

Design Mockup

Interfaces

Hardware

- Switch to turn hardware system (Jetson PCB, and Cameras) on/off
- Button to start recording
- LED that shows power status, another LED for recording status (if recording is in progress)
- SD card to store video and transfer from Jetson to computer for viewing

See Hardware Internals image in Draft Schematics for sketch of interfaces (LED and button for recording on Jetson, power switch on battery, power LED on PCB)

Software: 3D application viewer, provided by SmartSystems Lab

- SD card with 3D video must be available
- See Storyboards below for example UI

Software application connects to the SD card reader. The user can input an SD card, and then will interface with a recorded video that has already been stitched into a 360-degree video format. In the software, the normal video viewing options will be provided as well as drag-around features to allow for viewing of different parts of the 360-degree recorded video footage.

Systems

Camera System:

- 6 total cameras output video stream of different angles
- Connected over USB protocol to USB Hub/Controller on PCB

Custom PCB: USB Hub/controller:

- Combines 6 input USB data lines (from cameras) into 1 output USB
- Output USB connects to the Nvidia Jetson through USB protocol

Nvidia Jetson:

- USB driver to decode and merge raw data from the multiple streams from the USB Hub
- Processes video data into single stitched video
- Outputs data to SD Card

- Software: Looks in /dev/input for video data
Uses openCV library SIFT for feature matchup in order to stitch the images
Saves stitched output on SD card in /dev/input

Power System:

- Provides consistent battery power to the cameras and Nvidia Jetson.
- Power routed through the PCB to power cameras over USB

Viewer Application, provided by SmartSystems Lab

- Interfaces with SD card data received from Nvidia Jetson
- Runs on external computer
- Allows for viewing of Stitched 3D video with video panning

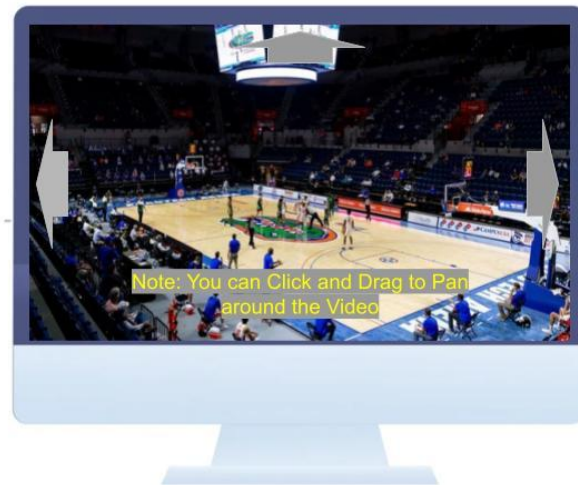
Networking

- All hardware systems communicate with USB protocol.
- Data saved on SD card for transfer computer
- A stretch goal is to have the stitched video streamed to the computer without the SD card. This could be done with an HDMI connection

USB Protocol

- NVIDIA Jetson - Single Error Correction, Double Error Detection
- USB Cyclic Redundancy Checks (CRC) - Error detection which can allow for corrective action. This code detects changes in data after each packet. When an error is found, the USB does not acknowledge the data was received.

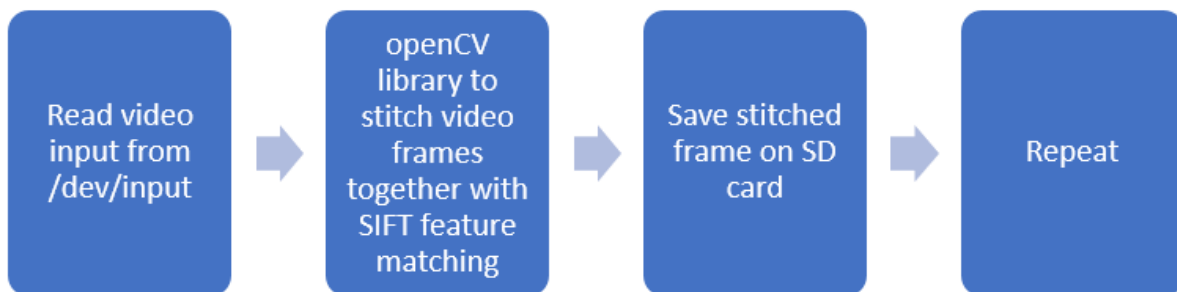
Storyboards



Virtual Experience Viewing Application

This Application will read from SD Card and Display Stitched Video with ability to pan around. Otherwise, our project does not have user input/interaction for the stitching software.

Stitching software program flow:

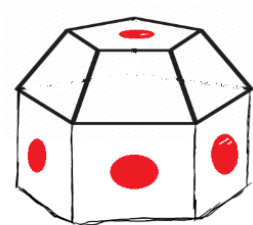


Draft Schematics

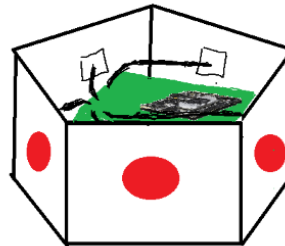
External Appearance and Housing



360 Camera on Stand (Actual Look)

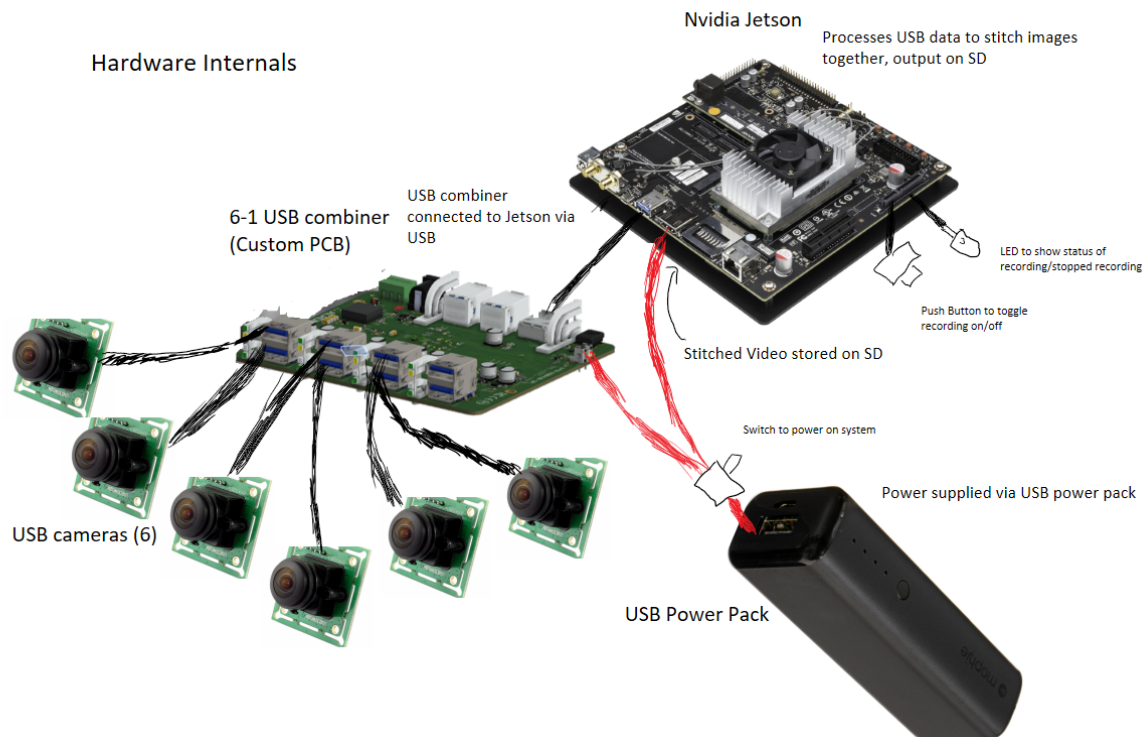


360 Camera with lid removed exposing PCB and Jetson (top camera not shown)

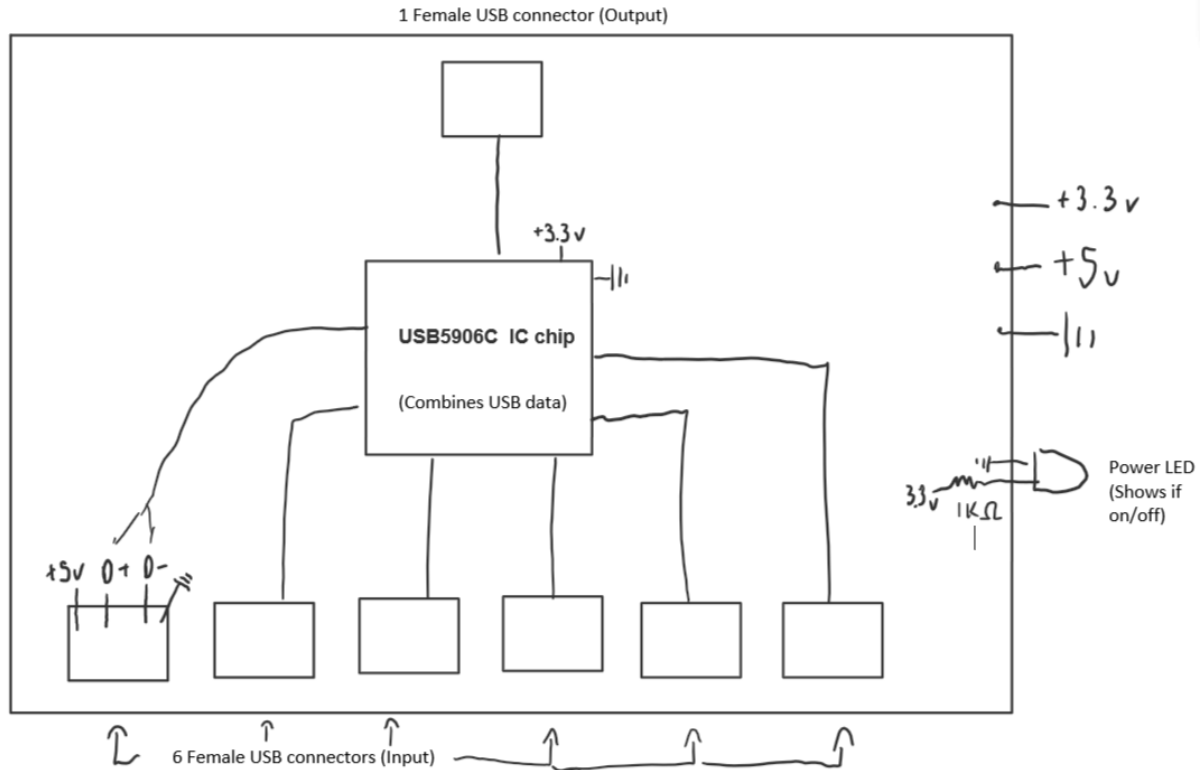


360 Camera External Shape (Red circles are cameras):
6 Cameras (1 on each vertical face, 1 on top face)

Hardware Internals



Custom PCB for 6 to 1 USB combiner



Hardware Options (Tentative)

Possible USB hub controller chip: **USB5906C** from Microchip Technology.

- [Datasheet](#)
- [Purchase Link](#)
- Specifications:
 - 6 USB type A downstream ports (connected to cameras)
 - upstream port (interfaced with jetson) compatible with USB type A, B, or C connectors
 - USB 3.1 Gen 1 compliant 5 Gbps, 480 Mbps, 12 Mbps, and 1.5 Mbps operation or USB 2.0