Software Design Specification

for

Structural Health and Rupture Detection (SHARD)

Version 1.0

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10/5/2022

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Revision Number	Description	Date
1.0	Initial revision	10/5/2022

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3.1 Overall System Architecture

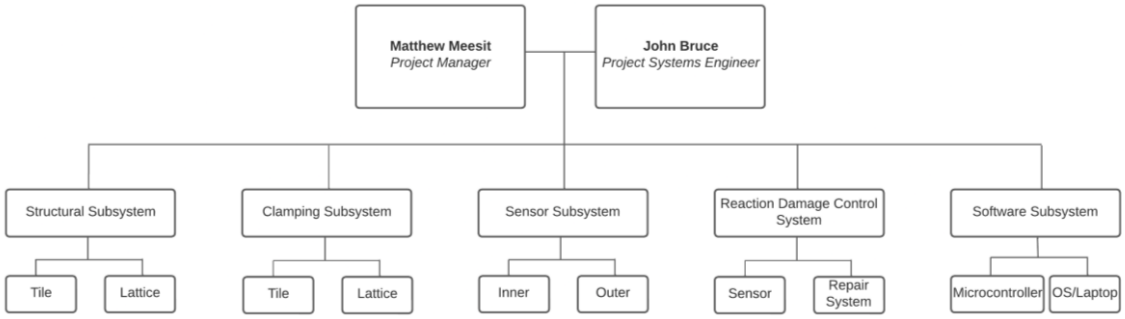

Figure 1: System Architecture

There are five subsystems apart of our system. The structural subsystem manages the designing of a structure that can withstand the stresses of space flight while maintaining the integrity of the other subsystems. The clamping subsystem manages the connections between each tile and lattice, making sure that the connections between the tiles are airtight enough to protect against pressure loss in space. The sensor subsystem contains many sensors which interact with software. The sensors are used to send data for use by the software subsystem. The Reaction Damage Control System (RDCS) manages the repair system for when there is a rupture in the tiles. This is done with a sensor, and it works autonomously. The software subsystem provides a user with a graphical user interface (GUI) that displays the status of tiles and alerts the user if a rupture occurs. This is done by interfacing with the sensors to obtain the data.

There is a hardware-to-hardware interface in our system, which is the clamping system connecting to the tiles and lattices. There is a hardware-to-software interface in our system, which is the tile, lattice, sensors, and software interacting with each other. The sensors are attached to the tiles and are wired to microcontrollers. These microcontrollers are wired to the software application, which uses the data obtained from the microcontrollers to display to the user. The last interface in our system is the software-to-user interface, which is the interface that takes place between the software application and the user who uses the application. The user generates input for the program in which case the software will respond.

3.2 Overall Concept of Operations

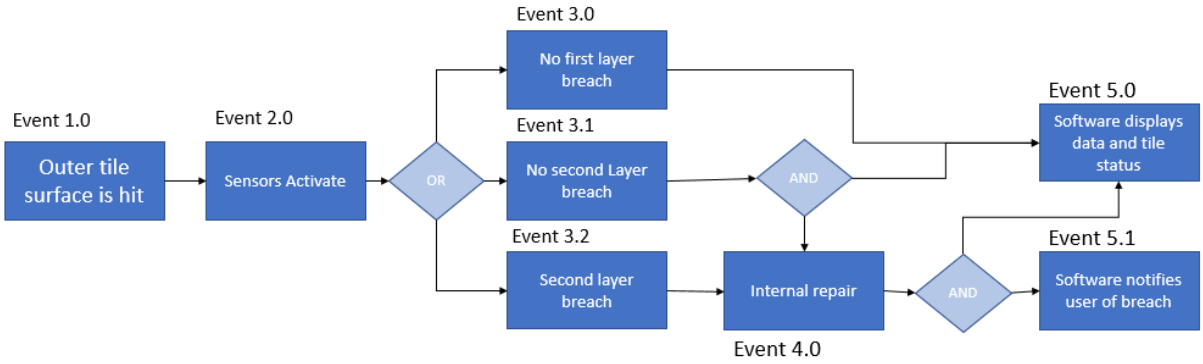

Figure 2: Concept of Operations

S.H.A.R.D tiles will be able to be applied to any spacecraft and operate in space. Each tile will operate the same way to be easily universal and replaceable. The tiles' surfaces will be hit by space debris. This will cause the sensors to trigger and communicate with the software to determine if a breach occurs. It will also be able to determine where the breach has occurred as well as from which direction the breach has occurred, in the event of an internal explosion or similar failure. After determining if the breach has occurred it will notify the user if it can self-repair the damage or if it is not possible to be repaired and requires replacement.

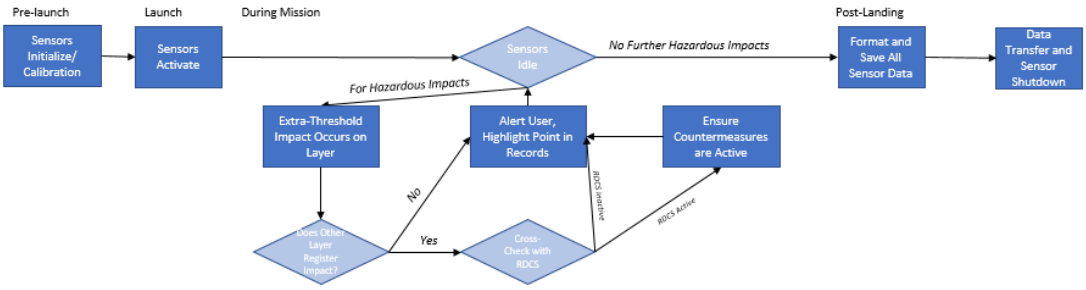

Figure 3: Concept of Operations (1)

3.3 UML Diagram

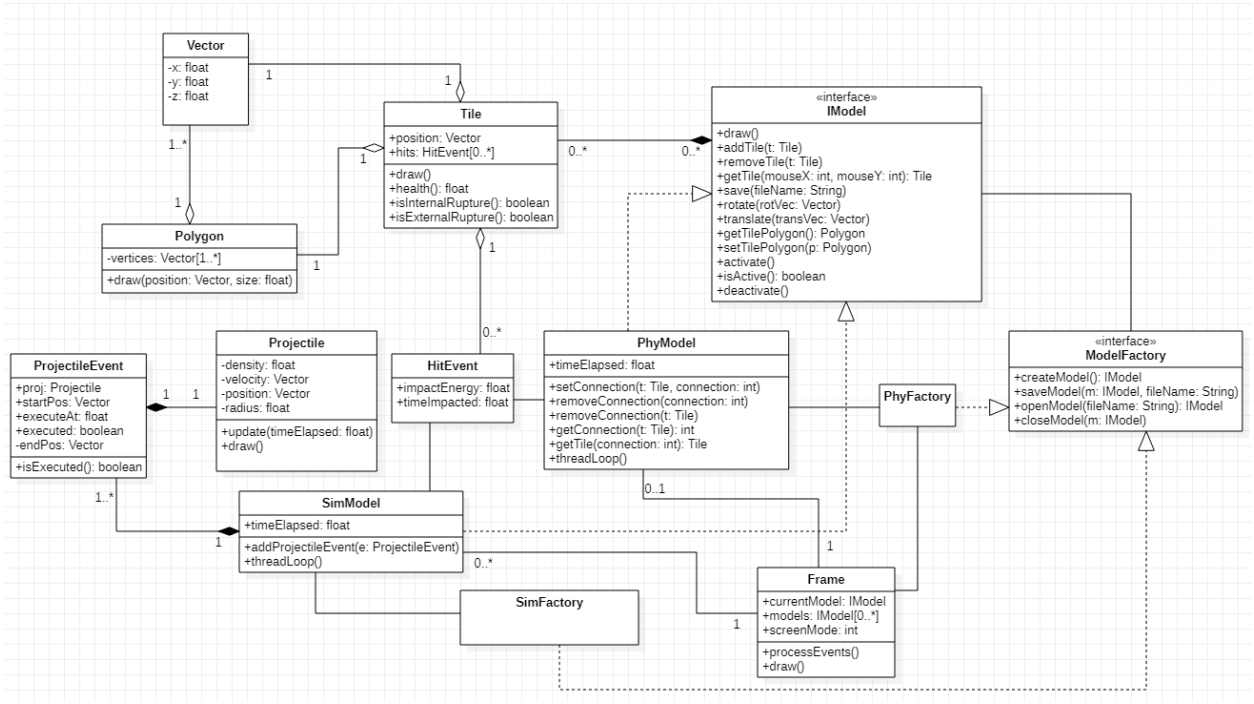

Figure 4: UML Diagram

3.4 Sketch of GUI

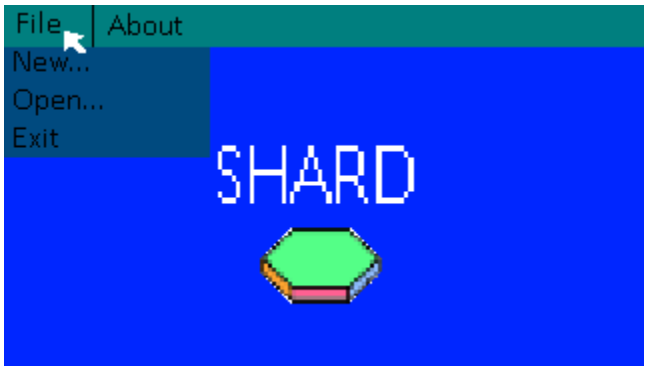

Figure 5: Welcome screen

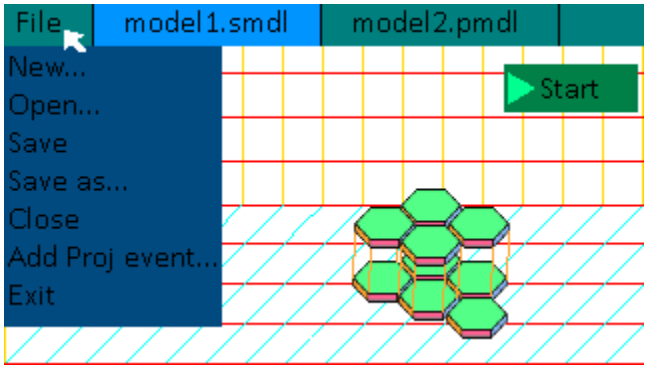

FIgure 6: Models