to the Input stick, interface the negative prompt the Common stick and after that when you turn on the power, you get a 5 volt supply from the yield stick.

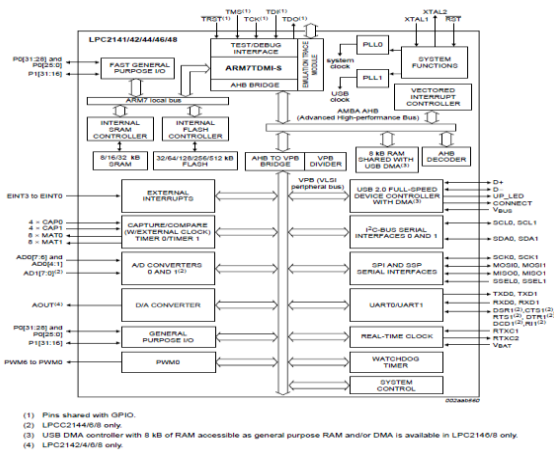


ARM LPC2148

Introduction

The LPC2148 microcontroller depends on a 32/16 bit ARM7TDMI-S CPU with constant copying and inserted follow bolster, that joins the microcontroller with implanted fast glimmer memory extending from 32 kB to 512 kB. A 128-piece wide memory interface and extraordinary quickening agent engineering empower 32-bit code execution at the greatest clock rate. For basic code estimate applications, the option 16-bit Thumb mode lessens code by more than 30 % with insignificant execution punishment.

BLOCK DIAGRAM



Architectural Overview

The LPC2148 comprises of an ARM7TDMI-S CPU with copying support, the ARM7

Local Bus for interface to on-chip memory controllers, the AMBA Advanced High-execution Bus (AHB) for interface to the intruder on controller, and the VLSI Peripheral Bus (VPB, a good superset of ARM's AMBA Advanced Peripheral Bus) for association with on-chip fringe capacities. The LPC2148 designs the ARM7TDMI-S processor in little-endian byte arrange. AHB peripherals are distributed a 2 megabyte scope of addresses at the extremely best of the 4 gigabyte ARM memory space. Each AHB fringe is assigned a 16 kB address space inside the AHB address space. LPC2148 fringe capacities (other than the intruder on controller) are associated with the VPB transport. The AHB to VPB connect interfaces the VPB transport to the AHB transport. VPB peripherals are additionally designated a 2 megabyte scope of addresses, starting at the 3.5 gigabyte address point. Each VPB fringe is assigned a 16 kB address space inside the VPB Address space.

ARM7TDMI-S Processor

The ARM7TDMI-S is a broadly useful 32-bit chip, which offers superior and low power utilization. The ARM design depends on Reduced Instruction Set Computer (RISC) standards, and the direction set and related disentangle system are substantially less difficult than those of small scale modified Complex Instruction Set Computers. This straightforwardness brings about a high guideline throughput and amazing ongoing intruder on reaction from a little and savvy processor center. Pipeline methods are utilized with the goal that all parts of the handling and memory frameworks can work ceaselessly. Regularly, while one guideline is being executed, its success or is being decoded, and a third direction is being go ten from memory.

The ARM 7TDMI-S processor likewise utilizes an exceptional building procedure known as THUMB, which makes it in a perfect world suited to high-volume

applications with memory limitations, or applications where code thickness is an issue.

The key thought behind THUMB is that of a super-lessened guideline set. Basically, the ARM7TDMI-S processor has two direction sets:

- The standard 32-bit ARM direction set
- A 16-bit THUMB direction set

Memory Maps

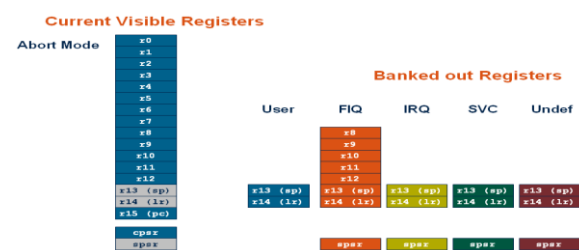
The LPC2148 joins a few particular memory areas, appeared in the accompanying figures. Figure demonstrates the general guide of the whole address space from the client program perspective after reset. The intruder on vector range bolsters address remapping, which is portrayed later in this segment.

Operating Modes of ARM

ARM has seven essential working modes

- User:** Unprivileged mode under which most assignments run.
- FIQ (Fast Interrupt reQuest):** Entered when a high need (quick) hinder is raised.
- IRQ (Interrupt reQuest):** Entered when a low need (typical) hinder is raised.
- Supervisor:** Entered on reset and when a product Interrupt guideline is executed.
- Abort:** Used to deal with vague guidelines.
- Undef:** Used to deal with vague guidelines.
- System:** Privileged mode utilizing an indistinguishable registers from client mode.

ARM Register Set



HD162A Liquid Crystal Display 16*2 Alphanumeric Dot Matrix Module



Liquid Crystal Display

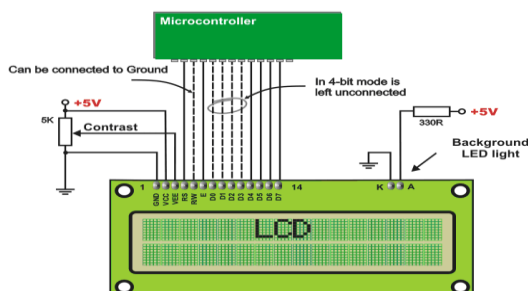
Liquid crystal displays (LCD s) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

LCD Operation

In recent years the LCD is finding widespread use replacing LED s (seven-segment LED or other multi segment LED s). This is due to the following reasons:

- ✓ The declining prices of LCD s.
- ✓ The ability to display numbers, characters and graphics. This is in contract to LED s, which are limited to numbers and a few characters.
- ✓ Incorporation of a refreshing controller into the LCD, there by relieving the CPU of the task of refreshing the LCD. In the contrast, the LED must be refreshed by the CPU to keep displaying the data.
- ✓ Ease of programming for characters and graphics

LCD Interfacing



SERIAL COMMUNICATION

Computers can transfer data in two ways: parallel and serial. In parallel data transfers, often 8 or more lines (wire conductors) are used to transfer data to a device that is only a few feet away. Examples of parallel data transfer are printers and hard disks; each uses cables with many wire strips. Although in such cases a lot of data can be transferred in a short amount of time by using many wires in parallel, the distance cannot be great.

To transfer to a device located many meters away, the serial method is used. In serial communication, the data is sent one bit at a time, in contrast to parallel communication, in which the data is sent a byte or more at a time. Serial communication of the 8051 is the topic of this chapter. The 8051 has serial communication capability built into it, there by making possible fast data transfer using only a few wires.

Asynchronous Serial Communication and Data Framing

Start and Stop Bits

Data Transfer Rate

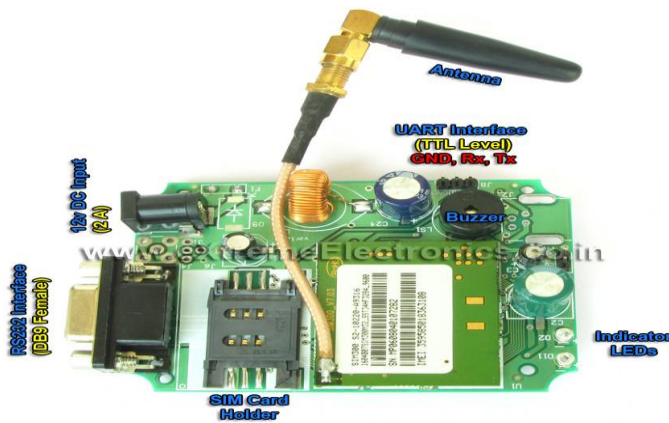
RS232 Standards

RS232 PINS

MAX 232 Serial Line Drivers

GSM MODEM

Unlike mobile phones, a GSM modem doesn't have a keypad and display to interact with. It just accepts certain commands through a serial interface and acknowledges for those. These commands are called as AT commands. There are a list of AT commands to instruct the modem to perform its functions. Every command starts with "AT". That's why they are called as AT commands. AT stands for attention.



KEIL μ VISION-3

Flash Magic 5.65

Flash Magic is a PC tool for programming flash based microcontrollers from NXP using a serial protocol while in the target hardware.

FEATURES

- Straightforward and intuitive user interface.
- Five simple steps to erasing and programming a device and setting any options desired.
- Programs Intel Hex Files. Automatic verifying after programming
- fills unused Flash to increase firmware security.
- Ability to automatically program checksums. Using the supplied checksum calculation routine your firmware can easily verify the integrity of a Flash block, ensuring no unauthorized or corrupted code can ever be executed.
- Program security bits.
- Check which Flash blocks are blank or in use with the ability to easily erase all blocks in use.
- Read the device signature.
- Read any section of Flash and save as an Intel Hex File.
- Reprogram the Boot Vector and Status Byte with the help of confirmation features that prevent accidentally programming incorrect values.

EMBEDDED C LANGUAGE

Data Types

We know the word “Data types” in C- Language. Here also the functionality and the meaning of the word is same except a small change in the prefix of their labels. Now we will discuss some of the widely used data types for embedded C- programming.

APPLICATIONS

APPLICATIONS

1. All the parameters can be viewed on the mobile phone.
2. Most reliable.
3. Cost effective.
4. Supports innumerable sensors to the system.

SENSORS

Introduction to Sensors

A sensor is a device that produces a measurable response to a change in a physical condition, such as temperature or thermal conductivity, or to a change in chemical concentration. Sensors are particularly useful for making on site measurements such as in industrial process control. Sensors are an important part to any measurement and automation application. The sensor is responsible for converting some type of physical phenomenon into a quantity measurable by a Data Acquisition System.

MQ-6 ALCOHOL GAS SENSOR

SEAT BELT SENSOR (SWITCH)

IR SENSOR

MEMS

ULTRASONIC

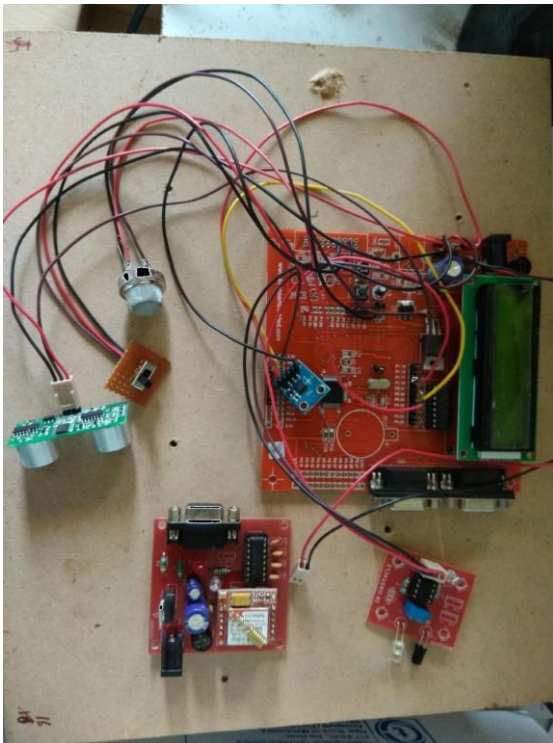
SENSOR

SOFTWARE REQUIREMENTS

This Design and Implementation of Driver Gaze Tracking And Eyes Off The Road Detection System can be employed in the following applications:

1. .Applicable in design of efficient automotive driver monitoring systems.
2. .Applicable in development of advanced automotive pre-crash alert systems.

RESULTS



CONCLUSION

This paper describes a real-time EOR system using the video from a monocular camera installed on steering wheel column. Three are the main novelties of the proposed system:

- (1) Robust face landmark tracker based on the Supervised Descent Method,
- (2) accurate estimation of 3D driver pose, position, and gaze direction robust to non rigid facial deformations,

(3) 3D analysis of car/driver geometry for EOR prediction.

The proposed system is able to detect EOR at day and night, and under a wide range of driver's characteristics (e.g., glasses/sunglasses/no glasses, ethnicities, ages, ...). The system does not require specific calibration or manual initialization. More importantly, no major re-calibration is necessary if the camera position is changed or if we re-define a new on-the- road area. This is due to the explicit use of 3D geometric reasoning. Hence, the installation of the system in different car models does not require any additional theoretical development. The system achieved an accuracy above 90 % for all of the scenarios evaluated, 63 including night time operation. In addition, the false alarm rate in the on-the- road area is below 5 %. Our experiments showed that our head pose estimation algorithm is robust to extreme facial deformations. While our system provided encouraging results, we expect that improving the facial feature detection in challenging situations (e.g., profile faces, faces with glasses with thick frames) will boost the performance of our system. Currently, we are also working on improving the pupil detection using Hough transform-based techniques to further improve the gaze estimation.

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