Wind Sensor:
CDR Presentation
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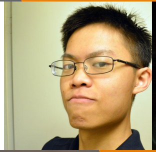
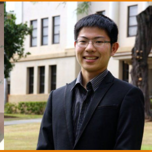




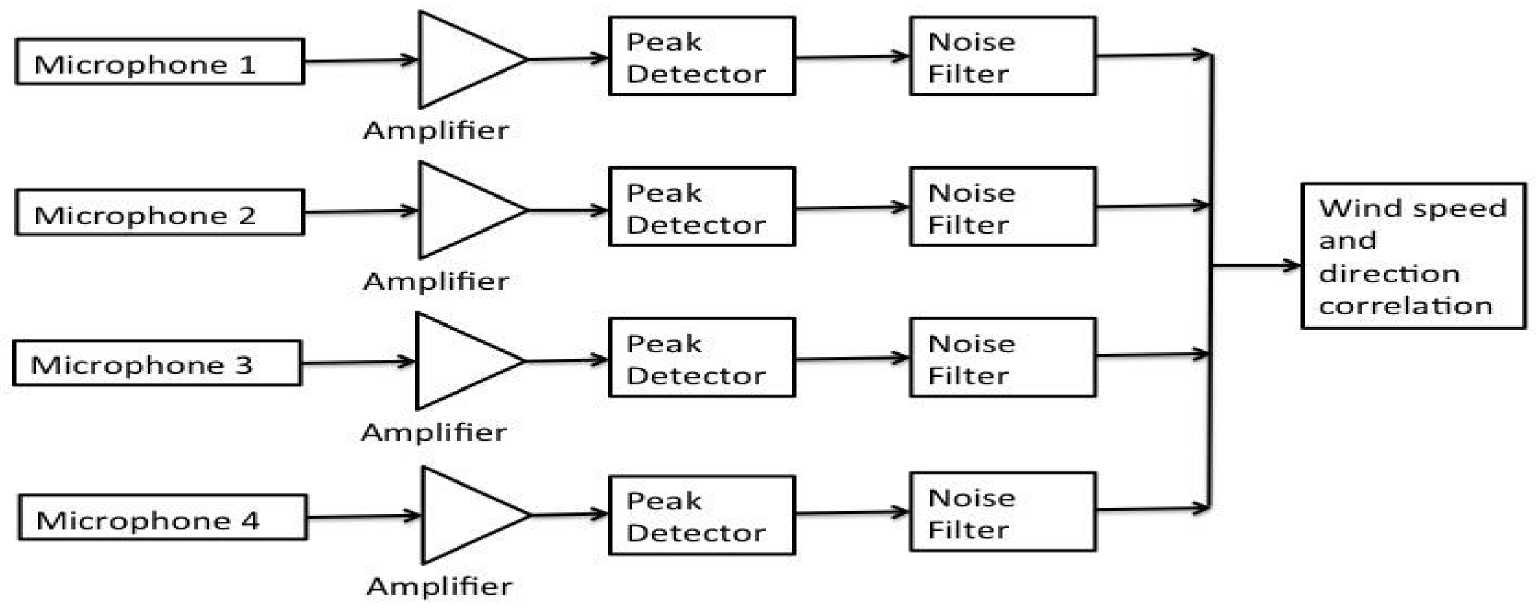
Summary

Acoustic & Ultrasonic:

- **Block Diagrams**
- **Progress**
- **Issues**
- **Future Tasks**

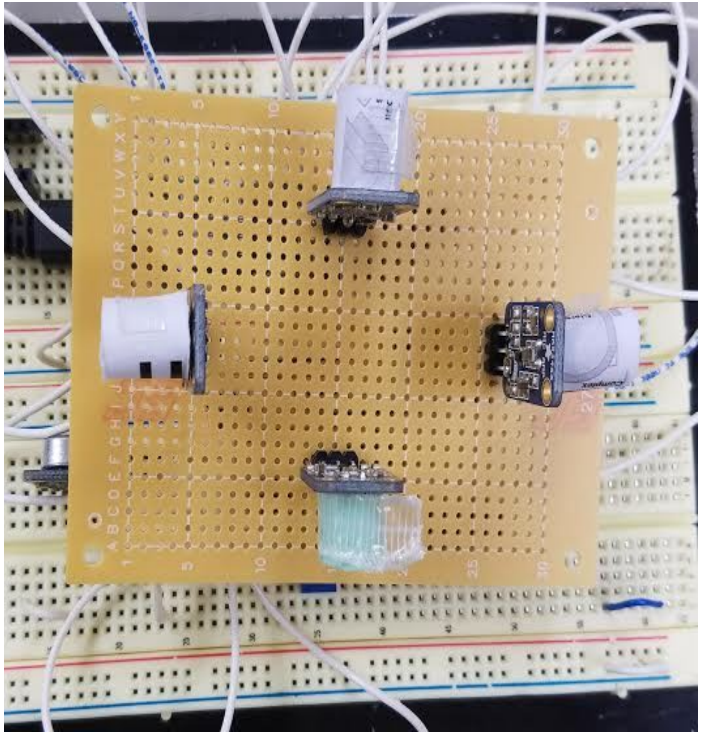
Acoustic Wind Sensor

Block Diagram



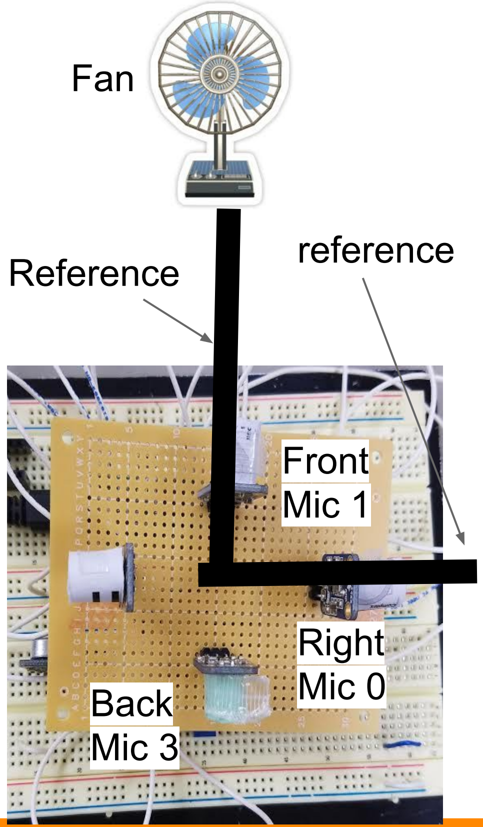
Progress

- Created perforated board for 4-microphone test
  - Values of old board inaccurate
- Tested 4 microphone setup
  - Collected raw data
  - Compared magnitudes and calculated wind speeds of each microphone
  - With and without crude wind channels
- Post-processing direction determination algorithm
  - Comparing wind speeds



Progress

- **Angle Determination**
  - Left Microphone not connected
  - Used ratios of wind speeds
  - Fan and Right mic used as references for angle
  - Front:right mics
    - ~1.3 at 90 degree reference angle
    - ~1 at 45 degree reference angle
    - ~0.78 at 0 degree reference angle
  - Further testing needed for 360 degree angle determination



Progress

- Preliminary Outdoor Tests
  - Conducted with several fan speeds
  - No audible background noise
  - Generated tones of different frequency
  - No considerable effect on single microphone real time processing algorithm

Problems

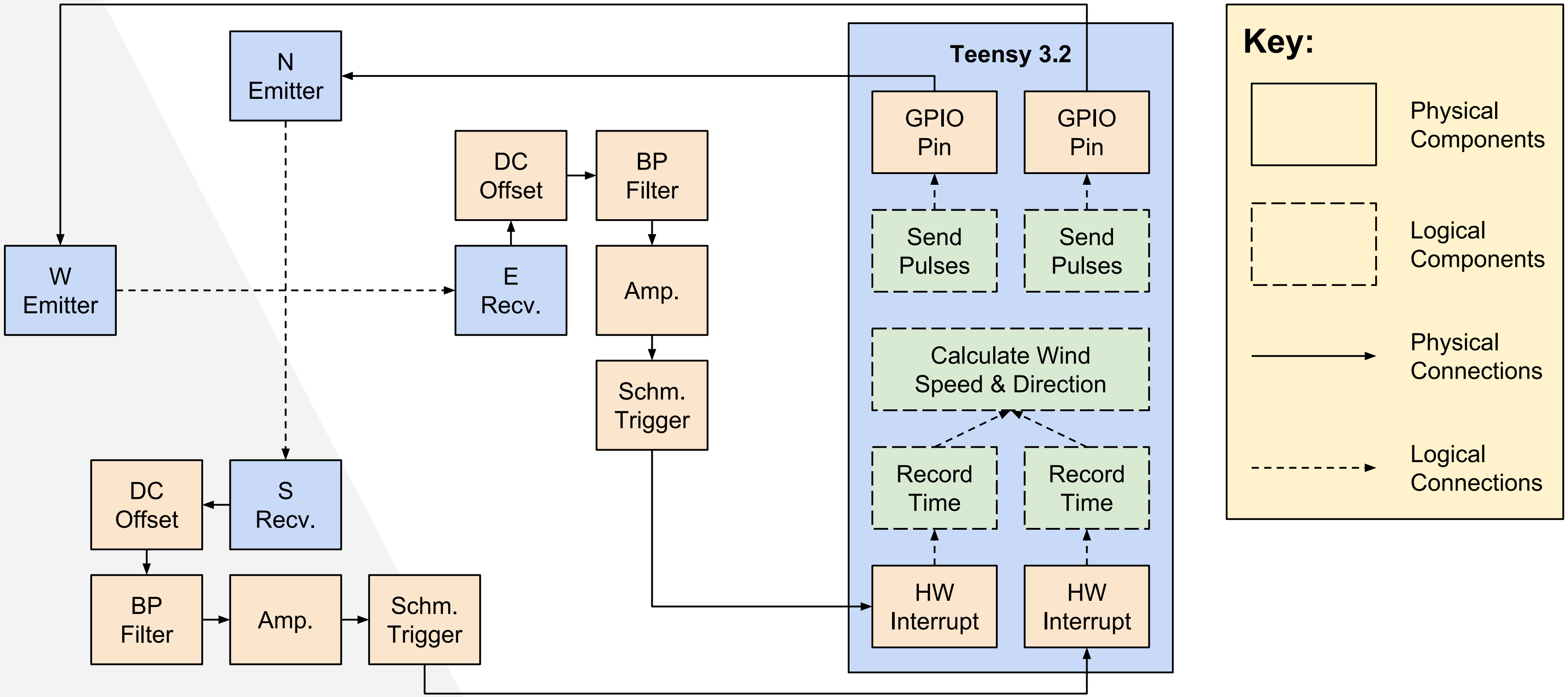
- Old PCB actually had faulty connections
  - Inconsistent results due to board
- Faulty connection on new perforated board

Tasks

- Fix left microphone connection
- Implement real time processing algorithm to determine direction
- Conduct additional outdoor tests to verify algorithm

Ultrasonic Wind Sensor

Block Diagram



Pseudocode

```
setup():
configure pins
attach interrupts
```

```
loop():
send_pulses()
while (count < 10)
     do nothing
calc_tof()
delay 2s
count = 0
attach recv_pulse()
```

```
send_pulses():
for i = 0 to 9
     set emitter HIGH
     send_t[i] = CYCLE
     delay 12us
     set emitter LOW
     delay 12us
```

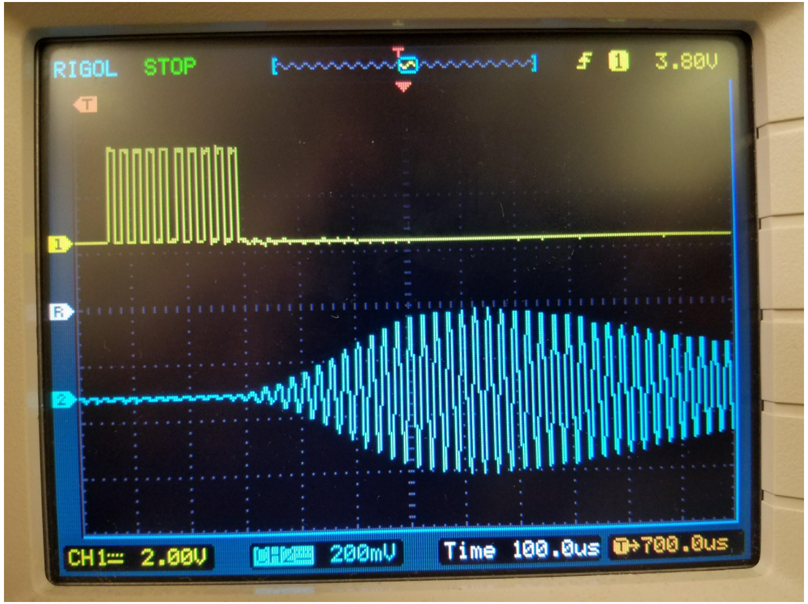
```
recv_pulse():
recv_t[count] = CYCLE
count++
if count >= 10
     detach recv_pulse()
```

* interrupt driven

```
calc_tof():
sum_tof = 0
for i = 0 to 9
     sum_tof += recv_t[i] - send_t[i]
return sum_tof/10
```

Progress

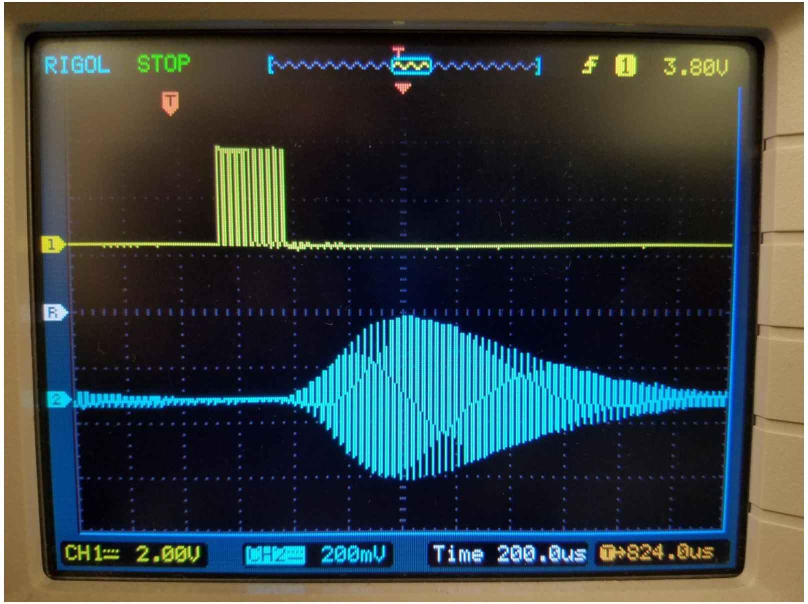
- Tested a 555 timer and an amplifier circuit to test driving the emitter
    - Distorted signal, SR exceeded
- Tested driving emitter using Teensy
    - Tested [0, 3.3V] square wave at 41.67kHz, good response
- Experimentally calculated the impedance of the transducer to determine max current draw
    - > 1kΩ, so I < 3.3mA, Teensy safe
- Observed receiver response when emitter sends 10 pulses



yellow = emitter, blue = receiver

Problems

- Receiver takes a while to "ramp up"
  - Can lead to unreliable triggers and inaccurate recordings
- Receiver takes a while to "ramp down"
  - Limits how often we can send pulses, since we don't want to be sending while still receiving
- Received signal is centered at 0V
  - Need to offset the voltage to be within the range of the Schmitt trigger



yellow = emitter, blue = receiver

Future Tasks

Semester Goals:

- Add the DC offset and voltage trigger to the receiver circuit so Teensy to record times
- Run experiments with current algorithm to see how precise the results are
    - Would probably need to modify the code to account for unreliable triggers
- Design, test, and integrate the remaining hardware into our design: amplifier, Schmitt trigger, bandpass filter (in that order)
- Modify algorithm to work for two sets of emitter-receivers and add direction calculation

Stretch Goals:

- Add functionality to interface with weatherboxes (or directly with the server)
- Software optimizations, custom PCB, etc.

The end.

Any questions?