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An Effective Pedestrian Detection Method for Driver Assistance System

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Abstract:

Due to the rise in the car accidents, the Driver Assistance System (DAS) becomes an important technology in the automobile industry. So many accidents occurred due to the non awareness of the driver and the pedestrians. So many methods are implemented previously. These methods are not effective. In our existing system there is no such automatic method to detect pedestrian. In the existed system, driver assistance system typically adopts the wide-angle camera to obtain a wide-view image. However, the wide-angle camera often produces radial distortion. To overcome these problems we go for a new system. This proposed system consists of two technologies for avoiding accidents. One is Driver Assistance System (DAS) to help the driver in the driving process and the other is the image processing technique in which web cam is used to capture and process the pedestrian image, and the outputs are sent to the driver. In the DAS, various sensors are mounted at the front side, and rear parts of the vehicle for sensing pedestrians or obstacles around the vehicle. If the pedestrian is detected, this information is sent to the driver circuit and the speed of the motor is decreased or stopped according to the distance provided by Ultrasonic Sensor. Day by day demand for the automation is increasing in square law manner to increase security, safety and life time of people and vehicles in different ways. This project comes under the same category.

I. INTRODUCTION

In the DAS, various sensors such as radar, laser, image, ultrasonic sensor are mounted at the front side, and rear parts of the vehicle for sensing pedestrians or obstacles around the vehicle. Among these sensors, the Ultrasonic Sensor is widely used in the DAS because it provides information about the distance between the vehicle and the pedestrian to the driver. This information is displayed on the LCD screen of type 16X2 which means two rows of 16 characters each. It has LED back light. If the distance is very far, then there is no change in the speed of the motor. If the distance is little far, then the speed of the motor is slow down. If the distance is very near, then the motor is stopped. This is the operation of the driver circuit involved in this project.

FIG 1: ULTRASONIC SENSOR - HC-SR04

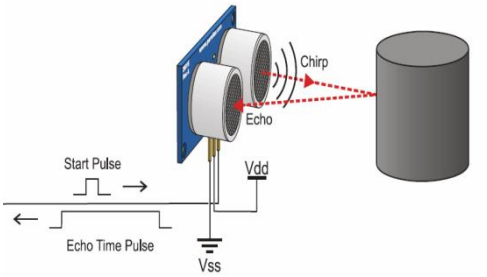

FIG 2: OPERATION OF ULTRASONIC SENSOR

RS-232:

In order to connect micro controller to a modem or a pc to modem a serial port is used. Serial is a very common protocol for device communication that is

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standard on almost every PC. Most computers include two RS-232 based serial ports. The concept of serial communication is simple. The serial port sends and receives bytes of information one bit at a time. Although this is slower than parallel communication, which allows the transmission of an entire byte at once, it is simpler and can be used over longer distances. RS-232 hardware can be used for serial communication up to distances of 50 feet.

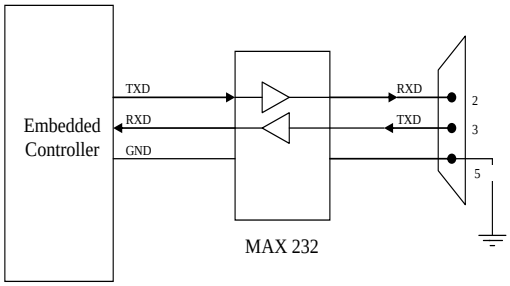

FIG 3: INTERFACING MICROCONTROLLER WITH RS 232

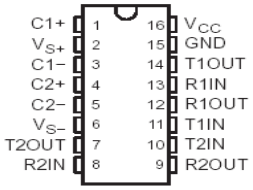

FIG 4: PIN DIAGRAM OF MAX232 Function Tables

Each Driver

INPUT TIN	OUTPUT TOUT
L	H
H	L

H=high level, L=low level

Each Receiver

Each Receiver

INPUT RIN	OUTPUT ROUT
L	H
H	L

H=high level, L=low level

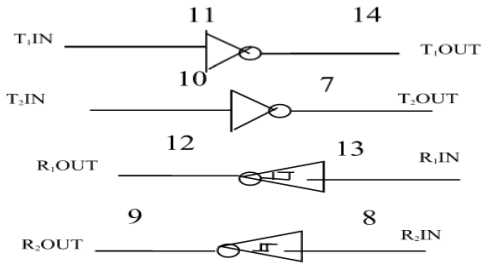

FIG 5: LOGIC DIAGRAM (POSITIVE LOGIC)

II. RELATED WORK

LPC2148 Internal Features: The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM7TDMI-S processor also employs a unique architectural strategy known as THUMB, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind THUMB is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets: The standard 32-bit ARM instruction set and a 16-bit THUMB instruction set.

On chip Flash Memory System:

The LPC2141/2/4/6/8 incorporates 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.

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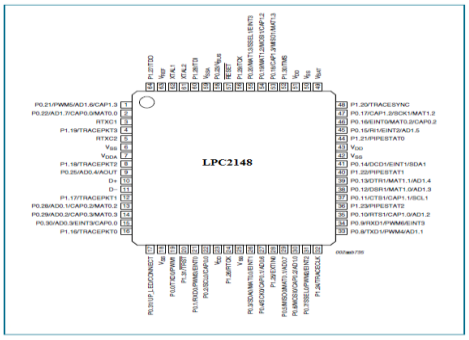


FIG 6: PIN DIAGRAM OF LPC2148

Image working formats in MATLAB:

If an image is stored as a JPEG image on your disc we first read it into MATLAB. However, in order to start working with an image, for example perform a wavelet transform on the image, we must convert it into a different format. This section explains four common formats.

- Intensity image (Gray scale image)
- Binary image
- Indexed image
- RGB image

Software Specification:

MATLAB (matrix laboratory) is a numerical computing environment and fourth-generation programming language. Developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and FORTRAN.

Features of MATLAB:

High level language for technical computing. Development environment for managing code, files, and data. Interactive tools for iterative exploration, design, and problem solving. Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, and numerical integration.2-D and 3-D graphics functions for visualizing data .Tools for building custom graphical user interfaces .Functions for integrating MATLAB based algorithms with external applications and languages, such as C, C++, Fortran, Java™, COM, and Microsoft Excel.

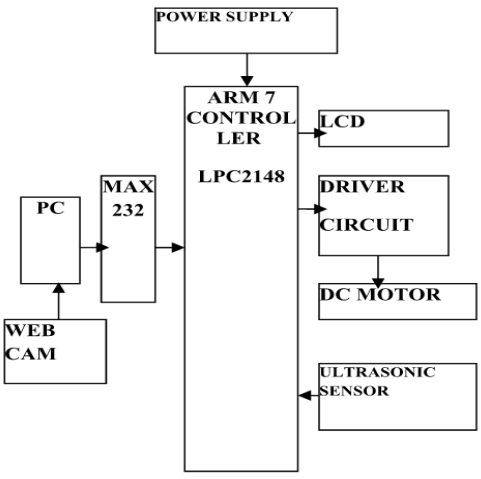
Interfacing with other languages:

MATLAB can call functions and subroutines written in the C programming language or FORTRAN. A wrapper function is created allowing MATLAB data types to be passed and returned. The dynamically loadable object files created by compiling such functions are termed "MEX files" (for MATLAB executable).

III. WORKING

This project is mainly used for detecting pedestrians and for avoiding accidents. In this project, the mat lab code written will be keep on detecting pedestrians. If the pedestrian is detected, the controller starts sending the characters serially to the driver circuit nothing but the relays. This information is compared with the stored information. If it is apt then the driver circuit sends information to the ultrasonic sensor. The ultrasonic sensor is used to find the distance between pedestrian and the vehicle. Depending on the distance calculated, the ultrasonic sensor sends information to the motor circuit whether it should be stopped or slow down. All the information is displayed on LCD screen of type 16x2 which means 2 rows of 16 characters each.

BLOCK DIAGRAM



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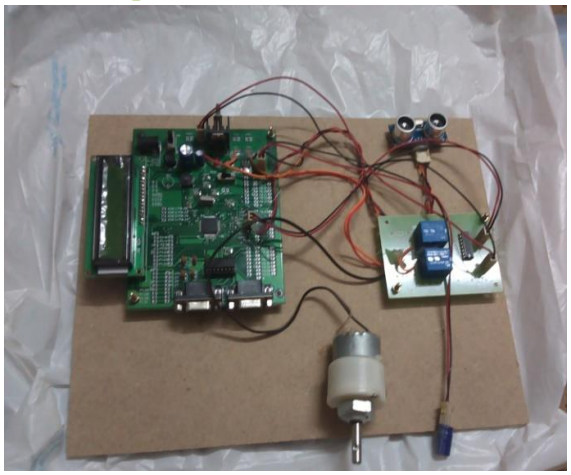
Hardware Implementation:



Hardware Components:

1.ARM7 LPC2148 Theory:

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real time emulation and embedded trace support, that combine 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.

Features:

• 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
• 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128 bit wide interface/accelerator enables high speed 60 MHz operation.
• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.
• Embedded ICE RT and 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 LPC2146/8 provide 8 kB of on-chip RAM accessible to USB by DMA.
• One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14 analog inputs, with conversion times as low as 2.44s per channel.
• Single 10-bit D/A converter provides variable analog output.
• Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
• Low power real-time clock with independent power and dedicated 32 kHz clock input.
• Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
• Vectored interrupt controller with configurable priorities and vector addresses.
• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.

• Up to nine edge or level sensitive external interrupt pins available.

Control Functions:

The System Control Block includes several system features and control registers for a number of functions that are not related to specific peripheral devices. These include:
• Crystal Oscillator
• External Interrupt Inputs
• Miscellaneous System Controls and Status
• Memory Mapping Control
• PLL
• Power Control
• Reset
• APB Divider
• Wakeup Timer
Each type of function has its own register(s) if any are required and unneeded bits are defined as reserved in order to allow future expansion. Unrelated functions never share the same register addresses.

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2. MAX 232 ---- Dual Driver/Receiver

Features:

- Operates from a single 5V Power Supply with 1.0uF Charge-Pump Capacitors
- Operates up to 120 k bit/s
- Two Drivers and Two Receivers
- ±30 V Input Levels
- Low Supply Current . . . 8 mA Typical

Upgrade with Improved ESD (15kV HBM) and 0.1uF Charge-Pump Capacitors is available With the MAX202.

Applications-- TIA/EIA-232-F, Battery-Powered Systems, Terminals, Modems, and Computers

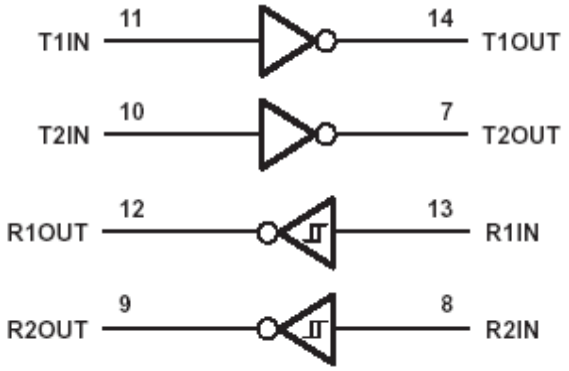
Description:

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5V supply. Each receiver converts TIA/EIA-232-F inputs to 5V TTL/CMOS levels. These receivers have a typical threshold of 1.3V, a typical hysteresis of 0.5 V, and can accept up to 30V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

MAX232 is primary used for people building electronics with an RS232 interface. Serial RS232 communication works with voltages (-15V ... -3V for high) and +3V ... +15V for low) which are not compatible with normal computer logic voltages. To receive serial data from an RS232 interface the voltage has to be reduced, and the low and high voltage level inverted. In the other direction (sending data from some logic over RS232) the low logic voltage has to be "bumped up", and a negative voltage has to be generated, too.

	RS232 Logic	TTL
High	-15 … -3V <-> +2V … +5V <->	
Low	+3V … +15V <-> 0V …+0.8V <->	

Logic Diagram: (Positive Logic)



In this circuit the microcontroller transmitter pin is connected in the MAX232 T2IN pin which converts input 5v TTL/CMOS level to RS232 level. Then T2OUT pin is connected to reviver pin of 9 pin D type serial connector which is directly connected to PC.

In PC the transmitting data is given to R2IN of MAX232 through transmitting pin of 9 pin D type connector which converts the RS232 level to 5v TTL/CMOS level. The R2OUT pin is connected to receiver pin of the microcontroller. Likewise the data is transmitted and received between the microcontroller and PC or other device vice versa.

3. Power supply:

The ac voltage, typically 220Vrms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltages regulator IC units.

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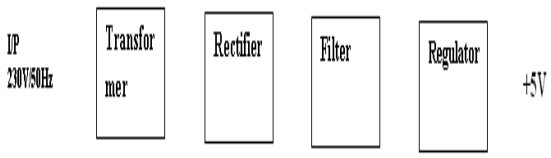
Block Diagram:



4. Ultrasonic Sensor:

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

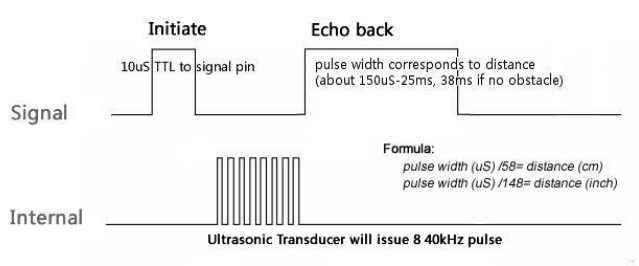
- VCC -> Arduino +5V pin
- GND -> Arduino GND pin
- Trig -> Arduino Digital Pin 2
- Echo -> Arduino Digital Pin 2

Features:

- Detecting range: 3cm-4m
- Best in 30 degree angle
- Electronic brick compatible interface
- 5VDC power supply
- Breadboard friendly
- Dual transducer

Hardware Installation:

A short ultrasonic pulse is transmitted at the time 0, reflected by an object. The senor receives this signal and converts it to an electric signal. The next pulse can be transmitted when the echo is faded away. This time period is called cycle period. The recommend cycle period should be no less than 50ms. If a 10μs width trigger pulse is sent to the signal pin, the Ultrasonic module will output eight 40kHz ultrasonic signal and detect the echo back. The measured distance is proportional to the echo pulse width and can be calculated by the formula above. If no obstacle is detected, the output pin will give a 38ms high level signal.



5. Driver circuit:

Driver circuit is nothing but the relay circuit in this project.

Applications:

Relays are used:

•To control a high-voltage circuit with a low-voltage signal, as in some types of modems,

•To control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile,

•To detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers (protection relays),

•To isolate the controlling circuit from the controlled circuit when the two are at different potentials, for example when controlling a mains-powered device from a low-voltage switch. The latter is often applied to control office lighting as the low voltage wires are easily installed in partitions, which may be often moved as needs change. They may also be controlled by room occupancy detectors in an effort to conserve energy,

•To perform logic functions. For example, the boolean AND function is realized by connecting relay contacts in series, the OR function by connecting contacts in parallel. Due to the failure modes of a relay compared with a semiconductor, they are widely used in safety critical logic, such as the control panels of radioactive waste handling machinery.

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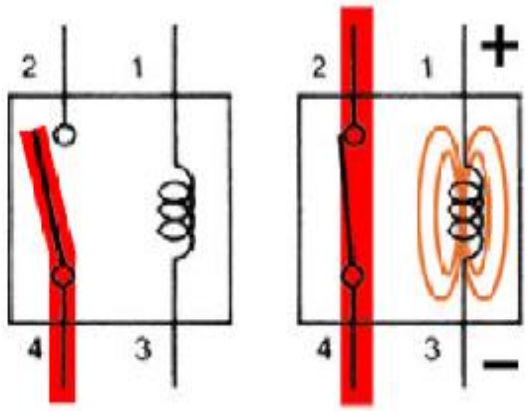
•As oscillators, also called vibrators. The coil is wired in series with the normally closed contacts. When a current is passed through the relay coil, the relay operates and opens the contacts that carry the supply current. This stops the current and causes the contacts to close again. The cycle repeats continuously, causing the relay to open and close rapidly. Vibrators are used to generate pulsed current.

•To generate sound. A vibrator, described above, creates a buzzing sound because of the rapid oscillation of the armature. This is the basis of the electric bell, which consists of a vibrator with a hammer attached to the armature so it can repeatedly strike a bell.

•To perform time delay functions. Relays can be used to act as an mechanical time delay device by controlling the release time by using the effect of residual magnetism by means of a inserting copper disk between the armature and moving blade assembly.



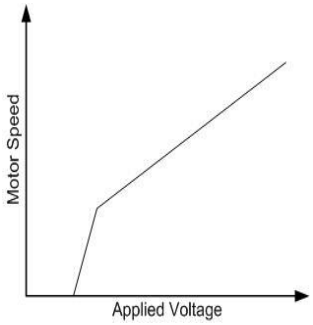
6. DC Motor:

The brushed DC motor is one of the earliest motor designs. Today, it is the motor of choice in the majority of variable speed and torque control applications.

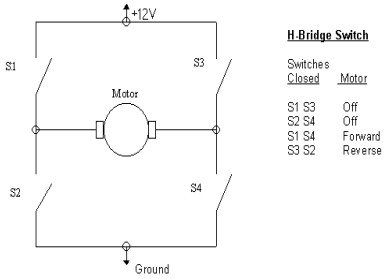
Advantages

•Easy to understand design
•Easy to control speed
•Easy to control torque
•Simple, cheap drive design

Motor Speed Curve



Motor Driver Circuit



Truth Table				
High Left	**High Right**	**Low Left**	**Low Right**	**Description**
On	Off	Off	On	Motor runs clockwise
Off	On	On	Off	Motor runs anti-clockwise
On	On	Off	Off	Motor stops or decelerates
Off	Off	On	On	Motor stops or decelerates

7. Liquid Crystal Display (LCD)

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing

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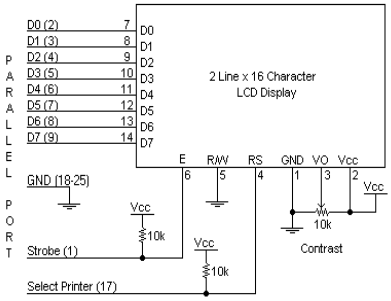
through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.
Here we use 16x2 LCD.

Description Of 16x2:

This is the first interfacing example for the Parallel Port. We will start with something simple. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if no all Parallel Ports. It however doesn't show the use of the Status Port as an input. So what are we interfacing? A 16 Character x 2 Line LCD Module to the Parallel Port. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board.

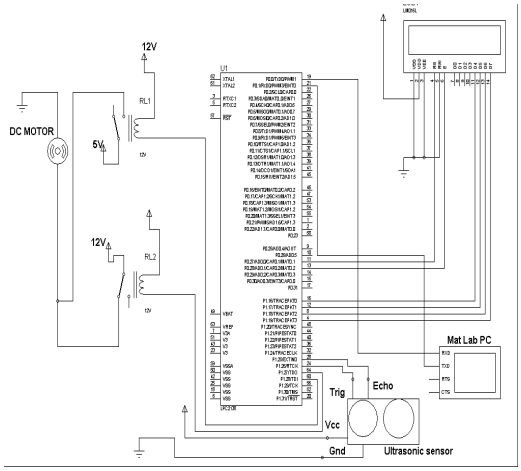
Schematic Diagram:



16 x 2 Alphanumeric LCD Module Specifications:

Pin	Symbol	Level	Function
1	V_{SS}	-	Power, GND
2	V_{DD}	-	Power, 5V
3	Vo	-	Power, for LCD Drive
4	RS	H/L	Register Select Signal H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (LCD->MPU) L: Data Write (MPU->LCD)
6	E	H,H->L	Enable
7-14	DB0-DB7	H/L	Data Bus; Software selectable 4- or 8-bit mode
15	NC	-	NOT CONNECTED
16	NC	-	NOT CONNECTED

Schematic Diagram Of Effective Pedestrian Detection method using ARM7:



ADVANTAGES:

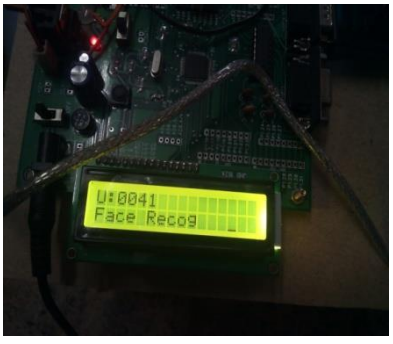
- Low cost
- Easy to implement
- Automated operation
- Low power consumption
- Fast and accurate
- User friendly design

APPLICATIONS:

- Used in Motor Vehicles and in Laboratories.
- Used to detect pedestrians and for stopping movement of the vehicle.

IV.TEST AND RESULT

A. When face is detected, output shown on LCD



Here U indicates Ultrasonic sensor and the number 0041 indicates distance between pedestrian and the vehicle.

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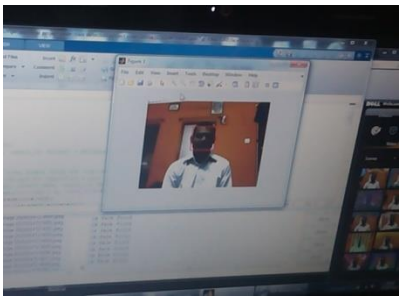
B. When the face is not detected, output shown on LCD

When the distance between vehicle and pedestrian is less than 40cm the vehicle stops automatically. If the distance is >40 and <100 the vehicle motor is slowed down automatically. If the distance is >2.5m the motor runs continuously.

C. When the face is detected, output shown in webcam



In this output a red line is shown if the face of pedestrian is detected.

V.CONCLUSION:

In this paper I have implemented an embedded system that identifies the pedestrians that come across the car and the breaks are applied automatically. The system identifies pedestrians with the help of ultrasonic sensor. All the information is displayed on LCD. Finally the system effectively works if it is fitted in the car.

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