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Content

No.	Article	Page
1	Screening of Candidate Mutants of KDML105 Rice using Salinity Tolerance Score and Physiological Indices Ranjit Singh Gujjar, Jyotsna Joshi1, Wannisa Chuekong and Kanyaratt Supaibulwatana	2-16
2	Mutant of KDML105 Rice Show Higher Potential to Retain Total Chlorophyll and Photosynthesis Capability Under Low Nitrogen Condition Pennapa Banyen, Suriyan Cha-um, Cattarin Theerawitaya and Kanyaratt Supaibulwatana[1]	17-22
3	Evaluation of Salt Tolerant Ability on Selected Thai Rice Cultivars Chanakarn Sangsiri, Metha Meetam, Wisuwat Songnuan and Aussanee Pichakum	23-29
4	Electrochromism of G/ITO/Nioxhy and G/ITO/WO3 Prepared by Reactive DC Magnetron Sputtering Technique Jarinya Yosthisud and Chumphon Luangchaisri	30-34
5	Plasma Irradiation Inducing Biochemical Stress in Hairy Root of *Artemisia Annua* L Ittipat Punlerd, Somsak Dangtip and Kanyaratt Supaibulwatana	35-40
6	Study Effect of Roller's Surface Coating on Sheet Metal Spinning Process Thanapat Sangkharat and Surangsee Dechjarern	41-48
7	Biological Activity of Partial Purified Polysaccharides from Thai Macroalgae Arpapat Jawana, Khomsan Ruangrit and Jeeraporn Pekkoh	49-56

No.	Article	Page
8	Improved Ethanol Tolerance in *Spathaspora Passalidarum* CMUWF1-2 Through Adaptive Evolution Thanyalak Saengphing and Nadchanok Rodrussamee	57-64
9	Activity Evaluation of Bioactive Compounds from Edible Freshwater Green Macroalgae Extracted by Ultrasound Assisted Extraction Saranporn Chaimuang and Jeeraporn Pekkoh	65-73
10	Determination of Humic Acids as a Precursor of THMs in Raw Water from the Chao Phraya River, Thailand Using Feem Technique Kitiyot Tungsudjawong, Supachai Hirunsupachote and Chawanee Suphirat	74-78
11	Inhibition Efficiency of Extracts from Leaves of Piper *Betle Linn*, Piper *Armentosum Roxb*, and *Andrographis Paniculata* (Burm.F.) Nees on the Growth of Colletotrichum Gloeosporioides in Nam Dok Mai Mango (Mongifera Indica Linn.) Thanapop Soteyome, Chayapat Kee-Ariyo, Nopporn Sakulyunyongsuk, Nomjit Suteebut, Duangkamol Tungsatitporn, Duangrat Saetang and Sumapar Thedkwanchai	79-86
12	Effect of Membrane Treatment and Operating Temperature on Performance of Alkaline-Acid Direct Glycerol Fuel Cell Ponkarnan Sangkheaw, Supaporn Therdthianwong and Apichai Therdthianwong	88-95
13	Design and Development of Pen Vending Machine Using Arduino Uno R3 Microcontroller Pawana Choosiri	96-99
14	Development of Demonstration for Hydro Power Generation Warinee Weerasin, Sivapong Na phol and Nuttakarn Khowjaroen	100-104

No.	Article	Page
15	The Real-Time Analysis for the Mechanical Properties of Red Bean Grains Thanavoot Nilmanee, Sompong Chuaprakha, Sorarat Hongprapas, Wanrak Srisung,and Paisan Kanthang	105-108
16	Designed Environment for People with Disabilities And Disability. Case Study: Improving the Environment of The Center for Social Welfare Development Elderly Home Khae. Bangkok Kornpong Thongsri, Sarayou Sawangmark, Noppadol Karwwisart, Rugiwan OunsongKarm, Parinan Bannchern, Sastra Srihabhak, Santi Kamonnarakit, Tansattha Atianuwat, Pinpawan Phakdesuwan	109-114
17	Designed Environment for People With Baby Aphasia. Case Study: Babies Aphasia and Intelligence. "Nontawith Home Landscape," Pak Kret District Some Makets. Nonthaburi Kornpong Thongsri, Sarayou Sawangmark, Noppadol Karwwisart, Rugiwan OunsongKarm, Parinan Bannchern, Sastra Srihabhak, Santi Kamonnarakit, Tansattha Atianuwat, Pinpawan Phakdesuwan	115-120
18	The Design Space for Recreational Activities for Children With Disabilities. Case Study: The Environment of the Orphanage for Disabled Children In Pak Kret. Nonthaburi Kornpong Thongsri, Sarayou Sawangmark, Noppadol Karwwisart, Rugiwan OunsongKarm, Parinan Bannchern, Sastra Srihabhak, Santi Kamonnarakit, Tansattha Atianuwat, Pinpawan Phakdesuwan	121-126
19	The Design Space for Recreational Activities for Disability. Case Study: Improve the Physical Environment of the Center for Social Welfare Development Elderly. Pathum Thani Kornpong Thongsri1, Sarayou Sawangmark, Noppadol Karwwisart, Rugiwan OunsongKarm, Parinan Bannchern, Sastra Srihabhak, Santi Kamonnarakit, Tansattha Atianuwat, Pinpawan Phakdesuwan	127-132

No.	Article	Page
20	Relationship between Media of Integrated Marketing Communications and Purchasing Decisions for Food & Beverage Products of Durian by Gender Tanapon Boonyatatrittichai, Pema Zangmo, Noppawan Jeyamapa, Suthassorn Thongkhum and Kwanruetai Boonyasana	134-137
21	The Future of Thailand Income Distribution Paweena Reanthong, Peerada Klinchumphon, Nipawan Noopakdee, Thanaphat Duangbuppha and Kwanruetai Boonyasana	138-142

Author index

Design and Development of Pen Vending Machine Using Arduino UNO R3 Microcontroller

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Keywords: Vending machine, Arduino UNO R3, Microcontroller

Abstract. The objective of the research was to design and development of pen vending machine which has 120 c.m. x 60 c.m. x 45 c.m. as width x length x height, respectively. Our designed machine has arduino UNO R3 microcontroller as the sensor and compressor to control the motor in the pen release set and the pen detects set. The experimental results show that the controlling of the pen release set according to the situation. Furthermore, the controlling of the pen detects set according to the number of coins and can withdraw coins correctly when the coin is withdrawn.

1. Introduction

Nowadays, there are many automatic vending machines. Vending machines are one example of an automation business process in which it utilizes meager supervision of the user. There are a lot of variety and forms of automation using vending machines [1].

Vending machines refers to a machine which accepts payments in the form of coin, token or card, and dispenses a product. Most often the vending machines used depend on coin intake with currency recognition techniques like image subtraction techniques [2-4].

The photocopy shop here in the Rajamangala University of Technology Phra Nakhon offers diverse services to its clientele. Primarily it offers documents photocopying and printing services. But sometimes customers need other learning materials such as paper pens etc. Therefore, if there is a machine that can facilitate the sale of teaching and learning equipment, it can make customers more comfortable.

This research aims to design and development automated piece-by-piece retail of common pens. This vending machine will dispense blue pens and red pens. This machine utilized coin slot to accommodate 1 baht, 2 baht, 5 baht and 10 baht. The buyer will simply select the type of pens and insert coins. This machine will not dispense change in amount.

2. Methodology

The design concept relates to the design of the model of the pen vending machine that accepts the pen currency by controlling it with arduino UNO R3 microcontroller through the use of the command input switch. Then the motor rotates the pen according to the order. The system will detect the pen when the specified amount has been reached, the display screen, the number of pens remaining and the amount, as shown in Fig. 1.

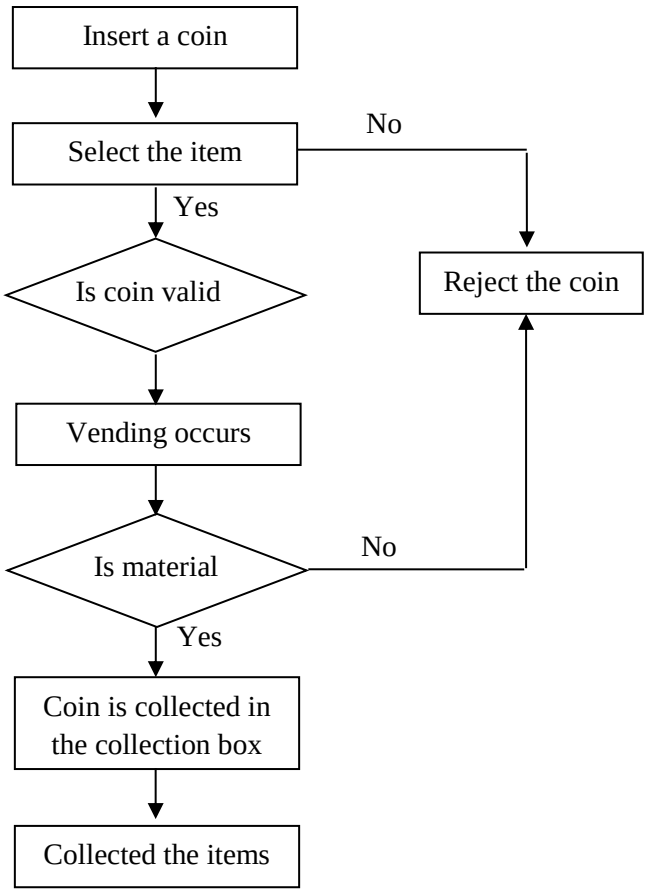

Fig. 1 The block diagram of the research concept

The mechanical structure of the pen vending machine. The prototype model is implemented by the help of the mechanical design setup. The various block present in the design are mentioned below, as shown in Fig. 2.

1. Lock and key
2. Display LCD
3. Coin insertion slot
4. Selection of the item
5. Control unit
6. Coin rejection slot

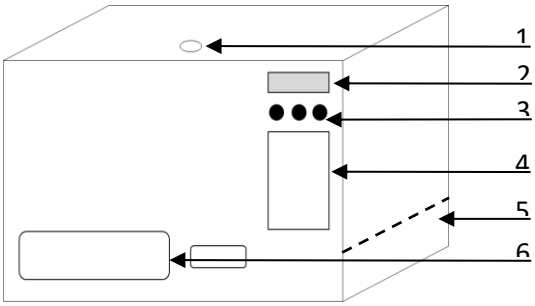

Fig. 2 Mechanical structure of the pen vending machine

The machine was evaluated using descriptive statistics utilizing the five-point rating scale that measures the acceptability of the pen vending machine in accordance to the following criteria:

- Functionality, technical evaluation of the machine in terms of its accurateness of dispensing, maintenance and power.
- Cost effectiveness, evaluation of the prototype as a stand-alone machine while rendering other services.
- Mobility, evaluation of the prototype considering its space occupancy and weight.
- Overall impression, in terms of aesthetics and marketability.

3. Results and Discussion

The machine stands 120 c.m. width, 60 c.m. length, and 45 c.m. height. The designed dimensions were sufficient in accommodating improvised printer dispensing section that is modified to be the storage and dispensing mechanism to pull the desired number of pens as shown in Fig. 3.

Fig. 3 The output prototype of the pen vending machine

The experimental results show that the controlling of the pen release set according to the situation. This machine can use the coin slot to accommodate 1 baht, 2 baht, 5 baht and 10 baht and have precise withdrawal as shown in Table 1.

Table 1 The test of accuracy of pen dispensed

Item	Total pen		Require pen		Select coin	Remaining pens		Withdrawal
	Blue pen	Red pen	Blue pen	Red pen		Blue pen	Red pen	
1	24	24	1	-	5	23	24	-
2	23	24	1	1	10	22	23	-
3	22	23	2	2	20	20	21	-
4	20	21	3	3	30	17	18	-
5	17	18	-	1	6	17	17	1
6	17	17	1	-	10	16	17	5

Table 1 shows the test of accuracy of pen dispensed found that the pen vending machine can choosing the pen type can supply the number of pens exactly.

The evaluation was in a form of questionnaires with specific points to assess the total functionality of the pen vending machine. The rating is from a 1 to 5 scale. Scale 5 to be the highest rate as shown in Fig. 4.

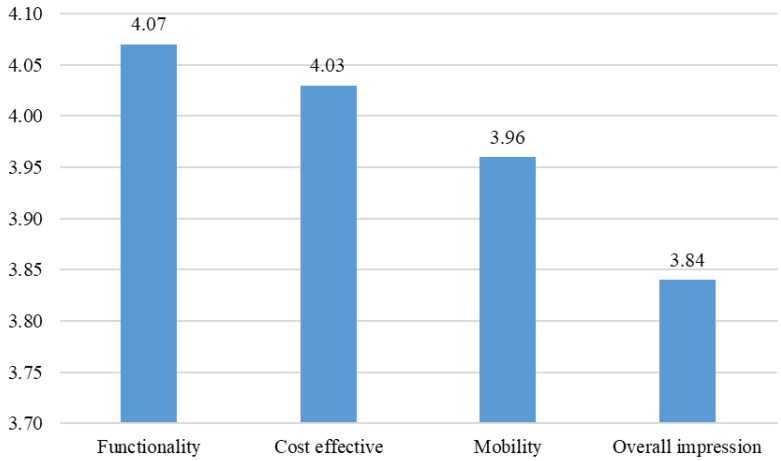

Fig. 4 The result of the assessment

Fig. 4 shows the result of the assessment. Both the mobility and overall impression parameters were quite a bit low, this is due to the usage of machine parts is large and the insertion of the pen is quite difficult was an issue in this prototype then. The functionality and cost effective clearly point out the demand for the prototype to be incorporated in the conduct of business among these shops.

4. Conclusion

The proposed system is the design of prototype model for pen vending machine. The controller part of the vending machine was working according to the specifications for which it was designed. The prototype model was designed for the implementation of the pen vending machine structure which can choose the pen type according to the amount of coins effectively. Coins were inserted and items were vended successfully. In future, pen vending machine of maximum accuracy and efficiency can be achieved with better design and faster control equipment's.

5. Acknowledgments

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