AN INTELLIGENT BUSINESS INVENTORY MANAGEMENT APPLICATION USING ARTIFICIAL INTELLIGENCE AND VOICE RECOGNITION

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ABSTRACT

Virtual Enterprise, a class that simulates real-world business world, is designed for high school students to improve their experience in buying and selling. In Virtual Enterprise, various virtual products are created by classes. Each class is trying to sell products to students from different class in exhibitions. However, in trading, thousands of different types of handwritings made the salesperson in exhibitions are too difficult to be organized by administrator. To solve this problem, this paper develops an application, called Easy Exhibition, using Artificial Intelligence technology, which uses voice recognition technology to automatically complete the sales order by voice instead of by handwriting. The experiments show that AI-assisted solution improves both accuracy and efficiency in transaction processing.

KEYWORDS

Virtual Enterprise, Artificial Intelligence, Voice Recognition

1. INTRODUCTION

There is a class for high school students to attend called Virtual Enterprise [7] [13], which is a class for students to have a basic feeling on the business world especially the exhibition and buy and sell experiences. In this class, the whole class together creates a business company, and each person have an assigned role such as CEO, COO, CFO, and department heads. The company togethers creates the virtual product to sell and try to sell them to other students from different class of virtual enterprise from different school in exhibitions, which is also called trade shows [6]. However, the high school students do not have sufficient experiences to perform efficiently in those exhibitions, and therefore students suffer so much when sales are signing orders with customers on paper, that thousands of different types of handwritings made the salesperson have a really hard time to sort things out and send confirmation emails or sales receipts. Especially as a vice president of sales, that manages all the sales processes. Basically, my daily work in that class is recognize the contact information that customer wrote down on the sales receipt and try to send the email based on their terrible and rushing handwriting. Reading one is fine, but 100 every day is a pain in the neck.

A real company could also face this kind of problem on their real-world exhibition. When their customer makes purchases, it is almost impossible for sales person to record all kind of product

with every detail. And once the booth gets popular, the sales person will easily forget about which customer they are helping and what did they order one minutes ago.

Manually writing and typing the sales order is tedious, error-prone and time-consuming. With all kind of different handwritings that were wrote by people with big diversity in a rushing period, it turns out the writing are not recognizable at all. People's handwriting in a rushing period on an unstable platform makes the writing very messy, to the fact that nobody else can read what's written on the paper. It is so hard afterwards for salesperson to recognize the letter wrote on the paper, and the handwriting creates such a similar between letter that looks alike. Also, writing sales order by hand on paper takes so much time for both customers and salesperson. The customer need to fill in all kind of information such as name, phone number, email, and school by hand, and salesperson need to write down all product that customer purchased and calculate the price manually by a calculator on their phone. The salesperson cannot reach the customer, and the order they make are not valid anymore.

Now in the world that the Artificial Intelligence are growing rapidly, we can easily use the AI and voice recognition [8] [9] [10] technology to automatically complete the sales order by voice instead of the old inefficient way of complete them by hand. This way, it will make the salesperson complete the order faster and have a valid contact information to customers, and buyers can waste less time finishing the paperwork with salesperson once the purchase agreement has met.

2. MOTIVATION

Here's two examples (Figure 1 and Figure 2) of handwriting on the sales receipt that is hardly to recognize for salesperson. The letter is all scramble together, and some letter are uncertain whether it is a r or n, a 4 or 9, and whether there is a dot or not on the email section. Those elements are combined to create a contact information that is not readable. With this kind of contact information on the paper, the salesperson suffers so much after the exhibition when they are trying to contact consumers with order details. Manually writing and typing the sales order is tedious, error-prone and time-consuming. That creates a huge disadvantage for virtual enterprise company to manually fill out the sales receipt.
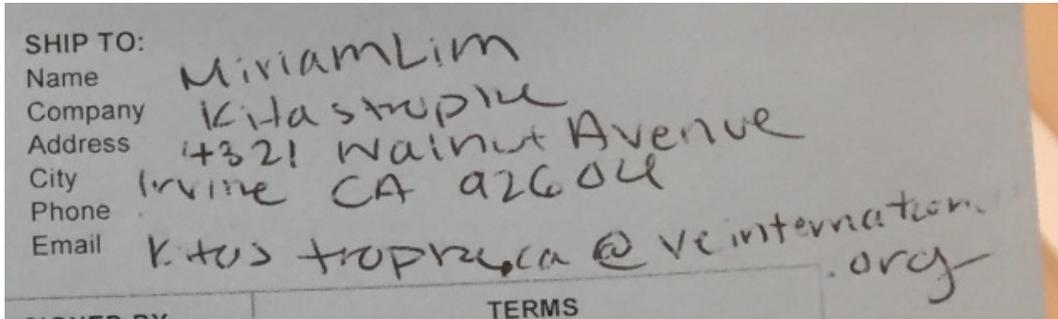

Figure 1: transaction written in handwriting

Figure 2: transaction written in handwriting

Different person in from different origin have different accent when they speak, and in this divergent nation all kind of accent exists. This creates a difficulty for voice recognition system to perform accurately on what the consumer says. Also, in the place where most of the voice recognition take place, there are a lot of different kind of unnecessary noise and might experience interference with the salesperson next to you. And, different category of information requires different way of voice input. For example, the company and school are one to five different word that customer and easily say the word, whereas the email is a series of random letter or number that requires to spell out every letter in order. The switch between saying the word and spell the letter and number make the voice recognition part hard to complete.

The user of the application is different companies, therefore there are different kind of products with different prices. Also, companies might locate in different states where the sales tax percentage is different. To set up a formula for calculating the price is confusing. And before this app, all the calculation is manually done by hand and a calculator on the phone, which is time consuming and error-prone.

The user needs to have the application that is going to help the business the best in term of time and effort. Some information on the sales order for company is just a simple number, that using voice recognition technique takes more time than handwrite a line on the paper to represent one.

3. SOLUTION

3.1. Overview of the Solution

The overview of the system is presented in Figure 3. The application created called Easy Exhibition, which uses voice recognition technology to substitute the customer information fill by hand. Also, the Easy Exhibition application can help the salesperson by automatically calculates the price and sends confirmation email to customers once the order being confirmed. The sales person only need to enter the quantity of product being sold and the application will help the salesperson do the rest of the work.
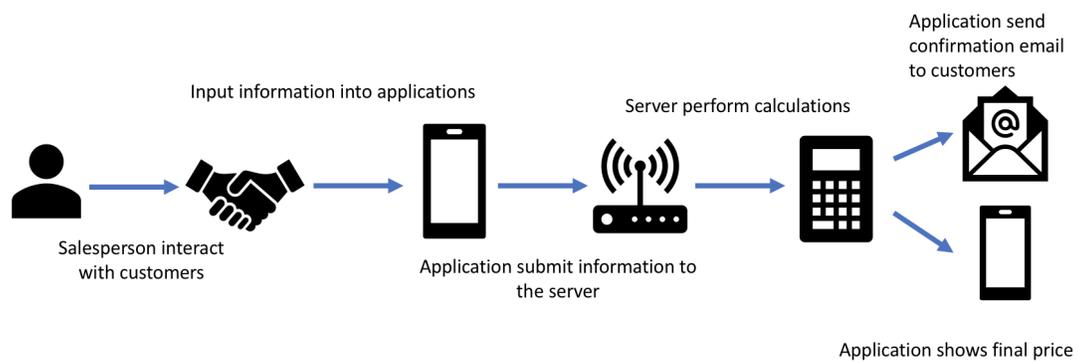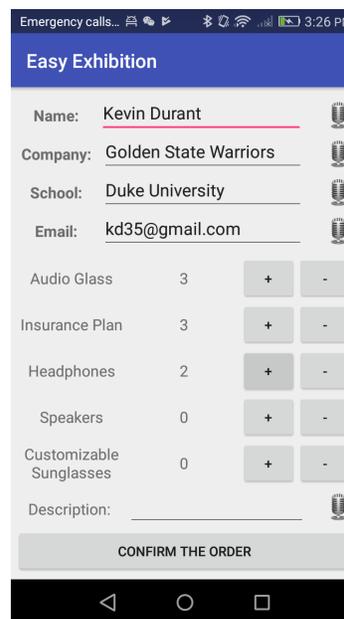
Figure 3: Architecture of Easy Exhibition

Figure 3: Screen shot of Easy Exhibition application

3.2. Voice Recognition

In the world of business, all information need to be completed and accurate. The voice recognition process in the app requires a high accuracy for the whole application function. In the app easy exhibition, we decided to use the voice recognition program established by Google. Based on my research, Google's voice recognition is one of the most popular and accurate voice input system.

3.3. Calculation System

On a trade show, not all the information is capable of using voice recognition system to operate. For example, the quantity of the product ordered is less efficiency to use voice recognition technology than a simple +/- button on the screen. Also, on the backend of the program, we use python calculation system [10] [12] to setup the equation to calculate the different kind of total price and taxation prices.

3.4. Interface

Not all the users for the business app are technical users, so the app (Figure 4) are created based on a friendly user interface. For the information that take a significant amount of time to write and hard to recognize on writing, the voice input system turns in to play. But for those section that only requires a number, an + or - button was used instead of voice recognition system to minimize and time taking to complete an order. This way, the final version of the sale receipt is clean and straightforward.

4. EVALUATION

To evaluate the performance of our system, we designed several experiments to test the performance of the system. Experiments are used to test accuracy, efficiency, and user experience.

A. *The Accuracy of the Voice Input*

To test the accuracy of the system, we tried to input 200 email address/names/school with 5 users. As shown in Figure 1, the average accuracy is 97.4%. Particularly, the accuracy of email recognition using voice is 97.3%, which is better than typing the email addresses manually.
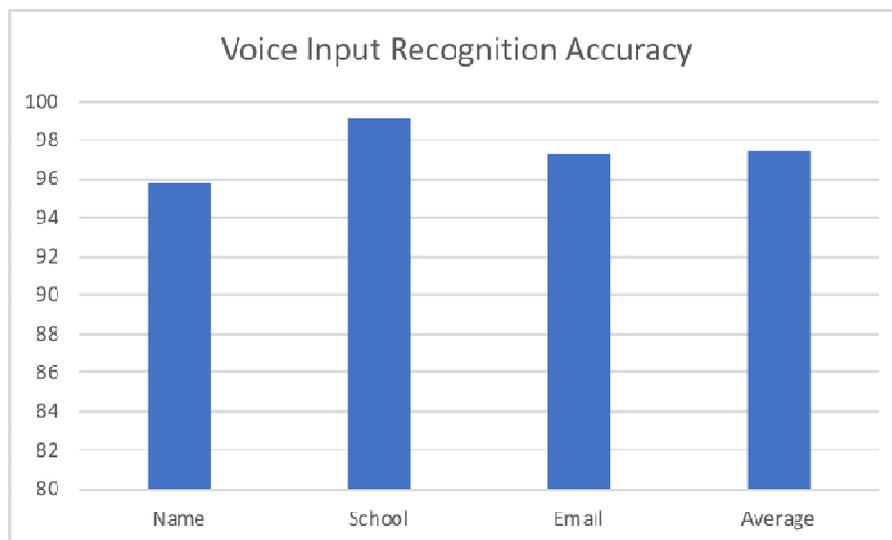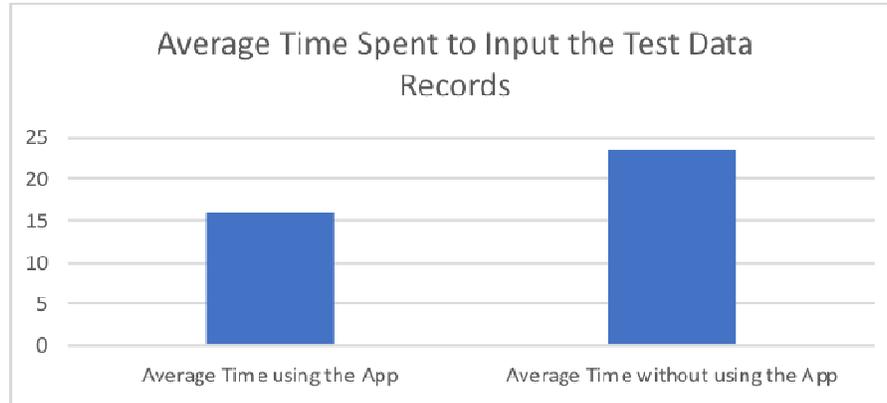

Figure 4. The Accuracy of the Voice Input Recognition Accuracy

B. *The Improvement of the Efficiency*

In this experiment, we divide the 6 users into 2 groups – one group use the app for data input, while the other manually type the same amount of information to an excel file. It shows that the average of time the App group is 32% faster, as shown in Figure 5.

C. The User Experience Feedback

We also created a questionnaire about the app and the user experience. 10 users participated provided the following feedback. As shown in Table 1, the overall experience from the users are very satisfying.

Question	Average Rating (1 is the lowest and 5 is the highest)
Does the app help you to input the information in a faster way?	4.5
Is the email voice input better than typing?	4.8
How accurate the information collected using the app is?	4.4
Is the app user-friendly?	4.8
Would you like to use the app to collect the customer information?	5

Table 1. The User Questionnaire Feedback

5. RELATED WORK

Similar work also applied machine learning to voice recognition. Muda, Begam [1], introduced one technique for voice recognition, which uses Mel frequency cepstral coefficient (MFCC) and dynamic time warping (DTW) technique to improve voice recognition efficiency. Lancker [2] investigated recognition of familiar voices and presented 45 famous voice stimuli to 94 subjects, forward and backward. Their results showed that each familiar voice is best viewed as a relatively unique pattern. Human voice is done by adjusting different voices parameters. Until now, voice recognition is applied in various domains [3] [4] [5], which brings us great convenience in daily life.

6. CONCLUSION AND FUTURE WORK

In this project, we proposed an intelligent approach to address the problem of keeping record of transactions in Virtual Enterprise. This is realized by using voice recognition technology to automatically complete the sales order supported by machine learning. A mobile app has been developed to allow users to input orders through voice instead of handwriting.

To evaluate the performance of the application, we did several experiments for testing in accuracy, efficiency, and users' feedback. Experiments show that our accuracy can reach to high level in regular mode.

As for the future work, we will investigate other machine learning algorithms to keep improving the accuracy. We also would like to explore the possibility of applying deep learning in this problem domain.

In addition, one limitation related with the app is that its performance is dependent on google voice. We will look for better voice recognition backend to support our system. One feature we plan to add in the next version of the app is to upgrade interface and performance.

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