LMC 6650: Seeing like a Bike

Surface Quality

Milestone 1

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Primary Measures

What to measure	Why we're measuring it	How (sensor type)
Swerve (rate of deflection)	Recorrecting course to show road obstacles and potholes	Magnetometer / Gyroscope
Vibration	Surface quality (type of surface)	<u>Vibration Sensor / Contact microphone</u>
Location	Location of data collected	GPS chip
Directional sound	Ambient noise, surface quality	Array microphones (to be trained)
Incline	Slope of road	Inclinometer
Pressure on handlebars	Physiological measure of stress	<u>Area pressure sensor</u>

Secondary Measures

What to measure	Why we're measuring it	How (sensor type)
Speed	Cyclist behavior could reflect how critical the condition of the road is (related to traffic speed or road obstacles)	Accelerometer / Hall effect sensor / Reid Switch
Temperature	Could be related to road conditions (potential for ice, long stretches of hot pavement, etc.)	Temperature and humidity sensor (single package)
Humidity	Weather (raining), could be used to back up data on cyclist actions (swerving)	
Direction	To detect the side of the road (since GPS will only give absolute location)	Accelerometer / Gyroscope
Gear Number	Could point to information on incline or cyclist exertion level	Rheostat / variable resistor

Shopping List

Option 1:

- Matrix One Creator Edition ($99)
- Raspberry Pi 3 ($35)
- Arduino Mega*
- Powered USB hub for dev
- External battery pack*
- Inclinometer
- GPS chip
- Pressure sensors for handlebars
- Low-sensitivity vibration sensors

Option 2: Buy individual sensors

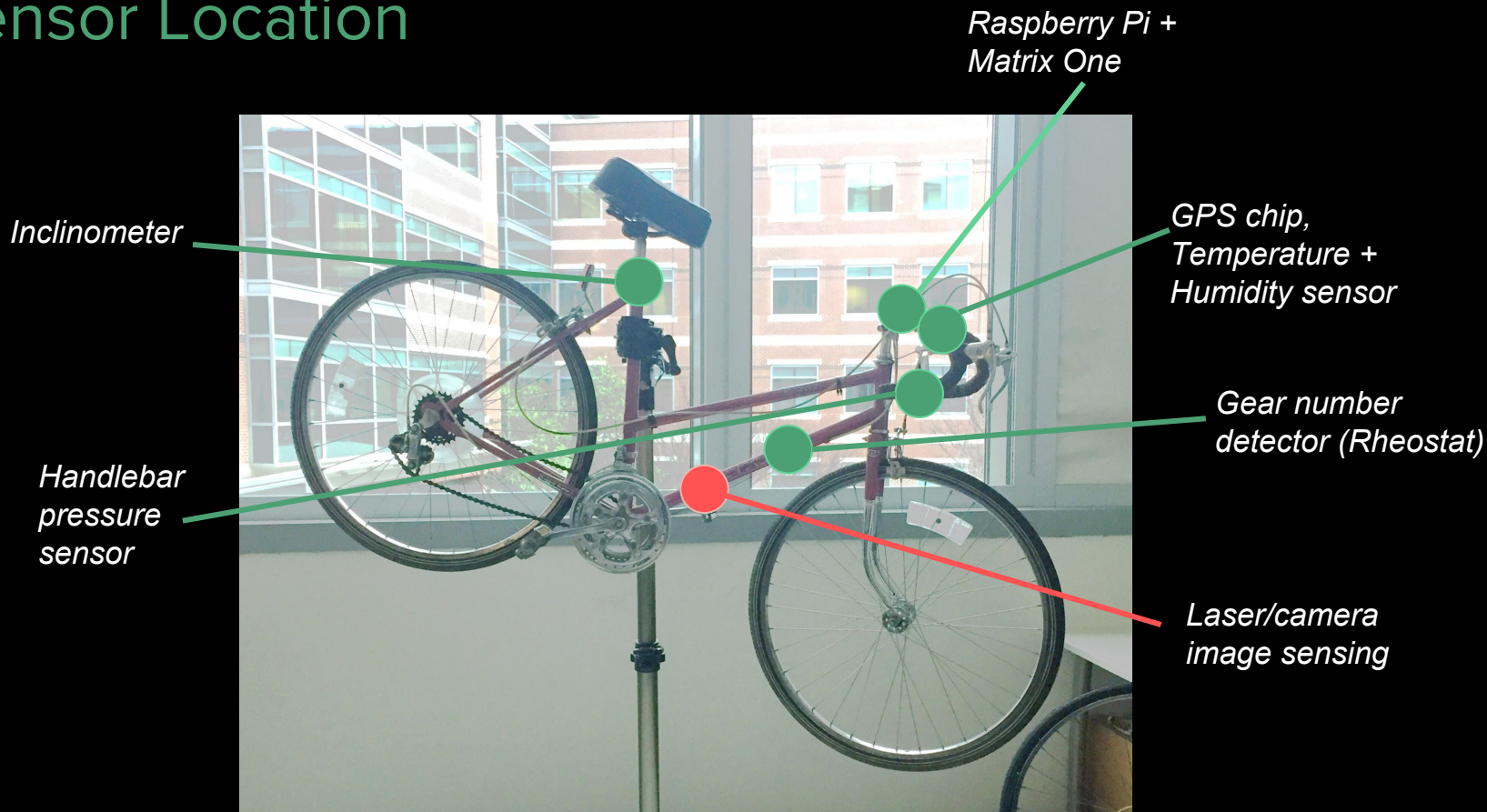*Matrix One Creator Edition - Integrated sensors for RPi*

Miscellaneous parts

- ⅛" cube magnets, 20x
- M/M, M/F, F/F patch cables, 20x
- Hair bands, 20x
- Cable ties, 20x
- Breadboards to prototype
- 5V 2A+ power supply, MicroUSB
- MicroSD card, 16 GB
- 3D printed parts (GVU lab)
- ???

Alternate method (to be explored):

- 20mW 3-5V laser diode, paired with USB camera
- Machine Vision to observe changes in laser pattern on surface) - apparently not hard to do on OpenCV/Raspberry Pi
- Most obvious way, but potentially risky - can only get surface quality

Sensor Location

Raspberry Pi + Matrix One

GPS chip, Temperature + Humidity sensor

Gear number detector (Rheostat)

Inclinometer

Handlebar pressure sensor

Laser/camera image sensing

Progress

- Tested high-sensitivity vibration sensor, discovered we needed much lower sensitivity
- Reclassified measures as primary and secondary based on feedback from Dr. Watkins
- Reached out to civil engineering students for additional feedback on measures

To-do

- Sketches - how to interface sensors
- System Architecture (in collaboration with other teams)
- Calibration parameters