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Research Article

AUTOMATIC FIRE ALERT SYSTEM FOR AUTOMOBILES

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ABSTRACT

Automatic fire alert system for automobiles is a system which can sense the presence of fire and smoke and generate a series of alarm driven events after it. When the fire is detected it turns on a motor which is depicted in the project as breaking mechanism. Thus by this the car can be stopped and the passengers and other payloads can be safeguarded thereafter. Along with breaking, the system sounds a buzzer that would alert nearby people around it so that they can be cautious about the presence of fire in the vehicle. Also, an SMS is sent to the Fire safety Authorities which will help them to take quick decisions to take control of the fire. Hence this project offers a very robust mechanism for safety in the vehicles which works automatically with the help of microcontrollers and sensors.

INTRODUCTION

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc. Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose. Examples Small controllers and devices in our everyday life like Washing Machine, Microwave Ovens, where they are embedded in.

Through this system we aim to integrate the various features of an embedded system to solve a real time problem. In our system we plan to inherit various functions performed by different components and program it to function based on a systematic alarm driven manner. Some of these functions include hazard detection, buzzer alert system, deceleration using braking mechanism and finally data transfer through Global system for mobile communication (GSM).

Ease of Use

Even though the system is capable of handling multiple tasks at various levels, it is user friendly in nature. The construction is robust and easily comprehendible. The various compositions of chemicals leading to a fire outbreak in a vehicle are monitored using a sensor. The sensor gets activated when the appropriate conditions leading to a fire outbreak prevail. This is followed by a number of alarm driven events. The events preceding are fully automatic and require no manual intervention. Hence it has quick response feature along with good reliability.

OBJECTIVES

The objectives of the system fall under two categories-Long term and Short term.

The Long-Term Objectives Include

- Highly efficient and reliable method for fire detection and prevention in automobiles.
- Easy identification of the causes leading to a fire outbreak in automobiles.
- Increasing the rate of response for safety systems in automobiles.

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The short-term objectives include

- Early detection of possibility for fire outbreak in automobiles
- To design a system requiring minimal manual intervention.
- To design and develop a user-friendly device in order to prevent the loss of life and property due to fire outbreak in automobiles.

METHODOLOGY

The automatic fire alert system for automobiles is a system which works based on four stages. All the stages are activated within a specified time interval and programmed to function in a well-organized manner. The use of embedded system greatly reduces the size of the system and can be easily fixed on a vehicle with easy. Due to the versatility of embedded system components in today's world, the cost of such components are found to be reducing and this eliminates the cost barrier.

The four Stages of the System are as Follows

- ✓ Fire detection.
- ✓ Deceleration using braking mechanism.
- ✓ Activation of buzzer alarm to alert the driver as well as the people around the vehicle.
- ✓ Transfer of information to the nearest fire authority regarding the event.

Block Diagram

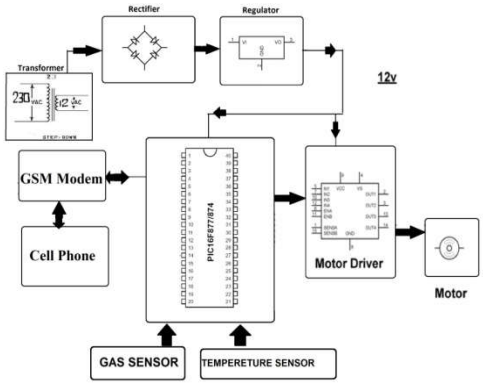

Figure 1 Block diagram of Automatic fire alert system for Automobiles

The figure 1 depicts various amenities used in developing a robust automatic fire alert system for automobiles. The central processor is a PIC16F877A microcontroller. It is programmed to execute various alarm driven events. The microcontroller is connected to a gas sensor and a temperature sensor. The gas sensor used in the system is sensitive towards fumes produced due to LPG, Petroleum, Kerosene and Butane. The temperature sensor senses the temperature and detects the temperature increase. When there is an optimum composition of chemicals and a linear increase in temperature, the first section of the system gets activated. This marks the beginning of the second phase which involves deceleration using a motor which is connected to the microcontroller through a motor driver IC. The motor acts in such a way that it pushes the brake pedals and slows down the vehicle, eventually bringing it to a halt. Subsequently, a buzzer is activated which produces a loud noise which can be heard by the driver and he/she can recognize the possibility of a fire outbreak inside the vehicle. The microcontroller is also connected to a GSM module which sends a text message to the fire authorities stating the details of the event along with the information regarding the vehicle. The whole system is powered using 12V DC and the power circuit utilizes a rectifier and a regulator. In this way the system successfully reduces the risk caused to life and property by employing a accurate and reliable mechanism to identify the hazard and providing ample amount of time to take corrective measures.

Layout Diagram

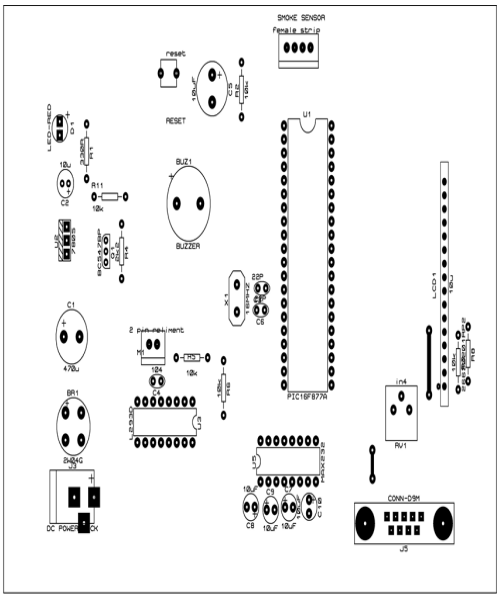

Figure 2 Layout diagram for Automatic fire alert system for Automobiles

Figure 2 represents the PCB layout diagram used to design the automatic fire alert system for automobiles. The diagram is designed using computer software. The layout is further printed out in a photo paper. After further processes the layout is finally implemented on a copper board which acts as a printed circuit board. Conductivity is achieved at required terminals and the components are soldered onto the board.

Microcontroller Description

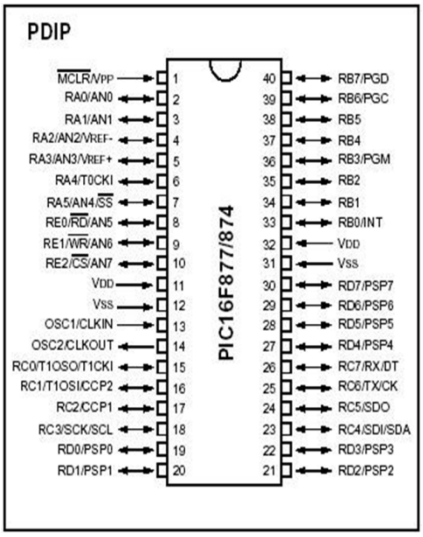

Figure 3 Pin diagram of microcontroller

Figure 3 describes about the various pins included in the PIC16F877/874 microcontroller. There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The EEPROM data memory block is detailed in Section 3.0 "Data EEPROM and Flash Program Memory". Additional information on device memory may be found in the PIC micro Mid-Range MCU Family Reference Manual (DS33023).

The PIC16F87XA devices have a 13-bit program counter capable of addressing an 8K word x 14 bit program memory space. The PIC16F876A/877A devices have 8K words x 14 bits of Flash program memory, while PIC16F873A/874A devices have 4K words x 14 bits.

Special Microcontroller Features

- ✓ 100,000 erase/write cycle Enhanced Flash program memory typical.
- ✓ 1,000,000 erase/write cycle Data EEPROM memory typical.
- ✓ Data EEPROM Retention > 40 years.
- ✓ Self-reprogrammable under software control.
- ✓ In-Circuit Serial Programming™ (ICSP™) via two pins.
- ✓ Single-supply 5V In-Circuit Serial Programming.
- ✓ Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation.
- ✓ Programmable code protection.
- ✓ Power saving Sleep mode.
- ✓ Selectable oscillator options.
- ✓ In-Circuit Debug (ICD) via two pins.

Db9 Connector

This is a common connector used in many computer, audio/video, and data applications. The official name is D-sub miniature, but many people call it "D-sub" or just "DB". The connector gets its name from its trapezoidal shape that resembles the letter "D". Most DB connectors have two rows of pins. Common types of D-sub connectors are DB9 and DB25, used on PCs for serial and parallel ports.

Table 1 for DB9 Connector pin description.

Pin number	Name	
1	CD - Carrier Detect	
2	RXD - Receive Data	
3	TXD - Transmit Data	
4	DTR - Data Terminal Ready	
5	GND - Signal Ground	
6	DSR - Data Set Ready	
7	RTS - Request To Send	
8	CTS - Clear To Send	
9	RI - Ring Indicator	
	Shield	

Table 1.drafts out details regarding the pin functions in DB9 connector. D-sub connectors are usually described by the total number of pins that they can hold. In some cases, a DB25 connector may only have 4 or 5 pins loaded into it; however, it is still called a "DB25" connector and not a "DB4" or "DB5". Another example is the HD15 connector used by monitors—most monitor cables only are loaded with 14 pins, but it is still called an HD15 connector.

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One special type of D-sub connectors is the High-Density DB style, which looks just like a regular DB connector, only with pins that are slightly smaller and placed closer together. This is typically referred to as an "HD" connector. HD connectors often have three rows of pins instead of two. The most common HD connector is the HD15, which is found on PC video cards and monitors. DB- and HD-connectors use thumbscrews to secure the connector in place.

Output Window

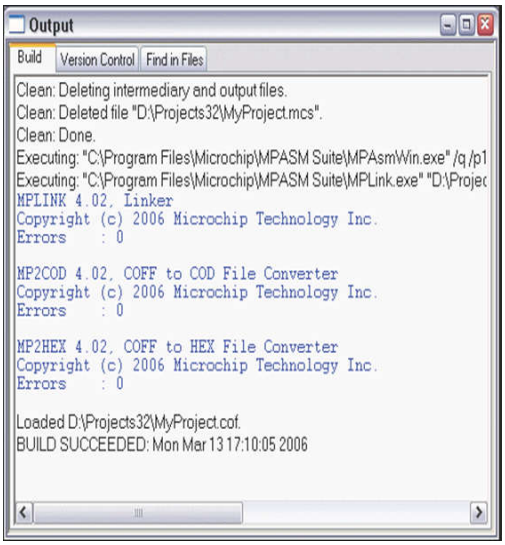

Figure 4 Ouput window after program execution

Figure 4 represents the output window after successfully compiling the program in the compiler.

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