

Alexa Skill Development for Shop Floor

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Abstract—Digital assistants, which are automated software applications or platforms that assist humans by comprehending natural language in written or spoken form, are rapidly attracting consumer and enterprise markets alike. The use cases for virtual digital assistants in these markets are proliferating rapidly thanks to accelerated innovation and scalability of underlying technologies, such as natural language processing and artificial intelligence. The Rave Gears Digital Assistant will be deployed over the Amazon Alexa and will be capable of answering questions which any human assistant can answer, after scanning and processing a large amount of data, within a few seconds. Thus, this project aims to create and deploy an A.I assistant for our client, Rave Gears Private Limited, which shall let them to use their data in a much easier manner. This shall be achieved by training the Alexa to process the human language questions asked to it and directing the question to the appropriate algorithms in order to provide the appropriate output.

I. INTRODUCTION

Rave Gears and Machining provides high quality, precision CNC machining, reverse and re-engineering, prototyping, and supply of gears, pistons and gear shafts with shared customer focus on meeting delivery commitments through complete transparency and the utmost trust. There are many orders comprising of many jobs present in the manufacturing unit or the shop floor of the company. A lot of information is present, which is very relevant to the supervisors and the managers. This project is undertaken with the aim of providing a more efficient solution for retrieving the information in an elegant and efficient manner for the manufacturing unit supervisors or shop floor managers to use. Currently Rave Gears Pvt. Ltd. uses an enterprise management software called E2. This is a bit complex software that requires a great deal of effort by the staff to access and analyze relevant data in a short amount of time. This is because all information is scattered or fragmented across the entire system. So, to access a particular information, a user has to go through different channels making the process time consuming. The essence of the project is to construct and deploy a software with the ability to converse naturally with the employees. This shall make accessing information quite straightforward. This can be achieved by the device called the Amazon echo dot. An intuitive voice service powers the echo dot, called Alexa. Alexa has to be programmed so as to act as an assistant to the shop floor manager of the company. The goal is that Alexa must answer all the relevant questions put forth by the shop floor manager. These include a large set of questions related to various categories like- Job Deadlines, Customers Information, Pending Orders, Jobs On Hold, Jobs Logged Onto, Jobs due Next Week.

These are just some of the categories that are present and have questions associated with them. It also provides answers to the current status, progress and estimated time of completion of a job. For this purpose, multiple intents shall be defined and various statements/ questions will be trained to understand and distinguish between these intents. This training shall ensure that the intent of a certain question can be successfully

recognized and further processing can be facilitated. The intents are recognized by finding keywords in the said question. The reply to any question can be pre-determined and all relevant data from the database is saved in slots. These slots are used in a sentence that is a direct reply to a question. Any training carried out leads to the development of a skill on the Amazon platform. This training is carried out by using the Amazon web services and Alexa skill development tools which provide the platform for developing a skill. An interactive model is built online. This model is then linked to the database containing all the relevant information. No skill can be completely developed without testing it. Platforms like Echosim provide an efficient testing mechanism for any skill. But the physical echo dot device can be considered to be the best platform for testing a skill.

II. LITERATURE SURVEY

Currently Rave Gears Pvt. Ltd. uses an enterprise management software called E2. E2 is an Enterprise Resource Planning System provided by Shoptech that is specially modified for various companies. Rave Gears and Machining and Rave Gears India Limited are the companies under consideration that are using E2 to efficiently manage their operations. As a result E2 has been modified to suit the needs and provide efficiency to their business procedures. A team of consultants is always available for implementing any new feature or utility required by the client company.

E2 is capable of handling a lot of complex operations (for Rave Gears Pvt. Ltd.) like

A. Data Collection

Storing data regarding all the jobs, orders, customers, raw materials, deadlines and any notes that further provide information.

B. Quality Control

It ensures that all products undergo quality inspection before being dispatched. Various tests that are required for any special product are also mentioned and are to be carried out.

C. Shipping

All shipping records regarding every product is stored after the product is dispatched.

D. Accounting

All finances and company account transactions are stored in the system. This is also used for invoice generation. This basically includes all client payments and payments to all vendors.

E2 is a very secure and closed system granting access only on machines that are licensed to utilize it. One cannot remotely access the E2 system even by using a Virtual Proxy Network. This makes the system inaccessible from outside the assigned work stations and makes the working environment more secure. There is a slight drawback in this E2 system. Although confidentiality and integrity of data is adequately provided, the

availability of relevant information is an issue. This is a system which comes with a bit complex User Interface that requires a great deal of effort by the staff to access and analyze relevant data in a short amount of time. This is because all information is scattered or fragmented across the entire system. So, to access a particular information, a user has to go through different channels making the process time consuming.

III. PROPOSED SYSTEM

Amazons voice control system is called Alexa. It lets you speak your wishes and see them fulfilled at least simple ones, like dimming your lights or playing music tracks. It turns the Echo, Dot, and Tap streaming audio players into de facto smart- home hubs and Internet assistants. And it's what turned Echo into not just one of this year's biggest tech products, but possibly the biggest news so far for those interested in smart-home control.[1] A companion app is available from the Apple App Store, Google Play, and Amazon App store. The app can be used by owners of Alexa-enabled devices to install skills, control music, manage alarms, and view shopping lists. It also allows users to review the recognized text on the app screen and to send feedback to Amazon concerning whether the recognition was good or bad. A web interface is also available to set-up compatible devices (e.g., Amazon Echo, Amazon Dot, and Amazon Echo Show). Thanks to the Echos far-field microphones, Alexa can respond to voice commands from almost anywhere within earshot. And there's no activation button to press. Simply say the trigger word (either Alexa, Echo, Amazon, or Computer.) followed by what you want to happen, and it will be done. This depends on the skill that is being used. [2] Alexa Skill: The Alexa skill is a product being developed by any developer that can be deployed on the Alexa platform, so as to perform those skills and provide additional functionality and third-party integration. Amazon allows developers to build and publish skills for Alexa using the Alexa Skills Kit. These skills are third-party developed.

Voice experiences that add to the capabilities of any Alexa-enabled device (such as the Echo). These skills are available for free download using the Alexa app. Skills are continuously being added to increase the capabilities available to the user. A Smart Home Skill API is available. All of the code runs in the cloud nothing is on any user's device. A developer can follow tutorials to learn how to quickly build voice experiences for their new and existing applications. We as a group are developing a skill that seamlessly integrates the E2 system with a voice based assistant like Alexa to make complex query execution more easy and hassle-free. The Alexa skill would be able to interact with the shop floor user in a conversational nature. It would be able to understand and remember context of the statements made by the user. The proposed system will act as an interface between natural language and lower level querying language.

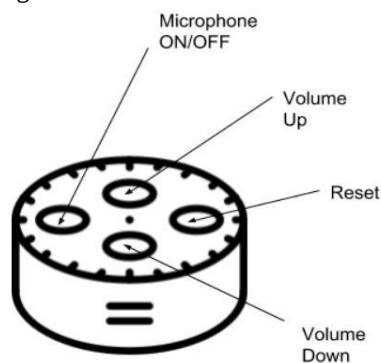


Figure 1: Echo Dot Device

The device can be an Amazon echo or an Amazon echo dot. The device by itself is convenient and easy to use. It is a black box with a button to reset that helps to set up the WiFi. Another button to start or stop the microphone. The remaining two buttons are for increasing or decreasing the volume of the response. It also includes a 3.5 mm jack port and a USB port and includes seven strategically placed microphones that can pick up voice commands from anywhere in the room. The device needs a constant power supply and can be attached to a computer or a laptop by a USB cable.

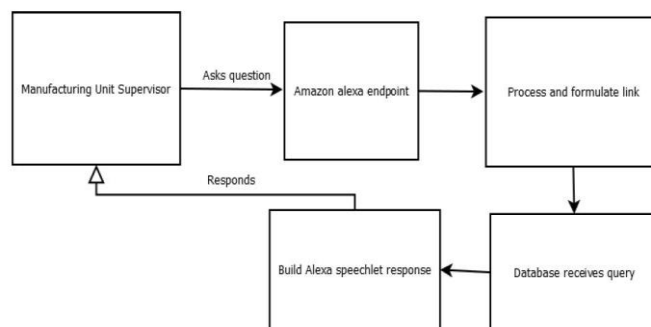


Figure 2: Block Diagram

The Block diagram depicts the working of the system. The Manufacturing Unit Supervisor asks a question to the device, which is the amazon Alexa endpoint. Then this process is linked to the database, an appropriate response is formulated.

The user then receives the response. The following is a brief description of the blocks.

A. Manufacturing Unit Supervisor

The Manufacturing Unit Supervisor is the end user who interacts with the system. All queries originate from him in the form of questions.

B. Amazon Alexa Endpoint

This is the physical echo/echo dot device on which the designed skill runs.

C. Process and Formulate A Link

Here the parameters are identified and the necessary link to the database in the form of queries is made. This is done only if the intent is comprehended by the skill.

D. Database Receives Query

The database then receives the query from the internet. This connection takes place with the help of Alexa SDK, NodeJS and PHP.

E. Build Alexa Speech-let Response

Once the answer to the query is retrieved an answer or a response is formed. This uses the Alexa Skill Set. This response is the output from the device that is heard by the Manufacturing Unit Supervisor.

The Flow Graph or the Work Sequence diagram gives the working states of Alexa. The system is initially present in the idle state. When an input is received, the input parameters are detected. It then tries to understand the intent. If the intent is understood then a connection to the database takes place and a response is generated. The response is then uttered. Else if the intent is not understood, a fixed response is uttered and the system goes back to the idle state. The states are as follows:

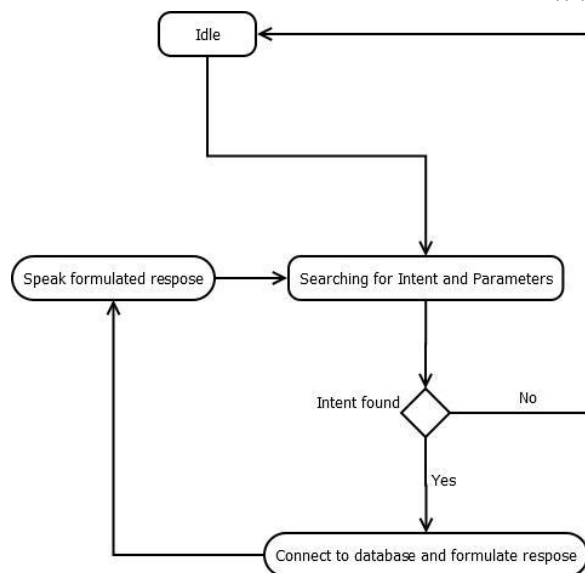


Figure 3: Flow Graph

1. Idle State:- The state when no interaction with the system takes place

2. Active State:- This state is basically when a user is interacting with the system. There are two sub states present.

- i. Active Listening State:- This is the state when the device is listening to a user's command.
- ii. Active Uttering State :- This is the state when the device is uttering a response to the question posed by the user.

3. Processing State:- This state is an instantaneous state between the two active states where all the processing occurs.

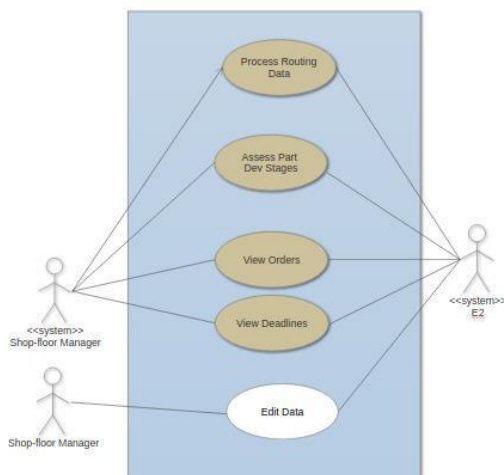


Figure 4: Use Case Diagram

The use case diagram has list of use cases or operations. These use cases are linked to particular users of the system. The shop floor manager can manually edit the data in the database. But all day to day operations are answered by the system in a convenient fashion. The E2 system holds the consolidated data and can access all the modules linked to the new system and can also be used to edit data.

IV. SCOPE

The scope of this project is to plan, design, build and implement an artificial intelligence based digital assistant that can answer the manufacturing unit supervisors (of Rave Gears Private Limited) questions. This shall be developed on Amazons Alexa skills and voice services using the Alexa

SDK. The Alexa skill developed for this purpose shall have access to a PHP based API link that shall answer various questions based on the intent and the provided parameters. Thus, the project is limited to accessing the data and cannot update the data in any manner. Included in the scope are:

1. Answering various questions regarding routing of manufactured parts.
2. Answering various questions regarding the details of the order, such as the name of the customer, the due date of the order (deadline), etc.
3. Understanding the context of the questions asked based on previously asked questions
4. Providing a faster and more efficient management tool for the manufacturing unit

V. HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements are listed as below:

1. Alexa supported device like the Echo, Echo dot, etc.
2. A Smart phone with Alexa app installed.
3. A server to handle databases and requests.

Software Requirements for development are :

1. NodeJS
2. Alexa SDK for NodeJS
3. PHP
4. Python with various dependencies
5. SQL

VI. IMPLEMENTATION

In order to implement the proposed system, the amazon Alexa has been interfaced with our database in order to work seamlessly with the data given by Rave Gears. Via the interaction model and the lambda function, written in NodeJS, we can form an API link to our MySQL database. A PHP script then analyses the request to return the appropriate answer. The lambda function once again comes into the picture so as to form a response and allows the echo to speak the answer. The Alexa voice assistant was constructed mainly to aid the customers of Amazons smart home systems. However, with the willingness of Amazon to provide access to its Developer Portal to everyone, it is now possible to create custom skills which can work on all devices which support Alexa. A voice based Digital assistant which can understand a managers command and retrieve relevant information without even a click of a mouse button is a helpful tool in the right hands. Rave Gears shall benefit greatly from this custom skill that can understand intents and context and respond in a manner that can easily be understood by the users of the system. This project shall help them to eliminate the cumbersome task of reading through thousands of data entries made on their ERP system as they can simply ask Alexa to help them with their queries.

Acknowledgment

Firstly, we would like to thank our principal, Dr. S.M Khot, for giving the opportunity and permission to undertake this project. We would like to thank Prof. Lata Ragha, Head of Computer Engineering Department, for lending her full cooperation, despite her busy schedule, for the successful deployment of this project. We are also indebted to Mrs. Smita Dange, coordinator of Computer Engineering Department, for her endless inspiration and support. We take immense pleasure to thank our project internal guide Mrs. Sandhya Pati for her constant supervision as well as for providing necessary information regarding our project. We would like to take this

opportunity to thank her for her guidance and support throughout.

We would like to appreciate the constant interest of our external guide Mr. Aditya Gupte in our project and providing technical knowledge about the project. We would also like to thank all the other staff and non-staff members of Computer Department for their help.

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