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Fire Fighting Robot Remotely Controlled By Android Application

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Abstract: If the fire is noticed early on, a tremendous amount of damage may be prevented. If the fire is discovered quickly enough, it is possible to prevent significant loss of life and property. Thanks to their adaptability, robots have become a hot topic in the robotics industry. A fire extinguisher and measurement instrument make up the robot. Extinguishers are equipped with infrared (heat) sensors that detect the surrounding environment and trigger an appropriate response based on the measured distance and temperature. To guide the robot's movements, we used a simulated Android app. And here we use the Bluetooth Module to establish a connection between the controller and the Android device. The UART protocol allows the controller to be interfaced with the Bluetooth module. You may control the robot's main and secondary activities using commands provided via the android app.

KeywordsRobot, Bluetooth Module, Android Smartphone, ATmega328 Microcontroller, Arduino UNO

1. Introduction

Smartphones nowadays are quite powerful, with fast processors, plenty of storage space, improved entertainment features, and a plethora of communication options. Data sharing; expanding smartphone capabilities are the primary uses of Bluetooth. The incorporation of Bluetooth, a technology developed by telecom provider Ericsson in 1994[1], into cellphones demonstrates its benefits. The shift from wired to wireless technology has altered the way individuals use digital gadgets at home and in the workplace. Multiple Bluetooth Modules may be connected to a single host Bluetooth device using a single connection at once [2]. It is most practical for usage in a domestic setting because to its typical operating range of eight meters. The exponential growth in smartphone use, made possible by innovations like Bluetooth and others, has allowed these portable electronic devices to serve as people's go-to tools for a wide range of tasks [3][4]. Smartphones using the open-source Android platform have been more common in recent years [5]. An OS, a middleware layer, and the main apps make up Android's comprehensive software package. It differs from competing platforms like iOS (iPhone OS) in that it has an SDK, which contains necessary tools and applications for developing applications. The use of smartphones as the "brain" of robots is a rapidly developing area of study that holds great promise. We examine existing mobile phone-controlled robotics and propose a closed-loop control system that makes use of the Bluetooth Module found in smartphones and tablets in this study. Our job requires us to use an android app, such Arduino Bluetooth Controlled Robot, to drive the robot forward, backward, left, and right, as well as to activate the pump for fire extinguishing operations and the servo motor to move the sprinkler in either direction. The following is the outline of the article: Section 2 explains why this study was done, Section 3 lays out our experimental setup, Section 4 shows a discussion of our setup, and Section 5 gives our results.

2. Purpose

The purpose of research is to provide the robot’s simple hardware architecture but with having powerful computational abilities and platforms so that robot’s designer can focus on their research and tests instead of Bluetooth connection infrastructure. Motivate to work on robot architecture and work on the Microcontroller chip which is integrated with the various system on a single chip by the use of modern sensors we can embed the artificial intelligence into the microcontroller chip to perform the desired operation in their respective fields. This simple architecture is also useful for educational robotics because students can build their own robots with low cost and use them as a platform for experiments in several courses.

The objective of our project is to replace complex hardware architecture networks with simpler connectivity circuits so that designer can give major importance to build multiple, hazard preventing capabilities on his/her robot.

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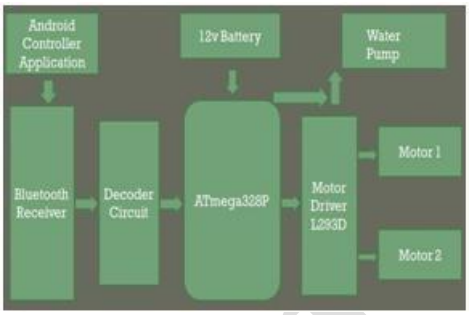
3. Block Diagram



1. Smart Phone Bluetooth is connected to the Bluetooth Module of System.
2. Android Application name "Arduino RC" is the application which is act as an interface between the Android Smartphone and the System. This android application allows us to control the steering, throttle, and special fire extinguishing options.The Android application consists of buttons which are used to move robot by sending the commands to the Arduino system by pressing the buttons of the android application. Android application provide option to configure the appropriate command for the operation of the robot,
3. Android Application sends the command in form of ASCII codes (like W, X, Y etc.) these are converted into the Binary codes and then the Bluetooth send them bit by bit to slave Bluetooth module of the Arduino system. These codes are decoded by the Bluetooth module and then send to the microcontroller ATmega328 IC. The program stored in the Microcontroller IC compares these codes in the programming and provide corresponding instructions to the connected systems. So that steering and extinguishing operations must be done.
4. Robotic System consist of some special functions like obstacle avoider using ultrasonic sensor (HR-SR04), Infrared Sensor is used for flame detection and Temperature sensor (LM-235) is used in this system for taking appropriate actions in emergency cases.

3.1. Microcontroller ATmega328P

The ATmega328P is an 8bit microcontroller. It consists of
13 digital I/O pins (of which 6 can be used as PWM outputs), 1 UARTs (hardware serial ports), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection,
a power jack, an ICSP header, and a reset button. Technical Specifications:

Microcontroller ATmega328P, Input Voltage (recommended) 7-12V, Operating Voltage 5V, Input Voltage is 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output), Analog Input Pins 6 DC Current per I/O Pin 20 mA, DC Current for 3.3V Pin 50 mA, Flash Memory 32 KB of which 0.5 KB used by bootloader, SRAM 2 KB EEPROM
1 KB, Clock Speed 16 MHz, Length 68.6mm, LED_BUILTIN Digital Pin 13, Width 53.3 mm, and Weight 25 g.

3.2. HC Serial Bluetooth

HC Serial Bluetooth product consists of Bluetooth serial interface module and Bluetooth adapter. Bluetooth serial module is used for converting serial port to Bluetooth. This module has two modes: master and slave device. The device named after the even number is defined to be master or slave when out of the factory and can't change to the other mode. But for the device named after an odd number, users can set the work mode (master or slave) of the device by AT commands. HC-06 Specifically includes Master device: HC-06-M, M=Master Slaver device: HC- 06-S, S=Slaver The main function of Bluetooth serial module is replacing the serial port line, such as One connects to Bluetooth master device while the other one connects to the slave device. Their connection can be built once the pair is made. Bluetooth connection is equivalently linked with a serial port and this connectionincluding RXD, TXD signals. And they can communicate with each other.

1. When MCU has Bluetooth slave module, it can communicate with Bluetooth adapter of computer and smartphones.
2. The Bluetooth devices in the market those are mostly slave devices, such as Bluetooth Stereo System, Bluetooth GPS etc. So, we can use the master module to make a pair and communicate with them.

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3. Bluetooth serial module's operation doesn't need drive and can communicate with the other Bluetooth device. But communication between two Bluetooth modules requires two conditions:

i) The communication must be established between the master and slave device.
ii) The password must be correct

Here are the main factory parameter of HC-05 and HC-06. Pay attention to the difference:

Table 1.1

HC-06	HC-05
Master and Slave mode can be switched	Master and Slave mode can't be switched
Bluetooth Name: HC-05	Bluetooth Name: HC-06
Password: 1234	Password: 1234

3.3. L293D

The L293 and L293D are quadruple high-current half –H drivers. The L293 IS designed to provide bidirectional drive currents of up to 1A at a voltage from 4.5V to 36V. The L293D is designed to provide bidirectional drive currents of up to 600-MA at voltages from 4.5V to 36V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high voltage loads in positive-supply applications. On the L293D, external high-speed output clamp diodes should be used for inductive transient suppression. A Vcc1 terminal, separate from Vcc2, is provided for the logic inputs to minimize device power dissipation. The L293 and L293D are characterized for operation from 0ↄC to 70ↄC.

3.4. UART

UART is the acronym of (Universal asynchronous receiver/ transmitter) usually an integrated circuit used for serial communications over a computer or peripheral device serial port. UART are now commonly included in Microcontrollers. Many modern ICs come with a UART that can also communicate synchronously; these devices are called UART.

3.5. DC Motor

Almost many of them mechanical movements that we see around us are accomplished by the electric motor. Electric machines are means of converting energy. Motors take electrical energy and produce mechanical energy. The electric motor is used to power hundreds of devices we use in everyday life. Applications of Electric Motors

nclude Automobiles, Drilling Machines, blenders, and robots. Micromachines are electric machines with parts the size of red blood cells and find many applications in medicine.

3.6. Ultrasonic Sensor

Ultrasonic sensors are also called as a transducer, and these sensors are used to measure the reflection of a moving object. When a voltage is applied in the form of an electric pulse to the ultrasonic transducer, it vibrates with a certain spectrum of frequencies and produces sound waves. When any type of obstacle comes within the spectrum of the ultrasonic sensor, then the sound waves get to reflect back known as echoes and the process will generate an electric pulse. The motion of the object is detected by these echo patterns.

3.7. Infrared Sensor

One kind of sensor is the infrared sensor, which works as a transducer to pick up on certain environmental factors by the emission or detection of infrared light and the subsequent conversion of that light into a voltage. When an item emits heat, infrared sensors can detect motion and measure the amount of heat in the area. Object or proximity detection, as well as communication, are common applications for infrared sensors. A sensor takes readings of environmental factors like temperature or light intensity and transforms them into a digital or analog signal. 3.0V to 5.5V is the power supply range.The electromagnetic spectrum

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that falls between 750 nanometers (nm) and 1 millimeter (mm) is known as infrared (IR) radiation. Its wavelength is greater than that of visible light but less than that of radio waves.

3.8. Servo Motor

Servo implies an error sensing feedback control which is utilized to correct the performance of a system. It also requires a generally sophisticated controller, often a dedicated module designed particularly for use with servo motors. Servo motors are the DC motors which allow for precise control over angular position. They are actually DC motors whose speed is slowly lowered by the gears. The servo motors usually have a revolution cutoff from 90° to 180°. A few servo motors also have revolution cutoff of 360° or more. But servo motors do not rotate constantly. The rotation is limited in between the fixed angles.

4. Application Instructions

1. When we send the data "1" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "1" and the robot/robot car moves FORWARD.
2. When we send the data "2" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "2" and the robot/robot car moves BACKWARD.When we send the data "3" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "3" and the robot/robot car turns LEFT.
3. When we send the data "4" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "4" and the robot/robot car turns RIGHT.
4. When we send the data "7" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "7" and the robot/robot car turns on the Pump.
5. When we send the data "6" from the application to Bluetooth module which is connected with the circuit. Then the Microcontroller detects "6" and the robot turns on the Servo.

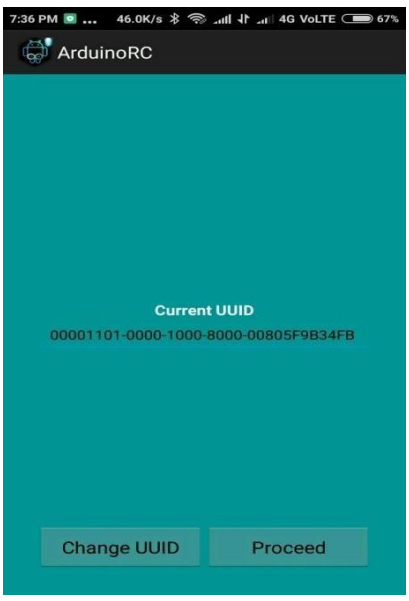

Figure 4.1.1: Android Application

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Figure 4.1.2: Bluetooth Connection search

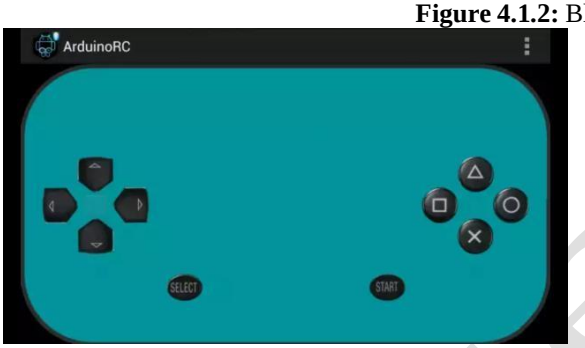

Figure 4.1.3: Bluetooth connection on to move the robot Forward, backward left and right direction

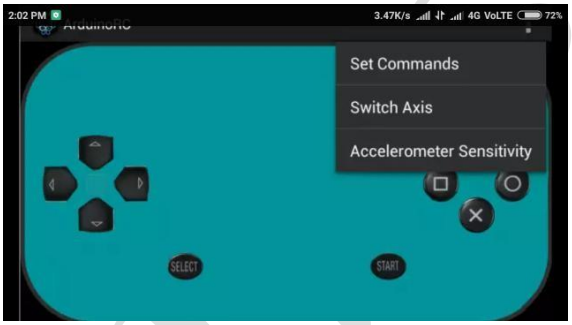

Figure 4.1.4: Setting the Commands

5. Conclusion

The objective of the paper is to realize the smart living, more specifically the home lighting control system using Bluetooth Technology. Robot and smartphones is a perfect match, especially mobile robots. As phones and mobile devices are each time more powerful, using them as a robot for building a robot with advanced feature such as voice recognition. It is concluded that smart living will gradually turn into a reality that consumer can control their vehicle remotely and wirelessly.

6. Future Work

The knowledge is ever expanding and so are the problems which the mankind strive to solve. In this spirit, it is hoped that the

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current activity will lead to further enhancements. Further modification can be done by replacing the sensors with the Camera to provide the accuracy and overcome the issues suffered by the sensors.

For example:

- Work on future for the Military purpose by the robot.
- Fire Fighting Robot can be made by enabling a robotic arm.

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Page 9 of the Arduino Guide (http://arduino.cc)
In July 2014, Ritika Pahuja and Narender Kumar published an article in the International Journal of Scientific Engineering and Research (IJSER) titled "Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller."