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Design and Implementation of a Fire Extinguisher Robot

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ABSTRACT

Fire Extinguisher Robot is a Hardware based model used to extinguish the fire during fire accidents. This paper describes the basic architecture, operation of individual components, basic algorithm, working principle and applications of an Android con-trolled fire extinguisher robot. The robot can be operated using an Android mobile phone. The controlling is done wirelessly through an Android smartphone using the Bluetooth feature present in it. It also will enable wireless connections for desktop computers, making connections between monitors, printers, keyboards, and the CPU cable-free. The controlling device of the whole system is a Microcontroller. Bluetooth module, DC motors are interfaced to the Microcontroller. The data received by the Bluetooth module from Android smartphone is fed as input to the controller. The controller acts accordingly on the DC motors of the Smart Fire Service Tank. The robot can move in all the four directions using the Android phone. In achieving the task, the controller is loaded with a program writ-ten using Embedded 'C' language. In this paper, the authors explain about the smart fire service tank design, implementation, coding and relevant problems they faced along with their possible solutions.

Keywords: Arduino Uno R3, Ultrasonic sensor, IR Array, DC motor driver circuit, Voltage regulator circuit

1. INTRODUCTION

With the expansion of Robotic Applications, some tasks may require quick and efficient action to be performed. A Robot is a re-programmable, multifunction manipulator designed to move materials, parts, tools or special devices-es through variable programmed motions also be defined as an automatic device that performs functions normally ascribed to humans or a machine in the form of a hu-man. The Robot in this paper is an Automatic Fire Extinguisher which detects and extinguishes the fire sensed by a Thermocouple.

In this paper, the detailed component wise construction will be discussed in section 2, circuit diagram and working principle will be explained in section 3, flow chart and relevant explanations 4 will be discussed in section and the programming part 5will be illustrated in section.

2. COMPONENTS OF LINE FOLLOWER ROBOT

2.1 Arduino UNO (ATmega328)

Arduino Uno is a microcontroller board based on the ATmega 328 (datasheet). 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; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a

series of USB Arduino boards, and the reference mod-el for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. The Arduino UNO can be powered via the Mini-B USB connection, 6-20V unregulated external power supply, or 5V regulated external power supply. The power source is automatically selected to the highest voltage source.

2.2 Arduino UNO (ATmega328)

The term H Bridge is derived from the typical graphical repre-sentation of such a circuit. It is a circuit which can drive a DC motor in forward and reverse direction. It is consisting of 4 electronics switches S1, S2, S3 and S4 (Transistors / MOSFETs/ IGBTS). When the switches S1 and S4 are closed (and S2 and S3 are open) a positive voltage will be applied to the motor. So it rotates in the forward direction. Similarly, when S2 and S3 are closed and S1 and S4 are opened a reverse voltage is applied across the motor, so rotates in reverse direction. The switches in the same arm (S1, S2 or S3, S4) are never closed at the same time; it will make a dead short circuit. H bridges are available as integrated circuits, or you can build your own by using 4transistors or MOSFETs [4]. In our case, we have used LM298 H-bridge IC that can allow controlling the speed and direction of the motors.

2.3 Arduino UNO (ATmega328)

The HC-05 module is easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial con-nection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (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). The Bluetooth module HC-05 is a MASTER/SLAVE module. By default, the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device but can accept connections. The master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish a connection between MCU and GPS, PC to your embedded project, etc.

2.4 4WD Smart Fire Service Tank Chassis kit

4WD Smart Fire Service Tank Car Kit Maximum Load 15KG Aluminum Smart Fire Service Tankics Chassis Kit for Arduino Smart Fire Service Tank Projects (Red Tires)

4WD Smart Fire Service Tank Car Kit Details: All-Metal Motor, full aluminum alloy Smart Fire Service Tank car chassis kit.

2.5 Submersible Pump

Electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of radial and mixed flow pumps.

The pump shaft is connected to the gas separator or the protector by a mechanical coupling at the bottom of the pump. Fluids enter the pump through an intake screen and are lifted by the pump stages. Other parts include the radial bearings (bushings) distributed along the length of the shaft providing radial support to the pump shaft. An optional thrust bearing takes up part of the axial forces arising in the pump but most of those forces are absorbed by the protector's thrust bearing.

There are also screw-type submersible pumps, there is a steel screw which is used as a working element in them. The screw allows the pump to work in water with a high sand content and other mechanical.

The authors have used a toy car for demonstration. Here an RF toy car has been selected with moving left-right steering feature. The car's RF circuit has been replaced with Arduino circuit. This car has two dc motors on its front and right side. Front side motor is used for giving direction to the car means turning left or right side (like real car steering feature). And right-side motor is used for driving the car in forwarding and backward direction. A Bluetooth module has been used to receive a command from android phone and Arduino UNO has been used for controlling the whole system.

3. CIRCUIT DIAGRAM

In the circuit diagram a Motor driver is connected to Arduino to run the car. Motor driver's input pins 5, 7, 10 and 12 are connected to Arduino's digital pin number 6, 7, 8 and 9 respectively.

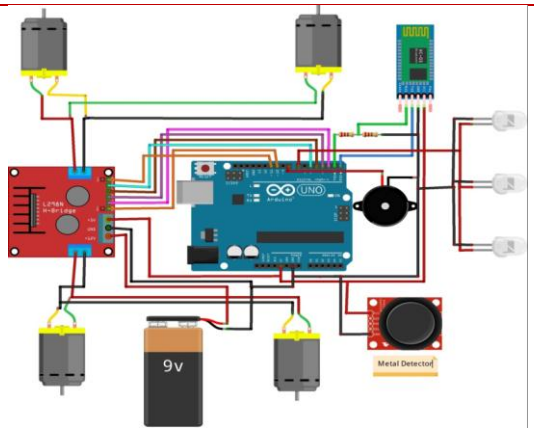

Figure 1: Circuit diagram of the fire extinguisher robot.

Here we have used two DC motors to driver car in which one motor is connected to the output pin of motor driver 2 and 3 and another motor is connected at 13 and 14. A 6-volt Battery is also used to power the motor driver for driving motors. Bluetooth module's RX and TX pins are connected through 1k and 2k register at TX and RX of Arduino. And VCC and ground pin of Bluetooth module is connected at +5 volt and gnd of Arduino. And a 9-volt battery is used to power the circuit at Arduino's Vin pin.

4. FLOW CHART

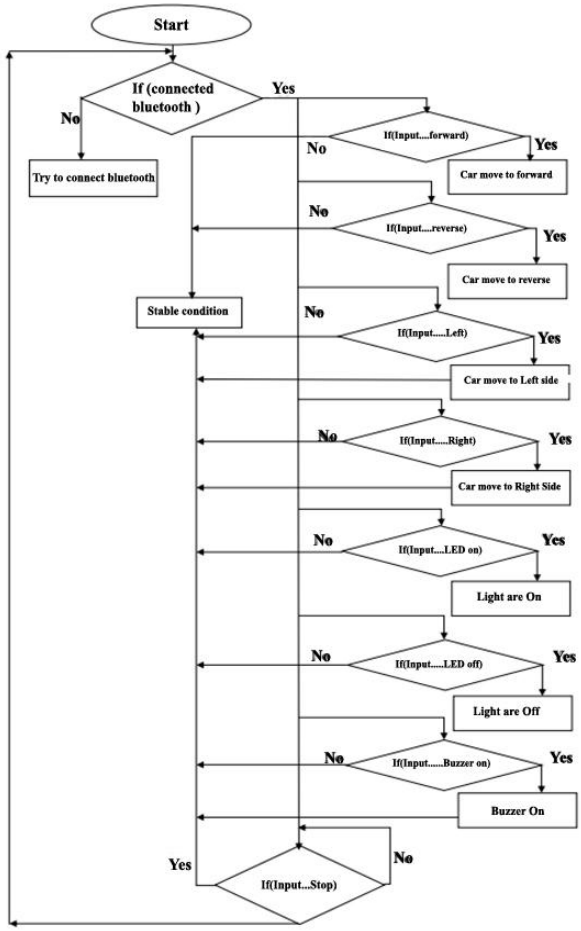

Figure: Flow chart of the line follower robot.

5. SOURCE CODE

Arduino microcontroller has its own IDE for coding. It sup-ports C as a programming language. Arduino IDE has it's own facility to connect Arduino to computer via USB cable and passes enough current and code through it.

```
#include <servo.h>
Servo myservo;
int potpin=0;
int dcpump=4;
int Val;
int Angle ;
int If=12;
int If_1=11;
int Ib=10;
int Ib_1=9;
int rf=8;
int rf_1=7;
int rb=6;
int rb_1=5;
int state=0;
```

```
void setup()
{ pinMode  (dcpump, OUTPUT);
myservo. attach (3);
PinMode (If, OUTPUT);
PinMode (If_1,OUTPUT);
PinMode (Ib, OUTPUT);
PinMode (Ib_1, OUTPUT);
PinMode (rf, OUTPUT);
PinMode (rf_1, OUTPUT);
PinMode (rb, OUTPUT);
PinMode (rb_1, OUTPUT);
Serial.begin(9600);
}
Void loop() {
If(serial.available()>0) {
State=serial.read();
}
//val=analogRead(potoain);
Val=state;
Val=map(val,70,249,0,179);
If(val>0 $$ val<179) {
Myservo.write(val);
}
If(state==`1`) {
Digitalwrite(If, HIGH);
Digitalwrite(If_1, HIGH);
Digitalwrite(rf, HIGH);
Digitalwrite(rf_1,HIGH);
Digitalwrite(Ib, LOW);
Digitalwrite(Ib_1, LOW);
Digitalwrite(rb, LOW);
Digitalwrite(rb_1, LOW);
}
If(state==`2`) {
Digitalwrite(If, LOW);
Digitalwrite(If_1, LOW);
Digitalwrite(rf, LOW);
Digitalwrite(rf_1, LOW);
Digitalwrite(Ib,HIGH);
Digitalwrite(Ib_1, HIGH);
Digitalwrite(rb, HIGH);
Digitalwrite(rb_1 HIGH);
}
If(state==`3`) {
Digitalwrite(If, LOW);
Digitalwrite(If_1, LOW);
Digitalwrite(rf, HIGH);
Digitalwrite(rf_1,HIGH);
Digitalwrite(Ib, LOW);
Digitalwrite(Ib_1, LOW);
Digitalwrite(rb, LOW);
Digitalwrite(rb_1, LOW);
}
If(state==`4`) {
Digitalwrite(If, HIGH);
Digitalwrite(If_1, HIGH);
Digitalwrite(rf, LOW);
Digitalwrite(rf_1, LOW);
Digitalwrite(Ib, LOW);
Digitalwrite(Ib_1, LOW);
Digitalwrite(rb, LOW);
Digitalwrite(rb_1, LOW);
}
If(state==`5`) {
Digitalwrite(If, LOW);
Digitalwrite(If_1, LOW);
Digitalwrite(rf, LOW);
Digitalwrite(rf_1, LOW);
Digitalwrite(Ib, LOW);
Digitalwrite(Ib_1, LOW);
Digitalwrite(rb, LOW);
Digitalwrite(rb_1, LOW);
}
If(state==`6`)
{
Digitalwrite (dcpump,HIGH);
}
If (state==`7`)
{
Digitalwrite (dcpump, LOW);
}
}
//
```


6. END SECTION

6.1 Conclusion

In this project, Bluetooth based controlled fire extinguisher robot has been designed. The system is successfully implemented and tested. After the detailed experiment, it is observed that it is robust, sensitive and fast moving, hence can be applied in rescue operations. This system could be more reliable and usable by developing the range of connectivity which can be increased by using WiFi.

7. ACKNOWLEDGMENTS

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