1.2 Customer Needs

1.2.1 Interpretation of Needs

The CIA has partnered with the FAMU-FSU College of Engineering to develop a device to discretely relay the location of human traffickers. Joe, a government employee and point of contact, is responsible for answering any questions that are present. The customer for the device is anyone who will be using the device firsthand to locate human traffickers. It is our responsibility to design the device to our best ability under the standards and regulations that our customers require.

The questions that were proposed and answered are listed below, as well as the interpretation for each answer.

Question	Customer Response	Interpretation
Is there a specific size/weight requirement?	"No dimensions are on hand but will be researched, the smaller the better, battery size is typically the largest issue, will double check to make sure no specific dimensions"	The smaller the device, the more reliable it will be.
Is there a budget for this device?	"No one has discussed budget but would shoot for a practical, practicality is more of a driving factor than price"	Practicality, when making decisions about the device, takes priority over budget.
Should the device be tailored to any specific demographic (age or gender)?	"No particular demographic, think about how the device will be used, won't hand it directly to a trafficker"	All demographics will be considered.
Where do current human trafficking deterrents fall short?	"Battery life is one of the biggest issues, look at something that transmits in lower frequencies, could store GPS coordinates for later retrieval, depends on the target and where they are going, recent technology has	A longer battery life and lower frequencies compared to existing technologies.

	looked into Apple find my location"	
Should the device be tailored to a specific type of trafficking (Sex, labor, etc.)?	"All trafficking should be considered, big target on child and sex trafficking"	All types of human trafficking will be taken into consideration.
Should the device work without user activation?	"It can be up for discretion but would consider it being interactive because something may need to be customized later on, we love to have some control over our technology"	Control over technology is a large positive and is more reliable than no interaction.
What existing systems may we be able to utilize?	"Laura is the biggest technology right now, outside of that its mostly GPS coordinates, accelerometers are used after GPS signal is lost"	Research Laura, GPS, and accelerometers.
Should the device be designed for sale to the general public?	"I will leave that up to your discretion, one company I work with has both a commercial version and a private version"	Sales to the general public is up for discretion.
Are there specific battery requirements for the device?	"Battery life is the most important aspect of the device"	Battery life will be of very high importance in the design.
Are there any specific materials that should be used?	"As long as the materials have a wide temperature range"	Consider materials that withstand a wide range of temperature.
What type of signal should we be transmitting to reveal the victim's location?	"No specific signals, discretion can be used to decide method"	All types of signals will be considered when designing the device.
Are there any CIA regulations or codes that we should follow?	"Technically there are no codes besides they can't kill anyone"	Device is free from any specific codes or regulations.
Can we assume the user will not know how to operate the device?	"Victims will have zero interaction"	User interface will be catered towards front line human trafficking correspondents.
What temperatures should we account for?	"A wide range of temperatures is needed"	Account for all temperatures found in Florida.
Any recommendations for where to look for research?	"In particular no, we usually go to individual components"	Research individual parts, ex) gps trackers, tracking frequencies, etc.

Table 1: Interpretation of Sponsor's Answers

1.2.2 Explanation of Results

The purpose of the project is different than what Team 503 had first anticipated. The device will be used to help rescue human trafficking victims, but it is to be focused on catching the actual traffickers themselves. The victim will have no interaction with the device, meaning the interface will be catered towards the agent. Changes to the project scope will need to be made to adjust to the new circumstances.

The Central Intelligence Agency (CIA) wants to develop a device to help front line human trafficking correspondents discretely locate traffickers. There are not many explicit technical requirements, however, our sponsor emphasized the need for the device to be as compact as possible, dust and water resistant, and have ample battery life. Battery life is the most prominent issue in today's human trafficking technology and the most prioritized need. The device can utilize existing technologies but is not beholden to any certain one. Overall, the customer's priorities are battery life, tracking capabilities, and environmental resistance.

1.3 Functional Decomposition

1.3.1 Introduction

Using a functional decomposition analysis, the complex overall system of the device can be broken into subsystems and individual functions. Firstly, the customer needs are gathered and analyzed so that the required functionalities of the device can be determined. These functionalities are then categorized into separate sub systems that are required to achieve the targeted operation of the device. Performing this functional decomposition analysis organizes the function and establishes a hierarchal representation

of the operational components necessary to accomplish the project goals. The following functional decomposition was developed based on the customer needs interpreted from a conversation with the project sponsor.

1.3.2 Hierarchy Introduction and Data Generation

The customer needs, key goals, and assumptions were used to collect the data to organize the functions of the device into systems based on complexity. Every action of the device was listed in the lowest level of sub-sections, followed by consecutive sub-sections that are organized based on relationships. Figure 1 shows how each action of the device is connected to make the final product.

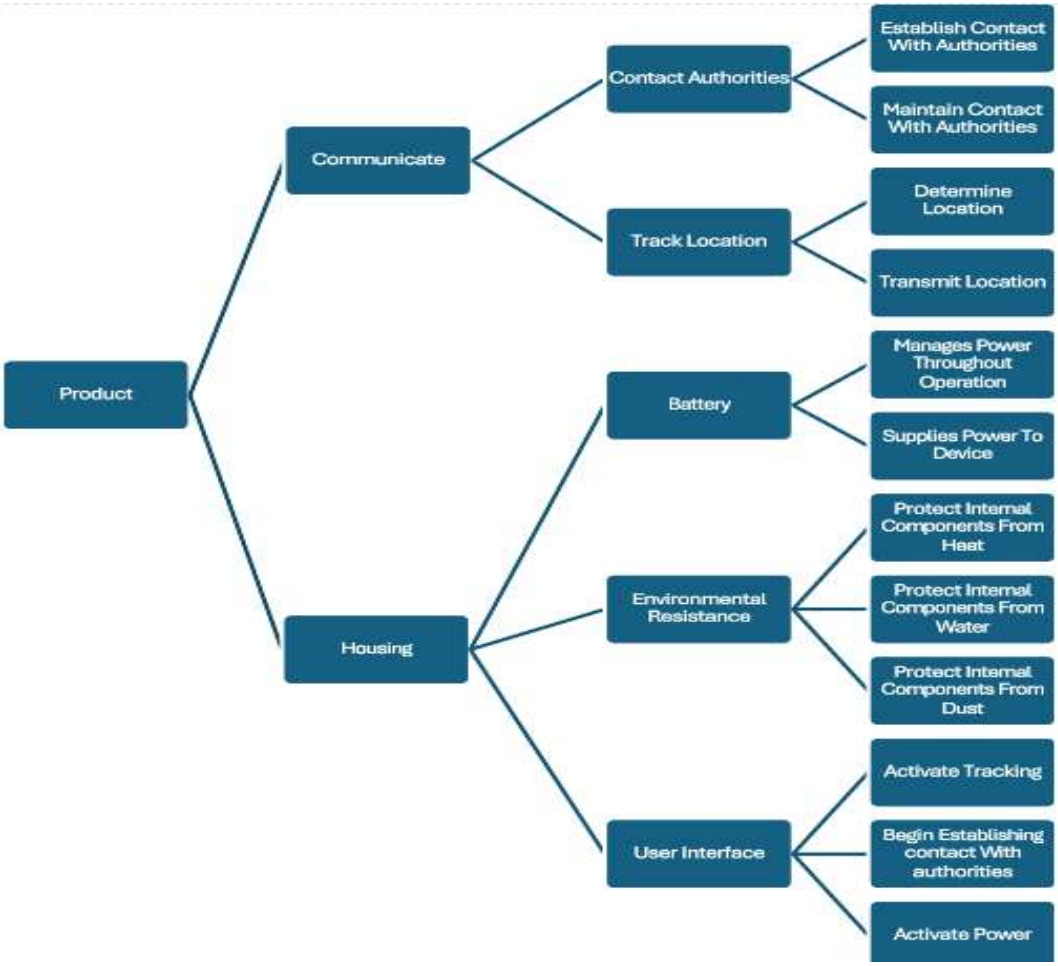

Figure 1: Hierarchy Chart

1.3.3 Explanation of Hierarchy Chart

The highest level of the hierarchy chart is the product. This includes everything in the key goals that the product is trying to accomplish.

The second level is made up of housing and communication. The device will work to transmit location to outside parties which will involve setting up a line of communication. The authorities will need to be contacted when the device has a location and is ready to transmit. Housing describes all of the components that will be enclosed within the physical structure of the device.

The third and fourth level are made up of the main components of the device, as well as the actions to be completed. The lowest level describes what the device will be doing to the lowest degree.

1.3.4 Connection to Systems

Viewing Table 2, we ended up with the following sub-systems: Contact Authorities, Track Location, Battery, Environmental Resistance, and User Interface. Each section below will discuss the priority ranks of the system and function relationships.

Contact Authorities

The sub-system of Contact Authorities has the function of establishing and maintaining contact with the authorities that have ownership over the device. It is important to establish contact with the correct signal and at the right time as time is crucial when activating the device. Contact must be maintained throughout the entire operation once the connection is established with authorities, as any location data is crucial to the operation.

Track Location

The location must be determined and transmitted as a function of the Track Location sub-system. An accurate location is vital to accurate data collected by the device; Authorities will be depending on an accurate location. The transmission of the location needs to be consistent along with the accuracy to have maximum effectiveness of the device.

Battery

The battery must supply power throughout the device and be able maintain the device's efficiency during the entire operation. Battery life should be targeted to be as long as possible due to the variations of time this device may be out in the unknown. The battery will provide adequate power to function and perform its tasks but should be conserved where it is necessary.

Environmental Resistance

The device will be exposed to all sorts of environments whether it is in use or not. It is important that the device is built to withstand any environmental conditions such as water, dust, and heat. The material may experience one or all of these conditions at once, requiring it to be able to adapt to its environment and be serviceable in any condition.

User Interface

The device may need to be activated when it is deployed, requiring the power source to turn on or increase intensity. This also includes the device activating its tracking method as well as sending out an initial connection to authorities.

1.3.5 Smart Integration

The following figure is the cross reference table which was created from the hierarchy chart. A cross reference table connects each of the lowest level actions to however many higher level systems that they interact with. The purpose of the table is to show the interactions between each action of the product.

Sub-System	Contact Authorities	Track Location	Battery	Environmental Resistance	User Interface	Total
Establish Contact with Authorities	X	X			X	3
Maintain Contact with Authorities	X	X	X			3
Determine Location		X				1
Transmit Location	X	X				2
Manages Power Throughout Operation			X			1
Supplies Power to Device			X			1
Protect Internal Components From Heat				X		1
Protect Internal Components From Water				X		1
Protect Internal Components From Dust				X		

Activate Tracking		X			X	
Begin Establishing Contact With Authorities	X				X	
Activate Power			X		X	

Table 2: Cross Reference Table

1.3.6 Actions and Outcomes

This device is intended to be deployed by law enforcement agents to track the location of potential suspected traffickers and send a signal containing that information back to the agent. The aim of this device is to help disrupt the human trafficking process by capturing location data of the suspects and relaying this data to law enforcement. The device is expected to be discreate, provide a reliable signal, and have long lasting battery compared to similar devices.

The device itself must be designed to track the location of suspects even when moving between different destinations. Therefore, the device must be relatively compact to ensure it will not be identified by the suspect. Further, the device must be durable enough to withstand a wide range of environmental conditions and maintain operation. The housing of the device should be moisture, dust, and wind resistant to prevent damage to interior components when exposed to different environmental conditions. It must also be capable of operating at high speeds in the case that it is attached or placed within moving vehicles.

1.3.7 Function Resolution

The device primarily operates based on two essential functions: activation and transmission. Its purpose is to aid in locating trafficking activities once triggered. The activation process is similar to existing technologies, enabling the device to transmit a signal to the relevant authorities. This transmission includes the location where the device was activated, as well as a tracking system that monitors the device's movement. The information is then relayed to the authorities, allowing them to track the device's location and take appropriate action to intercept the trafficking operation.

1.4 Target Summary

1.4.1 Introduction

After the functions of our device were determined, the targets and metrics were taken from the functional decomposition and the hierarchy chart. The target represents the value that each function is required to satisfy while the metric is how each of the targets will be measured. The critical targets for our device were decided based on which targets are most important to satisfy the key goals of our product. A full list of the targets and metrics for this project can be found in Appendix C: Target Catalog.

1.4.2 Derivation of Critical Targets

Targets were first determined with no priority given to importance or criticality. Then, the primary functions of the device were considered, namely, tracking and transmitting. The goals most directly related to these are considered mission critical.

Determine Location

To satisfy the need to determine location, our device will need to be within a fifty-meter range of its exact location. Determining a correct location is crucial to the device as incorrect or inconsistent readings will throw off the tracking route. A buffer to the exact