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RESEARCH ARTICLE

Fully Automated Fire Fighting Robot with Radio Frequency Module

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Abstract

The role of automation industry to solve real life problems is increasing day-by-day. In some kind of emergency situations like fire control in a building, it is so difficult for a human being to go inside the fire to extinguish it. So, in future aspects there is a need to build some special robots/machines having better heat resistant properties under high temperature conditions. The robot should automatically detect the fire with the help of temperature sensors which are mounted on the robot's surface and to take quick action to extinguish the fire. Another most important feature is required in the fire fighting robot should be connected to the control room with the help of wireless connection. This study represents the design of a fully automated fire fighting robot and includes various modules such as temperature sensor LM35, microcontroller PIC 16F8778, 16*2 LCD and RF (Radio-Frequency) module at 433 MHz. A 12V dc motor is used to derive movements. When fire in a particular zone gets detected by the robot then it automatically reached to that zone with the help of wheels connected to the robot with the help of dc motor. All the modules of the study project such as RF transmitter and receiver unit, temperature sensor with LCD interface and dc motor control unit are mounted on a single ply board. The schematic of PCB (Printed Circuited Board) for each module is designed with the use of software. All the stages to design a fire fighting robot are discussed step by step in the present investigation.

Keywords: Fire fighting robots, radio frequency module, temperature sensor, microcontroller, RF transmitter.

Introduction

From the recent years, robotics has turned out to be an ingredient over which many people had shown their interest (Ren and Kuo, 2007). Robotics has gained popularity due to the advancement of many technologies of computing and nanotechnology making human life easier and comfortable (Sivas and Kalaimani, 2013; Sangaralingam and Sathish, 2014). Here, the interest of this study is to make a fully automated fire fighting robot which can help in dealing fire problems in households and small scale industries. This study is not concentrating on making a fire-fighting robot that can deal with fire on large scale, but 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 household items catch fire when someone is either sleeping or away and that lead to many hazardous conditions if the fire is not put off. So, this study helps a computer engineer to design and build a system that can automatically detect and extinguish fire (Sunil, 2013). This study used a very basic concept, easy to understand from the prospective of beginners or for the masters of this field.

Materials and methods

Experiment module: This study is the combination of various modules such as temperature sensor LM35, microcontroller PIC 16F8778, 16*2 LCD and RF module at 433 MHz (Sengupta, 2012), a 12V dc motor is used for servo mechanism. Figure 1-9 shows the schematic layout of modules used in the study. The program code to control the fire fighting robot is written in C language.

Fig. 1. Schematic layout of temperature sensor module with LCD display.

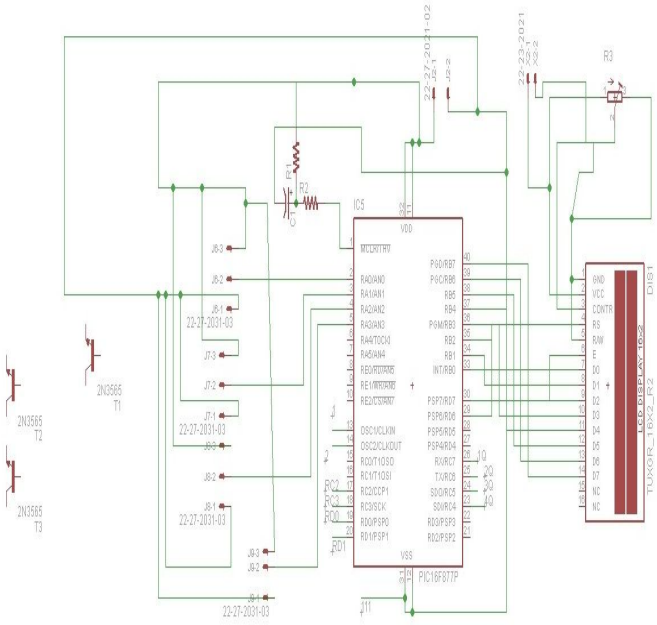


Fig. 2. PCB layout of temperature sensor.

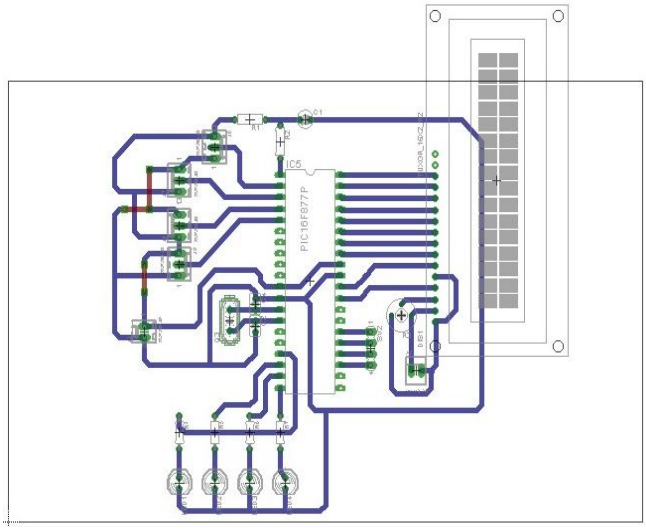


Fig. 3. Schematic of transmitter module.

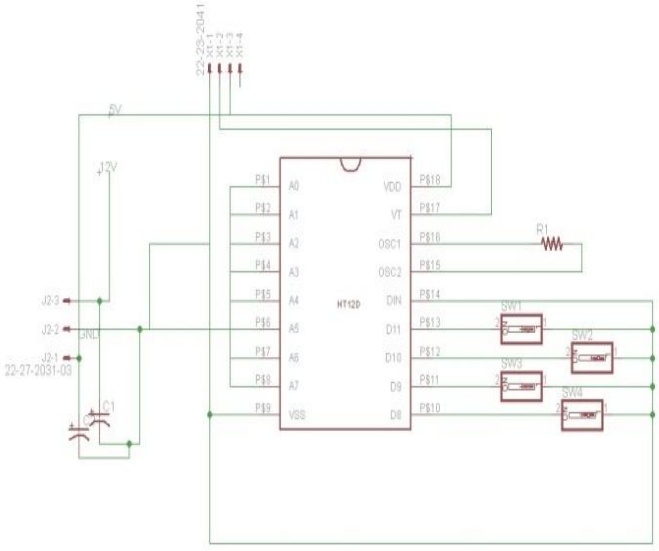


Fig. 4. PCB layout of transmitter module.

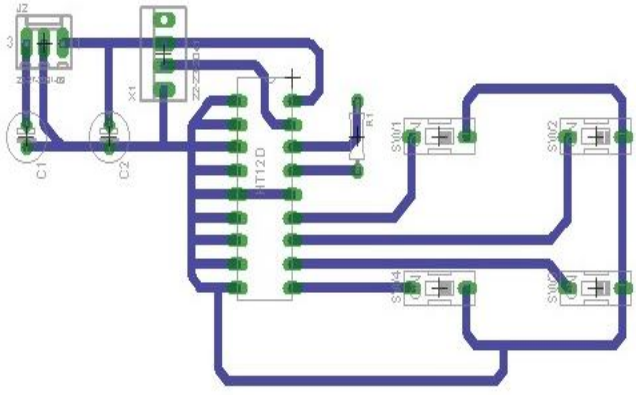


Fig. 5. Schematic diagram of receiver module.

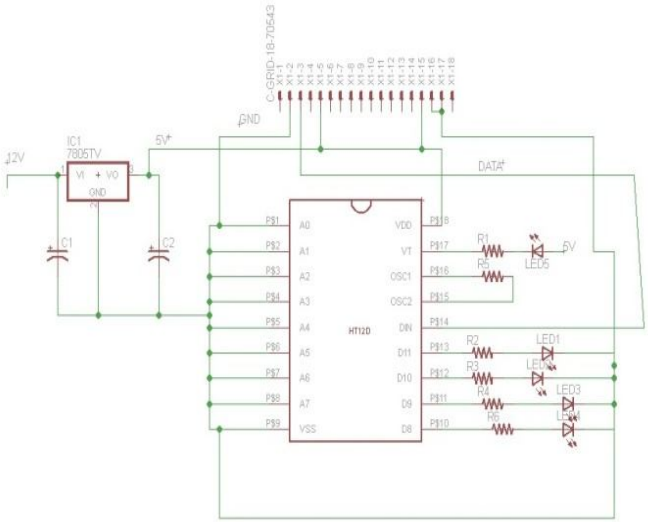


Fig. 6. PCB layout of transmitter module.

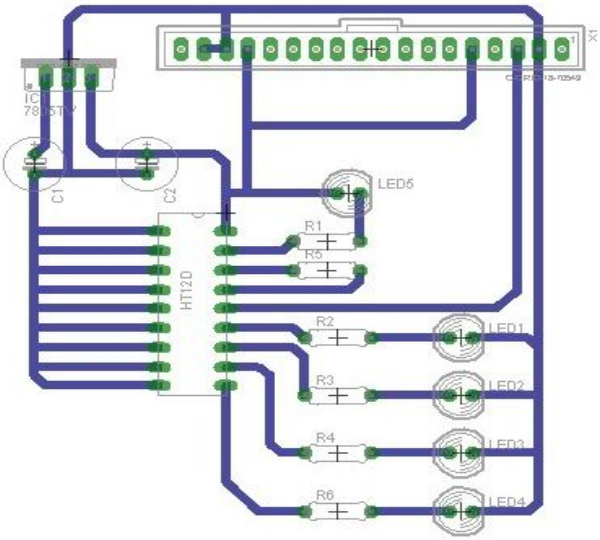


Fig. 7. Hardware implementation of RF module.

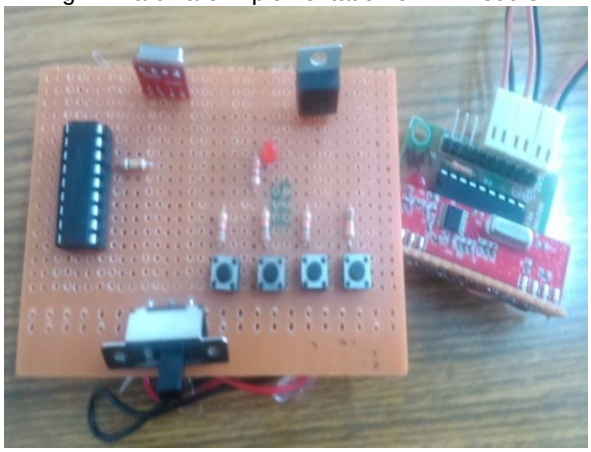


Fig. 8. Schematic of motor driver module.

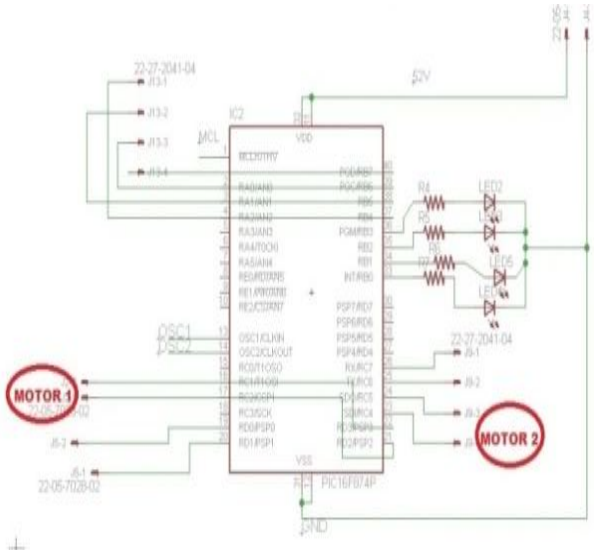
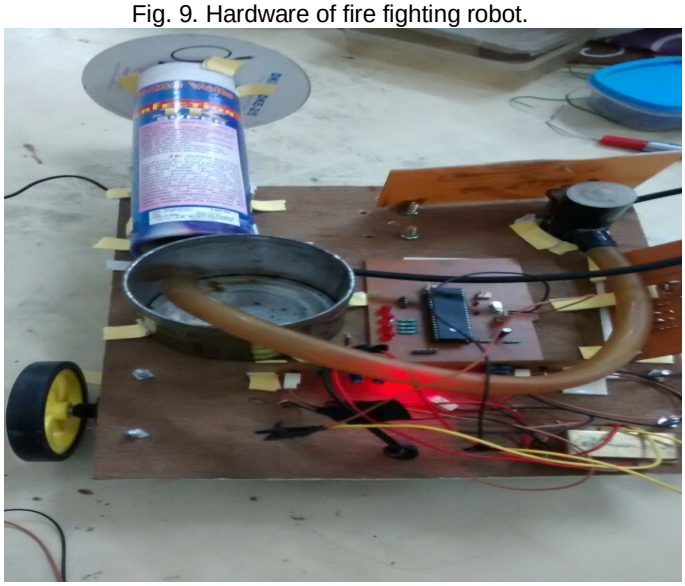


Fig. 9. Hardware of fire fighting robot.



Design aspects of the study project: The block diagram for the study is given in Fig. 10 which describes all the steps involved to design a fire fighting robot.

Step 1: Temperature sensor modules were made to detect the temperature of the four different zones.

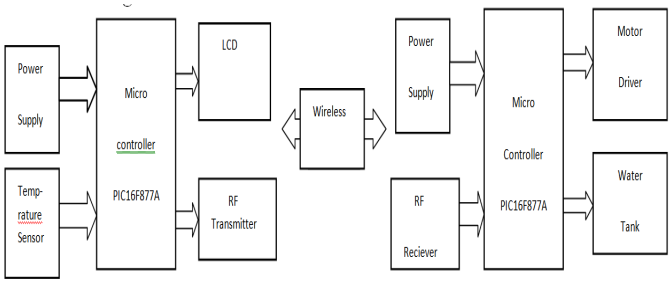
Step 2: The voltage output of the temperature sensor is converted into digital voltage with the help of ADC in the microcontroller (16F877A).

Step 3: The output of the microcontroller is displayed on LCD to show the temperature value of four different zones.

Step 4: A signal is sent through RF transmitter module if there is an increase in temperature beyond the reference value of 35°C. This signal is received by the receiver of RF module placed on the robot and microcontroller will receive the pulse to operate the corresponding motor motion.

Step 5: The water tank placed on the robot will extinguish the fire.

Fig. 10. Block diagram of the study.



Results and discussion

The main goals while making this study were (a) It must run automatically (b) It must sense fire and extinguish it without making direct contact and the budget of the study should be minimum. This fire extinguish robot sense the increase in temperature by comparing it with the reference value i.e. 35°C. The robot gives command to a 12V dc motor and it will give movements to the robot so it can reach to emergency zone. DC motors drive the robot wheels, we choose a dc motor for this robot because it is simple to control in terms of their speed and direction. Battery with long amp hour is used; the main idea is to design this robot and make it think entirely on its own and should not depend on human input for direction or speed or for power supply. This robot can be used as a guide to the visitors from the entrance to the main office. It can help doctors to carry the medicines from one ward to another.

Conclusion

This study presents a design of a fully automated fire fighting robot and includes various modules such as temperature sensor LM35, microcontroller PIC 16F8778, 16*2 LCD and RF (Radio-Frequency) module at 433 MHz. The approximate cost of this study project is `1000. In future work, a camera can be installed on robot to check the obstacles.

Acknowledgements

This study was completed during the specified time limit. All the authors are highly appreciated for their contributions and time to time guidance in this study.

References

1. Ren, C. and Kuo. 2007. Autonomous fire detection system for intelligent security robot. *IEEE/ASME Trans. Mechatron.* 12(3): 274-281.
2. Sangaralingam, C. and Sathish, R. 2014. Design of surveillance robot with obstacle sensing and movement control using arm controller. *Int. J. Engg. Res*. 2(2):201-206.
3. Sengupta, M. 2012. Microcontroller based infrared tracking device in 2D motion. Int. J. Sci. Engg. Res. 3(9): 1-10.
4. Sivas, A. and Kalaimani, S. 2013. Wireless surveillance robot with motion detection and live video transmission. *Int. J. Emerg. Sci. Engg*. 1(6): 14-22.
5. Sunil, M. 2013. Design of an event based surveillance system using advanced technology. *Int. J. Engg. Sci. Innov. Technol.* 2(6): 451-459.