Sdmay19-42

Quadcopter Cameraman

Aamid Ahbab - Alex Nicklaus - Isaac Holtkamp - Luke Rohl - Nate Allen

Client: Aamid Ahbab

Advisor: Zhengdao Wang

Problem

The problem that we are trying to solve is that the Descarga Latin Dance Club on campus is having difficulties recording themselves and other members during performances. The main issue is that a camera man can be obtrusive on a dance floor and get in the way of the dancers themselves or other dancers that may or may not be on the floor at the same time. We also wanted to provide a more dynamic approach to recording dancers. Most dances involve moving across the dance floor and will make a stationary tripod less optimal and result in a poorer quality video. To solve this issue our client has hired us to design, build, and program an autonomous quadcopter. This quadcopter will be able to identify the target dancers and follow them around at a preset distance.

Scope

The objective is to build a camera drone capable of maneuvering and keeping multiple people within the frame. To minimize externalities, we have set the project in the context of a dance performance. Target tracking and following are our primary goals. Performance and stamina come secondary. The drone should be able to follow the lead dancer at all times. The second dancer should be in frame whenever possible. As for performance, the drone should react quickly enough to create a seamless and effective recording of the dance. In terms of endurance, the drone should be able to maintain flight for the extent of the dance, a maximum of 5 minutes. The types of dances include swing, west coast, salsa, and bachata.

Intended Use

As for performance, the drone should react quickly enough to create a seamless and effective recording of the dance. In terms of endurance, the drone should be able to maintain flight for the extent of the dance, a maximum of 5 minutes. The user will record a session of a performance for up to 5 minutes. The drone will be robust enough to record a variety of dance styles including swing, west coast, salsa, and bachata.

Functional

-Computer Vision sees target, that information is interpreted by Flight Controller to dictate drone's behavior

-Computer vision can track Multiple Targets Simeoultaneously

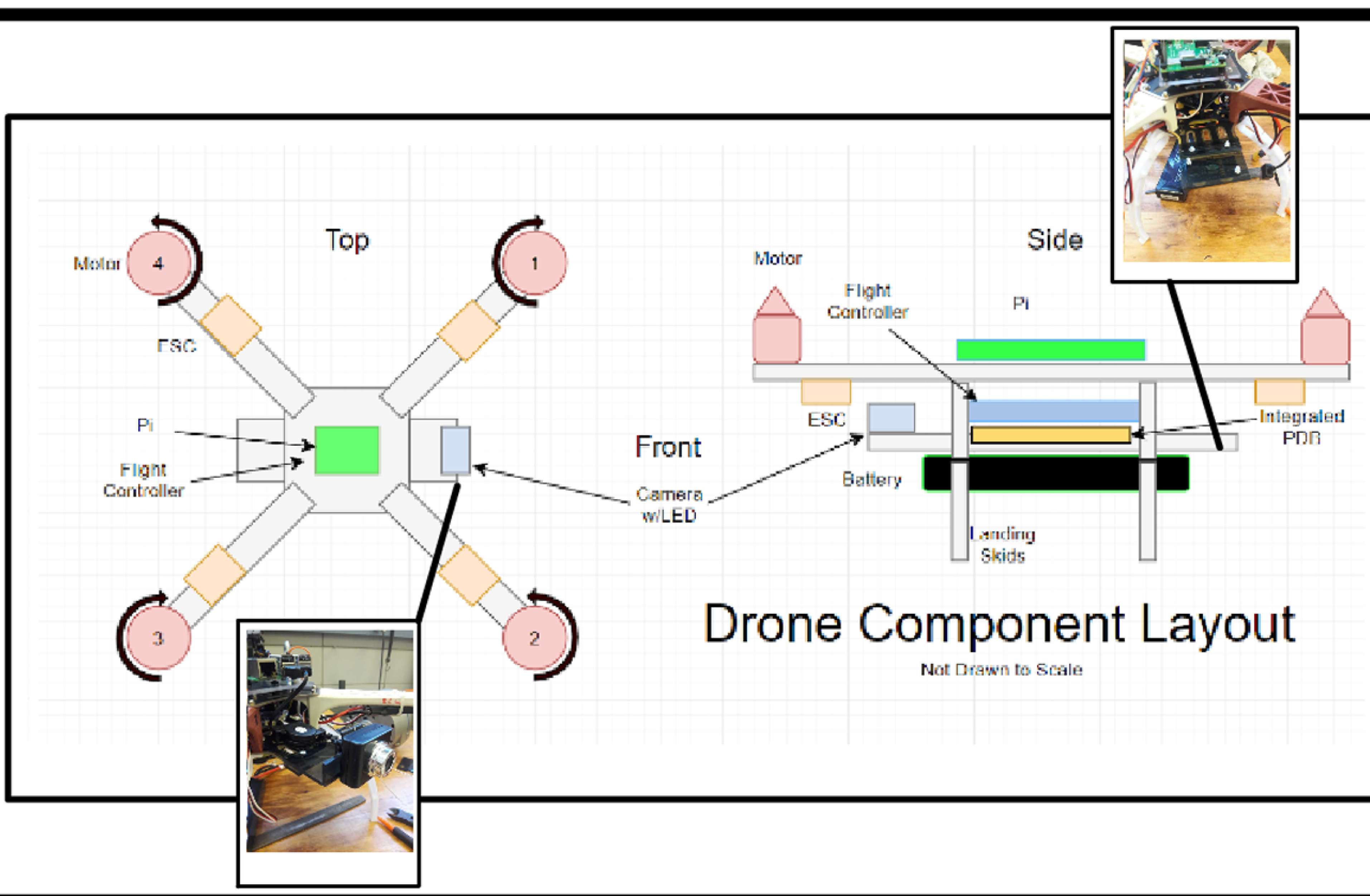
-Video is recorded during flight and uploaded to a repository for the user to retrieve

Non-Functional

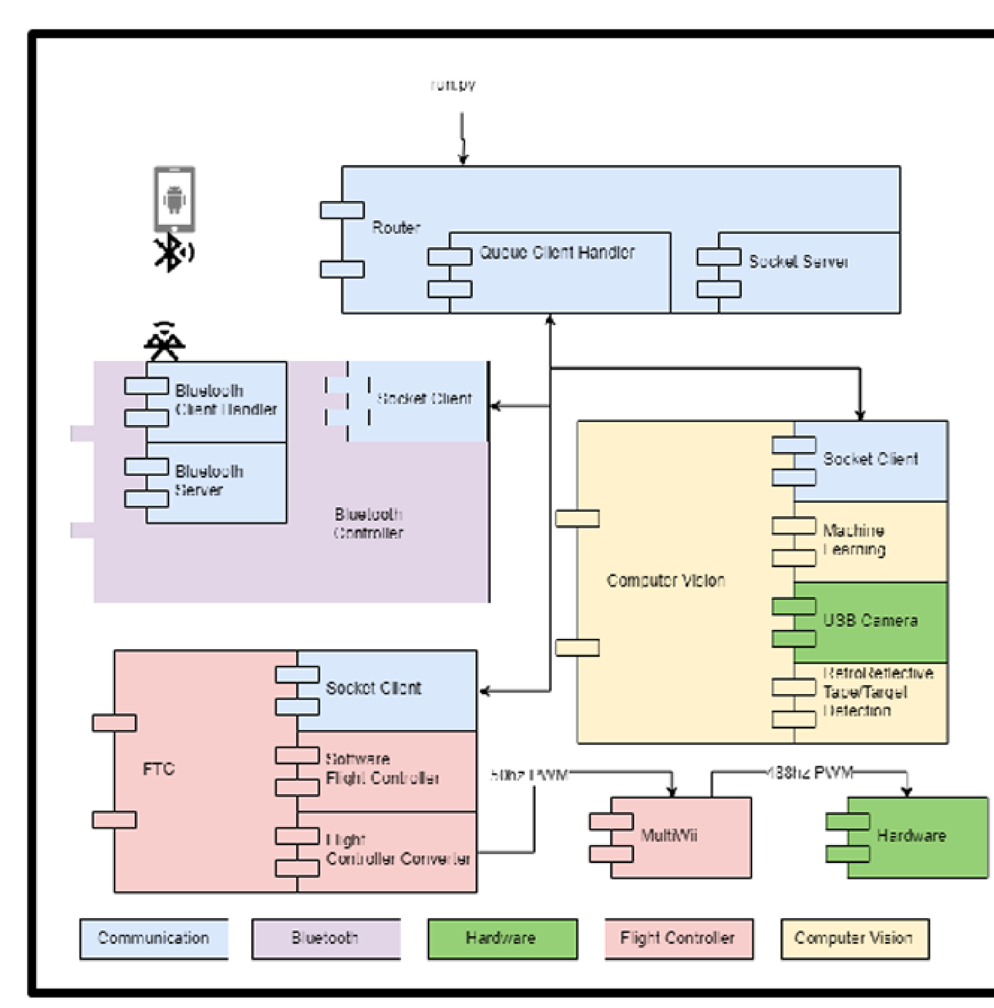
-Flight time of up to 5 minutes
-480p Video Quality
-It is imperative that the drone maintain connection with the app. Losing connection almost inevitably means crashing the drone.
-The drone must be responsive enough to keep the target in frame

Project Constraints

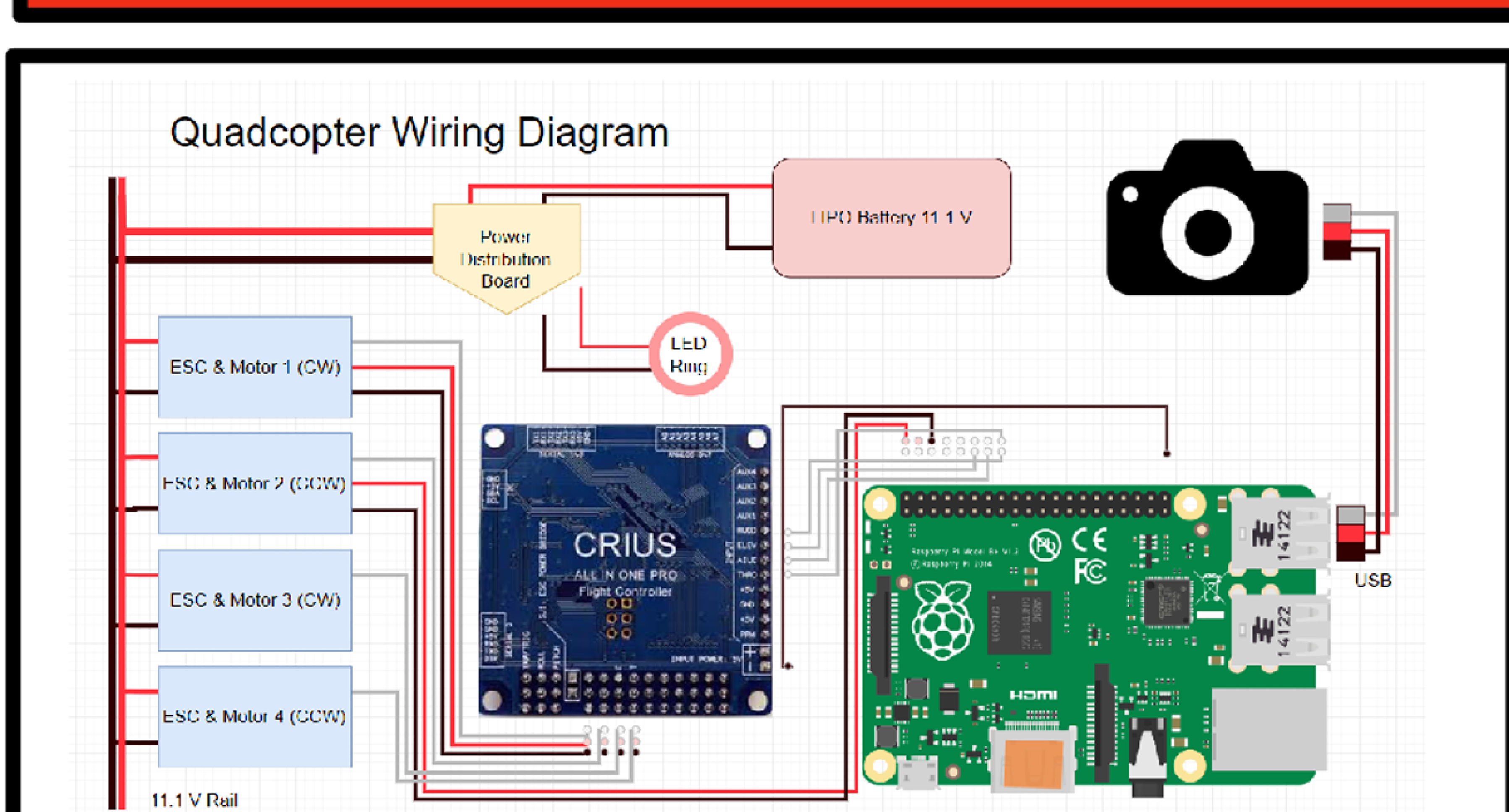
-Budget of $550
-Time Window combined with the need to learn and understand new technologies and how to integrate them



The software must interface with all of the hardware modules, capture video, process images for target recognition, and compute an adaptable course of action through artificially intelligent algorithms. This will require a number of independent threads to monitor each of the separate modules. The AI will rely on the router module to handle all inter-thread communication.



General Design



Our project design uses an autonomous quadcopter equipped with target tracking software to follow dancers during a performance. Additionally, the quadcopter interfaces with the user through a phone app. Computations will be done on a Pi mounted on the drone which will feed information to the Flight Controller. The Flight Controller is a component normally found on drones it interprets commands from a wireless transceiver, which receives commands from the user/remote control, and translates them into a signal it sends into the ESCs (Electronic Speed Controllers). The ESCs control the amount of power sent to the motors from the battery. Each motor has its own ESC and each ESC has its own connection to the flight controller; our design has four motors thus four ESCs. By having seperate connections the flight controller can control each motor speed individually allowing the drone to execute complex maneuvers such as banks, turns, and flips. In between the battery and the ESCs is a power distribution board which acts as a node to all four ESCs. The drone will use a camera, sonar, and flight controller's on board accelerometer as sensors for flight control. The Pi, camera, and sonar sensors have a seperate power source. Figure 2.6.1 below shows a conceptual sketch with wiring.