

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
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**SYSTEM REQUIREMENTS SPECIFICATION
CSE 4316: SENIOR DESIGN I
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**TEAM ROCKET
ROCKET BOARD**

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1 PRODUCT CONCEPT

This section describes the purpose, use and intended user audience for the Rocket Board. Rocket Board is a system that collects flight data and provides tracking capabilities to model rockets. Rocket Board will enable users to gather flight information about their rocket and provide GPS tracking capabilities for rocket recovery.

1.1 PURPOSE AND USE

Rocket Board is a sensor suite intended collect data on board a model rocket during flight. Rocket Board will be accompanied by a separate base receiver to receive flight data live. The receiver will then re-transmit the data to a companion mobile app which will provide data visualization and GPS tracking capabilities. The data collected from the sensor suite can be used to analyze flight performance and inform future launch decisions.

1.2 INTENDED AUDIENCE

Rocket Board is intended for use by hobby model rocketeers as well as in STEM classrooms. Model rocketeers will gain access to a wealth of information about the performance of their rocket previously unavailable to them. Educators in STEM classrooms will gain a fun and interactive tool to help teach concepts of aerospace engineering and data science.

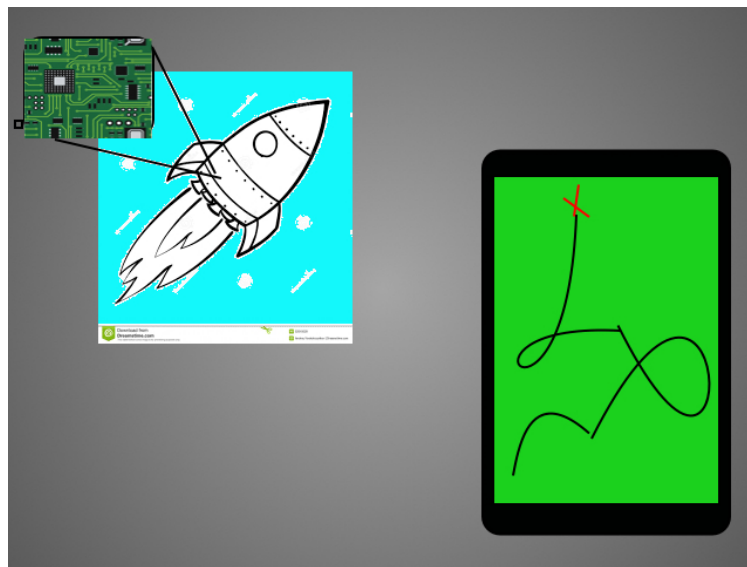


Figure 1: Rocket Board conceptual drawing

2 PRODUCT DESCRIPTION

This section provides an overview of the Rocket Board. The primary features and functions, external and internal outputs, and product interfaces are all defined and described in detail in this section.

2.1 FEATURES & FUNCTIONS

The Rocket Board will collect and send data at regular intervals from a model rocket while in flight. The data will be collected from various sensors on the product and will be transmitted over FM radio. A USB receiver connected to an Android smart phone will receive the data and will display it on the accompanying application along with visualization of the flight path. A GPS module in the app will allow the user to find the location of the rocket for easier retrieval. Rocket Board will not give constant real time data, nor will it directly guide a user to their rocket. The whole system will involve three primary parts: the physical board connected to the model rocket, the FM receiver, and the accompanying application, see figure x to view the product concept.

2.2 EXTERNAL INPUTS & OUTPUTS

Type	Description	Function
Input	FM Transmissions	The FM signal will contain the data collected from the Rocket Board
Output	Altitude	Altitude of model rocket will be displayed to the user
Output	GPS	Location will be displayed to the user
Output	Flight Path	Visualization of flight path will be displayed to the user

Table 2: External Inputs & Outputs

2.3 PRODUCT INTERFACES

The main menu of the application will provide the user with the ability to start receiving data from the Rocket Board, enter the settings menu, or exit the application, see figure x. After starting the primary function the user can view some of the data being transmitted, see figure x. After flight the user will be presented with the options to visualize the flight data or to use the GPS to view the location of the model rocket, see figure x. The settings allow the user to change some features like volume, see figure x.

3 CUSTOMER REQUIREMENTS

This section outlines the requirements and key functionality of the Rocket Board. All requirements in this section have been derived from the customers needs to ensure that the desired product is the one that's built. These requirements describe in detail all of the features that are to be implemented prior to delivery of the product.

3.1 ALTITUDE DATA

3.1.1 DESCRIPTION

Rocket Board shall record the altitude of the rocket at regular intervals.

3.1.2 SOURCE

Customer

3.1.3 CONSTRAINTS

The rate at which the altitude is recorded should be such that the processor is not overwhelmed.

3.1.4 STANDARDS

RoHS compliance

3.1.5 PRIORITY

Critical. This is one of the main functions of Rocket Board

3.2 GPS

3.2.1 DESCRIPTION

Rocket Board shall provide its location via GPS module.

3.2.2 SOURCE

Customer

3.2.3 CONSTRAINTS

The rate at which the GPS is recorded should be such that the processor is not overwhelmed.

3.2.4 STANDARDS

GPS Civil Monitoring Performance Specification, SPS performance standard, WAAS performance standard, PPS performance standard

3.2.5 PRIORITY

Critical. This is one of the main functions of Rocket Board.

3.3 PITCH/ROLL DATA

3.3.1 DESCRIPTION

Rocket Board shall record the pitch and roll of the rocket.

3.3.2 SOURCE

Customer

3.3.3 CONSTRAINTS

The rate at which the IMU records the pitch and roll should be such that the processor is not overwhelmed.

3.3.4 PRIORITY

Moderate. Because we are not actually controlling the vehicle, this information is not critical for the

3.4 COMMUNICATIONS

3.4.1 DESCRIPTION

Rocket Board shall communicate with a base receiver using FM radio transmissions.

3.4.2 SOURCE

Customer

3.4.3 CONSTRAINTS

Communications shall take place in unregulated frequency spaces to avoid conflict with radio stations and other radio devices.

3.4.4 STANDARDS

U.S. Federal Communications Commission (FCC) 15

3.4.5 PRIORITY

Critical. Being able to communicate with a cell phone is one of the key features of the product.

3.5 FLIGHT DATA VISUALIZATION

3.5.1 DESCRIPTION

The Rocket Board companion app shall provide visualization of all recorded data with respect to flight time.

3.5.2 SOURCE

Customer

3.5.3 CONSTRAINTS

Data visualization will not be real time. The data can be visualized after end of flight.

3.5.4 PRIORITY

High. This is one of the main features of the application.

3.6 COMPANION APP

3.6.1 DESCRIPTION

Rocket Board shall have a companion application to provide tracking

3.6.2 SOURCE

Source

3.6.3 CONSTRAINTS

Detailed description of applicable constraints...

3.6.4 PRIORITY

Priority

3.7 DETECT TIME OF FIRST MOTION

3.7.1 DESCRIPTION

Rocket Board shall detect time of first motion of the rocket after engine ignition.

3.7.2 SOURCE

Customer

3.7.3 CONSTRAINTS

Rocket Board will only detect and record the time of first motion, it will do nothing to create it. Meaning Rocket Board will not be responsible for igniting the rocket motor.

3.7.4 PRIORITY

High. This time will serve as a baseline for visualizations.

3.8 DETECT PARACHUTE DEPLOYMENT

3.8.1 DESCRIPTION

Rocket Board shall detect and record the flight time at which the parachute was deployed.

3.8.2 SOURCE

Customer

3.8.3 CONSTRAINTS

Rocket Board will only record this time, it will do nothing to control the deployment of the vehicles parachute.

3.8.4 PRIORITY

Low.

3.9 STOP RECORDING AFTER LANDING

3.9.1 DESCRIPTION

Rocket Board shall stop recording flight information once the vehicle has stopped moving.

3.9.2 SOURCE

Customer

3.9.3 CONSTRAINTS

All flight data should stop recording within 500 milliseconds of last motion.

3.9.4 PRIORITY

Moderate. Stopping the recording of flight data will create a cleaner data set of only relevant values.

3.10 RECORD FLIGHT TIME

3.10.1 DESCRIPTION

Rocket Board shall start recording flight time at the time of first movement and continue recording it throughout the flight until the vehicle has stopped moving.

3.10.2 SOURCE

Customer

3.10.3 CONSTRAINTS

Rocket Board shall record time in milliseconds.

3.10.4 PRIORITY

Critical. The flight time is one of the most valuable pieces of information we collect.

3.11 SIZE

3.11.1 DESCRIPTION

Rocket Board shall measure no more than 2.5 inches wide, and 5 inches long.

3.11.2 SOURCE

Customer

3.11.3 CONSTRAINTS

These measurements shall be made within a tolerance of +/- .1 inches.

3.11.4 PRIORITY

Critical. An oversized board will not fit in the test vehicle.

3.12 VISUAL READINESS INDICATION

3.12.1 DESCRIPTION

Rocket Board shall provide a visual queue to the user that it is ready for launch.

3.12.2 SOURCE

Customer

3.12.3 CONSTRAINTS

Visual signaling shall be accomplished by flashing LED's.

3.12.4 PRIORITY

Low. This feature is not critical to the function or delivery of Rocket Board.

3.13 AUDIO SIGNALING

3.13.1 DESCRIPTION

Rocket Board shall be able to emit noise to send various audio signals to the user.

3.13.2 SOURCE

Customer

3.13.3 CONSTRAINTS

The noise emitted shall be at a level that is comfortable to listen too.

3.13.4 PRIORITY

Low. This feature is not critical to the function or delivery of Rocket Board.

3.14 TRACKING

3.14.1 DESCRIPTION

Rocket Board shall provide vehicle tracking capabilities via its GPS module and the companion application.

3.14.2 SOURCE

Customer.

3.14.3 CONSTRAINTS

The tracking range will be limited by the capabilities of the FM transmitter which in our case is approximately 2 miles.

3.14.4 PRIORITY

Critical. This is one of the main features of the product

4 PACKAGING REQUIREMENTS

The requirements specified in this section detail how the product is to be packaged and made ready for customer delivery.

4.1 STATIC FREE BAG

4.1.1 DESCRIPTION

Rocket Board shall ship inside of a static free bag to prevent shorting out any components during shipping.

4.1.2 SOURCE

Customer

4.1.3 PRIORITY

High.

4.2 SOFTWARE DISTRIBUTION

4.2.1 DESCRIPTION

All software artifacts will be maintained and distributed publicly on GitHub.

4.2.2 SOURCE

Customer

4.2.3 PRIORITY

High

5 PERFORMANCE REQUIREMENTS

This section details requirements related to the performance of Rocket Board. These requirements are to ensure a smooth and useful experience for the user.

5.1 TRANSMISSION FREQUENCY

5.1.1 DESCRIPTION

Rocket Board shall transmit flight data to to the companion app at least once per second.

5.1.2 SOURCE

Customer

5.1.3 PRIORITY

High.

6 SAFETY REQUIREMENTS

Rocket motors are flammable objects and as such must be treated with appropriate safety measures. The requirements specified in this section are meant to insure that all users and developers of Rocket Board do so in a safe manner.

6.1 IGNITION

6.1.1 DESCRIPTION

Rocket Board shall not provide controlled ignition to the rocket motor. This will be provided by an external system.

6.1.2 SOURCE

Development Team

6.1.3 CONSTRAINTS

Not having direct control of rocket motor ignition means that Rocket Board will be responsible for starting the flight timer.

6.1.4 PRIORITY

Critical

7 MAINTENANCE & SUPPORT REQUIREMENTS

This section describes how this release of Rocket Board will be maintained and supported. The information specified here will ensure that users of Rocket Board will be able to use it for a long period of time.

7.1 DOCUMENTATION

7.1.1 DESCRIPTION

Source code and manuals for Rocket Board shall be maintained on GitHub.

7.1.2 SOURCE

Customer

7.1.3 CONSTRAINTS

Detailed description of applicable constraints...

7.1.4 PRIORITY

Critical. The user will need access to these manuals in order to utilize Rocket Board.

8 OTHER REQUIREMENTS

The requirements outlined in this section pertain to keeping the test launch vehicle in compliance with the Federal Aviation Administration's regulations.

8.1 WEIGHT

8.1.1 DESCRIPTION

The test vehicle shall weigh no more than 1 pound with Rocket Board installed.

8.1.2 SOURCE

FAA

8.1.3 PRIORITY

Critical. The vehicle must comply with all FAA regulations.

8.2 PROPELLANT

8.2.1 DESCRIPTION

The test vehicle shall fly on no more than 4 ounces of propellant.

8.2.2 SOURCE

FAA

8.2.3 PRIORITY

Critical. The vehicle must comply with all FAA regulations.

9 FUTURE ITEMS

This section describes features that are not within the scope of this version of Rocket Board, but are features that would be beneficial if added at a later time. Should development go faster than expected new features from this list will be added to the customers requirements.

9.1 FLIGHT CONTROL

9.1.1 DESCRIPTION

Rocket Board shall provide thrust vector control capabilities to the vehicle.

9.1.2 SOURCE

Customer.

9.1.3 PRIORITY

Future.

REFERENCES