

Robotics Mechanisms and Automation in Warehousing Management

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ABSTRACT

Robotic warehousing is a sprouting trend in the recent times. According to the survey of robotics.org, about 80 percent warehouses are operated physically by man power. Nevertheless, the upcoming impenetrability in the warehouses makes it necessary for the management to implement the latest robotic technology. This will boost up the level of order picking and placing in the respective shelves. This will inevitably diminish the service costs such as lighting, stock items, air conditioning and labor. The intensification in the warehouse advancements is the basis for these kinds of automations. The IOT and big data plays a chief responsibility in these encroachments. These innovations will automatically trim down the human errors. This study underlines the awareness of logistics employees towards implementation of robots in the warehouses. From this study, it is apparent that robotic warehousing will assist the warehouses to perform dangerous jobs without difficulty.

1. Introduction

The narration of robots coalesces the supreme of science fiction along with real life technology. The prompt forwarding of years towards industrial revolution, created demand for advancements in the production sector. The industrial robots are automatic devices which replicate human motions to a higher extent. The prospect of robotics is complicated to gauge due to the innovation rate. However, it's envisaged that robots will for the most part play a bigger role in the residence and business. The preponderance of the manufacturing as well as production units is transforming employing conventional human labour to a throng of robots. The latest invention of robotic technology is the autonomous mobile robots (AMRs) which will possibly perform the similar functions like automated guided vehicles (AGVs). The chief function engrosses moving substance from one location to another location within the distribution centres. This is for the reason that they do it quicker, smarter and with added efficiently. The robots are used in warehouses to diminish operational as well as logistical costs. It also put aside delays and facilitates speedy delivery. The intrusion of robots inside warehouses has abridged the general expenditure and time although it requires higher investment and rightsizing at the instant of implementation. The improvements that will be accomplished according to this study for the assessment of perception amongst employees of warehouses towards implementation of robotic warehousing are executing dangerous jobs, operating in hazardous environment, zero Absenteeism, quick inventory process, minimized floor space, artificial intelligence system, amplified efficiency, reduced faults, quality work, avert delays, economical cost and rapid retrieval.

2. Review of Literature

Tatsumoto et al. (2018) developed a modified framework for replacing the already existing supervisory control that is available online for the purpose of multi agent DES. The functioning operated by plentiful robots within the warehouse automatic system is demonstrated in this study. The preponderance of robots utilized is LEGO.

Vimal kumar. N and Selva kumar. C (2018) stressed the stipulation for the implementation of mobile robots for operating in tedious and wide-ranging jobs as a result of human force deficiency. In the warehouse, the robots pick and drop the appropriate item from and to the shelves respectively without any breaks.

Ma et al. (2014) constructed a scientific model for cataloguing out the exertions in the path planning under double warehousing. The characteristics of the constructed model are demonstrated in the study. The particle swarm optimization based on multi robot paths are being proposed to triumph over these issues.

Yuan and Gong (2016) scrutinized the assistance of utilizing mobile robots in the warehouses for fulfilling system by replacing the manual picking. These kind of improved green warehouses will upshot in boosting the productivity and flexibility. The queue modelling is employed to conquer the automatic fulfilling systems.

Wang et al. (2018) cracks out the predicaments of NLOS emerging in warehouse atmosphere. There are two types of errors encountered. They comprise obscuring of occasional and fixed objects. According to this study, these improvement leads to elevated accuracy. The automatic sharing of information is enabled.

Zhou et al. (2017) tracked about equipments and items employed in the warehouse. The products are pulled out and plummeted according to the allotments of the shelves. This can be accomplished on the foundation of flexibility. This will help the management to lighten up the location and capacity stuffs.

Hanson et al. (2018) examines regarding the technological advances in the warehousing. These encroachments would possibly ensure enhanced fulfilment systems inside the warehouses. Thus it is concluded from the study that the automation in the fulfilment system will elevate the efficiency.

Boysen et al. (2017) crafted a mechanism for scheduling regarding the kiva system. It is found that this would influence the problems in the customary problems that are existing in the warehouses. This infers that the robots picking order is more productive than manual picking of orders.

Culler and Long (2016) depicts the utilization of robotic customization within the handling of material and manufacturing appliances. This will facilitate control of wireless technology. This ensures automation in an assortment of areas such as receiving, shipping, staging, storage, milling, turning and cutting. An updated technology named cyber physical systems is implemented for process integration.

Cardarelli et al. (2017) pioneered cloud robotics for automated vehicles. This enables efficiency in the global routes. The improvement in terms of safety is accomplished by implementing the automation within the warehousing management. The congestion zones can be trimmed down.

Upadhyay et al. (2018) discussed regarding the implementation of robots in the research field. The path estimation can be done through the technological advances in the robotic field. The softwares like python and matlab is put into operation for the ground programs. The static obstacles can be defeated.

3. Perception towards Robotic Warehousing

The intention of this learning is to track the most conspicuous improvement on implementation of robotic warehousing. This is done with the assistance of a questionnaire comprising a combination of characteristics that are the results of implementing robotic warehousing. The sample size is 40. The respondents are employees working in the warehouses. The demographic outline includes gender, age in years, and edification. The analysis of frequency for the demographic outline is shown in table 1.

Table 1: Frequency Analysis of Demographic Outline

Gender	Frequency	%	Age	Frequency	%	Education	Frequency	%
Male	37	92.5	<25	9	22.5	UG	17	42.5
Female	3	37.5	25-35	18	45	PG	19	47.5
			>35	13	32.5	Ph.D	4	10
Total	40	100	Total	40	100	Total	40	100

It is remarkable from the table abridgment that high proportion of employees working in warehouses are male (92.5%) belonging to middle age group (45%) and are post graduation (47.5%). Table 2 gives additional information about

the scrutiny of mean for the discernment of employees regarding the upshots of implementing robotic warehousing. This is carried out with the backing of likert's scale.

Table 2: Scrutiny of Mean

S.No	Improvements in implementing Robotic Warehousing	Mean	Rank
1	Robots helps in speeding up the inventory process in the warehouse (Quick inventory process)	4.25	4
2	Utilizing robots is cheaper than paying for humans in the long run (Economical cost)	3.13	12
3	Automated warehouse uses less floor space than a traditional warehouse (Minimized floor space)	3.58	11
4	Usage of robots helps to create an artificial intelligence system (Artificial intelligence system)	4.30	3
5	Robots reduces errors in the processes and minimizes wastage (Reduced faults)	3.93	6
6	Robots prevents the delay in mode of transport between the manufacturers and the distribution (Avert delays)	3.85	8
7	Dangerous jobs can be performed by robots (Execute dangerous jobs)	4.68	1
8	The quality of the work increases due to automation (Quality work)	4.08	5
9	Productivity can be achieved due to increased efficiency of robots (Amplified Efficiency)	3.92	7
10	Robots don't require sick leave or holidays and also can work without any breaks (Zero Absenteeism)	3.78	9
11	Robots are capable of working in hazardous environment (Operate in hazardous environment)	3.60	10
12	Introducing robots in warehouses increases the speed of product retrieval (Rapid Retrieval)	4.38	2

Table 2 illustrates the mean analysis of perception among the employees towards Robotic warehousing. It is evident from the table that the highest mean value is for the variable execution of dangerous jobs. Therefore, it is clear that the employees working in warehouses believe that implementation of robotic warehousing will facilitate trouble-free execution of dangerous jobs. Table 3 discloses the relationship amongst the improvements through factor analysis.

Table 3: Sampling Capability Examination

Sampling Capability Quantity		.770
Bartlett's Test for Sphericity	Chi-Square value	390.799
	Significance value	.000

Table 3 exposes the data capacity through the analysis of KMO and Bartlett's. This test indicates the KMO and significance value to be > 0.6 and 0.000 respectively. Accordingly, the congregated data is up to standard for undergoing factor analysis.

Table 4: Reduction of Data

S.No	Total	Variance %	Cumulative %
1	2.630	21.914	21.914
2	2.582	21.515	43.429
3	2.002	16.684	60.113
4	1.788	14.897	75.010

Table 4 intricate the components' variance values. This test reduces 12 improvements in implementing robotic warehousing into 4 components which explicates 75% of variance.

Table 5: Categorizing and Naming of Improvements as Components

S.No	Improvements	Component				Component Name
		1	2	3	4	
1	Execute dangerous jobs	0.782	-	-	-	Hazard resistance
2	Operate in hazardous environment	0.641	-	-	-	
3	Zero Absenteeism	0.638	-	-	-	
4	Quick inventory process	-	0.517	-	-	Updated technology
5	Minimized floor space	-	0.975	-	-	
6	Artificial intelligence system	-	0.531	-	-	
7	Amplified efficiency	-	-	0.827	-	Guaranteed Efficacy
8	Reduced faults	-	-	0.647	-	
9	Quality work	-	-	0.840	-	
10	Avert delays	-	-	-	0.868	Pertinent promptness
11	Economical cost	-	-	-	0.917	
12	Rapid retrieval	-	-	-	0.692	

Table 5 exhibits the categorizing and naming of four components correspondingly on the basis of allocation of improvements.

4. Conclusion

The prospective of robotics is captivating and ever budding. The probable savings made by robotic warehousing will be massive, particularly at enterprise level. It is significant to recognize that there are veiled aspects that must be sorted

out at the trial stage itself. The confront within supply chain and manufacturing are the collaborations they exercise for emerging in the business. It is headed in the direction of user-friendly communal robots spreading out their responsibility in both manufacturing as well as warehousing. The robots can moreover defend humans in from dangerous jobs. In fact, robots are programmed to terminate instantaneously simply when compared to human.

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