Robotics in the Hospitality Sector of the Russian Federation*

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Abstract. The paper is devoted to the analysis of service robotics development trends in the Russian Federation. The paper examines the trends and prospects for the implementation of robotics in the hospitality sector of the Russian Federation, technical equipment of smart hotels. This technology benefits the hospitality market in equal measure by enabling them to create customized services for their clients. By adopting mobile robotic solutions in hotels or restaurants, employees can spend more time creating a unique experience for each guest based on their personal preferences. The unique advantages of mobile robots are currently increasing the demand for robotic solutions in hotels. Similarly, in restaurants, waiters are gradually being replaced by robots to offer guests a wider range of services.

Keywords: Service Robotics, Robot Application, Robot-Staffed Hotels**,** Service Firms, Tourism.

1 Introduction

Customer satisfaction has become more important than ever in today's hospitality sector. The deployment of mobile robots creates a unique experience for guests during their stay in hotels and restaurants. Communication with these robots is made flexible with a smartphone app. What's more, the response time of these mobile robots to every room service request is faster than that of the average person. These unique advantages of mobile robots are currently driving the demand for robotic solutions in hotels. Likewise, restaurants in restaurants are gradually being replaced by robots to offer guests a wider range of services.

This technology benefits the hospitality market participants equally by allowing them to create personalized services for their clients. By introducing mobile robotic

solutions into hotel or restaurant environments, employees can spend more time creating a unique experience for each guest based on their personal preferences.

It is more pleasant for customers to interact with mobile robots than with humans. Restaurant mobile robots fill orders faster than regular people, further enhancing restaurant customer satisfaction during their stay. Thus, restaurant owners are trying to increase their attendance by capturing the attention of customers with these revolutionary robots [1, 2, 3, 4].

2 Main Content

The global market for mobile robots in the hospitality industry is developing at a rapid pace. The market size of mobile robots in the healthcare and hospitality sector may grow by 1 billion. US dollars during 2020-2024 and the market growth rate is 17% per year and will accelerate during the forecast period. The main share of the world market is shared by ABB Ltd., Amazon.com Inc., Awabot, Clearpath Robotics Inc., Myomo Inc., OMRON Corp., Panasonic Corp., Savioke Inc., Starship Technologies Inc., and Teradyne Inc. [4, 5, 6, 7].

Sales dynamics of professional service robotics in 2014–2019and forecast for 2020-2021 showed in figure 1.

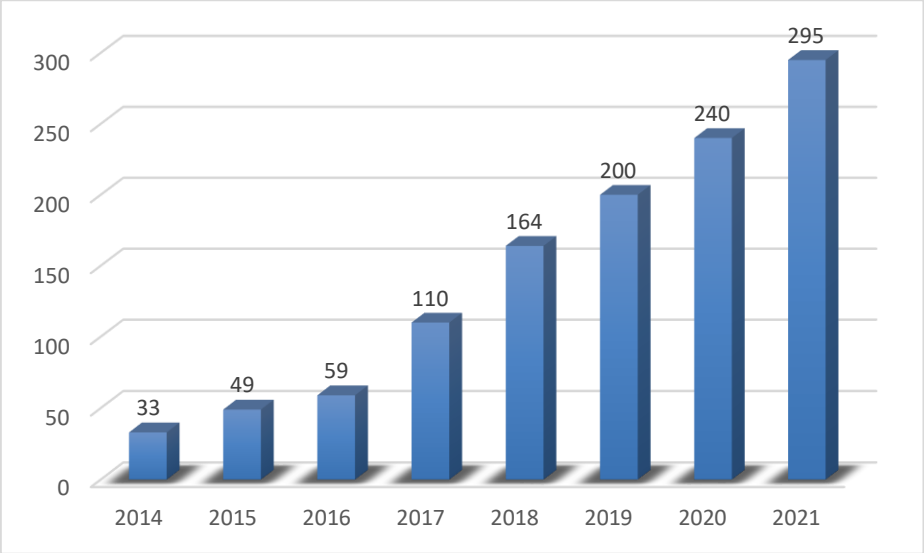

Figure. 1. Sales dynamics of professional service robotics in 2014–2019and forecast for 2020-2021, thousand units.

The number of service robotics manufacturers by company type in selected countries showed in figure 2 [8-15].

About ten years ago, the Danish company Universal Robotics and the German company KUKA were already coming up with robotic solutions, such as industrial manipulators for factories. But the Russian company developer realized that the most valuable

and underdeveloped on the market is software for robots. That is, everything related to the control of a device is already assembled from parts. Kravt Robotics works in this direction. The robots have already been assembled, but universal programs that could be simple and understandable to operate for the user are still in development.

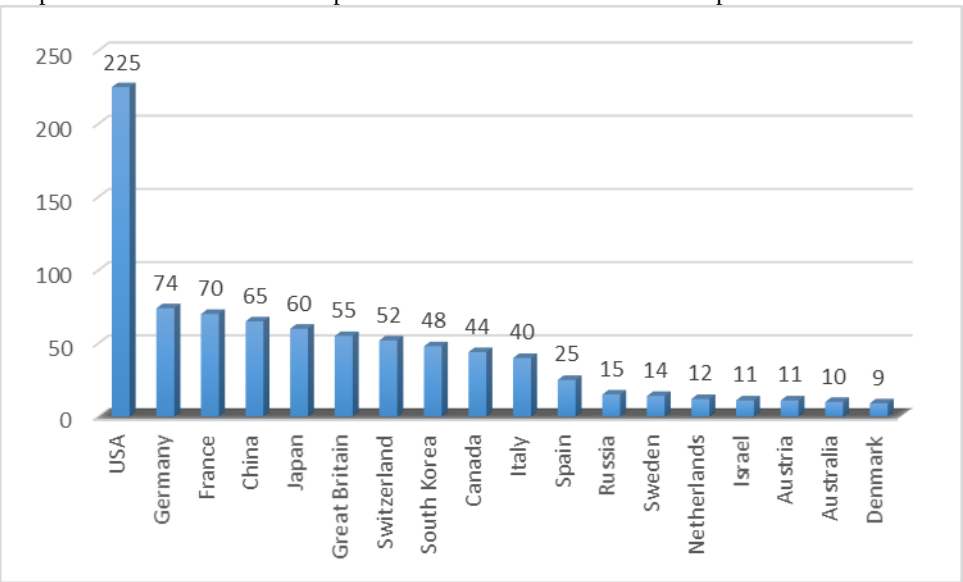

Figure. 2. Number of service robotics manufacturers by company type in selected countries at the end of 2019.

The company makes the software itself as friendly as possible for guests and administrators if they want to adjust the settings. It is important that robots do not complicate the stay of guests, but simplify it. Ideally, only two buttons will be involved: downloading the application and activating the robot. The rest of the functions are embedded in the software. After activation, the machine should immediately start solving problems.

In 2021, the IT and high-tech company Kravt Invest launches the first robotic hotel in Russia.

On the territory of the scientific town Innopolis near Kazan, a smart hotel with 30 rooms is being built. The hotel is equipped with technologies based on artificial intelligence. Computers will analyze the preferences of guests based on three hundred parameters. The software with artificial intelligence functions can recognize the emotions of the guest by the entered text, sounds, photos, or videos. The program will analyze the guest's appearance, assess how tired he is, and make assumptions about his mood. Based on this, the computer will adjust the temperature and light in the room, offer tea or coffee, and snacks. The project is carried out with the support of the Innopolis University.

So far the level of technology development does not allow to completely get rid of people in favor of robots. All robotic solutions that will be in the new hotel are first tested at the existing facilities of Kravt Invest. After that, the robots will be deployed

in hotels across the country. They plan to transfer cleaning, delivery, and transportation of luggage, and food preparation to their responsibility.

Hotel robotization will allow minimizing the number of service personnel. This will save on taxes and salaries, which will enable guests to rent rooms at the cost of a three-star hotel. One robot can replace from 2 to 6 employees since it acts much faster and is more focused than a person. In addition, robots can work around the clock and talk to guests in any language thanks to the built-in language recognition program.

The check-in counter will turn into a holographic image with a voice assistant or a separate drone. At the entrance to the room, there is an automatic identification of the guest and the unlocking of the door for him. Guests will be able to control the equipment through a speaker or smartphone. The application on your mobile device will tell you where to go to get to the desired floor, how to open a room and how to order breakfast [16-24].

Another feature of the smart hotel's technical equipment will be wireless sensors for noise, cleanliness, humidity, and light to create a comfortable atmosphere in the room. They will also regulate the temperature of air and water. The neural network assistant in the application will tell you how to use the hotel equipment. Orders and purchases can be made using a special application. Also, an IT infrastructure will be developed in the form of a mobile application for managing hotel services and communication with services. They will be available in one click in the client's native language. You will no longer need landline phones in the rooms, the application will maximally simplify communication and the speed of receiving services.

The hotel plans robotic logistics and food preparation for guests. That is, robots will also be involved in moving products, luggage, delivery, administrative support for cleaning, as well as serving breakfasts and mixing cocktails. To ensure the safety of guests, the hotel will not do without robotic guards.

There is no task to deprive people of their jobs - the company standardizes processes and optimizes manual labor so that human resources can be applied at a higher level. For example, if robots take over the cleaning of a room, then people will communicate with clients, take the positions of controllers and administrators. You cannot completely exclude people from the process, but you can free them from low-skilled labor. Robots will not replace humans but will allow them to focus on more interesting tasks. Plus, people will still work in the hotel, as the robots need technical operators to keep them running and troubleshoot sudden problems.

The software for the hotel of the future is being tested in laboratory conditions. One of the tasks is to prevent situations related to personal data leakage and computer hacking. Now people's access to devices is limited and there are no problems yet. When the robots are ready for use, the issue of cybersecurity will be further worked out. The developers' priority is to preserve the personal data of guests [25-34].

Therefore, action algorithms for any type of emergency are foreseen in advance: from robot breakdown to loss of the Internet or device theft. Automation and robotization of everything related to the service sector will allow Russia to maintain world standards in the service sector. This automation solves the problem that any user faces - the human factor.

The "smart hotel" project is being developed by a team from Russia together with like-minded people from California. Development testing takes place in two markets at once - in the American one, because there are already strategic partners-owners of apartments, and in the Russian one, to understand what can be improved. The team includes specialists in artificial intelligence and big data analysts and robotics. The guys are scattered all over the world and work remotely: from New Zealand, Russia, Germany, Spain, and Canada. The project is planned to be brought to the international environment, so the team also includes freelancers from America and India.

Even though the “smart hotel” project has no direct competitors in Russia, robotic hotels are a fairly widespread practice in the world. Back in the early 2000s, the Omenahotels chain was opened in Finland, in which there was practically no hotel personnel. This is because the main feature of the hotels was the principle of self-service. The key password for the room came to the smartphone immediately after registration and payment for accommodation on the network website and was valid during the entire stay at the hotel. The American company Starwood has been operating an automated robotic butler since 2014.

In 2015, at the Japanese Henn-na Hotel, half of the staff were robots: maids, porter, cleaning staff. A few years later, this practice was abandoned as robots showed an insufficient level of efficiency.

This does not mean that the robotization of the hotel environment should be abandoned. It should be borne in mind that the introduction of such technologies may require a radical redesign of existing buildings. In addition, the audience associates hotels with hospitality and friendly staff, and this attitude has yet to be worked out. By the end of 2021, the robotic hotel in Innopolis will host participants in industry events of the science city, students of university programs, and patients of the medical center [35-37].

Promobot, a Russian manufacturer of autonomous service robots, has entered into an exclusive contract with the Swiss company Advanced Robotics. From 2019 to 2024, Promobot will deliver about a thousand robots to Europe. Exclusive rights to the sale of Promobot robots apply to the entire territory of the European Union. The total amount of the contract is 18.5 million euros. Promobot robots are standalone service androids. They are used as consultants, administrators, guides, and promoters in hotels, museums, shops, government offices, residential and shopping centers.

At the first stage of cooperation, the parties envisage the opening of service centers and sales offices in Romania, Germany, and Austria during 2019-2020. Further - as the market develops.

The company is also considering the possibility of transferring part of its production processes to Europe. This will allow you to more quickly customize robots for local clients. Now promo bots are assembled in Perm, based on the Morion Digital Technopark. All robots are 80% Russian components. The company itself develops speech recognition systems, navigation, linguistic base, mechatronics, electronics, artificial intelligence. The Russian specialists of Promobot have also developed a microphone array, which has no analogs in the world - this is a device with which promo bots recognize the speech of people even in the noisiest places.

Available to the robot and the profession of a concierge. According to the developers, this became possible thanks to the android's ability to recognize a person by appearance: the system works with an accuracy of 99.9%. It consists of two cameras installed in the "head" of the robot. One of them has a large viewing angle, allowing you to quickly find all the faces of people in the immediate vicinity. After that, the robot turns to the person with whom it is supposed to communicate and turns on the second camera, which is responsible for obtaining images to identify faces.

Russian robots Promobot are the only service androids in the world that have an SDK system - the ability to connect to any external system: databases, services, applications, security, and access control systems.

3 Conclusions

A strong engineering school remains in Russia. This especially applies to programming and construction. Only in the specialty "mechatronics and robotics" annually about 800 young people receive engineering degrees in 60 universities in Russia.

The population of Russia demonstrates the speed of adaptation to new technologies. This can be seen in the example of the penetration of both smartphones and electronic types of interaction of the population with the state and business. This gives a chance for rapid adaptation of the population to new products and services that are based on robots and artificial intelligence. Difficulties with the creation of prototypes of robots are due to both the low speed of their creation using specialized prototyping centers and the high cost of work, compared to similar projects in Asian technological clusters such as Shenzhen.

Many successful robotics companies set up their rapid prototyping (development) centers right next to major electronics malls - this helps them get jobs done much faster than competitors farther from suppliers. High competition in the service robotics market only contributes to the constant opening of new markets for new players.

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