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D-VEND: AN AUTOMATED VENDING MACHINE FOR MEDICINES

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ABSTRACT

The D-VEND is an automated vending machine for medicines. In the Philippines, the demand for OTC (Over-the-Counter) medicines is high. This leads to long piles of people buying medicines from drugstores and pharmacies, which in turn brings hassle to almost everyone. This pursues with the main purpose of sending OTC medicines closer to people's homes.[1]

This study focused on how the costumers will have convenience in buying OTC medicines by implementing the use of an automated medicine vending machine. Based upon the results of the implementation, the researchers concluded that for the students, the machine is positively dispensing the right medicine requested by the user.[2] Apart from this, it is also said to be capable of storing medicines safely with correct and updateable information. It is therefore considered reliable, because it ensures the reliability of the medicines that it sells. Accuracy wise, the machine is correctly recognizing the coins inputted. [3] The warning system installed in the device gave the users the assurance that the medicines stored in the machine can be safely stored. It is therefore suggesting that this machine can be very marketable in terms of customer and medicine security.

As this research have proved that there is a significant difference between the assessments of the students and the pharmacists, a proposal for implementation to the general public would be very appropriate. Since this machine is just a prototype and is subjected for small population testing only, it would be very advisable if the future researchers would implement the machine in a larger population sample.[4]

Keywords
D-Vend, Machine, Vending Machine, Automation, Over-the-Counter Medicines

1. INTRODUCTION

Upon hearing the term 'vending machine', some are surprised to know that vending machines have originated in ancient Greece. The first known vending machine was invented by the Greek engineer and mathematician Hero of Alexandria around 215 BC. These first vending machines were located in Egyptian temples and dispensed holy water in exchange for coins. [5]

With consumers wanting quick and convenient access to competitively priced products, the vending industry has seen a great deal of growth over the last ten years. Vending offers new entrepreneurs a way to start businesses which can grow quickly.[6]

In connection with this, the advancement in equipment technology and computer software is being developed for the vending machine in order for its operators to have more control of their business and to give the consumers their needs and their demand for fast service.[7]

Research Paradigm

The researchers used the top-level algorithm as shown below in Figure 1 as used in vending machines.[8] The initial idea is that the users will be inputting coins, and then the machine will dispense the medicine it is set to dispense.

The programming language that will be used in the study will be Microsoft Visual Studio or also known as C# for the interface of the system.[9]

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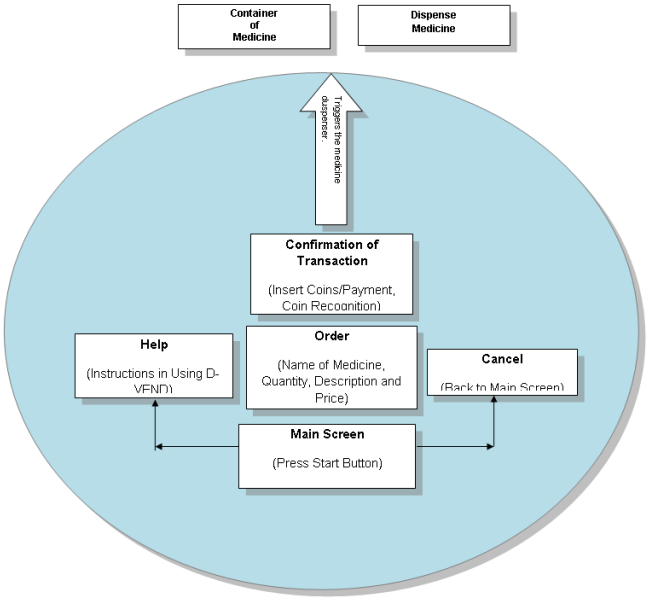

FIGURE 1

ANALYSIS AND INTERPRETATION OF DATA

The researchers randomly chose 127 respondents from the third year students from the College of Computer Management and Information Technology and 7 experts, specifically pharmacists and pharmacy attendants, from different local drug stores within the vicinity of Sta. Mesa, Manila. The respondents' identities are not stated in this paper for privacy purposes.

Table 1
Weighted Mean of the Assessment of Students with the Functionality of the System

Item	Weighted Mean	Verbal Interpretation
1. The machine dispenses the medicine that the customer wishes to buy	1.29	Very Good
2. The buttons of the machine quickly responds to the needs of the customer.	1.49	Very Good
3. the labels assigned to the buttons show the actual function stated.	1.29	Very Good
4. the machine correctly recognizes the amount of coins inputted.	1.81	Very Good
5. the machine portrays the actual functions of a typical vending machine.	1.72	Very Good
6. the machine doesn't give any monetary change	2.28	Very Good
Overall	1.66	Very Good

Table 2
Weighted Mean of the Assessment of Pharmacists with the Functionality of the System

Item	Weighted Mean	Verbal Interpretation
1. the machine dispenses the medicine that the customer wishes to buy.	1.88	Very Good
2. the buttons of the machine quickly responds to the needs of the customer.	3.13	Very Good
3. the labels assigned to the buttons show the actual function stated.	**2.38**	Fair
4. the machine correctly recognizes the amount of coins inputted.	3.63	Fair
5. the machine portrays the actual functions of a typical vending machine.	3.88	Fair
6. the machine doesn't give any monetary change	3.63	Very Bad
Overall	3.09	Fair

Table 3
Weighted Mean of the Assessment of Students with the User-friendliness of the System

Item	Weighted Mean	Verbal Interpretation
1. the machine is easy to use and to understand.	1.35	Very Good
2. the machine provides a user interface that is simple enough for the	1.37	Very Good

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users to understand.		
3. the "Help" menu provided in the interface really helps the first-time buyers of D-VEND.	1.49	Very Good
4.the buttons are easy to press.	1.68	Very Good
5. the machine provides correct and up-to-date information about the medicines it sells.	2.02	Very Good
Overall	1.582	Very Good

Table 4
Weighted Mean of the Assessment of Pharmacists with the User-friendliness of the System

Item	Weighted Mean	Verbal Interpretation
1. the machine is easy to use and to understand.	2.25	Good
2. the machine provides a user interface that is simple enough for the users to understand.	2.75	Fair
3. the "Help" menu provided in the interface really helps the first-time buyers of D-VEND.	2.75	Fair
4.the buttons are easy to press.	3.25	Fair
5. the machine provides correct and up-to-date information about the medicines it sells.	3.13	Fair
Overall	2.83	Fair

Table 5
Weighted Mean of the Assessment of Students with the Reliability of the System

Item	Weighted Mean	Verbal Interpretation
1. the machine dispenses the right medicine the customer asks for.	1.32	Very Good
2. the machine dispenses the right amount of medicine that it is set to dispense.	1.90	Very Good
3. it provides accurate information about the medicines it sells.	2.13	Good
4. medicines are safely stored.	1.58	Very Good
Overall	1.73	Very Good

Table 6
Weighted Mean of the Assessment of Pharmacists with the Reliability of the System

Item	Weighted Mean	Verbal Interpretation
1. the machine dispenses the right medicine the customer asks for.	3.25	Fair
2. the machine dispenses the right amount of medicine that it is set to dispense.	2.88	Fair
3. it provides accurate information about the medicines it sells.	2.38	Good
4. medicines are safely stored	3.0	Fair
Overall	2.88	Fair

Table 7
Weighted Mean of the Assessment of Students with the Accuracy of the System

Item	Weighted Mean	Verbal Interpretation
1. the selected button responds correctly to the function assigned to it.	1.34	Very Good
2. the machine dispenses	1.35	Very Good

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the right medicine the customer asks for.		
3. the machine correctly recognizes the coin/s inputted.	1.92	Very Good
4. the descriptions of medicines are correct.	1.75	Very Good
Overall	1.59	Very Good

Table 8
Weighted Mean of the Assessment of Pharmacists with the Accuracy of the System

Item	Weighted Mean	Verbal Interpretation
1. the selected button responds correctly to the function assigned to it.	2.88	Fair
2. the machine dispenses the right medicine the customer asks for.	2.88	Fair
3. the machine correctly recognizes the coin/s inputted.	3.38	Bad
4. the descriptions of medicines are correct.	3.13	Fair
Overall	3.07	Fair

Table 9
Weighted Mean of the Assessment of Students with the Security of the System

Item	Weighted Mean	Verbal Interpretation
1. the money inserted is stored on a safe place.	2.07	Good
2. container does not have any sharp/edgy object that can hurt buyers.	2.13	Good
3. the machine has a warning system (that pre-empts the users when using), when the door is opened, or when the machine is being shaken	2.2	Good
4. The bought medicine is easy to get, and does not require troublesome picking up.	1.88	Very Good
Overall	2.07	Good

Table 10
Weighted Mean of the Assessment of Pharmacists with the Security of the System

Item	Weighted Mean	Verbal Interpretation
1. the money inserted is stored on a safe place.	3.75	Bad
2. container does not have any sharp/edgy object that can hurt buyers.	3.38	Bad
3. the machine has a warning system (that pre-empts the users when using), when the door is opened, or when the machine is being shaken	3.0	Fair
4. The bought medicine is easy to get, and does not require troublesome picking up.	3.38	Bad
Overall	3.38	Bad

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results gathered from the students after the implementation, the researchers concluded that the students agreed that the machine can be functional and friendly for the users. A lot of them have similar opinions that the machine dispenses the right medicine that the users asked for, and that the buttons are easy to press and quickly responds to the users' needs. It is functional because it performs the functions that it is set to perform.[6] On the side of the pharmacists, the machine is not as good as it is perceived by the students. They have even given Very Bad verbal interpretations regarding the matter. The researchers

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therefore conclude that there of a significant difference between their assessments.

Based upon the results of the implementation, the researchers concluded that for the students, the machine is positively dispensing the right medicine requested by the user. Apart from this, it is also said to be capable of storing medicines safely with correct and updateable information. It is therefore considered reliable, because it ensures the reliability of the medicines that it sells. Accuracy wise, the machine is correctly recognizing the coins inputted. The warning system installed in the device gave the users the assurance that the medicines stored in the machine can be safely stored. It is therefore suggesting that this machine can be very marketable in terms of customer and medicine security.

But, as for the pharmacists' evaluation, the results are quite different. They recognized that the machine must have softer buttons. It must be able to dispense monetary change. It should be made of a more physically secured material. There are more upgrades that should be added to the machine in order to ensure that it would be safe and its other features are more appropriate for users who are not so fond of technology.[10]

Recommendation:

As this research have proved that there is a significant difference between the assessments of the students and the pharmacists, a proposal for implementation to the general public would be very appropriate. Since this machine is just a prototype and is subjected for small population testing only, it would be very advisable if the future researchers would implement the machine in a larger population sample.

It is to be noted that the study is implemented for just a sample testing and that it requires further testing and application to the general public in order to check the assessment of people in real time. This must require more implementation time to ensure that the results woulde feasible. The effectivity and efficiency of the system of the proposed system is still a question that is needed to be answered. A test involving the actual users themselves should be conducted in order to obtain their perception with the use of an automated vending machine for medicines as opposed with the manual operations in buying medicines. [11]

After this, a comparison between the proposed system and the previous (manual buying and selling of medicines) system would be very appropriate in order to really see if there is a significant difference between the two systems in order to finally conclude which would be better suited for real time processes of buying and selling of medicines..

It is also recommended that to test the machine in a larger environment, the following questions should guide future researches:

1. How did the machine affect the perceptions of the people who wants to buy medicines?
2. What are the effects of the implementation to the general wellness of the community?
3. What is the success rate of the machine as opposed to the manual procedures in buying medicine?
4. How did the general public accept the machine?

Based also from the findings and conclusions of this study, the following guidelines for future machine developments are suggested:

1. It would be advisable for the next researchers to propose a touch screen interface.
2. The machine should also be available to recognize different types of coins, and paper bills.
3. It would also be very advantageous if the machine can give monetary change for the convenience of the users.
4. A more efficient database for the administrator part, and additional information important about the medicines.
5. Another feature that is important is for the users to be able to buy different quantities of medicines upon his request.
6. The machine must be stand-alone and usable even without electricity.
7. A less fragile container is necessary for more security of the medicines and the users of the machine.

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