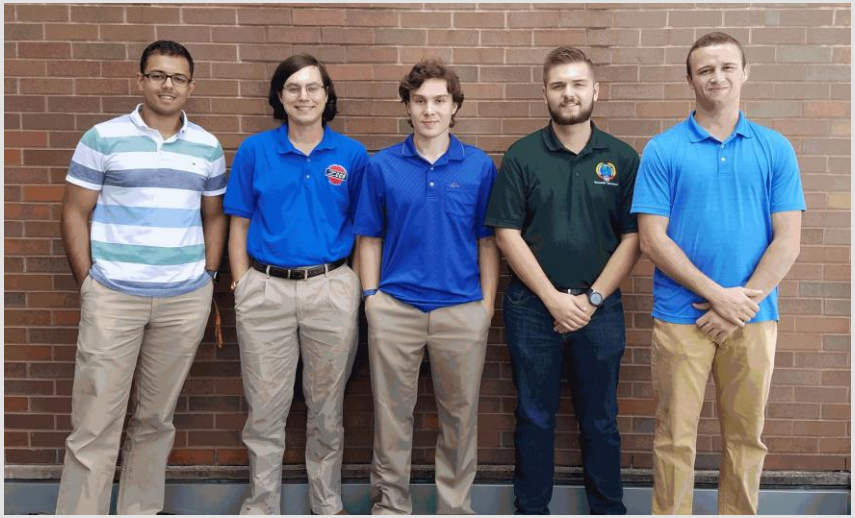
MSD Team 20225: The Doc B Racing Real-Time Telemetry System

The Telemetry Bois

Adam Bork, Sahil Gogna, Josh Henderson,
Michael Schroeder, Nick Washco

Introductions:



Member	Role	Contact
Nick Washco	EE Lead	njw6366@rit.edu
Josh Henderson	Facilitator	jh2290@rit.edu
Sahil Gogna	Project Manager	sxg4060@rit.edu
Michael Schroeder	CE Lead	mjs5127@g.rit.edu
Adam Bork	Team Liason	acb6075@rit.edu

Agenda:

- Team Vision & Project Summary
- Project Goals & Key Deliverables
- Use Cases
- Customer Requirements
- Engineering Requirements
- Risks & Constraints
- Plans for the Next Phase
- Q&A

Team Vision

- The Team's current vision is to carry on the work set forth by the previous team
- The Team reviewed the goals and deliverables to create a preliminary action plan

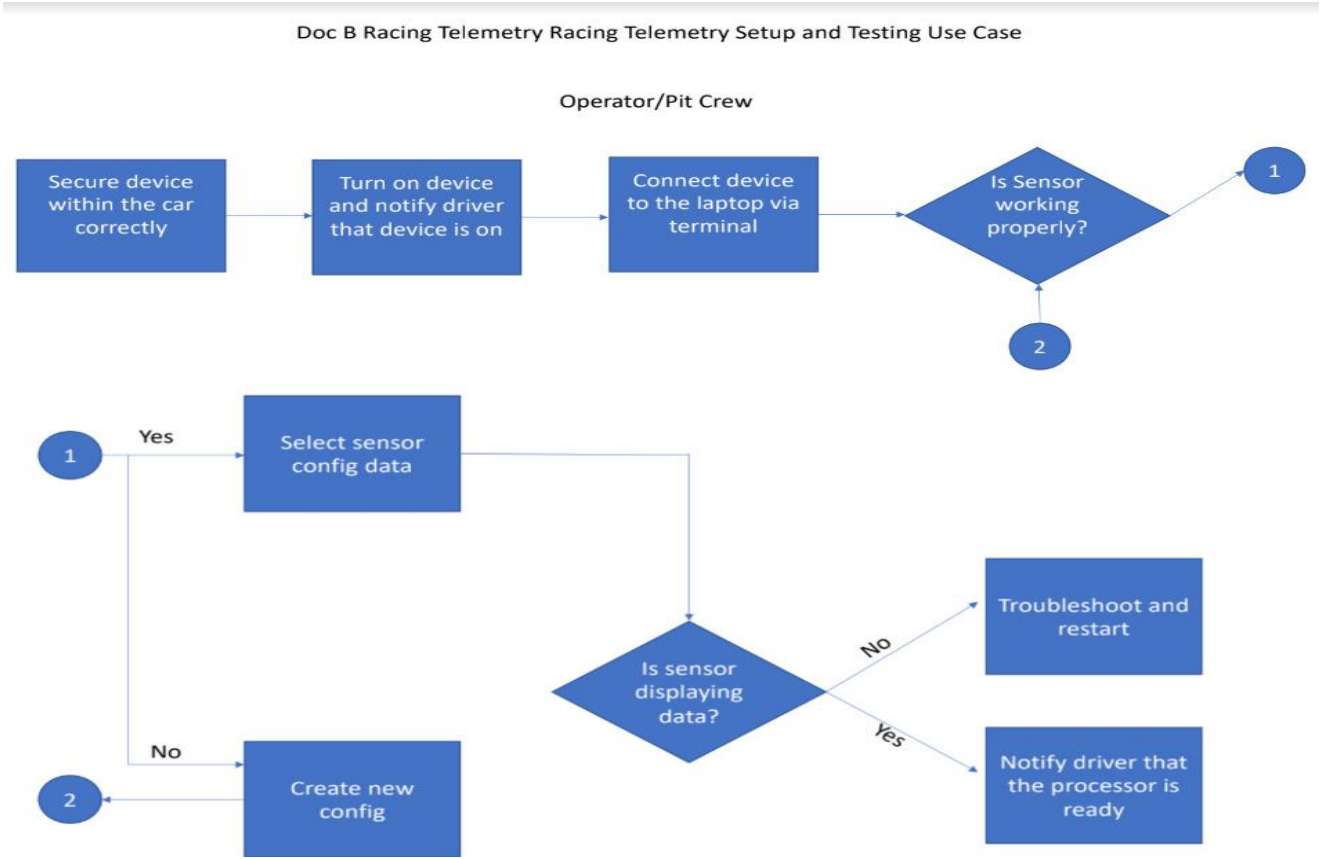
Project Summary

- The Doc B Telemetry System is an end-to-end system for data acquisition in the vehicle environment
- It uses a host of sensors and an onboard processor to log vehicle data
- The data is made available to the user via computer interface for the purposes of aiding in vehicle setup, driver performance, and general maintenance

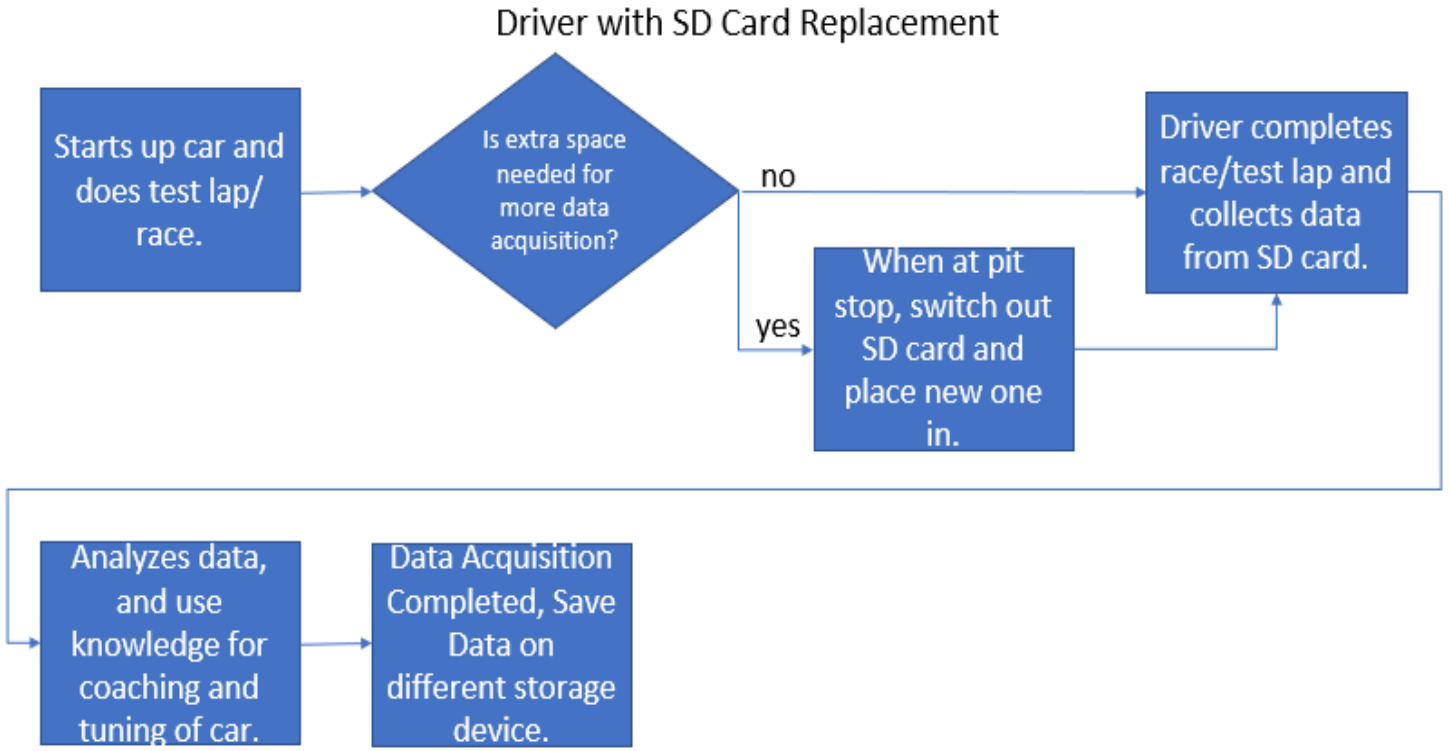
Project Goals and Key Deliverables

- Provide a working prototype with embedded data processing
- Be able to have a cost competitive product
- Telemetry System must be able to fit inside car
- UI for Driver Review after Session with possible Mobile Interface
- Ability to adapt to multiple sensor inputs
- Participate in Imagine RIT

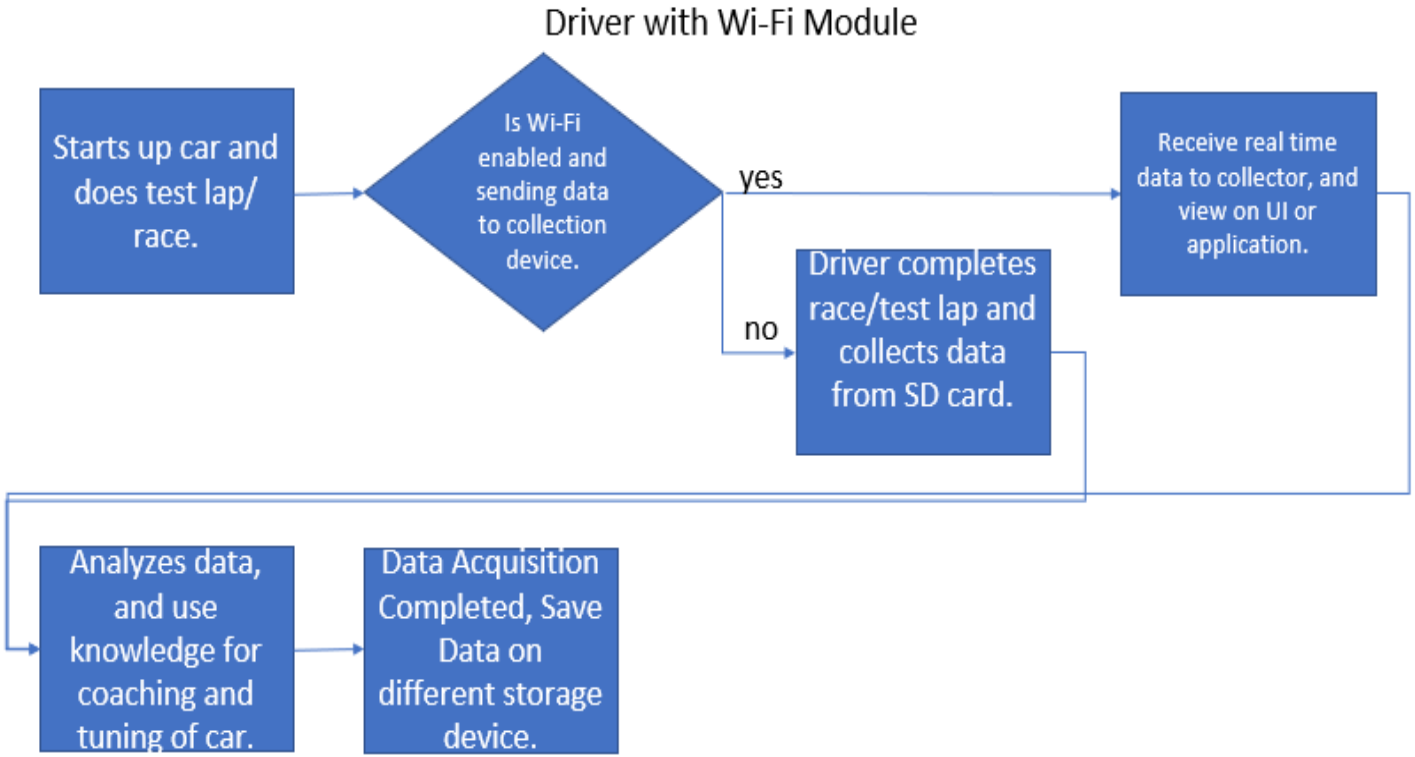
Use Cases


Doc B Racing Telemetry Racing Telemetry Setup and Testing Use Case
Operator/Pit Crew
Secure device within the car correctly
Turn on device and notify driver that device is on
Connect device to the laptop via terminal
Is Sensor working properly?
1
2
1
Yes
Select sensor config data
Is sensor displaying data?
No
Troubleshoot and restart
Yes
Notify driver that the processor is ready
No
2
Create new config

Use Cases Cont.



Use Cases Cont.



Customer Requirements

Customer Req. #	Importance	Description	Comment/Status
CR1	9	Modularity - Supports a variety of protocol complient sensors.	
CR2	9	Cost - Less than $1000	
CR3	9	Durability - Withstand road thrash and temperatures up to 350 F	
CR4	6	Interfaceability - Data is able to be extracted from device	
CR5	9	Correct Data - Sensor readings are accurate	
CR6	6	Accessability - System is easy to use and configure	
CR7	9	GPS Integration - Onboard GPS records car movement	
CR8	3	Mobile Companion - Read and control system from mobile device	
CR9	6	Must be able to record a minimum of an hour of drive data.	
CR10	9	Ability to use processor in a safe and viable area (bay area)	

Engineering Requirements

Importance	Source	Function	Eng. Req. Metric	Unit of Measure	Marginal Value	Ideal Value
9	CR5	Electrical	GPS Module - Geo-coordinate must be within 5% of the advertised accuracy	Degree	+/-5%	
9	CR5	Electrical	Accelerometer - Acceleration data must be within 5% of the expected value on bench test.	G	+/-5%	
9	CR5	Electrical	Tire Temperature Sensor Package - Temperature data must be within 5% of expected value	C	+/-5%	
9	CR5	Electrical	Tire Temperature Sensor Package - Data acquisition must be running at full speed (32 Hz)	C	0Hz	32Hz
9	CR5	Electrical	Temperature Sensors (Engine Water, Transmission, Oil Temperature)	C	+/-5%	
9	CR5	Electrical	Wheel Speed Sensor - RPM	RPM	+/-5%	
9	CR5	Electrical	Wheel Speed Sensor - Yaw, Wheel slip, Locked wheels. Yaw cross confirms accelerometer reading	RPM, Degrees, G	+/-5%	
9	CR5	Electrical	Pressure Transducer - Oil Pressure	KPa	+/-5%	
9	CR5	Electrical	Pressure Transducer - Fuel Pressure	KPa	+/-5%	
9	CR5	Electrical	Pressure Transducer - Brake Pressure, with lock up confirmation	KPa	+/-5%	
9	CR5	Electrical	Exhaust Gas Temperature Sensor - Gain in from dashboard. Comfirm with MECE Lab Thermocouple	C	+/-5%	
9	CR5	Electrical	Intake Air Temp - Turbo Cars – Modify tune as temperature changes	C	+/-5%	
6	CR5	Electrical	MAP Sensor	KPa	+/-5%	
6	CR5	Electrical	O2 Sensor	Unitless		
6	CR5	Electrical	Battery Voltage	V	+/-5%	
6	CR5	Electrical	Throttle Position Sensor	%	+/-5%	
6	CR5	Electrical	CAM/Crank Position Sensor	Degrees	+/-5%	
6	CR5	Electrical	Knock Sensor - Cross confirm O2	Unitless	+/-5%	

Engineering Requirements

Importance	Source	Function	Eng. Req. Metric	Unit of Measure	Marginal Value	Ideal Value
9	CR1	Computer	Multi Sensor Input - System must be configured to process multiple forms of telemetry concurrently.	Unitless		
9	CR1,CR6	Computer	Configurable Channels - Most of the above sensors operate with the same input voltage level, and therefore may share a channel input on the system. The system should have a variety of 'open channels' which the user can plug a variety of different sensors into to suit their telemetry needs	Unitless		
9	CR1	Computer	CAN & LIN Bus compliance for digital sensors	Unitless		
9	CR7	Computer	Lap Time Acquisition - Configuration of timer module to pair to GPS data for timestamps	Mln, sec	+/-5%	
6	CR7	Computer	Lap Time Segmentation/Optimal Lap Timing - Data must be separated by lap and allow the user to segment the track for automatic 'hot lap' calculation	Min, sec	+/-5%	
9	CR3	Mechanical	Vibration and Torture Testing of System and Enclosure - System must be able to withstand volatile in-car environment	Unitless		
9	CR10	Mechanical	Mounting Bracket Design and Production - Brackets must be manufactured/adaptable to the various mounting locations within the vehicle.	Unitless		
3	CR8, CR4	Computer	Device is able to communicate wirelessly with a mobile device over bluetooth or WiFi	Unitless		
6	CR9, CR4	Computer	Device is able to store at least one hour of data to an external storage device 32GB in size without overwritting	Unitless		
6	CR2	Computer, Electrical, Mechanical	Components used must be feasibile and affordable for manufacturing.	Unitless		

House of Quality

House of Quality - Doc B Racing Telemtry - P20225

		Customer Requirements	Customer Weights	Engineering Metrics: GPS Accuracy within 5% accuracy	Accelerometer should be within 5% accuracy	Tire Temperature Sensor must be running at full speed	All Temperature Sensors should measure within 5% accuracy	Pressure Transducer should measure Oil/Fuel Pressure within 5% accuracy	Wheel Speed sensor should measure RPM, yaw, wheel slip, and locked wheels	MAP Sensor Accuract should be within 5% accuracy	O_2 Sensor should measure within 5% accuracy	Battery Voltage should be measure within 5% accuracy	CAM/Crank Sensor measurement should be within 5% accuracy	Lap Time Acquisition should use GPS Timer and be lap-by-lap time separated	Vibration and torture testing of system/enclosure	Mobile data acquistion should be possible over bluetooth/Wifi (32 GB)	Cost ($) < 1000
	CN1.1	Supports variety of protocol compliant sensors	9	9	9	9	9	9	9	6	6	6	9				
	CN1.2	Data should be easily extracted on any vehicle	6											6	6	3	
	CN1.3	Processor should be used in any safe enviroment	9				6										
Modularity	CN1.4	System is easy to use and put in any vehicle	9														
	CN2.1	Data is to be viewed on any device	6													3	
Interfaceability	CN2.2	Read and control system from mobile device	3													3	
	CN3.1	Onboard GPS Telemetry	9	9													
Integration	CN3.2	Mobile Data Acquistion	3													3	
Durability	CN4.1	Withstand road thrash and temperatures up to 350°F	9												9	3	
Cost	CN5.1	Should fit within budget	9														9
		Technical Targets (Specifications)						5%								32 GB	1000
			Raw Score	81	81	81	135	81	81	54	54	54	81	36	117	81	81
			Relative Weight	7%	7%	7%	12%	7%	7%	6%	6%	6%	7%	3%	11%	7%	7%

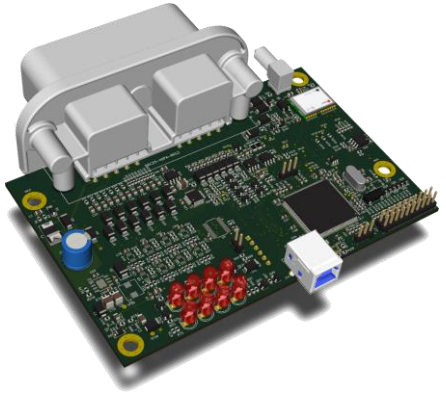
Constraints

- Unit size for car implementation
- Sale Price cannot exceed $1000
- Current budget for development is $500

Risks

- Damaging the Main Board or a Sensor
- Inability to make use of the current codebase
- Injury during testing

Plans for the Next Phase



- **Systems Design**
  - Functional Decomposition
  - Benchmarking
  - Concept Development
  - Feasibility Analysis
  - Concept Selection
  - Systems Architecture
  - Risk Assessment
- **Field Testing**
  - Test Mk.I Unit in car at Watkins Glen VRG weekend: Oct 11-13th

Thank You from The Telemetry Bois

Questions?