Wireless RF Audio System

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Introduction

Problem Statement

- To build a high clarity wireless speaker system.
- Should give optimum sound clarity for a large room
- Large variance of hearing needs
    - By bringing the speakers closer to the audience, we can fix many of these issues

Functional Requirements

- Provide clear audio signal from a transmitter to receiver device via radio frequency.
- Customizable transmission frequency to avoid noise
- Multiple speaker output to accommodate larger venues.

Clarity of Audio

- Need a working definition to guide our work
- Three main concerns
  - Background Noise
  - Interfering Signal
  - Feedback

Non-functional Requirements

- Ease of use.
- Stand alone speaker system.
- Minimal delay in data transmission.
- Scalable to match size of audience

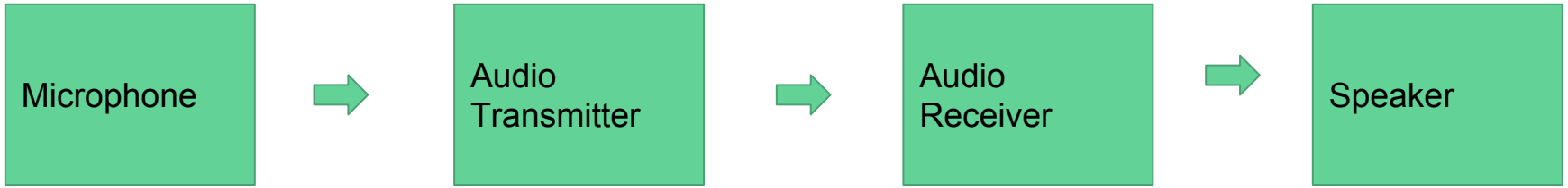
Constraints and Considerations

- Synchronized input and output
- We are only given a year to complete the project
- We want our solution to be as cheap as possible

Potential Risk & Mitigation

- Frequency wave may be interfering with other devices
- Lag between speakers
- Conversions from digital to analog

Conceptual Sketch



Initial Ideas

- Infrared
  - Needs a physical line of sight
- Bluetooth
  - Synchronization issues, latency times
- Wifi
  - Synchronization issues,

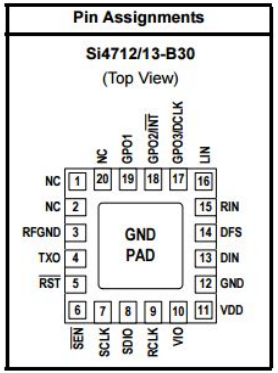
Initial Materials

- Texas Instruments Launchpad
- GNURadio

Hardware Specifications

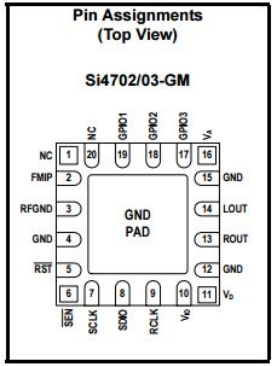
Transmitter

- Take audio signal from the microphone and convert to a digital signal
- Silicon Labs Si4713 Chip
- 88-108MHz
- FM Band Scan for clarity
- Arduino Friendly



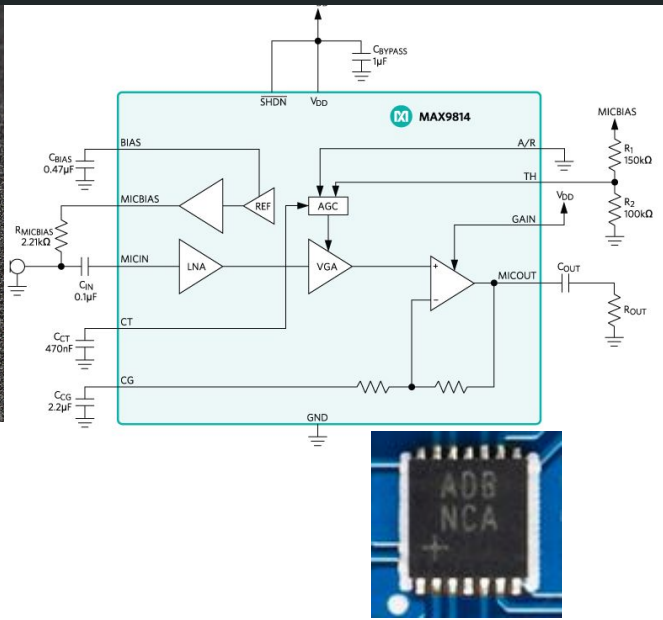
Receiver

- Receive a clear radio transmission from FM band
- Silicon Labs Si4703 Chip
- RDS available (Radio Data Service)
- Arduino Friendly
- Output/Antenna option



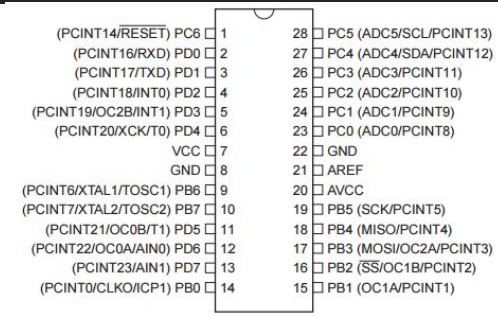
Hardware Input

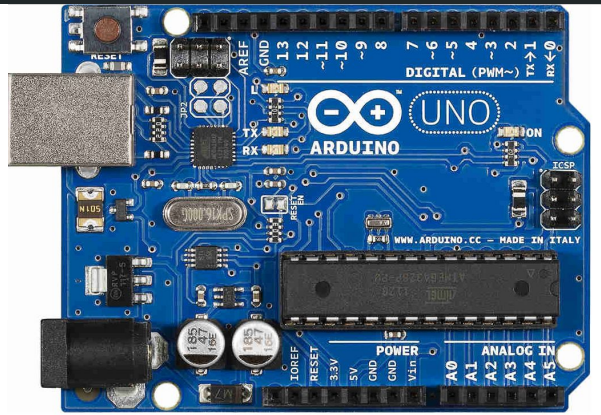
- Electret Microphone
- MAX9814 Amplifier



Microcontroller

- Arduino Uno
- Atmega 328 Chip
- Analog in and Digital out

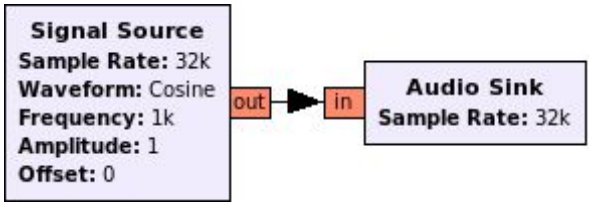




Software Specifications

GNURadio

- Analog to Digital
- Flow Graphs
- Sinks and Sources
- Modular Creation
- C++/Python



Moving Away From GNURadio

- Large library of dependencies
- Latency during transmission
- Moving from Linux to Arduino

Arduino Software Requirements

Transmission side:

- Run on the Arduino controller.
- Use I2C to communicate, arduino provides libraries via github.
- First implementation will be to set stations in software.

Deliverables:

- Text/data transmission
- Ability to tune many frequencies, and scan available frequencies to find most available.
- Output important data to screen(transmission data/set frequency)

Software Requirements(continued)

Receiver Deliverables:

- Volume control
- Tuning control
- Read current channel
- Seek to find frequencies that are transmitting

Conclusions

Project Outcomes

- Created a speaker system that works wirelessly via radio frequencies
- Scanning Feature for choosing clearest frequency
- LCD Screen for display of output
- Able to change volume and channel via button presses
- Near autonomous setup

Future Goals

- Build speakers with hardware installed
  - Move away from a breadboard implementation
- Ability to choose different transmissions in the area
  - Potential of having multiple different systems in a building
- Completely autonomous setup

THANK YOU