

Bluetooth Operated Robot Vehicle Using Mobile Android App

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Abstract: A robot is basically a machine which is based on an electro-mechanical interface and is being operated through computer and electronic program. In a summarized form, our project is predominantly a robot vehicle which is being controlled by accelerometer installed on a mobile phone or a tablet. Controller and android are interfaced through a Bluetooth module attached to the robot vehicle and the protocol used for communication in UART protocol. The robot motion is governed by the command received from the android. The uniform output, quality and repeatability of the robotic vehicle are unmatched. The tools can be altered while pick and place robots can be reprogrammed for multiple application.

Keywords :Bluetooth module, microprocessor chip, android based smartphone, robot vehicle

1. Introduction

In present era ,the mobile phone have become smarter with highly powerful processing units,increased storage capacity, improved entertainment features and utilities and comprising of easier communication methods. Bluetooth systems are mostly used for data transfer. Bluetooth technology, developed by Swedishtelecommunicationservice provider Ericsson in '94, can be attached and interfaced with advanced mobile phones. Today,robots are essentially used to do works that need high accuracy, and are used in those instances that are vulnerable on humans, like handling bombs etc. Robotic engineering is concerned with the study of machines and equipments that can replace human efforts in executing various processes, related to physical activities and interactive decision making. Robotics is the branch of mechanical ,electrical and computer science engineering that deals with the designing,operation and application of robots,which are interfaced to computer systems for their efficient control,feedback and processing of information.Developmentand consequent study of robots was based on three elementary laws; first one that robots do not trigger any sort of harm to human beings. Second one, robot must followthe orders given by humans and of course consider the first law while complying with the order. Last one, robots

must safeguard its occurrence, taking in mind the above two laws.

2. Objective

The primary aim of our research is to provide simple and efficient robotic hardware but with a dynamic computational platforms so that one can focus on design and experiment rather than Bluetooth connection. This efficient architecture is also helpful for educational field based robots, so that students can develop their own robots at a reasonable cost and use them as platform for their research in several fields.

Common control architectures: The following list shows typical robot control architecture:

2.1. AT89C2051

The AT89C2051 fully static,low voltage,24Mhz CMOS 8-bit microcontroller consisting of 2K bytes of Flash programmable and erasable ROM (PEROM). The device is fabricated using Atmel's high-density nonvolatile memory technology. By combining a flexible 8-bit CPU with Flash on a monolithic chip, this microcontroller becomes a powerful microcomputer which provides a highly-versatile and cost-effective provision to many embedded control applications.

The AT89C2051 provides the following standard features: 2K bytes of Flash, two 16-bit timers, a full duplex serial port,128 bytes of RAM, 15 I/O lines, a precision analog comparator, on-chip oscillator and

clock circuitry. In addition, the AT89C2051 is designed with uniform logic for operation reducible to zero frequency. The Idle Mode stops the CPU while simultaneously allows the RAM, timers, serial port and interrupt system to continue operating.

2.2. HC Serial Bluetooth

HC serial Bluetooth products consist of Bluetooth serial interface module and Bluetooth adapter, such as:

(1) Bluetooth serial interface module:

Industrial level: HC-03, HC-04(HC-04-M, HC-04-S)

Civil level: HC-05, HC-06(HC-06-M, HC-06-S)

HC-05-D, HC-06-D (with baseboard, for test and evaluation)

(2) Bluetooth adapter:

HC-M4, HC-M6

This report largely introduces Bluetooth serial communication module. Bluetooth serial module is used for transmitting serial port to Bluetooth kit. These modules essentially consist of two different modes: master and slave device. The device mentioned after even number is determined to be master or slave when out of factory unit and can't be altered to the other mode. But the device which is mentioned after the odd number, users can set the working mode (master or slaver) of the device through the AT commands. HC-04 specifically includes: Master device: HC-04-M, M stands for master Slave device: HC-04-S, S denoted by slaver. The default state of HC-04 is denoted by slave mode. The naming conventions for the HC-06 is identical. When HC-03 and HC-05 are out of factory premise, one part of parameters are set in order to activate the device. The work mode is not set at the initial instance, since user can set the mode of HC-03, HC-05 as required

The primary aim of Bluetooth module is to replace the serial port line, such as:

1. Basically there are two MCUs which are in operation. One attaches itself to the master device while the other to slave device. Their connection is generated only when the pair is developed.

2. When MCU is connected to a slave module it can exchange information with a Bluetooth adapting unit present in smart phones. Afterwards there is a software based exchange oriented serial port line between MCU and smart phone.

3. The Bluetooth devices offered in the market are mostly slave devices. So, we can use the master one in order to make pairing and information exchange with them.

Bluetooth module operations used here does not require drive, and can establish communication with the other Bluetooth device with serial module. But communication between two Bluetooth modules is based on two requirements:

(1) Such communication should be between the master and slave units.

(2) The password being entered should be accurate.

2.3. L293D

The L293 and L293D are quadruple high-current half-H drivers. The L293 is used to generate drive currents which are bidirectional in nature of up to 1 A at voltages ranging between 4.5 V to 36 V. The L293D being used here provides such bidirectional drive currents of magnitude 600-mA in the above given voltage range. Designs of both devices enables them to drive induction based loads such as relay units, solenoid mechanisms, direct current motors, as well as other high-current/voltage loads in positive-supply based applications. All inputs are Transistor transfer logic compatible.

2.4 DIRECT CURRENT MOTOR

Almost every mechanical movement that we come across is basically entitled and based on an electric motor. Electric machines are equipment combinations used as means to convert energy. Motors convert electrical energy to mechanical energy. Electric motor basically powers numerous devices we use in our day to day lives. Examples of small motor applications are motors used in automobiles,

healthcare units, industrial and consumer based actuators.

2.5 UART

A UART (Universal Asynchronous Receiver/Transmitter) is the microchip with inherited programs controlling the computer's interface to the serial devices attached to it. Distinctly, it provides the attached device with the RS-232C DTE interface so that it can "communicate" to and interchange data with modems and other related serial devices in consideration.

3. BLUETOOTH:

Bluetooth refers to a wireless mechanism that offers communications basically short range in nature, and as time is progressing they are replacing cable oriented connections. Bluetooth has many features like-robust in nature, low power capability, and reasonable cost. Bluetooth module was initially designed to support networking devices with wireless orientations. However, it is to be mentioned that it covers only short distances. Bluetooth devices mostly offer communication less than 1 Mbps. But the significant drawback of Bluetooth technology is that it covers a maximum range of only 10 mts due to its high frequency.

4. USING SMARTPHONE TO CONTROL ROBOTS:

The primary objective is to present a way to show how we can use a smartphone instead of a computer to control applications that need high computational platform. The smartphone used is powered by an android os platform and the phone acts as the robot's brain where all heavy calculations and manipulations are carried out as fully object oriented linux based android os.

This research is based on two modes-the first is the direct control mode in which the robot vehicle directly responds to the user commands of movement. While the other mode is to build a robotic mechanism that moves in an area consequently interacting with the surrounding environment. In direct drive mode (DDM) the we as a user send the directions to the robot vehicle which are move forward, break, turn left and turn right

5. Block Diagram

Given beside is a simple block diagram showing how to control a given robotic vehicle using a Bluetooth module HC-06 and 89c2051 microcontroller through your android powered Smartphone device. The main controlling device used here is the microcontroller which provides all sort of controlling operations. Bluetooth module along with the DC motors are interfaced with microcontroller. The data given by the smartphone is received by the Bluetooth module and it is being used as an input by the microcontroller. The controller then sends signals accordingly to the robot. Using android phone, robot can be moved in all 4-directions. The direction of the robot is indicators using LED indicators of the Robot system. The controller is imbued with an embedded 'C' program.

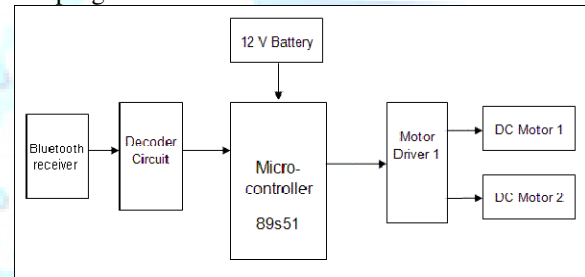


Figure 1.1: Block diagram of bluetooth based robot using AT89C2051 microcontroller

6. Operation instruction

6.1 Firstly it is to be taken care that HC-06 Bluetooth module should be paired with the given smartphone. The default password for this is set as "1234" or "0000".

6.2 Click on "SELECT DEVICE" icon for selecting paired Bluetooth kit module.

6.3 When phone is "tilted forward" it sends the data "A" to Bluetooth module connected with the circuit. When microcontroller detects "A" the robot moves FORWARD.

6.4 When phone is "tilted backward" it sends the data "B" to Bluetooth module connected with the circuit. When microcontroller detects "B" the robot moves REVERSE.

6.5 When phone is "tilted left" it sends the data "C" to Bluetooth module connected with the circuit. When microcontroller detects "C" the robot turns LEFT.

6.6 When phone is "tilted right" it sends the data "D"

to Bluetooth module connected with the circuit. When microcontroller detects “D” the robot/robot car turns RIGHT.

6.7 When phone is held straight it sends the data “E” to the Bluetooth module connected with the circuit. When microcontroller detects “E” the robot/robot car gets stopped

6.8 By clicking on “DISCONNECT” icon, pairing is finished with Bluetooth module.

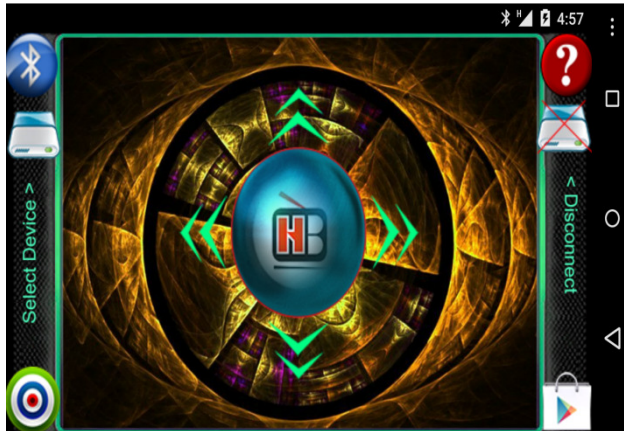


Figure 1.2: Bluetooth car application

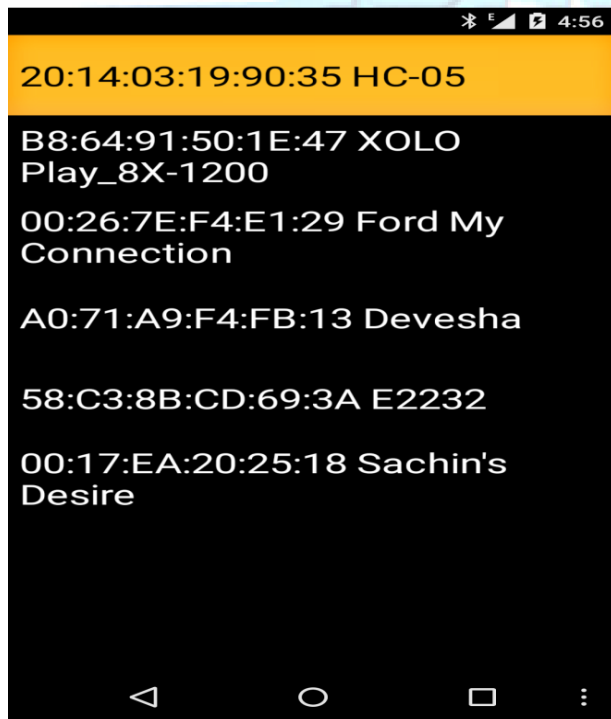


Figure 1.3: Bluetooth connection search

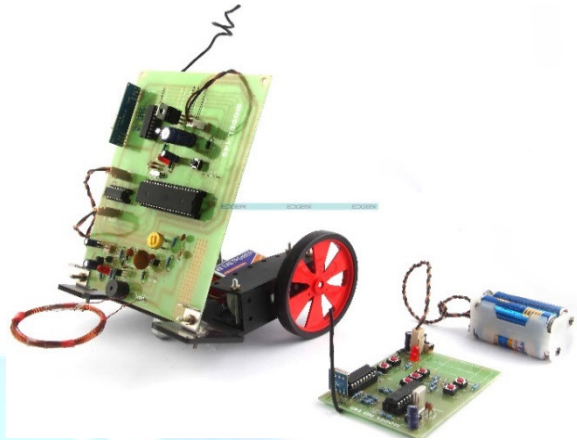


Figure 1.4: Android phone Bluetooth controller ROBOT/ROBO

7. Conclusion

This experiment has integrated a given smartphone with the robotic vehicle and makes use of Bluetooth technology for reliable connection between them. Through this experiment we came to know that it is possible to control any sort of hardware equipment with the use of given hierarchy. Robot and smartphones are discovered as a perfect match, especially mobile robots. Thus the conclusion is that, smart living will slowly turn into a reality that mankind can operate their home remotely and wirelessly.

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