

AUTONOMOUS DELIVERY ROBOTS AND THEIR CONTRIBUTION DURING THE PANDEMIC¹

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ABSTRACT

In this research paper, we present autonomous delivery robots and their contribution during the pandemic. The paper introduces two autonomous delivery robots in more detail. These are Starship and Scout. Starship is under the company Starship Technologies, and Scout is part of Amazon. Both robots have made a significant contribution to the field of autonomous delivery robots. During the pandemic, the need for these robots was further highlighted. In the future, these robots will appear everywhere, and there will be even bigger upgrades on them - this is just the beginning of the era of autonomous robots as we see them now. We found out that both robots are in broad use on many fields. Scout is about two times heavier, four times faster in speed and can carry 27% more freight in comparison to the Starship robot.

KEYWORDS: autonomous, delivery, robots, pandemic

¹ original research paper

INTRODUCTION

As the pandemic struck, we had to adapt rapidly as a whole society so we could live on, without us getting infected or spreading the virus - practising social distancing. That is when autonomous delivery robots come into the picture. They have been in noticeable use until now. It was after the pandemic when the demand for them and their usage skyrocketed. With the help of delivery robots, people could stay at home and order necessities from couches not needing to go to the store. Robots would deliver them the ordered products and provide easy contactless delivery. The robots were used on college campuses to deliver food to students right to their dorms. One of the companies contributing to this is Starship Technologies with their six-wheeled delivery robots. These robots use certain technology to help them deliver from point A to point B. An increased number of companies, i.e. from restaurants to grocery stores, have started to use these robots. The lack of staff affected the vast majority of countries during the pandemic and these robots have proven to be of immense help. What is more, drone delivery is becoming huge also.

During the last few years, delivery robots have got big on their popularity. Their ways of use are vast, i.e. from autonomous delivery robots navigating the streets to delivery drones flying above us in the sky to help us customers and businesses with coordination in delivering goods from one point to another. This technology has been in extreme demand since the outburst of the corona virus. The way autonomous deliver robots work is by using the latest technology, that includes: cameras, lidar sensors, AI and deep-learning algorithms (Marr, 2020).

What is more, autonomous robots can be used in several other ways as well. People tend to use them in food delivery, package delivery to hospitals and room service. Shopping centres even have autonomous robots guiding customers to a specific store (Marr, 2020).

In this article, we aim to answer three research questions: Are delivery robots good enough for mass use? Are there still problems with these robots? Are people worried about the robots in any way?

For collecting data, we used sources from Google and Google Scholar. The key search words used were: autonomous, robots and delivery.

LITERATURE REVIEW

In the article, we will prominently focus on delivery robots of two companies. We will introduce two delivering robots. One being the Starship robot from Starship Technologies and the other one being the Scout from Amazon. Both share similar design and technology. Throughout the article we note that delivery drones and other autonomous robots are in rapid development and use across the world right now.

DELIVERY ROBOT STARSHIP

The company was founded by two Skype co-founders in 2014. Their headquarters are in the US, while their engineering department is set in Estonia. They introduced the autonomous delivery robot called Starship in 2015. By October 2021, Starship Technologies managed to complete 2,000,000 autonomous deliveries with their robots. They launched their services on university campuses in the US, Canada and UK. They are one of the many contributing to the revolution in local delivery with the help of autonomous robots (Starship company, 2021).

The delivery robots in mass use on campuses are produced by Starship Technologies. Their popular product is a six-wheeled robot that can navigate through the streets and sidewalks autonomously using cameras, sensors, lidars and deep-learning algorithms and AI. They designed the robot to be safe and robust for optimal on-demand delivery for consumers and businesses (Robotos, 2021).

As mentioned above Starship is an autonomous delivery robot created by Starship Technologies. During the pandemic it was used to deliver food to students on campuses and deliver groceries around towns in the UK and US. The robot's exterior consists of six wheels and a robust body that protects whatever the robot is delivering. Their top speed is about 6.5 km/h. The battery life of the robot averages on about 16 hours, before it needs a recharge. The robot can carry up to 9kg of groceries (Food delivery robots, 2021).

The technology inside allows them to deliver without any major problems. The robot uses ten cameras, including special cameras to determine depth, 3D radars and an array of ultrasonic sensors. The robot does not exactly rely on GPS. Due to the fact that it is driving on pavements, where it needs to be

extremely precise, it follows pre-mapped routes (Food delivery robots, 2021).

Accompanying all this is machine learning. The hardware is there with the cameras, sensors, and additional features. Now the robots also need software to work properly. As robots drive around and deliver miscellaneous items, the software part keeps adding to their database of experiences. One of good examples stated on the Autocar article is that they learn to discern an approaching vehicle from its reflection in a puddle (Food delivery robots, 2021).

Figure 1 shows Starship with its storage chamber open and a person taking out the delivered goods.



Figure 1. Delivery robot Starship

Source: PostGazete, 2021

DELIVERY ROBOT AMAZON SCOUT

Amazon has been known for investing in many advanced technological fields. One of the fields is the autonomous robot. They developed a fully-electric delivery system called Amazon Scout. They designed it in the same way as Starship and described it as an autonomous delivery device for delivering packages safely to their customers.

The design of the Amazon Scout features an array of cameras, sensors, and other technology to make the robot work autonomously. The exterior design reminds of the Starship robot mentioned above with it having a box design and six wheels, with the top part of it being the part where it opens and items can be safely put inside or taken out. With all the features it can safely

navigate the streets and watch out for other obstacles like pets, pedestrians, and cars (Amazon Scout, 2021).

Amazon started its Scout service in 2019 in the Snohomish County area. Shortly after that it was expanded to more areas. Now it is available in other states, e.g. Georgia, Atlanta, Franklin, and Tennessee. Six Scout robots started delivering packages from Monday through Friday during the day. Initially, the robot was accompanied by an Amazon employee, but now it delivers items fully autonomously without anyone watching over it (Amazon Scout, 2021).

During the pandemic, Amazon also started trials at various locations like college campuses and office complexes. The robot is still being developed further for better optimisation and the possible application of mass-use of these robots all around the country (Jaller, Otero-Palencia and Pahwa, 2021). Figure 2 shows us Amazon Scout on the pavement near a house while delivering goods.



Figure 2. Delivery robot Scout

Source: The Prime Challenges for Amazon's New Delivery Robot, 2019

THE COMPARISON OF THE STARSHIP AND SCOUT ROBOTS

Table 1 shows that the Scout weights 45 kg, which is two times heavier than the Starship, which weighs 18,14 kg. Scout is about four times faster with 24 km/h in speed compared to the 6,44 km/h that Starship can do. The amount of capacity the Scout robot can carry at 23 kg is 27 % more compared to the 18,14 kg the Starship can.

Table 1: Comparison of the Starship and Scout

Autonomous deliver robot	Weight (kg)	Speed (km/h)	Capacity (kg)	Capacity (chambers)	Range (km)
Starship	18,14	6,44	18,14	1	6,44
Amazon Scout	45	24	23	1	/

Source: own research with (Figliozi and Jennings, 2021, author's calculation)

Mass use for such robots started around 2019. They are complete enough to do the job compliant with expectations without the need of any human interference during the delivery process. What is more, companies are investing in further development of these robots seen with Amazon and Starship Technologies. Their robots are already moving through the streets and campuses, yet they keep improving them, so they become infallible in all possible aspects and can be expanded even further (Amazon Scout, 2021).

Laws and regulations are not complete or still filling the gaps of certain concerns. Some countries and states also prohibit the use of autonomous robots on public grounds, which is hindering the process of expansion of this type of delivery, but slowly those laws are being changed or terminated all together (Othman, 2021).

Some people are still in doubt about robots taking over such tasks, as they may take some jobs from people in the process. No need for delivery employees for example. Others are embracing them and following with the advancements of technology (Othman, 2021).

Below are the answers to the research questions.

Are delivery robots good enough for mass use?

The robots we mentioned in this article (Starship and Scout) are designed well enough to be used in mass use, considering the fact that they are already used throughout the world, especially across some states and campuses for package and food delivery. One thing holding the use of these robots back

may be the laws of some countries and states that prohibit autonomous devices to navigate independently on public grounds.

Are there still problems with these robots?

Considering the fact that such robots have been in use for a few years now, they have already been adapted and fixed, therefore there are little larger flaws that may have occurred. Now the robots move along the streets and other objects on pavements without any issues. They manage to avoid any collision with obstacles such as pets, pedestrians, and cars.

Are people worried about the robots in any way?

Since these robots are fully autonomous and can execute the delivery process on their own, they do pose a potential threat. People are worried that the robots might be replacing employees that work in delivery and rendering them without a job. In the end, we cannot stop the technological development and need to adapt to the rapid changes that technology offers.

CONCLUSION

Autonomous robots are evolving and improving each year. We mentioned two autonomous delivery robots that are in use at this time. They are of foremost importance to society at this stage. With coronavirus being on the surge for 2 years now, they helped many people and organisation with contributing contactless delivery of food, groceries, and other packages during these times. With technology evolving, we will see similar robots everywhere in the next few years. There is still room for improvement and research is still being done on this field, thus contributing to even more advanced autonomous robots on all fields.

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