Introduction
The Binaural Audio Capstone Project is a new, self-contained, product aimed at a wide consumer base. This product aims to outperform current mobile recording with peer interconnections between the Android application, the Web Server, and a SQL Database.

This product aims to outperform current mobile recording systems by exceeding the shortcomings in terms of binaural audio and head tracking. The combination of these two products yield a large improvement in the capabilities of accurately recreating an event as it was experienced. There are many possible applications for such a device in recreational, military, medical, and hobbyist domains.

The Binaural Audio Capstone Project is being developed as a Senior Design Project at Embry-Riddle Aeronautical University in Daytona Beach Florida. The customer for this project is Dr. Timothy A. Wilson, the chair of the ECSSE department, hereafter referred to as the customer. This design has a maximum schedule of 9 months with a monetary budget of $1,200. The product that will be designed is an inexpensive, rapid development prototype used as a proof of concept.

Methods and Current Work
The System Architecture for the Binaural Audio Capstone project can be decomposed into a hardware-based, and software-based section. The hardware side of the project encompasses the various data recording devices, microcontroller, and the power supply. The recording devices are mounted onto a hardware chassis that will be worn by the user on a pair of glasses. This chassis is directly wired to the microcontroller, which acts as the processor of the data. The microcontroller is powered through a rechargeable external battery to increase the portability of the project. The recorded data is streamed to the users’ smartphone using a Wi-Fi Real-Time-Stream.

Once the data has been received by the smartphone, it transitions through to the software side of the project. The software architecture is comprised of an Android Application installed onto the users’ smartphone, an online firebase database, and a webserver. The Android App will be used to start and stop recording as well as to play the recordings in both near-real-time and later. The Android App also streams the data to the firebase database for long-term storage. The software side of the project all interface via internet connections through cell service or Wi-Fi networks.

In the far-left, the home page is where the users will be able to login to their accounts keeping the data safe and secure. The next page is for prototyping and testing for a stream to be initiated using the built-in camera or with the streaming of the hardware. The third page illustrates the view when streaming. They can type in the address of the stream in the RTSP bar and the stream displays below in near-real-time. The fourth page illustrates the various tab options for the user, so they can navigate in the app. The final page to the right shows where the videos are saved and can be watched when the user wishes to.

The hardware unit for this device contains the relevant sensors and equipment for recording audio, video, IMU, and GPS data. Each of these pieces of equipment was selected, integrated, and tested to prove functionality to meet the requirements.

Applications and Future Work
There are many applications and uses for such a device. It could be used in military settings for both training and combat scenarios. In training situations, realistic audio and video captured from a first-person perspective can be used to create the best training simulations where the recorded data could be played back during training. This methodology would provide the most realistic scenarios as each person would hear and see the video exactly as if they experienced it firsthand. In a combat scenario, the recorded audio could be transmitted between soldiers so that each soldier knows the relevant position and environment of every other soldier. This would assist a team in identifying threats and ensuring that everyone remained coordinated and safe. Further, the device can assist users that struggle with short-term memory loss, a common side-effect of a large swath of medical conditions. If the user is having difficulties remembering a situation that happened, they can use their Android Device to easily playback the recorded environment to assist them in remembering the details. For hobbyists, this would allow them the best method to capture and record their experiences such that they could reexperience them. Regardless of the hobby, using this product would give someone a versatile way to capture the highlights.

Acknowledgements and Contact
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Figure 1: High-Level System Architecture highlighting the main components of the system

Figure 2: High-Level System Context Diagram for the Binaural Audio Capstone Project

Figure 3: High-level overview of the Software System Architecture with peer interconnections between the Android application, the Web Server and a SQL Database

Figure 4: Binaural Audio Android Application Use Pages

Figure 5: Binaural Audio Prototype Control Unit with attached hardware components for functionality and testing

Figure 6: Executive summary abstract of the Binaural Project

Figure 7: Potential areas of application for the device

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