SNRU Journal of Science and Technology

Journal home page: snrujst.snru.ac.th

The Development of Smart Farm Solution Machine in a Community Enterprise: A Group of Growers and the Rainbow Mango Processing, Ban Nong Bua Chum, Tambon Nong Hin, Nong Kung Sri District, Kalasin Province

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Received: 12 May 2020; **Revised:** 30 September 2020; **Accepted:** 2 October 2020; **Available online:** 1 January 2021

Abstract

The objectives of this research were to develop the Smart Farm Solution Machine in a community enterprise in Ban Nong Bua Chum, including a group of growers and rainbow mango processing, and examine the capability of the Smart Farm Solution Machine. The development used Visual Basic to manage the database with an MS SQL Server Program. Based on the findings from this examination, the system could perform quickly and effectively, and it had, therefore, made it easier to access and appraise the required information accurately. The capability examination utilized Black Box Testing and was carried out by five experts. The statistics used in this research study were averages and standard deviations (S.D.) The research results were as follows: (1) The overall capability examination was at the maximum ($\bar{x}$ = 4.71, S.D. = 0.50) as many parts under consideration found that the highest evaluation had consisted of two equal parts: the system Functions and the Systems manual. (2) The examination of the two equal parts had been at the maximum ($\bar{x}$ = 4.80, S.D. = 0.45). (3) The system outcome had also been at the maximum ($\bar{x}$ = 4.70, S.D. = 0.50). (4) The system use and the security had also been at the maximum with ($\bar{x}$ = 4.65, S.D. = 0.58 and ($\bar{x}$ = 4.60, S.D. = 0.55), respectively. The results of this research indicated that the Smart Farm Solution Machine had been suitably developed and had worked authentically.

Keywords: Visual Basic Language; MS SQL Server; Black Box Testing; Radio Frequency Identification (RFID)

1. Introduction

The Rainbow Mango is a natural cross between the Sunset mango and the long-lasting mango. According to the export principles to foreign markets, it has been recognized as the correct variety because it is tasty, has beautiful skin, and has a good shape. Moreover, the fruit is durable during transportation and has a longer shelf-life. Presently, the export market targeted both in Europe and Asia. The Mango Public Company Limited is attempting to create a new customer base. Apart from solely exporting mangoes in fresh form, the company also exports in the form of processed products. Especially in Japan, these products are gaining in popularity. The export volume is increasing rapidly because of the mango high nutritional value, including carbohydrates, dietary fiber, vitamins (especially Vitamin A in the form of beta carotene), and minerals (Calcium and Potassium) [1].

A group of agriculturists and Rainbow Mango Processing in Ban Nong Bua Chum, Nong Hin Sub-District, Nong Kung Sri District, Kalasin Province is based on a group of rainbow mango local growers. In order to distribute the products to many companies and to export to other countries, the group gathers and collects the rainbow mango processed products. As a result, several agriculturists are earning higher incomes. The agricultural group management has been working gradually. Their

workplace is located in the center of No.46, Ban Nong Bua Chum, Nong Hin Sub-District, Nong Kung Sri District, Kalasin Province. They provide different types of services to their working members: 1) data management and accounting to manage the information of the members, 2) information about the processing of Rainbow Mango products, 3) the details of purchasing and distributing the Rainbow Mango processed products, 4) the data and the customers of the company, 5) the members' incomes, and 6) the report summaries for government and private sectors, such as the District Agricultural Extension Office, the Provincial Agricultural Extension Office, and many other companies.

The members of the agriculturists and the Rainbow Mango Processing consist of thirty-seven individuals and three officers. There are three ways to distribute processed rainbow mangoes. The first is conducting wholesale sales to companies. The second is exporting to other countries, and the last is conducting retail sales to the merchant middlemen, who directly come to get the products at the center of the village. The total business profits in 2018 were based on the sale of 580 tons with a value of 10,450,000 Baht. Regular customers purchased 350 tons at a value of 7,000,000 Baht, while 230 tons with a value of 3,450,000 Baht were exported to other countries (Malaysia, Vietnam, and Singapore).

Based on the working group, it was found that the group data management (the members, the products, the details of purchasing and distributing the Rainbow Mango Processing products, and the member incomes) is still being recorded using a hand-written notes, which means that the information system is not well-organized. Moreover, some information has been lost, cannot be regained, and is difficult to find. When the members come to deliver the rainbow mangoes at the center of the village, they are often unable to find the officers, who are supposed to receive the products so the process cannot be facilitated. Moreover, this is a waste of time for the members. Sometimes, the delivered products are not sorted with the orders, and at other times, the information is not related to the companies. Therefore, they will receive their money late.

In light of these problems, The Development of the Smart Farm Solution Machine in the Community Enterprise: A Group of Growers and the Rainbow Mango Processing in Ban Nong Bua Chum in Tambon Nong Hin in the Nong Kung Sri District of Kalasin Province was created in order to conduct the data management, to receive and deliver the products, and to easily access member data and the information about the products. Moreover, important information can be accurately and effectively recalled. Therefore, by utilizing this technology to access and summarize significant information, as well as to report the information, will make the process more accessible and comfortable. Instead of using paper and taking hand-written notes, Radio Frequency Identification (RFID) Tags are used when individuals become the members of the group, which is more preferable. Finally, this process is easier for managing the group because it allows all information to be summed up systematically.

2. Materials and methods

The research methods for The Development of the Smart Farm Receiving Machine in a Community Enterprise: A Group of Growers and the Rainbow Mango Processing in Ban Nong Bua Chum in Tambon Nong Hin in the Nong Kung Sri District of Kalasin Province were divided into the following steps of system analysis and design:

System planning

The researchers obtained access to a Community Enterprise: A Group of Growers and the Rainbow Mango Processing in Ban Nong Bua Chum in Tambon Nong Hin in the Nong Kung Sri District in Kalasin Province in order to study the requirements and to collect the necessary information by conducting interviews with the Chairman of the group, the Officers of the group, and the Mango growers, as shown in Fig 1, in order to create a better system, the information was collected and analyzed as follows: 1) gathering the working methods from the original ones, and 2) planning and designing the working process models. [2]

Fig. 1 Show visiting the area to analyze the problems in the community

Refer to a group of agriculturists and Rainbow Mango Processing in Ban Nong Bua Chum, Nong Hin Sub-District, Nong Kung Sri District, Kalasin Province

Systems analysis

Collecting the information and requirements

The researchers analyzed the required surveys and the information of the users. Collecting the information and studying the system were the methods of the required users. The analysis was related to the system structures and was correlated with the design of the step system, which is related to the authentic systems and to the characteristic functions of this Community Enterprise.

Analyzing the new requirement system

According to the problems and requirements, it can be inferred that the requirements of the system development in the Community Enterprise: A Group of Growers and the Rainbow Mango Processing should improve the system machine so that the Community Enterprise can proceed and efficiently manage the system. In order to effectively run the processes, technology needed to be implemented. Therefore, it was essential that the following be required:

An information system about the members, which consist of the members basic information and the product information, etc.

A product management system, which would be comprised of the cultivated area and a number of products.

The product delivery management system for the group, which would be composed of the delivery data at the time, the number of products at the time, and the time of year.

The accounting management system, which would consist of the data of the members receiving the products, the benefits from the profits, the financial information, and the business partners.

The report management system, which consist of summary data.

The confirmation and inspection of the product delivery system, which would consist of product confirmation by the members and the group Product Manager.

The creation of the inspection of the member product delivery, which would include member cards (Radio Frequency Identification (RFID) tags, Radio Frequency Identification (RFID) reader machine, delivery camcorders, the data recorders and data storage, a product delivery record system, receipts, and the report of product summary at that time).

Based on the problems, the researchers had the conceptual ideal to develop the system of the Smart Farm Solution Machine in the Community Enterprise for a Group of Growers and for Rainbow Mango Processing so that these two groups could work authentically and could respond to the entrepreneurs' demands and so that this machine could create good results for data management.Which has designed an overview of the system as shown in Fig 2.

The Smart Farm Solution Machine in a Community Enterprise: A Group of Growers and the Rainbow Mango Processing not only helps facilitating the accounting part, but also assists in recording the data and in producing delivery records and the data of the sale information with partners. As shown in Fig. 3, Show the concept of the idea of the inspection of the product delivery and record data

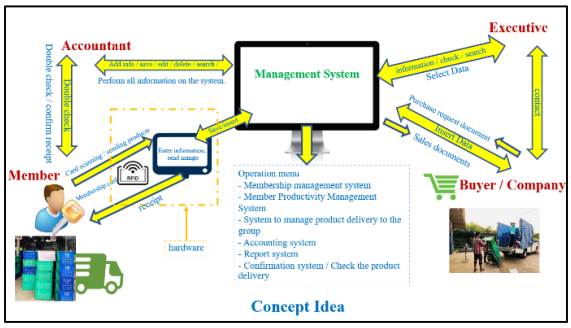

Fig. 2 Show the concept of the idea of the overall working system for product management

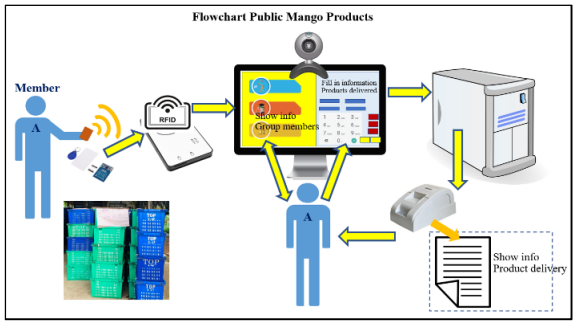

Fig. 3 Show the concept of the idea of the inspection of the product delivery

Systems design

Use Case Diagram

The Use Case Diagram will show the information of the users, who log in and log out, from the system. It is shown in the following diagram. as shown in Fig 4 [3].

Description of Actor 1: An officer is a person, who checks the product delivery in the system, while the members send the information into the system. Moreover, each officer will examine the products, calculate the prices, deliver the products to the market, and fill-out a report summary, and summarize the amount that has been generated from the input of product output into the system.

Description of Actor 2: A member is a person, who receives a member card, which is used to log into the system when the products are delivered.

Description of Actor 3: An admin is a person, who takes care of the system during log in and then gives username and password to the group officers. as shown in Fig. 4.

Activity Diagram is a system that shows the working steps when the users log in. [4]

Class Diagram is a machine invention that is used as a Class Diagram to help designing the working model. The working system of the machine consists of 13 classes. as shown in Fig. 5 [5].

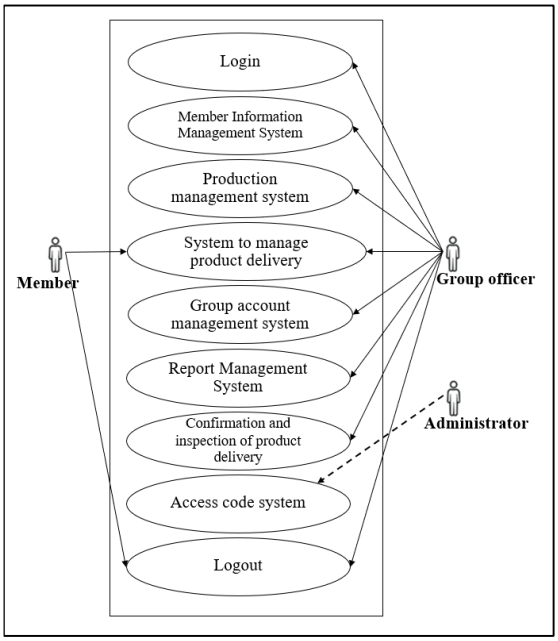

Fig. 4 Show the Use Case Diagram of the smart farm solution machine

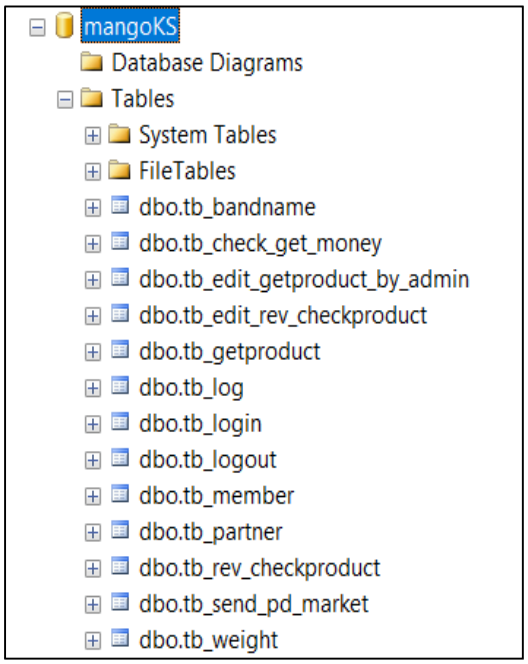

Fig. 5 Show data storage tables in the database

According to Fig. 5: data storage tables in the database. The report management of Data, which has been developed for the Smart Farm Solution Machine in a Community Enterprise: A Group of Growers and the Rainbow Mango Processing and which was created using a database design of 13 tables

The design of the Rainbow Mango Smart Farm Solution Machine

The designed product receiving machine is composed of 155 cm of height, 80 cm of width, and 70 cm of thickness, respectively. Its keyboard base support design is slanted up in order to help facilitate input from the users. The front of the machine prints out the receipts. Moreover, for easy use, the machine's start button is on the front as shown in Fig. 6

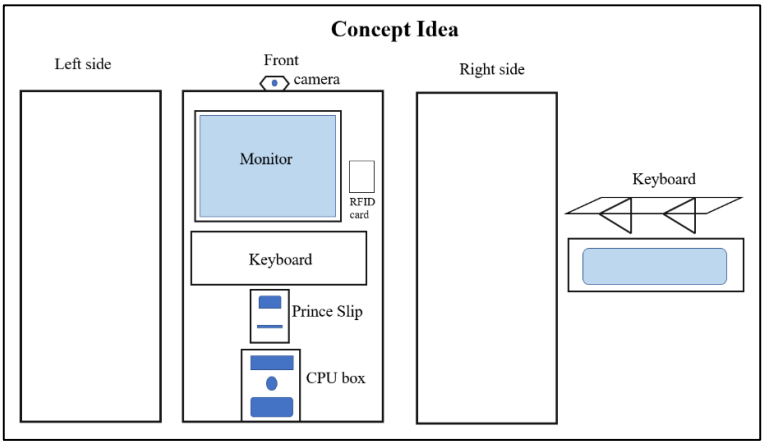

Fig. 6 Show the Rainbow Mango Smart Farm Receiving Machine

The UI design of the Smart Farm Solution Machine in a Community Enterprise: A Group of Growers and Rainbow Mango Processing

The researchers have designed the presentation standards for product management in the Smart Farm Solution Machine in a Community Enterprise: A Group of Growers and Rainbow Mango Processing. The screen design is easy-to-use. Each part of the screen has main titles, which are related to the model and are handy. In accordance with the design and in order to have an expedient screen, the researchers have cooperated with the people, who are directly involved.

Systems development

From the systems development, the working group presented the designed information regarding the system development.Computer languages such as VB.NET and MS SQL Server were used to develop the system [6].

System testing

To test the working system, the researchers utilized the services of two computer technology experts and other three individuals, who were professionals in the Community Enterprise of a Group of Growers and with Rainbow Mango Processing. All of these people examined the systems to seek out errors and to evaluate the capability of the working system of the machine. The Black Box testing process was divided into two steps as follows:

The Alpha Test was the test that the researchers gradually used to test the working systems of the machine and to seek out and to fix the errors in the system.

The Beta Test was the test that checked the working systems of the machine, which was based on utilizing the competencies and knowledge of the experts and the other concerned individuals, who improved the system capabilities.

Systems implementation and operation

The researchers set up the systems and authentically brought the Smart Farm Solution Machine into the Community Enterprise [7].

3. Results and Discussion

After the system development of the Smart Farm Solution Machine into the Community Enterprise: A Group of Growers and the Rainbow Mango Processing, the results showed that the machine had been able to work effectively and that for the process of saving information, it had been expedient. Therefore, the agriculturists will, in the future, be able to deliver their products by themselves. The machine system was also able to analyze the information and to release the reported information correctly so that the individual agriculturists will be able check the overall data by year. Hence, they will be capable of performing data analysis in order to expand the procedures of

Rainbow Mango Processing in advance. For instance, they will be able to bring products for delivery in order to analyze the following: 1) how much product they can take to the center of the village and 2) when their products should be transported in order to receive the highest profits. Furthermore, the Community Enterprise will be able to manage the data system to make the information accessible and to report it to other organizations. Accordingly, the community enterprise members will be able to take their own products. This means that there is no waiting for the officers to receive the products. In addition, time is not wasted when delivering the products, which means that the operations of the Community Enterprise can have higher standards and quality. as shown in Fig. 7 Show the capability testing of the working system of the Smart Farm Solution Machine and Fig. 8 Show the working operations of the Smart Farm Solution Machine.

The Testing of the smart farm solution machine and the system used by the agriculturists and the officers

Fig. 7 Show the capability testing of the working system of the Smart Farm Solution Machine

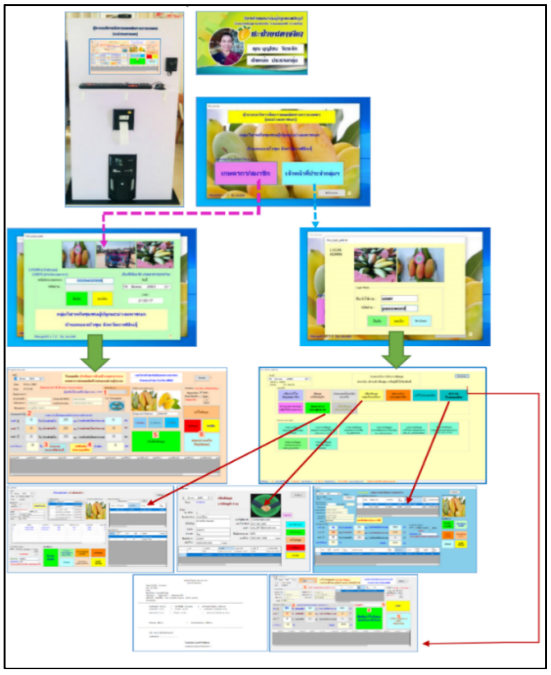

Fig. 8 Show the working operations of the Smart Farm Solution Machine

Refer to a group of agriculturists and Rainbow Mango Processing in Ban Nong Bua Chum, Nong Hin Sub-District, Nong Kung Sri District, Kalasin Province

After the researchers had tested the working system capability and had brought the authentic information to the system machine, the two computer technology experts along with the other three members used Black Box Testing to evaluate the capabilities of the working system. The results are shown in Table 1 [8].

Table 1 The evaluation of the results from the Experts

Sequence	Assessment	Mean	S.D.	Qualitative
	Functional Test	4.80	0.45	Maximum
2	Usability Test	4.65	0.58	Maximum
3	Result Test	4.70	0.50	Maximum
4	Security Test	4.60	0.55	Maximum
5	Documentation	4.80	0.45	Maximum
	Overall	4.71	0.50	Maximum

According to the Table 1, the overall capability evaluation was maximum ($\bar{x}$ = 4.71, S.D. = 0.50). When considered from the different parts, it indicated that the highest evaluation parts had been the two equal ones, which had been the *Functions* and the *Systems Manual*. Therefore, the two are at the maximum ($\bar{x}$ = 4.80, S.D. = 0.45), and from that, it can be inferred that the capabilities of the Smart Farm Solution Machine are excellent. Thus, it can work authentically and effectively.

4. Conclusion

The Smart Farm Solution Machine in community enterprise: a group of the growers and the rainbow mango processing in Ban Nong Bua Chum in Tambon Nong Hin of the Nong Kung Sri District of Kalasin Province is used a language called Visual Basic to develop and the data base management is applied by MS SQL Server. Based on the system analysis, the original one used only document but nowadays it is changed into information technology which helps facilitate the users for seeking and proceeding the information easily. After the system analysis, the system will be tested by taking the information to an authentic system and evaluate the system capability by using Black Box Testing from the experts. It was found that the average and the standard deviation (S.D.) had been 4.71 and 0.50, respectively. Therefore, it can be inferred that the Smart Farm Solution Machine works in maximum, based on Likert's 5 rating scales. The system can be very beneficial for the operations of the community enterprises, which can smoothly analyze the information. However, concerning technology, the problem is that the majority of the agriculturists in the community are illiterate. Thus, it is essential for them to rely on the new generation to ask for suggestion on how to use technology. Because the agricultural field will become more competitive in the future, the group of growers and the rainbow mango processors will have to learn more about the new technology.

5. Suggestions

With regard to helping to improve the systems so that they can become more progressive in terms of systems development, The Smart Farm Solution Machine has received suggestion. Then the system was improved and easier to use given that with respect to using technology, the majority of the group members have lower level skills and the machine should be used online in order to facilitate the users.

6. Acknowledgements

We would like to thank all staff members of Computer Engineering major, the Engineering faculty and Computer Education, the Faculty of Education of Northeastern University for all of their support and for the use of the facilities of the computer lab. In addition we extend our gratitude to A Grower's group of in the community enterprise and to Rainbow Mango Processing in Ban Nong Bua Chum in Tambon Nong Hin of the Nong Kung Sri District of Kalasin Province for sharing the important information for this research.

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