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Fire Extinguisher Robot

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Abstract:
The primary objectives of this project are building this robot and devising candle-finding and candle-extinguishing strategies. The secondary objectives of this project are to introduce us to both the Handy board platform (in particular) and to implementation issues in robotics (in general).

Keywords: *IR sensor, Extinguisher, Robot.*

1. Introduction

A robot is a thing which runs automatically without human intervention. Typically, a robot is endowed with some artificial intelligence so that it can react to different situations it may encounter. Two common are agents and spiders. A robot is "a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks". We are attempting to construct and program a robot capable of moving through a semi-arbitrary maze to locate a candle, and then extinguish said candle. This project has been done many times in years past. Many solutions from previous years were mentioned in class. These included a variety of both candle-finding and candle-extinguishing strategies. In a broader sense, this project touches on many of the fundamental problems of robotics. Thus, we are faced with challenges of:

- Navigation - We need to make our way through a maze to a goal; neither of which are known *a priori*.
- Sensing - The robot needs some way to determine the position of the candle, the walls, etc.
- Interaction - The candle must be extinguished; our robot must interact with its environment.
- Autonomy - The robot must be able to both navigate and interact without any human assistance.
- These challenges, as well as others not mentioned, are crucial to both our project and to robotics in general.

2. Working Principle

Conceptually, we divided this task into two parts: finding the fire and extinguishing the fire. To find the fire, initially all the IR sensors will sense whether fire is present or not. If fire is not present then robot will not move from its position it will be in stable mode. By sensing the fire using IR sensors, we will eventually be able to find the candle. If one of the IR sensors sense the fire, then robot start moving towards the fire. If fire is not in front of the robot i.e. besides the robot or behind the robot, then robot will move in anticlockwise direction towards the fire and when the long range sensor placed in front of the robot sense the fire, robot will stop and move ahead of the fire until the short range sensor detects the fire. Once the fire is detected by the short range sensor robot will stop and our fire extinguishing mechanism will start. In fire extinguishing mechanism, we use the CO2 can to extinguish the fire. Once the fire is detected by the short range sensor, microcontroller 89C51 will turn ON the relay which will drive the motor. This motor provides the pressure on the nozzle of the can and CO2 will automatically come out from the can. It will continue until the sensor detects the fire. Once the fire is extinguished robot will stop and again starts to sense the fire by the IR sensors.

3. Block Diagram Description

A firefighter robot is one that has a small fire extinguisher added to it. Small fire extinguisher will be attached to the robot. The fire detection scheme to be put into use is relatively free of false alarms, it is anticipated that it will not overreact in non-fire simulations.

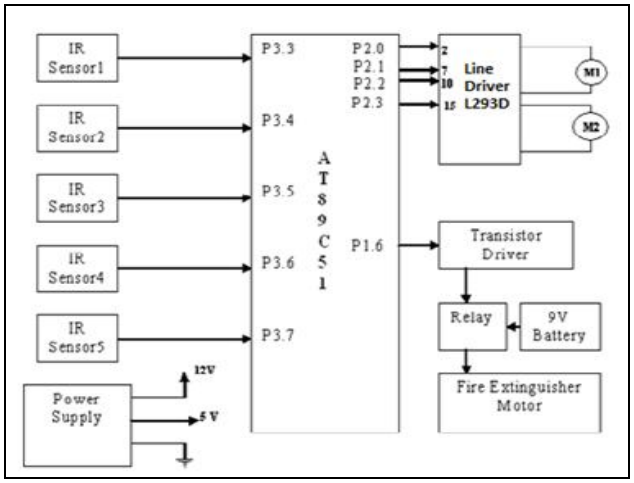

Figure 1: Block Diagram

3.1. Two types of IR Sensors

Two IR sensors will be attached to robot assembly. The robot will rotate continuously. One IR sensor is used for short range & second is used for long range fire detection. When long range IR detects the fire, robot starts moving towards the fire till the short range IR detects the fire. When short range is detected robot will stop moving & will start the extinguisher. The extinguisher will remain ON till the IRs stop detecting fire. Water or CO2 can be used as extinguisher.

3.2. Five IR Sensor

In this scheme four long ranges (0°, 90°, 180°, 270°) & one short range IR will be used. Initially the robot will not move. Three long range IR sensors are placed at right, left, & backward position. Whenever any of these IRs detects fire, robot starts turning to that particular direction till the forward long range IR detects fire. Once forward long range IR detects fire, it starts moving towards fire till short range IR detects fire. Extinguisher starts as short range is detected. The range of IR Sensor can be changed by varying the pot on its respective PCB.

3.3. Microcontroller

It performs two functions; one is to detect the fire with the help of IR sensors. After detecting the fire it will turn the robot in the direction of fire and move towards it and it will start extinguisher motor with the help of relay.

3.4. Line Driver

It is used to drive the dc motors.

3.5. Relay

It will be turned on by microcontroller when fire is detected by short range sensor.
Relay is used to drive the extinguisher motor.

4. Software Implementation

For coding the CPU, we have utilized the KEIL software. The software enables the programmer to use high level languages such as C to code the microcomputer. The use of high level language enables efficient coding and provides ease and greater flexibility as compared to assembly languages. KEIL encases and supports a well equipped chip library from a variety of manufacturers which provides a broad environment for software development. KEIL supports various register architectures which can be incorporated in the code by including a header file (e.g. Reg51.h). KEIL 8051 development tools are designed to solve complex problems faced by embedded software developers. It has the following features:

- When starting a new project, simply select the microcontroller you use from the Device Database and the µVision IDE sets all compiler, assembler, linker, and memory options for you.
- Numerous example programs are included to help you get started with the most popular embedded 8051 devices.
- The Keil µVision Debugger accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 device. Simulation helps you understand hardware configurations and to begin testing your software application with target hardware, use the MON51, MON390, MONADI, or FlashMON51 Target Monitors, the ISD51 In-System Debugger, or the ULINK USB-JTAG Adapter to download and test program code on your target system.

4.1. Algorithm of Program

1. Start
2. The machine rotates in anticlockwise direction in the same position till a fire is detected.
3. When the fire is detected, appropriate bits at port 3 are set. When this occurs, main program is interrupted.
4. Calculates the direction of the fire by determining which bit is set.
5. The vehicle rotates till the front sensor detects the fire.
6. Initiates motion in the direction of the fire.
7. The robot moves towards the fire till the short range sensor is activated.
8. The machine stops.
9. Activates the extinguisher.
10. Stop.

5. Result

To find the fire, we mounted the four long range sensors on four sides of robot and one short range sensor at the front side of robot, if fire is detected by one of the long range sensors then robot will turn in that direction and march towards fire .When fire is detected by the short range sensor the robot will stop and the extinguisher will turn ON and fire is extinguished

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