Cloud Control
Design Review
Team

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- 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
<table>
<thead>
<tr>
<th>Ground Control System</th>
<th>Drone Receiver Module</th>
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<tbody>
<tr>
<td>● User Interface runs on Raspberry Pi and Android Drone</td>
<td>● Drone with mounted PCB and speaker system</td>
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<tr>
<td>Controller</td>
<td>● Flies 5-10 feet over target audience</td>
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<td>● Records the user via a microphone</td>
<td>● Receives digital audio samples from GCS, converts to analog,</td>
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<tr>
<td>● Transmits the digital audio samples to the drone receiver</td>
<td>and outputs to speakers</td>
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<td>over NRF24 wireless module</td>
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System Flow
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
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.

- **UAV** (Yuneec Typhoon H Pro Drone)
- **Power Supply (11.1V Vcc)** (Venom RC 25028)
- **3.3V Regulator (LD1117S33CTR)**
- **Speaker (CSS-1021028N)**
- **Amplifier Circuit (MAX9744 20W)**
- **Audio Codec (NXP SGTL5000)**
- **Microcontroller (EA LPC4088)**
- **Tranceiver Module (NRF 24LR01+)**
- **RF Communication From GCS**

Connections:
- **HP-out** from **Speaker** to **Amplifier Circuit**
- **Lineout** from **Amplifier Circuit** to **Audio Codec**
- **1.8V Regulator (LD1117S18CTR)**
- **SPI** from **Microcontroller** to **Tranceiver Module**
- **I2S (audio data)** from **Audio Codec**
- **I2C (clk & control)** from **Audio Codec**
- **RF Communication From GCS** to **Tranceiver Module**
Ground Control Station

Ground station used to broadcast audio streams to the drone platform.

- RF Communication to Cartridge
- Tranceiver Module (NRF 24LR01+)
- SPI
- Base Station Audio Streaming Application (Raspberry Pi)
- TCP over WiFi
- Optional Drone Controller Android Application (Drone Controller)
- MIC-in
- Microphone
PCB Layout
Finished PCB
Ground Control System

Raspberry Pi GCS

Android Drone Controller
Drone Module

Drone Module Enclosure

Drone with attached module
Demo Video
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Qualcomm

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Q & A