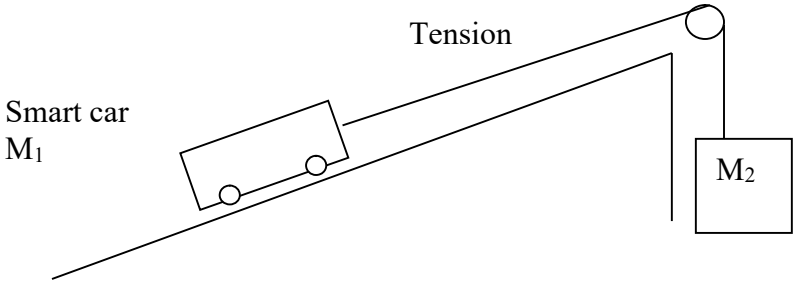
Determination of tension in a two-mass, coupled system. (o.k., this needs a better title).

In this lab, students will first determine the expected acceleration of the coupled mass system (up the ramp) and the associated tension in the string and then measure, using Excel to 'smooth out' the data set. Two scenarios will be addressed.
Case 1: The system is not moving (i.e., acceleration is zero) and the system is in equilibrium. Case 2: The system is in 'free fall' and accelerating due to the sum of the forces of the system acting on it. How does the tension change between the two cases?

Experimental set up.



Logistics:

1. Turn on your smart phone, turn on BlueTooth and start the Spark Vu ap. (note: they have recently released their latest version, so go ahead and install it).
2. Turn on one of the smart cars and try to establish contact with your phone.. the smart car may need to download the latest firmware update, so with your wifi turned on, go ahead and let that happen.
3. Reboot the car (to install the firmware update) and restart your Spark Vu ap, and once again, establish contact between car and phone.
4. Turn off all sensors except Force sensor and Acceleration data. (note:the new version allows for two screens at once).
5. Set the resolution to 100 Hz.

Part 1: The system at equilibrium: (start recording data holding the suspended mass as still as possible, for several seconds, making sure the mass and car in 'in tension'.

Part 2: release the mass as quickly as possible and let the mass drop to the floor.. recording data along the way. (note: this is the same, overall data set, the only difference being that you first held the mass, and then released it).

Using your smart phone, determine the range of time which contains 'the best data' bridging the two scenarios.
Now export your data sets via email to the PC to analyze in Excel.

You'll notice that the force data is 'squiggly'.. why is that? How can we 'smooth' that data out in Excel?
Plot the force data and acceleration data into a pair clean, labeled graphs, showing the original data and the smoothed data superimposed on top (as a different trend line)

Using Word (or something comparable), create free body diagrams of the system under both scenario's showing the collection of forces and determining what the tension in the string ought to be (and describe with a progression of ideas how you determined this). Compare the graphs from Excel showing the force of tension and acceleration for each. Discuss any differences you see and calculate the percent error for each scenario.