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Review on Fire Fighting Robot

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Abstract: *The challenge of creating a fire extinguishing robot to operate in lighting conditions that are not fixed is a difficult one. Completing each of the different components was not easy. However, Firebot's hardest task was integrating all of its components. The experience and the difficulties faced taught us valuable lessons that we can use on future projects. The security system of the home and building contains fire fighting robot security vehicle, RF module. Themain controller of the fire fighting robot is a microcontroller. We programmed the microcontroller to control the robotic vehicle to acquire flame sensor data, and run the vehicle towards fire by giving directions using Sound swawes. Once the flame is detected by flame sensor. Here we present the type of fire fighting robot that can be elaborate all that problem and work in almost all environment and all type of the condition which can faces during the fire in any building or any particular place.*

We also discussed the microprocessor and the main component that may used in the fire fighting robot. They are the very fast equipment and they responses in the very less time probably millions part of the second which can provide you real time fire safety without delay and it can also activated with the different sign of fire taking over the place like smoke, increasing temperature etc.

Keyword: *Microcontroller, Temperature Sensor, IR Sensor, Smoke Sensor, Automation.*

I. INTRODUCTION

The project presented here is based on fire fighting robotic . It has term that has since been used refer to a machine that performs works to assist people or work that humans which find difficult or undesirable. They are capable of performing repetitive tasks more quickly, cheaply and accurately than humans. Robotics has gained popularity due to the advancement of many technologies of computing and non technology making humanoid is easier and comfortable. The fire fighting robot is design to search for a fire in a small floor plan house of the specific dimension. The robot must run automatically, avoiding obstacles and at the same time find and track two flames (candle light) and extinguish them. To achieve the best performance with an effective implementation, we have taken a modular design strategy, where the robot is divided into a number of logical modules based on functionality.

This project, which is our endeavour to design a fire fighting robot. Comprises of a machine which not only has the basic features of a robot, but also has the ability to detect fire and extinguish it. The need of the hour is to make a device which can detect fire, even if it is small and take the necessary action to put it off. Many house hold item catch fire when someone is either sleeping or away and that lead many hazardous conditions if the fire is not putted off in time. So, we work as an electronics engineer is to design and build system that can automatically detect and extinguish fire. We have used very basic concept here, easy to understand from the prospective of beginners or for the masters of this field

II. GOALS OF THIS PROJECT

- A. Using 6 panels It must run automatically
- B. It must avoid any obstacles present
- C. It must track and find flames (candle lights) and extinguish them without making direct contact
- D. The entire project must have a affordable prize for use of the common man.

III. MODULAR DESIGN OF THE ROBOT

Modular designs of the robot are contain these parts

- A. of sensors, capable of detecting flame sources in a 360 degrees fashion
- B. Use Servos or DC motors
- C. Use IR sensors for proximity detection
- D. The project also has a modular design as illustrated in figure are
 - 1) Proximity, this involves the interfacing of a number of proximity sensors to detect the presence of objects
 - 2) Motor, this involves the making of a motor controller that can interpret commands sent to it, and perform corresponding motor actions

- 3) Flame Tracking, this involves the interfacing of sensors in such a way that we can reliably detect flame sources in a 360 degrees fashion
- 4) Fire fighting, this involves finding a suitable way to put out a fire
- 5) Core unit, a core unit will be present to co-ordinate the actions of all the sub units listed above

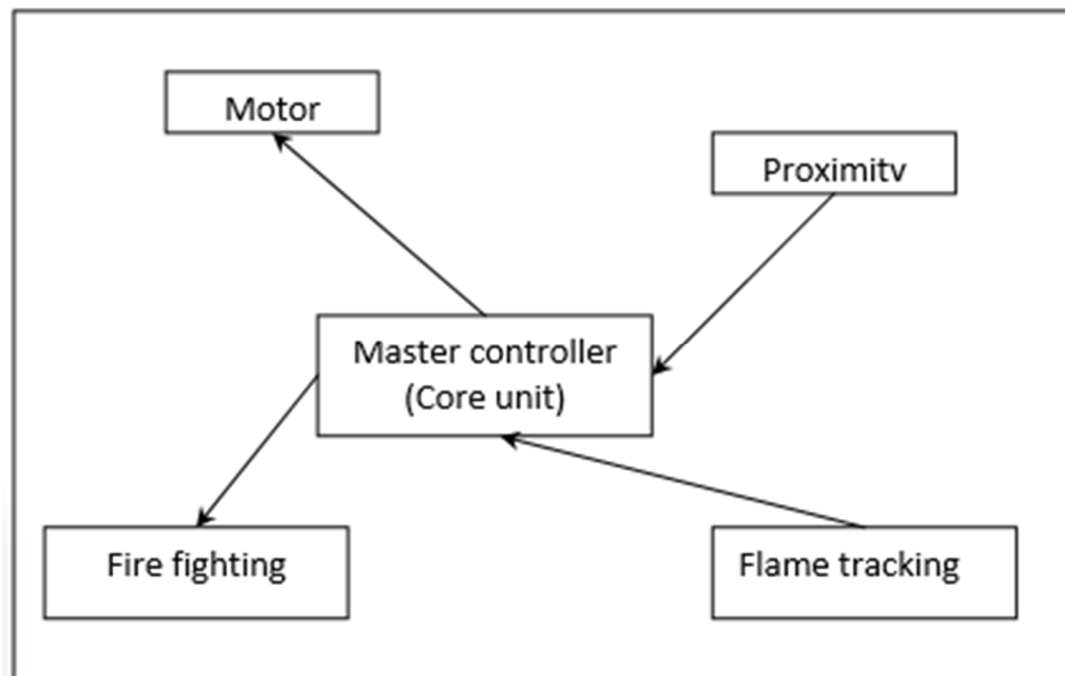


Fig.1 Modular design of the robot[1]

IV. ADVANTAGE OF MODULAR DESIGN OF THE ROBOT

- A. We have a clear separation of tasks, and thus each team member is more likely to be able to meet the deadline
- B. Having all components required for a particular set of sensors on a single board means that each team member can work independently, according to their own schedules
- C. Because each board is independent, they can be tested independently before the integration step
- D. Functionalities of the finished robot can be switched on and off by simply removing power from the individual modules. This makes debugging the final robot easier
- E. Modular designs have many redundancies, and as such as less prone to component failures. Broken parts can be swapped out very quickly
- F. Reaction speed lower than 25ms
- G. Must have speed control
- H. Must have special modes, it turns 180degree
- I. Must be based on interrupt
- J. Power requirement must be under 9v

V. CONSTRUCTION DETAILS OF FIRE FIGHTING ROBOT

Component used in fire fighting robot-

A. IR transmitter & IR Receiver

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). The RF module we will use comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 433 MHz and it has 4 output pins i.e. it can operate 4 peripherals remotely. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for

transmission feed while reception is decoded by a decoder. HT12D-HT12E, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs

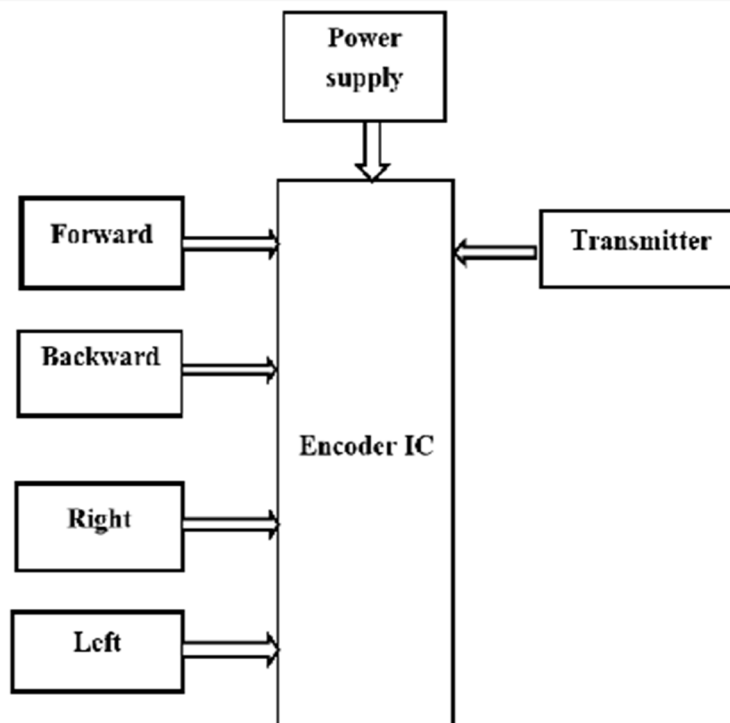


Fig.2 Block diagram of the Transmitter unit[2]

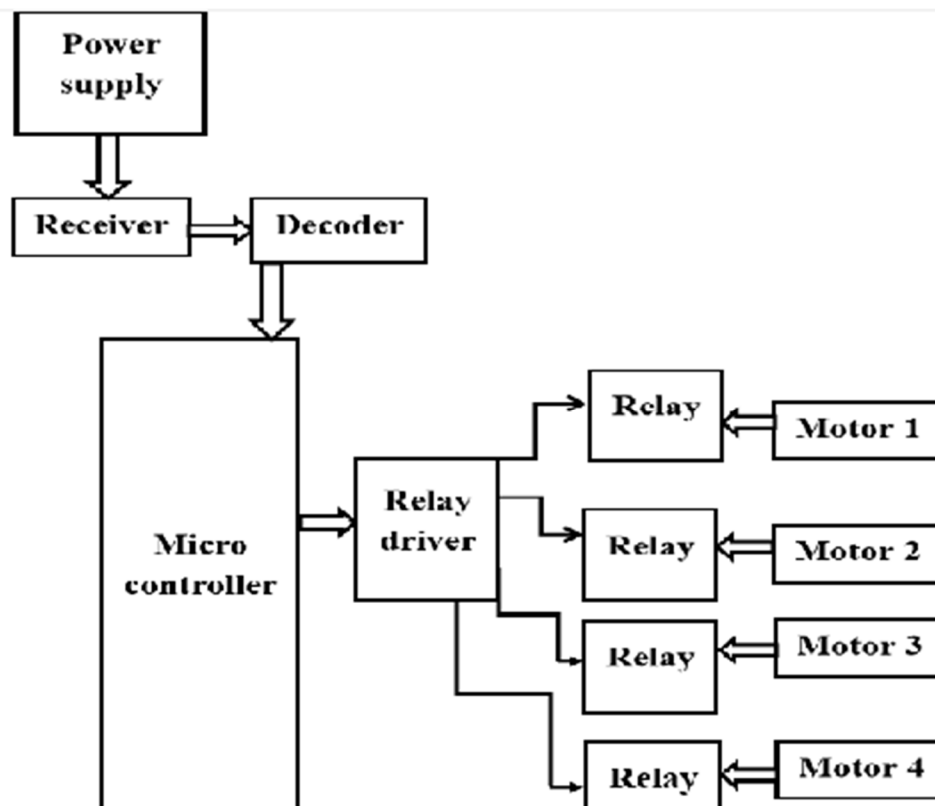


Fig.3 Block diagram of the Receiver[2]

Voltage regulator

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current (over load protection) and overheating (thermal protection). Many of fixed voltage regulator ICs has 3 leads. They include a hole for attaching a heat sink if necessary.[2]

B. Decoder

HT12H converts the serial inputs into parallel output. It decodes the serial data into parallel for transmission through an RF transmitter. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission is indicated by a high signal at VT pin.

HT12D is capable of decoding 12 bit, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new is received.

C. Encoder

HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 bits.

HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops. [2]

D. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Relay driver. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

E. Relay driver IC

ULN2003 is a high voltage and high current Darlington transistor array. The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode Clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current capability.

F. Proximity control

Proximity generally refers as the nearness the proximity control is used in the Fire fighting robot is very much essential because it helps to prevent damage to the fire fighting robot from the fire and also the smoke because it damages the very sensible part of the robot that are probably electronic component that are very much destroyed by the fire as well as various other sources. Proximity sensor is attached with the motor through the Microcontroller and motor take instructions from the microcontroller by means of the proximity sensor.

G. Flame Tracking System

Fire detection unit are attached to the IR transmitter and it activated when the heat or smoke generated in the particular area the flame or fire tracking system is activated and send the signal to the transmitter and the transmitter activated and then it send the signal to the receiver or receiver receive the signal and then the signal goes to the decoder and then decoder decodes all signal to its acceptable form of the signal and the fire fight robot start the fighting against the fire and flame. The robot uses a CMU Camera to detect the fire. The camera communicates to the processor through UART1 and has a built in IR filter. This is helpful because of the use of IR for room finding. The camera processes the video stream onboard and then sends back several values over a serial connection. A GUI is provided by the camera that allows the user to see what colours the camera is detecting. These values are then used to calibrate the colour of the candle. The camera is then told what colour to track. When the correct colour is seen by the camera, the user is given the X and Y mean coordinates of the centroid of the colour being tracked.

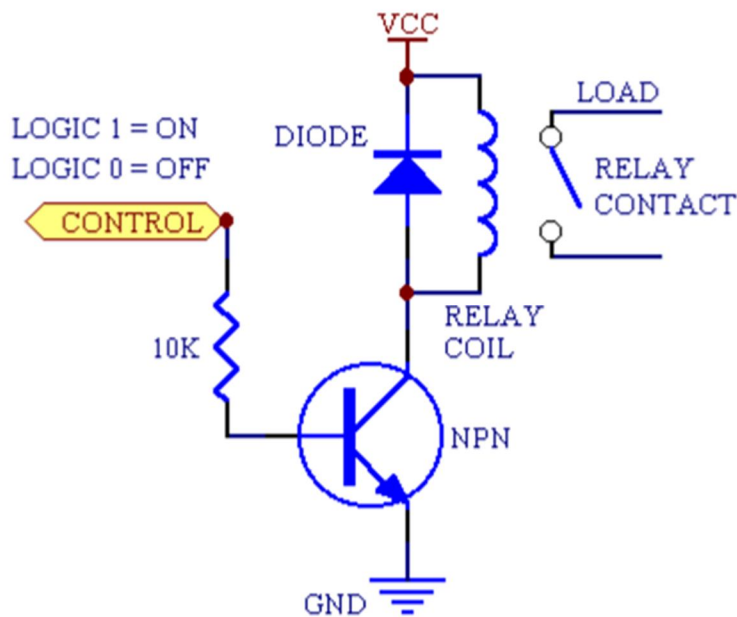


Fig.4 Circuit diagram of the relay[2]

H. Microcontroller

The main function of microcontroller is to control all the essential equipment used in the overall circuit the microcontroller is also used as a heart of the any electrical component. It can also be the programmable it has its own memory and saves functions of the entire process that will lead a precise automation of the entire fire fighting robot.

The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K of EEPROM, and 2K of internal SRAM.

The Atmega328 is one of the microcontroller chips that are used with the popular Arduino Duemilanove boards. The Arduino Duemilanove board comes with either 1 of 2 microcontroller chips, the Atmega168 or the Atmega328. Of these 2, the Atmega328 is the upgraded, more advanced chip. Unlike the Atmega168 which has 16K of flash program memory and 512 bytes of internal SRAM, the Atmega328 has 32K of flash program memory and 2K of Internal SRAM. The Atmega328 has 28 pins. It has 14 digital I/O pins, of which 6 can be used as PWM outputs and 6 analog input pins. These I/O pins account for 20 of the pins.

VI. EVALUATION

- A. We see that some design principle paid off for the project:
- B. By not allowing the robot to stop, we have produced a very responsive unit (Respond to any external event within 500ms). The Robot does not stop under any circumstance, and can deal with difficult situations such as entering a right angle corner at 45 degrees
- C. By using cheap components, we were able to incorporate individual panels for fire detection.
- D. The use of capacitors is vital to parts that are sensitive to voltage drops. As we found out with all of our PIC boards, adding a capacitor between power and ground can prevent the PIC from randomly resetting due to sudden voltage drops caused by components somewhere else.
- E. We used machined pins for all connections, the advantage is plug and play, we can plug in different modules with all sorts of devices such as power supplies, signal generators, oscilloscope etc[1]

VII. CONCLUSION

The challenge of creating a fire extinguishing robot to operate in lighting conditions that are not fixed is a difficult one. Completing each of the different components was not easy. However, Fire fighting robot's hardest task was integrating all of its components. In this paper discusses the development of each component of the robot that is designed to find a small fire represented by a light emitting diode in a model home and extinguish it and we will talk about each component of the robot from the start signal to the robot platform to the line following and room finding and finishing with the fire detection The water container is placed on the robot when the fire is detected, it sprays the water on the fire and extinguish it.



Therefore, our final model of the robot can successfully find “fire” and reach it without running into obstacles. Also, we managed to construct the robot comfortably within the budget Throughout the project, our technical knowledge was put to practical use and hence learnt many technical skills. This project also made us aware of the markets of technical components and many other factors we didn’t realise before.

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