DC motor Speed Control by Android using Bluetooth Technology

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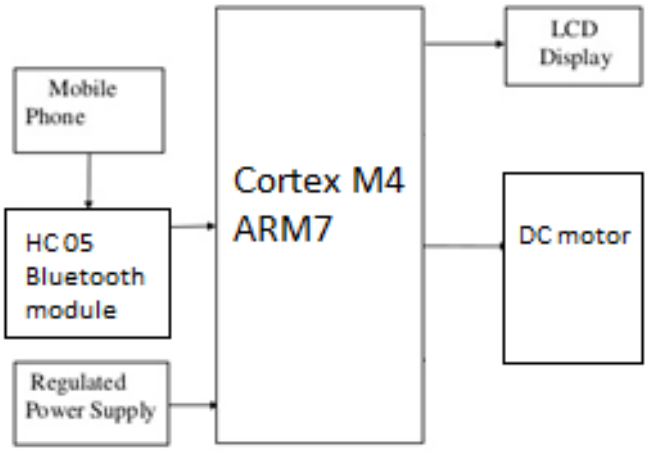
***Abstract*—Automation of the surrounding environment of a modern human being allows increasing his work efficiency and comfort. There has been a significant development in the area of an individual's routine tasks and those can be automated. In the present times, we can find most of the people clinging to their mobile phones and smart devices throughout the day. Hence with the help of his companion – a mobile phone, some daily household tasks can be accomplished by personifying the use of the mobile phone.**

I. DESCRIPTION

This system DC motor Controller by Android is developed to control the speed of the DC motor. For this DC motor is interfaced to the ARM7 controller. A Bluetooth modem is used to receive PWM commands. When an Android device sends commands, it is received by the Bluetooth modem which then sends the commands to the microcontroller. The microcontroller the controls the DC motor through motor driver. The entire system is powered by 12V transformer. LCD display is used to show the status and the speed of the DC motor. The android application is used to control the entire system. Simultaneously the status of the system is displayed on the LCD screen and also the speed of the DC motor is displayed on the screen. Thus the speed of the motor can be increased or decreased. the help of this android application.



Principle of Operation

The speed of DC motor is directly proportional to the voltage applied across its terminals. Hence, if voltage across motor terminal is varied, then speed can also be varied.

This project uses the above principle to control the speed of the motor by varying the duty cycle of the pulse applied to it (popularly known as PWM control). Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation.

The project uses Bluetooth device, interfaced to the microcontroller, which are used to control the speed of motor. PWM (Pulse Width Modulation) is generated at the output by the microcontroller as per the program. The program can be written in Assembly language or in Embedded C.

The average voltage given or the average current flowing through the motor will change depending on the duty cycle (ON and OFF time of the pulses), so the speed of the motor will change. A motor driver IC is interfaced to the microcontroller for receiving PWM signals and delivering desired output for speed control of a small DC motor.

Further the project can be enhanced by using power electronic devices such as IGBTs to achieve speed control higher capacity industrial motors.

Components

- **ARM 7 Processor**

The ARM® Cortex®-M4 processor is a high performance embedded processor with DSP instructions developed to address digital signal control markets that demand an efficient, easy-to-use blend of control and signal processing capabilities. The processor is highly configurable enabling a wide range of

implementations from those requiring floating point operations, memory protection and powerful trace technology to cost sensitive devices requiring minimal area.

Key Benefits

Gain the advantages of a microcontroller with integrated DSP, SIMD, and MAC instructions that simplify overall system design, software development and debug

Accelerate single precision floating point math operations up to 10x over the equivalent integer software library with the optional floating point unit (FPU)

Develop solutions for a large variety of markets with a full-featured ARMv7-M instruction set that has been proven across a broad set of embedded applications

Achieve exceptional 32-bit performance with low dynamic power, delivering leading system energy efficiency due to integrated software controlled sleep modes, extensive clock gating and optional state retention.

- **HC-05 Bluetooth Module:**

HC-05 module is an easy to use **Bluetooth SPP (Serial Port Protocol) module**, designed for transparent wireless serial connection 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. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.

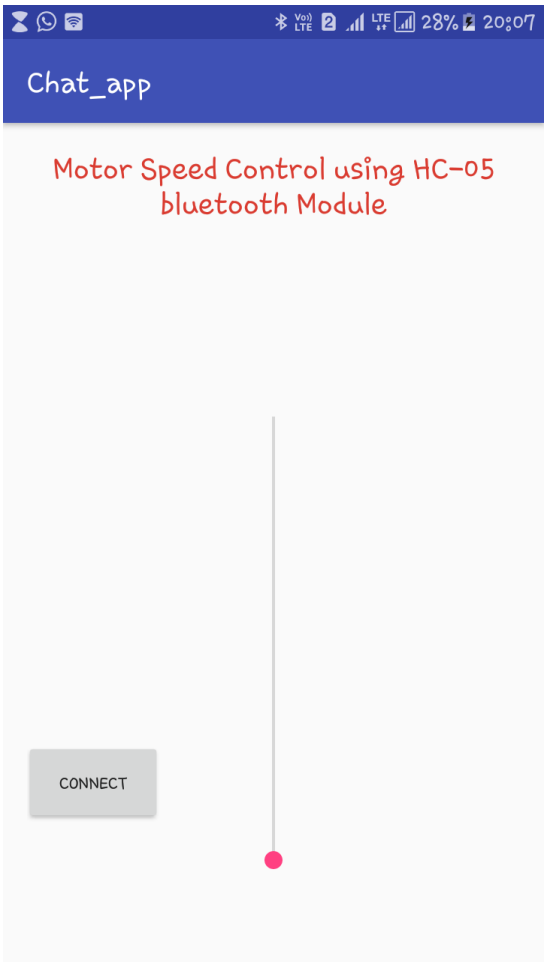
- **LCD:**

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Some common components are also required for microcontroller to work. Microcontroller works on 12 MHz clock signal. Also the port 0 is required to connect with pull up resistor, all other ports are pulled up internally.

III. Working:



Snapshot of Android App

An android app developed, which has seek bar. Seek bar is a scrolling type View component in android whose values varied from 0 to 100 in integer form.

A code is written for the application whose work is to connect with HC-05 module which is interfaced with ARM microcontroller. Whenever user scrolls over seek bar its values varies between 0 to 100, this value is sent to Bluetooth module.

We written an embedded C code for ARM in which it continuously receives value from HC-05 module and convert it into decimal format. If 10 is receiving from module it changes to 0.1 if 100 received it converts into 1, means value from 0 to 100 will be converted into 0 to 1. The purpose of converting this value is, we have to write this value on PWM pin of arm and PWM value must be in between 0 to 1. Now this value will be written on PWM output pin and this pin is further connected with motor driver circuit which drives motor according to the value received from android Seek bar.

IV. Code

```
#INCLUDE "MBED.H"

SERIAL PC(SERIAL_TX, SERIAL_RX);// THIS IS MAIN SERIAL PORT DRIVEN BY USB CABLE.

SERIAL HC05(D10, D2);// THIS USES A SINGLE WIRE RECEIVING GPS SIGNAL AND GND. NO DATA IS SENT TO GPS.

INTERRUPTIN MY(USER_BUTTON);

PWMOUT MYLED(PWM_OUT);

TEXTLCD LCD( D13,D12,D11,D10,D9,D8, TEXTLCD::LCD16X2); // RS, E, D4-D7, DEFAULT 16 COLUMNS X 2 ROWS


INT I,J; // DEFINE TWO DUMMY VARIABLES.

INT VAL,X;  CHAR C[]=" ";

CHAR Z[]="  ";

VOID MYY(){

MYLED.WRITE(X/100);}


INT MAIN() {

MYLED.PERIOD_MS(10);

MY.FALL(&MYY);

PC.PRINTF("\N\R PROGRAM TO TEST SIGNALS COMING FROM GPS..... \N\R");

LCD.CLS();

PC.BAUD(9600);// PC DEFAULT BAUD RATE IS 9600

HC05.BAUD(9600);// GPS DEFAULT BAUD RATE IS 9600


WHILE(1)

{INT COUNT=0;

// CHECK WHETHER A CHAR HAS RECEIVED FROM GPS, IF YES THEN SEND IT TO PC ELSE SKIP
```

```
WHILE(HC05.READABLE())
{/*     IF(COUNT==0){
            C[0]=HC05.GETC();
                COUNT++;
                    }
        ELSE IF(COUNT==1){
        C[1]=HC05.GETC();
            COUNT++;
                }
        IF(COUNT==2){
          INT X= ATOI(C);
        SPRINTF(Z,"%D",X);
        PC.PRINTF("%S",Z);
            PC.PRINTF("_");
              COUNT=0;}
           */


   FLOAT A=HC05.GETC();
        PC.PUTC(A);
     PC.PRINTF("_");
            MYLED.WRITE(A/100);

                }

              }

              }
```


ACKNOWLEDGMENT

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REFERENCES

1. https://developer.mbed.org/
2. https://developer.android.com/reference/android/widget/SeekBar.html