1.4 Targets and Metrics

After identifying the functions for our design project, each function must be assigned a target and metric. Targets are specific values used to quantify qualities of a design. Metrics are the tools used to validate those targets. Critical functions were identified from the product's functional decomposition hierarchy chart and cross reference table. Team 506 Engineers based the targets and metrics on the project scope, customer needs and the team's interpretation of a feasible target. A complete catalog of the targets and metrics for all functions can be seen in Appendix C: Target Catalog. The full Target Catalog includes the targets and metrics of both Team 505 and Team 506 to help show the overall project targets and metrics. Of our targets, the designated critical targets and metrics are essential for our project's success.

1.4.1 Critical Targets/Metrics

Table 3 shows the critical functions of the product and their assigned targets.

Table 3: Critical Functions and Defined Targets

System	Function	Target	Metric
Inputs	Identifies combustible gases	Focus on 3 combustible gases	Voltage
Inputs	Identifies volatile organic compounds (VOCs)	Focus on 1 VOC: paint thinners	Voltage
Additional	Measures gas	Read at least 300 parts per million (PPM)	PPM or volume %

	concentrations		
Outputs	Sends signal to notification system	±10%	Voltage

1.4.2 Targets/Metrics Derivation

Identifies combustible gases

This system will focus on three (3) main combustible gases. This is due to the situation of a building collapse and only being able to accessible gases to test. Propane, methane, and carbon monoxide are the main combustible gases that will be focused on. Other gases will still be detected, such as oxygen for oxygen deprivation. The sensor should be able to detect these gases if they are mixed as well. This target can be measured through the sensor and read in through a string to be serialized.

Identifies volatile organic compounds (VOCs)

The device will also read at least one volatile organic compound (VOC). The goal is to be able to detect paint thinner or any VOC that relates to a building collapse scenario. For example, any chemicals left on burning wood could be a potential VOC. This target can be measured through the sensor and read in through a string to be serialized.

Measures in the amount of gas concentration

Once the gases are detected the system will have the ability to measure the amount of gas in the air. The ability to recognize and measure the amount of gas in PPM is important to keep

the user safe. Once measured in PPM it can be compared against dangerous levels and this data will be used to save the user.

Sends signal to notification system

Commented [JN1]: Takes readings from LEL and UEL comparison to warn user if threaten. As well if gas is a VOC, it warns user

The gas detection system's ability to send signals to a notification system is a critical safety metric. It ensures that when dangerous gas levels are detected, alarms are triggered, and appropriate personnel who are wearing the device will be informed promptly. This feature can save lives and minimize the potential damage caused by gas-related incidents**.**

1.4.3 Method of Validation

To validate our targets, different methods will have to be used depending on the specific target. To validate our targets related to sensor inputs, we will expose the sensors to a known environment and compare sensor outputs to known air content. To validate our targets related to computational speed and volume, known test signals will be run through the system. Our output system will be validated through extensive testing to ensure reliability, as well as redundancy in code.

The inputs to our system are responsible for detecting gasses present in the surrounding atmosphere. A mixture of analog and digital sensors is likely to be used to detect these gases, so results will be measured via changes in voltage as well as through serial communication. Code will be written to input these signals to our computation center, where further processing will occur. To validate our input targets, we will place our sensors in a chamber with known gas content and our read values will be compared to the actual. There will be an error associated with this reading, this will be accounted for. Errors will be mitigated through various methods

including taking RMS of read values over set intervals (not to delay sensor readings), twisted pairs for wires, and any other methods that can be practically applied.

For our computational system, targets will be assessed by inputting known quantities where outputs can be validated analytically. It will be difficult to real-time validate results in this program due to the variable nature of the data, so fixed values will be needed for testing. The code will be validated in stages to ensure that errors will not accumulate. This staged validation process will be used both in testing and application stages.