Real Time Operating Systems

UNIVERSITY OF IDAHO – JOHN C. SHOVIC, PHD

COEUR D'ALENE

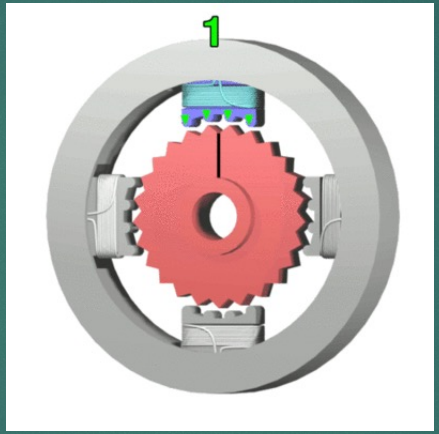
Discussion of Current Assignment

- I2C is still a mysterious protocol. ☺

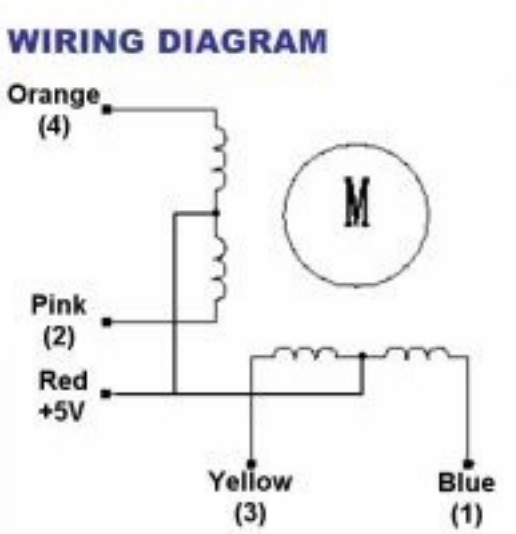
The Big Pico Assignment

- This is our last major project for the Pico. We will add a few more functions and then we will move to the ESP32 and IOT designs.
- We bring all of our RTOS knowledge together in a substantial project.

Stepper Motors



Stepper Motor Sequence



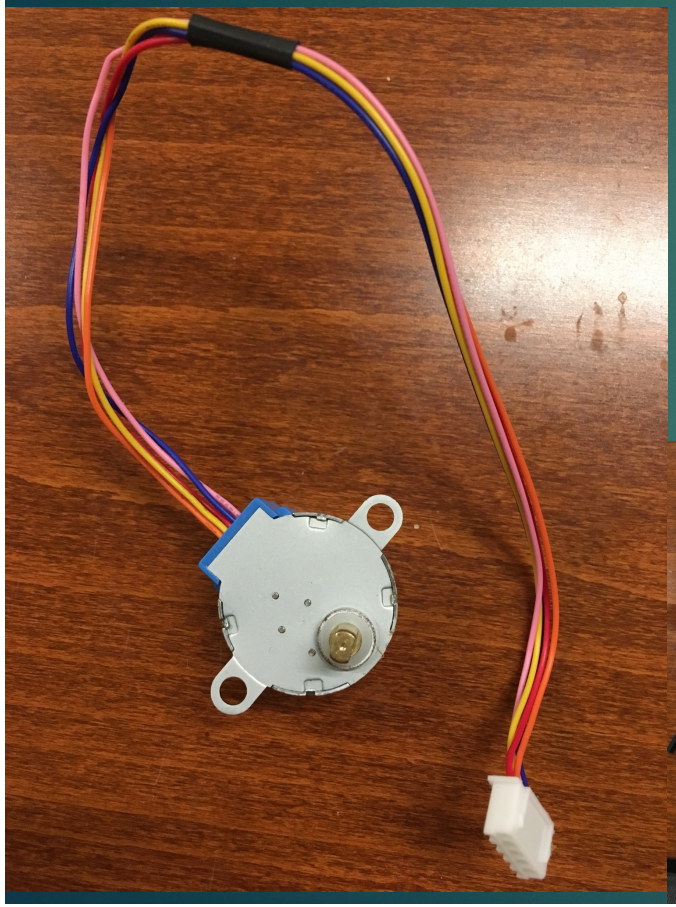
Switching Sequence

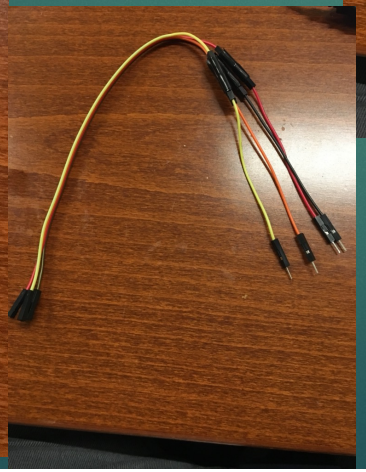
Lead Wire Color	---> CW Direction (1-2 Phase)							
	1	2	3	4	5	6	7	8
4 Orange	-	-						-
3 Yellow		-	-	-				
2 Pink				-	-	-		
1 Blue						-	-	-

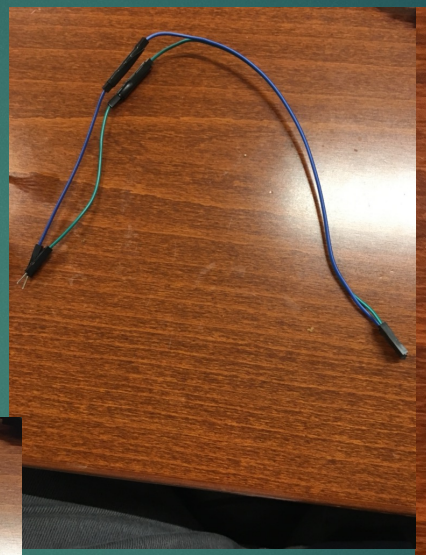
Stepper Motor Driver

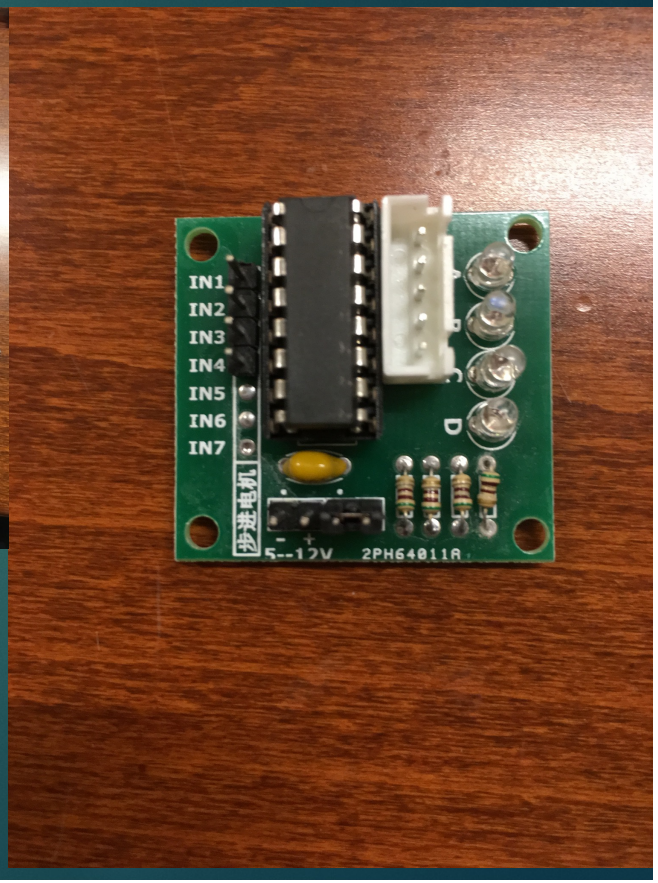
- Each input is connected to a GPIO pin (through the motor driver)
- You set all four lines in sequence to go through a step
- Some windings are always powered which give more resistance to torque at the cost of power

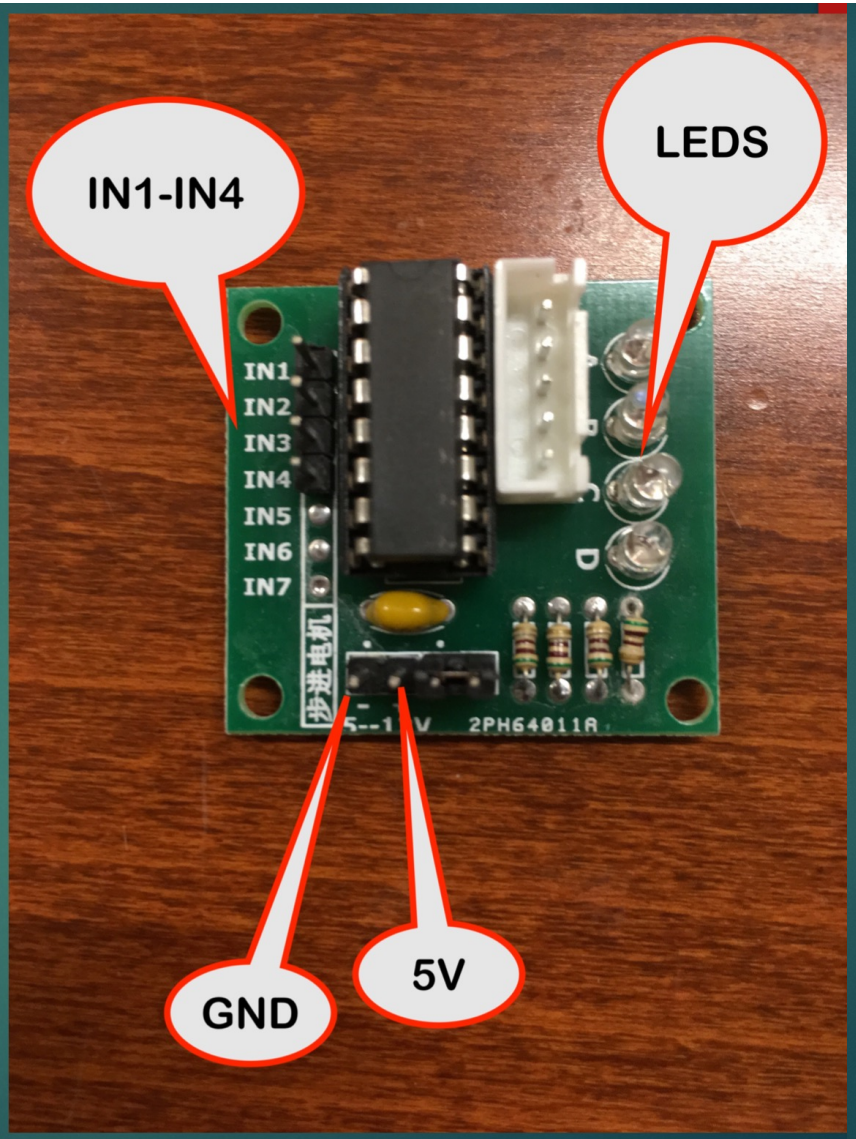
Stepper Motor Parts





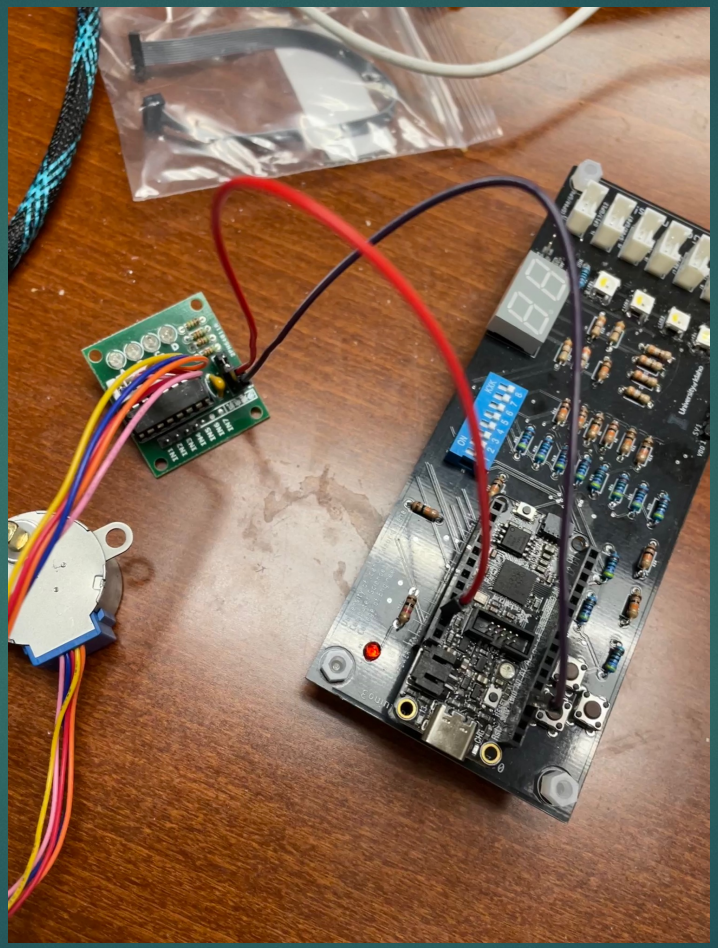


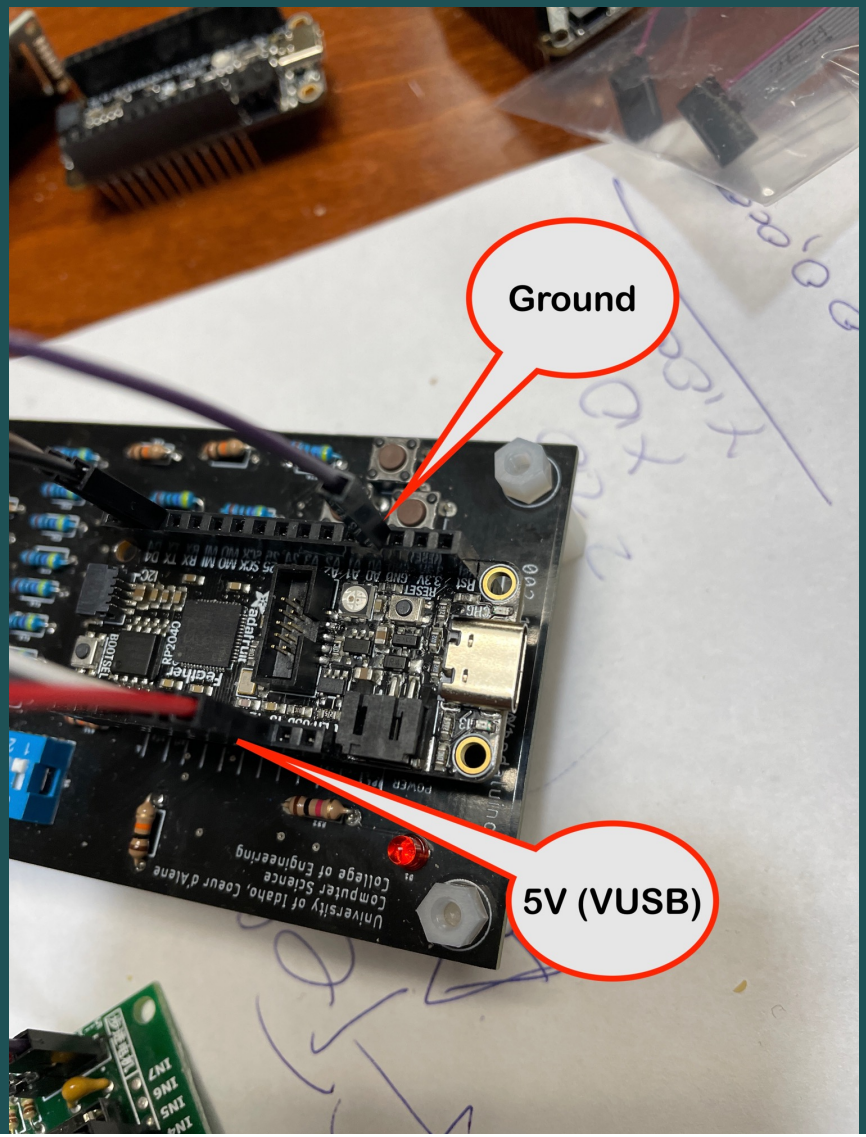


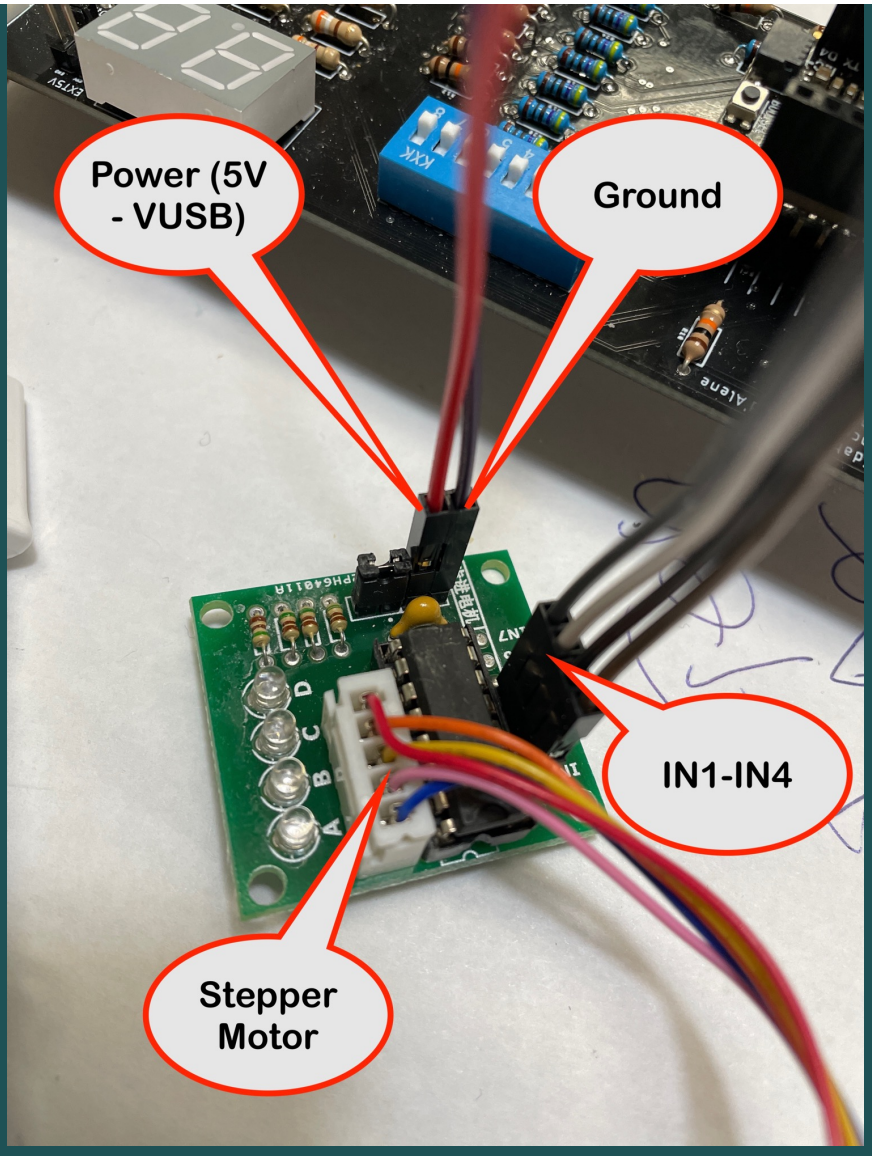

IN1-IN4
LEDS
IN1
IN2
IN3
IN4
IN5
IN6
IN7
步进电机
2PH64011A
GND
5V

Carefully Connecting your Stepper Motor

- POWER OFF!
- Be careful! Check twice before you power up!
- Plug the Stepper Motor into the Controller Board
- Jumper Wiring List:
  - + On Stepper Motor Controller Board to +5V on the Pico Board (VUSB or USB on board)
  - - On Stepper Motor Controller Board to GND on Vanduino3 Shield
  - IN1 – IN4 to your chosen GPIO ports on Vanduino3 Shield
  - Do not use your GPIO pins for the 7 Segment display or the Buttons for your GPIO pins for the Stepper. LOOK AT THE SCHEMATIC POSTED ON Canvas




Ground
5V (VUSB)


Power (5V - VUSB)
Ground
IN1-IN4
Stepper Motor

Assignment # 9/10 Next Project – The Stepper Motor and Temperature Project

- Stepper Motor / T/ H Project
- Control a Stepper Motor with your RTOS program based on Temperature and Humidity
- Put a flag or something on your motor shaft so you can see it rotate
- Your 7 Segment Display Task
  - Modify your Display Task to display Hex Numbers
  - Modify your control queue to display message for X seconds before advancing to next value
  - If your Control Queue goes over 10 entries, clear queue and display OF (overflow) for 5 seconds, then continue

Stepper Motor T/H Project

- Connect the HDC1080 (HDC1000 compatible) to the I2C Grove Plugs
- Use your driver from the previous assignment
- Find a stepper motor driver to modify or write your own.
- Display The temperature / Humidity / Stepper Motor Status
- After getting your program to work, implement a task list vTaskList task and grab the data for each of your major button modes , as a snap shot (say once a second). Include them in your report with an interpretation. Try it, you will like it as a debug aid. Put #ifdef around the code to remove it for production.
- Push Button Switches:
  - Button S1 – Move stepper on humidity, Two pushes within 2 seconds, move on temperature, 3 pushes within 2 seconds, stop everything and display "EE" on 7 segment. Four pushes within 2 seconds toggle display from decimal to hex .
  - Button S2 – continuously move stepper clockwise, Two pushes within 2 seconds, move counterclockwise, Three pushes within 2 seconds, then do one revolution clockwise and one counterclockwise and repeat.
  - Button S3 – One push, change display to show Temperature. Two Pushes in two seconds, change display to show humidity, three pushes in two seconds, show stepper motor status
  - REMEMBER SWITCHES CAN BOUNCE!

HW - Stepper Motor T/H Project

- For Tuesday February 28, 2019, submit a project plan (Assignment #9) to Canvas for the project describing:
  - How many tasks you are going to have and what each task does – Assign Priorities with enough information for me to understand what each task does.
  - How are you going to handle unknown input from the buttons?
  - Draw a state diagram of your system showing what causes each task to run (and showing priorities)
- Submit to Canvas Videos (Assignment #10) before midnight on Monday March 6.
  - Have state diagram of your system with Priorities
  - I will select three people to show their demos live. Everybody be ready on March 7th
- Specification and Code due at Midnight Monday, March 6th (Assignment #10) – I want a full specification about what you have done including operator instructions
- BTW, We will have an assignment #11 on Thursday March 7th (due after spring break) that will add additional functionality for the March 7th assignment.