ECEN 4013
Project 2

October 14, 2023

Create a localization device which will:

1. Capture the following GPS data
   (a) Latitude
   (b) Longitude
   (c) Elevation (Specify which model you are using: Ellipsoid, Geoid, MSL)
   (d) Number of locked satellites
2. Capture the following IMU data
   (a) Angular velocity in radians per second for the X, Y, and Z axes of your device
   (b) Acceleration in m/s^2 for the X, Y, and Z axes of your device
   (c) Magnetic field in μT for the X, Y, and Z axes of your device
3. Create a CSV log for this data and output this data to the following locations
   (a) An SD Card - continuously write to a file
   (b) A USB port (mini, micro, usbc, ...) - data stream, NOT file transfer
   (c) A radio transmitter (UHF range - 300 MHz to 3 GHz) - data stream

   These outputs must have the ability to all be active at the same time. The CSV log must have a header that specifies the columns of the CSV. I should be able to save the stream to a csv file and open it in a spreadsheet program and get a result similar to the following:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date	Time	Satellites	Latitude	Longitude	Elivation MSL (m)	X Accel (m/s^2)	Y Accel (m/s^2)	Z Accel (m/s^2)	X Mag (uT)	Y Mag (uT)	Z Mag (uT)	X Gyro (rps)	Y Gyro (rps)	Z Gyro (rps)
2	9/28/2021	20:13:34	0	36.177311	-96.836736	409.69	-0.31	-6.71	7.61	-65.91	30.64	22.96	0.01	-0.02	-0.02
3	9/28/2021	20:13:34	0	36.177311	-96.836736	410.38	-0.24	-6.71	7.65	-65.45	29.82	22.86	0	-0.02	-0.02
4	9/28/2021	20:13:35	0	36.177311	-96.836736	409.26	-0.27	-6.71	7.65	-65.55	29.91	22.76	0.01	-0.02	-0.02
5	9/28/2021	20:13:35	0	36.177311	-96.836736	410.55	-0.31	-6.71	7.49	-65.45	30.18	22.96	0	-0.02	-0.02
6	9/28/2021	20:13:35	0	36.177311	-96.836736	409.34	-0.31	-6.67	7.61	-65.55	29.91	22.96	0	-0.02	-0.02

Create a GUI interface that will run on a computer/OS of your choosing.
This GUI will:

1. include a "Start Display" button that will display data transferred from the USB stream of your connected device.
   (a) Fail gracefully if no USB stream is available and allow the user to return to the main screen
   (b) Display 2 sections of data, one for the GPS and one for the IMU and update these values in real time as they are received.
   (c) The GUI should not scroll data, but instead update the fields for Latitude, Longitude, Elevation, Angular Velocity X, Angular Velocity Y, Angular Velocity Z, Acceleration X, Acceleration Y, Acceleration Z, Magnetic Field X, Magnetic Field Y, Magnetic Field Z, so that only one number is presented for each data field at any given time.
2. include an "End Display" button that will take the user back to the main menu
3. include a way to easily and gracefully close the application at any given time.

Additional Requirements:

- Your device must be able to output to the three locations at all times.
- Your device must have some form of display that will inform user when GPS is searching for satellites, or locked on.
- Your device must be fully portable, which means battery powered.
- Your device must be able to run for at least 1 hour.
- Your device must include a quality fitted case.
- Your device must include a fabricated circuit board.

All modern processors are fair game. Your GPS, IMU, and radio modules must be separate from your processing device. I do not want a COTS all-in-one solution. You have a budget of $250 for parts that cannot be found in the part store. The team that produces a working design of the smallest form factor (case included) will be awarded a grade 'bonus' of 5 points on the project report grade.

Due Dates:
Sprint 1 progress report - Monday Oct. 30 11:59pm
Sprint 2 progress report - Monday Nov.13 11:59pm
Final Demo - Week of Dec. 4th
Final Report - Friday May 15th 11:59pm (last Friday of finals week)
* I recommend you work on the report progressively throughout the project so that you are not left with a bunch of work on Finals week.