

Automated Fire Detection and Fighting Robot using IoT

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Abstract - In the development of robotics, the human involvement is becoming less and robots are being used widely for the safety purpose. Now-a-days fire accidents are becoming common and it sometimes lead to accident that makes it hard for fireman to protect the human life. Our proposed system is used in these situations where it is difficult to protect. We designed a robot which is operated in two modes- Automatic mode & Manual mode. In Automatic mode, the robot is operated by itself based on the command defined by the user. In Manual mode, PHP webpage is used to control the robot in remote locations using IoT. The switching from Automatic mode to Manual mode can be done by using PHP webpage.

Keywords - Raspberry Pi 3, IR sensor, DC motor, fire detection, L293D Driver IC, IoT.

I. INTRODUCTION

As the robotic technology have becoming improved and plays an important role in our day to day life. The protection of human life from the fire accidents is also plays a crucial role for fireman. This system is developed to find an alternate solution for human work and efforts with the improvement in technology of embedded system particularly when fire hazards occurred. The fire sensors are positioned by estimating the range of fire detected and placed in various directions. The Ultrasonic sensor is connected with Raspberry Pi 3 for obstacle avoidance. Whenever the fire is detected water pump is turned ON to extinguish the fire. To sprinkle water in various directions the water pump is connected with servo motor to rotate in various directions.

II. LITERATURE SURVEY

A. Existing System - Automatic systems that are developed in the stream of robotics can't be controlled manually when needed. Manually controlled robot can be operated by the human in the vicinity of fire which can be harmful.

Drawbacks of Existing System

- In some situations the robot may get lost from the field of fire.
- Operation of manually controlled robot is limited in the existing system.

B. Proposed System - In this system, we have implemented both Automatic and Manual mode of operation to overcome the drawback of the existing system. Manually controlled robot can be operated from anywhere by using the PHP webpage. The fireman work can be minimized by operating the robot in Automatic mode.

The advantage in this system is we can switch from Automatic to Manual mode whenever we need.

D. Proposed system Modules -

- The manual mode can be operated by using controls on PHP web page that contains Left, Right, Front and Back.
- To avoid obstacles, we are using Ultrasonic sensors.
- There is a possible to switch between Automatic and Manual modes.
- We can detect the fire in various directions of front, back, left and right by placing various sensors in different sides of robot.

III. HARDWARE REQUIRED

The movement of the robot can be done by using four-wheeler motor with L293D Driver IC which is used to control 100RPM motor. Raspberry Pi 3 is used as a controller to read the values from the sensors and sends the signals to control the robot movement. The Ultrasonic sensor is used for avoiding the obstacles when the robot is in moving condition. In order to sprinkle the water we are using water pump connected with servomotor in what direction the sprinkling is needed.

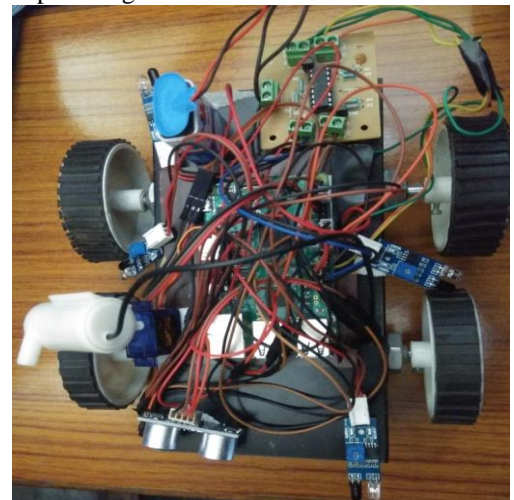


Figure 1: Top view

The IR sensors are placed in various directions for the detection of fire in what direction the fire is occurred. The Ultrasonic sensor is not only used for obstacle avoidance but also used to maintain a safe distance from fire source to robot.

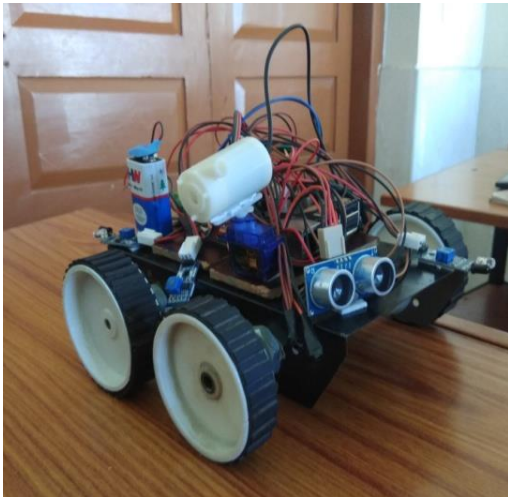


Figure 2: Front view

The movement of the motors can be achieved by providing the power supply of 9V DC. In that case we are using a battery connected to Driver IC L293D.

IV. SOFTWARE IMPLEMENTATION

The controller used in this system is Raspberry Pi3 microcontroller which is programmed using Python language. When it is powered ON, the Raspberry Pi 3 initializes the GPIO pins as outputs, in order to send the controlling signals to Ultrasonic sensor.

If the fire is detected, the servo motor rotates in that direction and sprinkles the water. This can be achieved by the predefined commands given to the microcontroller.

In manual mode, the robot is controlled from the PHP webpage from the different location. This can be done through IoT.

action and the servo motor is rotated in that direction and the water pump is turned ON to extinguish the fire.

This action can be done in automatic mode in what direction the fire is detected the motor will rotate in that direction and stops the movement and the servo motor has to rotate in that direction with sprinkling of water. In manual mode, the mode is switched from the automatic to manual mode on PHP webpage. If it is switched, the robot controls can be available on that page to operate the robot in remote locations.

A. Manual mode - In this mode, the controlling action can be done by using PHP webpage where we can send commands to motor driver through GPIO pins of Raspberry Pi 3 to move in required direction.

The PHP webpage contains the following commands:

1. Forward
2. Back
3. Turn left
4. Turn right
5. Stop
6. Motor ON
7. Motor OFF
8. Back right
9. Back left

There is also a control to switch between automatic and manual modes.

B. Automatic mode - In this mode, the robot initially in forward direction when the obstacle is detected the robot stops and moves in another direction. When the fire is detected, the robot will do its operation based on the predefined commands provided in the program. Only one thing to do is, we have to select the automatic mode in PHP webpage.

V. WORKING

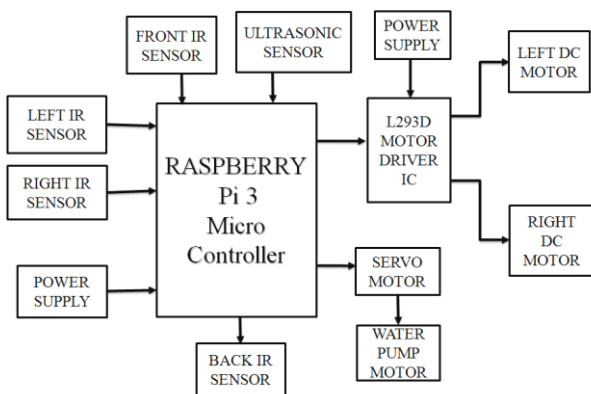


Figure 3: Block Diagram

Initially the robot is in moving condition in forward direction, the ultrasonic sensor reads the data whether the obstacle is presented or not. When the fire is detected in left side of the robot, it will rotate in left direction, stop the

VI. FLOW CHART

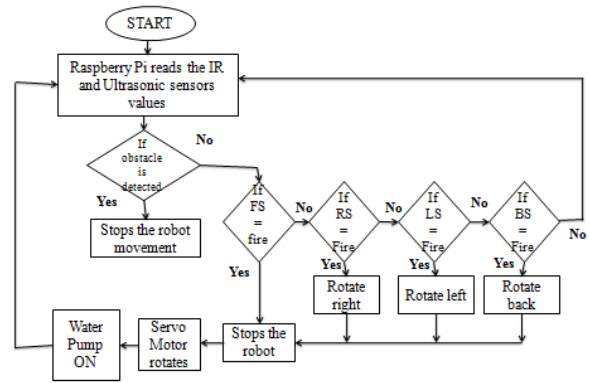
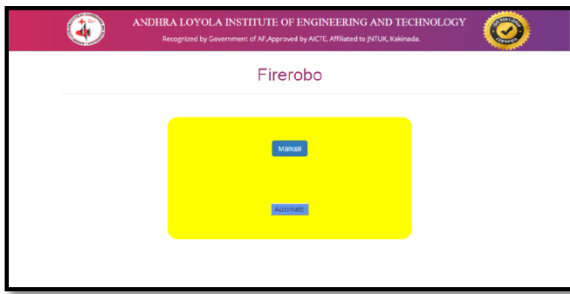


Figure 4: Flow chart for proposed system

VII. RESULTS

This system is capable of detecting fire and extinguishes the fire successfully. The robot is in continuous rotation whenever the fire is detected; the robot will rotate in that direction and extinguishes the fire.



VIII. CONCLUSION

In order to reduce the manual work we are introducing the “Fire Fighting Robot” with the above mentioned features. This robot can work automatically or manually based on our requirement. It is easy to control and feasible.

IX. FUTURE SCOPE

- Implementation of this robot with addition to the camera can be monitored and controlled from anywhere using PHP webpage.
- By inserting the camera we can visualize to what extent the damage has been occurred.

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