In this document we will explore decisions we made during our project, how they were made, what their impacts were and how negative aspects of these decisions could have been prevented. Our first major decision was on how to start. We met with the sponsors for this project and they vaguely expressed what they wanted for this project. Using the skills gained from our designs concepts class we managed to accurately translate the needs into requirements that are exact and measurable. This helped us make our initial design much more accurate than otherwise it could have been. We have not made any fundamental changes to these requirements that we first made as they are a strong base and still hold after other changes and ideas have affected the project. Our sponsors were very satisfied with this design which leads us to agree that we made a very solid base with the correct decisions from the start. There are ways to improve as not having many restrictions made coming up with a design easier. However, if there were more restrictions there would have been more problems with coming up with the design, and would have required more effort and research to solve the problem.

A second decision we could have improved upon was finding and ordering the correct parts, due to insufficient knowledge and incorrect calculations we ordered parts that were not compatible with each other causing us to order new parts which took more time and effort to arrive. Even though we had used our learnings from classes of photovoltaics on aspects such as components compatibility, area of the solar panels vs umbrella area, and circuit voltage and power consumption, we still made mistakes while ordering the parts. We were not effective at using our knowledge for this aspect. Because of this, we were more careful when considering details and dedicated more time to research and to organize plans so this mistake does not happen again. One of the reasons why our decision was suboptimal was due to miscommunication which caused us to rush decision making in order to be on time making us skip over details.

On the third instance, we could have improved the ordering of required parts ahead of time and some replacement parts in scenarios where our parts do not arrive. Major parts of our project such as solar panels and lithium-ion batteries did not arrive or arrived late due to supply chain issues and delivery problems which made us use parts that were not efficient enough to produce the results we initially planned for. The lessons we learned from our class on design concepts that could be used to make this decision always leaves room to fix unexpected errors in this case order parts in advance and have a plan B if something does go wrong as well as be flexible with the constraints we put upon ourselves.

The fourth major decision we made was on how to test the circuit. Since our parts came in at different times we tested each component separately first to get a better understanding of each component in the meantime. Once all parts came in, we were able to combine all the previous tests such as testing the extender range with a hotspot and checking to see if the solar panels were charging the battery. Individually testing then the circuit as a whole allowed us to make sure each part functioned properly and learn the limitations of our design. We used prior knowledge from our previous lab classes such as ECE Tools Lab and the Circuits II Lab, to determine what tests we should do. We also learned how to use instruments like the multimeter to measure the voltages and currents across different points in the circuit. The downside to this decision was with limited replacements we could not risk pushing the limits of the design as we had the risk of parts malfunctioning or the battery running out and having no way to charge it. Next time, with the unused budget we could push the design to the fullest extent to develop other potential improvements and testing without having these concerns.

The fifth major set of decisions were on developing the circuit. The circuit consists of four PV panels in a parallel configuration with diodes in between each panel. The panels are directly connected to a solar charge controller. The solar charge controller connects a lithium-ion battery to the panels and to the rest of the circuit. The rest of the circuit consists of three USB ports and a 12V-5V voltage converter connected to a Wi-Fi repeater. The classes used to form the circuit are electronics and photovoltaics. This circuit was what was originally intended to be built, but the PV panels never arrived, so a new circuit had to be developed. Using a solar panel that was given to us a completed circuit was able to be built. Based on the panel’s specifications new requirements for the solar charge controller and the battery can be chosen. We effectively used our knowledge from these classes to correct our design regardless of what components we had. With our calculations the designs matched our expectations after testing.

Lastly, a major area of this project was the WiFi architecture for the umbrella. We used our knowledge from computer networks and micro electronics to choose our WiFi repeater. We effectively estimated the data rate and range for the repeater as well as the configuration that we should do for it. We also knew how to bypass the AC to DC converter because of these classes to power and work with our circuit.The outcomes were what we expected. Our repeater is effective for our proposal but has some problems if it is implemented on a great scale. To increase scalability, we could have changed the repeater for multiple other devices that could have improved the design. These other devices also have their disadvantages but could have made our design a more solid proposal if we implemented it with more time.