Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

Call Center Monitoring for Emergency Services

Ana Kobiashvili
Georgian Technical University, Professor
a.kobiashvili@gtu.ge

Nodar Darchiashvili
Georgian Technical University, PhD student
n.darchiashvili@gtu.ge

Tea Todua
Georgian Technical University, Associate professor
tea_todua@gtu.ge

Abstract

Speech recognition applications can increase the efficiency of simple tasks and greatly expand the range of tasks that call center operators perform. To increase the productivity of the public security management center, a software module was created which analyzes incoming calls, converts them into text form and places this text in the database. Operators are given the opportunity to read the call text after the end of the call to better understand its content and to improve the quality of the corresponding response.

The article discusses the module, which was created to convert the incoming calls into text form. The service is a .NET Core Web API application created using the C# programming language. It uses a NuGet package to communicate with Google's Speech service. The components of the system are described, the JSON format of the message is given, the structure of the database is discussed, the corresponding software codes of the module are given.

The article also shows the customer irritating factors, analyzes the situations that create a series of calls, presents the results of customer surveys, which relate to the needs of customers in terms of waiting time. The paper discusses the mechanism for prioritizing calls, the algorithm for its implementation, as well as ways to manage non-targeted calls. The article shows the pros and cons of a system for queuing priorities.

Keywords: Database, call center, conversation recognition system, phone call analysis, average call duration

Introduction

The efficient operation of any call center is quite difficult to achieve, because there are thousands of calls every day, a lot of questions are answered and a lot of problems are solved. To improve the quality of service, it is extremely important to introduce methods that will reduce the duration of call service.

Effective operation of the call center is

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

greatly influenced by how the queue of incoming calls works [1]. Call centers use different methods, tools, and practices to reduce customer wait times. Our goal is to have the lowest possible waiting time, which will result in more efficient service and customer satisfaction.

Development of the Call Management System

It is necessary the queues of the call center to be constantly monitored and appropriate actions are taken to reduce customer dissatisfaction and disconnection of calls before answering. Every call is an opportunity to give the customer an impression about the company.

Fig. 1 shows what factors annoy the customer the most when calling. One of the most annoying factors is the long waiting time. While waiting for an answer, the user has two options: hang up until they answer, or hang up and try to connect later. High waiting time for the call center causes many disconnected and repeated calls, as well as dissatisfaction of customers [2].

When connecting to a telephone system that uses call queues, the caller typically hears a welcome message and then the call is sent to a queue where the user is notified by an answering machine of their position in the queue.

Fig.1. User irritants

Situations that create a call queue are:

High call processing time. The call center is delayed due to longer than expected working time on the call. The reason for this may be the carelessness of the operator, the initiator interrupting the conversation or the lack of experience of the problem solver.

Lack of employees. Increased queues are sometimes the result of a shortage of operators. If the call center does not have operators with a ratio of proportional to the volume of calls, a long queue of calls and a long waiting time will be accepted.

Outdated technology. Outdated or user-unfriendly phone software affects the effective operation of the call center operator. Advanced telephone systems provide the operator with information about the initiator of the call before answering the call, which

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

reduces the conversation time.

The diagram created by Vocal Laboratories (Vocalabs) presented in Fig. 2 [3] shows what duration users consider reasonable while in standby mode. Here is the customer satisfaction index, which decreases proportionally to the duration of high waiting.

In the case of normal queue distribution, calls are answered in the order in which the call was received. To transfer calls to operators, call centers use an automatic call distributor (ACD), which holds the call until the answering operator is released. This sequence is logical and fair, although sometimes it is in the interest of the company to give some calls a higher or lower priority, which will cause it to shift in the queue [4]. Many factors can affect the change of priority of the number in the queue. It may be the manager's personal decision that the number chosen by him should spend less time waiting for an answer than other numbers.

Based on the collected data, the analytical system makes an analysis of each item. By sorting these calls by numbers, the system has different indicators for each number, for example, how many times the customer calls on average, how long he/she has to wait, how long it takes to solve his/her problem, how he/she evaluates the received service, and other analytical data.

Fig.2. Users' opinion on being on standby

The call center has the right to change the priority of the number based on any indicator. The automated priority distribution system creates a priority list of numbers using different algorithms. With these algorithms, some of them increase the priority, others decrease it. The priority can also be negative, that is, answering a number with a negative priority will happen later than a number that has no priority at all.

The queue management system works as follows: according to the priority value of the number added to the priority list, this number will change its position and move forward or backward.

Positive priority. Let's assume that the number has a positive priority with a value of 3. If a call is made from this number to the call center and there are 6 people waiting,

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

the number will be found in the 4th position instead of the 7th position. If the number of waiting calls is less than the number's priority, the number will be answered as soon as an operator is free.

Negative priority. Let's say the number has a priority of -2. In case, when making a call from this number, there are 5 calls waiting, initially this number will be in the 6th position. If other calls are added to the queue before this number is answered, this number will be changed first to the 7th position, and then to the 8th position. The shift will occur at most twice, because its priority value is -2.

If no calls were added to the queue (or a number of calls were added less than its priority value) and this number went to the first position in the queue, then it will be answered normally.

The list of priorities looks like this:

Phone number	Time of adding to the list	Time of removing from the list	Priority value
111111111	17/07/2019 15:30	20/07/2019 15:30	3
222222222	16/07/2019 12:13	19/07/2019 12:13	2
333333333	17/07/2019 18:05	20/07/2019 18:05	2
444444444	18/07/2019 20:25	21/07/2019 20:25	–1
555555555	18/07/2019 14:12	19/07/2019 14:12	–2
666666666	18/07/2019 21:43	23/07/2019 21:43	–2

The system has calculated various analytical indicators for each number, according to which it is possible to assess the risk of losing this or that user. For example, if the average waiting time of the customer or the duration of working on his/her calls is higher than the set, the probability of losing him/her increases significantly. Also, the customer's dissatisfaction can be determined according to the evaluation fixed by him.

The factors mentioned above are used to increase the priority of the user in the queue. For example, if the acceptable duration of working on a call in the call center is 5 minutes, and some customer had to wait for 8 or 10 minutes, the system assigns him/her the priority „+1“, if this is repeated, his/her priority is „+“. It will increase to 2 and so on.

The number is added to the list for a certain period of time. The term is determined as a result of data processing of the analytical system. Automatic change of priority takes place depending on the duration of the time period. The company can choose how long the numbers will appear in the list when configuring the system. In the above given example, it is assumed that the number is added to the list for 3 days.

The call may be inappropriate for the company, for example, if the initiator calls for fun or with a question that is not relevant to the given company. Such calls simply waste time for operators and negatively affect the waiting time of other users.

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

There are many ways to detect spam calls. To recognize such calls, we may use a conversation analytics system that can recognize the spoken text and give us a percentage indicator of the probability of the call being untargeted. Also, as non-targeted, we can consider calls that last up to 3-5 seconds or that do not contain more than 2 or 3 words (we will also get this information using the speech analytics system) [5].

If the call is evaluated as untargeted, the number that originated it is put in the „black list“, that is, its priority in the call queue is reduced. If the system detects that this or that number repeatedly makes calls irrelevant to the company, it will include this number in the call priority list with a negative priority for a certain period of time. For example, if the system detected that between 13:00 and 15:00, the number 456XXX made 3 untargeted calls, then it will assign priority -1 to this phone number. If similar calls continue from 15:00 to 17:00, its priority will be reduced to -2 and so on.

Conversation analytics is the process of analyzing voice recordings or ongoing calls using speech recognition technology. Its purpose is to find useful information from the content of the call and improve the quality of the conversation [6].

The public security management center receives thousands of calls every day. For a quick and correct response, it is necessary for the operator to fully and accurately reflect the information provided by the initiator in the system. Because the initiator of the call may speak quickly and unintelligibly, it often happens that the operator does not get all the information from the call in one hearing, which can be important for the correct response. Because of this, operators often need to listen to the call recording several times and extract information that way. The operator wastes too much time trying to answer the call again, and in an emergency, every second counts.

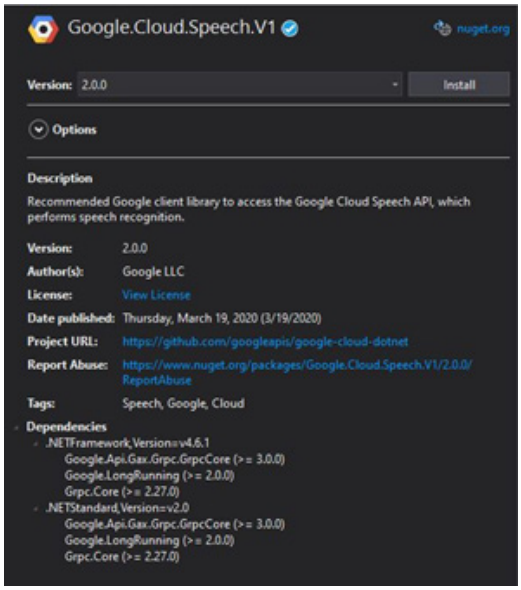

Fig.3. API controller

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

Speech-to-Text is speech recognition software that allows to recognize spoken language and convert it to text using computational linguistics [7]. It is also known as speech recognition or computer speech recognition. Specific applications, tools, and devices can transcribe audio streams in real-time to display and act on text.

A module was introduced in the 112 system, which ensures the analysis of each call and placing it in the database in its textual form [8]. As soon as the call ends, the operator sees the text of the newly connected call in the corresponding part of the program (although due to the algorithm is not 100% accuracy, in some cases the call still needs to be listened again).

The system consists of three components:

- A program (service) that communicates directly with the Google Cloud Speech service.
- Database, in which the program places the data converted into the text form of the calls.
- Integration into the 112 operating program. Through this integration, the 112 operating software communicates with the service mentioned above and transmits call records to it.

The service is a .NET Core Web API application, created using the C# programming language [9]. To communicate with Google's Speech service, we use a NuGet package (NuGet is a platform that allows developers to create, share, and consume useful code), named: Google. Cloud.Speech.V1.

The database is shown in Fig.4.

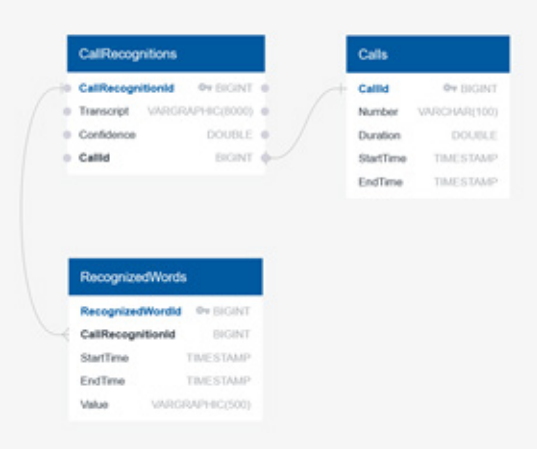

Fig.4. System database diagram

The Calls table contains a description of incoming calls to 112 (an incomplete list of columns is given). The program receives this data from the telephone system.

The CallRecognition table contains the text data recognized from the voice recording. This table is linked to the Calls table through the CallId field. Each Call record may correspond to more than one CallRecognition record, in case the Alternatives array consists of more than one value.

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

The RecognizedWords table contains each word and its start and end points. This table is linked to the CallRecognition table via the CallRecognitionId field. For each CallRecognition entry, we will have as many entries in the RecognizedWords table as there are words in the recognized text.

The 112 system is connected to the telephone system through a network, and through communication with it, operators receive calls in a Windows WPF application.

During a call, the system receives a stream of data from the phone, which it simultaneously stores in the file system. In the configuration parameters of the program, the address of the file system is specified, in which directory the temporary file of the call record should be created.

After the call is completed, a method is executed that sends the call log file to two addresses: the file storage service on the file server and the text recognition service by calling an HTTP Post request.

This system, in addition to operators, significantly simplifies the work of those employees of the organization who need to extract various information from incoming calls. To do this, it is enough to run a query with the database for the desired keywords, and the system will return information about which calls contain the given texts.

Conclusion

This system significantly simplifies the extraction of various information from incoming calls. To do this, it is enough to run a query with the database for the desired keywords, and the system will return information about which calls contain the given texts.

The program was created for the automatic management of telephone call queues during the emergency response center. It reduces customer downtime and provides them with more efficient service.

References

Darchiashvili N., Kobiashvili A. (2020). Call Center Data Analysis and Monitoring Electronic System. Georgian Technical University, Proceedings, Automated Systems, N1(30), Tbilisi, pp. 54-61

Kobiashvili A., Darchiashvili N., Gegechkori M. (2019). Text Recognition Technology from the Conversation. Archil Eliashvili Institute of Control Systems of the Georgian Technical University, Proceedings, #23, Tbilisi, pp.171-177

https://www.explainthatstuff.com/voicerecognition.html,was checked on 7.08.2024

https://cloud.google.com/speech-to-text, was checked on 01.10.2024

https://summatti.com/top-5-use-cases-for-speech-analytics/ was checked on 01.10.2024

https://www.datapine.com/blog/call-center-metrics-and-kpis/, was checked on 17.08.2024

https://www.openaccessbpo.com/blog/6-

Journal of Technical Science & Technologies; ISSN: 2298-0032; e-ISSN:2346-8270; Volume 8, issue 2, 2024

forms-of-data-analytics-in-the-call-center/, was checked on 17.08.2024

https://www.tenfold.com/customer-experience/managing-call-queues-customer-service-call-centers, was checked on 17.08.2024

https://docs.microsoft.com/en-us/dotnet/core/whats-new/dotnet-core-3-0, was checked on 10.07.2024