BluBO: Bluetooth Controlled Robot

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Abstract: *This project is aimed to control a robot using an android application. Bluetooth device's interfacing is done with the control unit on the robot for receiving the signals transmitted by the android application. These signals are send to the control unit which moves the robot as required. An 8051 series microcontroller is used as control device in this project.*

Keywords: Bluetooth, GUI (Graphical User Interface).

1. Introduction

The project's purpose is designing a Robot that can be controlled using Android mobile phone. The operation of the Robot is done wirelessly through Android smart phone using the Bluetooth module present in it. In the project the Android smart phone is used as a remote control for controlling the Robot [1].

Android is a software stack for mobile devices that consist of an operating system, middleware and key applications. Android gives a healthy array of connectivity options, including Wi-Fi, Bluetooth, and wireless data over a cellular connection (for example, GPRS, EDGE (Enhanced Data rates for GSM Evolution), and 3G). Android gives access to a wide range of useful libraries and tools that can be used to form rich applications. In addition, Android consists of a full set of tools that have been made from the ground up alongside the platform providing developers with high productivity and deep insight into their applications [1] [2].
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2. Block Diagram

BluBO is a modern day robot which is especially researched for Domestic purposes. The BluBO is so called because is comprises of capabilities and advancement to work in daily life. The BluBO is being made by using the common and well known technologies. These technologies are user friendly and economically available in the market.
The BluBO is using

- Bluetooth Technology

- android phone control

The block diagram of project is shown in figure 1. In this block diagram a LCD display, 89C51 microcontroller, L293D motor driver circuit, HC-05 bluetooth module and high torque DC motors are used.
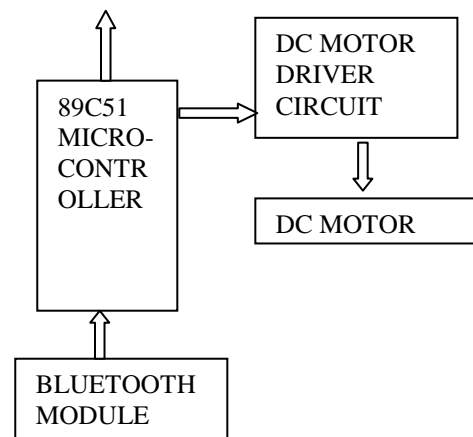

Figure 1: Block Diagram of project [11][13]

3. Circuit Diagram

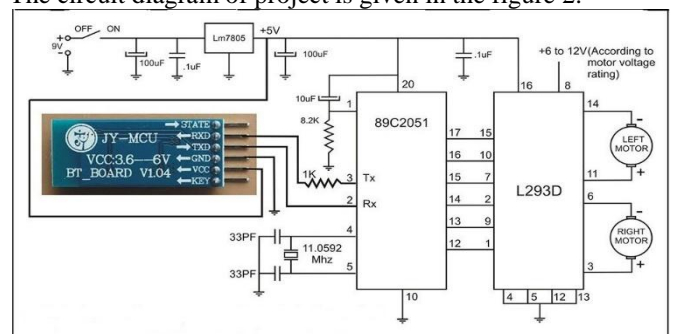The circuit diagram of project is given in the figure 2.

Figure 2: Circuit Diagram of project [11][13]

4. Working

- Here at this robot we have used a Bluetooth module which control the robot via 2 DC High Torque motors at 10,000 RPM appox.[4] The robot is control by an android phone application. Microcontroller used here is AT89S52 form 8051 family which contributes in a serial communication UART mode and the communication is
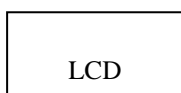
governed on 9800bps to communicate it with the Bluetooth module.

- The Bluetooth module, HC-05 in smd package is used here which works on a 3.3v and have a serial communication with any device connected to it the communication speed can be configured on various speed using AT Command[11].

- The BT module is a SPP supported profile therefore it can be connected easily to any phone. The data can be sent and receive to module in this profile. The RX pin of microcontroller is connected to the BT module.

- The L293D is a motor driver IC which is used to operate the motors in any required direction dependent on the logic applied to the logic pins[11].

- A readymade compact size chassis is used here to avoid the chassis assembly. The chassis contains 2 decksie. for high torque motors fitting the lower is used and as a battery stack .on top the upper is used the plate the board is mounted by screw fitting [5][9].

5. Components Description

5.1 HC-05 Bluetooth Module

The Bluetooth module used is a HC-05 based on SPP support

5.1.1 Features
- It is a wireless serial Bluetooth port.
- With free power adapter bottom board come with well power regulator. User can connect 3.3 to 5VDC and connect TX and RX to you control IO (general 3.3 to 5V digital input output of MCU or IO is ok, or general TLL IO)[10].
- Easy to connect this module with PC, just search and key "1234" passcode [6].
- With white SMD LED on the adapter board, can see the Bluetooth connection status[10].

5.2 High Torque DC Motors

5.2.1 Key Features

- 10RPM,60RPM,100RPM,200RPM,300RPM,600RPM,900RPM High-Torque DC Motor.
- Metal Gearbox and Gears.
- 18000RPM base motor.
- High-Current DC Constant-Torque motor drive integrated with the motor [3][6].
- Motor speed control interface via UART, I2C, PPM signal and analog input.
- Speed control possible in both directions down to almost 1% of max. speed.
- Small package and integration allows for easy installation and operation[10].
- Speed/Motion can be controlled using a terminal or MCU via simple UART/I2C commands [7] [8].

- I2C master device can control multiple RMCS-210x via simple I2C command structures.
- An RC receiver or any PPM source can directly control the speed of the motor [10][13].
- An analog signal or fixed analog voltage from a potentiometer can directly control the speed of the motor.
- Max-speed setting to limit the maximum speed of the motor[2].
- Damping setting to damp the change in speed on the motor for smoother operation.

5.3 L293D Motor Driver

5.3.1 Features:

- Easily compatible with any of the system
- Easy interfacing through FRC (Flat Ribbon Cable)
- External Power supply pin for Motors supported [3][8]
- Onboard PWM (Pulse Width Modulation) selection switch
- 2pin Terminal Block (Phoenix Connectors) for easy Motors Connection[12][13]
- Onboard H-Bridge base Motor Driver IC (L293D)

5.4 LM 7805 Voltage Regulator

5.4.1 Features

- Output current in Excess of 1.0 A
- No external component required
- Internal thermal overload protection[5]
- Internal short circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 2% and 4% tolerance
- Available I n surface mount D2PAK and standard 3-lead transistor packages[12]
- Previous commercial temperature range has been extended to a junction temperature range of -40 degree C to +125 degree C [7].

5.5 Resistors

The flow of charge through any material faces an opposite force similar in many respects to mechanical friction which is called resistance of the material.Resistor usually fall in three categories , from which only two are color coded which are metal film and carbon film resistor .the third is the wire wound type ,where value are casually printed on the vitreous paint finish of the component [9]. Resistors unit are in ohms and are represented in Greek letter omega, looks as an upturned horseshoe. Most electronic circuit needs resistors to make them work properly and it is obliviously important to search out something about the different types of resistors available[12][14]. Resistance is measured in ohms, the symbol of ohm is an omega. 1 ohm is very very small for electronics so resistances are generally expressed in kohm and Mohm. Resistors generally can have resistances value as low as 0.1 ohm or as high as 10 Mohm [1].

5.6 Capacitors

Generally, a capacitor is a something like a battery. Although they work in fully different ways, capacitors and batteries both are used to store electrical energy[14].

5.7 Micro-Controller AT89S51

5.7.1 Features

- Compatible with MCS-51® Products
- 4K Bytes of In-System Programmable (ISP) Flash Memory– Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz[10]
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines [1][7]
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer [10]
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time[2]
- Flexible ISP Programming (Byte and Page Mode) [10]

5.8 Crystal Oscillators

Crystal oscillators are oscillators whose primary frequency determining element is made up of a quartz crystal. The crystal oscillator may be held to extreme accuracy of frequency stability because of the inherent characteristics of the quartz crystal [3][10].Temperature compensation may be applied to crystal oscillators which improves thermal stability of the crystal oscillator. Crystal oscillators are generally, fixed frequency oscillators in which stability and accuracy are the primary considerations. For example for the upper HF and higher frequencies without resorting to some sort of crystal control it is impossible to design a stable and accurate LC oscillator. The frequency of older FT-243 crystals can be moved upward by crystal grinding.

5.9 Switch

Here SPST switch is used. A Single Pole Single Throw toggle switch connects or disconnects one terminal either to or from another. It is the simplest switch.

5.10 Battery

Here two batteries are used which are 9V DC battery and 12V DC battery. It is used a power supply to the circuit.
5.11 Caster Wheel

A caster (or castor) is an undriven, single, double, or compound wheel that is designed to be mounted to the bottom of a larger object (the "vehicle") so as to enable that object to be easily moved. They are available in various sizes, and are commonly made of rubber, plastic, nylon, aluminum, or stainless steel [14].

5.12 Iron Angle

An L-shaped steel structural member classified by the thickness of the stock and the length of the legs. Sometimes referred to simply as angle. Here we have used one 8 ft. iron angle[12].

5.13 Iron Sheet

Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are constructed with sheet metal [14][9]. Thicknesses can vary significantly; extremely thin thicknesses are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate. Sheet metal is available in flat pieces or coiled strips. The coils are formed by running a continuous sheet of metal through a roll slitter. Here we have used 1 sheet of iron of 60x60 cm.

5.14 Nylon Wheels

Nylon wheels feature an exclusive, ultra-tough thermoplastic compound that resists hard impacts and drop-shocks[6]. The wheel is impervious to most chemicals, solvents, salts, gases, alkaline and steam cleaning and does not absorb water. When compared to other hard tread wheels, these Glass Filled Nylon wheels require less force to roll and swivel. It is ideal for many industrial and institutional applications and is NSF listed for the food service industry. The wheel is non-marking. Here we have used two nylon wheels[14].

6. Applications

- **In Domestic Use:** This project can be used at homes for many purposes like picking up and placing some objects from one to other. [11]
- **In Spying Operations:** This robot can help in spying operations. The object recognition and android control makes it Hi-Fi.
- **For Handicapped People:** This project can help the handicapped people especially those who had lost their feet unfortunately
- **Robo Races:**The tilt control of robots can be used in robo races which willbe revolutionary[14].

7. Conclusion

Wireless control is one of the most important basic needs for all the people all over the world. But unfortunately the technology is not fully utilized due to a huge amount of data and communication overheads.Generally many of the wireless-controlled robots use RF modules. But our project for robotic control make use of Android mobile phone which is very cheap and easily available. The available control commands are more than RF modules. For this purpose the android mobile user has to install a designed application on her/his mobile. Then he/she needs to turn on the Bluetooth in their mobile. The wireless communication techniques used to control the robot is nothing than Bluetooth technology. User can use several commands like move reverse, forward,

move left, move right using these commands which are given from the Android mobile. Robot has a Bluetooth receiver unit that receives the commands and snd it to the microcontroller circuit to control the motors. The microcontroller then transfers the signal to the motor driver IC's to operate the motors.

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