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Project Proposal
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Learning Platform Bot

Problem to be Solved

Shueh (2017), "Yellow Circle is a free online learning platform for cloud computing. The company has reached more than 40,000 students that have signed onto the free platform since it launched in 2014. User growth has skyrocketed with greater demand for affordable tech education and a scarcity of affordable options to learn cloud skills. Like Codecademy and other coding sites, Yellow Circle provides a virtual learning environment for students in middle school and up to learn the complexities behind cloud-based infrastructure, applications, servers and databases."

I have served as a member of the advisory board of Yellow Circle not-for-profit company since February 2017. I have received permission from the company CEO to collaborate on a topic and produce a problem solving educational project.

Limited by donated funding sources, the human resources to manage customer service at the educational not-for-profit Yellow Circle do not meet the requirements of 40,000 global users on a 24x7x365 basis. Currently 4 part-time staff and up to 10 interns manage the questions as Yellow Circles primary support as available. The problem is educational global students need personalized answers in real-time around the clock in a human voice as well as chat capabilities. What this project recognizes is the different learning and teaching styles of students as well as the technologies that can enable them such as chat or voice, hence the project name Learning Platform Bot.

Existing Solutions

This project will build on two current class projects:

1. Lara, S., Lane, J., Fund, J. (2016) in the project *BuzzChat: Answers your OMSCS Questions* setout to answer commonly asked OMSCS questions using an application developed with artificial intelligence.

2. Gregori, E. (2017) in the project *Evaluation of Modern Tools for an OMSCS Advisor Chatbot* proposed an automated advisor for the OMSCS program in the form of a chatbot. A chatbot to answer student's questions immediately 24/7.

This project will extend these papers into voice technology using Amazon Alexa along with Lex Chatbot technology to provide personalized advice to new and current students using the Yellow Circle educational platform. The focus will be on the personalized interaction based on the profile of the student.

Design of the Tool

Research by Martin (2017) recommended starting the design of a chatbot with a framework as the best method to ensuring outcome success. This framework is based on four factors scope, chatbot personality, a prioritized list of features, and chatbot flow.

Scope

The project will simulate the interaction between a student user of YellowCircle.net using both a text-based chat bot and voice based chat bot. The simulation front-end will include a simulated YellowCircle.net user environment that includes the end-user profile information, a text chatbot, and a voice chat bot. The back-end will include question and answer content, natural language processing, ability to find answers to questions, and user authentication to enable the access.

The project scope excludes access to real end-user data as many of the end-users are student minors. End-user profile data will be simulated based on conversations with company personnel.

Chatbot Personality

User Interface research by Zilnick (2016) found guiding conversations, tracking points, and reacting to users were all part of the process. Storytelling and brainstorming with post-it's were determined to be a valuable method in designing a Chatbot Personality.

The project recognizes the typical age of real users of YellowCircle.net ranges from 12 through 20. However, teachers and advisors may also use the environment. Typical initial questions of these potential users involve cost, how to access, limitations, how to create a blog, how to create a website, etc. Potentially parents may also be coaching their children in how to use the site. Another words, while the typical user is a young student it is possible that any age may use this environment.

According to Grewall (2018) the story of YellowCircle is a good place to start to understand the needed chatbot personality. Just when our founder, Navneet Grewal thought that he was done answering all the questions regarding "SQL Injection" to his 11 year old son, his son asks "So where can I test my SQL injection skills". Yes, the answer to this question prompted Navneet to create a small instance of Openstack cloud environment in their garage with just a few images and flavors, but the word spread and some of his son's friends wanted to be creative with their computer ideas but no place to play.

A small information technology infrastructure sandbox in the garage for Navneet's son and his friends to build on-demand virtual data centers with routers, networks,

switches, load-balancers, firewalls, and virtual servers. Best of all, there is no one to tell them — “You are going to mess up the family computer”

Few months into this, demand outgrew the small setup in the garage, and Yellow Circle was started to make this learning experience open to everyone. Within two months of open beta-testing period, Yellow Circle had over 100 students from 40 different countries building virtual data-centers.

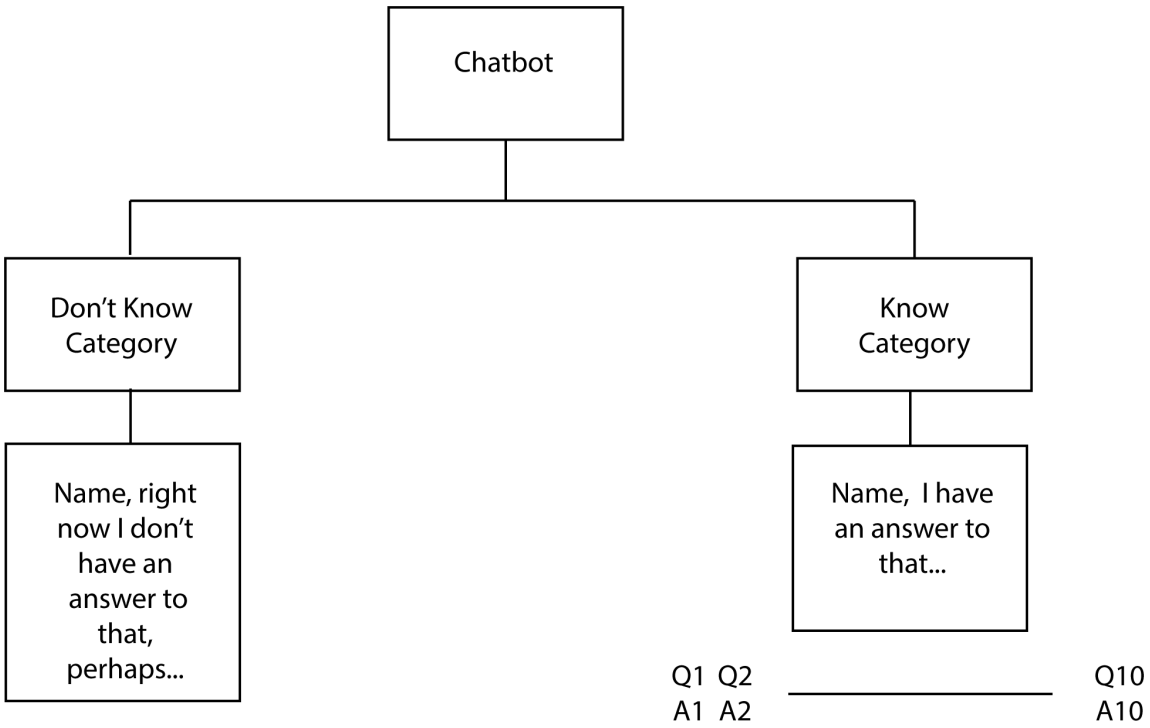
The chatbot will be personalized and understanding of an average young student.

Prioritized List of High Level Features

1. Must self-register user name and demographic information
2. Must allow administrator enter questions and answers into a form and store in a database for later retrieval
3. Must allow output to user on a web page, chat or voice
4. Must use user profile information in response to a user
5. Must manage non-responses in a friendly manner

Example Chatbot Flow

While developing a list of potential questions and answers using the chatbot framework, here is an example a non-response and response using a chatbot.



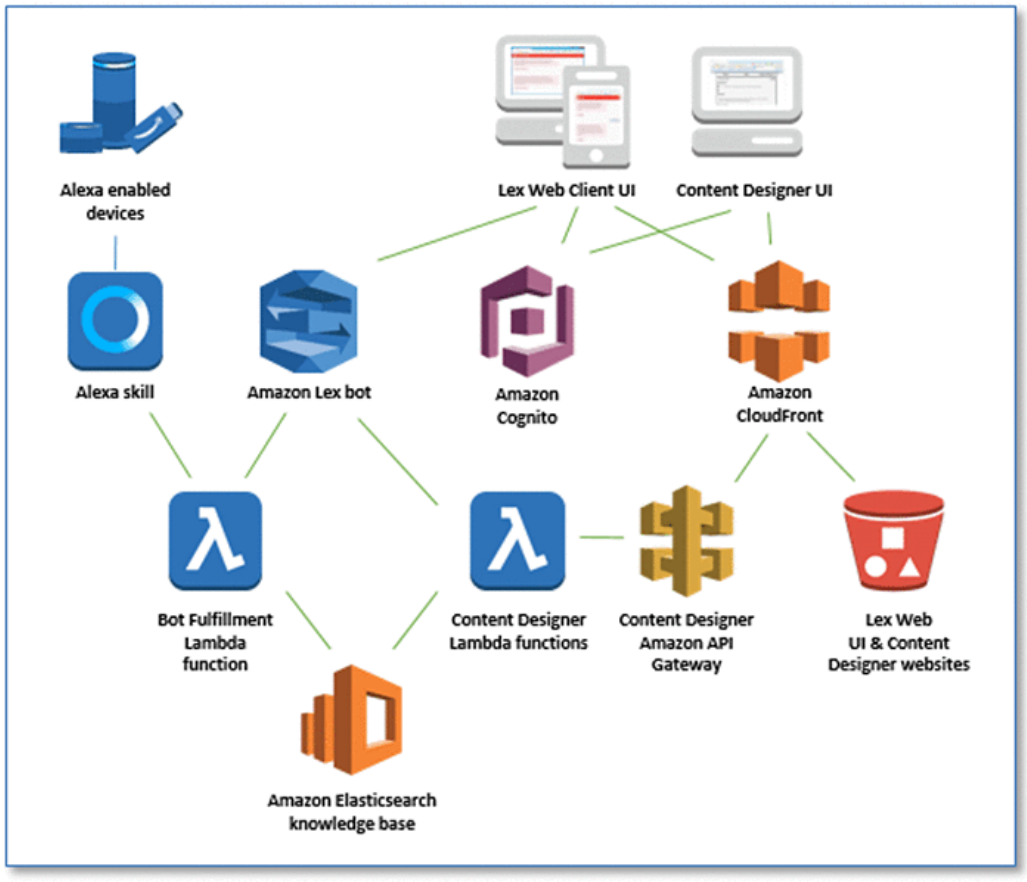
Technical Description

Foundational

Strahan and Calhoun (2017) of Amazon Web Services (AWS) implemented a demonstration bot which will serve as a foundation for the design of Yellow Circle Bot.

- Amazon Elasticsearch Service domain to store and search content in Amazon S3 buckets.
- Amazon Lex Bot to provide natural language processing.
- AWS Lambda functions used to administer content and to find answers to questions.
- Amazon API Gateway REST APIs used by the web UIs.
- Amazon Cognito configured to authenticate clients and provide temporary AWS credentials.
- Amazon CloudFront distribution used for websites and API endpoints.

Figure 1. Voice Enabled Chatbot. (Strahan, 2017)



According to Amazon Lex (2018), Amazon Lex is a service for building conversational interfaces into any application using voice and text. Amazon Lex provides the advanced deep learning functionalities of automatic speech recognition (ASR) for converting speech to text, and natural language understanding (NLU) to recognize the intent of the text, to enable you to build applications with highly engaging user experiences and lifelike conversational interactions. With Amazon Lex, the same deep learning technologies that power Amazon Alexa are now available to any developer, enabling you to quickly and easily build sophisticated, natural language, conversational bots ("chatbots").

Speech recognition and natural language understanding are some of the most challenging problems to solve in computer science, requiring sophisticated deep learning algorithms to be trained on massive amounts of data and infrastructure. Amazon Lex democratizes these deep learning technologies by putting the power of Amazon Alexa within reach of all developers. Harnessing these technologies, Amazon Lex enables you to define entirely new categories of products made possible through conversational interfaces.

The tool will also utilize Amazon Alexa, which is described as follows:
According to Amazon Alexa (2018), Alexa is Amazon's cloud-based voice service available on tens of millions of devices from Amazon and third-party device manufacturers. With Alexa, you can build natural voice experiences that offer customers a more intuitive way to interact with the technology they use every day. Our collection of tools, APIs, reference solutions, and documentation make it easy for anyone to build with Alexa.

Code

The tool will utilize JSON code for intents and utterances. The programming language for the Lambda function is JavaScript. Amazon Lambda function will be used to connect the front and back-end Amazon services. Regarding using existing code base, Schmidt (2017) has forked a GitHub repository for the Amazon Demonstration Question and Answer Bot under the Amazon License. Strahan (2017) is the source of this GitHub repository.

Integrations

The project will simulate portions of a real educational environment to demonstrate the capabilities. An integration between a WordPress environment using API calls from the backend chat bot will provide simulated end-users. The simulation will not impact YellowCircle.net production environment. Integrations will also occur between various Amazon Web Services functions leveraging existing examples from the services.

Project Tasks and Schedule

The following is a tentative outline of work required to successfully complete the project. Each task could be further divided into subtasks, but each week should have about 10-15 hours worth of capacity. Ideally, development should be finished by week 8, leaving weeks 9 & 10 available for integration testing and bugfixing, as well as adding in additional features (if time permits)

The following represents the proposed project schedule and tasks in calendar form.

Project Week	**Class Week**	**Description of Task or Milestone**
0	Project Start	
1	7	Review proposal, review existing projects
2	8	Review code base, determine additional code needed, validate platform needed, validate requirements, develop outline of paper, build test plan and chat questions, start Amazon AWS infrastructure deployment
3	9	Review AWS infrastructure deployment, update design plan
	Milestone 1	CloudFront Design Diagram, Testing Plan, Outline of Paper
4	10	Build final AWS Platform using CloudFront, Validate Platform for building questions and user works including simulated Mock Learning Site.
5	11	Build and deploy code such as integration between AWS and Mock Learning Site, Draft Paper, Unit Test
6	12	Continue validate testing, review logs for errors and resolve code issues.
7	**Milestone 2**	Unit Test Complete, Video of Initial App, Draft Paper
8	13	System Test
9	14	Acceptance Test
10	15	End-User Test, Video of Final Test
11	16	Final Project Completed, Project Paper Completed, Project Presentation Completed and Published
	Project End	Lessons Learned

Milestone Descriptions

Milestone 1: This milestone will consist of the outline of the paper, test plan, chat questions, and an AWS diagram using CloudFront based on what I have learned about the AWS architecture. By this milestone, the infrastructure components are setup in AWS.

Milestone 2: This second milestone will consist of the first draft of paper, initial published video of the application operating, documented results of the unit testing.

Team Description

The team will consist of Robert Schmidt as sole team member.

Conclusion

While this Learning Platform Bot project will a challenge, I do believe it is scoped for this class. I will be leveraging what exists and building upon the ideas of my predecessor classmates. It extends on the concepts of learning methods and teaching methods by voice as well as chat and the existing text. I am excited to get this project start on this project and look forward to the contributions it makes.

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