Mechanica:Rocket science

Sam Motmans

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Rocket height measurement

- Principles & Methods
- Electronic hardware & software
- Data structure & example

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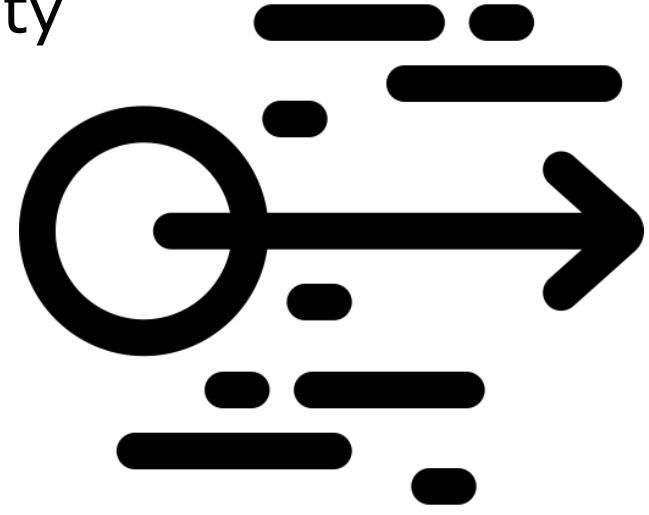
Principles & Methods

- Height measurement?
  - Accellerometer?
  - Gyroscope?
  - Altimeter?
  - Gyroscope + Accellerometer?
  - **Altimeter + Accellerometer?**

Accellerometer

- Measures acceleration of object
  - Measurements at steady intervals
  - Possible to acquire velocity
  - In function of time



Gyroscope

- Measures orientation of object
  - No measurements of displacement of object
  - In function of time

Accelerometer+ Gyroscope

- Measures acceleration & orientation of object
  - Problems with this method?
    - If object starts rotating around it's axis it introduces acceleration in all directions. → Height can not be estimated correctly

Altimeter + Accelerometer

- Measures height and acceleration of object
  - Height in function of time
  - Acceleration in function of time
  - Velocity in function of height

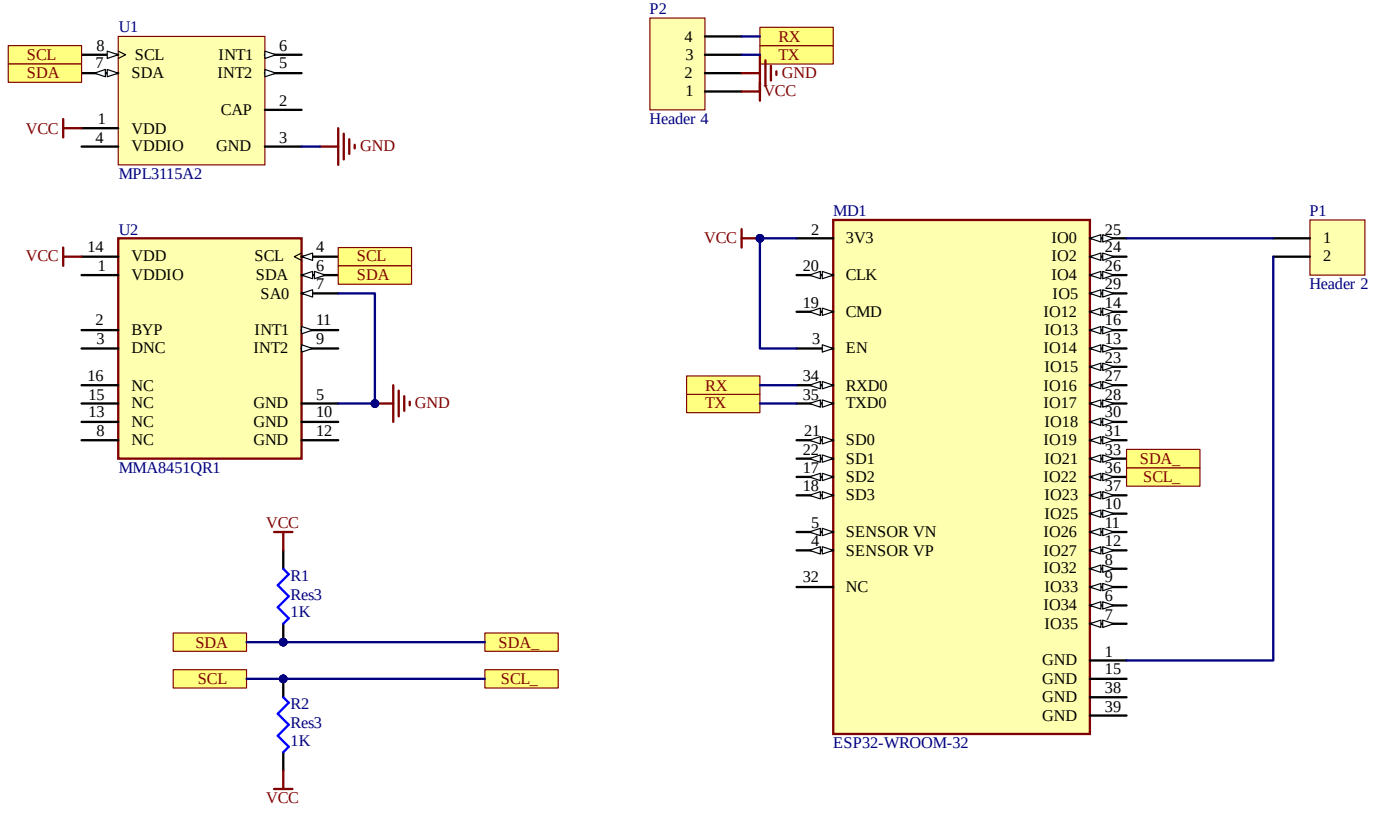
Electronic hardware & software

- Components
  - Espressif-ESP32 Microcontroller
  - MMA8451Q Accelerometer
  - MPL3115A2 Altimeter
- Specs
  - Operating voltage: 2.6v – 3.6V
  - Weight : ~40g

Electronic hardware & software: Datasheets

- Espressif-ESP32 Microcontroller
  - https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32e_esp32-wroom-32ue_datasheet_en.pdf
- MMA8451Q Accelerometer
  - https://www.nxp.com/docs/en/data-sheet/MMA8451Q.pdf
- MPL3115A2 Altimeter
  - https://www.nxp.com/docs/en/data-sheet/MPL3115A2.pdf

Electronic hardware & software: Schematic



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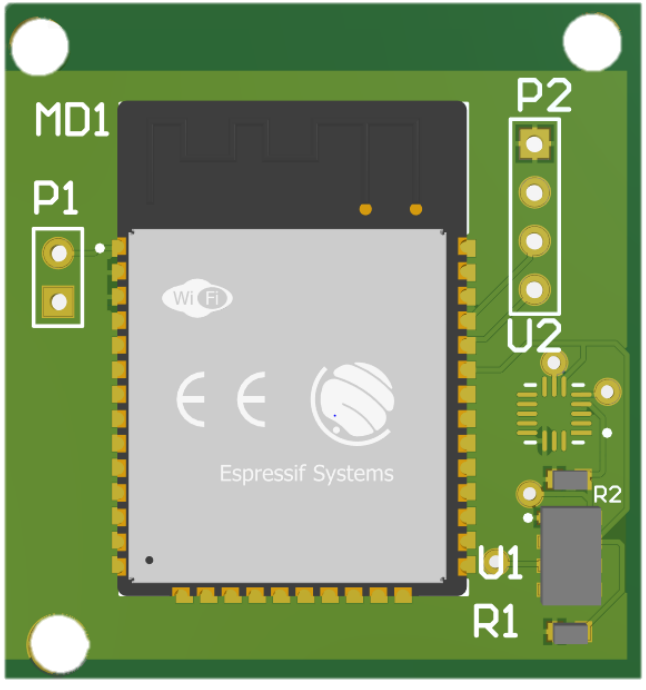
Electronic hardware & software: PCB



Electronic hardware & software

- Language driver C++
- Language dashboard/ parser: Python
  - See attachment

Data structure & example

- Data structure: .CSV FORMAT
  - Comma separated value
    - Height , accel_x, accel_y, accel_z

Rocket Science

- Place the circuit board as seen fit in your design
- Read out the data and visualize to see the height trajectory of the rocket
- Utilize acceleration and height data to get x, y, and z directions of the trajectory.
  - Visualize this data

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