CS486C – Senior Capstone Design in Computer Science
Project Description

Project Title: **The Chatterjack chatbot: If I only had a brain!**

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Project Overview

Chatbots have become a ubiquitous part of customer support in the past decade, demonstrating ever more realistic conversational skills, and providing answers to a broad range of basic information seeking questions. For instance, Facebook has used chatbots since 2016 to deliver automated customer support, e-commerce guidance, content, and interactive experiences; similarly, Amazon, Overstock, and many online retailers use chatbots as part of their customer support ecosystem. Some companies have even started using chatbots internally to handle human resource requests and even simple healthcare requests that involve basic tasks such as setting up appointments, locating offices, and providing medical information.

Certain universities have begun deploying chatbots to streamline access to a growing set of information and basic functions as well. In 2018, St. Louis University installed a chatbot "Echo Dot" in every residence hall room and campus apartment, managed through the Amazon Alexa for Business service. During the first year, students interacted with Alexa more than 150,000 times through the Amazon Echo devices in the University.

By 2021, Gartner predicts that 15% of all customer service interactions will be handled completely by chatbots (often driven by AI back ends). A study by Juniper Research estimates retail sales resulting from chatbot-based interactions will reach $112 billion by 2023.

Envisioned Software Product

The aim of this Capstone project will be to create a "Chatterjack" chatbot system. This chatterbot will initially be deployed and refined on the College of Engineering, Informatics, and Applied Science (CEIAS) website and/or in a kiosk browser system to engage student users and provide answers to a wide range of information requests. The ultimate goal, however, is to use Chatterjack as the "brains" of a mobile robot in the form of Louie the Lumberjack, which is being designed and prototyped by a parallel Capstone team in Mechanical Engineering. The two projects are de-coupled to reduce constraints in design and implementation but, if both teams are successful, they may be integrated next Spring to present a walking, talking, physical Chatterjack!

The specific aim for the CS half off the project centers around designing, implementing, and refining a flexible, extensible and highly usable chatbox system. We expect that the solution will leverage (but likely extend) existing chatbot systems or frameworks. Interaction with the chatbot will minimally work via text (typing questions), but a voice recognition interface should be possible to integrate using off-the-shelf voice-to-text and text-to-voice frameworks developed in recent years.

Some content areas Chatterjack should support will include: able to act as a virtual advisor for engineering majors, provide information about instructors (including their office hours), provide information about rooms in the engineering building (directions, class schedules, etc.), and provide the kinds of high level overviews of programs one might expect to get from a Daily Campus Visit (DCV) or Discover NAU (DNAU) tour.

A few specific features expected in this first version of Chatterjack include:

Level 0: the Minimum Viable Product (MVP):
- Explore and compare chatbot frameworks to select system based on capability, maintainability, and cost.
- A secure Web2.0 web application to serve as the administrative interface for chatbot. Chatterjack should be configurable and maintainable by non-technical CEIAS staff.
- A basic proof-of-concept chatterbot, able to respond to typed questions in the content areas listed above
- GUI for basic configuration and administrative functions
- A basic way to add content to the chatterbot, i.e., a mechanism to load or scrape information into an internal knowledgebase based on a variety of specified websites and other information sources.
- Basic functioning expertise in: questions about classes/classrooms, questions about CEIAS majors.
- Conducts conversations in English

Level 1: A well-appointed and usable product
- Integrates voice-to-text/text-to-voice to provide an interactive audio interface.
- A modular system for extending Chatbot content/expertise, plus GUI to manage it.
- More refined conversational abilities, higher accuracy in returning appropriate info.
- Incorporation of expertise regarding buildings/room (location, usage, etc.), and other areas provided by client.
- Some ability to learn from conversations, i.e., improve its responses or knowledge base based on conversations.

Level 2: Stretch goals
- Integration with the ME project, i.e., runnable in physical Chatterjack.
- Ability to support questions in multiple languages

These are just a sampling of envisioned features to help sketch out an initial understanding of project goals. A detailed list of project requirements will be developed by the team in the first phases of the project, and may result in modification and extension of the above features.

If successful, the Chatterjack chatbot will be immediately deployed on the website and a lobby kiosk, tasked with helping to recruit prospective students, engage current students, and help alumni in communications. The capability to answer many basic informational requests will also help to alleviate the workload on faculty and staff.

Knowledge, skills, and expertise required for this project:
- Familiarity with web programming and web services.
- Familiarity with chatbot frameworks and technologies.
- Familiarity with databases and knowledge representation.
- Good communication skills and teamwork.
- Persistence; trying to find the solution to a difficult problem.

Equipment Requirements:
- Free/open-source software tools should be preferred but commercial solutions for text-to-speech and speech-to-text would be acceptable and could be purchased by the sponsor.
- CEAIS staff will be available to assist the team in identifying and verifying appropriate knowledge sources.

Software and other Deliverables:
- A fully-functioning chatbot as outlined above, installed and demonstrated on the CEAIS webserver.
- A "system administrator's manual," which details step-by-step how the system can be installed on a platform of the client's choice, as well as how to perform basic configuration and maintenance.
- All the software engineering documents, including requirements specification, design, and implementation details. It should allow future team to easily pick up where left off.
- Complete professionally-documented codebase, delivered as a repository on GitHub. There should be special attention to the API usage documentation, which will be used by future developers programming Chatterjack.