

Embedded System Hardware Design (EECE8010)

Spring 2020

Project Milestone #1

Project Document

Submitted by:

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Purpose of project:

The purpose of project is

- to learn PCB design.
- steps included in PCB design.
- to learn Altium software used in PCB designing.

What is PCB: PCB stands for Printed Circuit Board. It connects electrically and supports mechanically electrical or electronic components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

There are different types of PCB:

- Single-sided,
- Double-sided, and
- Multi-Layer.

Altium Software: Altium Designer is a PCB and electronic design automation software package for PCB. It allows us to create a PCB design in fast way possible with error free layouts.

Scope of Project:

The scope of project is to build an PCB. Later, anyone can use this PCB to create project.

The components list is as follows:

- PWM Constant Current Micro Stepping Driver
- 2x H-Bridge driver
- 2x Quadrature Encoder interface
- Character LCD interface
- RS-232 level interface
- Analog inputs
- STM32F3 Nucleo-64 board interface
- Speaker
- Temperature sensor
- Distance Sensor
- 4x PCB terminal block

Intended Audience:

The intended audience for this document can be

- PCB designers,
- Engineers, and
- Students who wants to work on this PCB.

Description of Solution:

We will follow the following steps:

1. Design PCB in software.
2. Mount all the components on PCB.
3. Test the PCB.

Components will be mounted using soldering.

Description of components:

1. PWM Constant Current Micro Stepping Driver:

It is a stepping motor driver of the micro step drive. As name mention, it control PWM current and allows micro stepping.

We will be using LV8712T.

2. H-Bridge driver:

An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. It allows DC motors to run forwards or backward.

Here, we are using L293D H-bridge driver for our project.

3. Quadrature encoder Interface:

It is used to measure speed and direction of a rotating shaft and keep track of how far we have moved.

A quadrature encoder normally has at least two outputs Channel A and B - each of which will produce digital pulses when the thing they are measuring is in motion. These pulses will follow a particular pattern that allows you to tell which direction the thing is moving, and by measuring the time between pulses, or the number of pulses per second, you can also derive the speed.

4. Character LCD Interface:

It is an electronic display which uses liquid crystal to produce visible image. There are different types of LCD available in market.

For this project, we will use 16x2 LCD display. This can help user to display any message.

5. STM32F303:

It is complete package from ARM cortex M4 based microcontroller. It includes various peripheral like USB connector, embedded debug tool interface and LEDs.

We will use STM32F303-re board.

6. RS-232 level interface:

It is used for serial communication. It is used to connect computer and its peripheral device and allows a serial data exchange between them.

We will use MAX3222

7. Bluetooth module:

Basic circuit used in wireless transmission. With the help of this, we can control our project with the help of android phone.

For this project we will use HC-05 Bluetooth module.

8. **Speaker:**

It is an output device used to produce sound.

For this project, it will be an additional component used to generate sound depends on user application.

9. **Temperature Sensor:**

It is used to measure the amount of energy, that is generated by an object or surrounding system, also can sense any physical change.

For our project we will use **MCP9700** temperature sensor.

10. **Proximity sensor:**

It is used to detect any obstacle or object within some range without any physical contact.

11. **PCB terminal block:**

They are used to connect wires.

For our project we will use 3 PCB terminal block in case if they want to connect any external circuit with this project.

Block diagram:

Block diagram for project is given below:

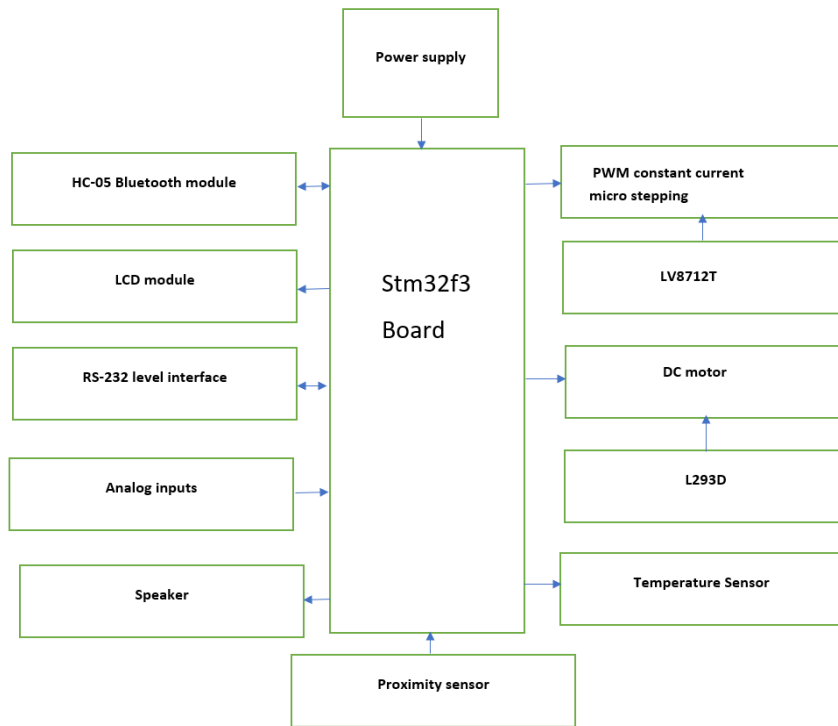


Fig no: 1 Block diagram of project.

Cost estimation:

We are just estimating total cost for our project with some spare parts included.

Following table shows the list of components with no of components and price.

Sr. no	Number of units	Component	Single unit cost	Total cost
1	1	STM32 board	\$17.00	\$17.00
2	1	PWM Constant Current Micro Stepping Driver	\$5.00	\$5.00
3	2	H-bridge	\$3.00	\$3.00
4	2	Quadrature encoder interface	\$15.00	\$15.00
5	1	Character LCD interface	\$7.00	\$7.00
6	1	Proximity sensor	\$5.00	\$5.00
7	1	Bluetooth module	\$0.60	\$0.60
8	2	Temperature sensor	\$0.50	\$1

9	3	PCB terminal block	\$3.00	\$9.00
10	1	Speaker	\$2.00	\$2.00
11	1	RS-232 interface	\$4.00	\$4.00
12	1	Stepper motor	\$21.00	\$21.00
13	1	DC motor	\$11.00	\$11.00
14	1	PCB board	\$30.00	\$30.00
		Passive components	\$15.00	\$15.00
Total cost				\$145.60

Note: all the component cost is estimated may differ

Note: passive components include resistor, capacitor, transistor, diodes.

Team member:

Simran Padaniya.

Background information:

There are many projects available in market, like this. This project does not have anyone functions. It can be helpful in more than one field.

As an example,

It can be used as

- farming robot
- android operated robot
- automated wheelchair.

References

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