Cloud Control

Design Review

Team

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- Project Lead, Audio Streaming

Anna Lee

- Audio Processing

Reed Taylor

- PCB Design, Audio Streaming

Brent Morada

- Wireless Communication

Project Vision, Applications

- Crowd control system using a drone equipped with a speaker
- Relay important messages to a target audience without being physically present
- Perfect for emergency situations where the target is difficult to reach quickly

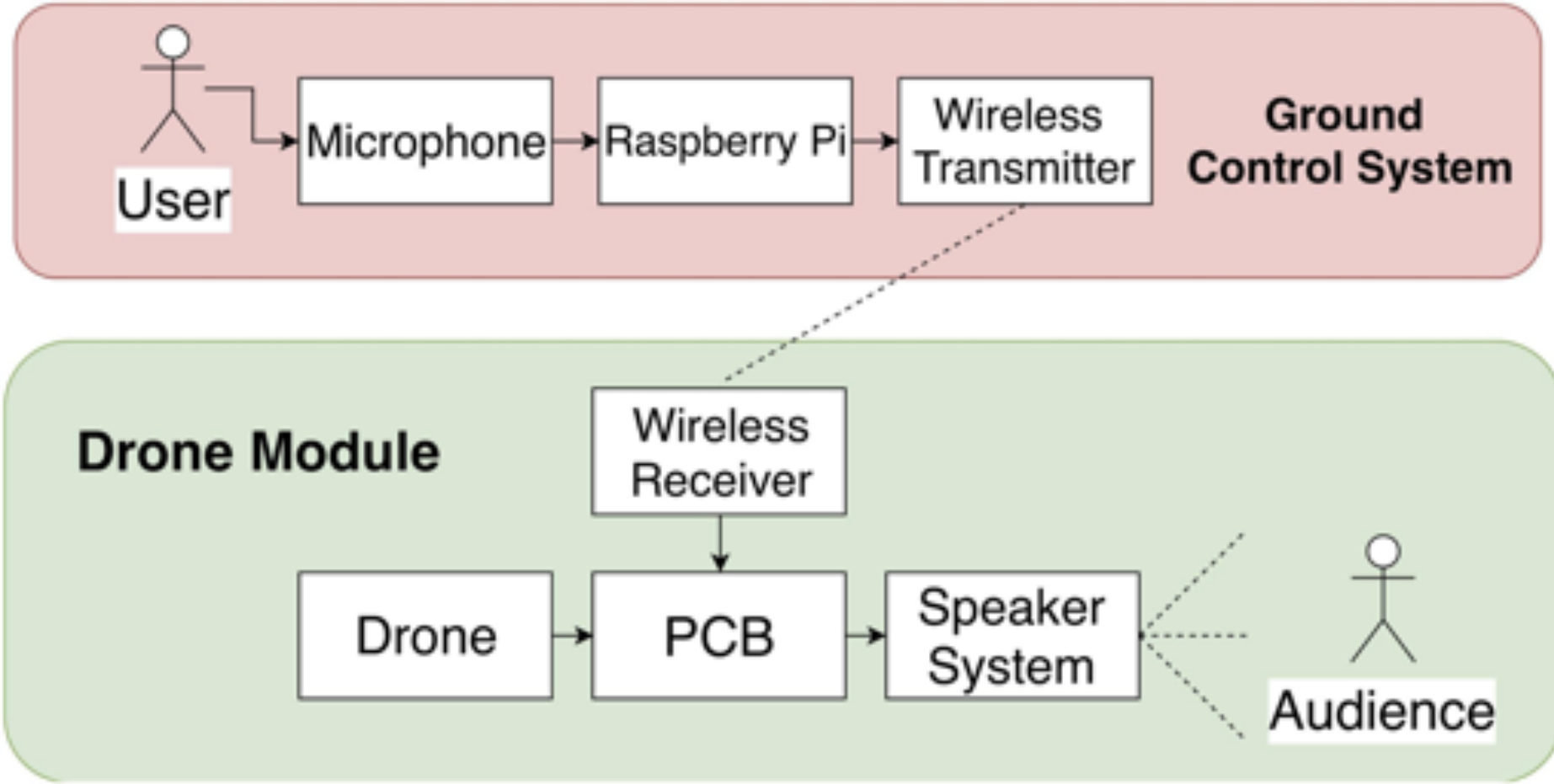
Ground Control System

- User Interface runs on Raspberry Pi and Android Drone Controller
- Records the user via a microphone
- Transmits the digital audio samples to the drone receiver over NRF24 wireless module

Drone Receiver Module

- Drone with mounted PCB and speaker system
- Flies 5-10 feet over target audience
- Receives digital audio samples from GCS, converts to analog, and outputs to speakers

System Flow


User
Microphone
Raspberry Pi
Wireless Transmitter
Ground Control System
Drone Module
Wireless Receiver
Drone
PCB
Speaker System
Audience

Design Constraints

- Weight
  - Light enough to be carried by the drone
- Power
  - Loud enough to be heard over the propellers and background noise
- Size
  - Small enough to fit between the landing gears

System Architecture

Drone

- Yuneec Typhoon H Pro
  - Capable of lifting ~ 2 lbs
  - Relative operating loudness around Phantom 4 (~78 dB)
  - Room between landing gear to attach speaker assembly

Ground Control System (GCS)

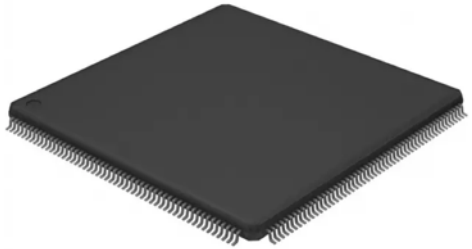
- Raspberry Pi connected to a 7” touch screen display
- Running our audio streaming code
- Simple user interface which allows for tap-to-record and connection status

GCS Remote

- Android application that runs on our drone controller
- Connects to Raspberry Pi GCS through WiFi
- Mic on drone controller used for recording
- UI shows connection status and updates GCS when recording status changes

Primary Components

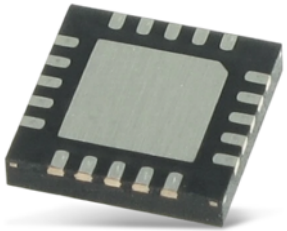
- NXP LPC4088
  - Cortex-M4 based Microcontroller
  - Has useful peripheral interfaces for our project such as SPI, I2C and I2S
  - Versatile, with 32MB SDRAM, 96KB internal SRAM, 512KB internal flash and can operate at up to 120MHz



- Nordic NRF24L01+
  - RF Communication on the 2.4GHz ISM Band
  - Interfaced with the microcontroller via SPI
  - Can transfer data at rate up to 1Mbps
  - Theoretical distance can reach 1000 meters, and tested up to 200 meters

Primary Components

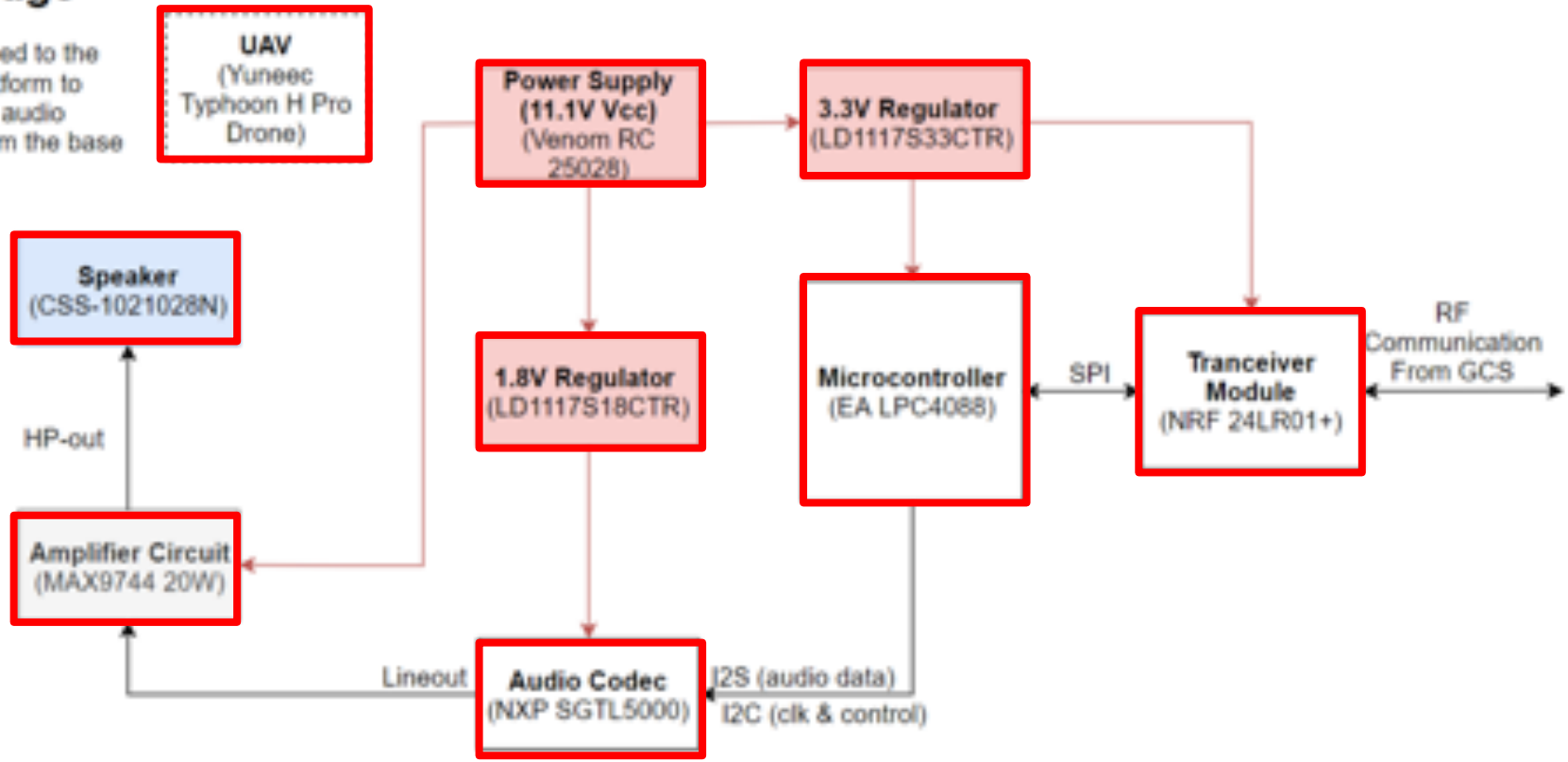
- NXP SGTL5000
  - Audio Codec
  - Interfaced, using I2C for configuration and I2S for audio data



- MAX9744
  - 20W Class-D Audio Amplifier
- CSS-1021028N
  - Magnet driven speaker

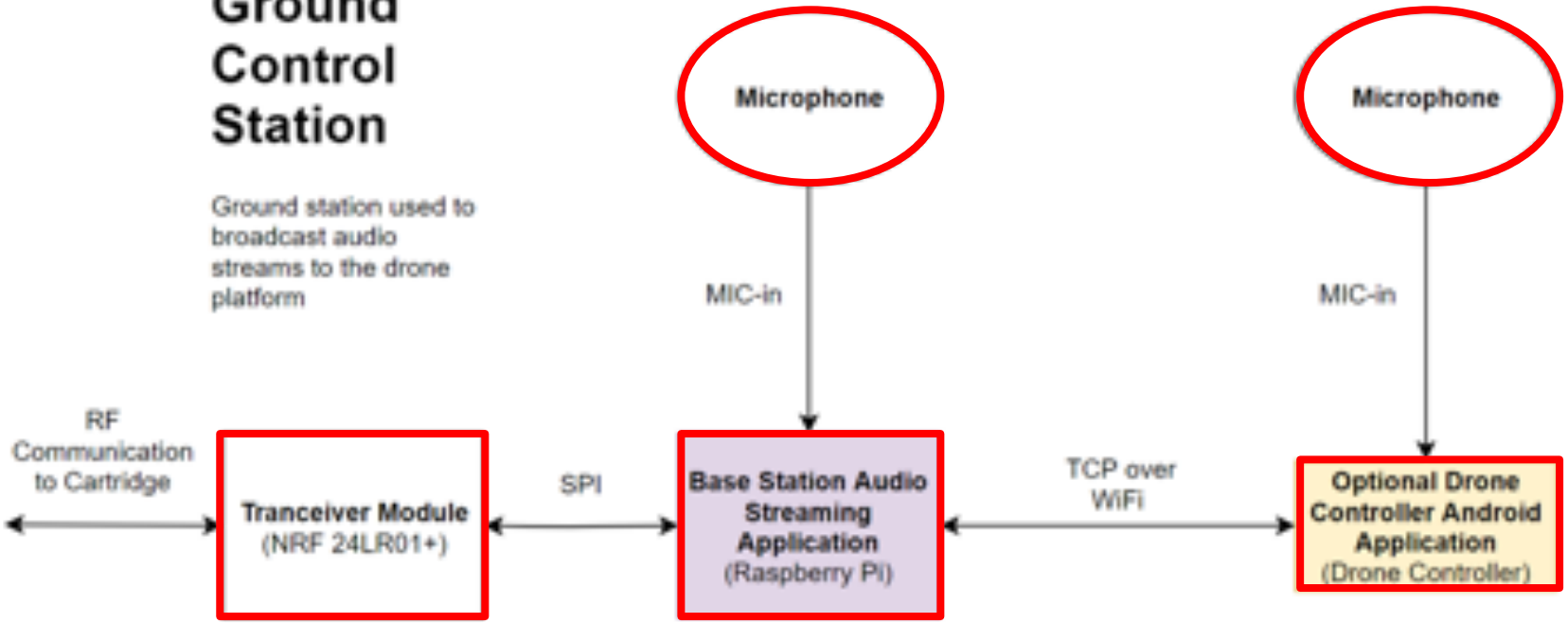
Audio Cartridge

Module fitted to the Drone Platform to output the audio stream from the base station.

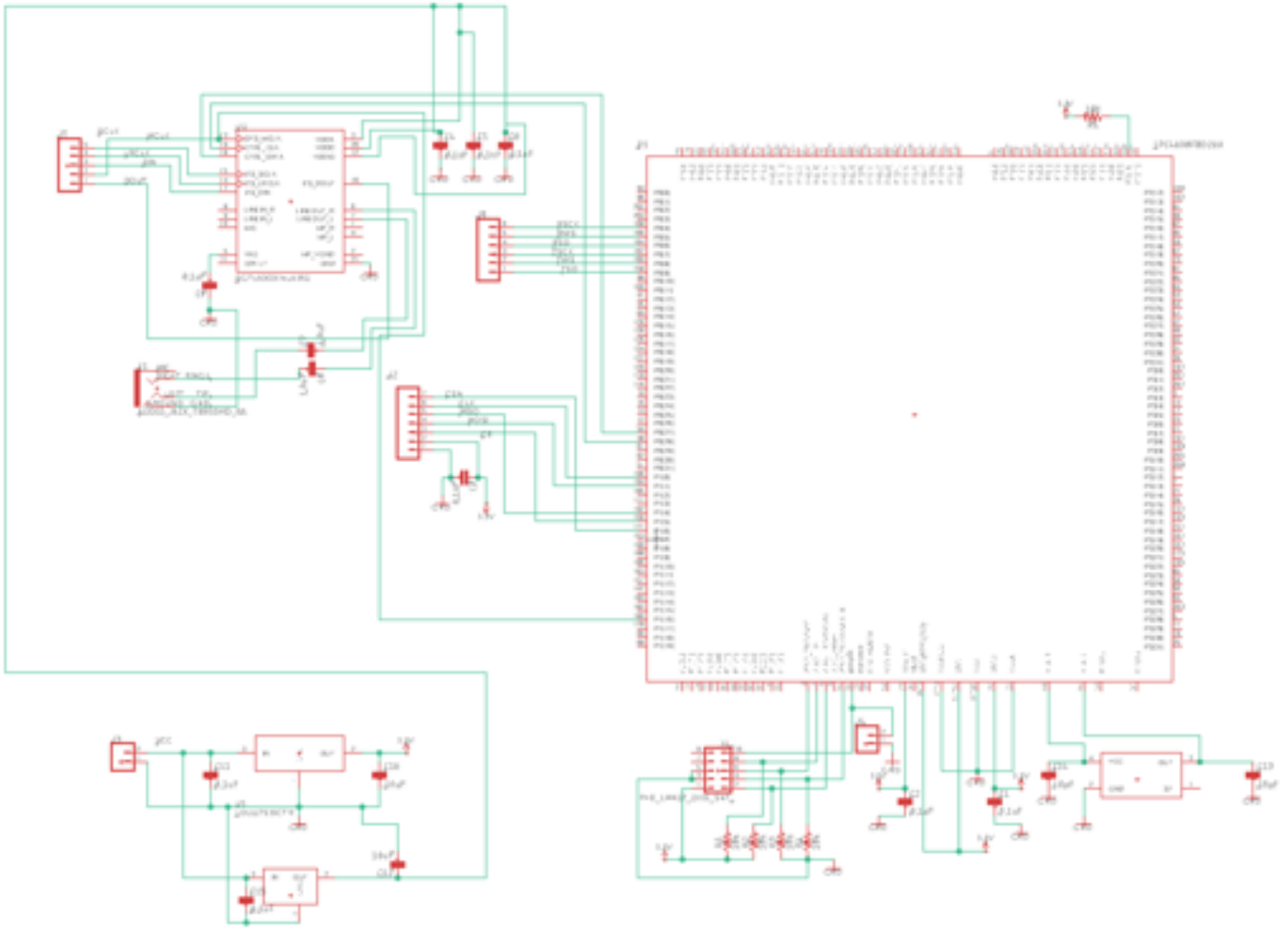


Ground Control Station

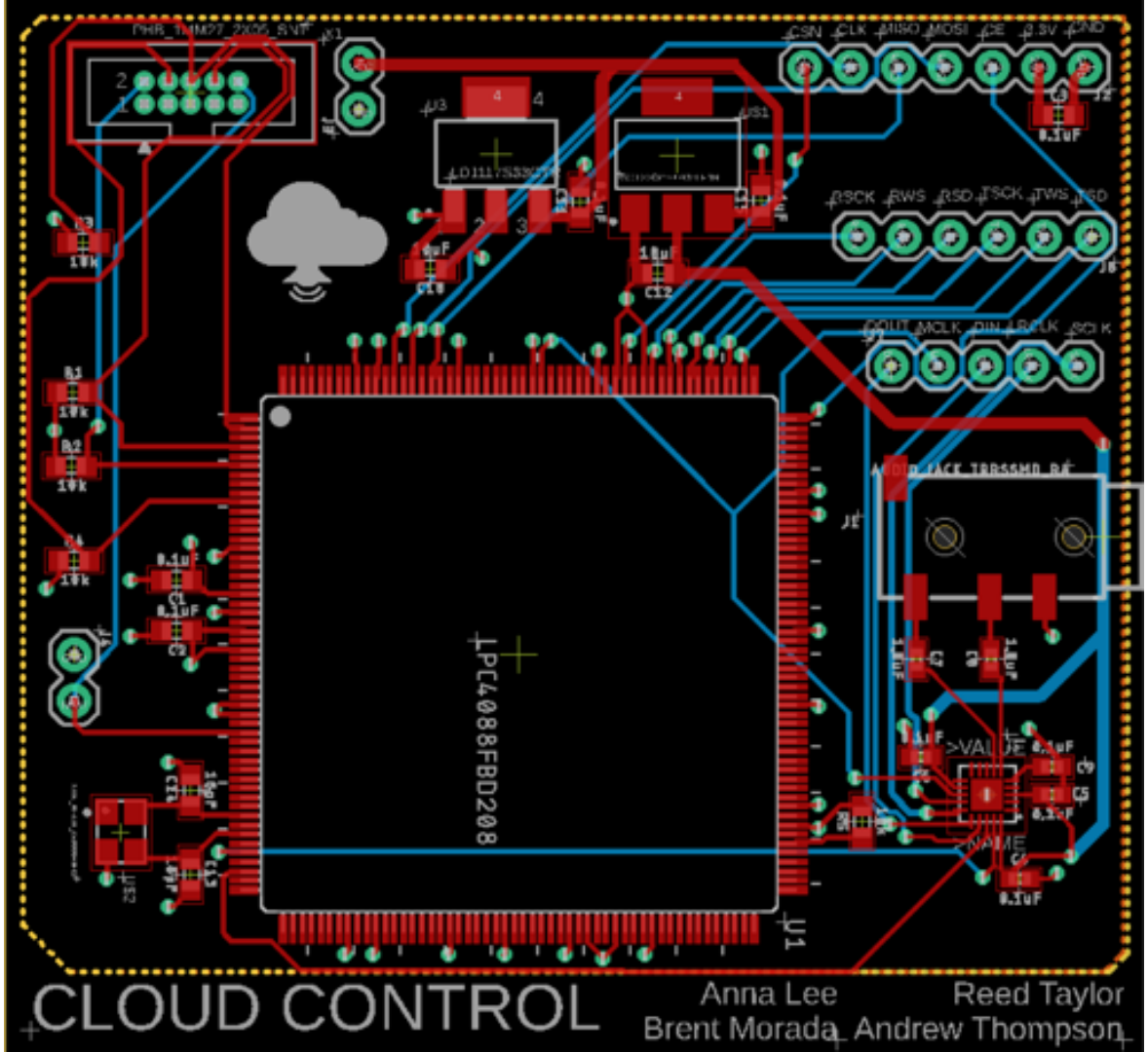
Ground station used to broadcast audio streams to the drone platform



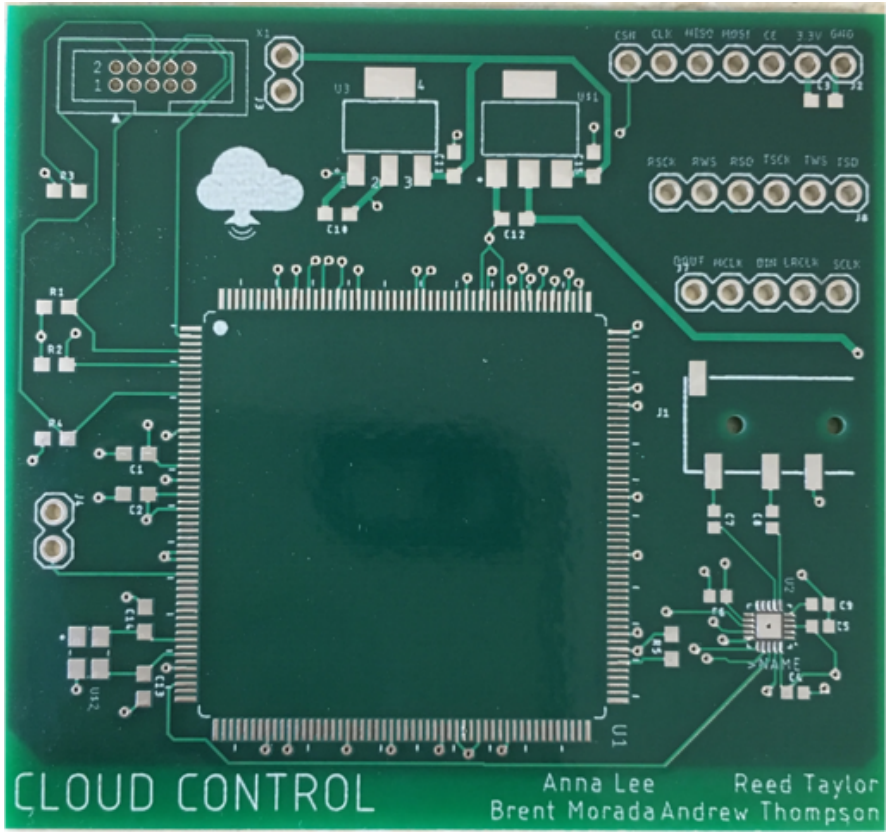
PCB Schematic



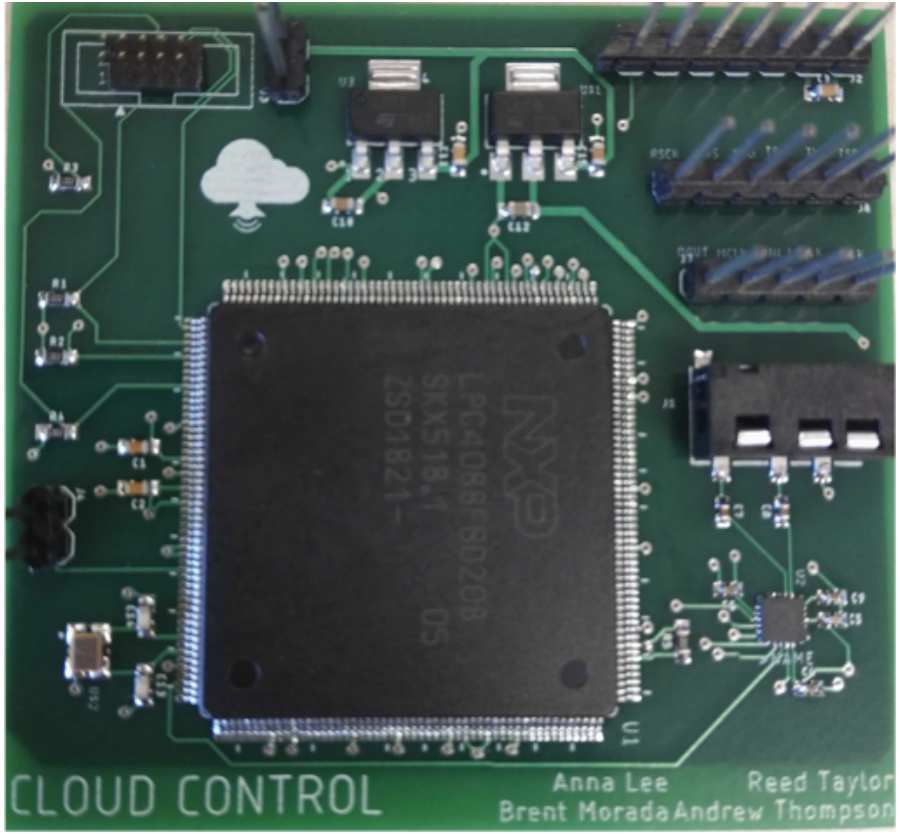
PCB Layout


CLOUD CONTROL
Anna Lee
Brent Morada
Reed Taylor
Andrew Thompson
LPC4088FBD208

Finished PCB



Bare PCB



Assembled PCB

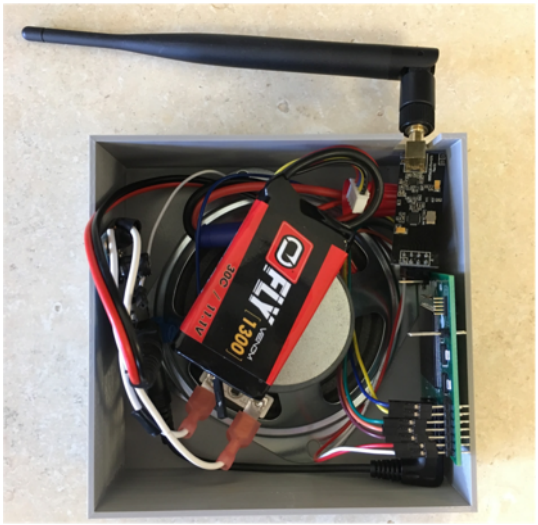
Final Prototype

Ground Control System

Raspberry Pi GCS

Android Drone Controller

Drone Module



Drone Module Enclosure

Drone with attached module

Demo Video

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- Yogananda Isukapalli
  - Capstone Instructor
- Brandon Pon
  - TA
- Carrie Segal
  - TA

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UC SANTA BARBARA engineering

Q & A