Term Project 0x00 - Preliminary Design and Romi Familiarization

New Attempt

- Due Sep 21 by 11:59pm
- Points 10
- Submitting a file upload
- File Types pdf

Overview

In this short assignment you will work to become familiar with the Romi robot chassis and will begin selecting additional sensors.

Romi Familiarization

Navigate to the Romi Chassis product page on the Polulu website: **https://www.pololu.com/category/202/romi-chassis-and-accessories (https://www.pololu.com/category/202/romi-chassis-and-accessories)** . Browse around the website to become familiar with the Romi hardware. Each team will be provided the following products.

- Romi Chassis (PN 3500, 3501, 3502, 3504, 3506, or 3509)
- Motor Driver and Power Distribution Board for Romi Chassis (PN 3543)
- Romi Encoder Pair Kit (PN 3542)

Critical Parameters

As you read about the Romi hardware, create a table with useful information, such as the the one started for you below. Include any additional parameters that may be pertinent when considering the dynamics as Romi drives. Use millimeter units preferably.

Chassis Diameter	
Track Width (Wheel Center to Wheel Center)	
Wheel Radius	
Gear Ratio (Exact)	

Encoder Resolution (at Motor)	
Motor Voltage (Rated)	
Motor Torque (Stall)	
Motor Speed (No-Load)	
Max Speed (Translational)	

Component Functionality

1. Read about the Motor Driver and Power Distribution board. Determine the main purpose of this board and read about its functionality.
    1. What motor drivers are on this board?
    2. How many pins and timers will be needed to interface with both motors? (Note that each STM32 Timer can control up to 4 PWM outputs)

2. Consider the motors, wheels, and encoders that will be provided with the Romi kit. Focus on how these components interact with one another.
    1. Based on the encoder resolution and gear ratio, what is the effective encoder resolution at each wheel?
    2. What is the smallest increment of distance that the encoder can measure if Romi is driving in a straight line?
    3. Does having a sensor on each wheel affect the resolution for translational motion?
    4. If the system is powered by 6xAA NiMH batteries, what is the maximum translational velocity of Romi?
    5. How much faster will the robot driver if powered from 6xAA Alkaline batteries.

3. Consider the types of driving Romi is capable of. Can Romi move holonomically? If not, what sort of constraints are there on the shape of path that Romi may drive. What effects will be noticed if Romi's wheels can slip? Is it likely that Romi's wheels can slip?

Additional Sensors

In addition to the Romi hardware mentioned above, you will also be provided a BNO005 inertial measurement unit which will provide sensor data as Romi operates.

BNO055 IMU

In addition to the Romi-specific components listed above, you will also be provided with an Inertial Measurement Unit (IMU) called the BNO055, manufactured by Bosch. The sensor will be provided in the form of a development board that Adafruit makes so that you can more easily interface with the IMU; see here: **https://learn.adafruit.com/adafruit-bno055-absolute-orientation-sensor/overview (https://learn.adafruit.com/adafruit-bno055-absolute-orientation-sensor/overview)** .

What information will the IMU provide to Romi? Will this information supplement, or overlap with, the information provided by the wheel encoders?

Line Sensors

Research what kind of sensors are useful for sensing lines, so that Romi may be used to follow a pattern printed or drawn on a sheet of paper. How many sensors will be useful? Does the placement of the sensors matter much? How will the MCU interface with these sensors? What drawbacks are there in terms of MCU resources if you use too many sensors?

Bump Sensors

Finally, consider what kinds of sensors could be used to detect when Romi bumps into objects. How many of these will be helpful, and how will they mount to Romi? Do you need to sense frontal impacts only, or also side and rear impacts?

Other Sensors

What kind of sensors, not mentioned above, would contribute useful information to Romi? Consider things like navigation, path planning, obstacle avoidance, or anything that a traditional autonomous vehicle might have onboard. Are each of these sensors simple enough to interface with a standard Microcontroller?

Submission

For this assignment you will write a memo summarizing the information you considered above. Be as thorough as possible as you work on this preliminary consideration, as it will save you lots of time in the future if you plan well from the beginning.

Please submit on Canvas before Sunday night, 9/21, at 11:59PM so that we can start working with Romi in lab as soon as possible.