Voice Picking Implementation Plan in a Warehouse: Case Study

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Abstract

The present study intends to plan the implementation of a voice picking system in a warehouse operated by a pick-by-line scheme. The need to improve and to make processes as efficient as possible was the engine that drove the company *Jerónimo Martins* to engage this venture. Voice picking systems are highly recognized amongst the logistics wise people due to the superior levels of productivity and low error levels it offers. Along this paper it is presented the VP system operation, and the modification in the current warehouse way of functioning that have to be made, specifically in the reception, labeling and work acceptance tasks.

The tests performed to measure the proposed system's productivity showed that it would be increased by about 5%. This result may lead to the need of less two or three employees, depending on their own productivity, while maintaining the productivity level as it is.

It was also observed, by inquiring 40% of the pickers, that only 15% of the sample both believed that the proposed system is more productive and simpler than the current RF system and prefer to use it. In this case and in order to get a successful implementation, this group of workers is essential to demonstrate the technology advantages to the other pickers who are reluctant about its benefits.

Key words: Voice Picking, *Jerónimo Martins*, Pick-by-Line, Functioning, Productivity

1. Introduction

In the current context of competitive markets, the need to better serve the costumers and to incessantly improve the processes to achieve that goal have been increasing enormously. The multinational retailing company *Jerónimo Martins,* which is continuously trying to find new solutions for their operations, is no exception.

The goal of this project is to provide the company with a proposal of a new technology that improves the performance of the picking activity in the fruit and vegetables warehouse located at the *Azambuja*'s distribution center. It is expected that, with the thesis that supports this paper, the company gets a plan of the system functioning and a preview of the improvements acquired by the operation.

2. Case Study

As the introduction suggests the firm that the assignment was made with is *Jerónimo Martins*. The company is currently present in three countries, and has more than 95 thousand employees. In Portugal the company plays under two brands in the food distribution area to serve two different markets. The 413 *Pingo Doce* stores act in a strategy B2C, focusing on families, and the 42 *Recheio* stores act in a B2B strategy, concentrating in HoReCa channels (hotels, restaurants and cafés).

The wide spread of the almost 500 stores around the country, required the company to divide the country in three areas of distribution: North, Center and South, so that each area is supplied by the distribution centers of its zone.

At the central area, in the *Azambuja* distribution center, more precisely in the fruits and vegetable warehouse the picking operation was then analyzed. The picking in this warehouse is made in a pick-by-line (PbL) strategy, i.e., each worker picks a pallet and places the items in store locations, in opposition to the usual strategy pick-by-store (PbS) where the worker picks items from their own locations to create one store pallet.

Currently, all the warehouse operation is handled with a RF system, and it was found that it was a field that might profit of some new improvements if the methodology and the technology used to perform it changed. In particular, the productivity would increase, if the picking operation could become hand free of any devices and if the pickers could, with the same workload, perform the task faster.

The presented opportunities for improvement match the benefits given by the voice picking systems, so it was essential to do some research about voice picking systems and cases where it was previously implemented.

3. Literature Review

The picking activity is one of the most important and most expensive activities in warehouses nowadays. Around 60% of the HR costs are linked to this task. The task is described as the separation of the products by orders, and there are a few technologies that provide assistance to perform it. One of the most commons is the radio frequency. It consists on storing and transferring information by reading barcodes with a portable RF reader. However, the RF systems are not refereed in the literature as those having the best productivity results. The need to carry the reader, use it to know which location to go in the warehouse and how many units to pick, makes the RF technology lose the first place in the productivity ranking for the VP systems.

The voice picking systems are based on a technology that recognizes verbalized information, and transmits audio commands. This means that a picking activity that uses a voice picking system is performed with voice commands and enables the workers to have their hands free. It requires the picker to wear a headset to listen and emit commands and a portable computer to transfer them wirelessly to the voice system program. The program allows the connection between the picker and the warehouse management system.

The technology has many pros such as the simplicity of use, the low injury rate, the

multilingual capacity but the best benefits are the productivity and the precision rates. In more than 70% of the cases analyzed the productivity has raised and, in some, the number of workers needed was reduced by 40%. The indicator to measure the precision is the service level. In the studies considered, the service level raised to levels never achieved before. Although the growth is most of the times less than 0,5%, it is very significant for large companies meaning less 5000 error per million.

The pick by voice, or voice picking, has however some points that might be not so attractive for the companies, such as the initial investment required, the regular maintenance and the incapability to coexist in too noisy environments.

Although all the biography found exclusively reports cases of voice picking implementation in warehouses, where the picking is made in PbS, it is expected that the voice picking system, properly designed, can work and get as good or better results in a PbL warehouse.

4. Research Methodology

Firstly it was made a search for gaps in the picking operation and analyzed the current situation of the warehouse and the picking task. The identification of the points where improvements where possible lead to the literature review to search for similar cases and learn how those were answered in order to get to a solution to this specific case. The search focused on the questions: “What are the VP advantages?”; “How are VP systems implemented?”; “How do VP systems function?”; “Are the results obtained similar to the expected ones?”.

Once the research finished it was created a design of the voice picking system interaction with the users, the pickers. It required the full understanding of the entire warehouse operation from the reception, goods conference and work acceptance to picking and put-away. With that information, and with the informal help given by the whole warehouse team it was design the communication procedure for the voice picking system.

The warehouse team also answered a quiz developed not only with the support given by the literature studied but also with the informal understanding of the team knowledge, expectations, fears and opinions about the technology. The goal of the quiz was to measure these four indicators to try to plan how to present the new technology once implemented.

In the light of the search for a technology that would bring improvements, some experiments were also performed measuring the time of picking tasks made with both RF and VP in order to compare the technologies values of productivity and precision.

5. Proposal of a Voice Picking Operation Planning

The application proposed in this chapter suggests the alteration of the picking methodology. However, for the VP system to work it is essential that some tasks take some modifications. Those tasks are: the reception, the goods conference and work acceptance, the labeling and the picking process.

5.1. Reception

The first alteration proposed for the reception is the limit to receive pallets with a maximum number of three different item codes (it is important to emphasize that the nomenclature "received pallet" refers to the ones that have already gone through the reception operation and are ready to be picked). This limitation has origin on the new method of visually distinguish items on the multi-items' pallets. The distinguish method, only used in the multi-item pallets, firstly passes through piling the boxes with the same code in the same column and then applying one of three different colored cards to the different item piles (**Figure 1**).

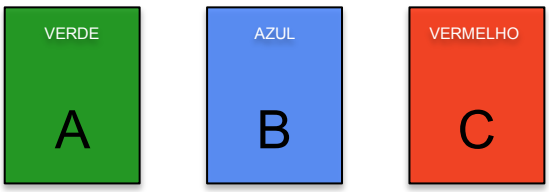

Figure 1: Colored cards used to identify items.

If the pallet will carry more than one item (two or three) after computerizing "multi-item" information, the WPMS (warehouse management system used by the company) is going to require a color for each one, eliminating the choices of the colors already assigned. As the receptionist is allocating the colors in the system he should immediately place the card(s) on top of the pile(s) of that item(s). After, the identification of all items the pallet is ready to go to the next step.

The cards method also allows the use of letters instead of colors, which might facilitate its utilization by foreigner operators, yet this method should not be preferred.

However, if the pallet received is composed by just one item, the system will allow the worker to computerize that information and no more handling will be needed at this stage.

5.2. Goods Conference and Work Acceptance

Before starting the picking of a work unit (received pallet), it has to be conferred. A different worker, other than the one who handled the reception, always takes this stage, a picker. To perform this task it will be used both RF and VP technologies. The picker starts the conference by asking the system to accept a work unit (VP), and it responds requesting an item code (VP); the picker then reads one of the codes present on the pallet in which he/she will do the picking (RF) and immediately the system reports the number of colors present in the pallet [0,3], and the color of the item read (VP) waiting for the picker to report the number of boxes of that item (VP). If there is more than one color, the system will keep waiting for the picker to repeat the process for all of them. This methodology restricts the picker to accept all the items in a unit load. Finished the items, the system will inform the worker that the conference is concluded and that he may start doing the picking.

Figure 2 represents a multi-item pallet with two different codes, one identified by a blue card and the other one by the green card. This example will be used along the paper to specify some of the system's functions.

Figure 3 symbolizes the proposed dialogue system for the work unit represented in the **Figure 2**.

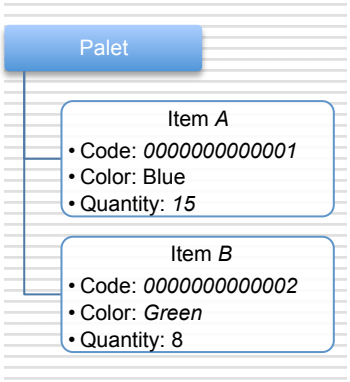

Figure 2: Multi-item pallet with two different codes.

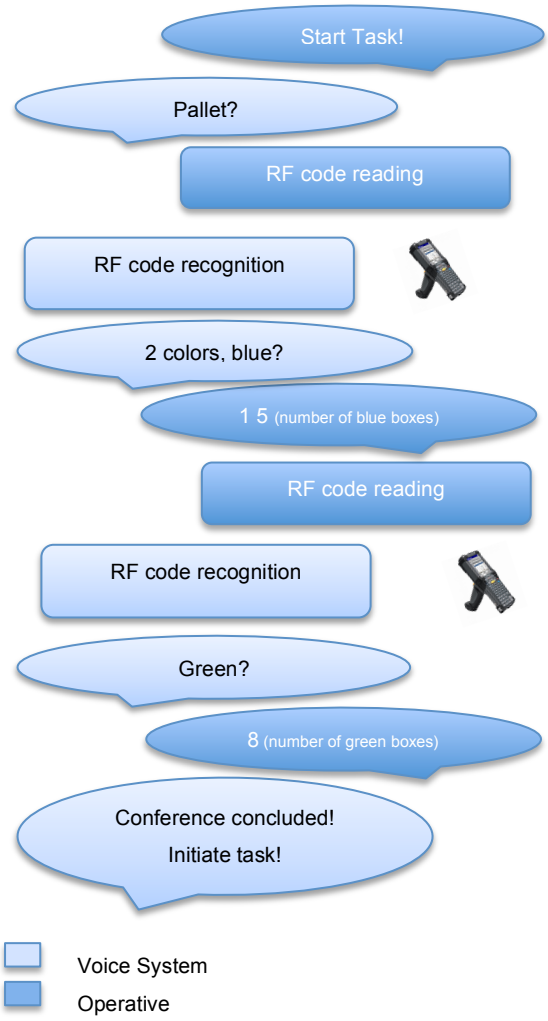

Figure 3: Conference and work acceptance interaction with the system. Balloons represent dialogue and boxes represent RF commands.

5.3. Store Station Pallets Labeling

Labeling is one of the most crucial activities for the VP system to work. The first suggestion in this field is to change the way codes are created. Currently, the thirteen to fifteen digit codes are printed according the following rules: the first three digits identify the warehouse code (WWW); the last three/four digits indicate the destiny store number which, depending on the LG, will have three or four digits (SSSS); the digits in-between are sequenced and represent the oneness of the pallet (PPPPPPP).

The new model should change the existing digits order from: WWWPPPPPPPSSSS to WWWSSSSPPPPPPP, having the sequenced number at the end of the code. This way, the model can be standardized so that the last three digits can identify one single pallet in a store station per day (as long as the number of pallets per store doesn't get to 1000/day). These will be the numbers used by the picker to confirm to the system that he got to the correct location while performing the picking task, which leads to the last physical change in labeling, the identification tag layout.

The tag's layout has also to be modified in order to have the last three digits shown in a bigger size. (**Figure 4**) The motive in the origin of this reformation is for the worker to be able to confirm, from a few meters distance, that he/she is arriving to the location the system has sent him/her.

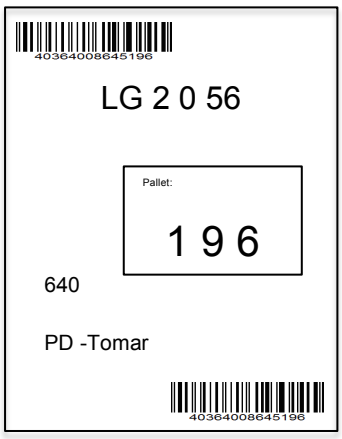

Figure 4: Proposed layout for pallet's identification tag. The pallet label shown has the terminology 196, and begins with the digits 403640, associated with the warehouse and the store to be sent respectively.

This requires that each station is always associated to a pallet code. When the code needs to be changed, the picker should report that the pallet is full and its ending. The system will then ask for a new code which the operative will have to say digit by digit all the code (skipping just the warehouse ones). (**Figure 5**)

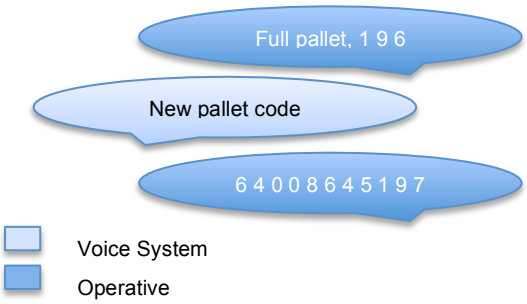

Figure 5: Pallet code modification from the ending "196" to the "197" one.

To prevent this new method to fail, three new habits will have to be taken by the warehouse team:

The labels have to be hanged vertically (instead of horizontally as they are currently).

- The most recent printed labels have to be hanged on the back of the ones already hanged.
- The first task to be taken is to associate a code to a pallet, but this association is only physically concretized once the pallet is full (in opposition as it is made today).

5.4. Picking

The picking process will be the operation suffering most of the changings. The task that is now entirely made with RF will completely rely on a VP basis.

The operation will begin with the vocal command of the location with a difference to the RF system, the voice system will distinguish aisles (first LG digit) from locations (two last LG digits), and will provide them to the picker separately in two commands.

Then, when the operative is getting closer to the correct location and he/she confirms the pallet code and, by doing it, instantaneously the system notifies him/her of all the items that the unit has to be placed at that store location.

After performing and confirming the tasks the picker updates the system with the tasks that are done and it will ask him/her to go to a different location. (**Figure 6**)

Figure 6: Information transmitted by the VP system proposed during the picking operation.

Figure 7 represents an example of a picking dialogue for the pallet presented on **Figure 2**. It shows a task where there are being placed three boxes of the blue item and one box of the green item in the pallet with the ending "196" of the store station "56" of the aisle number "2".

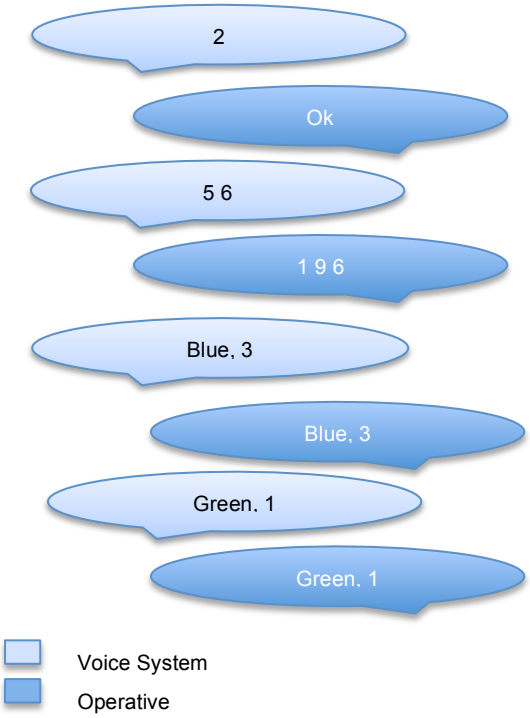

Figure 7: Proposed picking dialogue for the pallet on Figure 2.

In the picking operation it was also added some new commands that the picker may need to use during the operation:

- "Continue XX" – The command "Continue" should be given to the system when the picker is placing the amount of picking order given by the system in two different pallets (of the same LG). After placing a partial number (XX), in the first pallet he/she should verbalize "Continue" and the number of boxes placed in the first pallet (XX). Then the employee should report the full pallet state, change the pallet and continue the picking to the new pallet (as a new picking order).
- "Skip" – This command allows the picker to skip a location during the picking tour and postpone it. This will be the only command that is able to change the tour sequence given by the WPMS. It appears as an adaptation of a current method used for large picking amounts.
- "Cancel XX" – The "Cancel" command should be verbalized when the picker intends to delete the last picking confirmed. It is also necessary to transmit the number of boxes to be canceled (XX).
- "Restart Unit" – Finished the tour and the goods conference, it might be noticed that an error occurred during the operation. The command "Restart Unit" should be transmitted to the system in those circumstances. It will make the system repeat the total tour enabling the picker to find the mistakes' origin. This command does not record nor delete information to/from the system.

6. Results Discussion

In order to prove the positive impact the voice picking technology has on the picking operation and to plan a proper implementation two different indicators have been studied: the acceptance of the warehouse team by analyzing quizzes answered and the productivity improvement, by measuring the picking times.

6.1. Team Adjustment

The quizzes were answered by a sample representing 40% of the warehouse workers that perform the picking operation. Its answers analyses showed that the whole warehouse team is familiarized with the VP technology, but only about 70% of them have used it.

When it concerned the simplicity and productivity of the technology only about 60% of the sample seemed to believe that would be better the VP system compared with the RF one, all of them belonging to the 70% group that have tried it.

Afterwards it was also presented the VP functioning proposed and the answers were the same in all the cases. This allowed to make the correlation that pickers are only aware of the technologies' benefits once they have experienced it.

When asked about their technology preference only 15% said voice picking against the 85% left that chose RF. This reconfirms the tendency observed of not wanting to change and preferring to keep the operation as it is. However the group of 15% is going to be crucial for the implementation process since those are the ones who will voluntarily make efforts to evidence the voice advantages to the rest of the team.

6.2. Productivity

To measure productivity there were made five groups of tests. The first one measured the time of performing the picking of one single box, the second, the third and the fourth measured the picking times of three different mono-item pallets, and the fifth measured the picking of a multi-item pallet.

All the tests were performed ten times (except the fourth that was performed only five times) and twice, since it was used both RF and a simulation of the VP system proposed to compare the results.

The results showed a tendency of improvement to the current picking RF technology. (**Table 1**)

Table 1: Average times per box picked and rate of productivity increase

Tests	RF time (s)	VP time (s)	Increase (%)
T #1	8,78	4,69	46,6%
T #2	9,78	9,00	7,9%
T #3	10,28	9,67	6,0%
T #4	14,4	14,05	2,4%
T #5	17,56	16,69	5,0%

It was observed that one of the most obvious aspects of improvement was the LG code identification. The first test showed that by using the proposed VP method the pickers would take about half of the time to perform that task. However it is not accurate to take that result as the operation improvement. By analyzing the remaining four experiences, which have dealt with workloads with an amount of boxes between 16 to 120, it was

concluded that the operation productivity's level have achieved an improvement of 5,3%.

7. Conclusion

Although the implementation did not actually occur, the present document, and the thesis that supports it, intends to provide *Jerónimo Martins* a planning proposal, and a measure of its benefits to the warehouse.

It was proven that the system is able to function the way it was design and it would bring an increase of 5% to the warehouse productivity, which might be more evident in small work units that require the visiting many locations.

However, it is still needed to study if the implementation costs related to the technology pay off the improvements gotten from the technology's implementation.

For further analyses it would be interesting to study the benefits of an implementation of a voice system in the other tasks of the warehouse operation as the reception and the expedition.

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