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SYSTEM DESIGN OF FIRE FIGHTING VEHICLE

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ABSTRACT

In this robot provides fire protection when there is a fire in a tunnel or in an industry by using automatic control of robot by the use of microcontroller in order to reduced loss of life and property damage. This robot uses dc motors, castor wheel, microcontroller, sensors, pump and sprinkler. Microcontroller is the heart of the project. Microcontroller controls all the parts of the robot by the use of programming. In this robot as the fire sensor senses the fire, it sends the signal to microcontroller; since the signal of the sensor is very weak the amplifier is used so that it can amplify the signal and sends it to microcontroller. As soon as microcontroller receives the signal a buzzer sounds, the buzzer sound is to intimate the occurrence of fire accident. After the sounding of the buzzer microcontroller actuates the driver circuit and it drives the robot towards fire place, as the robot reaches near the fire microcontroller actuates the relay and pump switch is made ON and water is sprinkled on the fire through the sprinkler.

INTRODUCTION

System Design: In system design mainly concentrated on the following parameters:

1. System Selection Based on Physical Constraints:

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room.

2. Arrangement of Various Components:

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

4. Chances of Failure:

The losses incurred by owner in case of any failure are important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

5. Weight of Machine:

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in transportation & in case of major breakdown; it is difficult to take it to workshop because of more weight.

SYSTEM DESIGN

Integrated Circuit:

L293D is a Motor driver integrated circuit which is used to drive DC motors rotating in either direction. It is a 16-pin IC which can control a set of two DC motors simultaneously. The L293D uses 5V for its own power and external power source is needed to drive the motors, which can be up to 36V and draw up to 600mA.The L293D works on the concept of typical H-bridge, a circuit which allows the high voltage to be flown in either direction. In a single L293D IC there are two H-bridge circuits which can rotate two DC motors independently. Due to its size and voltage requirement, it is frequently used in robotics applications for controlling DC motors, including

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in Adriano projects. The L293D is also a key component in larger 'motor driver' boards available premade for hobbyists.

Working of L293D

There are two drive pins on L293D. Pin 1 (left H-bridge) and pin 9 (right H-bridge). To turn ON the corresponding motor, pin 1 or 9 need to be set to HIGH. If either pin 1 or pin 9 goes low then the motor in the corresponding section will go OFF (high impedance). These inputs (1 and 9) are the ones that should be used to control motor START/STOP and motor speed under PWM, since there would be high impedance output during low semi period of PWM, it would not provoke overload of the L293D when the motor is turning. Thus, PWM or motor ON/OFF control should never be input to pins 2, 7, 15, 10, which should only be used to control direction (Clockwise – Counter Clockwise).The direction-defining four Input pins for the L293D are pin 2 and 7 on the left and pin 15 and 10 on the right as shown on the pin diagram. Left input pins will determine the rotation of motor connected on the left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided at the input pins as LOGIC 1 or LOGIC 0.

L293d Logic Table

Assuming a motor connected on left side output pins (pin 3,6).

1. Pin 2 = Logic 1 and Pin 7 = Logic 0 | Clockwise Direction
2. Pin 2 = Logic 0 and Pin 7 = Logic 1 | Anticlockwise Direction
3. Pin 2 = Logic 0 and Pin 7 = Logic 0 | Brake (this is not high impedance) (force stop rotation using electric brake = same voltage both pins of the motor = overload while the motor is still running)
4. Pin 2 = Logic 1 and Pin 7 = Logic 1 | Brake (this is not high impedance) (force stop rotation using electric brake = same voltage both pins of the motor = overload while the motor is still running)

In a similar way, the motor can be operated across input pins 15 and 10 to control the direction of the motor attached to the H-bridge's right side. Using pins 2 and 7 (15 and 10) to determine motor START/STOP or PWM duties it's dangerous, since there wouldn't be high impedance outputs: Current would flow back during the low semi period of PWM when the motor is turning. For on/off purposes or PWM speed control, pins 1 and 9 should be used.

Voltage Specifications

The voltage (Vcc) needed to for its own working is 5V but L293d will not use that Voltage to drive DC Motors. That means you should provide that voltage (36V maximum) to drive the motors. A maximum current of 600mA per output is allowed.

Voltage Regulator:

Ah the venerable 7805, who amongst us has not used this popular linear regulator? This big chunky regulator will help you get your 7-35V battery or wall adapter down to a nice clean 5.0V with 2% regulation. Perfect for just about all electronics! This is the TO-220 version, with up to 1.5A current capability, and has internal current limiting + thermal shut-down protection which make it sturdy and pretty much indestructible - at least electronics-wise (we're pretty sure a hammer might work...) This regulator has a ~2V linear drop-out. That means you must give it at *least* 7V to get a clean 5V out. There is a constant 'quiescent' current draw of 6mA. This regulator can provide up to 1.5A as long as it has proper heat-sinking. The higher your input voltage and output current, the more heat it will generate. Without an extra heats ink, you can burn off up to 2W. We like this calculator for determining your heat sink requirements It's a TO-220 package, so use 62.5°C/Watt junction thermal resistance. The wattage of your set up is = (Input Voltage - 5V) * Average Current in Amps. E.g. a 9V battery and 1 Amp of average output current means the regulator is burning off (9 - 5)*1 = 4 Watts! This setup would definitely need a heat sink!

This regulator does not require capacitors for stability, but we recommend at least 10uF electrolytic capacitors on both input and output.

Microcontroller

AT89C52 is an 8-bit microcontroller and belongs to Atmel's 8051 family. AT89C52 has 8KB of Flash programmable and erasable read only memory (PEROM) and 256 bytes of RAM. AT89C52 has an endurance of 1000 Write/Erase cycles which means that it can be erased and programmed to a maximum of 1000 times. Though very slight difference between the features of AT89C51 and AT89C52, they are very similar in their pin configurations* and operations. The differences between AT89C51 and AT89C52 have been tabulated below.

	AT89C52	**AT89C51**
RAM	256 Bytes	128 Bytes
Flash	8 KB	4 KB
Number of Tamers/Counters	3 (16-bit each)	2 (16-bit each)
Number of Interrupt Sources	8	6

Table No.1 Difference between AT89C51 And AT89C52

The pin configuration of AT89C52 is exactly similar to that of AT89C51 except that the first two pins, P1.0 and P1.1 are multiplexed to correspond to Timer2 operations as given in the following table.

Existing	**Alternate**	**Function**
P1.0	**T2**	Timer/counter 2 External Count input
P1.1	**T2 EX**	Timer/counter 2 Trigger input

Table No.2 Timer Operation

While AT89C51 has two timers (Timer0 & Timer1), AT89C52 also has Timer2. Corresponding to Timer2, there are extra SFRs (Special Function Registers) T2CON & T2MOD. Also there are registers RCAP2H & RCAP2L to configure 16 bit Capture & Auto-reload modes of Timer2.

PCB

A printed circuit board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. Components — capacitors, resistors or active devices — are generally soldered on the PCB. Advanced PCBs may contain components embedded in the substrate. PCBs can be *single sided* (one copper layer), *double sided* (two copper layers) or *multi-layer* (outer and inner layers). Conductors on different layers are connected with visa. Multi-layer PCBs allow for much higher component density. Printed circuit boards are used in all but the simplest electronic products. Alternatives to PCBs include wire wrap and point-to-point construction. PCBs require the additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Manufacturing circuits with PCBs is cheaper and faster than with other wiring methods as components are mounted and wired with one single part. Furthermore, operator wiring errors are eliminated. When the board has no embedded components it is more correctly called a *printed wiring board* (*PWB*) or *etched wiring board*. However, the term printed wiring board has fallen into disuse. A PCB populated with electronic components is called a *printed circuit assembly* (*PCA*), *printed circuit board assembly* or *PCB assembly* (*PCBA*). The IPC preferred term for assembled boards is *circuit card assembly* (*CCA*),[1] and for assembled backplanes it is *backplane assemblies*. The term PCB is used informally both for bare and assembled boards.

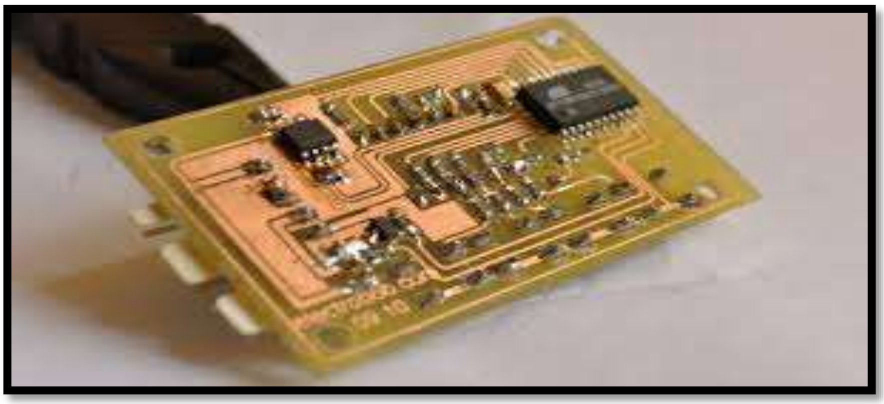

Fig.1 Printed Circuit Board

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency. This frequency is commonly used to keep track of time, as in quartz wristwatches, to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits. Quartz crystals are manufactured for frequencies from a few tens of kilohertz to hundreds of megahertz. More than two billion crystals are manufactured annually. Most are used for consumer devices such as wristwatches, clocks, radios, computers, and cell phones. Quartz crystals are also found inside test and measurement equipment, such as counters, signal generators, and oscilloscopes

CONCLUSION AND FUTURE SCOPE

The fire fighting vehicle we can extinguish the fire. By using the remote control we reduce human efforts. This paper work has provided us an excellent opportunity and experience, to use our limited knowledge. Fire accidents can be controlled to a great extent in places such as forests, homes, colleges, industries, trains and some other public places.Fire accidents leads to death of people by using this technique we can save those lives easily. Camera and video transmission can be added. Improve the weight capacity of robot [3].

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3. Dr. Raju N.Panchal , Anant D.Awasare , Dr. Jagruti R.Panchal “Fire Fighting Vehicle: Constructional Design” ISSN 2394 – 3386 Volume 4, Issue 9 September 2017,PP:863-867.

BOOKS

[1] erdman&sandor, engg. Mechanism.
[2] r s khurmi, machine design.
[3] v b bhandari, design of machine elements.
[4] p s g design data