ORIGINAL ARTICLE

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FABRICATION OF FIRE DETECTION AND WATER SPRINKLER ROBOT USING BLUETOOTH

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Abstract Nowadays, fire accidents are very common and sometimes it becomes very hard for a fireman to protect someone's life. It is not possible to appoint a person to continuously observe weather accidental fire has started where robot can do that. Robot will detect fire remotely. These robots are mostly useful in industries. The proposed vehicle is able to detect presence of fire and extinguishing it automatically by using temperature sensor. The proposed robot has a water spray which is capable of sprinkling water in 360 angles. The sprinkler can be move towards the required direction. At the time of moving towards the source of fire it may happen that it will come across some obstacles, then it has obstacle avoiding capability. It detects obstacles using ultrasonic sensors. Communication between the mobile phoneandrobot 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. It is feasible to implement Bluetooth communication between smartphones and micro-controller. Android controlled robot can be used easily in everyday life such as in homes, market, companies etc. The development of apps for Android in Android SDK is easy and free of cost.

Keywords *Temperature sensor, GUI, Bluetooth, Micro controller, Robot, Android*

INTRODUCTION

Now a day's mobile robots are very useful in construction sites, warehouses and manufacturing plants. Mobile robots can also be used in material handling applications which applications are growing day by day. For analyzing 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 does not need any mathematical model controlling. Previously Fire Fighting Robots were controlled by using different electronics devices. But this reduces the scope of control of firefighting robot. However, with the advanced techniques we can build the same robot by using android application to control the actions of the robot. With the help of such robots, fireman's work really decreased and movements of robot are so much effective. By using an android app fireman man detect the fire and can able to extinguish it. At the same time robot can detect the obstacles and can avoid them by using ultrasonic sensors. Our project is designed to build an android application which can control operations of the firefighting robot. Fireman can send commands to robot through Bluetooth module which is mounted on robot itself. Smart phones have facility of Bluetooth, through that Bluetooth fireman can control the movement of firefighting robot. For fire detection it is using two sensors. One is temperature sensor and second is smoke detector. Fire extinguishing system will be get activated when fire detection system detects fire. Sprinkler will start sprinkling water when it detects fire. At the transmitting end android application is used and at receiving end two motors are interface to micro-controller.

OBJECTIVEOF THE STUDY

Fire disasters can occur anytime and result in high losses. It is often that fire fighters cannot access the source of fire due to the damage of building and very high temperature, or even due

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to the presence of explosive materials. With such constraints and high risk in the handling of the fire, a technological breakthrough that can help fighting the fire is necessary. Our paper proposed the use of robots to extinguish the fire that can be controlled from a specified distance in order to reduce the risk. A fire extinguisher robot was assembled with the intention to extinguish the fire by using a water pump as actuators. The robot movement was controlled using Android smartphones via Wi-fi networks utilizing Wi-fi module contained in the robot. User commands were sent to the microcontroller on the robot and then translated into robotic movement. We used ATMega328 as main microcontroller in the robot. The robot was equipped with cameras and ultrasonic sensors. The camera played role in giving feedback to user and in finding the source of fire. Ultrasonic sensors were used to avoid collisions during movement. Feedback provided by camera on the robot displayed on a screen of smartphone. In lab, testing environment the robot can move following the user command such as turn right, turn left, forward and backward. The ultrasonic sensors worked well that the robot can be stopped at a distance of less than 15 cm. In the fire test, the robot can perform the task properly to extinguish the fire.

REVIEW LITERATURE

TawfiqurRakib, M. A. Rashid Sarkar Proposed movable robot consists of sensor like LM35 and Arduino Flame Sensors are used to detect the fire and distances on its way towards fire. In this for the mobility of the Robot, two wheels made of Nylon and a caster ball is used. This is mainly a rear wheel drive type of vehicle. The water container has the capacity to contain at least 1L water. It is made of strong cardboard which has water resistant property. A fuzzy controller is used to control an obstacle avoidance of Vehicle. The aim of the proposed solution which is given in the paper is to guide the Vehicle along its path to avoid any static environments containing some static obstacles in front of it. Obstacle avoidance in real-time is a mandatory feature for Vehicle in an unknown environment. ShivamAgrawal ,NidhiAgrawal proposed that the human can control the robot by using the Bluetooth module. The Bluetooth module is work with the android application. In this the Bluetooth model communicate android application by using driving motor, arduino mega, voltage divider, tyres, Bluetooth, motor driver. Saravanan P., SoniIshawarya stated that there are three different types of system unit is used as follows:

1. Locomotion system
2. Fire detection system
3. Extinguishing system
4. Communication system.

The Locomotion system is used for obstacle detection and four ultrasonic range finders to find the distance between obstacle and system. Fire detection system is used for the detection of fire in this the gas sensor is used. Extinguishing system is for successfully extinguish the fire.

S. JakthiPriyanka,R. Sangeetha proposed that Arduino (UNO R3), gas sensor, motor driver, gear motor, Relay driver, Bluetooth module, pump and sprinkler are used. To program Arduino UNO R3 open source software Arduino IDE is required. The detection and extinguishing were done with the help of Arduino in which the temperature sensor gear motor and its driver relay driver etc. are interfaced. The" Android controlled firefighting robot" is useful in everyday life such as in homes, laboratories, parking lots, supermarkets, companies, stores, shops etc. Important function of the robot is patrolling. Limitation of the robot is Bluetooth range and water capacity. The system controls four DC Geared motors which is powered by the atmega2560 and controlled autonomously by Navigation system which comprises of integrated ultrasonic and infra-red sensors. The bot carried wireless camera with it which captures the video and transmits it to the base station. The fire detection system consists of LDR and temperature sensor. If fire is detected there then the bot will be moved to the source and starts extinguishing it. The Extinguishing System mounted by BLDC motor with water container. At extreme conditions SABOT is manually operated also.

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METHODOLOGY

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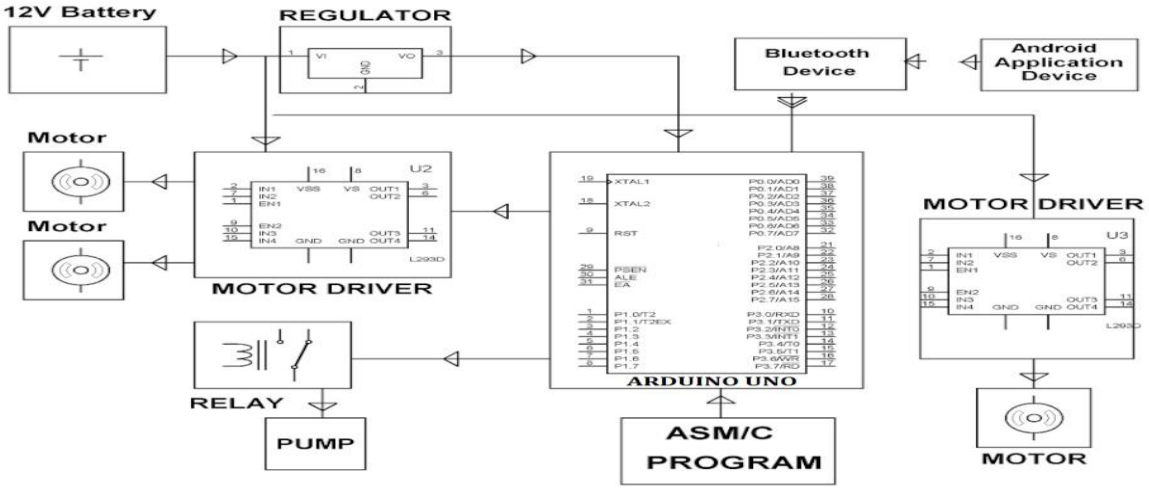
There are two types of robot navigation in environment by using FLC. Tracking Fuzzy Logic Controller (TFLC) Obstacles Avoiding Fuzzy Logic Controller (OAFLC) following flow diagram can give the clear idea about the flow of TFLC and OAFLC.

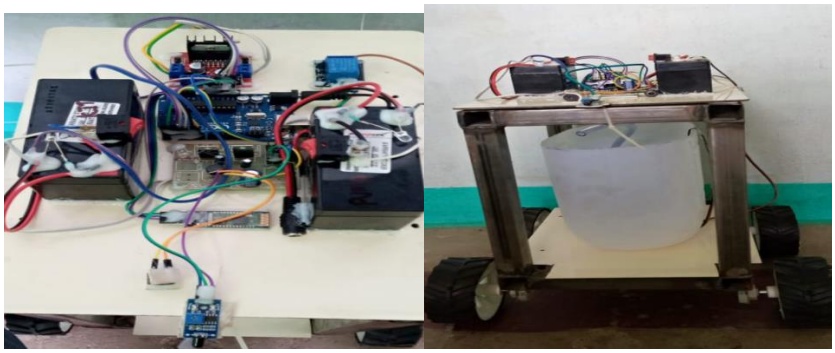
TFLC is used to move robot in any direction according to the commands sent by the fireman. As soon as obstacle is detected control transfers to the OAFLC to avoid obstacles.

BLOCK DIAGRAM



Block diagram of fire detection and water sprinkler robot using Bluetooth

WORKING MODEL



TOP VIEW MODELFRONT VIEW MODEL

WORKING PRINCIPLE

- Firstly, HC05 Bluetooth is connected to the analog pins of the Arduino.
- Vcc is the supply for the Bluetooth, ground is given to the GND & D11 RX,D10 TX are the receiving and transmission ports which are connected to the digital pins side of the Arduino because RX&TX is done through digital pins of Arduino.
- The relay control pin from resistor is been connected to the digital pins so they receive the command from the software through Bluetooth which runs the motor'. The common port the motor is been connected and the VCC supply of the relay to drive motors are taken from the 12v battery this is description of above circuit diagram.

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The first device is the Android mobile phone which is use to controls the different tasks of the robot with the help of the self-designed application. The command from the phone is transferred to the microcontroller wirelessly interfacing HC-05 Bluetooth between them. After receiving the command wirelessly to the Arduino, the relay which is connected to the Arduino by the given 0, 1 conditions it operates the specific task by the given command.

The main aspect of this multi-tasking robot is to decrease the life risk for the human being while under going into dangerous situations; these robots play a vital role in saving and rescuing human beings without taking help of them in any situations and conditions. In this one of the applications like fire thrower which helps to distract or to injure the enemies for some extent. The other application is shooting which also plays an important role in the multi-tasking robot because in tough conditions. In the terrorist attacks when the situation goes under control by the human then the robots are been used to tackle the enemies by shooting with their guns without putting human life into risk. So, the above two applications are already in use by the military and police forces. The next application watering which also plays an important role in the fire department. This type of robot helps the fireman or any rescue people to enter into the scenario. These are mainly used because for the typical places where no one can reach. Surveillance is must for any kind of multi-tasking robots because the any action or the application which is going to implement by the robot, such applications should be monitored and controlled by the controller. So, the visualization is must for every robot for knowing its progress by the human being.

HARDWARE & SOFTWARE DETAILS

HARDWARE USED:

1. ATmega328P microcontroller (Arduino UNO):

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

2. Flame Sensors:

This sensor is able to detect a flame by sensing light wavelength between 760 – 1100nano meters. The test distance depends on the flame size and sensitivity settings. The detect on angle is 6 degrees, so the flame does not have to be right in front of the sensor.

There are two sensor outputs:

i. Digital– sending either zero for nothing detected or one for a positive detection

ii.Analog– sending values in a range representing the flame probability/size/distance; must be connected to a PWM capable input

3. DC Motors:

In this project we use simple DC motor for the rotation of the wheel which are responsible for the movement of the robot. Usually DC motors convert electrical energy into mechanical energy.

4. Pump:

Pump is a mechanical device which is used to pump water on to the fire to extinguish it. It uses a simple motor to pump water.

SOFTWARE USED:

1. Arduino IDE 1.6.7 For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.The open source Arduino IDE makes it

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easy to write code and upload it to the board.

ADVANTAGES

- The robot will be used at places where it is dangerous for humans to enter.
- It can move automatically inside the room without any supervision
- The automatic water sprinkler
- start whenever the fire is detected.
- The robot is fire resistance and can be used at situations where temperature is 120 degree Celsius.
- It can be controlled by android phone externa.

BLUETOOTH CONTROLLED ROBOT USING ARDUINOPROGRAM

```
#define m11 11    // rear motor
#define m12 12
#define m21 10    // front motor
#define m22 9
char str[2],i;void forward()
{digitalWrite(m11, LOW);
 digitalWrite(m12, LOW);
 digitalWrite(m21, HIGH);
 digitalWrite(m22, LOW);}void backward()
{digitalWrite(m11, LOW);
 digitalWrite(m12, LOW);
digitalWrite(m21, LOW);
digitalWrite(m22, HIGH);}void left()
{digitalWrite(m11, HIGH);
 digitalWrite(m12, LOW);delay(100);
 digitalWrite(m21, HIGH);
 digitalWrite(m22, LOW);}void right()
{digitalWrite(m11, LOW);
 digitalWrite(m12, HIGH);delay(100);
  digitalWrite(m21, HIGH);
  digitalWrite(m22, LOW);}void Stop()
{digitalWrite(m11, LOW);
  digitalWrite(m12, LOW);
  digitalWrite(m21, LOW);
  digitalWrite(m22, LOW);}void setup()
{Serial.begin(9600);
 pinMode(m11, OUTPUT);
 pinMode(m12, OUTPUT);
 pinMode(m21, OUTPUT);
 pinMode(m22, OUTPUT);}void loop()
{while(Serial.available())
{char ch=Serial.read();
 str[i++]=ch;
 if(str[i-1]=='1')
{Serial.println("Forward");
forward();i=0;}
```

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```
else if(str[i-1]=='2')
{Serial.println("Left");
right();i=0;}else if(str[i-1]=='3')
{Serial.println("Right");
left();
i=0;}
else if(str[i-1]=='4')
{Serial.println("Backward");
backward();  i=0; }
else if(str[i-1]=='5')
{Serial.println("Stop");
 Stop(); i=0;}
delay(100);}}
```

RESULT AND DISCUSSIONS

The Fire Fighting Robot employs Bluetooth technology to control the directions of the robot. We design the fire detection system using flame sensor that is capable of sensing the flame of wavelength range 760 to 1100 nm, and the sensing range depends on the sensitivity and varies from 10cm to 1.5feet. The robot can operate in the environment which is out of human reach in very short time, the delay employed is very minimal. The robot accurately and efficiently finds the fire and within minimum time after the fire is detected it is extinguished.

CONCLUSION

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 can move in forward, backward, left, right and can stop also. It reduces human efforts and protect their property. Robot detects fire and extinguishes the fire with the help of sprinkler pump. For extinguishing that fire robot has to reach up to there and it moves towards the target with the obstacle avoidance property. In this way robot can detects obstacle and avoid them also.

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