Application of Interactive Pervasive Computing for bike geo-tracking & accident alert

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BIJU ALE

160026, 19-A

STW307CR

in collaboration with

Softwarica College of IT & E-commerce | Coventry University

Introduction

- Security for bike riders is a must; security for the bike & the bike rider
- EMT personnels must locate you during accidents on the trail or on the road during adventure or daily rides.
- Bikes once stolen are difficult to track & recover.

Aim

- To develop a low-profile, low-powered, & a high-coverage IOT system that can be installed on a bike which can send GPS coordinates during an accident or upon remote request during theft.

Objectives - Technical

- To understand the scope & domain of the problem to be solved.
- To identify the components required to construct the proposed solution.
- To model the structural aspect of the system.
- To model the dynamic aspect of the system.
- To design the sub-routines to be executed in the Arduino.
- To unit test each routines and to integrate them.
- To make use of IOT web services for dashboard.

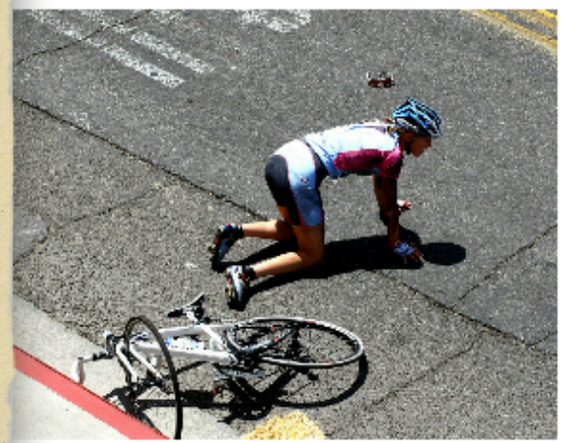
Objectives - Academic

- To create a simple user-centric interactive pervasive computing application.
- To understand if a problem is solvable using pervasive computing and to come up with a prototype soultion.
- To utilize IOT web services and web APIs and integrate them into the project for notification and/or data persistence.

Problem Statement

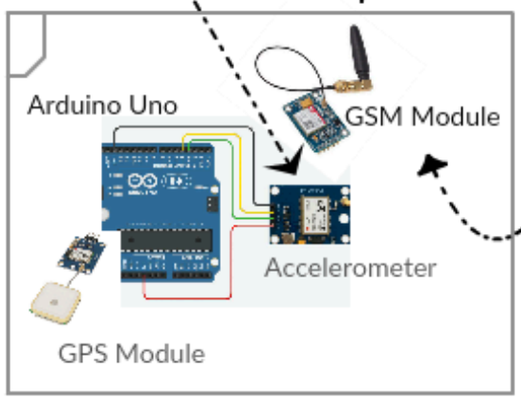
- Send an alert with GPS coordinates of the accident site during an accident.
- Track the bike and continuously send the GPS coordinates of the bike upon receiving track command remotely.

Justification

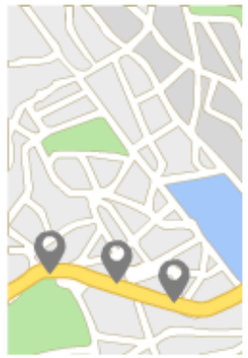


1. Accident occurs on a bike installed with the tracking system.

2. Accelerometer detects the accident



3. GSM uses GPRS internet to send the GPS coordinates to DWEET



Fretboard dashboard connected to DWEET shows the map with the bike's dynamic location

4.

The tracking system is concealed underneath the bike's saddle.

In case, the bike is stolen, the rider can send a text message to trigger continuous posting of GPS coordinates.

Proposed Solution

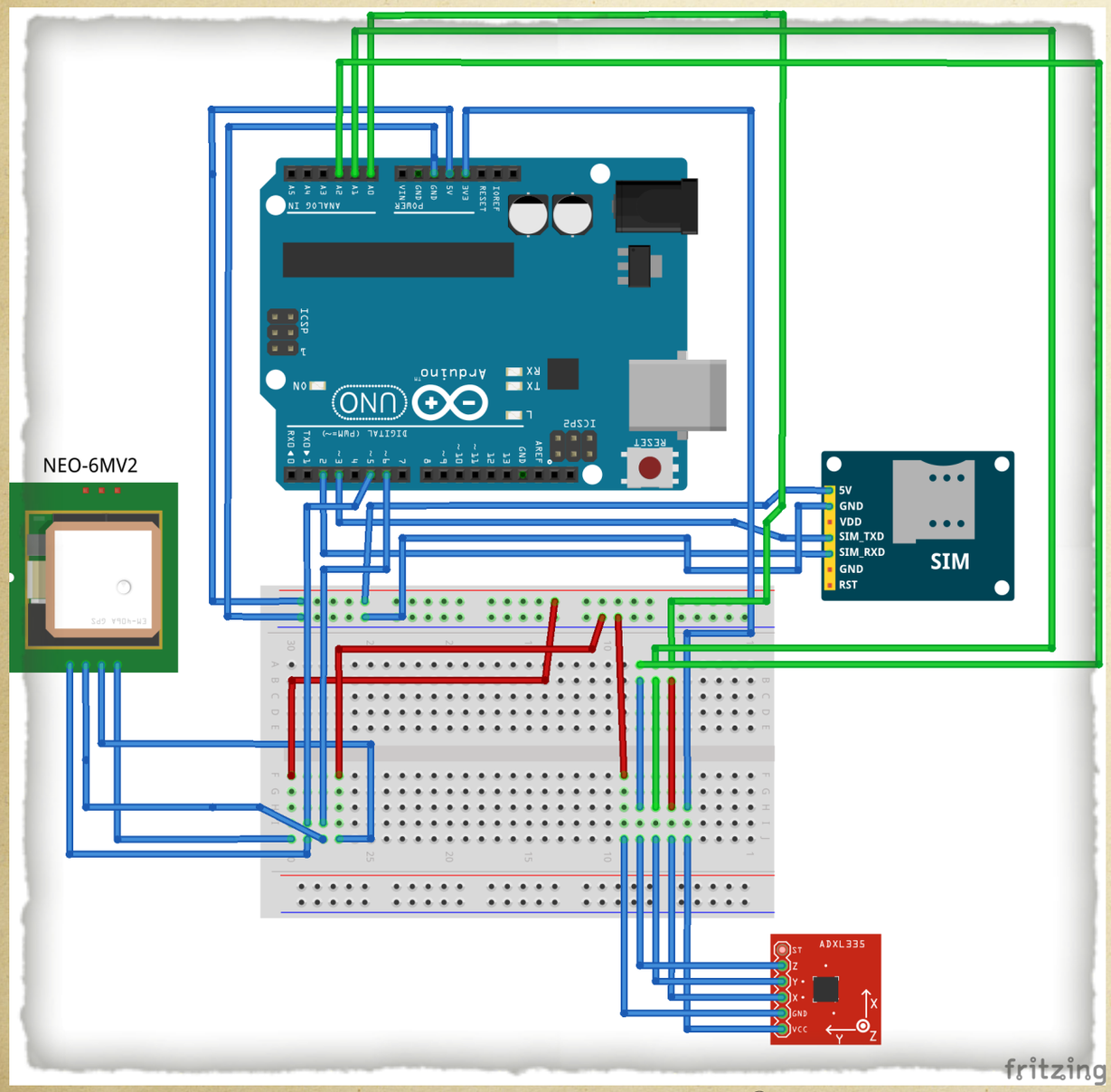
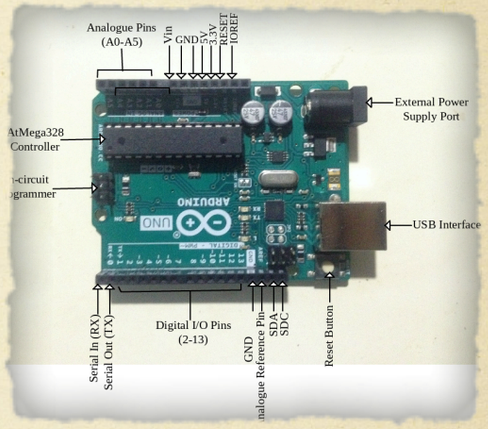
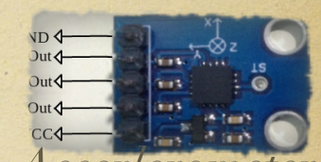


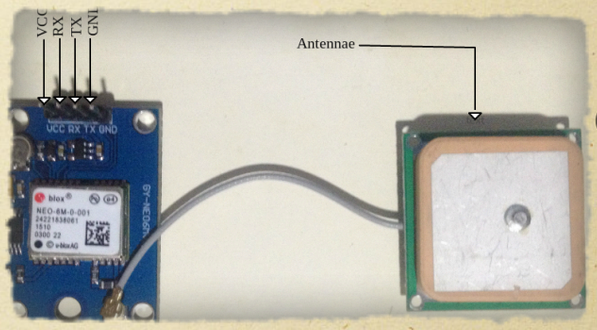
Figure: Circuit Layout of Prototype



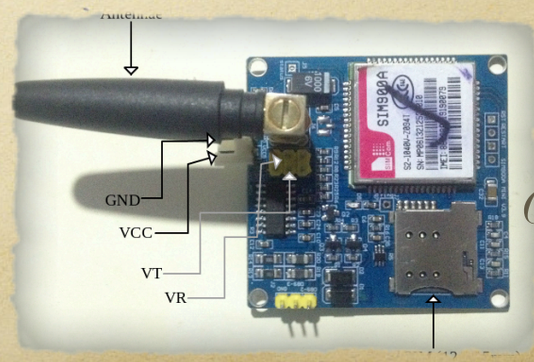
Microcontroller board (Arduino Uno R3)



Accerlerometer (ADXL335)

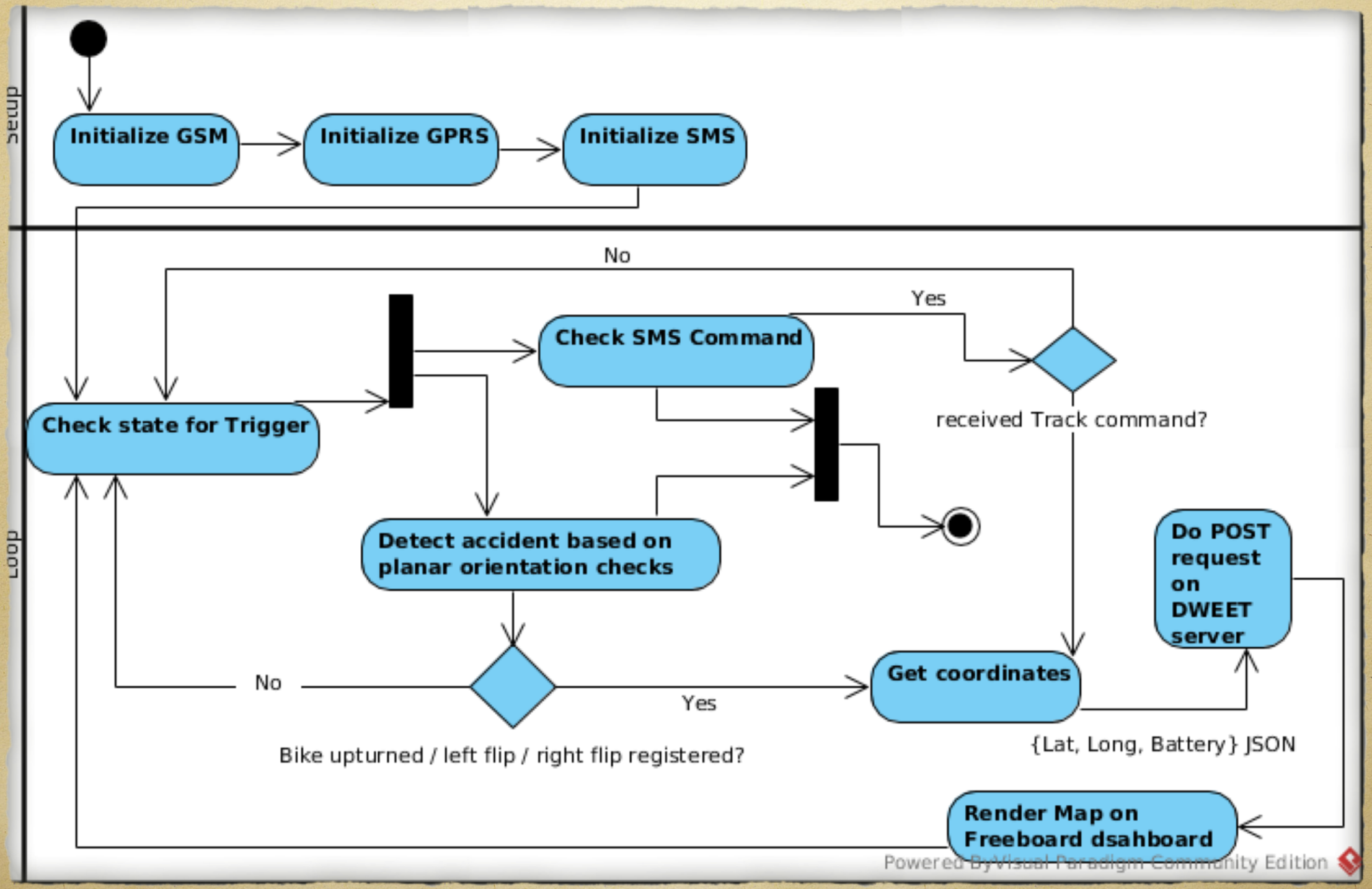


GPS Module (NEO-6M)

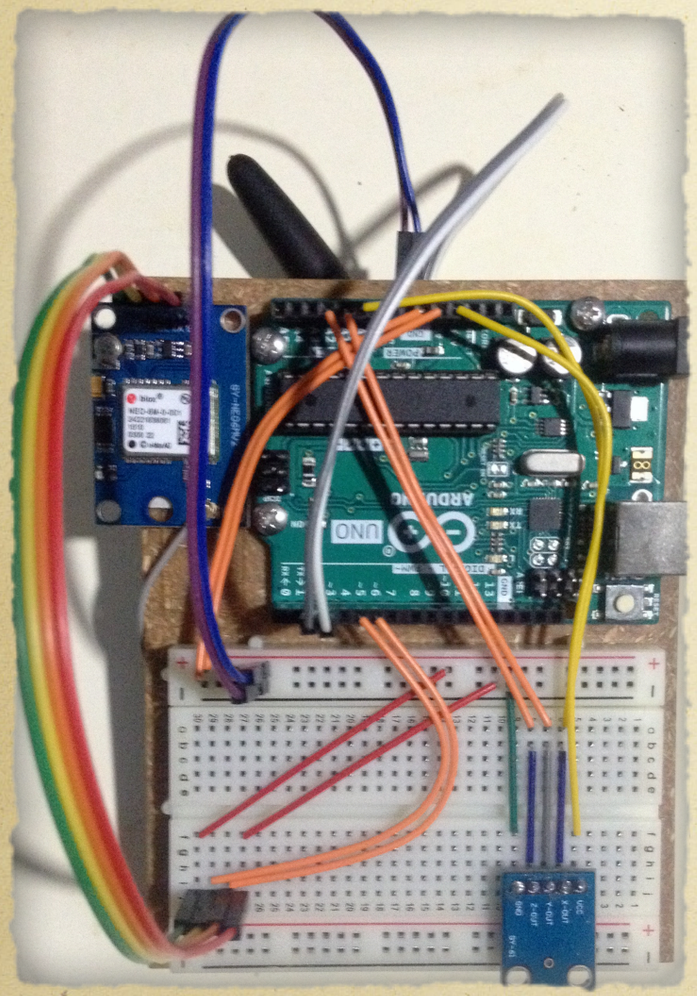


GSM Module (SIM-900a)

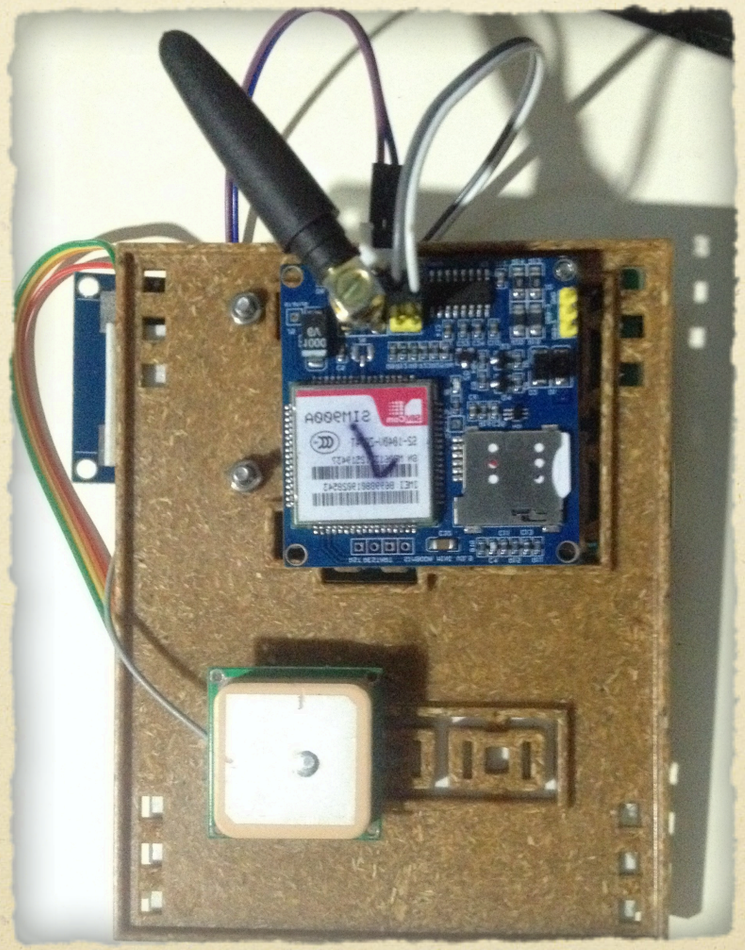
Dynamic Modeling



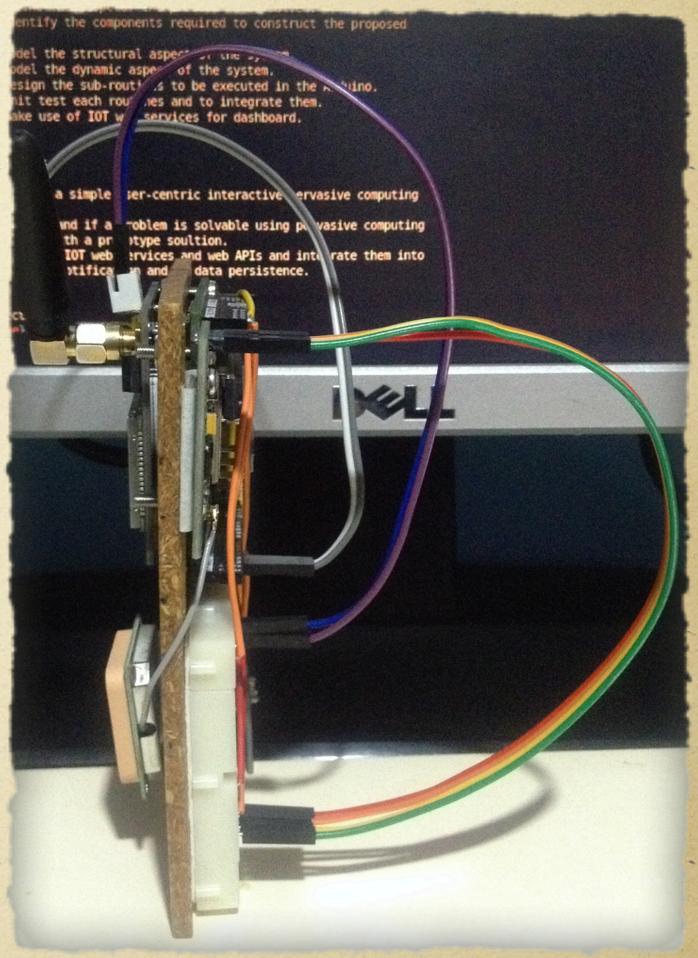
Final Prototype



Front

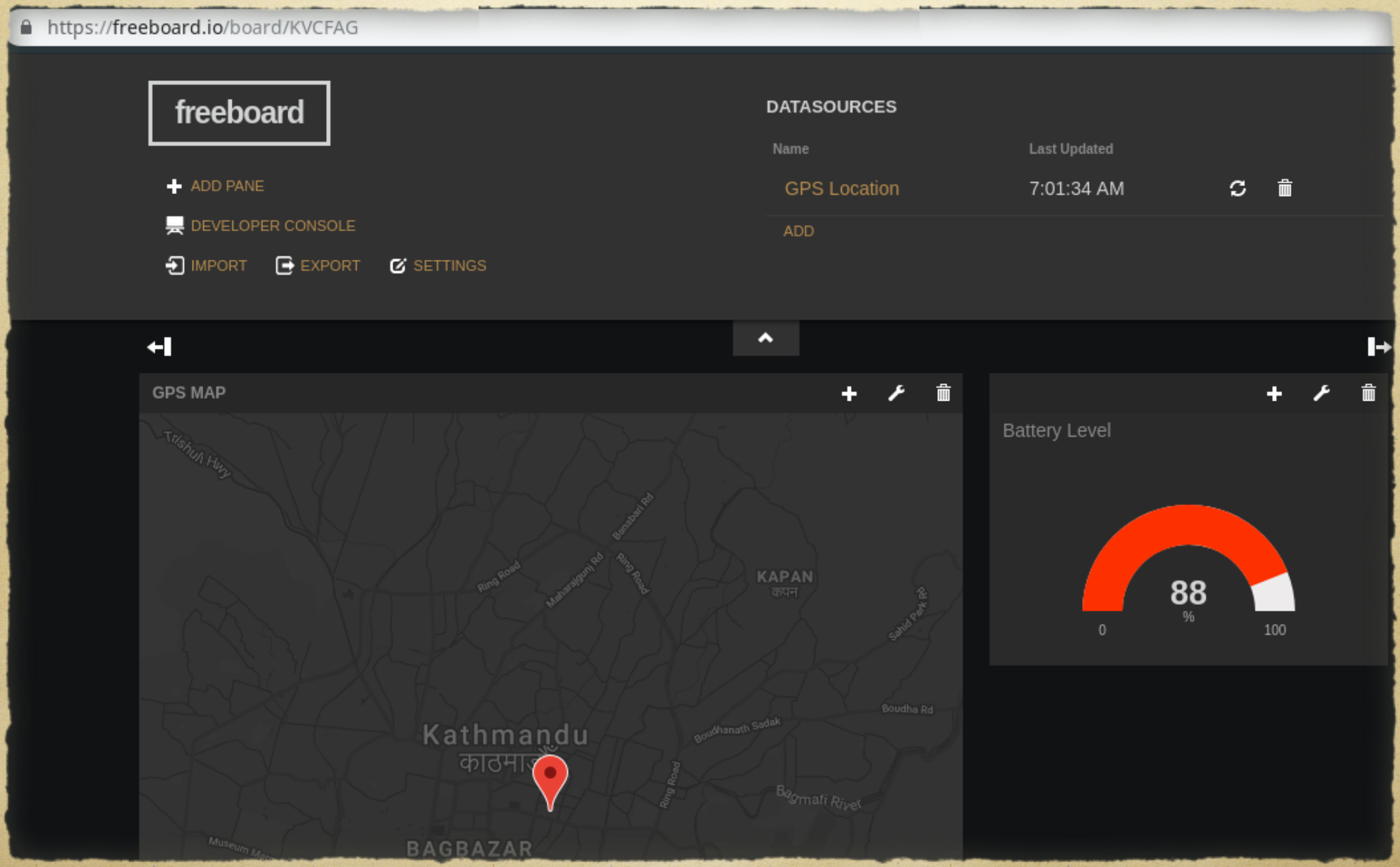


Back



Side

Dashboard - Tracking data



Troubleshooting

- GPS Issues - Clear line of sight, soldering, pin & antennae configuration,
- GSM Issues - SIM placement, Library imports
- Arduino Issues - Library imports, debugging
- Accelerometer Issues - Calibration

Future Work: Areas of Improvement

- Minify device footprint with Nano, matrix board.
- Waterproof casing.
- Use 4G for better networking.

Future Work: Areas of Extension

- Phone interface to program preferences and calibration.
- Use custom web server and richer dashboard.
- Leverage other GPS data over 4G - velocity, direction.
- Data persistence on cloud for data analysis and analytics.

Lessons Learnt

- Analysis, design, implementation of Interactive Pervasive Computing solutions.
- Pervasive computing as a means to a humanitarian goal.'
- Research, troubleshooting, and replicable documentation authoring skills.
- Translating phenomena data into valuable utility.
- Importance of user-centric design.
- Ethics & Service driven engineering.

Bibliography

- Blum, J. (2018). Exploring Arduino. 1st ed. Indianiapolis: Wiley \& Sons Canada, Limited, John.
- Priest, D. (2019). NMEA data. [online] Gpsinformation.org. Available at: https://www.gpsinformation.org/dale/nmea.htm [Accessed 19 May 2019].
- Javed, A. (2016). Building Arduino Projects for the Internet of Things 2016. Berkley: APress.
- Schwartz, M. (2016). Internet of things iwth Arduino cookbook. 1st ed. Birmingham, UK: Packt Publishing Ltd.
- Arduino Learning. (2019). Arduino and ADXL335 accelerometer example - Arduino Learning. [online] Available at: http://arduinolearning.com/code/arduino-adxl335-accelerometer-example.php [Accessed 19 May 2019].
- Wisesa L. (2019). NodeMCU, Dweet.io \& Freeboard.io. [online] Instructables. Available at: https://www.instructables.com/id/NodeMCU-Dweetio-Freeboardio/ [Accessed 19 May 2019].