Chapter 41
Autonomous Vehicle in Industrial Logistics Application: Case Study

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ABSTRACT

Rapid technological advances have revolutionized the industrial sector. In the global market, it is necessary to consider the new paradigm of Industry 4.0 that presents a lot of features in the industrial logistics application. It has been seen through literature that innovation management practices enable companies to compete within the autonomous and connected vehicle market and is considered as an emerging and competitive differentiator towards the growth of the product and that of meeting customer demands within the changing markets. The first case study explores the integration of GPS and GLONASS signals in AGV for localization and navigation of customer destination and materials in the indoor and outdoor environment. The second case study implemented in obstacle environment that recognized the obstacle in front of the robot and also identified the dimension of the obstacle size, length, width, circumference, height, and distance from a robot. The strength and disadvantages of the system are discussed in the logistical application and future outlines are provided.

INTRODUCTION

Logistics is the lifeblood of the fourth industrial revolution and makes a key contribution to the Industry 4.0 concept. Automated Guided Vehicles (AGV) become an integral part of the solution portfolio

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for fully-automated logistics to transport loads to places where repetitive movements of material are required with little or no human intervention. In recent times, labour shortages and rising labour costs have forced manufacturers to adopt decisive solutions in order to remain competitive on the market. Shortage of labour and increasing labour cost in recent times has forced manufacturers to undertake decisive solutions in order to stay competitive in the market. AGV are unmanned automated systems that transport all kind of products within warehouse, distribution and logistics environment that reduce cost and increase profitability, reliability and flexibility in the system (Brent & Heard, 2018). The current challenges faced in all in-house and industrial need are to satisfy manufacturing and control system automation based on Internet of things technology. However, the main issue faced in current transportation is unavailable or shortage of drivers to transport goods. Thus, the research is going on to find alternate solution by replacing existing vehicles with AGV's in the Logistic application for public and commercial need. Sousa et.al., (2018) stated the loading and unloading operation of goods are arranged and carried out in the linear path inside the warehouse is a complicated task. Few researchers suggested that handling materials using AGV, without a change in path and carried out in a straight line using Scott-Russel Mechanism (SRM) was a proper solution. Logistics literature rigorously recommends that implementing automated vehicles in commercial indoor and outdoor applications and made a smart logistic system by adding intelligent over the system. The introduction of Industry internet of things (IIOT) in a logistic field made self-organization arrangement to solve all conditional tasks and problems. Currently, indoor and outdoor vehicle identification or navigation has been a major problem in the application of logistics warehouses. In this chapter we elaborate the navigation of autonomous vehicle and its obstacle avoidance system in detail.

BACKGROUND

Manufacturing companies are subject to permanently changing environments. The factories have to be continuously adapted to stay sustainable and competitive in the global market. Especially the smart driven logistic system facing huge problem relating to data processing and analyzing mechanism in navigation and control of the system. While the introduction of IIOT in logistic systems encounter solution for Automated Guided vehicle problems like planning path to reach destination, localize the material and localize the vehicle itself, navigate the customer location/ navigate the vehicle by the customer and sender itself, identifying the obstacle in the tracked path, recognize the obstacle and materials to pick and place operation with low budget by Mac et al., (2016). The laser and camera-based image processing-based vehicle positioning and obstacle avoid methodology were frequently followed (S. Lee & S. Lee 2013). For example, the PAN robot in advance where the laser mapping technology synchronized with stereo camera-based vision sensor to handle autonomous trouble-free loading and unloading in modern factory warehouses in European countries. Zhang et.al., (2018) pointed that the sensor data must be handle carefully and stored in repository in secured manner, by deploying fog computing cyber security system in industry 4.0. Thus, the data driven model based on data processing and analyzing data in a more secure manner to avoid the error-free system. These vehicles encounter problems like unable to predict alternate path when it identifies obstacles, when it deviates from a predefined path, the navigation and localization of vehicle are complicated.

The mobile robots are used to collect packages from vendor end to customer end in outdoor applications and as like the same in indoor application it carries spares, materials from warehouse. In the early