PDR Presentation
SmartWheel
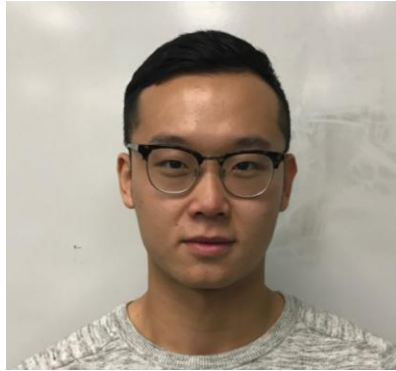
Yaroslav Burdin

Jack Tam

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Bingze Li

Department of Electrical and Computer Engineering
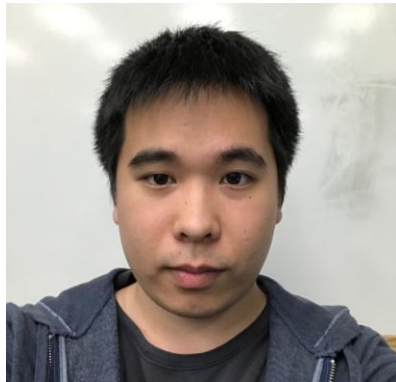October 21, 2016

Team Members

Advisor
Lixin Gao

Bingze Li
EE

Bingjun Wang
EE

Jack Tam
CSE

Yaroslav Burdin
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Problem

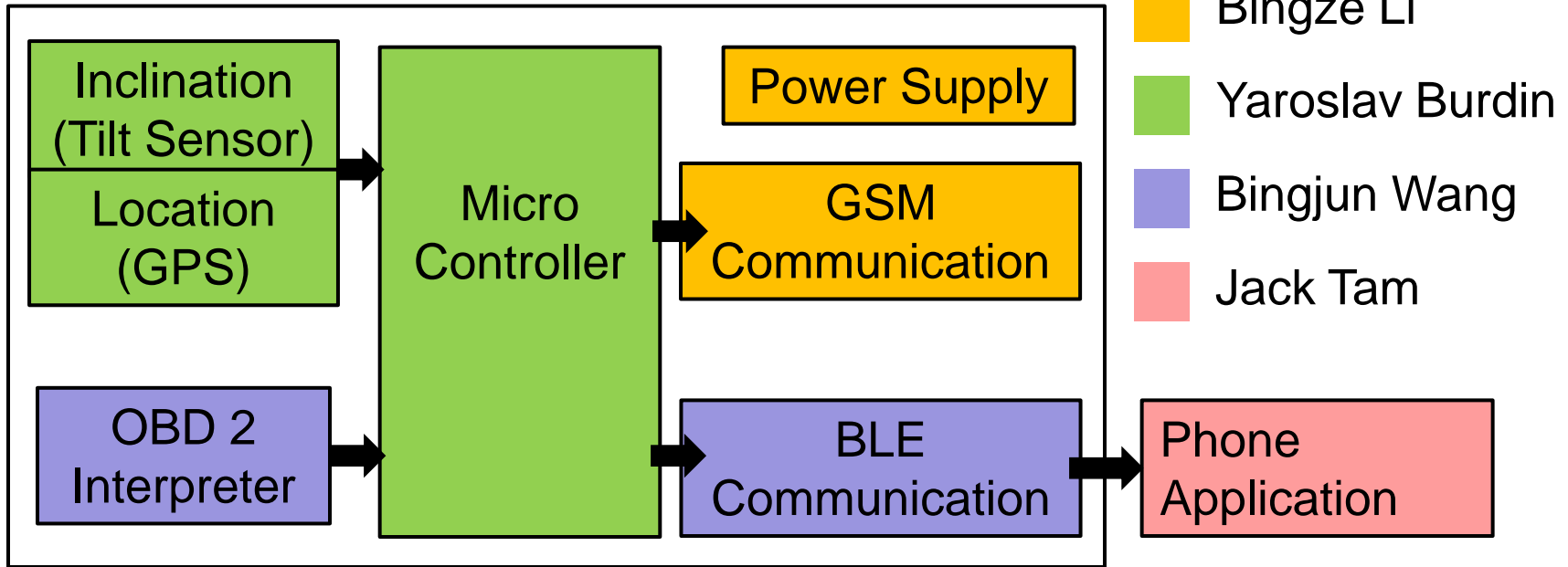# Existing Solutions

Our Solution

Develop a multi-purpose car device that will make owning and driving a car safer, more convenient, and more cost effective by implementing the following functions:

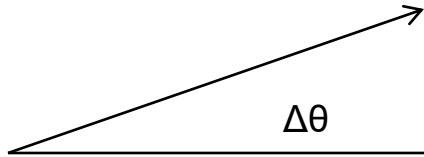- Anti-Tow System
- Car Health Monitor

Block Diagram

SmartWheel Box

🟧	Bingze Li
🟩	Yaroslav Burdin
🟪	Bingjun Wang
🟥	Jack Tam

Block diagram contents:
- Inclination (Tilt Sensor)
- Location (GPS)
- OBD 2 Interpreter
- Micro Controller
- Power Supply
- GSM Communication
- BLE Communication
- Phone Application
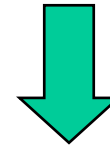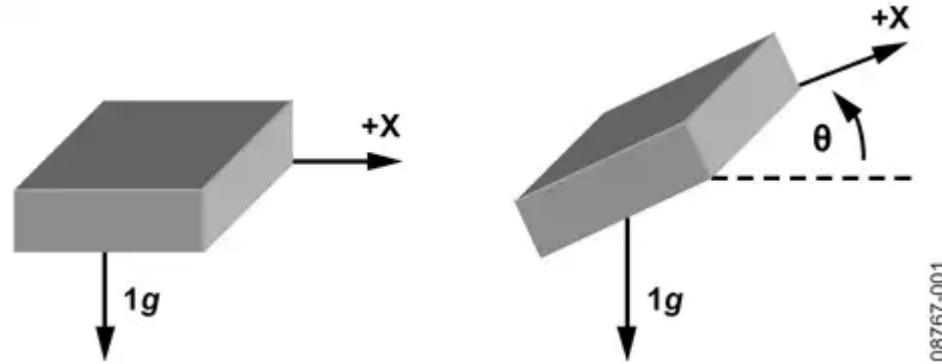
Change of angle

Inclination angle changed while the car is parking

Δθ

Got towed!

Change of acceleration

Acceleration on x-axis :

$$A_{X,OUT}\ [g] = 1\ g\ \times\ \sin(\theta)$$

Inclination sensor ADXL335

Detect the inclination change on x-axis by detecting the acceleration on x-axis

Change of voltage:
-160mV to -600mV

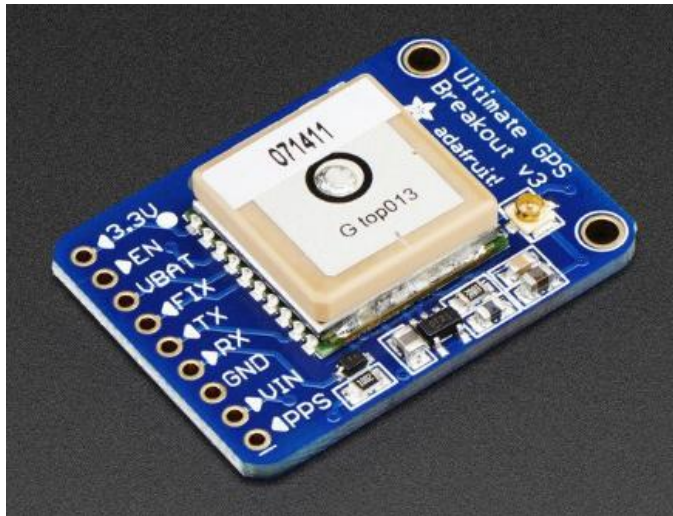|					
Output Change at X_{OUT}	Self-Test 0 to Self-Test 1	−150	−325	−600	mV
Output Change at Y_{OUT}	Self-Test 0 to Self-Test 1	+150	+325	+600	mV
Output Change at Z_{OUT}	Self-Test 0 to Self-Test 1	+150	+550	+1000	mV

GSM modem- SIM900A GSM model

Connect to microcontroller to send message when the inclination changed to a certain angle.

Message only,
no GPRS involved

GPS Breakout- LLC 746

- Detect location
- Breadboard friendly

OBDII interpreter : STN1110 vs ELM327

	ELM327 v1.4	STN1110
Base microcontroller	PIC18F2580	PIC24HJ128GP502
Architecture	8-bit	16-bit
Processing speed	4 MIPS	40 MIPS
Flash (ROM)	32 KB	128 KB
RAM	1.5 KB	8 KB
Pin count	28	28
Available packages	PDIP, SOIC	PDIP, SOIC, QFN
Supply voltage range	4.5 to 5.5V	3.0 to 3.6V[1]
Supports all OBD-II protocols	yes	yes
ELM327 command set	yes	yes
Enhanced "ST" command set	no	yes
Firmware upgradeable	no	yes
Large OBD message memory buffer	no	yes
Low power mode	yes	yes
Supported UART baud rates	9600 bps to 500 kbps	38 bps to 10 Mbps
OBD message filtering	basic	advanced
Price each, for 1000 units	$24	$10
Price each, high volume	$19	$4.95

STN1110!

- High Performance
- Low Cost

STN1110

What we need from STN1110?

- Speed
(for anti-tow system)

- Problem Code
(for car health monitor)

Raspberry PI 3
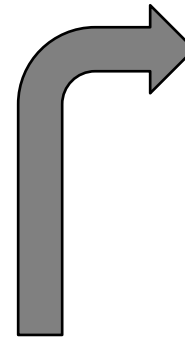

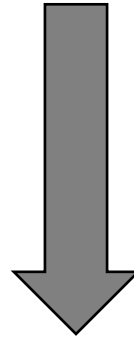Processor speed from 900MHz to 1.2GHz

BLE on board

Communication

Requirements:

- data transfer

- Secure

- text immediately

Implementation:

- GSM MODEM

- Simcar

- Bluetooth

Communication

GSM MODEM

Simcar

- Cheaper than before

- $10=102 message

Communication

Bluetooth

- Benefit

    Accuracy in LAN

    Operating range

    Inexpensive

- Weakness

    Data rate of only 1 MBps

    Battery use increased on devices

    cannot work in a long distance environment

Phone Application
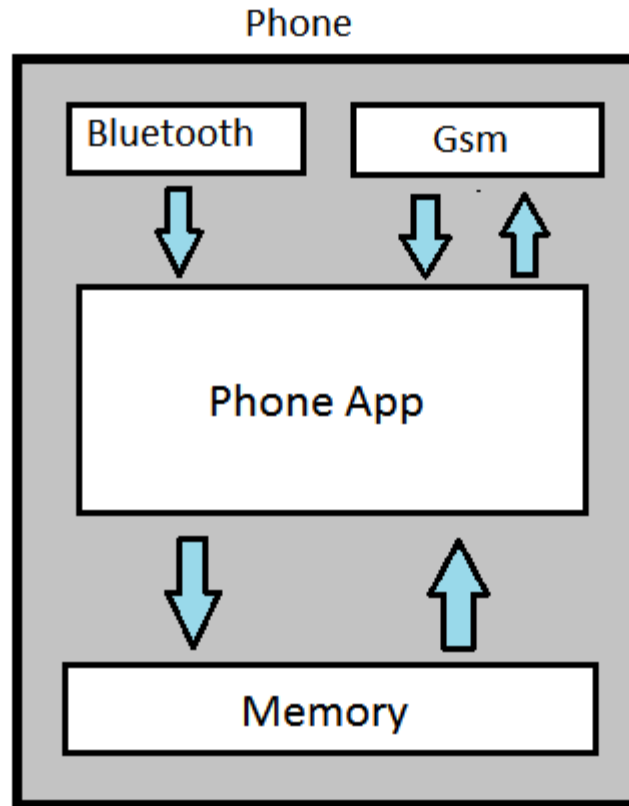
Phone Application

Requirements:
- Location of car readily available to be displayed
- Low power consumption while idle
- Minimal memory usage
- User settings
- Process data sent from car device
- Run properly on Android phones

Implementation:
- Chart/graph speed and fuel consumption of car over time
- Alerts(Oil change, car being moved, broken parts)
- Obtaining location of car

Approximate Cost

Name	Quantity	cost
Raspberry pi 3	1	$36
ADXL335	1	$15
GPS breakout	1	$40
STN1110	2	$20
SIM900 modem	1	$26
Other cost		$15

Total cost: $152

ACTIVITY	PLAN START WEEK	PLAN DURATION	18-Oct 1	25-Oct 2	1-Nov 3	8-Nov 4	15-Nov 5	22-Nov 6	29-Nov 7	6-Dec 8	13-Dec 9
Order parts	1	1	■								
Power supply	2	2		■	■						
GSM	4	2				■	■				
OBD II Interface	2	3		■	■	■					
Bluetooth	4	2				■	■				
Tilt sensor	2	2		■	■						
GPS	4	2				■	■				
Phone app functions	1	4	■	■	■	■					
Phone app format	4	2				■	■				
End to end implementaton	5	3					■	■	■		
MDR Report	7	3							■	■	■
MDR Presentation	7	2							■	■	

MDR Deliveries

Group
- Have a set of data gathered from car and sent and displayed on phone

Bingze Li
- Working power supply for SmartWheel box
- Able to send data to phone using GSM

Yaroslav Burdin
- SmartWheel box able to sense inclination in appropriate situations
- Able to locate the car and send coordinates when requested

Bingjun Wang
- Obtain necessary information from OBD II
- Working Bluetooth data transfer when in range

Jack Tam
- Create layout of android app
- Implement ways to process and display given input data