Research on the Design of Intelligent Delivery Vehicles in the Post-epidemic Era

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ABSTRACT

In the context of the post-epidemic era, the demand for online consumption is greater and the demand for take-out has soared, so a safer and more efficient delivery needs to be addressed urgently. In the Internet era, delivery industries such as take-out are becoming more mature, and delivery products need to be designed more scientifically and rationally. This research and design focuses on the food delivery problem, redesigning the delivery product, replacing manual labor with intelligent technology to efficiently complete the delivery operation, and ensuring a safe environment in delivery, thus safeguarding food safety and improving the quality of delivery. This will result in a complete set of delivery processes designed to optimize the consumer experience.

Keywords: Post-epidemic era, Intelligence, Take-out delivery.

1. INTRODUCTION

Since 2020, the COVID-19 has been rampant in China, spreading rapidly and widely, so unmanned delivery services are more in line with the needs of the post-epidemic era. Nowadays, intelligent products have gradually entered the life of the public, "intelligence" has become a high-frequency word in the 21st century, and the field of logistics delivery has also begun to integrate new technologies. Under the normal management of epidemic prevention and control, the highest demand for delivery is for take-out food delivery. Unmanned delivery can not only improve the efficiency of logistics delivery, but also reduce the risk of infection, which is safe and efficient. It is foreseeable that the era of using intelligent unmanned delivery methods is coming with the support of the Internet of Things era and technology.

2. DEVELOPMENT AND OPPORTUNITIES OF THE DELIVERY INDUSTRY

The delivery industry is an emerging industry that has developed gradually in the last decade, and is an accessory of the takeaway industry. In a fast-paced life, people will choose to order food from platforms or buy groceries online at home, and occasionally buy emergency medicines. Convenience is a popular demand point, so the delivery industry is growing very fast.

Compared with the development of foreign delivery industry, Chinese delivery industry started late, but since the popularity of the Internet, take-out catering e-commerce has been rapidly emerging. The delivery industry has broadened the sales channels of merchants and also changed the consumption habits of the public.

This study mainly addresses the problem of delivering food commodities. The main needs of users can be classified as punctuality, safety and efficiency. In the post-epidemic era, thorough disinfection and safety without harm are top priorities. In a large-scale and scenario-complex business, delivery intelligence is very important. The core of delivery is the optimal allocation of resources. Take-out delivery is a typical o2o [1] scenario, which mainly includes online business and offline operation, and the two ends of delivery

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1. o2o is an abbreviation of Online To Offline, referring to the combination of offline business opportunities with the Internet, so that the Internet can become a platform for offline transactions.

are order demand and transportation supply. In order to achieve a balance between supply and demand, it is not only necessary to operate merchants and deliverers offline, but also to make a reasonable allocation of these demands and transportation supply online. Intelligent unmanned delivery can solve the problem of delivery area allocation, and the algorithm decides the number of vehicles dispatched, frequency and optimal delivery route. Compared to manual work, intelligence has absolute advantages, especially in the context of the post-epidemic era, intelligent unmanned delivery is ushering in a new wave of development.

3. ANALYSIS OF INTELLIGENT DELIVERY

The first is to analyze the applicability based on the delivery environment. After determining the destination, the unmanned intelligent delivery vehicle will follow the optimal route and be able to avoid obstacles and evade pedestrians. Before arriving at the destination, the unmanned intelligent delivery vehicle automatically sends SMS notifications, and then sends pickup codes to the customer upon arrival, and finally, the customer arrives at the shelf and picks up the items. At the end of each delivery, the unmanned intelligent delivery vehicle will disinfect the box, directly cutting off the virus transmission path caused by logistics delivery.

Next, it is the analysis of the application of Internet technology in intelligent delivery. With the development of technology, the Internet is able to integrate with the traditional delivery industry, and the take-out delivery industry relies on the Internet for optimization and upgrading. This delivery vehicle design uses AGV [2] technology, which is widely used in industry and can travel according to a planned route without driver operation. The industrial AGV has higher intelligence and greater flexibility than traditional manual handling and semi-automated conveying methods, greatly improving efficiency. The scope of application of unmanned intelligent operating system is gradually becoming wider and the technology is being improved.

Intelligent unmanned delivery is a new commodity delivery mode, which is an intelligent

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2. AGV is an abbreviation of Automated Guided Vehicles, which refers to transport vehicles equipped with automatic guidance devices such as electromagnetism or optics, capable of traveling along a prescribed guidance path, with safety protection and various transfer functions.

supplement to the enterprise logistics delivery system, taking the existing take-out delivery network and logistics delivery system as the framework, using unmanned intelligent technology and making full use of the existing basic transportation facility resources.

In the implementation plan of intelligent unmanned delivery, it is necessary to consider the business attributes, service scale and the nature of delivered goods of each industry. The use of unmanned equipment and the pursuit of technology without analysis is bound to cause some problems. For example, unmanned driving is based on artificial intelligence technology, and its autonomous decision making in certain special situations may be risky. At present, China's policies and regulations on unmanned aerial vehicles and driverless vehicles are in a blank state, which to a certain extent hinders the development and utilization of driverless technology. For this reason, in the construction of the unmanned delivery logistics service system, government departments should also do a good job in guiding the work, improve the industry standard of unmanned delivery logistics, specify the application standards and related requirements, make the unmanned delivery logistics service work more standardized and reasonable, and improve the safety of unmanned technology in specific applications.

4. INTELLIGENT DELIVERY DESIGN PRACTICE

4.1 Design Orientation

The focus of this design is to meet the customer's take-out delivery needs. Therefore, it is important to focus on fast delivery, ensuring a contact-free process and the combination of delivery boxes. To solve the problem of contact-free delivery, independent delivery boxes with automatic disinfection can be used, while avoiding the problems of food taint and food container extrusion and leakage. Each delivery vehicle comes with a cruise system that can independently plan the optimal route to complete delivery tasks efficiently and accurately.

4.2 Summary of Improving User Experience

Based on the analysis of the problems in the take-out delivery, firstly, it is to realize contact-free delivery. Secondly, it should be heat-retaining, and

the basic dining needs of users should be guaranteed. Thirdly, it should be fast. Users want to save time as much as possible, so the transport vehicle should choose the optimal route in a timely manner. Fourthly, it needs the disinfection function to ensure safety. Fifthly, it needs to solve the problem of taking the wrong meal and losing of food. A code for a box system can be used. When the vehicle arrives at the destination, it will send a unique pickup code to the user's cell phone, while there is QR code for query, which can eliminate the problem of taking the wrong food.

4.3 Modular Components

The modularity of delivery box components facilitates replacement and reduces maintenance costs. The exterior material of delivery vehicle can refer to the galvanized steel sheet of automobile, which is less costly and has good corrosion resistance. The corners of the delivery box need materials with cushioning effect. One delivery box contains only one take-out food, which can reduce the use of external bags and help environmental protection.

4.4 Final Product Display Effect

Each individual delivery box can hold one take-out food, as shown in "Figure 1", and the opening method is folded down. There is a hidden handle on the top of the box, which is convenient for extraction. "Figure 2" is a three view of the delivery box, which has an integrated heat dissipation net on the back side and four collision avoidance strips on the side to avoid bumping the box.

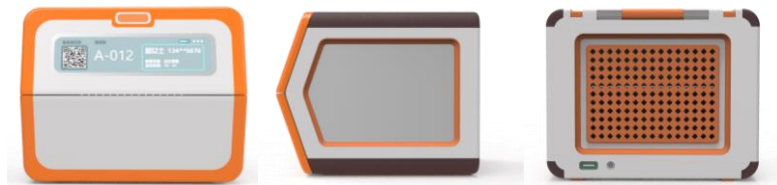Figure 1 Exterior drawing of the delivery box. (Source: self-made)

Figure 2 Three view of the delivery box. (Source: self-made)

The delivery box has an interface with an exclusive pickup code, so users can scan QR codes to open the delivery box before picking up the meal. The digital screen replaces the original printing and binding method, which can be hygienic and reduces the probability of picking up the wrong food. A positioning device is placed inside the box to facilitate maintenance personnel to find the location of the equipment to be repaired.

The delivery vehicle has an autonomous navigation system for planning the best route, which is displayed on a display screen in the window section, as shown in "Figure 3". The storage shelves at the fixed points have advertising on the side. The delivery vehicle has three layers of delivery sliding rails, and after each layer is assembled, the next layer of delivery sliding rails is opened, and the sliding rails are folded to retrieve the delivery vehicle after all the delivery boxes are transferred. The delivery vehicle is connected to the

storage shelf by a sliding rail, and the box body is placed orderly. "Figure 4" is the display diagram of the sliding rail. The smart track transports the delivery boxes to the conveyor belt of the shelf in turn, and the conveyor track carries the boxes to the other end until they are full. The sliding rail consists of four metal movable ball bearings and a track. A small transport table operates on a fixed track.
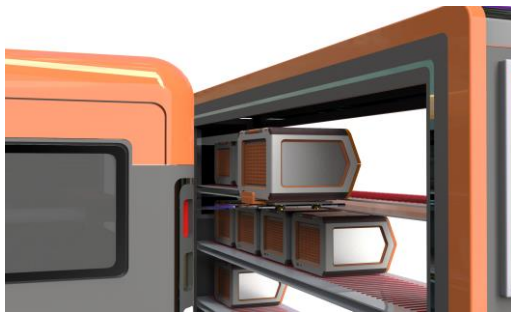
Figure 3 Usage scenarios. (Source: self-made)

Figure 4 Detail drawing. (Source: self-made)

5. CONCLUSION

The globalization of the epidemic has to some extent accelerated the implementation process of unmanned delivery, but the fact is that intelligent unmanned delivery technology can only be used as an aid, and the machines are not yet able to replace human labor in every field. Machines can't be used to replace humans in some tasks that require the use of human initiative. However, intelligent technology can be used in some fixed operations. For example, it is entirely possible to use existing feasible technologies to improve the delivery process, which can increase efficiency while saving manpower. Only by scientifically understanding and making good use of the value of intelligent machinery can users better enjoy the scientific and technological dividends of unmanned delivery. In the future life, unmanned intelligent technology will accelerate the pace to the public, but there are still problems in this area such as high costs and imperfect corresponding regulations, which need further in-depth discussion and research.

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