Stepper Motor Control using STM32 -Arm MCU Development Board

A Mini Project Report

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Abstract

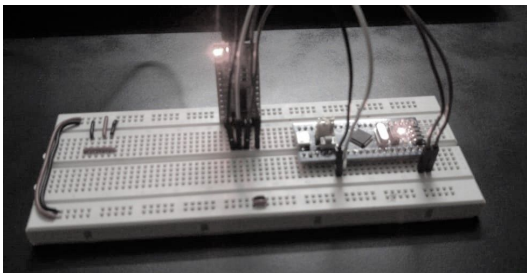
In this mini project we are interfacing Stepper Motor with STM32F103C8 (Blue pill) board. . Stepper motor is brushless DC motor, which can be rotated in small angles, these angles are called steps. Generally stepper motor use 200 steps to complete 360 degree rotation, means its rotate 1.8 degree per step. Stepper motor is used in many devices which needs precise rotational movement like robots, antennas, hard drives etc. We can rotate stepper motor to any particular angle by giving it proper instructions. Mainly two types of stepper motors are available, Unipolar and Bipolar. Unipolar is easier to operate, control and also easier to get.. Here we use a 32 step sequence. The motor rotates depending on the input we have given in the serial monitor. An ft232 usb serial connector has been used to flash the bootloader. And a ULN2003 motor driver was used to drive the stepper motor. Additionally a potentiometer has been connected to to vary the speed of the motor. Depending on the potentiometer resistance the speed of the motor varies. The circuit used in this mini project can control the direction of rotation and the speed of rotation of a stepper motor.

Methodology:

1. Resetting the bootloader:

So that the micro usb can be used to flash programs. The usb bootloader has been reset so that the micro-usb slot can be used to flash the program. An ft232 USB to ttl serial connector has been used to do this.

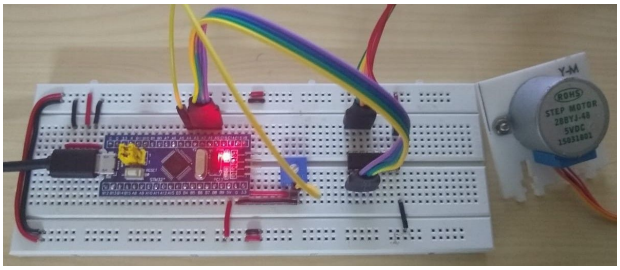
Flash Loader was used to flash the usb bootloader. After flash the required program with the flash loader, We were able to use the micro-usb in the development. This reduced a ton of hassle and the setup became very limited.



2. The Circuit:

are made such that the output from the STM32 goe to the ULN2003 steppers drivers pins A0, A1, A2, A3 we connected to the INN1, IN2, IN3, IN4 pins of the UNL2003. The no of degrees to rotate is given from the serial monitor and the corresponding voltage is sent to the stepper motor via the ULN2003 and the stepper motor rotates to set degrees.

The image of the final setup is shown Below:



3. Defining Angle:

Then we define no. of steps to complete one rotation, here we use 32 because we are using **Full-Step (4 Step-sequence)** so (360/32 = 11.25 degree). So for one step, the shaft moves 11.25 degree that is stride angle.

So the Approximated Calculated values are, for eg:-

2048 = 360 degree

1024 = 180 degree

512 = 90 degree

Depending on the angle given, the respective coils inside the stepper motor energises and the motor rotates in the respective direction. If the value given is NEGATIVE, the motor rotates in the opposite direction.

Conclusion:

This mini project consisted of STM32 an ARM Based microcontroller and a ULN2003 motor driver to control the direction of rotation and the speed of the stepper motor. This mini project can make the motor rotate in any direction at any speed within the range of the motor's datasheet. Resetting the bootloader also played an important role in flashing the program to the microcontroller everytime.

Appendix:

Code:

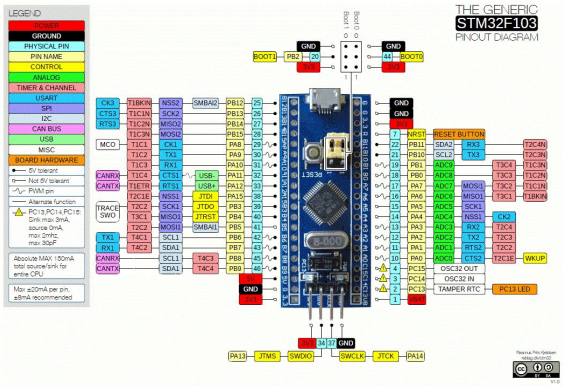
```
#include <Stepper.h>
#define STEPS 32
const int speedm = PA4;
Stepper stepper(STEPS, PA0, PA2, PA1, PA3); //given according the the coils.
int angle_rot = 0;
void setup()
{
  Serial.begin(9600);
  pinMode(speedm, INPUT);
}

void loop()
{
  if (Serial.available() >0 )
  {
    angle_rot = Serial.parseInt();
    int speedcntrl = analogRead(speedm);
   int cntrl = map(speedcntrl, 0, 4096, 0, 1023);
    stepper.setSpeed(cntrl);
    stepper.step(angle_rot);

  }
}
```

Block Diagram:

STM 32: Blue pill



Connections: