Functional Decomposition

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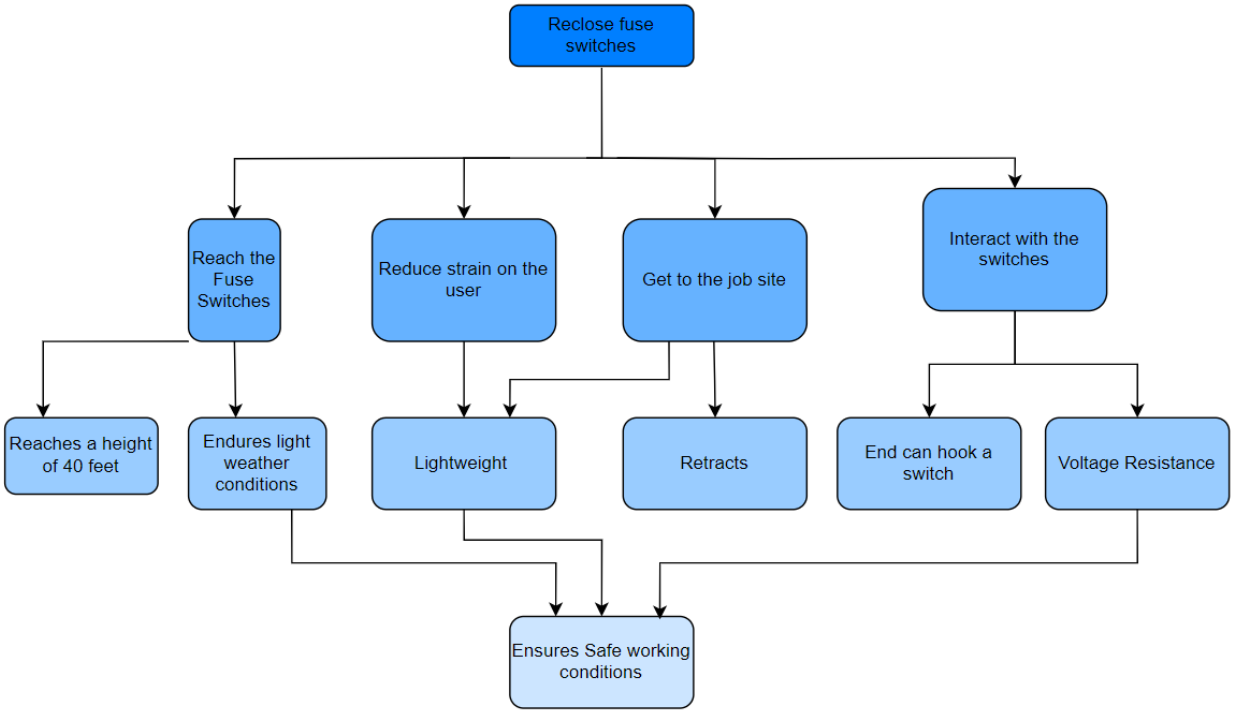
Functional decomposition is an approach used to break down detailed processes into much smaller tasks and understand in the most simple way what a product must do. Unlike task analysis, it doesn't involve a step-by-step sequence. Instead, it begins with the task that the product aims to accomplish. In this case, functional decomposition is being applied in order to redesign the device that is used to close overhead fuse switches in storm restoration situations. It doesn't suggest specific solutions or elements, but reveals how the different subsystems interact to create the solution that solves the problem. Functional decomposition can also reveal features that can be implemented to improve an area that wasn't initially considered, enhancing the overall project.



After initial discussions with our sponsors establishing the scope of this project, we were able to determine the projects' preliminary requirements. With these requirements defined, we translated them to set an upper limit of specifications as to not limit the possibilities of the

design. We concluded that any design with a retractable length of greater than 15 feet and anything excessively heavy to be unreasonable for any design capable of fulfilling our sponsors' needs. In doing this, we limit extravagant time expenditures without compromising overall design potential.

During meetings with our sponsors to determine the customer needs we were able to understand the root task that needs to be accomplished; to close fuse switches that are being replaced or have been opened. This starts with our device being able to reach the fuse switches by arriving at the job site. Poles can be located in areas with vegetation and no road access, so it is necessary that the device can be transported to the location of the poles. The fuse switches are located at the top of the poles that can be up to 40 feet high, and the design will have to reach these heights to close them. Oftentimes, the switches need to be replaced as a result of storm conditions, so the design must be able to handle some weather conditions so it can be used for storm restoration. The sponsors and subject matter experts also expressed how physically strenuous the current method of closing the switches is because of the lack of leverage over the end of the pole that is 40 feet away when fully extended. Due to this, we want to use leverage more efficiently to make the device easier to control for the user.

By having a solution that is retractable, we create a more compact and easy to transport package that can still reach switches that are relatively high to perform operations on them. Our solution must be able to endure light weather, including some wind and rain in order to reach the site at which work is being done and perform operations in the field. Our solution should use leverage, so we can close the switch while reducing strain on those using our device. Our solution should be lightweight so it can be easy to transport and carry to a site where work is being done, while still being durable enough to endure some weather conditions. Our device

should have some level of voltage resistance so that the operators of the device are working under safe conditions. Our device shall also have a hook attached to the end so that it can reach the switch and interact with it in order to perform reclosing.

Cross-Reference Table

	Major Systems				
Minor Functions	Reach the fuse switches	Reduce strain on the user	Gets to the job site	Interact with the switches	**Total**
Retracts	X		X		2
Endures light weather	X				1
Uses leverage		X			1
Lightweight		X	X		2
Voltage resistance		X		X	2
End can hook a switch	X			X	2
Total	3	3	2	2	

Connection to Systems

The main systems in the project can be ranked by the number of functions they connect to. By looking at the cross reference table, the most important systems are the ones that allow the device to reach the fuse switches and reduce the strain on the user. The functions that fall within reaching the fuse switches include getting to the height of the switches, enduring the weather, and hooking the switch itself. To reduce the strain on the user, the device must resist a level of voltage, be lightweight and take advantage of leverage. The systems with slightly less

importance in terms of functions are arriving at the job site and interacting with the switch. This does not mean these systems are not important, but rather that there are less tasks required for this system to function as intended.

Smart Integration

There are multiple functions that overlap between other systems, which only signifies their importance. The device being lightweight would reduce the strain on the user, but it would also make the device easier to transport to the job site and likely very efficient as a result. Enduring light weather conditions would allow the device to reach the fuse switches, but it would also allow for easier transport to the job site and reduce strain on the user because it may not need to be stored in a heavy case or be constantly maintained.

Action and Outcome

Figure 1 shows the primary systems of the project. Each system has subordinate functions that allow for the system to operate. Consider subordinate functions as actions and primary systems as the actions' outcomes. To reach the fuse switches, the device must reach the heights that the fuse switches are located at and endure the conditions of the surrounding area. To ease the strain on the operator of the device, the device must take advantage of leverage and be lightweight. The device also needs to arrive at the job site, and so it must be light and small enough to fit into the work trucks that will transport it to the site. Lastly, to interact with the switches, it must hook the switch and have some level of voltage resistance.

Functional Resolution

Implementing a design that makes reclosing switches easier and more efficient is influenced by many factors. By breaking down the main task into reaching the switch, reducing the strain on the user, interacting with the switch, and arriving at the site, and then breaking each of those down into smaller tasks, the process for the design becomes much more approachable. This is because there are no restrictions on potential designs, and the design team can focus on the functions that need to be accomplished and use creativity to approach the project.