

COVID-19 Pandemic Impact on Mobile Robotics Market

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Abstract—This paper presents how the COVID-19 pandemic has changed the course of the mobile robotics market, showing the status of mobile robots in three stages: before, during and after the COVID-19 pandemic. By analyzing these stages, it is possible to estimate what awaits this market in the future. From the many applications of mobile robots found during the COVID-19 pandemic, as will be shown later, it is clear that mobile robots will be an important part of the future influencing the accelerated growth of their market and development.

Index Terms—Autonomous Systems, COVID-19, Locomotion, Mobile Robotics, Robotics Market

I. INTRODUCTION

At the time of writing, a clear impact of the COVID-19 pandemic has been observed in many industrial sectors, resulting from breaks in supply chains and the temporary closure of many industrial plants due to a lack of raw materials and intermediate products from China and India, for example. [1].

The mobile robots are automatic transport devices, that is, a mechanical platform equipped with a locomotion system capable of navigating through a certain work environment (Fig. 1), endowed with a certain level of autonomy for its movement carrying loads. Its use can occur in dangerous tasks such as the handling of explosive materials, exploration in risk areas such as underwater or underground and agriculture [2]. The mobile robotics market is divided into two main branches, such as service and security or military. In the services market, it can be subdivided into categories such as professional and domestic, such as industrial examples, robots for transporting industrial loads and inspection, and in the domestic area, the use of robots for entertainment or educational purposes can be seen [3].

This paper is organized as follows, first mobile robots applications are analyzed, then, the mobile robots prior to COVID-19 are discussed including their features, then the change produced over them due COVID-19 is studied and finally, the future trends after COVID-19 is discussed.

II. MOBILE ROBOTS

Nowadays the applications of robotics in the areas of defense, rescue and security are increasing considerably since



Fig. 1. Mobile robot with locomotion by wheels

new terrorist and biological threats. There is a very notable development in robots that help in some way to face this problem, at the same time, a lot of research and large amounts of money are being invested in these fields in order to design more versatile and efficient devices, with the appearance of integration of new technologies such as: internet of things, cloud computing, artificial intelligence, among other areas the development of sophisticated and complex devices continues to grow. These robots generally perform tasks such as explosives deactivation, reconnaissance, surveillance, rescue, military activities, and some interventions that includes biological or chemical contamination. The use of mobile robots in these areas is motivated by the need to facilitate the execution of activities in highly dangerous environments for humans and by the appearance of new biological and terrorist threats.

These robots can be fully controlled semi-autonomous or fully autonomous and are used in situations and activities that represent a huge danger to humans. They normally work in hostile environments that are difficult to access and very complex environments or poorly structured.

In recent days, the interest in this type of robot increased with the appearance of the COVID-19, since this type of mechanism can greatly help the tasks performed by medical

staff, this is the reason why the market for mobile robots is having a slight increase as will be discussed later.

III. PRIOR TO COVID-19

In the 80s the so-called AGV (Automated Guiding Vehicle) appeared, which will move without drivers and as a navigation mechanism had buried cables, regardless of this way of guiding without many sensors or evaluations of the environment that could generate failures during a non-event scheduled that overrides its sequence of steps to complete the task, however currently there are AGVs with better ways of guiding (fig. 2). In the 90s, the definition of mobile robot was created that includes vehicles that have the ability to move in unstructured environments using the information they collect through their sensors and the current state of the vehicle. [2].



Fig. 2. Modern AGV

The development of much smaller and more durable sources of power meant a great advance in the development of mobile robotics, however for the 90s the market was not too large to justify large investments in research on mobile robotics and with applications of mobile robots using internal combustion for energy made a massive deployment on the market impractical [4].

Years before the COVID-19 pandemic, the increase in research on service robots gave a clear picture of the escalation of applications for service robots, which speculated a solid growth in the market for mobile service robots [5]. Global Autonomous Mobile Robot market accounted for \$4.98 billion in 2017 [6]

IV. DURING COVID-19

If the COVID-19 pandemic has proof something is that there was no country, region or continent ready for a virus with such a high infection rate even capable of overwhelm any medical system. As the countries implemented needed containment measures some market sectors like the mobile autonomous robots has seen an increase in demand for its

products helping the robotics reach the 22% contribution to the fight against COVID-19 [7].

There are companies dedicated to the mobile robotics that had the design or even products with the potential of being helpful in many situations for example, SPOT® by Boston Dynamics (Fig. 3), a four-legged robot capable of walking up and down stairs, robust enough to move outside and of a size that allows it to be used indoors [8]. Requested from hospitals due to the COVID-19 pandemic, the development of a new application for SPOT® started, the result is a legged robot application that can be deployed to support frontline staff responding to the pandemic in ad-hoc environments such as triage tents and parking lots [9].



Fig. 3. SPOT® by Boston Dynamics [8]

It's worth mentioning that this is an Open-Source application. Thanks to this and other uses for the robot, it became a really popular and quick solution for many problems in many countries causing the company to go from "each sale being negotiated individually" to create an online shop to buy SPOT® and its payload options [10]. There have been other cases where the already existing hardware has been upgraded to help fight the COVID-19 outbreak like the Smart 5G patrol robots used in China (Fig. 4).

Developed by Guangzhou Gosuncn Robot Co. Ltd this robots are capable of scanning the temperature of 10 people at the same time within a 5 meters radius where if a high temperature or the absence of a mask is detected, the robots send an alert to the relevant authorities [11]. There are plenty more investments that China has made and keeps making to fight the COVID-19 outbreak that are causing the lack of products and raw material coming from China.

Since the transportation and distribution of non-first need products have gone harder due to the countries lockdowns, companies like DJI are making "organizational changes" heading to direct-to-client model or working only with major dealers affecting their economy and reach across the globe [12]. On the other hand, products like the Pudubot by PuduTech have found new uses providing non-contact delivery services in hospitals worldwide (Fig. 5) helping increase the company's reputation and value as well as their earnings [13].



Fig. 4. Chinese 5G patrol [11]



Fig. 5. Non-contact delivery system using PuduBot [13]

With the notorious success of the robots used in China to control and monitoring public spaces, international entities like the UN (United Nations) have promoted their use through donations in places like Rwanda (Fig. 6) [14].



Fig. 6. UBTECH Cruzr received by Rwanda government [14]

These types of actions will not only help to fight the COVID-19 pandemic, but also to decrease the cultural resistance seen in the US and Europe regarding the use of au-

tonomous robots giving this market greater reach and presence worldwide.

In a world that has changed drastically and mobile robots appearing as a necessity to adapt to these changes the money generated on this market has grown, this will make people and companies around the world want to invest on it as an opportunity to lower the effects of the measures taken to prevent the spread of COVID-19.

V. AFTER COVID-19

Regarding the future of the mobile robot market, it can be seen that there is a great opportunity, many applications that are emerging due to the pandemic and can support future applications and consequently can accelerate research on these technologies. As previously mentioned, the use of mobile robots extends from hospitals to surveillance, and the drone market can gain a lot of ground in terms of cargo supply and monitoring of public spaces. (Fig. 5). Recent reports, which take into consideration the COVID-19 pandemic expect that the mobile robots market is going to grow at a 24% per year from the US\$19 billion in 2018 to US\$23 billion by 2021 and further more to US\$54 billion in 2023, this will affect all sectors with the logistics by air and ground taking a significant role. [15].



Fig. 7. Supply delivery with UAV

One of the problems that many companies and industries face is the dependence on human labor, the policies of various countries encourage compulsory quarantine and restrict the number of operating personnel at minimum levels to operate or even cease operations to combat infection and spread of the virus, affecting the economy and markets of many regions [16], in scenarios like these is where the implementation of mobile robotics with cargo transport vehicles or for sanitation of facilities can stand out in the future, thus giving the possibility that a number reduced number of employees meet production targets, just as in front line sites against COVID-19 such as hospitals robots can be used to mobilize medicines, tests or waste in an automated way, thus promoting a new era in the use of technologies innovative and adaptation for future crises [17].

Considered as a part of the Industry 4.0, the autonomous mobile robots will require more development and labors such as designing, building and programming robotic hardware are just a few of what is left to do. Despite the major economy issues that the COVID-19 pandemic will bring it is expected that the mobile robots market will keep growing at a fast pace for the next 10 year, particularly logistics-wise according to Melonee Wise, part of the IFR (International Federation of Robotics) [18].

Regarding the future of these applications, it will also require the support of professionals in the area of technology, many of the industries will recognize that the updating of processes and the use of technology is key to maintaining stable operation in adverse situations. So robotics-focused engineering will play a fundamental role in the development of many regions in the world [19].

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