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Fire Fighting Robot for Disaster Management

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Abstract:
The need for a device that can detect and extinguish a fire on its own is long past due. Many house fires originate when someone is either sleeping or not home. With the invention of such a device, people and property can be saved at a much higher rate with relatively minimal damage caused by the fire. Our task as electrical engineers was to design and build a prototype system that could autonomously detect and extinguish a fire. Also aims at minimizing air pollution. In this Project we design a Fuzzy based PIC 18F4520 Microcontroller controlled Robot. It is the Robot that can move through a model structure, find a burning oil derrick (lit candle) and then extinguish it with help of a Blower. This is meant to simulate the real world operation of a Robot performing a fire extinguishing function in an oilfield. Fuzzy logic provided an appropriate solution to the otherwise complex task of mathematically deriving an exact model for the non-linear control system upon which conventional control techniques could then be applied. We are using the PIC 18F4520 Microcontroller of PIC family Microcontroller. Program code to control the fire fighting robot is written in C language.

Keyword: PIC 18F4520, Fire

I. INTRODUCTION

Robots are shrewd machines that can be controlled by. On the off chance that a sight and sound interface is given, it advance guides in route of the robot. Making the robot remote builds the compelling zone of operation, along these lines making it conceivable to control the robot from a remote area. Remembering all the above elements the, a robot fit for being remotely controlled through the Internet and having a mixed media interface, was imagined and created . I have utilized exceptionally essential idea here, straightforward from the planned of learners or for the experts of this field. The requirement for a gadget that can identify and quench a fire all alone is long past due. Numerous house fires begin when somebody is either resting or not home. With the creation of such a gadget, individuals and property can be spared at a much higher rate with moderately insignificant harm brought about by the fire.

Problem Statement: Design and Implementation For Fire Fighting robot is based on real-time system.
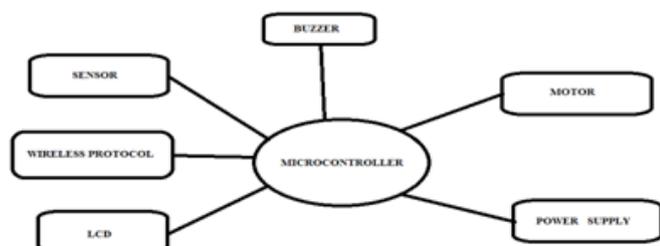
Block diagram:

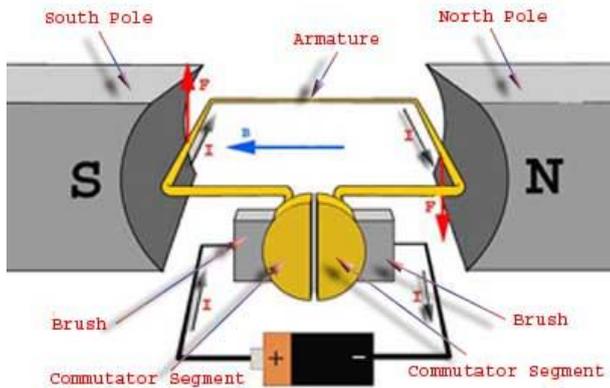**Figure.1.Block diagram**

II. WORKING PRINCIPLE

Robot uses microcontroller to drive temperature, LDR sensors, and pump and motors robot through driver interface. To drive the all the components 5v dc and 12 v dc are required. In this work the DC supply required for operation of microcontroller is obtained by using solar energy. To achieve this PV panel and battery are connected to microcontroller through regulator. The Regulator circuit consist of full wave rectifier. The rectifier eliminates the negative peek voltage of the input voltage .The output of the rectifier is the pulsating dc. The error pulses are eliminating by using capacitor filter. Then the output at the parallel of the capacitor is the 12v dc. But the Micro Controller is work on 5v dc.

To convert the 12v dc into 5v dc a regulator (7805) is used. The output of the regulator is constant irrespective of the input voltage. The Micro Controller requires the preset logic circuit for protection of the internal program and internal clock in case of power failure. A sudden change in the power may cause data error resulting in the corruption of the internal program. The reset logic circuit contains one capacitor and a resistor. The driver circuit generally made by using one transistor and one relay. The driver circuit is mainly operated by the Micro Controller. The Micro controller changes the state of the output pin from the low to high, i.e. from O level to the 1 level. The transistor will act as an ON/OFF switch corresponding to the input of the base. If the base current of the transistor is high the transistor is under ON condition else it is in OFF state.

 These conditions will be used to control the relay. The thermal sensors provide the senses the heat from within the room. First sensor will give the data to the micro controller if it finds the heat. The micro controller pin bit will goes low when the fire is present. The micro controller will always scan the input signal of sensors. If the first sensor gives the data about fire to the micro controller, it then finds the movement to reach the fire by calculating the input data. The micro controller can give the output to two motors. One motor is used to move in forward direction to reach the destination point and the other is used to put off the fire. After end of fire the robot will go back to the original position. and use this information to encode and compare individual face images. Mathematically, we wish to find the principal components of distribution of faces or the eigenvectors of the covariance matrix of a set of face images. These eigenvectors are a set of features, which together

characterize the variation between face images. Each image location contributes more or less to each eigenvectors, so that we can display the eigenvectors as a sort of ghostly face, which we call an eigenfeces. In the training set, each face image is represented by a linear combination of the eigenfaces. Hence the number of possible Eigen faces is same as the number of face images.

A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Among the different biometric techniques, facial recognition may not be the most reliable and efficient. However, one key advantage is that it does not require aid (or consent) from the test subject. Properly designed systems installed in airports, multiplexes, and other public places can identify individuals among the crowd.

III. DESCRIPTION OF COMPONENTS USED

TEMPERATURE SENSOR:

Figure.2. Temperature sensor:

A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range, typically −90 °C to 130 °C.

LDR:

A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

Figure.3. LDR

A **light dependent resistor** works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing throgh the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common **working principle of LDR.**

Driver Circuit:
The driver circuit generally made by using one transistor and one relay. The driver circuit was mainly operated by the Micro Controller. The Micro Controller was change the state of the output pin from the low to high that is from O level to the 1 level. By using this sequence to control the base of the transistor. The transistor will act as an ON/OFF switch corresponding to the input of the base. If the base of the transistor wills high the transistor will act as a ON switch otherwise it will act as OFF switch.

WATER PUMP:
Used to pump water when an abnormal condition arises in the system. When excess temperature, smoke and flame detected, the water pump starts pumping water. Water pump is connected to the relay, the relay becomes energizes according to the instruction from the MCU.

IV. DC MOTORS:

DC Motor with driver (L293D):

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The L293D is a Dual Full Bridge driver that can drive up to 1 Amp per bridge with supply voltage up to 24V DC motors are generally more powerful than servos in terms of speed and torque. Microcontroller could not accurately control DC motors without a motor controller. Therefore, motor Controllers are needed. An encoder used to get feedback from the DC motor. A Dc motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the working principle of DC motor in details that has been discussed in this

article. In order to understand the operating principle of DC motor we need to first look into its constructional feature.

The very basic construction of a DC motor contains a current carrying armature which is connected to the supply end through commutator segments and brushes it is placed within the north south poles of a permanent or an electro-magnet as shown in the diagram below. Now to go into the details of the operating principle of DC motor it's important that we have a clear understanding of conductors of DC motor.
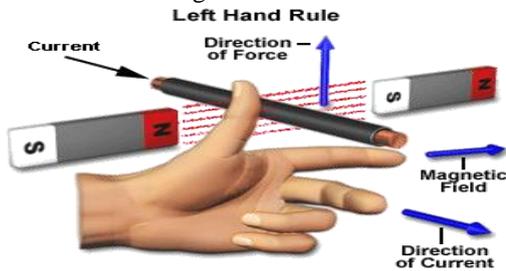
Fleming's left hand rule says that if we extend the index finger, middle finger and thumb of our left hand in such a way that the current carrying conductor is placed in a magnetic field (represented by the index finger) is perpendicular to the direction of current (represented by the Fleming's left hand rule to determine the direction of force acting on the armature handle finger), then the conductor experiences a force in the direction (represented by the thumb) mutually perpendicular to both the direction of field and the current in the conductor.

Motor driver (L293D)
The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications
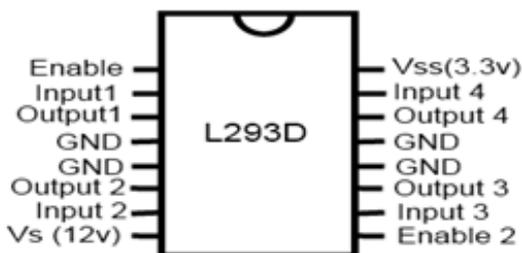
Figure.4. Motor driver (L293D)

V. SOLAR PANELS

Solar panels generate free power from the sun by converting sunlight to electricity with no moving parts, zero emissions,

and no maintenance. The solar panel, the first component of a electric solar energy system, is a collection of individual silicon cells that generate electricity from sunlight. The photons (light particles) produce an electrical current as they strike the surface of the thin silicon wafers. A single solar cell produces only about 1/2 (.5) of a volt. However, a typical 12 volt panel about 25 inches by 54 inches will contain 36 cells wired in series to produce about 17 volts peak output. If the solar panel can be configured for 24 volt output, there will be 72 cells so the two 12 volt groups of 36 each can be wired in series, usually with a jumper, allowing the solar panel to output 24 volts. When under load (charging batteries for example), this voltage drops to 12 to 14 volts (for a 12 volt configuration) resulting in 75 to 100 watts for a panel of this size.

VI. SYSTEM WORKING

The project is designed by following blocks fire sensor, Arduino board, line tracking sensor (2nos), Motor with driver Robot model, and Driver circuit with relay and Fire extinguisher. The flame sensor is used here to sense the fire. The flame sensor output is very low voltage so we give that signals to signal conditioning unit. The signal conditioning unit gives the signal to Arduino board. The Arduino board used is flash type reprogrammable controller. Therefore, it receives the signal from signal conditioning unit and activates corresponding driver circuit. If the fire is sensed by the sensor it gives the signal to Arduino board. By which the robot movement is controlled artificially, the Arduino board activates the alarm driver circuits. So the alarm makes sound for indication of fire. And at the same time Arduino board activates driver circuit for fire extinguisher. The keypad is used here to control the robot movements like as forward and reverse direction and left and direction control. The line tracking sensor is used to sense the line just below the robot model. There are two sensors kept at the front of the robot model at a certain distance. The two sensors are used to sense the left or right directions for further move of the robot model.

VII. FUTURE SCOPE

In the present condition it can extinguish fire only in the way and not in all the rooms. It can be extended to a real fire extinguisher by replacing the water carrier by a carbon-di-oxide carrier and by making it to extinguish fires of all the room using microcontroller programming. Robot can also be controlled by using Android phone.

VIII. CONCLUSION:

We have designed and implemented fire fighting robot using PIC 18F4520. It is a robot that autonomously detect and extinguish fire. This work gives a detailed mechanism about the robot that continuously monitors, intimates the respective personnel and extinguishes the fire. In the industry if any fire accident occurs, there is a need of person to monitor continuously and rectify it. In this process if any time delay takes place irreparable loss occurs industry. The robot could be run through the batteries because solar panel is used to charge the batteries

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