Monitoring and Controlling of Fire Fighting Robot using IOT

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ABSTRACT

The aim of this paper is to design a robot which acts as an extinguisher of fire. This proposed firefighting robot is expected to produce a small but very powerful and versatile robot. It detects fire in the disaster prone area. We design this project with the help of XLR8 board. It controls and detects fire automatically. With the help of the IOT we can also control our robot manually. We can switch between these two modes i.e., automatically or manually in either way we want. We are using a camera to know what is happening and Raspberry pi to know the status of the robot.Here, the fire detection robot overcomes the problem of hitting the obstacle by sensing the obstacle and moves into the direction where it is obstacle free.

Keywords

XLR8 board, camera, RaspberryPi, Fire, IOT, L293D.

INTRODUCTION

Autonomous Fire Fighter Robot is the robot which autonomously detects and extinguishes the fire, it uses the flame sensor for detection, and the fire extinguisher is used to extinguish the detected fire. The robot can rotate while actively scanning for the fire, this scanning is performed by the sensors placed on the sides, when the fire is detected, the robot can move in the direction of the fire and it stops in front of it and trigger the extinguisher to turn out the fire. The aim of this project is to design a robot which acts as an extinguisher of fire. This proposed fire fighting robot is expected to produce a small but very powerful and versatile robot. It detects fire in the disaster prone area. We will implement this by using FPGA board. Here, the fire detection robot overcomes the problem of hitting the obstacle by sensing the obstacle and moves into the direction where it is obstacle free.

The firefighting robots can save a lot of lives some day, The lives of those affected by the fire disaster as well as lives of those people working as the firefighters, It can be useful in certain types of incidents where the environment will be very dangerous for the humans such as the hazardous materials, the radioactivity or the propane tank which can explode. The robots assisting firefighters are not an often seen sight, there are robotic devices which can already be used for such purposes, these include the bots that can be thrown into the fire site to inspect the situation, as well as the large remote controlled fire extinguishers. The robot is used to fight the fire where the humans cannot enter , It can identify the fire location and it can move automatically , It can turn itself automatically if there are any obstacles , It can take many pictures of the fire place regularly and it sends it to the central system , once the robot detects the fire location etc.

DESIGN AND ANALYSIS

Block diagram

The block diagram for the proposed system consists of two IR sensors, one temperature sensor, XLR8 board, L293D current driver, two motors, Relay, Pump, RaspberryPi, Camera.
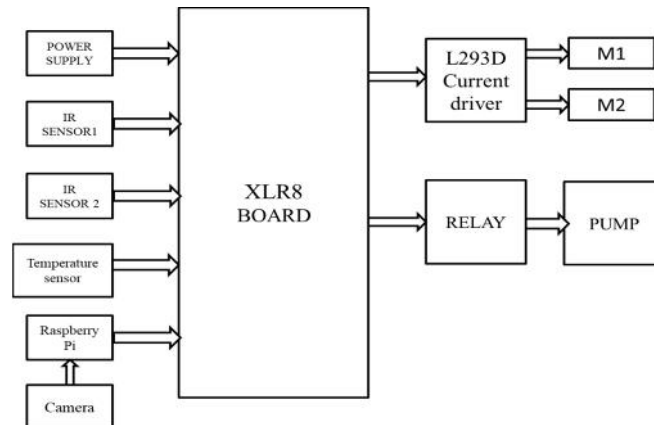

Fig: Block diagram

What is XLR8 and why do we use it?

XLR8 board is an Arduino-compatible board that uses a Field-Programmable Gate Array (FPGA) as the main processing chip. The FPGA provides a reconfigurable hardware platform that hosts an ATmega328 instruction set compatible microcontroller. The FPGA also accelerates specific functionality that is slow, problematic or even impossible for an 8-bit microcontroller. The FPGA-based hardware acceleration and offload provided by XLR8 results in significantly improved performance in the same physical footprint and using the same tool chain as standard Arduino Uno boards. This board is arduino compatible development board. It is FPGA based and embedded 8-bit AVR instruction set compatible microcontroller. It is programmable with Arduino IDE.The main advantages of this XLR8 board is that it works faster clock rates and overall application speed, higher performance through hardware accelerated functionality, configurable with custom xcelerator blocks on the FPGA. XLR8 can improve the speed, performance and functionality of your Arduino based applications and projects.

Working

We use a 12V 1 Amp battery to give power supply to the XLR8 board. Since the board's supply voltage is 3.3V, we use a voltage regulator LM7805 to limit the voltage and is passed to XLR8 board. We also use a voltage regulator LM1117 to limit the voltage to 5V and is passed to two DC motors. The Filter used in this is used to produce the complete DC pulsating voltage. Since the Micro processor used in this has very little voltage it can supply voltage to the motors which is 5V. So we use L293D driver to supply voltage of 5V to motors. So L293D acts as an interface between microprocessor and the motors in the robot. A threshold value is given to the temperature sensor which detects the temperature. In this the obstacle avoidance feature is maintained by two IR sensors. Initially, the XLR8 is programmed using embedded c code.

In this robot, if any object is placed infront of the device the IR sensors gets activated. If the obstacle is placed on the left side of the motor, the IR sensor on the left gets activated and drives the motor to another side. Similarly if the obstacle is placed on the right side, the IR sensor on the right side gets activated and drives the motor to another side. Thus the obstacle avoidance is maintained by IR sensors. And once the temperature value reaches the threshold value, the temperature sensor

Kalathiripi Rambabu, Sanjay Siriki, D. Chupernechitha, Ch. Pooja

detects it. Once it is detected, automatically the relay connected to the board gets on and the pump connected to it gets activated and sprinkle the water.

The user can switch in either modes i.e., automatic or manual. If it has been switched in automatic mode, the robot itself detects the fire automatically, then its relay gets ON and hence it goes to the fire detected area and then extinguishes fire by sprinkling water on to it. If it has been switched to manual control, the user gets the status of the surroundings of the robot through camera by creating a server page which is connected using IOT in order to control the robot with the help of Raspberry Pi. The Advantage of this manual control over automatic control is that in automatic mode it takes time for the robot to monitor itself. But whereas in manual mode when the users get the status regarding the fire, he can control it manually to save the time and to stop causing more harm.

In the working model of our project, we have been used IOT. Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions taken. In our project we are controlling our robot and giving the instructions as we needed.
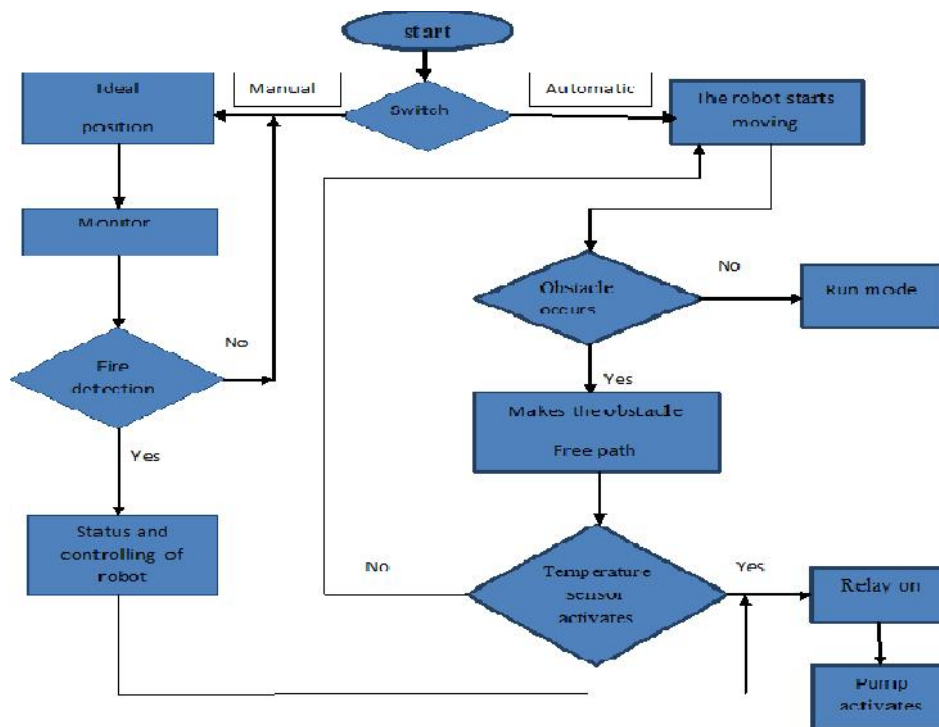

Fig: Flow chart representation

The figure represents the flowchart of our project. With the help of the slide switch we are going to slide into either the modes i.e. either manual or automatic.

Future scope

This project has been motivated by the desire to design a system that can detect fires and intervention. It can be modified to a real fire extinguisher by replacing the water by a carbon-dioxide carrier and by making it to extinguish fires of all the rooms using human controlling by IOT. This provides us the opportunity to pass on to robots tasks that traditionally humans had to do but were inherently lives threatening. Fire-fighting is an obvious candidate for such automation. Given the

number of lives lost regularly in firefighting, the system we envision is crying for adoption. Of course, this project has only scratched the surface. There will be a huge scope in the future upon these type of machines. As in the design simplifications and the implementation constraints in suggest, our project is very much a proof-of-concept. In particular, a practical autonomous fire-fighting system must include a collection of robots, communicating and cooperating in the mission; furthermore, such a system requires facilities for going through obstacles in the presence of fire, and ability to receive instructions on-the fly during an operation. All such concerns were outside the scope of this project. However, there has been research on many of these pieces in different contexts, e.g., coordination among mobile agents, techniques for detecting and avoiding obstacles, on-the-fly communication between humans and mobile agents, etc. It will be both interesting and challenging to put all this together into a practical, autonomous fire-fighting service.

RESULTS

The result that we wanted can get in two ways, either manually or automatic. The camera is connected to the raspberry pi board and the raspberry pi is connected to the XLR8 board.
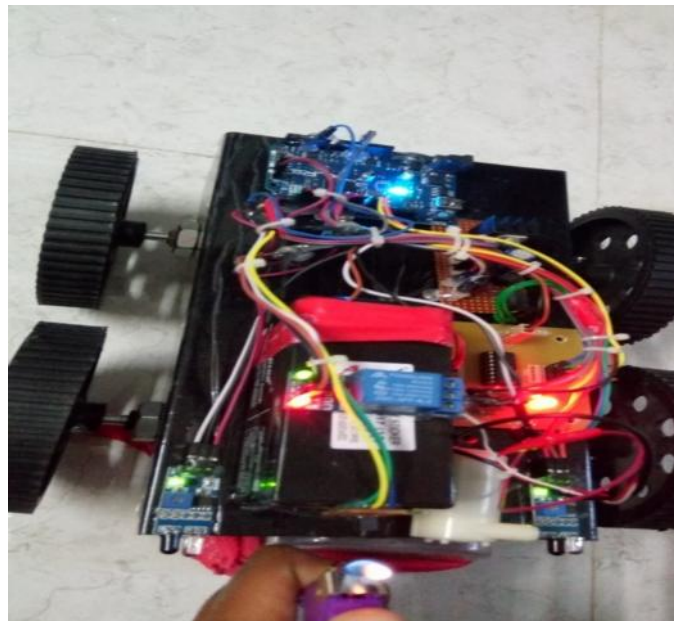

Fig: Fire detection with the help of temperature sensor

The above diagram represents the automatic mode in which the robot moves automatically and if there where any obstacles present in the path they will make an obstacle free path with the help of the IR sensors. This process is known as obstacle avoidance. When the temperature increases in room or in a area where robot is there, the robot stops moving and activates the relay and generates the pump.

When coming to the manual mode we are having a camera inserted. As we are creating a server page in order to control and get to know about the status. In our server page that we are creating will be having of the telecasting of the video that our camera as been capturing. We get to know the location of our robot where was it is. We can send the robot to the places where humans cannot go and also the places where there is a life threat to the people. We can control the robot functions easily at any place. Even though we can also provide the employment to the people or else we can look after it. The camera is inserted in front of the robot in order to know the location and easier to give directions.

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 5, Issue 3
March 2018

Fig : Front view of robot with camera.

The server page that we are created is shown in below figure. We are having five controls.
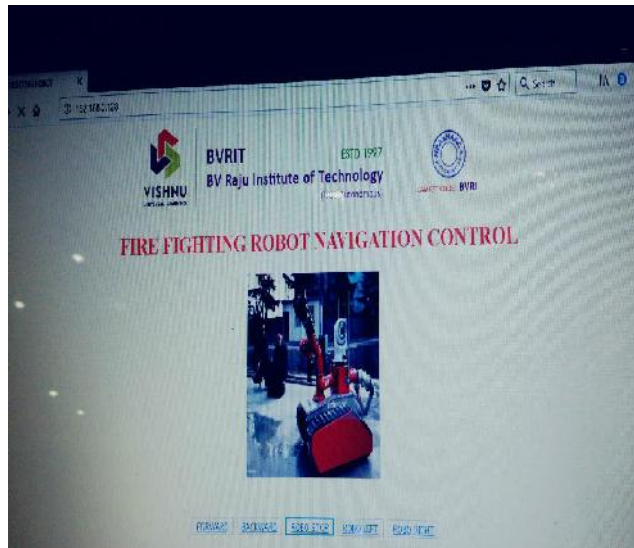

Fig: Web Server page

There are five command there were, Forward, backward, robo stop, robo left, robo right. By giving the instructions that we need or that are to be needed, the robot moves according to us. It does the operations as we like. We can send t the position where the fire exists and we can extinguish the fire. The forward operation does the work of moving of robot in the forward direction, and same as the backward it moves backward. Robo stop operation is nothing but the halting of the robot. The Robo left operations means that the turning of the robot in the left direction and same as the right for the Robo right. The image that we are capturing or seeing can be seen below the operation buttons.

Fig: Camera view of the Robot

CONCLUSION

It is designed by using a temperature sensor. Fire fighting is the act of extinguishing fires i.e., it sprinkles water on to the fire. Monitors the areas where natural calamities and bomb explosion occurs. Robot detects temperature, at the site where the robot exists. This robot is helpful in those areas where natural calamities and bomb explosions will occur. If fire is detected with the help of sensors or manually operates the water pump mechanism through relay circuit. The proposed method is verified to be great beneficial for the security purpose and industrial purpose. Through this we can conclude that a robot can be used in place of humans reducing the risk of life of Fire fighters. We can use them in our Homes, Labs, Offices etc. They provide us greater efficiency to detect the flame and it can be extinguish before it can become uncomfortable and threat to life. Hence, this robot can play a crucial role.

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