Use of Drones, Ground Robots and Autonomous Vehicles in Supply Chains

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***Abstract*—The advancements in robotics and Artificial Intelligence technologies are transforming the supply chain sector. These transformations are particularly significant in the last mile of the delivery routes. With an increase in the use of these technologies, we are facing a few ethical and practical questions including concerns regarding privacy and the loss of jobs to automation. This paper discusses these concerns in contrast with the benefits and costs of automation in the supply chains sector.**

Keywords*—Drones, Artificial Intelligence, Supply Chains, Ethics, Privacy*

I. INTRODUCTION

The supply chains have become a very significant part of the modern-day economies with the increase in online commerce and to the door deliveries. There is a big push to streamline these processes and to decrease costs. The most labor intensive and thus the costliest part of the supply chains are the latter end, called the "last mile", making up to 40 percent of the total transportation costs [1]. This paper discusses the ethical implication of using technologies like drones and robots to decrease the costs and improve efficiency. With recent technological advancements it is becoming extremely cost effective to employ autonomous agents in the supply chains [1]. This paper also highlights the practicality of embracing these technologies and coming up with proper safeguards, instead of trying to preserve the status quo.

II. ETHICAL THEORIES AND APPROACHES

A. Ethical Theories

In the given case, the most suitable ethical framework would be that of Utilitarianism and Consequentialism [2]. Increasing the use of drones and autonomous vehicles in the supply chain processes have the benefit of decreasing costs and increasing the speed of the processes [1]. These are the benefits that can ultimately be passed down to the end users or consumers. These benefits would be particularly significant in the case of developing and undeveloped countries with high poverty rate and low average incomes. On the other hand, it also has some drawbacks including the potential for compromising the privacy of end users or bystanders and causing large scale unemployment by replacing a large portion of workforce in the supply chain industry [1][3]. Some economic studies predict widescale loss of jobs in all sectors including supply chains in the next decade because of automation [3]. The worse effected portion of the people will be those residing in countries with manufacturing-based economies e.g., China and India [3]. By examining and exploring these benefits and drawbacks using the Unilateralistic ethical framework, we can come up with the appropriate course of action.

B. Ethical Approaches

The proper ethical approach to discuss a solution for this case should be the Common good approach and the Fairness approach. The common good approach advocates for preferencing the well-being of the society as the well-being of individuals are intricately linked to it [4]. The use of autonomous delivery vehicles and robots in supply chains are contributing to the well-being of consumers and the end users of the products by decreasing the cost and increasing the ease of access to the products. The fairness approach advocates for equal and fair treatments of everyone [4]. The unemployment and privacy concerns caused by using these technologies in supply chains is unfair to some people for other's benefits. The consumer's decrease in cost of products and services is generated at the expense of other people's income loss and compromise of privacy. Furthermore, there is an overlap in the three parties involved as the consumer's privacy is also compromised and the people working in the supply chain like the delivery drivers are also consumers themselves.

C. ACM Code of Ethics

The set of ethical guidelines provided by the ACM Code of Ethics describes methods to maintain an ethical setting in information technology environments. The case described in the given paper violates the following ethical guidelines: (1.1) Contribute to society and human well-being, (1.2) Avoid harm, (1.5) Respect the work required to produce, invent, and create [5]. The case of using technology in supply chains has various benefits but it also causes some harms by compromising the privacy of end-users and bystanders as well as causing a loss of jobs in the supply chain industry. The loss of jobs can be interpreted as not respecting the work of the employees of supply chain industry and causing harm via loss of income.

D. ACM Professional Responsibilities

ACM Professional Responsibilities describe a set of rules that guides the behavior and attitude of a good and ethical computing professional [5]. While discussing these professional responsibilities, we see some violations in case of using modern technologies in supply chains. One of the codes of Professional responsibility (2.9) is to "Design and implement systems that are robustly and usably secure" [5]. This code is violated in this case as, at present it is not possible to fully secure the privacy of the end users and bystanders while using drones extensively in the process of deliveries [1]. Another code, (2.1) is to "Strive to achieve high quality in both the processes and products of professional work". This code supports the use of these technologies as they improve the process's quality and efficiency.

E. Corporate Social Responsibilities

The idea of Corporate Social Responsibility advocates that corporations should act ethically and take responsibility for the impacts of their actions on all the concerned stakeholders and the community as a whole [2]. In the case of modern autonomous technology and supply chains the responsibility of "gaining goodwill of the community" is violated as the supply chains employs a significant number of people in the community who will be out of work because of this automation. This case study also violates the responsibility of "protecting from legal action" as the privacy concerns opens the organization and its employees to lawsuits.

F. Rhetorical Framework

When we think of the 3 V's framework for the given case study regarding modern technology and supply chain, we think of viewpoint, vision, and visibility.

Viewpoint: The discussion in this case can be framed from the viewpoint of either the consumers who benefit from improved supply chains using technology or the employees whose jobs are at risk as a result.

Vision: The aim of the discussion is to come up with solutions to the various drawback of using autonomous technology in supply chain. So, the vision would be to use these technologies for their benefits while at the same time minimizing the harms and risks from them.

Visibility: In this paper, we discuss the various solutions to decrease the loss of jobs and privacy concerns because of the mentioned technology use.

In the step of ethical decision-making process, we bring all the three perspectives into our focus to analyze the issues with autonomous technology and supply chains and the prospective solutions to rectify these issues.

The privacy theories that is most relevant here is the Seclusion Theory which discusses anonymity and secrecy for everyone [6]. The widespread use of drones will inevitably compromise the privacy of bystanders and end-users by virtue of just doing their assigned tasks, as we have not developed technologies to fully safeguard against these at present [1].

III. Ethical Decision-Making Process

A. Problem Identification & Applicable Privacy Policy

The extensive use of autonomous technologies to streamline and improve the supply chains and delivery process is accelerating [1]. Although this has benefits to consumers by decreasing the costs of products. It also has an adverse cost on the workforce by decreasing the net number of available number of jobs in the supply chain sector [3]. Also, the use of a subsection of these technologies e.g., drones, present some valid privacy concerns for both the consumers and bystanders [1].

The relevant privacy policy to this case is the Fourth Amendment of the US Constitution and the Communications Act of 1934. The Fourth Amendment provides for people to be secure in their persons and homes. This may be unintentionally or purposefully violated by drones doing deliveries.

B. Alternative Identification

One way to assuage the privacy concerns is to dedicate resources to the development of technologies that safeguard the privacy of unsuspecting bystanders and consumers while the delivery drones are operating. The safeguarding technologies available right now are still in the early stages of development [1].

Another method is to restrict the use of drones and other autonomous technologies in the supply chain and delivery processes.

C. Evaluation of Alternatives

On evaluating two alternatives with the background of the current scene in the supply chain industry, we realize that it is not very practical to restrict the use of drones as it will lead to significant losses to corporations which are restricted as other corporations will continue their use[1].

As of now, the best solution would be dedicating more resources to developing techniques to safeguard privacy and reeducate the workforce for other work opportunities.

D. Implementation

To implement the mentioned alternatives, one way to generate more resources is to tax the use of drones. The revenue generated from the taxes can be used to fund the research in the technology to safeguard privacy and to reeducate the work force.

E. Evaluating Outcomes

While evaluating the outcomes we relaize that it is possible to minimize the harms of technologies in supply chains while enjoying the benefits from them.

IV. Conclusions

With the advancement in technologies there are benefits but there is also a need for people to adapt to not become obsolete. With the supply chains, we can take measures to ensure that these harms are minimized.

References

[1] Paul Marks, "The Future of Supply Chains" Communications of the ACM, July 2021.

[2] George W. Reynolds, *Ethics in Information Technology*, 6th ed. Boston, MA, USA: Cengage, 2017.

[3] Morgan Forde, “Report: US could lose over 1.5M jobs to automation by 2030”, Supply Chain Dive, July. 1, 2019.

[4] Manuel Velasquez, Claire Andre, Thomas Shanks, S.J., and Michael J. Meyer, “Thinking Ethically”, Markkula Center for Applied Ethics, Aug. 1, 2015

[5] ACM Code of Ethics and Professional Conduct, ACM Professional and Technical Standards, 2008.

[6] Herman T Tavani, "Philosophical Theories of Privacy: Implications for an adequate online privacy policy" Metaphilosophy, Jan. 2021.