

Automated Handling Product Shelving and Checkout Application Management System

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Abstract: Automated Handling Product Shelving and Checkout Application Management System is an automatic guide vehicle that carries goods in and out of the warehouse in addition to warehouse inventory management system that aims to make the inventory management system to be more effective. Incoming and outgoing goods transfer is handled by an automated guided vehicles (AGVs). AGVs play a significant role in the efficient and accurate distribution of commodities and the movement of materials. AGVs route planning has made great achievements in warehouse management. It is simple to track the merchandise in the warehouse using an efficient inventory management system. An organised fulfilment centre results from an effective inventory management approach. More effective current and upcoming fulfilment strategies are produced by a well-organized warehouse. As software and sensor technology has advanced, AGV systems' capabilities have exponentially increased. Particularly, a number of technologies might have a significant influence on the AGV market. Cameras may enhance pallet detection in the future, enabling cars to communicate with manual trucks more successfully. Additionally, this technology may make standalone cars run more effectively inside of buildings. . The methodology that has been used to develop this system working on employs agile approach, with the primary goal of identifying flaws in the development process. This study reviews the literature on AGV system design and control in production, distribution, transshipment, and transportation. Also, we provide a more specialized research approach in the design and control of AGV systems and inventory management systems. For the key result, we expected the AGV to be moving according to the line on the floor and the inventory system to work well with the AGV web server.

Keywords: AGV, Following Line Car, Sorting Robot, IOT, Shelving

1. Introduction

The driverless transport system, an automatic guided vehicle (AGV) used for the horizontal movement of the material, was introduced in 1955 [1]. Automated handling product shelving is a type or genre of warehouse automation technology specifically designed to buffer, store, and retrieve product and inventory on demand [2].

The Inventory Management System will be able to track sales and available inventory, as well as notify business owners when it's time to restock and how much to buy. Inventory Management System is a Windows programme designed for Windows operating systems that focuses on inventory management and creates the necessary data [1]. Goods or products are usually stored in a warehouse. Consumers who want to find any product in the warehouse is difficult because the manual search is done in all the stock store rooms available by the user [3].

This project covers automatic handling product shelving to make it easier for users to bring goods in and out of the warehouse using an automatic guide vehicle and an inventory management system to help users maintain detailed product information and tell us in the stock room the product is located [4]. We are targeting the admin from any inventory store but for our project the admin came from 7Eleven edu hub Pagoh [5].

1.1 Problem background

Automated handling product shelving is a type or genre of warehouse automation technology specifically designed to buffer, store, and retrieve product and inventory on demand. Any automation that reduces or eliminates the need for humans to check-in, check-out, sort material, or to move totes and bins containing library material [6]. It's frequently used in conjunction with warehouse execution software (WES), warehouse management software (WMS), and other controls [4]. Automated handling product shelving can improve performance and productivity in the warehouse of an organization possible to never run out of a product or to never make the mistake of thinking that you have a product when you have run out of it [7]. This project needs to be done and developed because of its many benefits that will be able to be used with others. Among the objectives in this project are to design an Automated Handling Product shelving and checkout system, to develop an efficient Automated Handling Product shelving and checkout system and also to test users to swiftly and easily retrieve items when needed.

2. Materials and Methods

2.1 Materials

The project we are working on employs agile approach, with the primary goal of identifying flaws in the development process. Agile approach is not designed to be a quick or simple way to finish a development, but rather a place to assist you discover what has to change or be altered in order to reach the desired outcome.

As seen in the **Figure 1** below, agile model has different colour to differentiate the starting point until the last one. In the figure above our starting point is from requirement continue to design, develop, test, deploy, review and the final part in this agile model is launch. Each phase doing a specific job to make sure this project got the output that we wanted. Starting from the requirements phase, we gather all kind of information that will be needed for developing the system. Following to design phase, based on the requirements gathered in the first phase we have designed all the interfaces that will be used in our system. Next, during the developing phase we divided the group member into two team where team 1 will be assembling the AGV and also will be doing the programming and for the team 2 they were assigned to do the inventory system for storing the information of the item. Next is developing phase, in this phase we make sure our system to be integrated well with one another and fully functional before moving to the next phase. Continue to the next testing phase, the testing progress happened with our

supervisor as observer and the testing was conducted at a small grocery store that has an inventory store and for our study, we conducted the testing at 7Eleven edu hub Pagoh with their on duty workers as admin. For the deploy phase, our system are ready to use and all we did was to be prepared to counter any error or problem that could occurred last minutue. For the review phase we have presented the complete system to our supervisor and got the approuvement to proceed to launch phase where in this project it is the submission to our panel.

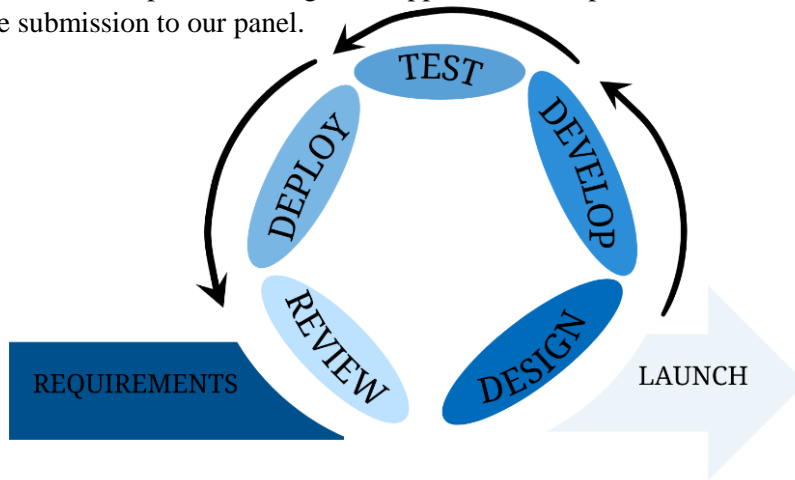




Figure 1: Agile model

2.2 Methods

Table below listed all the hardware and software used in this project.

Table 1: List of Hardware and Software

HARDWARE AND SOFTWARE	FUNCTION
 Arduino Uno R3 Board	Micro-controller board.
 Motor driver shield	Controlling DC motors.

Wemos D1 WiFi uno based

WiFi development board.



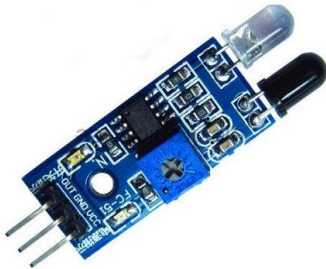
Relay 4 channel module

Controlling high voltage and designed to interface with Arduino.



Infrared Sensor

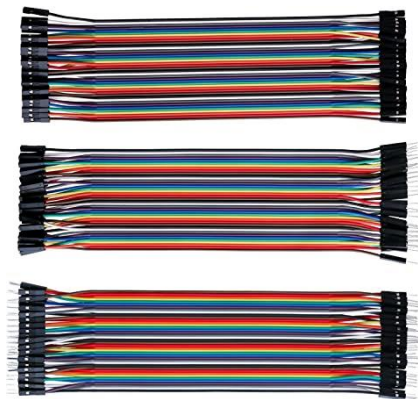
Detect infrared radiation surrounding it.



Male - female jumper wire

Connected all components without soldering process.

Male – male jumper wire



DC Power switch

Controlling the power flow.



18560 Lion battery

Supply power.



Arduino IDE

Coding and extracting code into Arduino board.



This project use both hardware and software for developing it and most of the item were bought through online shop since some component are rarely found nearby our location.

3. Results and Discussion

3.1 Results

This Automated Handling Product Shelving and Checkout Application Management System operated both system together in order to work which is the AGV web server and also inventory management system. The data from admin about the item that wanted to store in the house will be updated through the inventory management system as shown in **Figure 2**.

Home / Product

Manage Product

Show 10 entries Add Product

Search:

Photo	Product Name	Rate	Quantity	Brand	Category	Status	Options
	Wyze Cam v3 1080p HD Indoor/Outdoor Video Camera	\$53	105	WYZE	Security Camera	Available	Action -
	Ultraboost 21 Primeblue Shoes	\$140	118	Adidas	Shoes	Available	Action -
	Garment-Dyed Canvas Denim Jacket	\$210	97	Calvin Klein	Jackets	Available	Action -
	VansXPark Project Classic Slip-On	\$70	244	Vans	Shoes	Available	Action -
	TechFit Fitted Tee	\$29	368	Adidas	T-Shirts and Tops	Available	Action -
	Love Unites Tank Top (Gender Neutral)	\$28	512	Adidas	T-Shirts and Tops	Available	Action -
	R.T.V. Hoodie	\$87	216	Adidas	Hoodies & Sweatshirts	Available	Action -
	Adicolor Classics 3-Stripes Shorts	\$35	151	Adidas	Shorts	Available	Action -
	TP-Link AC1750 Smart WiFi Router (Archer A7)	\$60	256	TP-Link	Routers	Available	Action -
	Wyze Cam 1080p HD Indoor WiFi Smart Home Camera with Night Vision	\$45	126	WYZE	Security Camera	Available	Action -

Showing 1 to 10 of 14 entries Previous 1 2 Next

Figure 2: list of updated product in the inventory

Next, to move the item from one point to it shelve using the AGV, admin or the warehouse worker need to key in the item information such as product name, product shelve and also product code into the AGV web server before the AGV itself move to the location. The submit button work as the start button to the AGV.

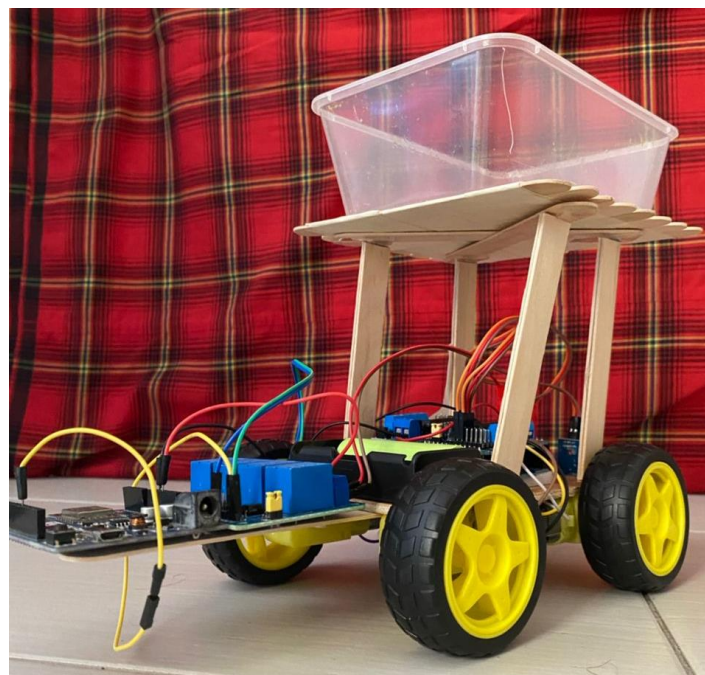


Figure 3: AGV prototype

Figure 5 shows the AGV model prototype. The container on top of the AGV will be the holder to put the item that wanted to delivered to it shelve. We have collected all thoughts and opinion about our system using google form platform where user will filled-in after they done the testing process. We found out that the three different stores have different evaluation on our system. Table below shows percentage of the respondents

Table 2: Frequency and percentage of respondents

Question: which store are you from?	Frequency	Percentage
7ELEVEN EDU HUB PAGOH	3	23.1%
TAN CHOON GROCERY MART PANCHOR	5	38.5%
MY BLOONJO MART PANCHOR	5	38.5%
TOTAL	13	100%

Table 2 show the frequency and percentage of the respondents from different store which 23.1% of respondents came from 7ELEVEN EDU HUB PAGOH which made it 3 participants. Next 38.5% of respondents came from TAN CHOON GROCERY MART PANCHOR with 5 participants and lastly 38.5% of respondents came from MY BLOONJO MART PANCHOR with also 5 participant and made the total 13 people involved in testing process.

3.3 Discussion

There are few types of sorting system in the warehouse but commonly used in the distribution progress is the conveyor belt system where a conveyor belt operates by looping two motorised pulleys over a long stretch of thick, sturdy material. The belt travels between the two when the motors in the pulleys spin at the same speed and in the same direction. Meanwhile for Automated Handling Product Shelving, it is a portable robot that follows long lines or cables on the floor that have been designated. Checkout Application Management System as these items cycle in and out of numerous checkpoints, enabling organisations to track, analyse, and analyse data.

These two systems are the best combination in sorting centre where they help in making the job more orderly because automated product shelving can aid in the improvement of systematic work, while a checkout application management system can prevent work conflicts and also contributes in increasing productivity in all departments.

From the overall findings of the data obtained, it can be concluded that generally user is satisfied with our developed system. However, there is a few persons who is not used with the system still preferred old ways of storing and sorting their inventory and that was something we could not change. Last but not least, from our findings we could conclude that our objective to developed an efficient system for user to easily retrieve their item are achieved.

3.4 Comparison

Table 3: comparison between Automated Handling Product Shelving and Checkout Application Management System and manual operation system

	Automated Handling Product Shelving and Checkout Application Management System	Manual operation system(conveyor belt)
Cost	Our system uses less cost to develop where all the components and tools could be found easily.	Requires high cost to buy the whole system and lot of people to assemble it.
Maintenance	Maintenance could be done anytime and anywhere without the needs of specific tools and can be considered as easy to do the annual check up on the system and also the AGV.	The conveyor belt itself is already hard to clean and need a specific tools to repair it also the annual check up will be hard and gives a negative impact to the warehouse.
Speed	Capable to set the speed	Limited speed range
Velocity	Velocity is capable to be consistent because each wheels have individual motor	Inconsistent of velocity due to belt slip.
Safety	Our system did not use any human labour since it is an automated handling where everything will be set first before doing the task.	Since this system are still using human in their sorting progress, variety of accident could appear during the progress and could slower the sorting progress time.

Based on the observation made on our system and existed system which is the conveyor belt system. We found out that there is a lot more improvement in our system compare to the old and manual system and the comparison can be clearly seen in the **Table 3**.

4. Conclusion

For the conclusion, our project has succeded in achieving the goals which to develop an efficient Automated Handling Product shelving and checkout system and since our world are going forward into the era where everything is human-less, Automated Handling Product Shelving and Checkout Application Management System are something that widely used in the warehouse sorting centre and has been improve the distribution progress to become more faster and less mistake during the progress. Not only that our system did not need any human interaction in moving the item from one point to another which help the user to retrieve the item without having a hard time to do it manually. Even though our system are launched and can be use by people that need it, we here are still doing the research and develop to upgrade our AGV so that it could do lot more task rather than what it could do now. There will undoubtedly be flaws in the system we have created after the study we completed, as well as improvements. In order to increase client happiness, several recommendations will be made.

To further enhance the quality of our project development, specifically the automated guide vehicle and inventory management system, additional research in the warehouse area is required for the enhancement of this system. This will undoubtedly be able to further enhance the economics of a warehouse in the area with the additional study we have conducted. As a result, the project we are working on can help our produced technology succeed.

Acknowledgement

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