Boston University
Electrical & Computer Engineering
EC464 Capstone Senior Design Project

Customer Installation

BUtLAR: Boston University Large Language Model Auditory Responder

Submitted to

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by

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Submitted: 4/27/25

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1. Customer Installation

On Friday, March 18th, at 2:30 PM in PHO 113 (ECE Lab), all group members were present to demonstrate to Hamid Nawab, Chief Scientist at Yobe Inc., the capabilities of BUtLAR. The Voice Chatbot is displayed on a MacBook with a web-based interface, where users can ask questions and receive answers relevant to the case-specific database. Our setup includes two Rode microphones mounted on a 3D-printed attachment, which easily slides onto the top of a laptop or LCD screen, and a Raspberry Pi that hosts the software.

During the meeting, it was discussed that integrating the Yobe SDK was not feasible due to licensing issues. Professor Nawab advised us to proceed with our current product, which does not rely on Yobe, ensuring that the voice chatbot can still operate with low latency.

Additionally, Professor Nawab informed us that Yobe's product was advanced to be compatible with macOS, rather than only being Linux-dependent. If Yobe can deploy it prior to ECE Day, they would like us to showcase this feature on ECE Day, in addition to BUtLAR. With this new macOS binary system, biometric capabilities (BioPSI - Biometric Personalization and Speaker Identification) will be possible.

2. Requirements

1. Software: System Integration
    a. Yobe SDK
    b. Digital Human
    c. Knowledge Documentation/ Database Combination
    d. User Interface
2. Hardware: Product Design
    a. Two Microphone
    b. Speakers
    c. Raspberry Pi
    d. LCD Screen
    e. Minimalist Design
3. Demo: Use-Case Specific Framework

The software requirements were either met, modified, or eliminated. The Yobe SDK was integrated at the end of the first semester. However, it did not work with live audio streams, which caused a high latency. Therefore, we eliminated its integration for the final product. Next, the digital human requirement was initially defined by generating AI human videos in real time using D-iD, a third-party service. However, due to its high cost and the delay it added to response time, we replaced it with a web-based conversation front-end, developed in Django. The third requirement, being the database, is implemented in the final product. This database approach began with a JSON file and OpenAI for prompt engineering, but was then modified to SQL for scaling in the final prototype. Now, we are applying Vanna AI to leverage RAG for ECE day. For the user interface, as mentioned, BUtLAR is displayed on a web application using Django. For this user interface, users can click start to begin the session, ask their questions, and end the session by saying “Goodbye, BUtLAR.”

All hardware requirements were met. The final product includes two Rode microphones housed in a 3D-printed enclosure mounted on a laptop, a Raspberry Pi 5, and a minimalist design. Since BUtLAR operates on a laptop, the speaker and LCD screen were seamlessly integrated.

For the use-case scenarios, BUtLAR supports multiple applications. The first prototype demonstrated professor office hours, while the second focused on ECE professors’ class times and locations. For ECE Day, we are expanding the database to include ECE team information, enabling navigation to student project tables and providing brief project descriptions.

3. Overall Assessment

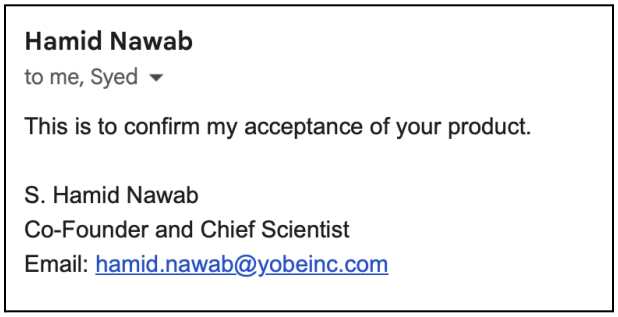
Professor Nawab approves of our current implementation. Our team met the project expectations, particularly with an emphasis on demonstrating the potential integration of the Yobe SDK for audio processing. Although Yobe will not be fully integrated for ECE Day due to its limitations with live audio streams, we plan to showcase Yobe's standalone product to illustrate how it could complement BUtLAR's live audio processing, database-driven user queries, and prompt responses.

Our client understands and supports the modifications to the original requirements, acknowledging challenges with certain components' compatibility. They are satisfied with our implementation of the core features—live audio transcription and rapid, accurate responses to user queries—which align with BUtLAR's use-case scenarios. On ECE Day, we will highlight how Yobe's product could be integrated into applications like BUtLAR to enhance functionality such as denoising and biometric tracking.

For future senior design teams or Yobe interns, next steps include achieving full integration of BUtLAR with Yobe's product, focusing on seamless real-time audio processing and scalability for diverse use cases. This work will build on our foundation to advance BUtLAR's capabilities.

4. Customer Acceptance

In our meeting with Professor Nawab, he approved of our current product and added that for us to demonstrate Yobe's product to have on the side the new Mac-based binary product that Yobe has recently designed. He additionally confirmed his acceptance in the email screenshot below.



Hamid Nawab
to me, Syed

This is to confirm my acceptance of your product.

S. Hamid Nawab
Co-Founder and Chief Scientist
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