

## ME461 Final Project

You and your three other partners will pick a project that uses either the three wheeled (one is the caster) robot car or the two wheeled balancing Segbot. (Talk to me if you have an idea that does not use the robot car and I will make a decision.) You will pick the sensors (and possibly more actuators) you will use to have your robot sense the world. These can be the ones already given to you: microphone, MPU-9250, optical encoders, joystick, real-time clock chip, RC servo, DC geared motors attached to wheels, buzzer, LEDs. There are also other sensors (listed below) that I have in the lab that you can use in your project. One very important part in your group's decision on what type of project to choose is that each partner needs to be in charge of one portion of the project. Partners will of course help each other on all parts of the project but the part you are in charge of will be what I base a good portion of your project grade. Each partner needs to have an important role in the project's success. One of the goals of Homework #4 is for your group and myself to sit down and make sure each of you has an important role in your project. Below I give project ideas but I am also interested in hearing project ideas you come up with.

### **Additional sensors/items I have in the lab that you can use for your project.**

1. OpenMV Camera. Self-contained computer vision module.
2. USB camera. To use a USB camera you will need to either use your own Raspberry Pi or one of the labs Raspberry Pis.
3. IR distance sensors excellent for wall following and obstacle avoidance.
4. Switches you could use as feeler switches. I have some switches but you can also make your own with bendable music wire.
5. Ultrasonic sensor. This sensor would require you to use the eCAP peripheral of the F28379D processor.
6. ESP32 UART to Wi-Fi board already on your robot. A Raspberry Pi would also give your robot Wifi.
7. There is a spot for a relay and two spots for higher current transistors on your green board that could be used for turning on and off a higher current device like a two position solenoid.
8. Your MPU-9250 also has a Compass that we did not read in Lab 5.
9. You can also purchase other sensors and actuators but make sure I approve the item before you purchase it.
10. I may have more sensors in the lab that your project ideas may jog my memory to remember.

### **List of Processors and Processor boards to choose from for your project.**

### List of ideas for PARTS of your project.

- Create a mechanism for the Segbot using RC Servos, that if the Segbot falls over the motors stop and wait for the RC servos to “right” the Segbot again and then the Segbot continues doing its task.
- Play with MPU-9250 registers and Compass. If you want to play with the Compass I suggest you pick the robot car since it lays flat.
- Play with eQEP and unit time capture (an extra feature of the eQEP) and use it to balance the Segbot. You would need to come up with something for the Segbot to accomplish.
- Play more with microphone. Use TI’s FFT library to detect different notes and make the Segbot receive commands by playing notes. Here you could look into the DMA of the F28379D processor.
- Make the Segbot do something. Make a gripper with a RC servo to hold something. Take it somewhere and drop it off.
- If you would like to use two robot cars, you could design 3D parts that turns your green board into a robot car base. (Talk to me early about this one.) Then you could perform tasks using two robots, but only one robot could have a RPI4. The only limit for using two robots is the amount of equipment/processor boards/sensors I have to give out to all the groups.
- Play with a cheap ultrasonic sensor to measure distance using the eCAP peripheral of the F28379D. Add it to Segbot or to robot car.
- Make the robot car or Segbot wall follow and avoid obstacles as it is commanded to go from one XY point to another XY point on the floor.
- Make segbot or robot car dance to beat of a song.
- Add bump switches feelers, to Segbot or robot car so it can recognize if it needs to backup and turn.
- Play with I2C more by writing code to overcome errors when the I2C communication runs into faults. Also look into using the receive and transmit interrupts of I2C. Here you would have to have an I2C sensor to work with.
- Change the code on the F28027 (DAN28027) chip so that it can be used for the PWM of the robot’s geared DC motors. I would like to figure out a fix so that the DAN28027 chip does not need to use a SPI TXDLY of 16 clocks. Also if the DAN28027 is not communicated with in say .25 seconds the PWM channels would be set to zero.

### **Project Submission and Demonstration Day:**

**Demonstration Day is Friday December 15<sup>th</sup> 11:00am to 2:00pm. I will bring donuts.**

I would like you to submit your project to the <http://hackster.io> website. When you sign up for an account at hackster.io make sure to use you U of I email account. I will be showing your projects to a few TI representatives to show all the hard work you performed with their F28379D processor. The hackster.io website submission is due Saturday December 17<sup>th</sup> midnight. Make sure to email your Hackster.io website to me before this due date.

**Items (minimum) that must be posted at your Hackster.io site:**

- Videos of your project working.
- Video of you explaining what sensors and actuators you used for the project and how they are connected to the Launchpad. Make sure to plug TI and the F28379D Launchpad board.
- Entire source code and Code Composer project files. Make a zip of your project directory in your workspace.
- Number of paragraphs explaining your project.
- If any algorithms used, make sure to explain how they were used and have links to websites or papers that explain the algorithm.
- If you added any sensors, maybe a video of how you soldered and interfaced with the sensor.

If you have trouble submitting your project to hackster.io first talk to fellow students to see if they can help. If you keep on having trouble talk to me.