1.3 Functional Decomposition

Figure 1. Functional decomposition diagram.

Table 1 *Cross Reference Chart*

	SYSTEM				
FUNCTION	**ATTRACT**	**CONFIRM**	**RECORD**	**ALERT**	**TRACK**
ATTRACT CHILD	x				
ATTRACT TRAFFICKER	x				
ALERT AUTHORITIES				x	
ALERT PAIRED DEVICES				x	
ALLOW TWO-WAY INTERACTION		x		x	
LOCATION OF VICTIMS			x		x
RECORD VISUALLY		x	x		
RECORD AUDITORILY		x	x		
SENSE CHILD ACTION			x		
LOCATION OF TRAFFICKERS			x		x
SURVEIL		x	x		
AVOID FALSE ALARMS		x			
ALERT COMMUNITY				x	
MEASURE INPUT		x	x		

Explanation of Results

The goal of this project is to save an endangered child that is in the process of being transported by a trafficker. In order to reach our goal, several systems and functions had to be defined. As a group, we came up with the following systems: attract, confirm, record, alert and track.

The systems of our device were able to be broken down by basing the necessary systems that the device must meet off the customer needs. For an example, the experts that were consulted for the customer needs emphasized that surveillance cameras were very useful in trafficking cases. For this reason, one of the systems that the device must meet is to record the moment: be recording visually, auditorily, or sensing action.

As seen in figure 1, the goal of this task was broken down into separate systems that must be met in order to reach the goal. These systems were broken down into functions that will allow for the systems to be satisfied. Table 1 shows the relationships between these functions. As seen in table 1, certain functions can be used to address several systems at once.

The first system our device should meet is attract. The device will need to have the ability to stand out in a very discrete way for a child to approach the device and ask for help (by using the device as a communication tool). This function is imperative so the child can access the device to use it to save themselves. We want to attract the aggressors so they can bring the child close enough to the device, thus helping the child see the sign so they can interact with the device.

The second system of our device will be confirmation. The device may be subject to false alarms for many reasons. In order to maintain the legitimacy of the device and ensure the device will not "cry wolf" to the local authorities, the device will need to have the ability to confirm the legitimacy of the situation.

The third system of our device will be to record. The device will need to have the ability to graphically or audibly record the victim or the trafficker to make identification of those involved possible. This system will allow the authorities identify the victims and traffickers.

The fourth system of our device will be to alert. The device will alert the authorities of the situation, as well as any paired devices.

The final system of our device will be to track. If the victim or the trafficker leave the location of the device before help gets there, we will need a way to track their movement. This function could be implemented using several different types of technology.

Connection to Systems

The "Attract" and "Track" systems of this functional decomposition are the top priority of the system, since they can only be met with two functions, making them most pivotal to meet at least one of their functions. The device should be able to attract the trafficker and child in a very discrete way. Similarly, the device must track the location of the child or aggressor. The "Alert" system is the next most important system, since it can be met with four functions. The device should be able to alert authorities, alert paired devices, allow for two-way communication, or alert the community. The "Confirm" system is the next highest in priority, because it can be met with six functions. The device should be able to confirm the situation by two-way action, recording visually, recording auditorily, surveilling, avoiding false alarms, and measuring input. The "Record" system is the lowest in the priority ranking, because either can be met with seven functions. The device should be able to record visually, auditorily, surveil, measure input, locate the child, locate the trafficker, and sense child action. Since the top systems of this project are attract and track, the device must, in some way, attract the trafficker and child and track the child in some way.

Some functions work together to meet several systems. For an example, allowing two way interaction can help to confirm the legitimacy of the situation as well as alert people of the situation.

There is a relationship between alerting authorities and allowing for two-way communication, a combination of which can be used to communicate the dangerous situation. Similarly, there is a relationship between attracting the child, attracting the aggressor, and influencing the child to interact with the device. The combination of these functions can be used to lure in the child to interact with the device. The device should meet the objectives of attracting the child or trafficker to locate near the device, confirm the urgency of the situation, record the situation, alert the authorities, and track the child or aggressor once the leave the device.

Smart Integration

As shown in Table 1, the "Record Visually" and "Record Audio" functions can be integrated into the "Confirm" and "Record" systems. This is based on the idea that our solution could be able to send recordings to authorities to confirm the legitimacy of a situation. Our solution could potentially be able to "Alert Paired Devices" in the "Track" system by having all devices synced so that when an event happens and passes the filtering in the "Confirm" system, the synced devices will be able to alert the community or authorities in the "Alert" system. The "Allow Two-Way Interaction" function can be integrated in the "Confirm" system by permitting the device to receive direct input from the child which would then be sent to the authorities and community in the "Alert" system. The "Attract Child" and "Attract Trafficker" function collects the signal of both the victim and trafficker in the "Record" system, filters it through the "Confirm" system, then relays that to authorities and the community in the "Alert" system. The "Record Auditorily" and "Record Visually" can be utilized in the "Record" system by organizing the information collected and then sending that to the "Alert" system where it will reach the authorities.

Action and Outcome

For our goal to be accomplished and our project to be successful, it is imperative that our device executes these five systems. The device must first attract our intended targets. The device will need to attract the aggressor in whichever way possible (i.e vending machines), allowing the child with the aggressor to locate closer to the device. Then by using a discrete method we need to attract the child as well, and catch their attention without the aggressor noticing. The child will be able to interact with the device. Through directed instruction, the child will be able to communicate with the device by performing an intended motion or, if the child is comfortable enough, allow them to have two-way communication through the device. This will trigger the device and immediately begin the confirmation process. The device must confirm if the situation is real or if it is a false alarm. If the device begins to have a reputation of reporting false alarms, it will ruin the legitimacy of the device and the relationship with the local authorities. Through this entire process, the device will be recording the whole scenario. Whether it is through auditory means, recording any conversations with the child and the aggressor, the aggressor alone, or the child once they have become in contact with the device. Similarly, visual means will allow for the device to capture images and video of the scene in order to identify the victim and the trafficker. Using the information gained from the recording and after confirming if it is a legitimate situation, the authorities and any paired devices will be immediately alerted. Once the authorities have been alerted, the device must track the child or the trafficker. In the case that the child leaves the scene, the device will have the ability to track the child or trafficker for the authorities to find the child

Function Resolution

After examining the different systems - attract, confirm, record, alert, and track - these systems were deemed necessary to be able to reach our goal of saving a child from being trafficked. Attract plays a big role because the device could potentially be able to not just attract the child, but also the trafficker. This device has to appeal to the child in a discrete manner, yet not seem suspicious to the trafficker in order for the child to seek help. This system is tied for the most pivotal because it can be met with the fewest functions.

To confirm, we want the device to be able to assess the situation and make sure it is not a false alarm. Once the device has assessed the situation, the device can alert the authorities and the community. The recording system ensures that information will be gathered on the child and/or trafficker for the authorities to be able to save the child. All the information would be gathered by recording visually or audibly -- that will be determined later in the prototyping process.

For alert, the device will trigger once the information is gained from the recording and after confirming if it is a legitimate situation. The device will then alert the authorities and any paired devices.

Tracking is a very important system because it can help to not only save the child, but also help identify the tracker for police records. The tracking system can be utilized within the device by implementing some sort of technology that will allow for the child or trafficker to be tracked. This system is tied for the most pivotal because it can be met with the fewest functions. Ultimately, these five systems will help our device reach our goal of saving a child from being trafficked.