

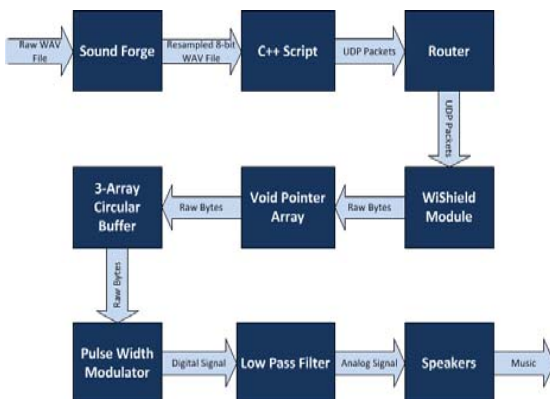
# Audio Wi-Fi Embedded Streaming Using Microcontrollers (AWESUM)

An ECE Master of Engineering Project by Joseph Montanino and Evan Respaut

## Summary

The AWESUM system streams audio from a computer over Wi-Fi. This audio is received by 8-bit microcontrollers that are connected to the same wireless network. Each of these microcontrollers can be wired up to a different set of speakers. Thus, one is able to keep their computer in one room while being able to hear music throughout the entire house. The system has the capability to connect to networks with different security types and encryptions.

Flow of data through the system:

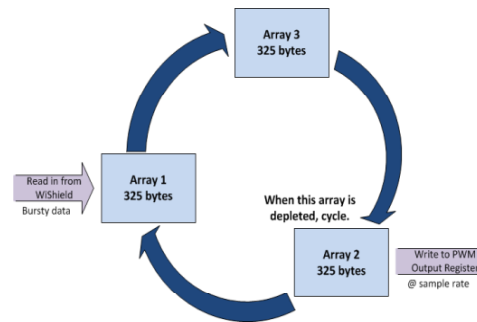
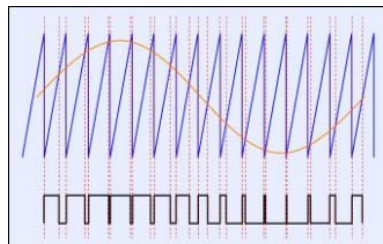


## Details

The microcontroller used is an ATmega328p. It is integrated onto a printed circuit board with a Wi-Fi receiver module called WiShield, which supports the use of Arduino libraries. The WiShield connects to a wireless network as any other device would, although it requires a static IP address.

### Circular Buffer

On the microcontroller, one array is used to accept data from the WiShield, while another array is used to pass values to the PWM output register. The third array is used to increase the buffer size. When all of the data in an array has been output, the arrays swap places.

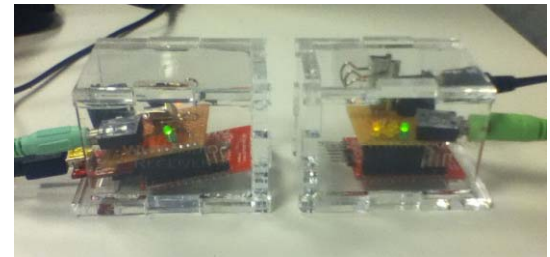


### Pulse Width Modulation

The ATmega328p produces music by using a technique called Pulse Width Modulation (PWM). Lower analog frequencies are encoded in a much higher digital frequency and then sent through a low pass filter in order to regain the desired signal.

## Results

We are able to transmit uncompressed audio at a rate of 176 kbit/s to each microcontroller. This allows for stereo 8-bit audio at a sampling rate of 22 kHz.



The quality is quite consistent, aside from the occasional audio glitch. These glitches are attributed to the unreliability of UDP which causes delayed packets to overrun our limited buffer (which uses less than 1KB of memory).



Screenshot from WireShark