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DESIGN AND IMPLEMENTATION OF A FIRE AND OBSTACLE DETECTION AND CONTROL SYSTEM USING FUZZY LOGIC WITH NOTIfiCATION SYSTEM TO AVOID AUTOMOBILE ACCIDENTS

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ABSTRACT

There is a large benefit of fire and obstacle detection in automobile which cannot be overemphasized. The proposed work consist of design of fire detection , obstacle detection system in automobile using Arduino microcontroller and fuzzy logic based monitoring , controlling and notification system to avoid damages of automobiles due to fire and collision. The system will give notification to user about maintenance date and oil changing date of the vehicles. In case of emergency, an automatic SMS is send to the relative of the user. The automatic system consists of flame sensors, temperature sensors, smoke sensors and a PIR (Passive Infrared) motion sensor. An innovative hardware implementation in fire detection, obstacle detection and control system for automobiles will be developed by using new various sensors and fuzzy logic system.

Keywords - Fire detection, Fuzzy logic control, Arduino, PIR

I. INTRODUCTION

Fire accident is common feature in automobiles in every country. Automobile industries are constantly defining and refining manufacturing techniques and services to avoid combusting their loyal customers. Yet for reasons ranging from fuel efficiency, manufacturing cost reduction, durability, through comfort and safety to aesthetics, motor vehicles are made with several potential ignition sources with prevalent threats of fire outbreak. Proactive manufacturers occasionally institute recalls to avert some of these threats of fire outbreak.

There are several advanced technology and innovations are available for vehicle safety. Even though there are advanced technological innovations for vehicle safety, the growth in number of accidents is continuously increasing. And these accidents are due to collision or intersectional accidents. Collision of vehicles occurs due to mistakes done by driver and intersectional accidents are caused due to bad weather conditions or obstacles in the path. Hence, to overcome these an intelligent collision avoidance system is proposed. So, that these type of accidents are eliminated. Only sports cars and other luxury cars consist of antilock brake system, speed sensor, and other automatic systems. But these cars cannot be affordable to everyone. So, this system is developed which can be implemented in every car.

A collision avoidance system consists of PIR(Passive Infrared) motion sensors that are placed within a car which provide warning to the driver if there are any dangers that lie ahead on the road. These sensors include how close the car is to other cars, how much its speed needs to be reduced when obstacles closer to the car, how

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close the car going off the road, And the system consist of audio warning to prompt the driver. Since the system consists of sensor which send and receive signals from other cars, obstacles on the road. A good example of the system is how it works when a driver is about to change lanes, and there is an obstacle in his blind spot. The sensor will detect that obstacle and give information to driver before him start turning his car, and prevent him from getting into serious accident.

II. PROBLEM IDENTIFICATION

The existing fire detection and obstacle detection system in market nowadays, is too complex in term of its design and structure. Since the system is too complex, it needs regular preventive maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is been done to the existing system, it could raise the cost of using the system. Therefore, the project is designed with a low cost and all level users can have one for a safety purpose. To monitor and detect fire in automobile system using various sensors such as Flame , Temperature and Smoke sensors. Also to detect the obstacles in the path and give command to user about the same.

III. OBJECTIVE

The objective is to design a Fire detection & Obstacle detection System that would fulfill the following objectives:

i) Indicate the area of automobile in which fire erupted.

ii) Sound the buzzer if fire occurs.

iii) Stop the engine and Run the cooling fans. Also operate the fire extinguisher in case of flame detection.

iv) Manual operation should be there in case of failure of automatic operation.

v) The system should also provide the flexibility to adjust the temperature.

vi) The system should never be in any ambiguous state. Under normal conditions the system should indicate the state of the automobile as 'safe' in order to avoid any confusion.

vii) Sense the obstacle in the path and give the instruction to the user.

viii) Give the alerts through SMS about the maintenance of the vehicle.

ix) Send automatically SMS to users relative in case of emergency.

IV. SYSTEM OVERVIEW

Figure shows the various sub modules. The engine ambient and exhaust/catalytic high temperatures demand different temperature threshold from the more human atmosphere within passenger cabin and boot. The control subsystem becomes dependent on the fire detection subsystem for appropriate compressor valve addressing through an Arduino microcontroller.

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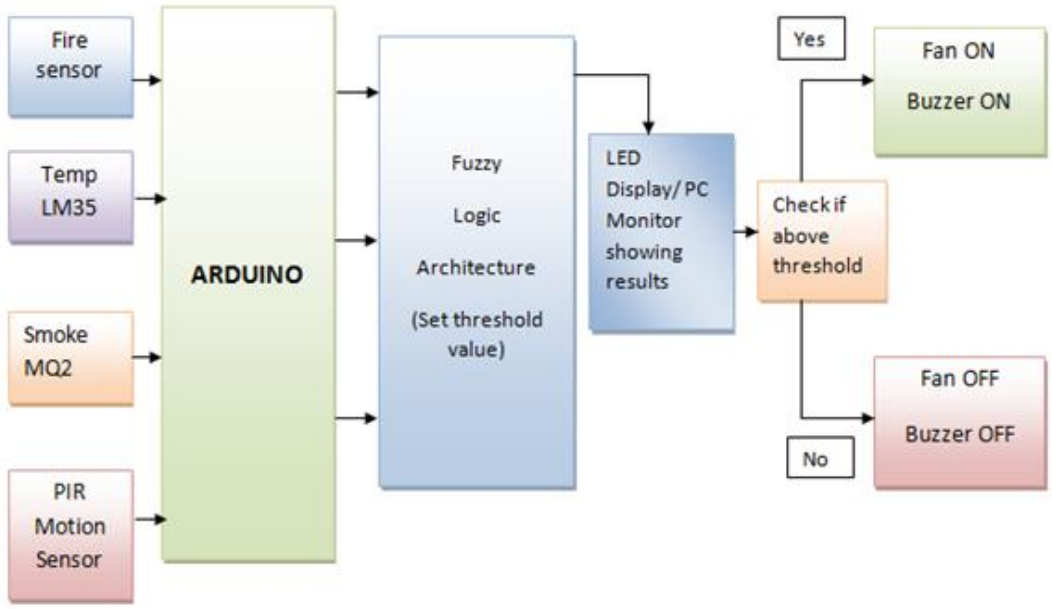

Fig: System Overview

The System consists of two modes of operations: 1. Automatic Mode & 2.Manual Mode

I. Automatic Mode:

1. If the fire sensor (or) sensor is detected the DC motor gets OFF.
2. Add one relay if any sensor get detected on that relay (it represents activation of fire extinguisher)
3. ON the buzzer once sensor detected.
4. ON the fan, once temp is increased with the ref value.
5. Ardino Uno/ ATmega328 is used here.
6. All data, Status will be sent over UART

II. Manual Mode

1. In manual mode user can start or stop FAN or Relay
2. Temperature reference value will be given as a input from user in manual mode which will be used in auto mode as well.
3. Status will be sent to UART.

V. SYSTEM DESIGN AND DEVELOPMENT

In this section the Explanation about the system Design construction through Hardware and development of software is given. The sensor basically will be the input that will be triggered the controller to control the motor by certain condition or programming. The controller is set to decide how the output will be produced from the motor and will be displayed at the display part. As the system requires the use of microcontroller, the design consists of two parts, hardware and software. Hardware is constructed and integrated module by module, hardware to software for easy troubleshooting and testing.

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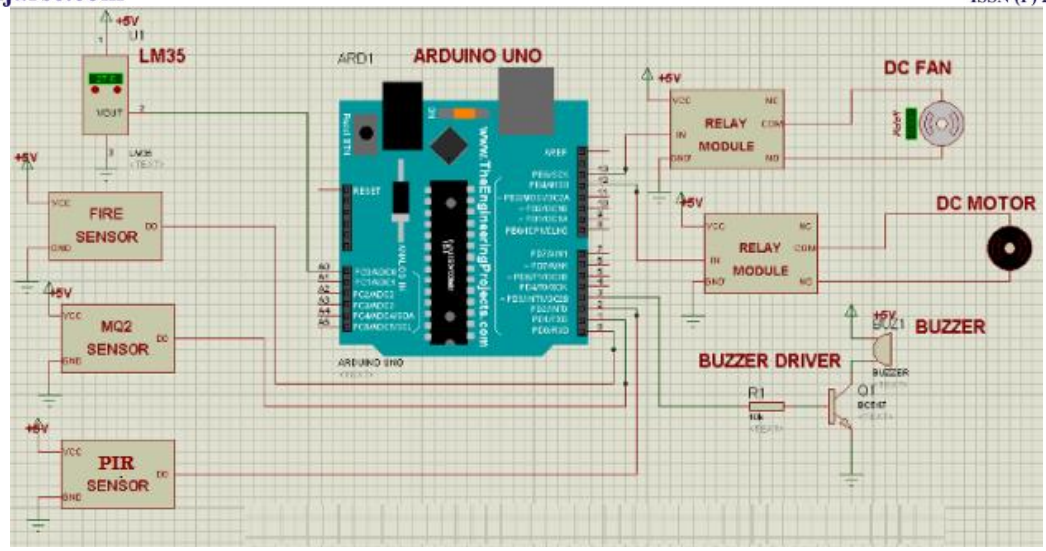

Fig: Circuit Diagram and Pin connection of Arduino UNO

The system architecture of the automatic output appliance can be divided into 3 main Modules. They are:

1. Microcontroller Module
2. Sensory Module
3. Appliance Module

VI. FUZZY LOGIC

The reliability of a fire detection system greatly depends on the sensors used and their ability to register accurately the fire signatures being monitored. The decision to use more than one sensor is informed by the numerous benefits presented by multisensory fire detection systems over the traditional single signature based system. The sensors were chosen based on detection range, size, and cost. By adopting a multistage approach, the need to fuse the data arises. Fuzzy logic provides an easy way of dealing with uncertain data from multiple sensors by aggregating these to make a decision. For instance, a crisp temperature value may be classified into cold, normal, or hot fuzzy set with a degree through fuzzification. This allows the use of the "IF THEN" rules defined in the rule base to make a decision. This fuzzy decision is then defuzzified into a crisp output value. For each sensor input (linguistic variable), three (3) fuzzy sets were created using grade, reverse grade, and triangular membership functions. The fuzzy membership functions were tuned with test data from the sensors during demo testing.

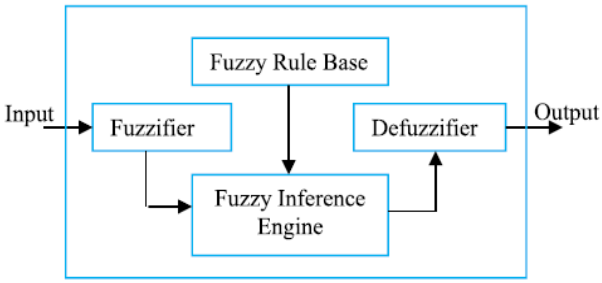

Figure: Fuzzy Logic System

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VII. TESTING & RESULTS

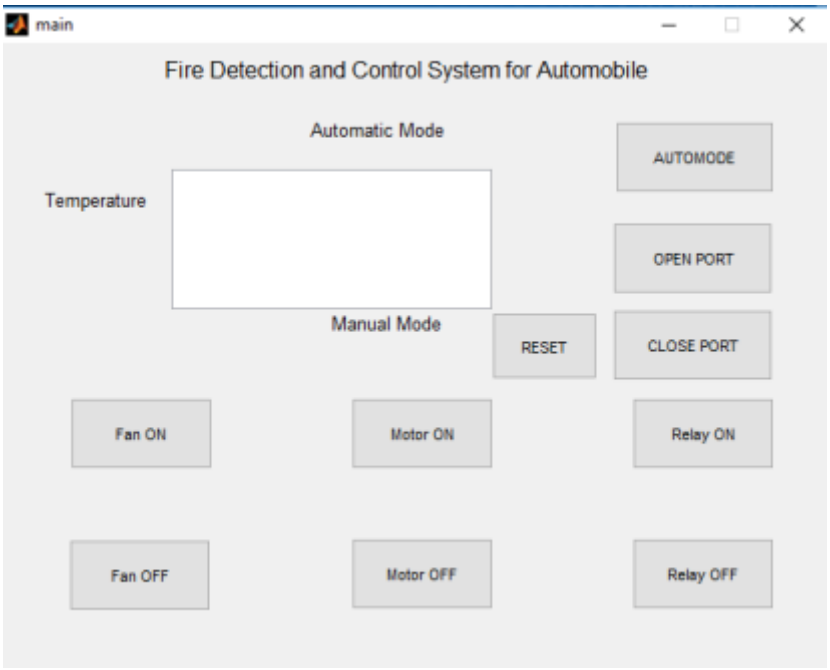
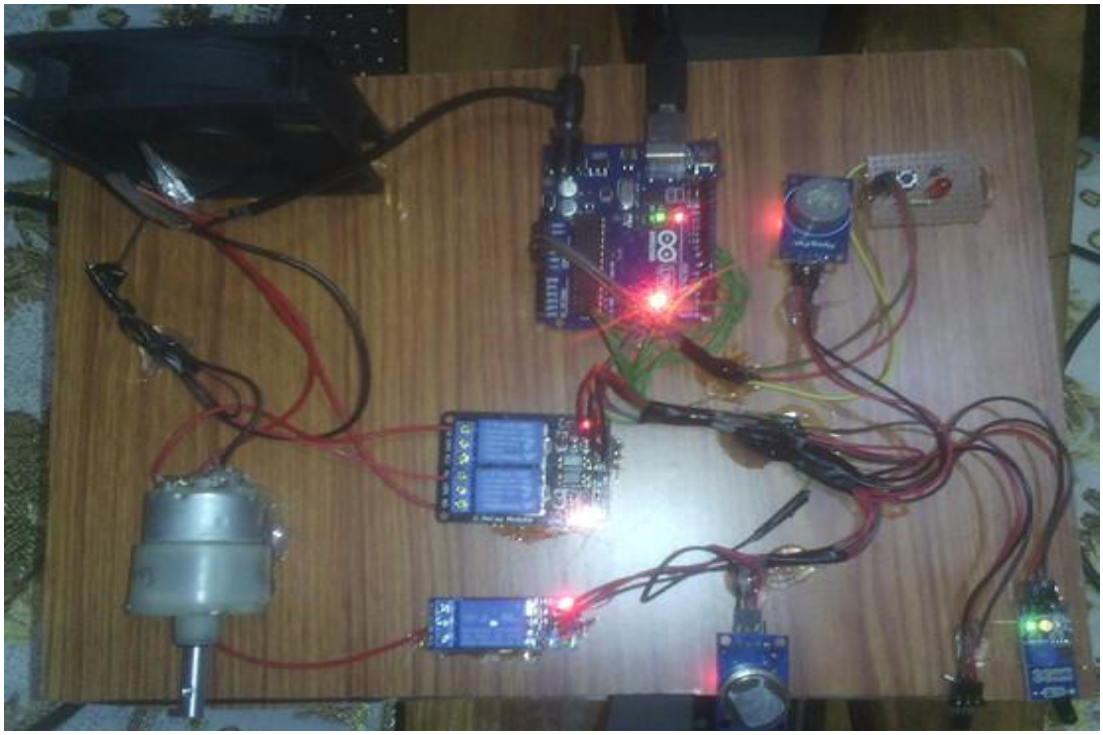


Figure: Block Diagram for Controlling of System on MATLAB

The aim of the project was to implement a fire detection system and the goal was met. The microcontroller unit responds to the instructions sent by the MATLAB R2014 a Software according to the necessity of the application as well as triggers the relay and Fan upon a critical situation. The aim of the application to manage the electronic devices remotely was also achieved.



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IX. RESULTS

1. If the Smoke Sensor, Gas Sensor Temperature sensor operates then Fan starts and Motor switches OFF
2. If the flame sensor detects flame then the Relay representing fire extinguisher switches ON
3. The PIR sensor senses the obstacles present near the vehicle and gives instructions to the user.
4. Notification will be sent to user after every operation.
5. After particular time period the notification for maintenance, oil changing, etc. is sent to the Users cell phone.
6. In case of Emergency the SMS will be automatically sent to the Users relative

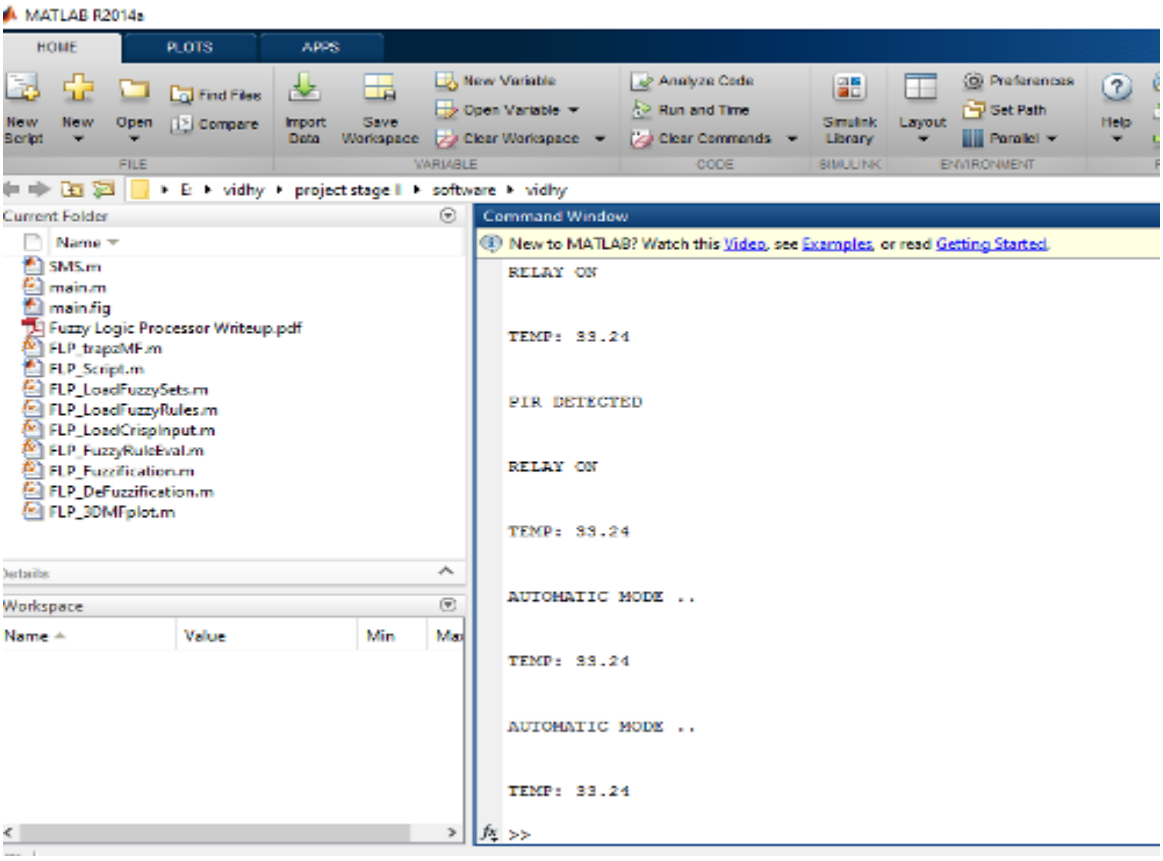

Figure:Output on MATLAB

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