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Fire Fighting Robot Using Arduino

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Abstract- Nowadays, fire accidents are common and sometimes it becomes very difficult for fireman to save human life. It is not possible for a human being to continuously monitor the accidental fire situations. Therefore in such cases firefighting robot used in picture. Robot will check fire remotely. These robots are mostly useful in industries where probability of accidental fire is large. The proposed vehicle is able to detect presence of fire and extinguishing it automatically by using gas sensor and temperature sensor. It contains gear and motor driver to handle the movement of robot. Relay circuit is used to control the pump and when it will detect fire then it will communicate with microcontroller (Arduino) through bluetooth module. The proposed robot has a water jet spray which is able to per form of sprinkling water. The sprinkler can be rotate towards the required direction. At the time of rotation towards the source of fire it may happen that it will come across some obstacles ,then it has obstacle avoiding capability. It will used GUI for arduino operation using android. It detects obstacles using ultrasonic sensors the range is 80m. Communication between the mobile phone and robot will take place through Bluetooth, which will have GUI to control the movement of robot. When mobile gets connected to Bluetooth firstly it will set module name, baud rate.

Keywords –Arduino, Bluetooth Module, Sensors, Android Application, Fire extinguisher.

I. INTRODUCTION

Now a days mobile robots are very important in construction sites, warehouses and manufacturing plants. Mobile robots can used in material handling applications which are growing day by day. For identify different items and for handling materials mobile robots can be used. Wireless navigation is also possible for movements of mobile robot, can be controlled through android. Fuzzy logic control mechanism is used to control robot. That model not required any mathematical model controlling.

II. LITERATURE SURVEY

In paper[1],the proposed robot have two wheels. The robot carries the sensors like temperature sensor LM35 and flame sensor which detects the fire and distance respectively. The water tank is mounted on the robot with capacity of 1 litre. The tank is made up of water resistant strong cardboard.

In paper [2], the vehicle uses fuzzy logic to avoid obstacle. The vehicle avoids static objects in static environment. It tracks the target in unknown environment.

In paper [3], the human can control the robot by using the Bluetooth module. The Bluetooth module works with the android application. In this the Bluetooth model communicate android application by using driving motor, arduino mega, voltage divider, tires, Bluetooth motor driver.

In paper [4], the proposed fire fighting robot is a semi-autonomous vehicle. The robot is controlled using android application, to extinguish fire.

In paper [5] Arduino, gas sensor, motor driver, gear motor, Relay driver, Bluetooth module, pump and sprinkler are used. To program Arduino Nano open source software Arduino IDE is required. The detection of fire as well as extinguishing was done with the help of Arduino in which the gas sensor, gear motor and its driver, relay driver etc. are interfaced. The "Android controlled firefighting robot" can easily be used in everyday life such as in homes, parking, chemical Labs, supermarkets, stores, shops etc. Important function of the robot is patrolling. Bluetooth range and water capacity is limitation of Robot.

III. PROPOSED SYSTEM

The proposed system is designed to build an android app that controls operations of the robot. Fire Engineers can send commands to robot using Bluetooth module which is mounted on robot. Android phones has facility of Bluetooth, using that Bluetooth fireman can control the movement of the firefighting robot. For fire detection uses two sensors. One is temperature sensor and other is smoke detector. System will be get activated when fire detection system detects fire, Sprinkler starts sprinkling water when robot detects fire. At the fireman end android application is used and at receiving end two DC motors are

interfaced to microcontroller. There are two types of robot control algorithms in unknown environment by using FLC. Tracking Fuzzy Logic Controller (TFLC) Obstacles Avoiding Fuzzy Logic Controller (OAFLC)

A. Description of Block Diagram

- 1) *Ultrasonic Sensor:* This sensor is used to detect the obstacle.
- 2) *DC Motors:* Are Used to make the movements of the robot.
- 3) *HC05:* To communicate the robot with Firemans Mobile Phone
- 4) *Android Device:* Android device is used for manual traffic signal control using Bluetooth modem.
- 5) *Arduino:* Arduino is used to control overall operation of system.
- 6) *Power Supply:* Power supply is used to provide power to system.

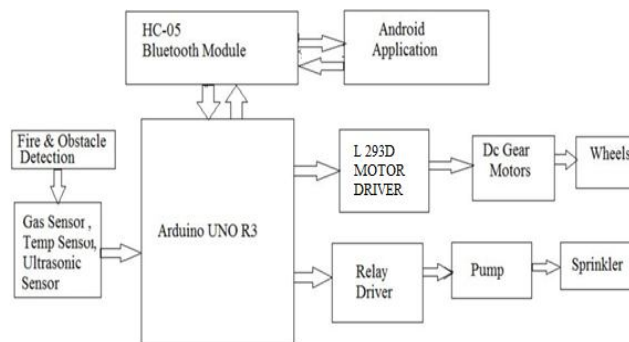


Figure 1: Block diagram of system

B. Deployment Environment

Arduino is an open source prototype. Software will operate in Arduino IDE Computer code can be written and upload to the physical board. Arduino board is a board that can be functioned via Arduino IDE by sending a set of instructions to the microcontroller on it. For controlling motion of robot. We are using GUI, for that purpose Android SDK is needed. For arduino programming we are going to use Embedded C. We are going to build robot in Embedded C and for controlling that robot we are using Android environment.

C. Hardware Requirements

- 1) Ultrasonic Sensor
- 2) Gas Sensor.
- 3) Temperature Sensor
- 4) Bluetooth module
- 5) Relay Driver
- 6) Gear Motor
- 7) DC motor
- 8) Arduino
- 9) Embedded C
- 10) Smart Phone
- 11) Power supply

D. Operation of Proposed System

Tracking Fuzzy Logic Controller (TFLC) and Obstacles Avoiding Fuzzy Logic Controller (OAFLC) are used to navigate the robot in unknown environment.

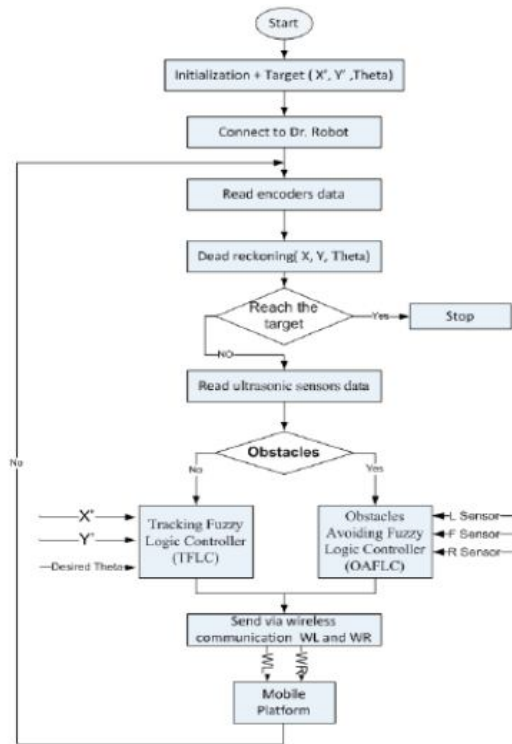


Figure 2: Flowchart of proposed system.

Above flow diagram give the clear idea about the flow of TFLC and OAFLC. Android Controlled Fire fighting Robot using Arduino is used to move robot in any direction according to the commands sent by the fire-man. As soon as obstacle is detected control transfers to the OAFLC to avoid obstacles. To travel robot towards the target TLFC and OAFLC these two FLC methods are useful because it assures the collision free path. Output of these two techniques will be velocities of left and right DC motors. TFLC moves robot smoothly towards the target and for that purpose TFLC will require two inputs. One is distance between obstacle and robot, and another one is angle between robot and obstacle. OAFLC is normally used to control signals and to avoid obstacles which may come along the path towards the target. For avoiding those obstacles OAFLC will require distance and angle between robot and obstacle. Ultrasonic sensors can provide that distance. Following table shows the use of fuzzy logic algorithm. Functional Requirements: Robot Automation Description and Priority Predictions will be done, on the basis of data collected by the sensors. These predictions will give idea to the user whether to turn the motor on through the android application and without human intervention. Hence sprinkler pump will be automated by fireman on the basis of predictions. Highest priority is given to automation. Response Sequences According to the obstacle detection, fireman will decide whether to turn robot to left or right. As obstacle will be detected robot will function accordingly. If fire is detected then microcontroller will send command to sprinkler for turning it on. Then sprinkler will sprinkle water to extinguish fire without any interference.

IV. RESULTS



Figure 3: Robot avoiding obstacle. In above diagram the robot is avoiding the obstacle and is moving safely.



Figure 4: Robot extinguishing fire.

In above diagram the robot is detecting fire and as soon as fire is detected the robot puts it off.

V. DISCUSSION

The proposed system avoided the obstacle successfully using obstacle avoidance fuzzy logic controller and the robot is directed to its destination using Bluetooth communication.

The fire is extinguished using pump and sprinkler.

VI. CONCLUSION

Thus we developed a robot which will be used for firefighting purpose. This proposes a great chance for automation and will be useful at places where human cannot reach or is dangerous. This robot will be helpful in automation industry also. Proposed approach of modular design strategy was a good solution in implementing the firefighting robot to help people at the critical condition. The proposed robot makes movements in forward, backward, left, right and stop also. It reduces the human efforts and also protect their property. Robot detects fire and extinguish the fire with the help of water sprinkler pump. For extinguishing that fire robot need to reach up to there and it starts movement towards the target with the obstacle avoidance property. Thus robot detects obstacle and avoids them.

VII. FUTURE SCOPE

The proposed robot can be further used in many industries for pick and place operation. This robot can be used in military applications for patrolling purposes with few advancement.

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