

Design and Construction of Supervising and Firefighting Self-Governing Robots

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Abstract: In Present world ROBOTICS is the leading and successful area. There are many robots are present in the environment such as rescue robots, agriculture robot etc., But there is an outstanding demand for the rescue robots only. Types of rescue robots are available such as Fire fighting bore well robots etc., Here Fire fighting robot is used to demonstrate and greatly strengthen the approach. These types of robot which help the human involve in danger. Fire quenching robot can be controlled in many different ways such as autonomous fire robots control, automatic, remote controlled and speech recognition, SMS control. Human cannot work systematically in all type of fire task environment. Robots can get in to small and limited holes and gaps and it is impractical for the trained dogs. Robot 1 and robot 2 are placed in the different rooms. Both the robot starts surveying in the different room. If robot 1 identifies fire in room 1, then it has to give the signal to robot 2 through RF. Then the robot 2 has to identify the path of the room 1 through the shortest path finding. Finally both robots have to extinguish the fire in the room.

Key words: Self-Governing Robots • RF signal • PIC 16F877A Microcontroller • Fire detector • IR sensor

INTRODUCTION

Fire fighting is dangerous job [1]. It causes more number of life and damage to whole entity. In April, 1925 the first fire administration was well-established in Korea. Ongoing firefighting mechanism is established upon humans using water guns and chemical fire control systems. Humans cannot assign completely in all fire circumstances. Fire detecting mechanism is suited on the walls and ceiling in the house, but it is not adaptable to recognize the fire act. To observe fire act and to extinguish the fire source Self-governing robots are used.

Fire Fighting Robot: Robot consists of microcontroller to attenuate catastrophic of life and property. Self governing robot contains PIC 16F877A microcontroller, dc motors, RF transceivers, Fire sensors are shown in figure 2.1(a) and 2.1(b). Microcontroller acts as heart. It consists of fire detector to find the candle fire, Infrared Sensor used to

search the obstacle and interference in front of the robot. Zigbee is used to transmit the data from PC to the PIC 16F877A Microcontroller.

MATERIALS AND METHODS

Existing System: The robot uses line following sensor [4] is passed to follow the line shown in figure 3.1. These robots are operated using remote control [1]. The working of line following sensor [7] is shown in the table 3.1. Leader-Follower relationship is maintained when using of more one robot [11]. It may crash with each other which results a fault signal. Fire detector can be distinguished between two types such as Fire and Non fire. False alarm will produce noise in the surrounding environment. Non fire sources such as hydro carbon such as methane, propane may cause the fault alarm occur in the rooms. Voice commands are also used to guide the robot motion [3]. This may cause inaccurate voices. False alarm gives SMS to the people [9] while detecting the fire place.

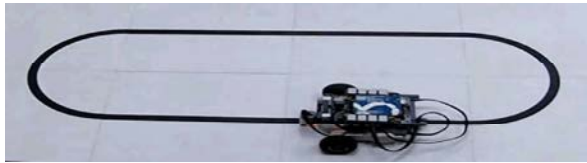


Fig. 3.1: Line Follower Robot

Table 3.1: Working of Line Following Sensor

Left Ir Sensor	Right Ir Sensor	Condition
0	0	Robot is outside the line
0	1	Left side of the robot is outside the line
1	0	Right side of the robot is outside the line
1	1	Whole robot is within the line

Proposed System: Self-Governing robots find fire using fire detector and detect it. The robot has been established to procedure in the direction area with respect to the fire expanse. The room can be identified by using IR sensor in the robot [2]. The working of camera to PC is shown in figure 3.2. It is done MATLAB programming. It is used whether it is a fire or a non fire. Then starts surveying near to the fire and extinguishes fully. Relationship between the robots is shown in Figure 3.3. Here two robots are used, both are used for surveying and fire detecting where the flowchart is shown in the figure 3.4. Leader- Follower relationship is not used. Two robots are placed in different rooms; therefore they will not collide with one another.

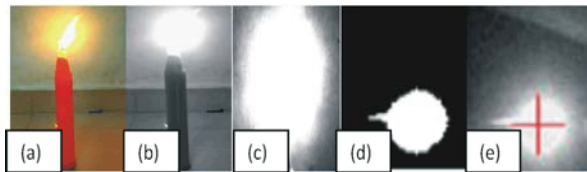


Fig. 3.2: (a) candle picture (b) Converting RGB to gray image (c) Camera reveals the flame not the candle (d) Fire image after thresholding (e) Threshold value is calculated using center of gravity

Relationship between Self Governing Robots

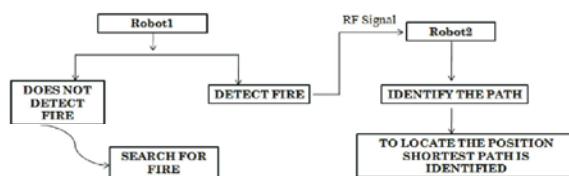


Fig. 3.3: Self-Governing Robot relationship

Flowchart

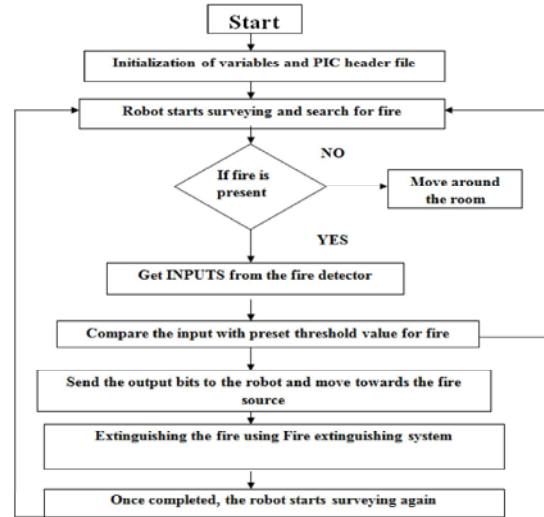


Fig. 3.4: Flowchart of the work

Robot System Model

Working: Fire detector is possessed by the PIC16F877A Microcontroller, Zigbee communication shown in figure 4.2. RF Transmitter transmit the RF signal to Robot 2 micro controller is present. It enclose RF receiver to receive the incoming signal from the robot 1. The main components of 5v dc and 12 v dc are desired to run completely. Microcontroller maintains Transistor and relay are containing in the driver circuit.

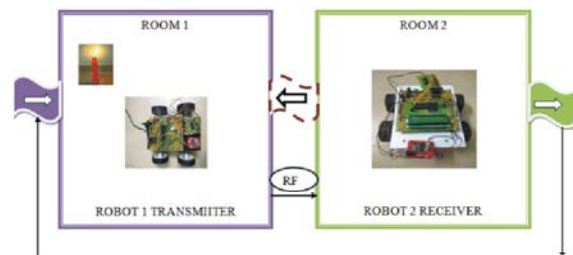


Fig. 4.1: Working of the robot

Figure 4.1 and Figure 4.2 shows Robot 1 observes any smoke/fire/obstacle detector will give the command to the microcontroller and it supervises the area within the distance Robot 1 receives the command through Zigbee module [5]. The microcontroller data pin bit will goes lower when the fire is present and always scans the input signal of detectors. If any of the sensors provides the call about smoke, fire, obstacle to the microcontroller, next the robot terminate and shows smoke/fire/obstacle is detected over LCD. Finally the robot moves the extent and extinguishes it.

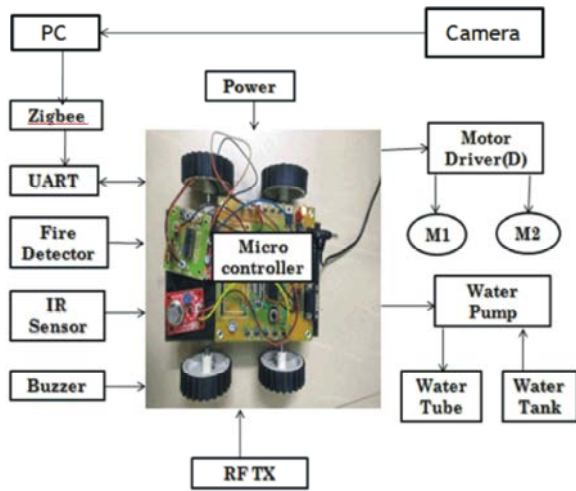


Fig. 4.2: Block Diagram of Robot 1

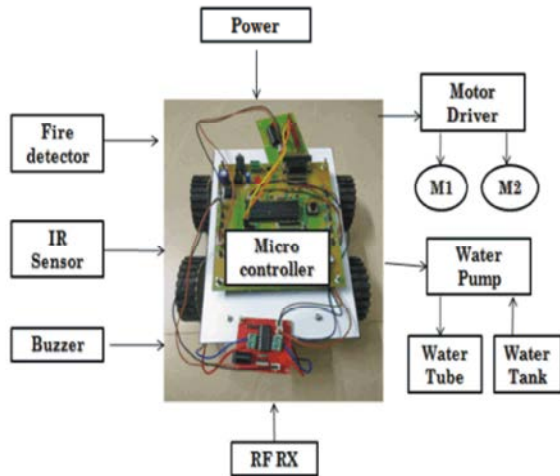


Fig. 4.3: Block diagram of Robot 2

Efficient Communication: RF is operates with voltage range of 3v to 12v gives a powerful communication distance. It is patterned to work with 433MHz frequency [8] shown in figure 5.1. It power about 4.5mA with 3V when transmitting logic shows 1. It transmitter logic shows 0 and then no power is drawn. RF Transmitter and Receiver features and applications are shown in table 5.1.

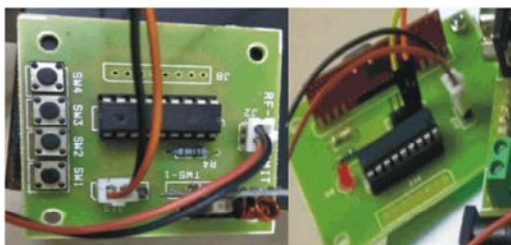


Fig. 5.1: RF Transmitter and RF Receiver

Transmitter supply voltage range 3V to 6V and the output power range 4V to 12V with frequency 433.9MHz. Working of RF communication is shown in the figure 5.2. The communication between the Transmitter and receiver is about 100 meter. RF Transmitter is used to send the signal to receiver present in the robot 2 to control the movement such as right, left, forward and backward.

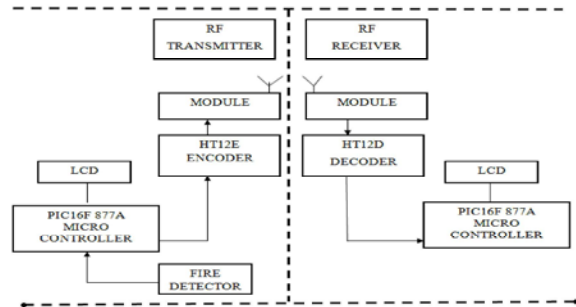


Fig. 5.2: RF communication working

Security: To bring about significance as well as modernism in the range of robotics while functioning towards an efficient result to recover lives and reduce the risk of accident in the fire location [6]. Two robots communicated wirelessly using Radio Frequency (RF) signal shown in figure 6.1. When the buzzer sound is received from the robot 1, it intimate to the peoples present in the surrounding area. Robots have the efficacy to move anywhere that is not gathered by the humans. It moves in trough small holes, gaps that are not movable for even skilled or experienced dogs.

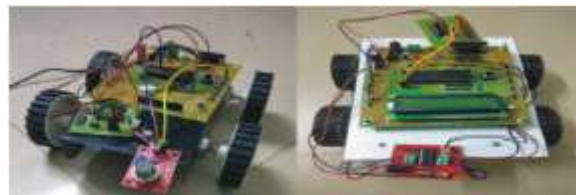


Fig. 6.1: Robot 1 Transmitter & Robot 2 Receiver

Table 5.1: RF Transmitter/Receiver Features and Applications

RF Transmitter	RF Receiver
Features	Features
Stable performance	Connect to decoder directly
Wider range of working voltage	Output data signal is TTL (Transistor-transistor logic level)
Application	Application
Wireless calling system	Wireless remote control switch
Burglar alarm	Remote control toys
Wireless data transmission	Anti-theft alarm host
Automated data acquisition system	Data transmission

RESULT

The Self Governing Robots are getting their inputs from various sensors are shown in the figure 7.1. The robots were successfully designed using RF module. Different kind of fire is identified wherever in the room and extinguished totally.



Fig. 7.1: Self Governing Robots

CONCLUSION

Development of Self Governing Robot using RF signal is achieved successfully. Table 7.1 shows the movements of the robot. An independent fire extinguishing robot can detect and extinguish in the location. Warehouses benefit from this type of rescue robot using.

Table 7.1: Movements of the Robots

MOTOR 1 LEFT	MOTOR 2 RIGHT	MOVEMENT OF ROBOT
0	1	SHARP RIGHT TURN
1	1	BACKWARD
1	0	SHARP LEFT TURN
0	0	FORWARD
1	STOP	RIGHT TURN
STOP	0	LEFT TURN

Applications of Self-governing Robots:

- ▶ Chemical industry, Nuclear plants
- ▶ Dangerous transport system, Mine Fields
- ▶ Military storage facilities.
- ▶ Used to monitor the guest from the main entrance to office.
- ▶ Help for the doctors to move medicines such as tablets and injection from one ward to another ward.
- ▶ Used in record maintaining room and server room for immediate action in areas such as office, schools, colleges, banks etc.,

Future Enhancement: As an improvement, the job of real fire extinguisher by reestablishing the water carrier or fan by a carbon-dioxide carrier and originating it to blow off the fire in total area using various microcontroller programming. These types of self-Governing robots are also used for bomb disposal, some other rescue work.

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