

Jan 26 (Wed) First Day of the Class.

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Office Hours: M.W. 4:30-5:30 PM.

Textbooks + References:

No Textbook, however GPU Datasheets Are employed as a Base Line Reference, and serves as a textbook.

1. ARM GPU Datasheet, from Samsung & SGH Document for the development Board.

2. NVDA Jetson Nano Developer Kit. Reference Source for people using NANO as a target platform.

System-on-module Document. (Not Used that much in this class).

Design Guide As 2nd primary Ref. for Jetson NANO.

3. Broadcom Pie, BCM2835 (CPU Datasheet).

Selection of Target platform for this course.

- a. NVDA Jetson NANO
- b. Broadcom Pie d. NXP i8
- c. Samsung ARM CPU

Note: Select your target platform from the options a-d.

(Consider Nvidia Jetson NANO).

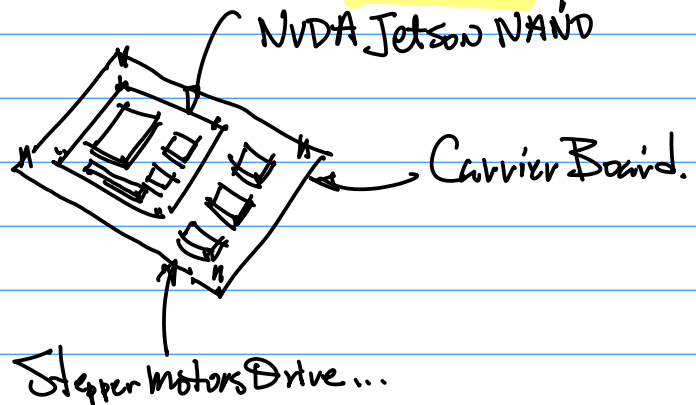
Programming Languages: { C/C++
python

O.S. Support: Linux.

Rich I/O I/F Support.

Requirements for the Course:

1. Design/Build A State-of-the-Art Prototype System; Each Person will have to have one individual system.



2. Form 4 person team, Work on Homework, Project, However All Coding, Report etc have to be completed individually, no Code, Report, Project etc. Can be Shared.

Grading:

1. Midterm Exam, Close Book/Close Notes 30%. Prototype System will be needed to Answer Design Questions, and to execute programs. Need to take photos of the prototype.

2. Final Exam, Similar Format, 40%. Prototype System is a Part of the Exam.

3. Homework, Projects. 30%.
1st Project During the 1st half of the Semester. 2nd Project By Team Project, @ End of the Semester, Requires PPT Presentation & Live Demo.

Announcement in Class, in Written form Both in the Lecture Notes and ON SSSU Canvas, Late Projects/Homework 1 pt Penalty.

Jan 31 (Monday)

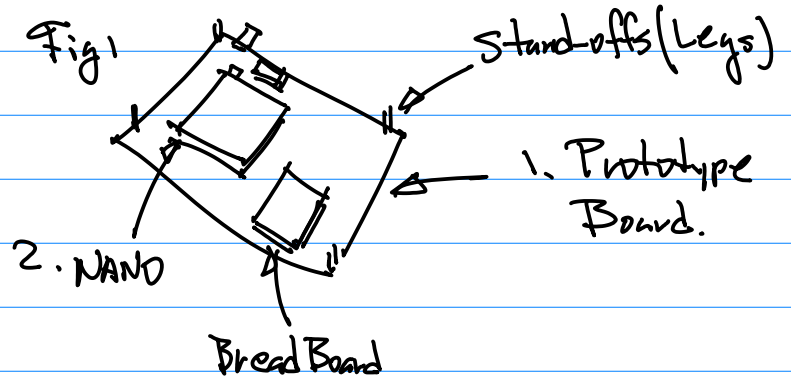
Today's Topic: Bill of Material & Prototype System.

Target platform to Consider for your Prototype :

- ↓ Nvidia Jetson Nano, 2GB
- ↓ Broadcom Pi. 3BT, 4.

Note: Jetson Nano is Better And more powerful with Almost the Same Cost.

Bill of Material for Prototype System



Note: a. Adequate size to host CPU module (NVIDIA Jetson Nano)

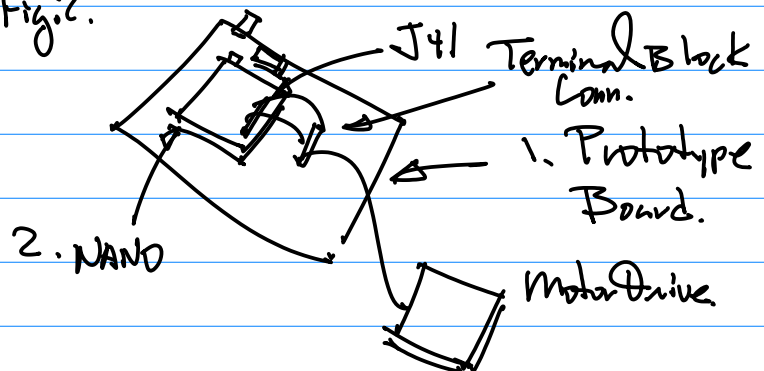
16 x 11 1/2 Cm.

b. Power Circuit.

c. Stepper motor Drive

Note: For Simple Testing Purpose, you can Choose to use Non-professional Grade Drive. Or Use professional Grade Stepper motor Drive. (Robotics, CNC, 3D Printer Additive Manufacturing), Size of the Drive can be same size of your CPU module

Fig.2.



Prefab "Through Holes" with Coating for Soldering.

Stand-offs (legs)
Components for:

External Power Unit
GPIO Testing Circuit

External Power Unit
Option 1: Wall-mount Adapter
Option 2: Battery Pack.

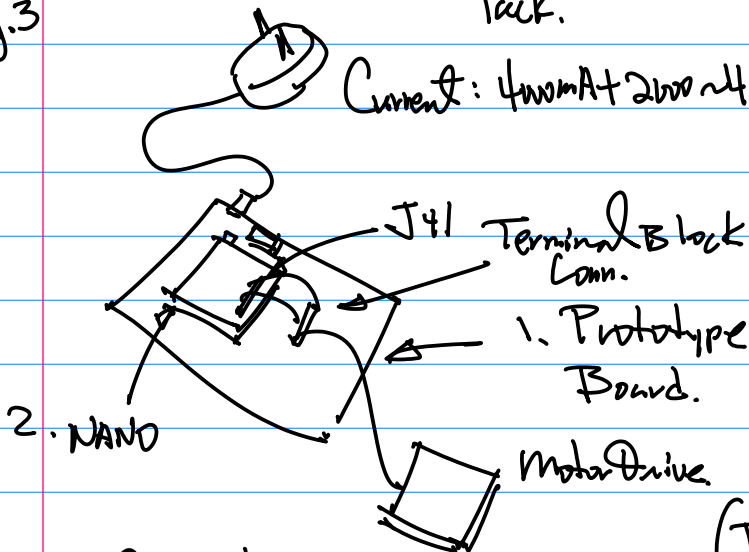
Make sure DC Regulator IC Can
Handle Adequate Current

Consider 7805 as an example. Only 1500mA
is allowed, No good
information

voltage integrated-circuit voltage regulators is designed for a wide range of ;
include on-card regulation for elimination of noise and distribution problems as
tion. Each of these regulators can deliver up to 1.5 A of output current.
thermal-shutdown features of these regulators essentially make them immune

(7805 Datasheet)

Fig.3



Current

Note: Adapter To provide power
Not just to the Target platform,
But also to the entire Board

NANO Target Requires 4A (4000mA)
Current for Peak Computing, On top of
it, you will need to consider providing
Adequate Current for Gpio Logic,
for Sensor I/F (LSM 303), for Stepper
Motor Drive.

Note: IC DC Regulator is Needed.

Note: Some power regulators will
have Different voltage Drop.

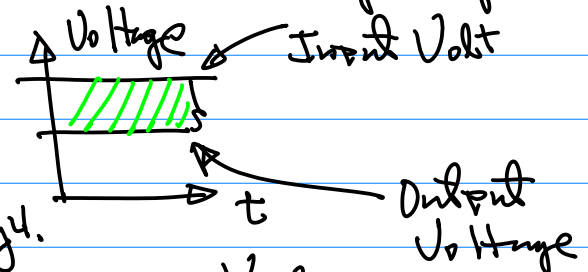
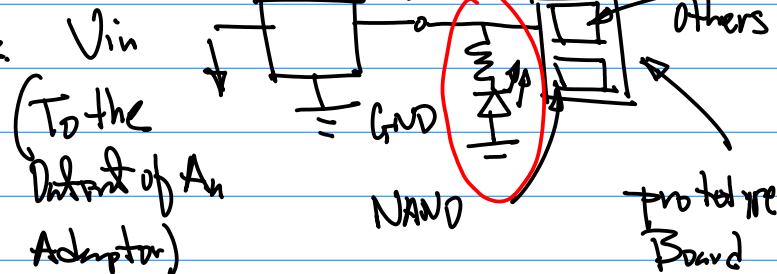


Fig.4.



(2) Red LED, $V_{LED} \approx 1.2V$, $I_{LED} \approx 10mA$

(3) Assorted Resistors (A few hundred
of Ohms to A few Mega Ohms)

Caps. for Noise Reduction. for
IC Regulator Compensation).

(4) Right Angle DC connector.

Right Angle

GPIO Testing { Input { "0"s
"1"s
Output { "0"s
"1"s



Fig.5

Anchor Electronics

Website Directions Save

4.6 ★★★★★ 50 Google reviews

Electronic parts supplier in Santa Clara, California

Long-running supplier of a huge range of electronic components, tools, cables & more.

Address: 2040 Walsh Ave, Santa Clara, CA 95050

Hours: Closes soon · 4PM · Opens 7:30AM Tue

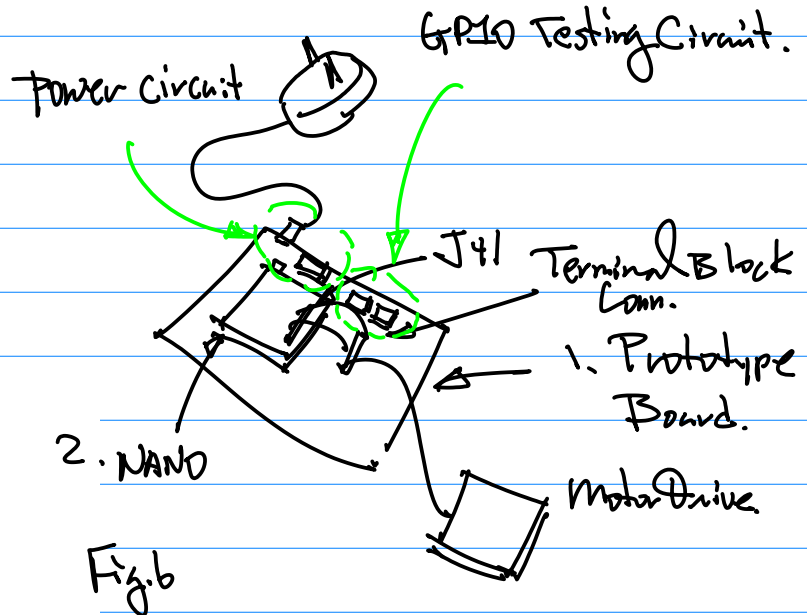


Fig.6

Input Testing:

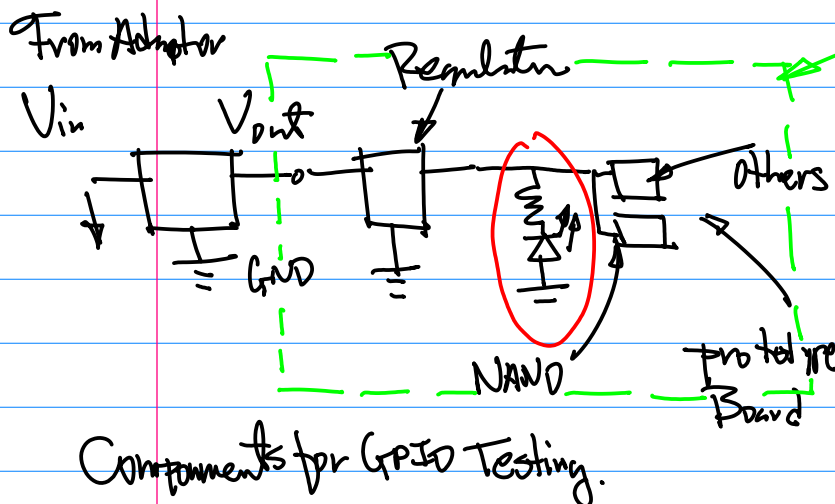
1. Toggle sw.
2. Assorted Resistors



(10 Ohms ~ A few Hundred Ohms)

Output Testing:

1. Color LED (Red, yellow, Green)
2. Assorted Resistors.



Feb. 2nd (Wed)

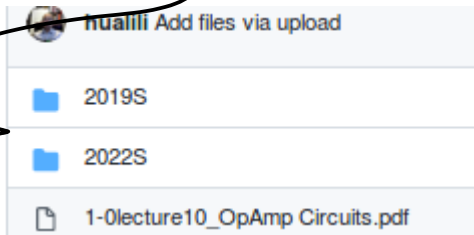
Today's Topics :

- 1° Bill of material (Continuation)
- 2° Prototype System Design.

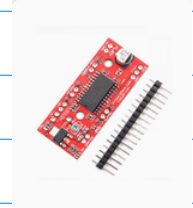
CMPE242 Spring 22

5

Class github



Option B for the motor drive
"Easy Drive" c. ~100mA.



EasyDriver Stepper Motor Controller
\$1.71
RobotShop.com

Example: Bill of material for PID controllers (Stepper motor etc).
GPIO Testing Circuit.

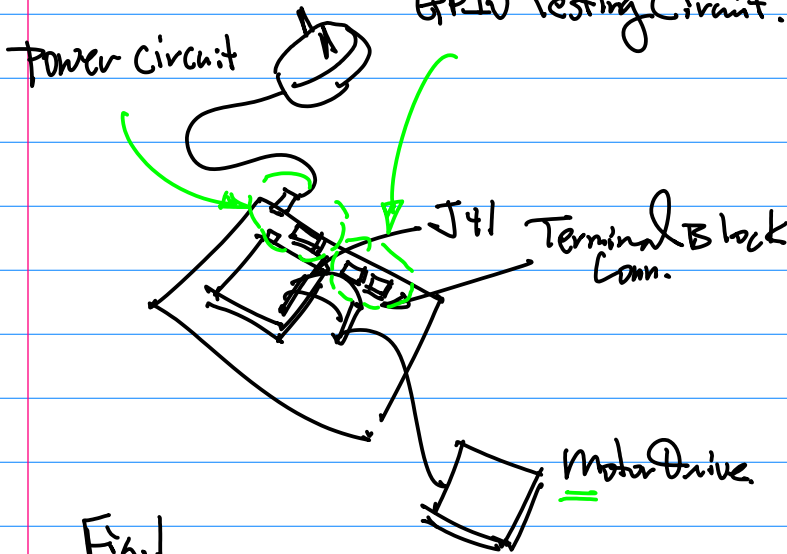
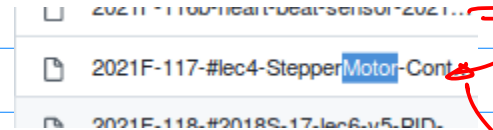


Fig.1

Ref. for Stepper motor Drive

<https://github.com/hualili/CMPE244>



PID Controller (P: Proportional, I: Integral, D: Derivative)

For CNC, 3D printer, for Self-Driving Robot

Motor Drive for Stepper motors.

Option A. Professional Drive

Option B.



InstaCNC Machining Center



Free 2-day
Integrated Stepper
\$265.00
Automation...

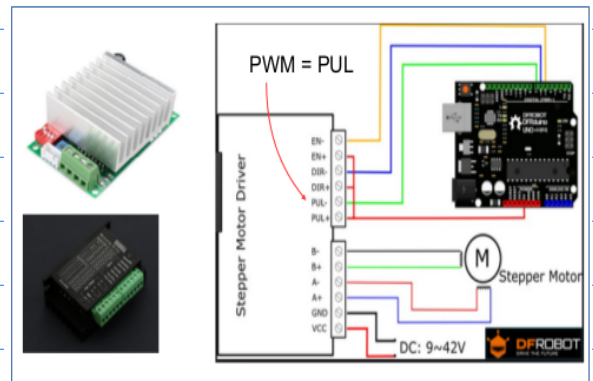


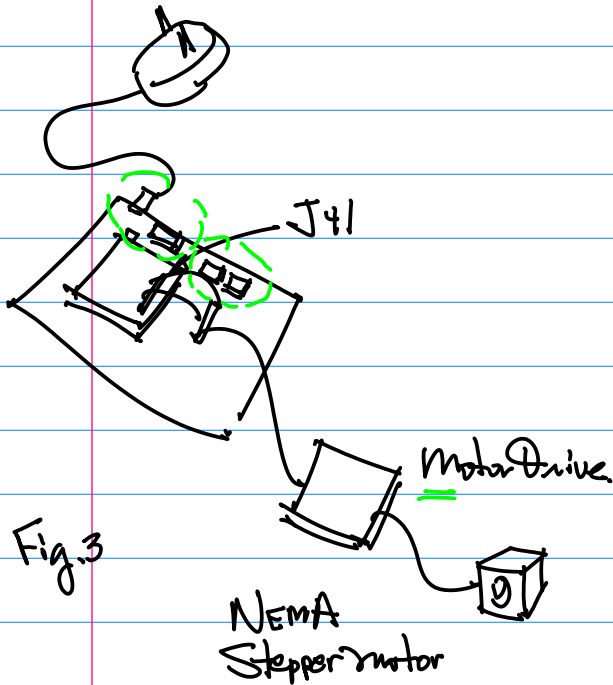
Fig.2

~\$15-\$40

Note: Specs for Option A: a.

4.5A. (2500mA ~ 3000mA for this class & Beyond) b. TB66xx (IC Chip Provides Adequate Power)

Bill of material (motor)



https://www.anaheimautomation.com/marketing/stepper/stepper-motors.php?gclid=EAlaIqobChMIqsaW3pbi9QIV-R6tBh1QBAFsEAAyAAEglhx_D_BwE



Stepper motor
- NEMA-17

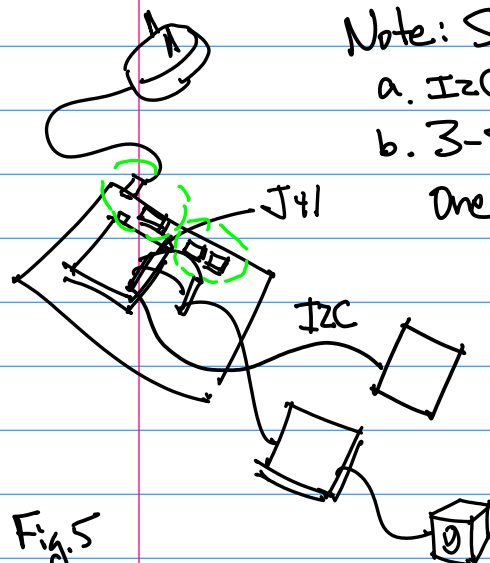
\$14.00
Adafruit Ind...



Fig. 4.

Bill of material (Sensors) for PID

Note: Sensor LSM303
a. I2C Sensor Interface;
b. 3-sensing units in
One package



Buying LSM303 module

Bill of material (IoT Applications
Analog Sensor I/F)
ADC module
(Analog/Digital Conversion)

I2C
SPI (Serial Peripheral Interface)



Adafruit 1018
Acceleration Sensor

\$17.95

Mouser Electronics



Adafruit Industries
LLC 1085 ADS1115

\$14.95
Digi-Key



Adafruit Industries
LLC 4648 PCF8591

\$6.50
Digi-Key

Selection guideline:

1. Digital Interface Protocol (CPU and ADC Interface);

SPI: 50± Mbps, I2C: 2M Mbps

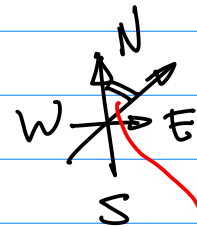


Fig. 6

LSM303



Ultra-compact high-performance eCompass module:
3D accelerometer and 3D magnetometer

LSM303DLHC

Datasheet - production data

including Temperature Sensing (the 3rd one)

Selection Guideline (Continued)

2. Sample Rate:

500KSPS or 1 MSPS (million Samples per Second)

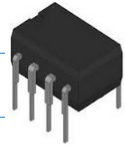
3. Quantization Level of ADC.

Bits Per Sample. 8~10 bit Resolution
minimum;

Nyquist Sampling Theorem.

$$f_{\text{sample}} \geq 2f_{\text{max}} \quad \dots (1)$$

Note: Optional Component — OpAmp.
Operational Amplifier



Single OpAmp.

OpLM358
(Quad OpAmps
in One Package).

Texas Instruments
LM741CN/NOPB
\$0.91
Digi-Key

Homework: One A week from Today. (Feb. 9) 11:59 pm

1. Identify your target platform, And provide A screen Capture or photo of its connector. with Table of pin Expansion Assignment;
2. Create A table of Bill of material Based on Lecture Discussion.
3. Submission: A pdf file with Naming: First-Last-3ID-Target-242.pdf. Submission to CANVAS.

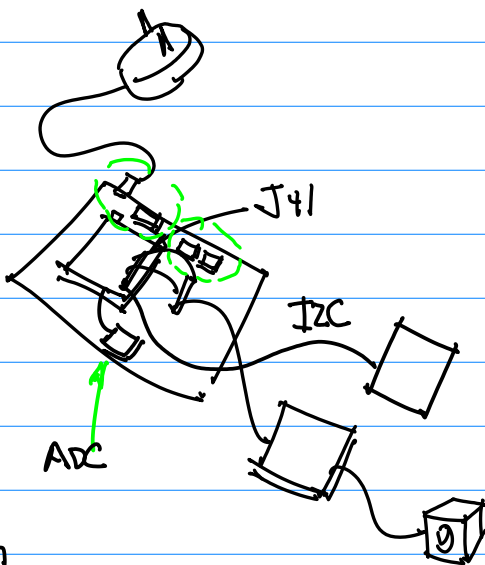


Fig. 7

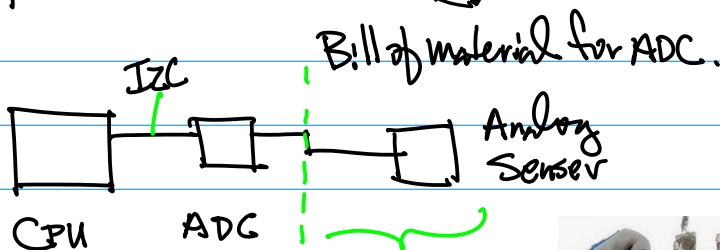


Fig. 8

