



Department of Computer Science

FROGSTAR

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Abstract

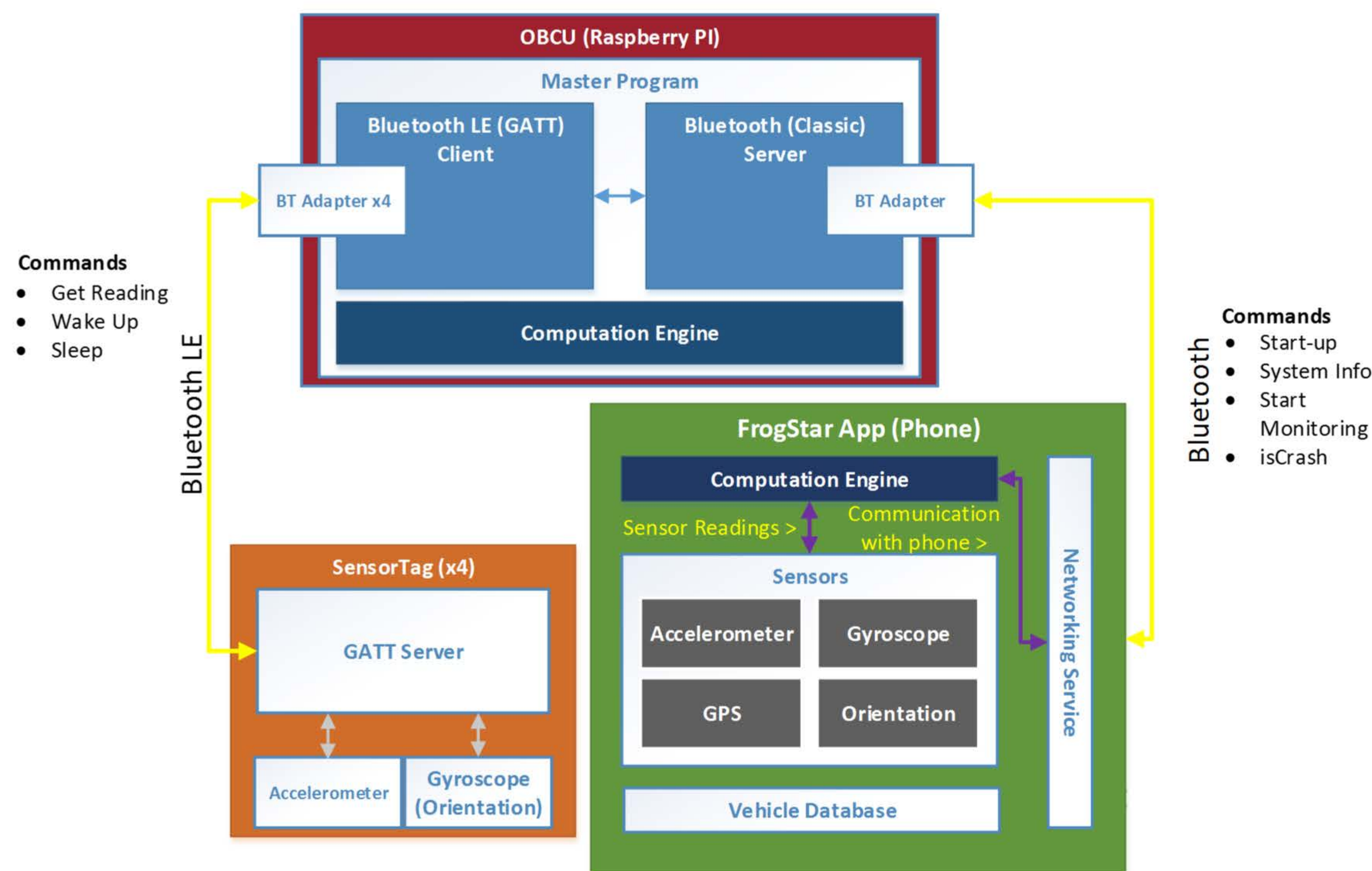
In the event of a vehicular accident, there are many scenarios in which the occupants become incapacitated and unable to call for assistance. There exist systems, such as OnStar, that currently provide accident detection and roadside assistance services. However, the cost of these proprietary systems and their availability for all vehicular models limit their use.

Project FrogStar provides for accident detection and emergency responder notification in an inexpensive and highly available system. The primary FrogStar system components include a smartphone, a single-board computer, and Texas Instruments SensorTags placed inconspicuously around a vehicle. The single-board computer monitors the TI SensorTags, via Bluetooth low energy, obtaining accelerometer and gyroscope data needed to detect accidents. The smartphone provides the means for emergency notification and, when utilizing its own sensors, allows for redundancy in accident detection.

Problem

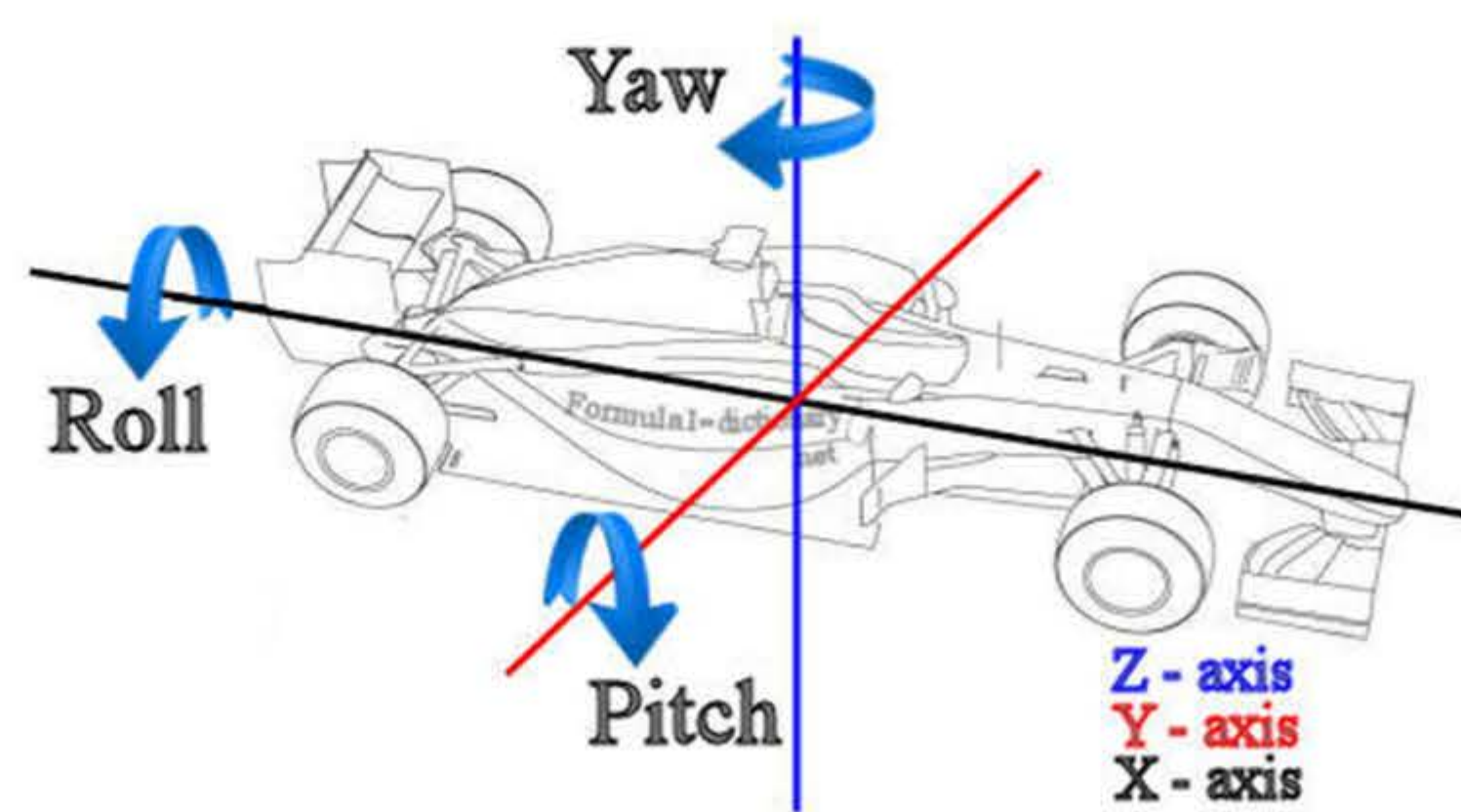
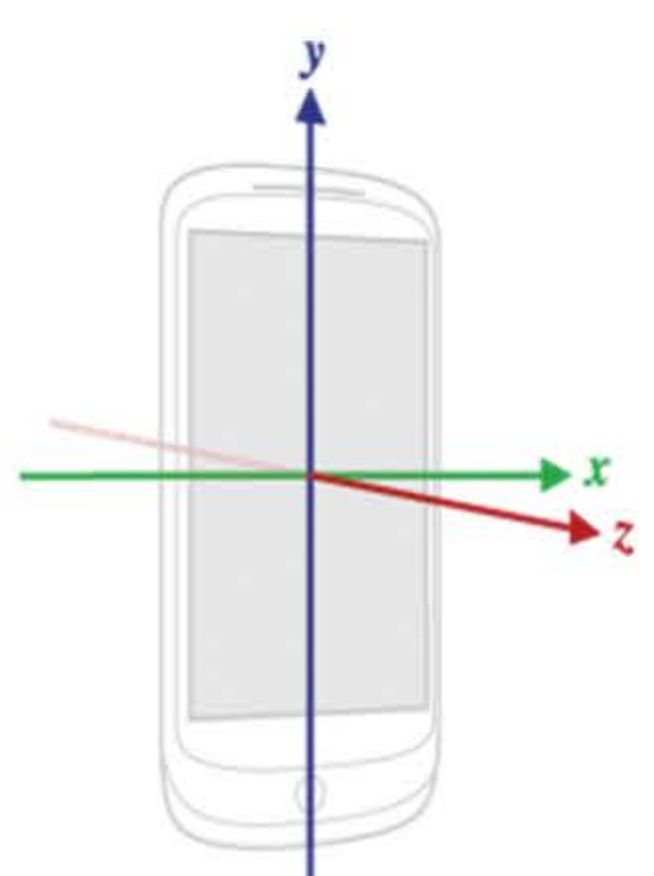
- Currently available proprietary systems that provide accident detection and roadside assistance services are typically expensive and may not be available for all car models. The FrogStar project seeks to develop an inexpensive, readily available system to provide accident detection.

System Architecture



Sensor Readings

Sensor readings are comprised of three vectors originating from the center of the device:

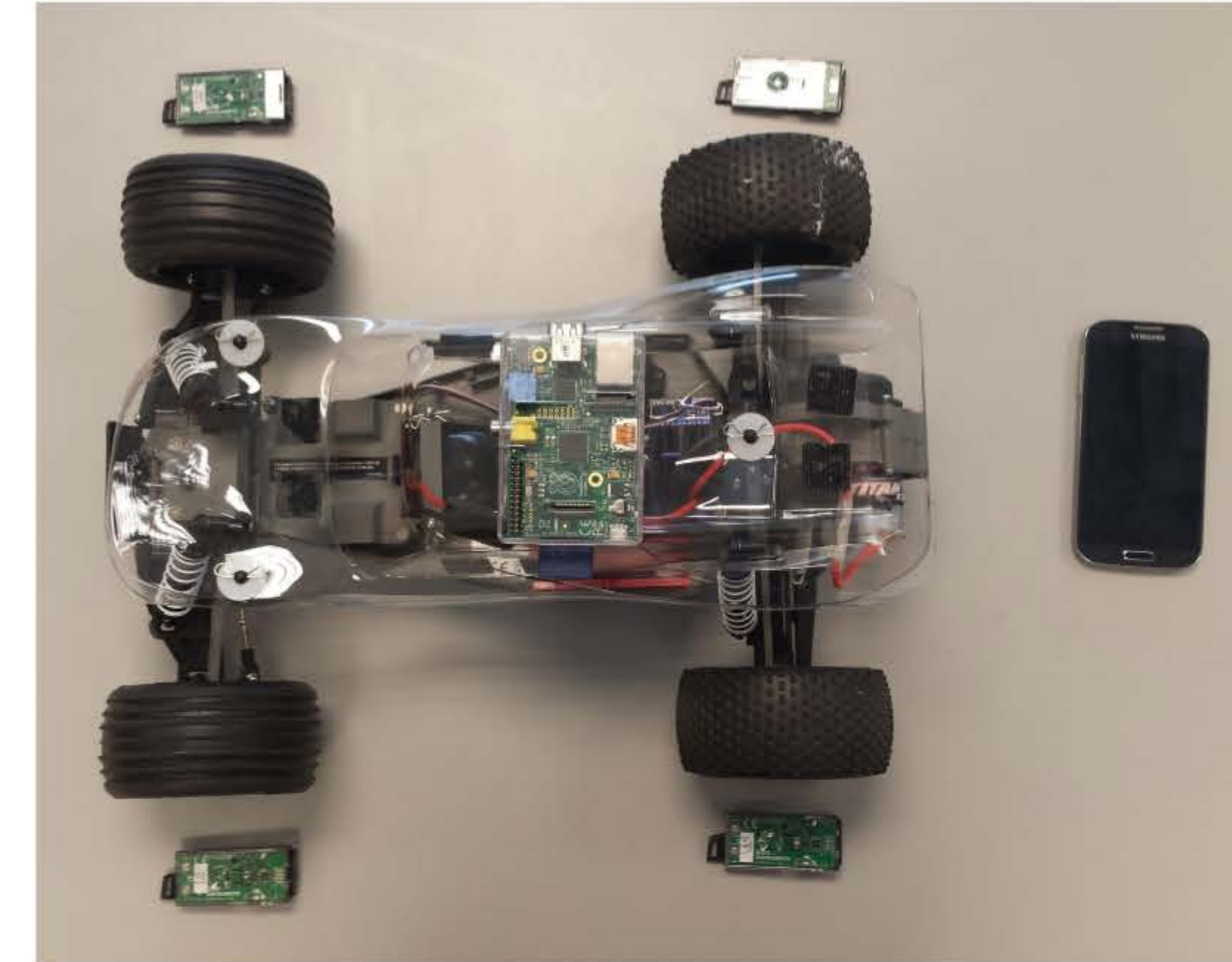


- **Accelerometer** – measures change in speed.
- Extreme Y = Head-On or Rear-End.
- Extreme X = T-Bone.

- **Gyroscope** – measures change in orientation.
- Extreme roll = vehicle rollover.
- Extreme pitch = vehicle flipping over.
- Extreme yaw = vehicle spinning-out.

Prototype Vehicle

- Testing is conducted using a remote controlled car in both indoor and outdoor environments.
- Smartphone is attached to the top and SensorTags are mounted on the interior of the frame.



NFC Tags



- Near Field Communication
- Store MAC addresses of SensorTags.
- Contents are read by Smartphone when swiped.
- Use no internal power – no batteries.
- Intended to be mounted in the car.
- Act as trigger to start and stop crash monitoring when user swipes phone.

TI SensorTags (CC2541)



- Inexpensive.
- Low power, runs on battery.
- Bluetooth LE communication.
- Accelerometer and gyroscope sensors.
- Placed around vehicle to provide readings

Raspberry Pi



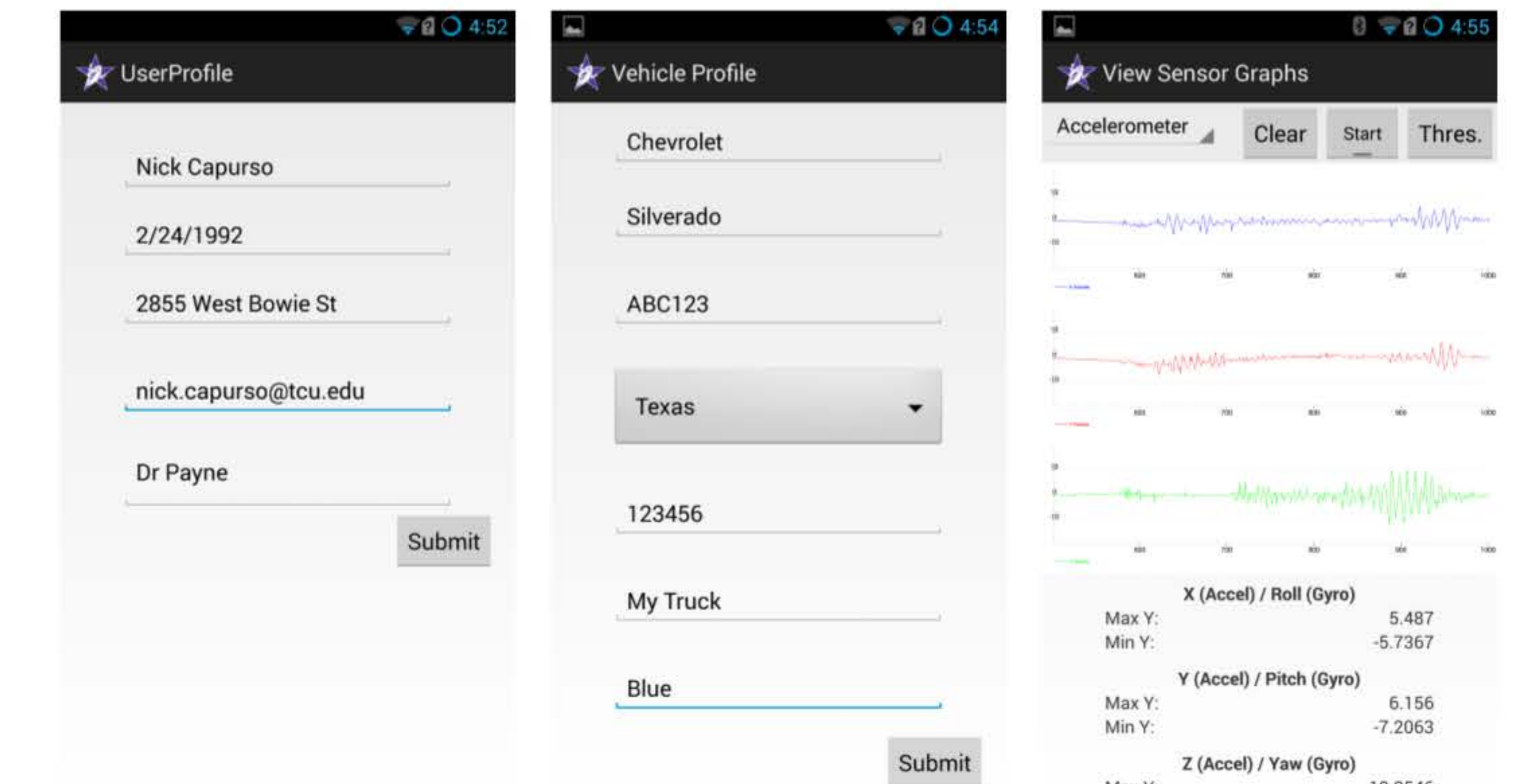
- A tiny, inexpensive, and low-power computer that runs Linux.
- Uses Bluetooth adapters to communicate with smartphone and SensorTags.
- Queries SensorTags and runs accident detection algorithm.
- Correlates potential accidents with smart phone.

Smartphone



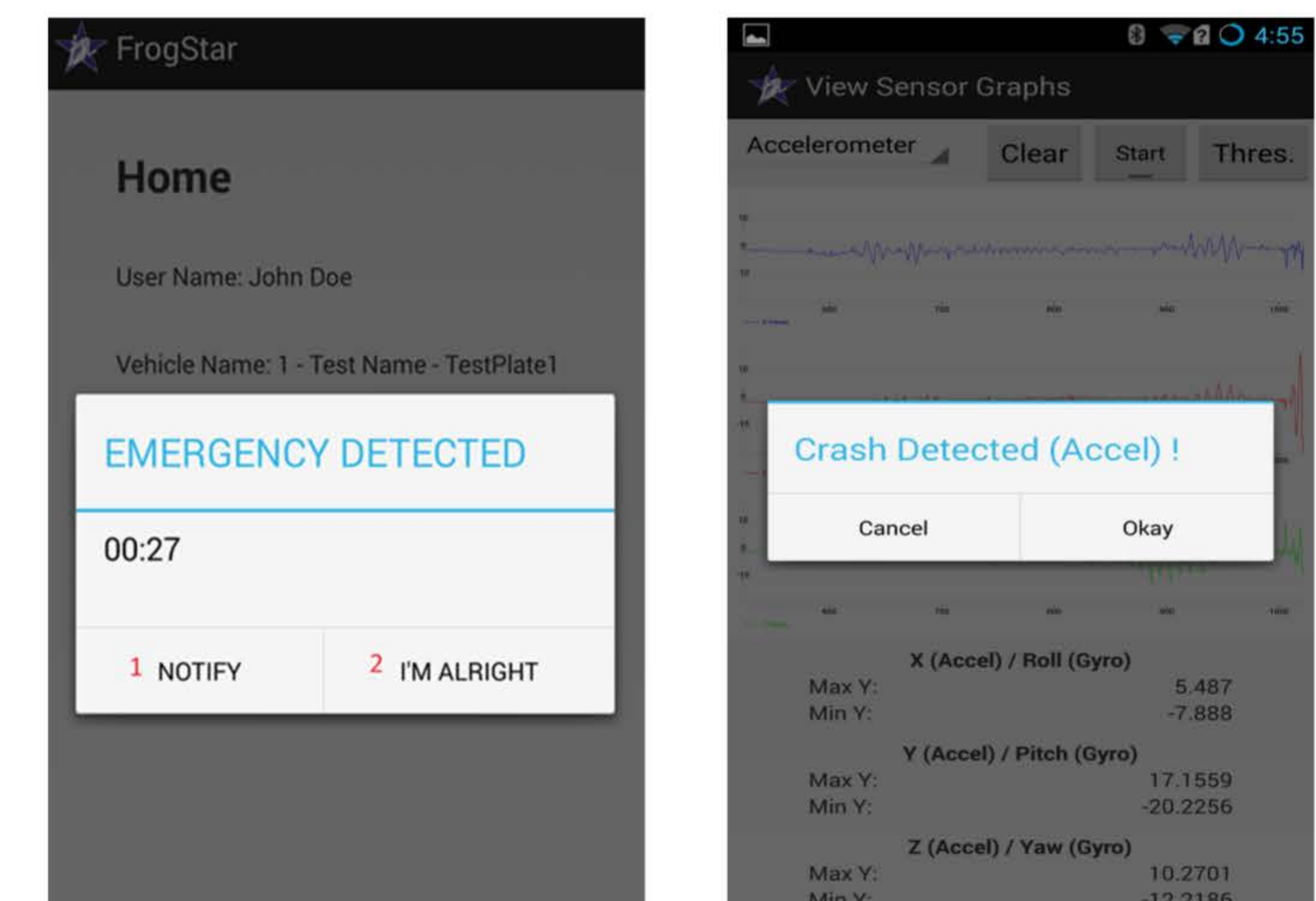
- Samsung Galaxy S4.
- 1.9 Ghz Quad-core CPU.
- 2 GB RAM.
- Android 4.3.1 (Jelly Bean).
 - Open Source Platform.
 - Easy transition for our developers.
- Important features:
 - Accelerometer and gyroscope.
 - NFC – Near Field Communication
 - Bluetooth.

FrogStar Application



- Stores user and vehicle information.
- Controls system startup and shutdown.
- Technician Mode – system setup and sensor debugging.
- Queries its own sensors and runs accident detection algorithm.
- Correlates potential accidents with OBCU.
- Can automatically contact emergency responders.

Results and Conclusions



- Baseline, normal operation sensor readings for the smartphone were established through testing.
- Accident detection is performed by comparing sensor readings against established thresholds.
- Currently working on accident detection with the SensorTags included.

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References

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