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Automation of Contact Center operations using a Chatbot

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Abstract: The relevance of the topic of automating contact center activities is increasing in the context of a rapidly changing service market and rising consumer expectations. Contact centers are key elements in managing customer relationships (CRM), as they provide the first level of interaction and can significantly impact customer satisfaction levels. Therefore, it is essential to find effective solutions for optimizing customer service, especially during peak loads, which poses a real challenge for traditional contact centers. Given this, the goal of this work is to automate the operations of the contact center to enhance its key performance indicators. The article investigates the mass service system model of a typical contact center, defines its main characteristics, analyzes existing methods for optimizing contact center operations, discusses the use of chatbots to automate part of the user requests, examines the performance indicators of the contact center, integrates the chatbot into the contact center, and conducts an experimental study to calculate the effectiveness of implementing the chatbot into the contact center's activities.

Keywords: automation; contact center; chatbot; mass service system; efficiency.

Automatyzacja operacji Contact Center przy użyciu Chatbota

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Streszczenie: Znaczenie tematu automatyzacji działań contact center rośnie w kontekście szybko zmieniającego się rynku usług i rosnących oczekiwań konsumentów. Contact center są kluczowymi elementami w zarządzaniu relacjami z klientami (CRM), ponieważ zapewniają pierwszy poziom interakcji i mogą znacząco wpłynąć na poziom zadowolenia klientów. Dlatego też istotne jest znalezienie skutecznych rozwiązań w celu optymalizacji obsługi klienta, zwłaszcza w okresach szczytowego obciążenia, co stanowi prawdziwe wyzwanie dla tradycyjnych contact center. Biorąc to pod uwagę, celem tej pracy jest automatyzacja działań contact center w celu zwiększenia jego kluczowych wskaźników efektywności. W artykule zbadano model systemu obsługi masowej typowego contact center, zdefiniowano jego główne cechy, przeanalizowano istniejące metody optymalizacji działań contact center, omówiono wykorzystanie chatbotów do automatyzacji części żądań użytkowników, zbadano wskaźniki efektywności contact center, zintegrowano chatbota z contact center i przeprowadzono badanie eksperymentalne w celu obliczenia skuteczności wdrożenia chatbota w działania contact center.

Słowa kluczowe: automatyzacja; contact center; chatbot; system obsługi masowej; wydajność.

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1. Introduction

The relevance of the topic of automation of contact center activities is growing in the conditions of a rapidly changing service market and growing consumer expectations. Contact centers are key elements in customer relationship management (CRM) because they provide the first level of interaction and can significantly impact customer satisfaction.

2. Analysis of recent research and publications

Current research highlights the importance of integrating the latest technologies, such as artificial intelligence (AI) and automation, to improve contact center performance. For example, studies show that the implementation of AI can reduce communication waiting times and increase the speed of processing requests [1]. Also, according to work [2], optimization of business processes through data analysis and demand forecasting allows to reduce costs and improve service quality.

In addition, the relevance of the topic is due to changes in consumer behavior: today, customers expect fast and convenient service through various communication channels. Accordingly, contact centers must adapt to these new conditions in order to remain competitive [3].

Thus, the study of the automation of contact centers is not only relevant, but also necessary to ensure the competitiveness of enterprises in the modern business environment.

In view of this, the purpose of this work is to automate the work of the contact center in order to increase the key indicators of its activity.

3. Presentation of the main material

A model of the mass service system of a typical contact center.

The *M*/*M*/*N* model is a mass service model used in queuing theory to model systems where customers arrive at random moments in time, are served, and leave the system [4-8]. In the *M*/*M*/*N* model, it is noted:

- *M* (Markovian): The time distribution between request arrivals (parameter λ) is exponential or, equivalently, a Poisson process, i.e. requests arrive randomly with mean arrival rate λ.
- *M* (Markovian): The service time distribution (parameter μ) is also exponential, i.e. the time required to service a request is random with mean rate μ.
- *N*: Number of service channels (or operators). This model assumes that there are *N* parallel service channels in the system.

The *M*/*M*/*N* model is used to describe systems where service is provided by multiple operators simultaneously and requests are received randomly. It is useful for evaluating indicators such as average waiting time in a queue, operator load factor, probability that a customer will wait, etc.

The main characteristics of the *M*/*M*/*N* model:

1. Distribution of customer arrivals and service times: Both distributions are exponential, implying the random nature of the arrival of requests and their processing times.
2. *N* service channels: The model has *N* operators serving customers in parallel. If all operators are busy, new customers wait in line.
3. Intensity of arrival and service: The intensity of arrival of customers is denoted as λ, and the average speed of service by one operator is denoted as μ.
4. Waiting time in the queue: The waiting time of the client depends on the ratio between the speed of requests and the number of operators, as well as on how loaded the system is.

This model is often used to analyze contact centers, queues in banks, network servers and other systems where there are many parallel service channels, and the goal is to estimate the service time or the probability of customer waiting.

3.1. Methods of optimizing the work of the contact center

Optimizing the operation of the contact center during peak load can be carried out by several methods [9-11]:

1. Intelligent routing of requests. Using automated systems to route requests based on their type, complexity or channel. This will help to more efficiently distribute work between agents and avoid overload.
2. Use of chatbots and automation. Automating part of the requests through chatbots or autoresponders can reduce the burden on operators. Bots can handle simple queries or provide basic information.

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3. Extension of working hours and flexible schedule. Implementing flexible working hours or extending working hours for individual operators during peak times will help reduce waiting times for customers.
4. Implementation of an omnichannel strategy. Integration of all communication channels into a single platform allows operators to work more efficiently with requests, regardless of how they were received.
5. Load forecasting and resource planning. Using analytics to predict peak load based on historical data and events that may cause a spike in activity (such as advertising campaigns). This will allow to prepare additional personnel in advance.
6. Shifting part of the load to other channels. Customers can be encouraged to use less busy channels such as email or chat instead of phone calls.
7. Improvement of the request prioritization system. Prioritizing more important or urgent requests will help optimize service and reduce the overall load.
8. Staff training. Regular training of operators helps to increase their efficiency and speed of response to requests, which will reduce customer service time.

These approaches can help reduce workload and keep the contact center running smoothly even during peak activity.

We will consider in the work the method of using chat bots to automate part of the requests from users, which can reduce the burden on operators.

3.2. Indicators of contact center activity

To describe the performance of a multi-channel customer service contact center, you can use formulas to calculate key metrics such as total inquiries, average processing time, load factor, etc.

1. Total number of service requests.
Let:

- Q_p — number of phone calls;
- Q_e — number of e-mails;
- Q_s — number of messages in social networks.

Then the total number of service requests Q_{total} can be expressed as:

$$Q_{total} = Q_p + Q_e + Q_s. \quad (1)$$

2. Average request processing time.
Let:

- T_p — average phone call processing time;
- T_e — the average time of processing an e-mail;
- T_s — average message processing time in social networks;
- Q_p, Q_e, Q_s — the number of requests on each channel.

Then the average processing time of one T_{avg} request is calculated as:

$$T_{avg} = \frac{Q_p T_p + Q_e T_e + Q_s T_s}{Q_p + Q_e + Q_s}. \quad (2)$$

3. Operator load factor.
Let:

- N — number of operators;
- T_{work} — the working time of the operator during the day (for example, in minutes);
- T_{total} — total time spent on processing all requests.

Then the load factor of the operator L can be calculated as:

$$L = \frac{T_{total}}{N \cdot T_{work}}, \quad (3)$$

where

$$T_{total} = Q_p T_p + Q_e T_e + Q_s T_s. \qquad (4)$$

4. Request waiting time.
If requests accumulate in the queue due to peak load, the average request waiting time W can be determined by considering the system throughput. Let:
- λ is the average speed of requests (requests per unit of time);
- μ is the average speed of processing requests by one operator.

For a mass service system (for example, the M/M/N model), the average waiting time of a request in a queue can be estimated using the Erlang formula:

$$W = \frac{(\lambda / \mu)^N \cdot \frac{1}{N!}}{N\mu - \lambda}. \qquad (5)$$

where N is the number of operators.
These formulas allow you to simulate the work of the contact center, calculate efficiency and estimate the loading of operators depending on the volume of requests.

3.3. Chat bot integration into the contact center

Adding a chatbot to the contact center allows you to automate the processing of some requests, which, in turn, reduces the burden on operators and increases the efficiency of the system. This can be reflected by formulas, in particular, in the calculation of the total number of requests and the average processing time.

1. Share of requests processed by the chatbot:
Let:
- α_p is the share of phone calls processed by a chatbot (for example, an automatic voice menu),
- α_e is the share of e-mails processed by the chatbot,
- α_s is the share of messages in social networks processed by the chatbot.

Then the number of requests processed by operators for each channel decreases:

$$Q'_p = (1-\alpha_p)Q_p,$$
$$Q'_e = (1-\alpha_e)Q_e, \qquad (6)$$
$$Q'_s = (1-\alpha_s)Q_s.$$

2. The total number of service requests by the operator.
Taking into account the chatbot, the total number of requests processed by operators becomes:

$$Q'_{total} = Q'_p + Q'_e + Q'_s, \qquad (7)$$

or, substituting the value:

$$Q'_{total} = (1-\alpha_p)Q_p + (1-\alpha_e)Q_e + (1-\alpha_s)Q_s. \qquad (8)$$

3. The total number of requests processed by the chatbot.
The total number of requests processed by the chatbot will be:

$$Q_{bot} = \alpha_p Q_p + \alpha_e Q_e + \alpha_s Q_s. \qquad (9)$$

4. Average request processing time.
Let's assume that the average processing time of a chatbot request is significantly lower (or close to zero) because automated responses are faster. Then the average processing time of one request T'_{avg}, which is processed by operators, becomes:

$$T'_{avg} = \frac{Q'_p T'_p + Q'_e T'_e + Q'_s T'_s}{Q'_p + Q'_e + Q'_s}. \qquad (10)$$

5. Operator load factor.
The operator load factor is also reduced thanks to the chatbot:

$$L^{'} = \frac{T^{'}_{total}}{N \cdot T_{work}}. \quad (11)$$

where the total time spent on processing requests by operators decreases:

$$T^{'}_{total} = Q^{'}_{p}T_{p} + Q^{'}_{e}T_{e} + Q^{'}_{s}T_{s}. \quad (12)$$

6. Request waiting time.
It can be hypothesized that as the number of requests handled by operators decreases, the average request waiting time also decreases because the service queue decreases.
For a mass service system (*M/M/N* model), the average request waiting time W' can be recalculated, taking into account the reduced request rate:

$$W^{'} = \frac{(\lambda^{'}/\mu)^{N} \cdot \frac{1}{N!}}{N\mu - \lambda^{'}}, \quad (13)$$

where λ' is the reduced speed of requests (after the introduction of the chatbot).
Thus, we can assume that adding a chatbot to the contact center optimizes the system, reducing the burden on operators and improving the overall efficiency of processing requests.

4. Experimental study

Using contact center activity statistics, we will conduct an experimental study of the proposed method of automating contact center work.
Let's plot the dependence of the operators' load factor on the share of requests processed by the chatbot for each channel (phone calls, e-mails, messages in social networks). This will help to visually assess the impact of automation on the workload of operators.

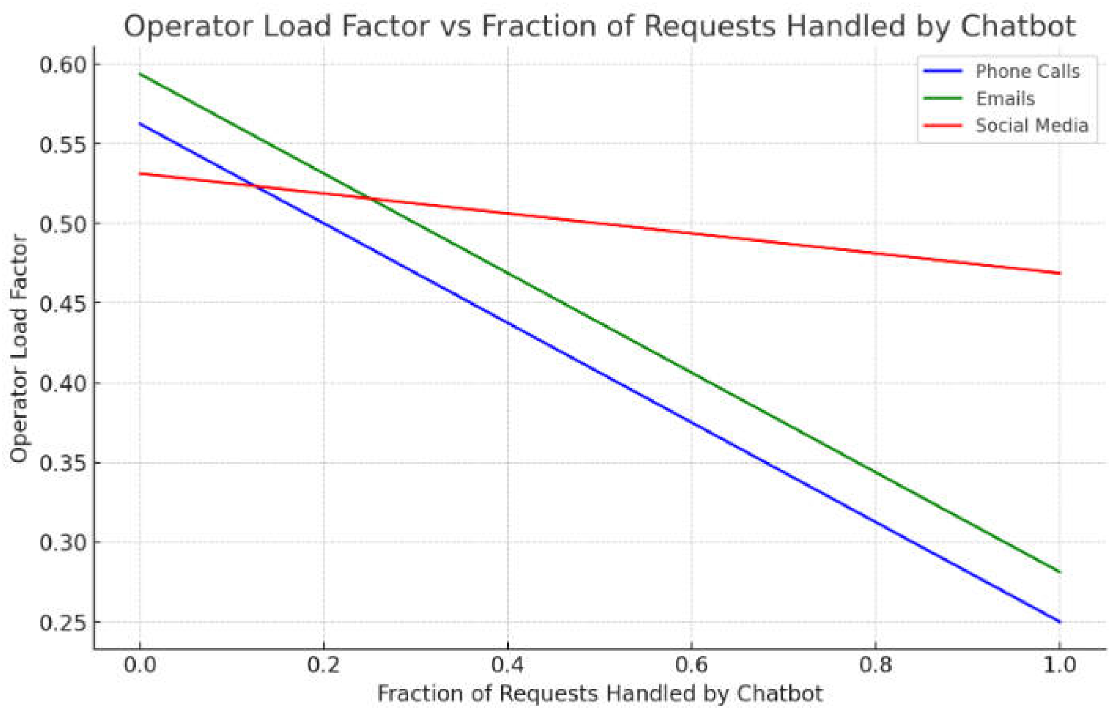

Figure 1. Dependence of operator load factor on the share of requests processed by the chatbot for each channel

The graph shows the dependence of the operator load factor on the share of requests processed by the chatbot for each channel, where the blue line represents the dependence for phone calls, the green line for e-mails and the red line for social media messages.

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The larger the share of requests processed by the chatbot, the less the operators are loaded, which allows them to optimize their work.

5. Conclusion

The implementation of chatbots in contact center operations is an effective tool for optimizing customer service, especially during peak times. The performed calculations showed that the share of requests processed by the chatbot has a significant impact on the operator load factor. In particular, reducing the number of requests that remain to be processed by operators allows to significantly reduce their workload, increase work efficiency and ensure better quality of customer service.

By automating routine requests, such as answering phone calls, emails and social media messages, operators can focus on more complex and non-standard questions that require more time and skill.

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