Contextualization

● ● ●

Sddec24-01

Faculty Advisor: Matthew Nelson

Project Overview:

- Create a project with a balloon that flies high up to collect data and record videos from near space.

- Work together with H.A.B.E.T. and other groups.

- Our aim is to get clear videos from up to 30,000 meters using software defined radios.

- We need to keep an eye on power use and how heavy the payload is.

Journey Map

- The journey map provided valuable insights into the user experience and helped us identify key touchpoints and pain points throughout the payload deployment process.
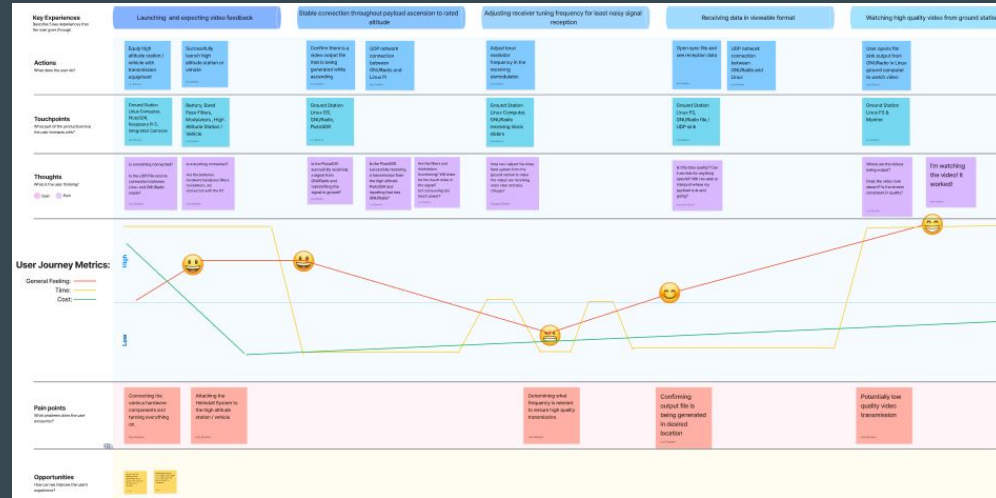
Pros/Cons Table

- This analysis allowed us to systematically evaluate the advantages and disadvantages of different design choices, aiding in informed decision-making.

	GNU radio (only software)	Simulink(only software)	Fully Analog Radio (Only Hardware)	Hybrid Analog and SDR(GNU Radio) (Our Solution)
Pros	-Accessible and well-supported. Others will be able to use it and make adjustments in the future. -Easy to make changes in the system via software	-Many students are already familiar with the interface and blocks -adjustments easily made to processing	- Cheap and widely available at most hardware suppliers -tested and well-defined by amateurs and professionals alike due to a long history -due to defined parameters, there is no guessing on functionality	-combines the robustness of analog with the flexibility of SDR. -Will allow us to make changes to processing while also using hardware filtration and amplification if necessary.
Cons	-requires background knowledge that most will need to learn. -adds complexity to the system	-unreliable license access from the university -adds complexity to the system	-little to no variability due to hardware limitations vs software. -Requires knowledge of hardware specifications (small electronics, controls, PCB design, power systems, etc)	-adds some complexity to the system -forces team to divide attention between different areas of focus

Technical Complexity Analysis

- By assessing the technical complexities associated with each subsystem and component, we gained a deeper understanding of the challenges and considerations involved in implementation.
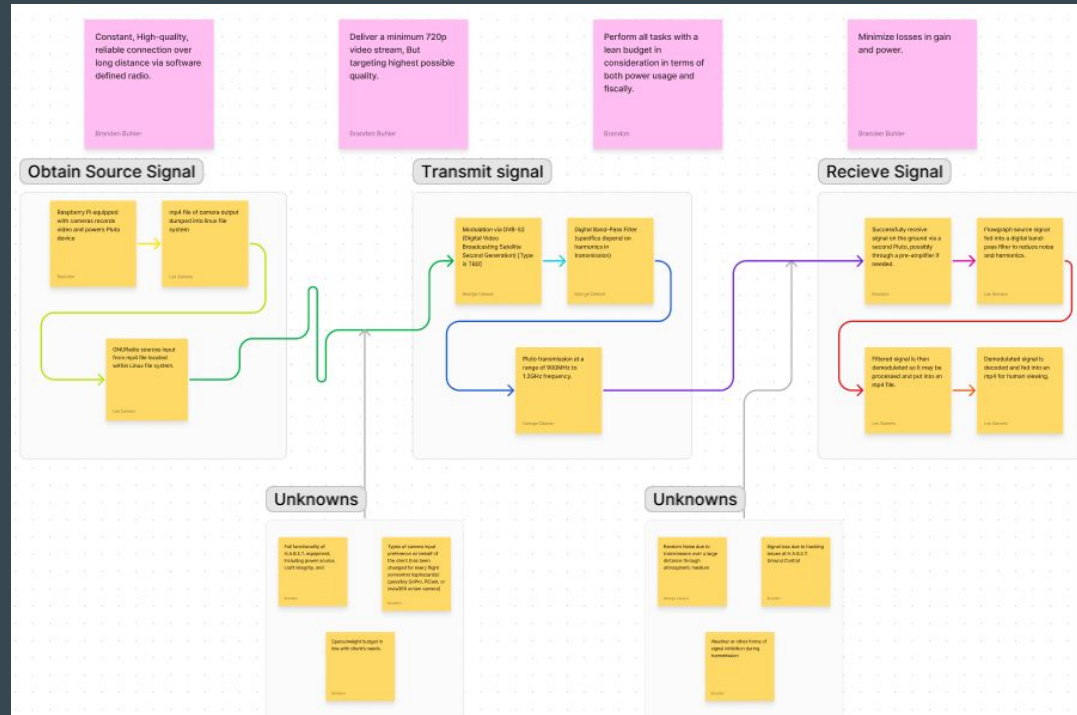
Human:

- Current solution addresses user needs sufficiently.
- Improvements could involve enhancing user interfaces and providing clearer operational instructions.
- Incorporating user feedback and refining design accordingly would ensure better alignment with user expectations.
- Offering customizable features would enhance solution versatility and usability.

Economic:

- Our solution improves upon existing solutions by offering flexibility, modularity, and functionality.
- Drawbacks may include initial investment required for development and testing.
- To mitigate expenses, we could explore collaboration or sponsorship opportunities.
- Continued refinement and optimization could further enhance cost-effectiveness and performance.

Technical:

- Internal complexity arises from the integration of multiple subsystems, such as the Pluto Board, Raspberry Pi, and SDR, each with specialized functions.
- External complexity stems from advanced signal processing techniques and radio communication protocols.
- This showcases our team's expertise in hardware and software integration, signal processing, and radio communication systems.
- Our ability to navigate these complexities effectively demonstrates our developed expertise.

Conclusion:

- Journey maps, pros/cons table, and technical complexity analysis provided valuable insights and guidance throughout the design process.
- Our current solution adequately addresses user needs, with potential improvements in user interface and operational clarity.
- Our solution improves upon existing solutions by offering flexibility, modularity, and functionality, albeit with initial investment considerations.
- The internal complexity of our design is justified by the integration of multiple subsystems, showcasing our team's expertise in hardware and software integration.
- External complexity arises from advanced signal processing and communication protocols, demonstrating our proficiency in navigating complex engineering challenges.