International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 4 Apr. 2021, pp: 535-539 www.ijaem.net ISSN: 2395-5252

Design and Analysis of Automatic Fire Exting using Robot

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Submitted: 15-04-2021 Revised: 28-04-2021 Accepted: 30-04-2021

ABSTRACT: Detecting fire and extinguishing is a hazardous job for a fire extinguisher, it often risks the life of that person. This project aims in giving a technical solution to the mentioned problem. A robot is a mechanical design that is capable of carrying out a complex series of actions automatically, especially one programmable by a computer. the flame sensor detects the fire and gives the further signal to the extinguisher units to trigger the pump and spray the water. The whole system is programmed using an arduino UNO board (ATmega328P microcontroller) which forms the brain of the system.

It is a arrangement of different elements in order to regulate, direct, sense and command itself to achieve a particular and desired result. "Automatic Fire Fighting Robot" project has a electric thermostat technology for controlling the fire 24hrs. This project is cost effective with a explore application which will show the best result. It can be use very much in Industrial, commercial and as well as domestic purposes.

The robot works with sensor for searching the fire and when fire is detected then automatically spray the water over it.

There are two dc motors used for motions. There are three sensors used Temperature for detecting the increase in fire, Smoke(gas) for detection of smoke and IR for detection of obstacle. Dc water pump is used to pump water for extinguishing the fire.

I. INTRODUCTION:

Robot is a machine that looks like a human being and performs various complex tasks. there are many types of robots such as fixed base robot, mobile robot, underwater robot, humanoid robot, space robot and medicine robot etc. In this paper a "FIRE EXTINGUISHING ROBOT" is proposed. This robot is equipped with a single flame sensor used to sense environmental fire and feed the signals to the microcontroller in order to trigger the pump which sprinkles water in order to extinguish the fire

This robot implements the concepts of environmental firesensing, proportional motor control. The motor driver is used for the bidirectional control of the motors equipped in the robot.

The programming of the robot is done using the arduino C which is derived from C and C++ languages. This paper is presented as follows. Proposed methodology in section II which constitutes of block diagram and components and their explanation. Hardware and software details are included in section III. In Section IV, results and conclusions are included. Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

This sensor is able to detect a flameby sensing light wavelength between 760 – 1100 nanometers. The test distance depends on the flame size and sensitivity settings. The detection angle is 60 degrees, so the flame does not have to be right in front of the sensor.

There are two sensor outputs

i. Digital – sending either zero for nothing detected or one for a positive detection
ii. Analog – sending values in a range representing the flame probability/size/distance; must be connected to a PWM capable input

Motor drivers are used to describe the direction of movement of the robot. It is used to give high voltage and high current as an output to run the motors which are used in the project for the movement of the robot. Below shown is the circuit of the H Bridge which is used for the motor driving in the IC l293D and also provides the bidirectional motor control. In this project we use simple DC

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motor for the rotation of the wheel which are responsible for the movement of the robot. Usually DC motors convert electrical energy into mechanical energy.

TECHNICAL SPECIFICATION:

Microcontroller	**ATmega328P**
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

SOFTWARE USED:

Arduino IDE 1.6.7;

For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.The open source Arduino IDE makes it easy to write code and upload it to the board.

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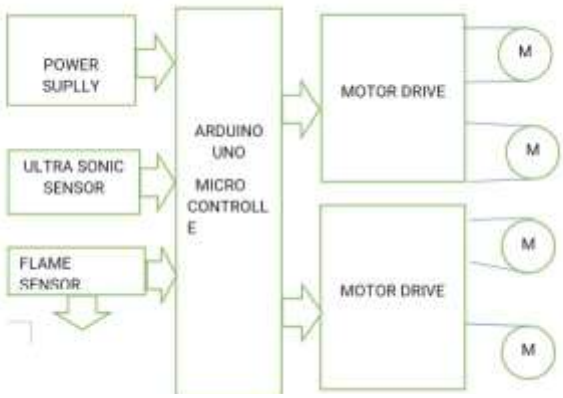
Advantages:

- It is useful where man cannot reach.
- It can work better than human being.
- It can work in hazardous environment.
- It can reist heat than human being.

Block Diagram: Below shown is the Block Diagram of Fire Fighting robot. The basic theme of this paper is to sense the environmental fire and extinguish it with the help of a water pump. The Arduino UNO Microcontroller board based on the ATmega328P. The ATmega328P is good platform for robotics application. Thus the real time fire extinguishing can be performed



WORK MODULES:

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here.

A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .

The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure.

This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction.

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This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor. At the first sight, the external structure of a DC geared motor looks as a straight expansion over the simple DC ones.On opening the outer plastic casing of the gear head, gear assemblies on the top as well as on bottom part of the gear head are visible. These gear assemblies are highly lubricated with grease so as to avoid any sort of wear and tear due to frictional forces. Shown below is the top part of the gear head. It is connected to rotating shaft and has one gear that allows the rotation. A strong circular imprint shows the presence of the gear that rotates the gear at the upper portion.

The gear assembly is set up on two metallic cylinders whose working can be called as similar to that of an axle.

A total of three gears combine on these two cylinders to form the bottom gear assembly out of which two gears share the same axle while one gear comes in between them and takes a separate axle.

WORKING :

If the left flame sensor detecting fire, the left sensor will send the data to Arduino telling that the fire is at the left-hand side, the Arduino will send the command to the motor driver to turn the robot to left direction. The robot will remain turning to left direction until the front flame sensor detecting fire.This process is also done for the right side.And this is the working of this robot.

WORKING OF THE DC GEARED MOTOR:

The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM (rotations per minute) of the motor. For example, if the motor works in the range of 6-12V, it will have the least RPM at 6V and maximum at 12 V.

In terms of voltage, we can put the equation as:

RPM= K1 * V, where,

K1= induced voltage constant,V= voltage given .

The working of the gears is very interesting to know. It can be explained by the principle of conservation of angular momentum. The gear having smaller radius will cover more RPM than the one with larger radius. However, the larger gear will give more torque to the smaller gear than vice versa. The comparison of angular velocity between input gear (the one that transfers energy) to output gear gives the gear ratio. When multiple gears are connected together, conservation of energy is also followed. The direction in which the other gear rotates is always the opposite of the gear adjacent to it.

In any DC motor, RPM and torque are inversely proportional. Hence the gear having more torque will provide a lesser RPM and converse. In a geared DC motor, the concept of pulse width modulation is applied. The equations detailing the working and torque transfer of gears are shown below,

$\tau_{in}\ \omega_{in} = \tau_{out}\ \omega_{out}$, where

τ_{in} = input torque by the driver gear

ω_{in} =angular speed of the driver gear

τ_{out} = output torque of the driven gear

ω_{out} = angular speed of the driven gear

In a geared DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear's duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft.

WORKINGOFSERVOMOTORS:

Servo motors control position and speed very precisely. Now a potentiometer can sense the mechanical position of the shaft. Hence it couples with the motor shaft through gears. The current position of the shaft is converted into electrical signal by potentiometer, and is compared with the command input signal. In modern servo motors, electronic encoders or sensors sense the position of the shaft .

We give command input according to the position of shaft . If the feedback signal differs from the given input, an error signal alerts the user. We amplify this error signal and apply as the input to the motor, hence the motor rotates. And when the shaft reaches to the require position , error signal become zero , and hence the motor stays standstill holding the position.

The command input is in form of electrical pulses . As the actual input to the motor is the difference between feedback signal (current position) and required signal, hence speed of the motor is proportional to the difference between the current position and required position . The amount of power require by the motor is proportional to the distance it needs to travel .

II. CONCLUSION:

This is a fully automated system and does not require any human interaction.

It aims to establish the technology innovation not only to achieve a responsible but also useful out come from the various instruments this autonomous robot successfully performs the task of a fire fighter in a simulated house,office,laboratoryetc,

It also helps us to identify the fire with in minimum time after the fire is detected.

Future scope:

The firefighting robot will have future scope that it can work with firefighters, which greatly reduce the danger of injury to victims. It is a innovative work in the field of robotics that operates towards a sensible and obtainable access to save the lives and prevents the danger to property.

REFERENCE :

[1]. "Autonomous Mobile Robot: Recognize & Response to Fire", Nik Md HafizulHasmie Md Suhaimi, UTHM, Malaysia, 2007.

[2]. "Rolly Firefighter Robot", William Dubel, Hector Gongora, Kevin Bechtold, and Daisy Diaz, Florida International University, Miami, 2003.

[3]. "Fire Protection Robot", Viet Do, Ryan Norder, and Ryan Spraetz, Moscow.

[4]. Microprocessor and Microcontroller, Second Edition, Department Of Computer Engineering, Faculty Electrical & Electronic Engineering, Universiti Tun Hussien Onn Malaysia (UTHM), Malaysia, 2008

[5]. Microcontroller Cookbook PIC & 8051, Second Edition, Mike James, Newnes, Reed Educational and Professional Publishing Ltd, Jordan Hill, Oxford, United Kingdom, 2000

[6]. Microcontrollers Theory and Applications, Ajay V Deshmukh, McGraw-Hill, Tata McGraw-hill Publishing Company Limited, New Delhi, 2005

[7]. Autonomous Robot Control Board Instruction Manual (SK40C), CytronTechnologies SdnBhd, Nov 2007.

[8]. Designing Autonomous Mobile Robots, Elsevier Inc, John Holland, 2004

[9]. Joga D. Setiawan, MochamadSubchan, and AgusBudiyono "Virtual Reality Simulation of Fire Fighting Robot. Dynamic and Motion." ICIUS, October 24-26 2007.

[10]. Gerald Weed, Michael Schumacher, Shawn McVay, Jack Landes "PPPPokey the Fire-Fighting Robot. A Logical Design Using Digital and Analog Circuitry", May 11 1999.

[11]. Chris Flesher, Devona Williams, Sean Benbrook, Somendra Sreedhar "Fire Protection Robot. Final Report" p. 1-78, 2004.50.

[12]. Myles Durkin, Kevin McHugh, Ryan Ehid, Brian Lepus, Stephen Kropp "Firefighting Robot. A Proposal." May 5 2008.