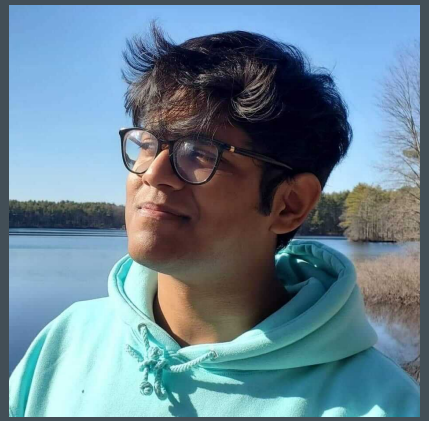

SafeX
Helping Riders Stay Safe

Meet the Team Members



Dhruv Vikram Krishna

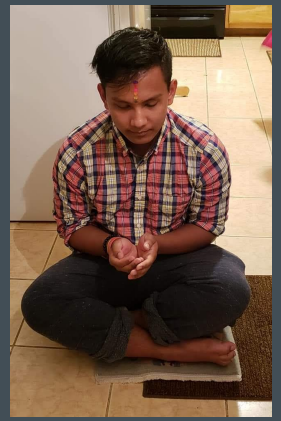
Computer Engineer

Jeffrey Wang

Computer Engineer

Paige Wadas

Electrical Engineer



Siddhanta Shrestha

Computer Engineer

Problem Statement

- Most safety features found in modern cars do not exist for motorcycles
  - There are no EM contact options for motorcyclists
- Riders must check blind spots manually
  - Products on the market are implemented in a way that is distracting and hazardous

Background

1-in-7

Motorcycle Accidents can be prevented by radar-based assistance systems [1]

2.8%

Of the vehicle population in the United States are motorcycles [2]

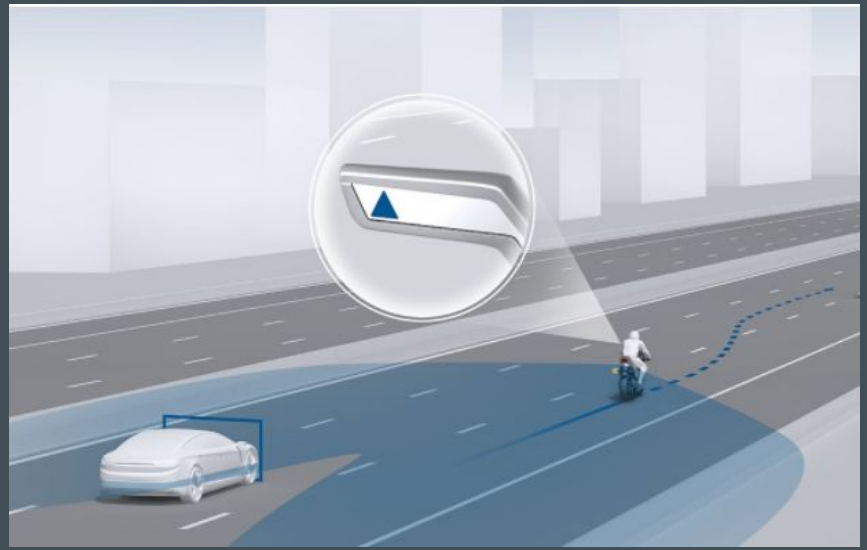
14.3%

Of vehicular deaths happen to motorcycle riders [2]

[1] Bose Accident Research - 2018 (Link)

[2] US Department of Transportation - 2019 (Link)

Blind Spots



Source:
https://www.bosch-mobility-solutions.com/en/solutions/assistance-systems/advanced-rider-assistance-systems-2w/

Source:
https://roadguardians.org/motorcycles-and-blind-spots/

Field Research

81.1%

Preferred notification on the **helmet**

9.4%

Preferred notification on the **dashboard**

9.4%

Preferred notification on the **side-view mirrors**

Interview Quotes

"You're on the right track, helmet mounting it. Additional displays on the dash/tank are garbage at increasing situational awareness because they demand you come "heads down" and therefore aren't looking for threats. You have to balance sufficient information with overload."

~ LeighHelm (experience with Motorcycle & Military Pilot Helmet HUDs)

"I would like to see some collision prediction like the Bosch design as well as a communication standard so the computers could talk with other vehicles (again something like the aviation world uses), but that is probably outside the scope of your project."

~ Blue_Sail

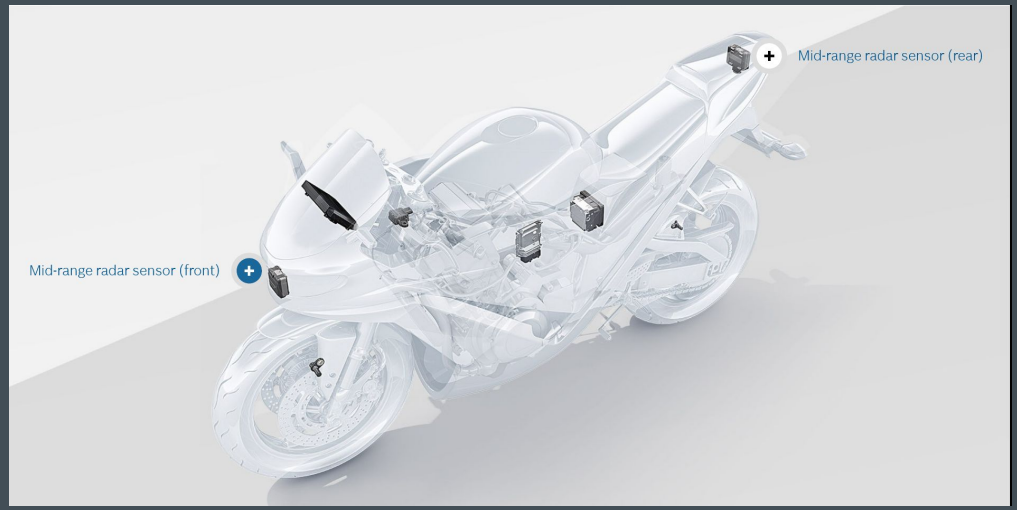
CrossHelmet X1

- Do-it-all with
  - Rear View Camera
  - Navigation
  - Music Integration
  - Phone calls
- Touch Panel
- Sound Panel
- Safety Battery
- Safety light to show oncoming vehicles App Connectivity
- $1,799.00

Source: https://www.crosshelmet.com/

Bosch Advanced Rider Assistance System

- Adaptive cruise control
- Forward collision warning system
- Blind spot detection
- AI-based prediction algorithms
- High-end and newer motorcycles
    - The Bosch system has been deployed in <10 motorcycles since its launch in 2019



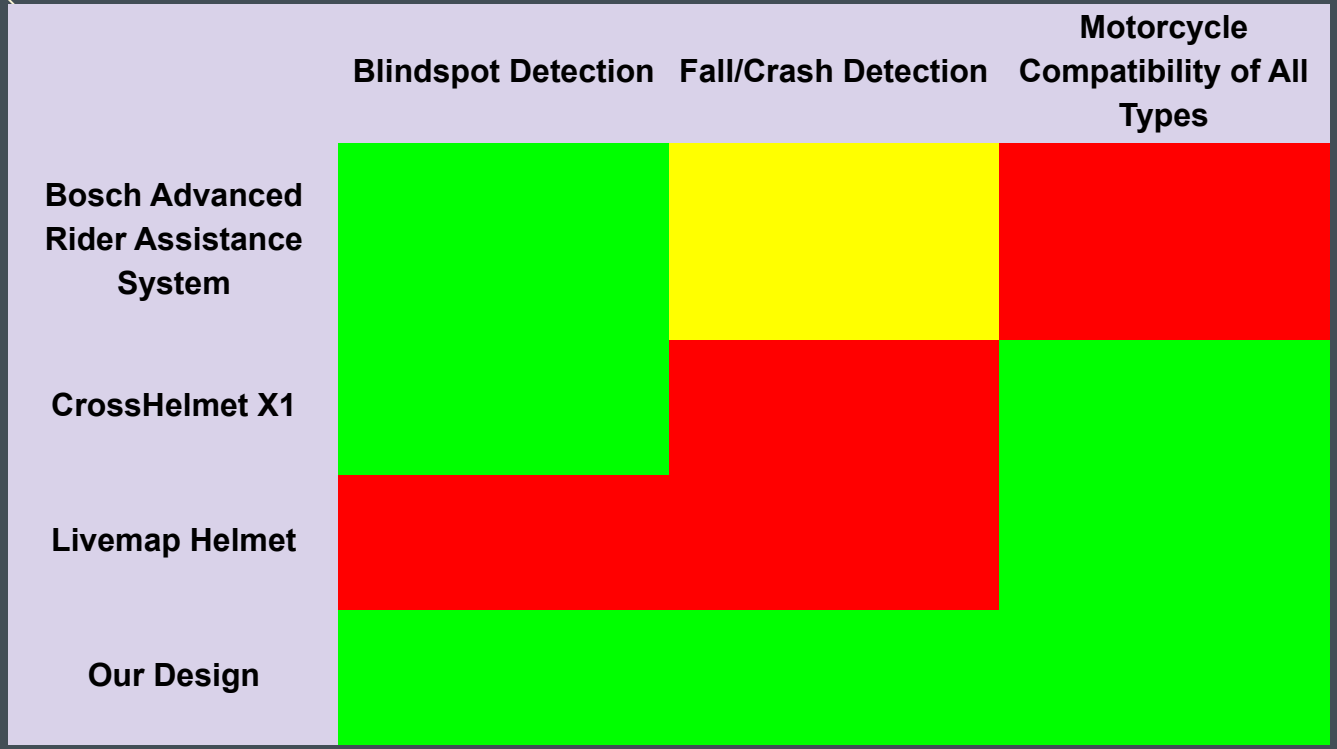
Source: https://www.bosch-mobility-solutions.com/en/solutions/assistance-systems/advanced-rider-assistance-systems-2w/

LiveMap Helmet

- AR-technology for maps/navigation
- Virtual Display on the visor thats shows accelerator
- In-built camera for recording
- Audio & voice control for calls and music
- $2,500.00

Source: https://livemap.info/

Competing Solutions Recap



Project Goal

Create a system that

Safety measures prior to accident

Detects and notifies motorcyclists of incoming hazards located on their blind spots

Safety measures after an accident

Detects and notifies Emergency Services about the accident by providing medical information and GPS location of the motorcyclists

Our Solution

A unique system that comprises of two parts that focus on driver safety.

Provides minimally distracting visuals for the rider of oncoming vehicles.

Compatible with all types of motorcycles that do not have the integrated blindspot detection system and/or fall detection system.

Preliminary System Specifications

Blindspot Detection

&

Fall Detection

Blindspot Detection

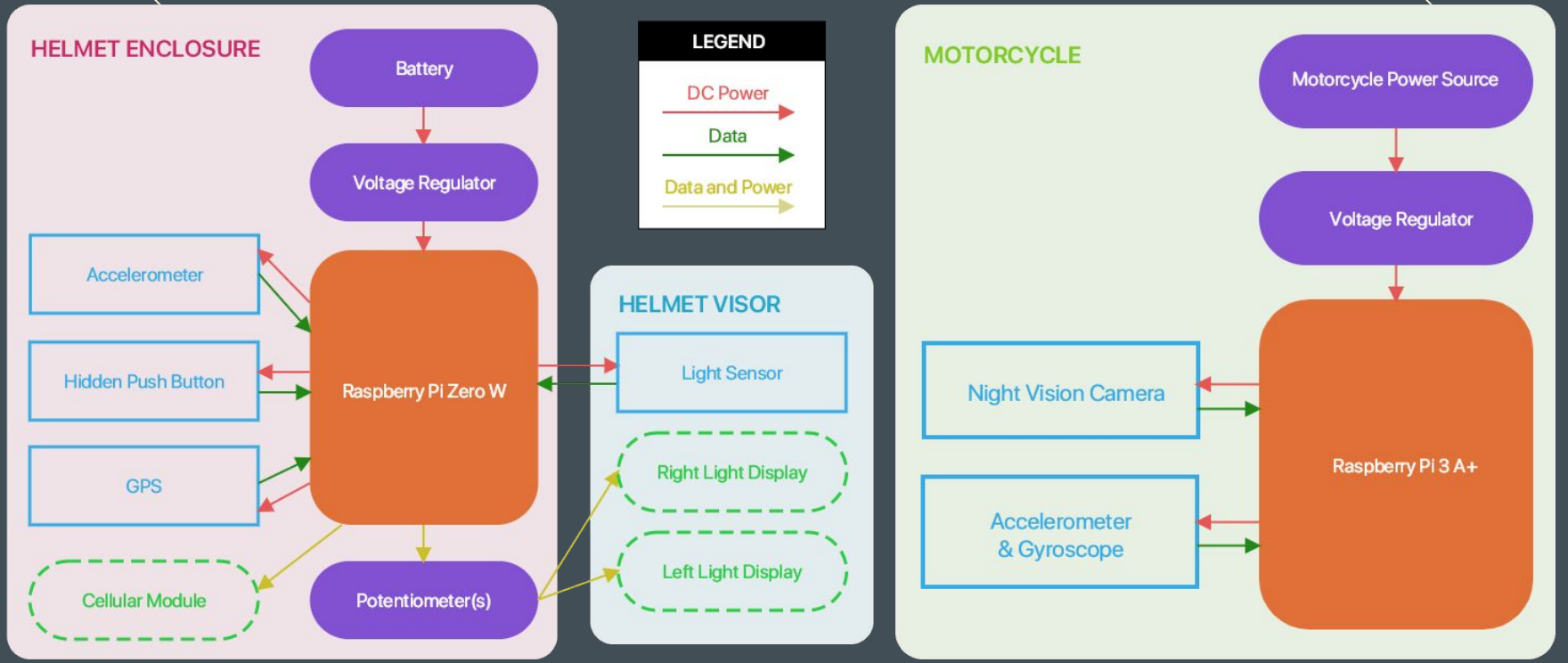
- Camera monitors vehicles in the motorcycle's blindspot
  - Recognizes vehicles behind and in adjacent lanes
  - Perceive vehicles at night
    - >95% detection rate
  - Classification of objects
    - Disregard rain, guard rails, mountains edges, etc.
- Alerts rider when a vehicle enters their blindspot
  - Light sensor will adjust the brightness of the lights for daytime to nighttime conditions
  - RGB lighting will notify the rider the proximity of the oncoming vehicle

Fall Detection

- Communicates fall detection between the helmet and motorcycle
  - Detect a crash or fall >95%
    - Using a system of sensors
    - Minimize false positives to under 5%
- Send medical ID and crash location to emergency services
- Provide a cut off option for the rider
  - Helmet interface
  - Cell phone interface

Design Diagrams

Hardware Diagram



Processing

Motorcycle

Raspberry Pi 3 A+

- BCM2837B0, Cortex-A53
- 64-bit SoC @ 1.4GHz
- 512MB LPDDR2 SDRAM
- 5V/2.5A DC power input
- Bluetooth 4.2/BLE modules
- Camera Module
- USB 2.0 port

Helmet

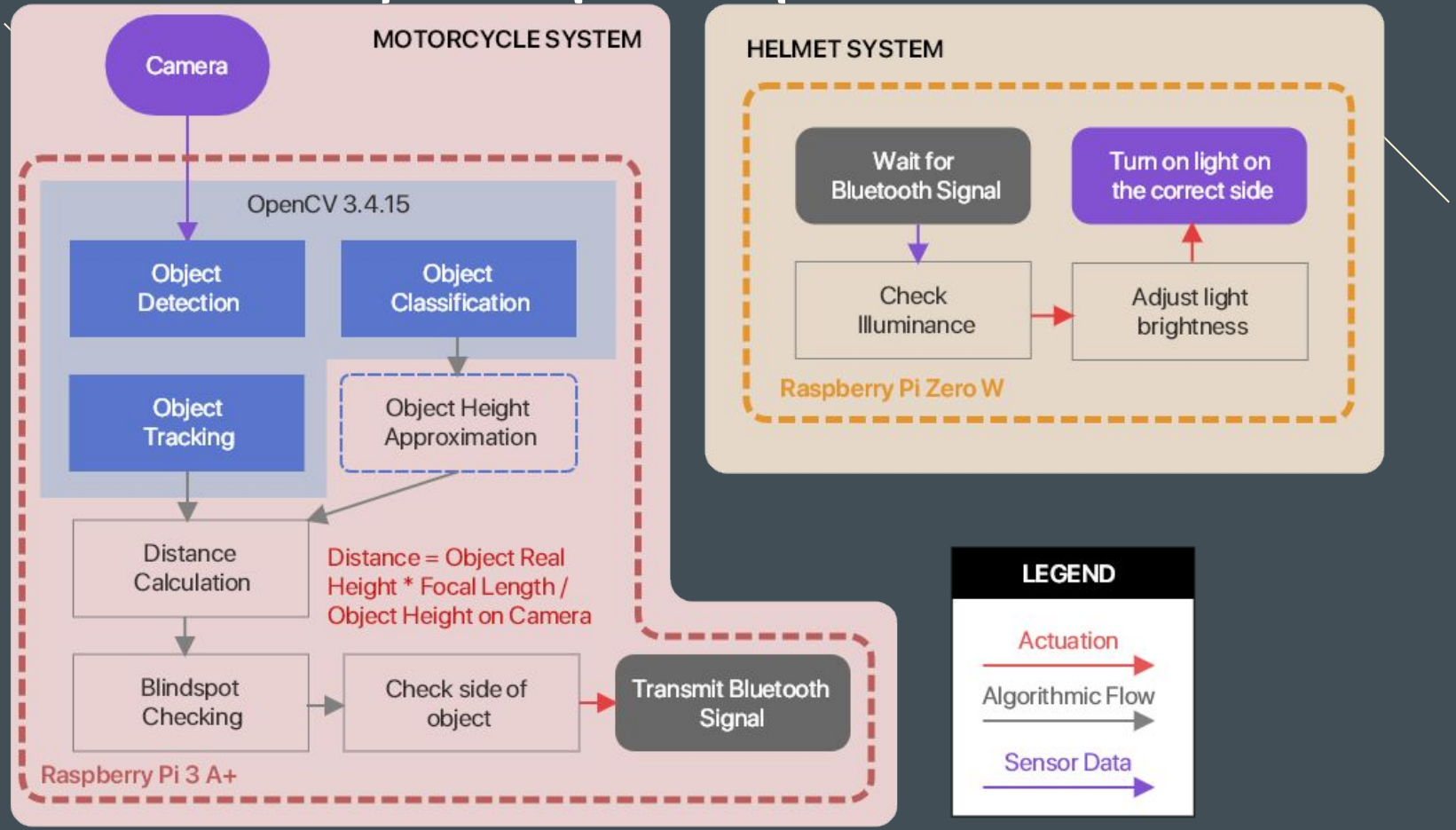
Raspberry Pi Zero W

- 1 GHz Single-Core CPU
- 512MB RAM
- Bluetooth 4.1/BLE
- USB On-the-Go ports

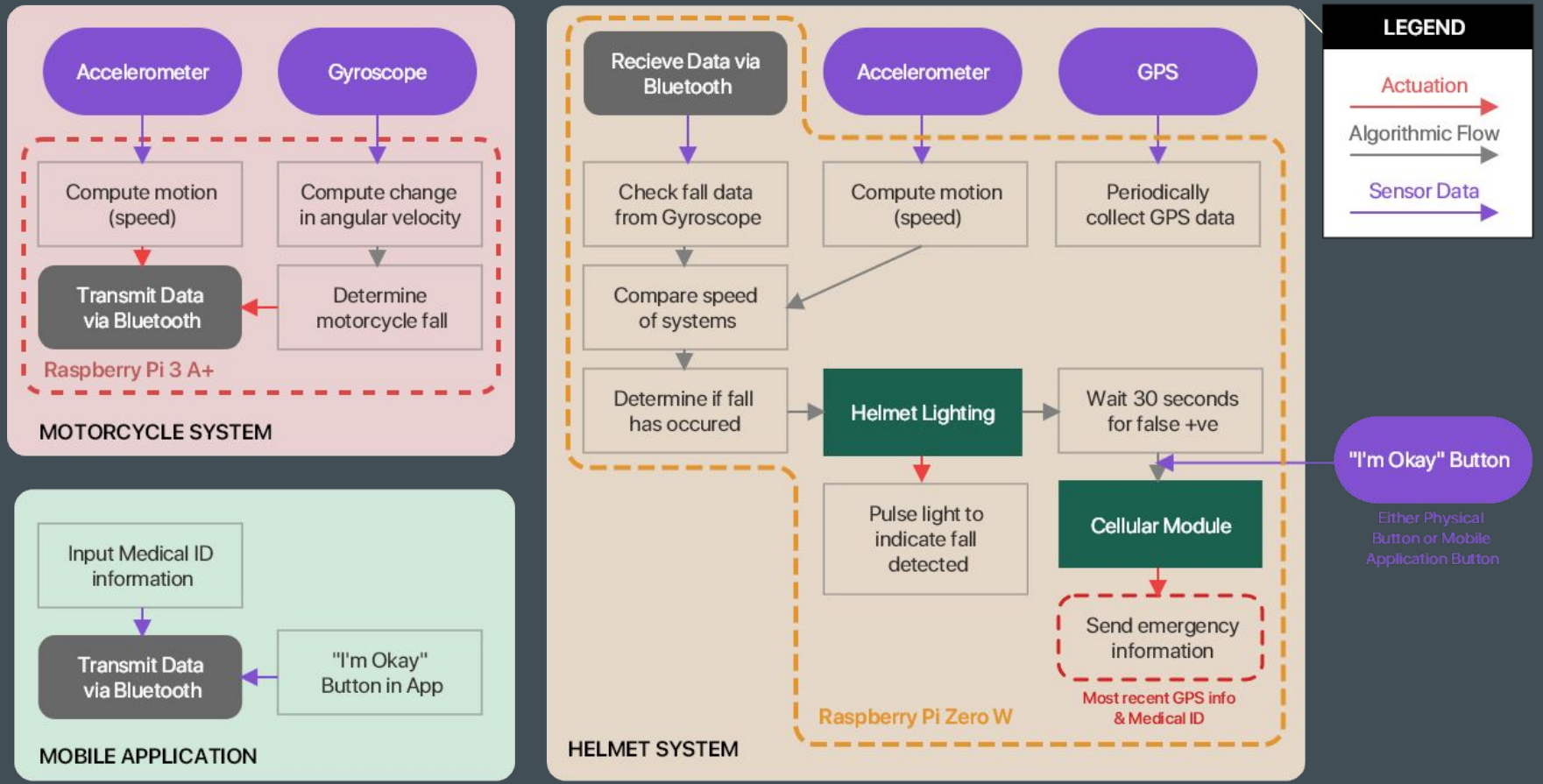
User Interface

- Post Accident Safety:
  - The helmet contains a cut off hidden button to be pressed within a determined amount of time
    - Yes: user is okay and does not need EM services
    - No: EM services will be contacted through the helmet's cellular module
      - Medical ID
      - GPS Location
- App
  - The user will fill out their general medical information necessary for EM response personnel
    - Blood Type, Medications, Conditions, etc
  - This app can also be used to inform the system that there are no EM services required

Software | Blindspot Detection



Software | Fall Detection



Cost Estimate

Material	Quantity	Cost per unit	Total Cost
Accelerometer	1	$5.00	$5.00
Accelerometer + Gyroscope	1	$7.00	$7.00
Raspberry Pi Zero W (or equiv.)	1	$14.00	$14.00
Raspberry Pi 3 A+ (or equiv.)	1	$25.00	$25.00
Sim card	1	$5.00	$5.00
Cellular Model	1	$40.00	$40.00
GPS	1	$15.00	$15.00
Light Sensor	1	$6.00	$6.00
PCB(w/ revisions)	2	$100.00	$200.00
Lighting	2	$30.00	$60.00
Wide Angle Camera	1	$75.00	$75.00
Bike	1	$0.00	$0.00
3D Printed Parts	N/A	$0.00	
			$452.00

Team Responsibilities

Dhruv:

- Software Lead:
  - Sensor protocol implementation for fall detection system
  - Developing algorithms for object detection and classification for hazards in blindspots

Sidd:

- Team Coordinator:
  - Communicates with and organizes all team members to ensure the project and demonstrations goes smoothly
- Communication Lead:
  - Responsible for incorporating data from GPS module and sending cellular modular.

Jeff:

- Budget Management:
  - Ensure SDP budget spent appropriately
- Mobile App Programmer:
  - Implement the user app and Bluetooth networking protocols

Paige:

- PCB and Breadboard Lead:
  - Design and prototype on breadboard for Altium PCBs
- Hardware Design Lead:
  - Design the hardware system and ensure the components can interface with each other successfully

Gantt Chart

Legends
Dhruv = DVK
Jeff = JW
Paige = PW
Sidd = SS

	Task Name	Team Member(s)	Start — End Dates	M T W TH F	M T W TH F	M T W TH F	M T W TH F	M T W TH F	M T W TH F	M T W TH F	M T W TH F
				Week 6 (Post PDR) 10/4 — 10/8	Week 7 10/11 — 10/15	Week 8 (Check-in 3) 10/18 — 10/22	Week 9 10/25 — 10/29	Week 10 11/1 — 11/5	Week 11 11/8 — 11/12	Week 12 11/15 — 11/19	Week 13 (MDR) 11/29 — 12/3
Blindspot Detection											
	Moving object detection from wide angle camera	DVK	10/20 — 11/5								
	Wide angle/Night vision Camera (with wide angle lens)	PW, JW	10/11 — 10/19								
	Left light vs the right side for blindspot detection	PW, JW	10/18 — 11/3								
	Light sensor to determine intesity of the lights	PW, DVK	10/4 — 11/19								
	Transmitting signals from motorcycle to helmet	JW	11/10 — 12/3								
	Breadboard Design	PW	10/7 — 12/3								
Fall/Crash Detection											
	Computing data recieved from Gyroscope and Accelerometers	DVK, SS	10/11 — 10/20								
	GPS implementation	SS	10/4 — 11/5								
	Detect falls	DVK, SS	11/10 — 12/3								
	Button clicking testing interupt aka button signal test	SS	11/3 — 11/9								
	Breadboard Design	PW	10/11 — 11/30								

MDR Deliverables

- Blindspot System
  - Detect moving vehicles by classifying objects within the blindspots
  - Transmit object detection data from the motorcycle to the helmet over Bluetooth
  - Configure lighting system to indicate direction and proximity using the detection data
- Fall Detection
  - Compare both data transmitted from the motorcycle's gyroscope/accelerometer with the helmet's accelerometer for fall/accident
  - Implement fall detection protocol by testing visual alert notification with cut off button in the helmet

Q&A

Thank you!