Pyrofighter

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Abstract: *This pyro fighter robot performs the operations of firefighting and rescue by virtue of its efficient robotic arm which facilitates evacuation, advanced temperature sensors to detect the intensity of fire, high power pump to control the fire using water which is stored in an storage tank, a camera fitted in front of the robot which aids the surveillance of critical situations. The robot can be remotely controlled by dtmf (dual tone multi frequency), transmitter receiver. The grip of the robotic arm is highly efficient to increase the effectiveness of the robot. The design of the robot is highly effective and economical as it uses minimum number of motors to perform its operations effectively.*

Keywords: Robotic Arm, DC Gear Motors, Transmitter and Receiver, DTMF Module, Wireless A/V Camera, Four Wheel Robotic Platform, AVR Controller Board, LM35 Sensor

1. Introduction

There are many technologies being produced every day throughout the world and this development is very well reflected in a country's defense prowess and a country always tries to protect its citizens at any cost. But unfortunately there are many soldiers who are martyred many a times. The defense also is utilized in carrying out Rescue operations and this rescue operation often turns into a hostage saving situation also and in such scenario extra care is the utmost priority for which there have been some technological advancements with few successes. There are often situations faced by the fire brigade department of a fire breaking out with in house hostages and in such a scenario both the fire fighter as well as the people inside any building are in danger of losing their lives. For such risky and daring scenarios technology has gone to such levels as unmanned rescue operations by utilizing a robot. This robot or Robo-Arm as commonly known can save many lives without risking even one. This Robo-Arm can even be utilized in the Armies to protect the lives of the soldiers who cannot be reached by their fellow soldiers due to inaccessible terrain. And even can successfully retrieval of ammunition from an unreachable position often seen in the extensive battle on battlefield without risking the soldier's life.

2. Robotic Arm

A robotic arm is a programmable control device, usually a robotic manipulator and derived from the concept of the working of a human arm. The replacement of human biceps by robotics in the field of electronics and heavy electrical control system engineering has gained a lot of popularity.

The most essential part of a robotic arm is 1 gear motor (10 rpm), another gear motor (60rpm), wood laminates and GI sheet. It is controlled and designed to function through an ATMEL 32 microcontrollers which is fitted to the body of the robotic system.

The robotic arm has been inspired from the concept of mechanism of the excavators; bulldozers where maximum load work is carried out using the minimum power or to be more precise minimize the unnecessary use of more number of motors. Hence, for this purpose the arm has been given the L-shape. The length of the vertical link is more than the horizontal link. The ends of the links are joint using the fillets to reduce the stress concentration.

This is a great factor in cost reduction. Even a small commercial robotic arm is quite expensive due to the practice of installing dc servos instead of the gear motors which are almost 4 times more expensive. This robotic arm has proved to be very eco-friendly as it has been developed completely from the waste scraps thrown away.

2.1 Salient Features:

1. The arm has 2 dc gear motors which are controlled by the use of only one microcontroller which is fitted on the body of the robot.
2. The gripper could be used to grab objects of sizes approximately of 6x4cm^2
3. The arm of this robot is very user friendly because of the computer interface developed. It has been designed to be accessible for operation ranging from beginner to the advanced machinist.
4. This lightweight robotic control system is capable of lifting loads up to 250 grams.
5. The base of the arm is fixed to the chassis of the robot.
6. Vertical arm rotates inside the U-block. It is powered with the help of 6Volt dc motor which is fixed on the one side of the U-bracket.
7. Shaft is connected with the vertical arm by a pin known as key.
8. In order to keep the design and the structure of the system analyzable and simple, the gripper is kept simple keeping in mind the implementation of the gripping mechanism without using the gear unit.

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Figure 2.1: Robotic Arm

Table 2.1

Length Variables	Link Length(cm)	Link weight(kgs)	Motor weight(kgs)	Total torque(kg-m)
L1	7	0.030	0.100	6.805
L2	15.2	0.040	0	3.085
L3	11.3	0.030	0	5.23

3. DC Gear Motor

Figure 3.1: DC Gear Motor

The motors used in 'Pyrofighter' were all "D.C gear" motors. These motors, like any other electrical motor, use the magnetism induced by an electric current to rotate a rotor that is connected to a shaft .As we know that a coil of wire with current running through it generates an electro-magnetic field aligned with the center of coil, these fields generated transfer energy from the rotor to the shaft of each motor respectively. In a gear motor, the energy output is then used to turn a series of gear of the motor in an integrated gear train.

There are various types of motors but the most common motors generally in terms of use are the AC gear motors and the DC gear motors (AC for alternating current, DC for direct current respectively).
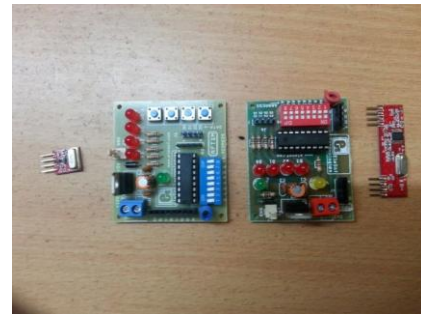
Transmitter and Receivers

Figure 4.1: Tramsmitter And Receiver

A " 434MHZ RF 4CH " wireless remote control was operated as a transmitter and also as a receiver. This device is a two module-a transmitter and receiver. Together they make an addressable wireless system that can range up to 65 meters .This RF module used is compatible to HT12D/12E standards.

Transmitter: Transmitter of wireless remote control is a powerful transmitter module based on CMOS technology. There is an internal calibrated crystal oscillator in module HT12E .This module has 18 pin encoder IC [HT12E], with which the pin female connector compatible with 12DRF transmitter antenna is connected and one 8 bit address selected is connected.

8 bit address select gives us the option of isolation the communication between the transmitter and the receiver module 4 bit data is available for providing input to the encoder I.C. On board we have a L7808 voltage regulator that regulates the voltage ranging from 3V-24

Receiver End: Receiver of wireless remote is a powerful transmitter module base on CMOS technology. There is an internal calibrated crystal oscillator in module IC HT 12D, so there is no need to provide crystal oscillator externally.

This module has 18 pin decoder IC (HT12D), with which 8 pin female connector compatible with 12DRF receiver antenna is connected and 8 bit address select is connected. 8 bit address select gives us the option of isolating the communication between the transmitter and the transmitter and the receiver module.4 bit data pins data pins are given for data output . One LED is connected to denote valid transmission.

4. DTMF Module

Figure 5.1: DTMF Module

DTMF module version (RM0033) decodes DTMF signal either from an audio source or phone line to 4 bit binary, TTL (SV) level output. It also indicates output with LED. It can be used with microcontrollers develop various DTMF related applications like remote control, caller ID, Auto Dialer. This module can be easily be used in conjunction with any of the Robosapiens development boards and develop mobile operated robots and gadgets.

Highly accurate filter circuits are implemented to divide tone signals into high frequency and low frequency signals. Basically it is an 18 pin IC. The HT9170 series consist of band pass filters and two digital decoder circuits to convert a tone DTMF signal into some signal output. It has a built-in amplifier circuit to adjust the input signals. The pre-filter circuit may filter out the dialing tone of 350Hz to 400Hz signal, and then use the high-pass and low-pass filters to split into high and low frequency signals. When the HT9170 receives an effective tone (DTMF) signal. The DV pin goes high and tone code (DTMF) signal is transferred to its internal circuit for decoding after setting the OE pin goes high and the DTMF decodes will appear on pin D0-D3. A standard 3.579545MHz connected to X1 and X2 terminals implement the oscillatory function.

5. Wireless A/V Camera

Figure 6.1: Wireless A/V Camera

The Wireless A/V camera is a high band receiver with sensitivity +18dB, receive signal picture sound 0.9H/1.2H with high quality output. The RM0100 is a 2.4 GHz wireless camera that works at 15m baret. It may cause interference with other wireless equipment that operates at the same band. The camera transmitter with receiver is set suitable for monitoring robot ,children and elder, and widely used for that presentation, after hour surveillance, home security, shops , factories, security ;you can view the cameras on your TV or record directly to VCB. The wireless camera and receiver will provide a day and night monitoring solution with the convenience of wireless technology.

6. Four Wheel Robotic Platform

In 4 wheel robotic platform v 2.0 have contain two 300 rpm dc geared motor, four double screw mount tire v 2.0 and one small chassis.

7. AVR Controller Board

Figure 8.1

AVR Controller Board is a complete starter kit and development system for the AVR Atmega16/32/8535 microcontrollers from ATMEL ® Corporation. It is designed to give designers a quick start to develop code on the AVR.

AVR Development Board kit is based on our 40 pin development board which is compatible with many of the Atmel AVR microcontrollers. This kit is an easy and low cost way to get started with microcontrollers. Included on board is an Atmega16/32/8535 microcontroller, external crystal with supporting capacitors, AVCC filter parts, Power supply parts and more. The Controller used is an 8-bit microcontroller. The versatility of board helps us to avail Programmable 16KB of flash, 1KB of RAM and Accessible 24C x I2C EEPROM. The board has 32 I/O lines, one programmable full duplex USART, 4 PWM channels and 8 channel 10-bit ADC Converter. The board creates a perfect platform for operating dual 8-bit Timers each having separate pre-scalars and compare modes. Additionally, a single 16-bit timer with a separate pre-scalar, compare and capture mode can be used. The Atmega16/32 is a feature packed and very versatile microcontroller. The board takes Input which can be either Analog or Digital in nature. On board we have PIN extensions of all the parallel I/O line available with the micro controller to make the peripherals plug n play.

Two L293D ICs are also available in Atmega-16/32 development board to run 4 different motors simultaneously. There is 1 DB-9 female connecter also mounted on board for PC connection. There is one 16 pins LCD connector (female) also available. There are four PWM channels also available by which we can control stepper/servo motors. Master/Slave SPI serial interface availability make use of USBASP programmer to flash program in controller.8 keypad switch and pattern of 8 different led's are also available on Atmega-16 board. There are two different options to provide power

supply (DC battery/adapter) to the development board. It also has 4 Interrupt switches to create interrupts.

8. Program Code for LM35 Diode

```
int motor = 12;
int sensorPin = 0;
void setup()
{}
void loop()
{
int reading = analogRead(sensorPin);
float voltage = reading * 5.0 / 1024;
float temperatureC = (voltage) * 100 ;
delay(1000);
if (temperatureC >= 100)
digitalWrite(motor,HIGH);
if(temperatureC<=80);
digitalWrite(motor,LOW); }
```
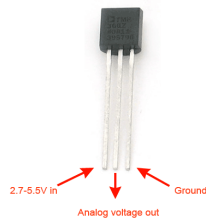
9. Flow Chart
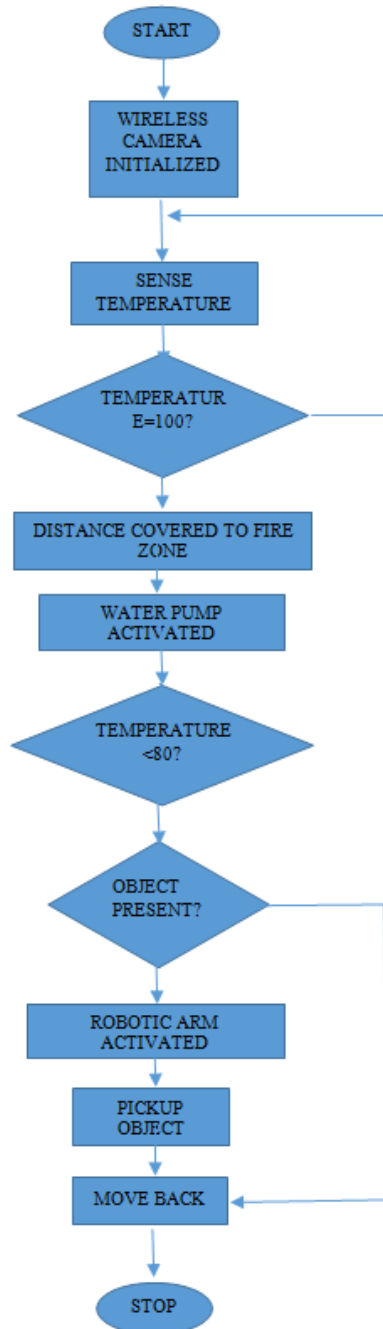
11. LM35 Sensor

Figure 10.1

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the users not required to subtract a large constant voltage from the output to obtain convenient Centigrade. The LM35 device does not require external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower in Still Air cost is assured by trimming and calibration at the ±¼°C Typical wafer level. The low-output impedance, linear output, 0.1 Ω for 1-mA Load and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power two Applications supplies, or with plus and minus supplies. As the device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to range −40°C to 110°C range. The LM35-series devices are available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D devices are available in the plastic TO-92 transistor package. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package.

10. Future Prospective

1. Unmanned firefighting systems
2. Remote sensing and fire tracking
3. Automatic fire extinguishing systems
4. Unmanned ground rescue operations

11. Conclusion

Thus this project is a working state-of-art developing technology in the field of fire extinguishing, military, heat sensing, tracking, temperature analysis on a large scale value. A fully automated system with unmanned and wireless controls helps in saving time and human power and life at very efficient power scales.

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[5] Had workshop in Delhi from where I get the idea

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