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Fogo Combatant Robot by Using Arduino Programming

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Abstract:"Fogo Combatant Robot" designed to douse fire or protect from fire. Fire fighting is an important but hazardous profession. Robots are designed to detect a fire, before it furies out of control, could one day work with fire scrappers greatly truncating the risk of bruise to fatality. The word "Fogo" is derived from Portuguese Language which means Fire and "Combatant" means Warrior. The purview of this paper is to be beneficial to the human resource for their life protection from fire calamities. This Robot is made with Arduino Programming controlled by a smart phone. It is user friendly so that it can ingress easily, by using Bluetooth Mobile application through Smart Phones. The Mobile application is designed with the help of simple C Language to sway the response of Robot. The robot development consist of three elements which is the hardware, electronic, and programming. The main intention of this project is to design a fire fighting robot using Android application for remote operation. The firefighting robot has a water tanker to pump water and spray it on fire, it is controlled through wireless communication. For the desired operation, microcontroller is used. In the proposed system, an android application is used to send commands from the transmitter end to the receiver, receiver end for controlling the movement of the robot in forward, backward, right or left directions. At the receiver side, two motors are interfaced to the microcontroller wherein two of them are used for the movement of the vehicle and the remaining two to place the arm of the robot.

Keywords: Arduino, Application, Bluetooth, Fogo Combatant, Microcontroller , Smartphone

I. INTRODUCTION

An essential task for a mobile robot system is navigation and motion control. The characteristics of perception required by environment modeling or motion control are very different. This may be basically obtained using several motors. The described Bluetooth system integrates the elementary data acquisition, modeling, planning, and motion control subsystems. A set of rules determines the dynamic structure and the behavior of the system and provides a man/machine and system to system interface.

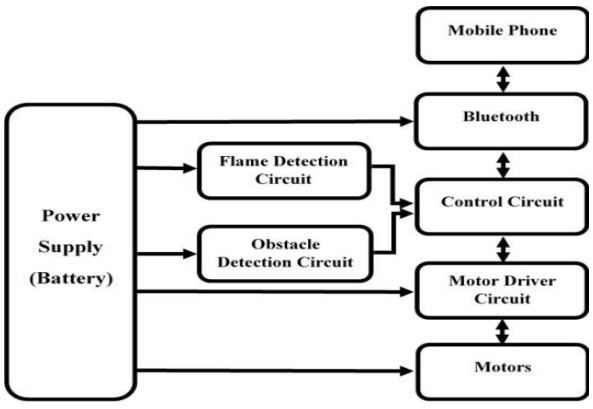

Fig.1. Block Diagram of Robot Design

The high desire of the Fogo Combatant Robot in this study to seek the way and to abolish the fire with the help of the Arduino Program through Smart Phone when the fire is found.

Major Advantages of the system are,

- Rescue – Dangerous fire can be extinguished by the smart phone control.
- Involves less manpower – It avoids health risk of human fire fighters.
- Database storage – No storage needed.
- Flexibility - There is no matter of Where and When, Only smart phone required.
- Interconnected – Robot hardware parts and Bluetooth applications are interconnected.
- Forecasting – Unless the machine get blemished in case of dangerous fire, not a Human being.

II. LITERATURE REVIEW

For many years robotics have become voguish in many ways because of its variety of depiction and technological

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furtherance. Our motivation to design a fire fighter robot is to help the community in effectively firefighting by searching the fire and swiftly acting without leaden losses of property or life.

In some projects a tracking line is stipulated for the robot to follow these paths to extinguish the fire. In some designs ultrasonic sensors are used. When it comes to simulation of this design it will make it onerous to implement it in real time situations. From the different projects reviewed, certain objectives helped us to choose a popular technique to fight fire efficiently by controlling it remotely by wireless technology application.

AN OVERVIEW OF RELATED WORKS

Sl.No	Method	Description
1	Systems, Man and Cybernetics, 2006. SMC '06. IEEE International Conference on 8-11 Oct. 2006	The adaptive fusion method is proposed for fire detection of firefighting robot
2	"Fire fighting robot" by S. Kannan, R. Karthikeyan, and S. Sathish Kumar, Chennai, MAY 2006.	Design a Fire fighting robot using embedded system
3	"Fire Fighting Robot" invented by Hadi A. Al-Azemi, Feb 26, 2013.	This invention relates to a firefighting robot with a caterpillar drive assembly including a left and right drive unit and an engine for each drive unit.
4	"Fire Fighting Robot" Choong, Cheat Sun 2015-11.	This project mainly to portray basic function of a real big scale firefighting robot into a small-scale robot.

III. PROBLEM DESCRIPTION

In existing system, Standard Fire Engine is an tackle drafted for Fire grappling operations. The motive is transporting the human contenders to the scene, rendering a supply of water to fight the fire. The engine referred exclusively to pump the important tool for obtaining water to a fire.

Human fire fighters have four liabilities

- Putting out fires
- Rescuing and caring for the sick and deformed.
- Working to restrain future fires.
- Probing the sources of fires.

These are all Major drawbacks of the existing system.

To overwhelm and contribute better solution to these problems we are scheming and implementing "Fogo Combatant" Robot. This will autonomously move around the house as in Figure 2 to rescue the victims much as possible and cease the fire in the particular period of time. The robot also needs to navigate itself in the maze without problems [2].

Fig.2. Fogo Combatant Robot

This project is divided into three sections. The first section of the project is the mechanical part, followed by electronic part and the endmost section is the programming part.

IV. MECHANICAL DESIGN STRUCTURE

A diversity of mechanical and electronic components was provided for this scheme and then the mobile robot was convened. Finally, the designed robot has been programmed to perform the intended obligations.

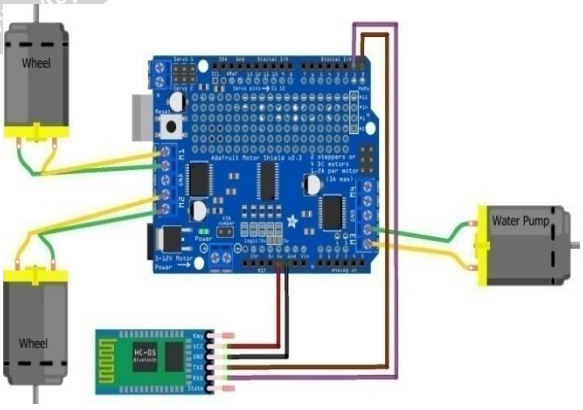

Fig.3. Circuit Diagram

The two wheels that make the movement of the proceeding robot are annexed to two DC motor. It can work singly from each other within the flow chart determined on both wheels. Both wheels can wield autonomously of each other within the specified flow chart. Rear wheels are fitted with ball bearings that do not interfere with rotation so that the wheels cannot keep the system footing [1]. The

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Motor Shield is used for the body where all the components belonging to Robot are stowed and assembled. The Arduino Uno R3 central control unit, the torpedo was installed and the other components of the system were built on the Ardunio Uno R3.

The wheels are mounted at the middle of the disk but this will make the robot to be unstable because it tends to fall to the front or to the rear side. To overcome the stability problems, several trans-wheels mounted around the robot's base [6].

V. ELECTRONIC DESIGN STRUCTURE

The electronic part is one of the cardinal parts in erecting the Fogo Combatant robot. It incorporates the UNO Board, power supply, DC motor, Jumper Wires, Motor Shield and Bluetooth Module most important in the robot is the microcontroller[1]. These entire components are yoked together to become a system.

To make sure the robot capable to arrant the entire task and procure rescue, the robot need to be design by following spare parts structure.

5.1 Arduino Uno R3

Arduino is an open source electronics platform based on easy-to-use hardware and software. Arduino boards are able to peruse inputs light on a sensor, a finger on a button, and turn it into an output like triggering a motor, turning on an LED, publishing something online. Arduino board can do these process by consigning a set of instructions to the microcontroller on the board.

Arduino consists of both a physical programmable circuit board often broached to as a microcontroller and a lump of software, or IDE Integrated Development Environment that runs on computer, used to write and upload computer code to the physical board.

Fig.4. Arduino Uno R3

In Fogo Combatant, the Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button.

5.2 Motor Shield

The Arduino Motor Shield sways various loads but typical Arduino pin cannot drive. The Shield is based on the L298, which is a dual full bridge driver can grasp upto 3amps for very short duration. It drives two DC motors with Arduino board, controlling the speed and direction of each one independently. The Motor Shield is able to drive 2 servo motors, and has 8 half-bridge outputs for 2 stepper motors or 4 full H-bridge motor outputs or 8 half-bridge drivers, or a combination. The voltage regulator on the Arduino board could get hot. To avoid this, the newer Motor Shields have connection points for a separate +5V for the servo motors.

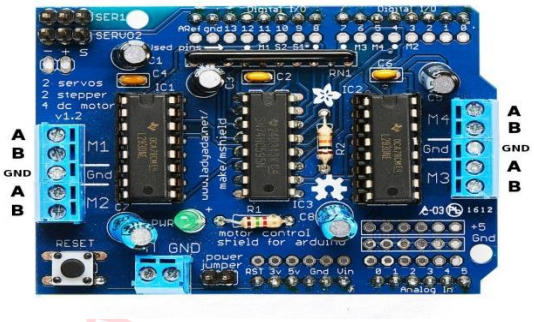

Fig.5. Arduino Motor Shield

5.3 Bluetooth Module HC-05

HC-05 module is an easy to use Bluetooth SPP - Serial Port Protocol module, designed for limpid wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR i.e. Enhanced Data Rate 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH Adaptive Frequency Hopping Feature. It has the footprint as small as 12.7mmx27mm.

Fig.6. Bluetooth Module

5.4 BO Motor 300rpm

BO(Battery Operated) flimsy DC geared motor which permits good torque and rpm at lower voltages.

Specifications:

- Working Voltage 3-12V
- No Load Speed: 300rpm +/- 10rpm
- No Load Current: 125mA (max.170mA)

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- Torque: 400gf.cm min 40gm weight

Fig.7. BO Motor 300rpm

This motor can run at approximately 300 rpm when driven by a single Li-Ion cell. Great for battery steered light weight robots. It can do reverse and forward directions.

5.5 Jumper Wires

Jumper wires are simply wires that have connector pins at each end, it allows to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. It works in a major role to connect the Bluetooth Module with Motor Shield.

Fig.8. Jumper Wire

5.6 Mini Water Pump

The Motor Smaller electric water pumps, such as the kinds used in homes, usually have small DC motors. The DC motor is contained in a sealed case attached to the impeller and powers it through a simple gear drive. Through a series of pushes, the rotor continues to spin, driving the impeller and powering the pump.

Fig.9. Mini Water Motor Pump

VI. PROGRAMMING DESIGN

Programming is the crucial element in erecting of robot which able it to make its own resolutions using Bluetooth connection via smart phone. The program code is written using C language and compiled using C-Compiler software [7]. Once the program code compiled, the software united by Arduino Uno.

Algorithm

Step 1 : Start the Process.
Step 2 : Include the AF motor Package.
Step 3 : Declare the global function right motor, left motor and
three motor with parameters.
Step 4 : Declare the readString variable as String.
Step 5 : Start setup() function.
Step 6 : Initialize the values serial.begin(9600),
right_motor.setSpeed(255),
left_motor.setSpeed(255),
three_motor.setSpeed(255),
Step 7 : To check this condition while(Serial.available()) by
using void loop() function.
Step 8 : If the condition met satisfies then initialize delay(50),
char c=serial.read(), readString+=c,
Step 9 : Check the if condition readString.length()>0 , then
process serial.println(readString)
Step 10: If (readString==" FORWARD"),The Robot can move
forward by using right_motor.run("FORWARD"),
left_motor.run("FORWARD"), delay(500)
Step 11: If (readString=="BACKWARD"),The Robot can move
backward by using right_motor.run("BACKWARD"),
left_motor.run("BACKWARD"),delay(500)
Step 12: If (readString=="RIGHT"), The Robot can move right
by using right_motor.run("BACKWARD"),
left_motor.run("FORWARD"), delay(500)
Step 13: If (readString=="LEFT"), The Robot can move left
by using right_motor.run("FORWARD"),
left_motor.run("BACKWARD"), delay(500)
Step 14: If (readString=="STOP"),The Robot Stops moving
using right_motor.run("RELEASE");
left_motor.run("RELEASE"),delay(500)
Step 15: If (readString=="RUN WATER"), the water from the

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pump flows using three_motor.run("FORWARD"), delay(500)

Step 16: If(readString=="STOP WATER"), the water from the pump stops using three_motor.run("RELEASE"), delay(500)

Step 17: Finally , Initialize readString=NULL.

Step 18: Stop the Process.

The main program is written to link all the subprogram using strategy buttons selection to become a complete Fogo Combatant robot program code. The Robot's operations has to be done with the help of this Bluetooth application module.

VII. ROBOT BEHAVIOR

The aim of the project is to make the robot to move around in the place using the forward backward direction method, water flowing method and able to rescue the victim and stop the fire [1]. The planning of the behaviour is starts by configuring the major movement probability of the robot such as following the right wall and following the left wall subroutine. After that, the route of the robot must also be planned by the one who operates the mobile that make sure the robot will suck the water from canister and supply this water to stop the fire as much as possible. In order to achieve this, the robot needs to perform several programmed subroutines such as

- Strategy 1 - Forward & Backward,
- Strategy 2 - Left & Right Direction and
- Strategy 3 - Water Supply On & Off.

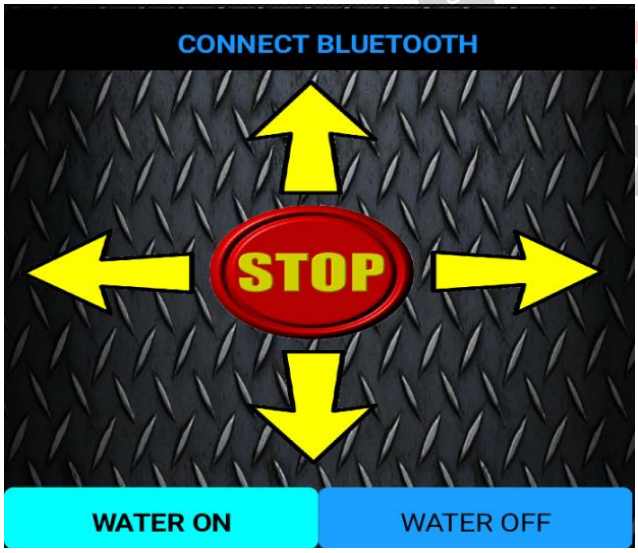

Fig.10. Bluetooth Mobile Application Screenshot

Then these sub routines are combined in a main program where the strategy button is configured.

VIII. CONCLUSION

Fire Enlisters are heroes and they are brave and do acts of heroism on a daily basis. They risk their lives to save us and they do without think of themselves. We from Theivanai Ammal College for Women(Autonomous), Department of Computer Applications designed and developed this Fogo Combatant Robot. Overall, Fogo Combatant Robot has been successfully built. All the fundamental actions such as moving forward, reverse, turn left and turn right function flawlessly. This system is capable of being used in everyday life if more professionals are selected instead of the elements used in the project. This can be used universally. By the fire extinguishers which can be added to the robot, the fire can be firstly detected and most of the fire can be extinguished without any growth. As a conclusion, the project entitled "Fogo Combatant" has achieved its aim and objective successfully.

IX. FUTURE ENHANCEMENT

The implementation of Fogo Combatant robot can save a lot of Indian Fire Service officer's life and in our army, it will help to recover from huge size of fire destruction. Here class 2 Bluetooth is used for wireless connection which transmits at 2.5 mW with a range of 10 meters or 33 feet. Most Bluetooth headsets and headphones are common Class 2 devices. To enhance in future higher range or class 1 device can be used which transmit at 100 mW with a range of 100 meters or 328 feet. In further the project can be improves as a movable one to cover a wide area. And can implement this fire fighter for sensing the fire by using Sensors and different colors for different areas can also be possible.

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