FIBC Autospecs to Aid Calculation of Cost and Materials of Flexible Intermediate Bulk Container

By

Mohd Harizhilmi bin Nasaruddin
16346

Dissertation submitted in partial fulfilment of
the requirement for the
Bachelor of Technology (Hons)
Information and Communication Technology

MAY 2015

Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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Approved by,

_____

(Saipunidzam Mahamad)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
MAY 2015

CERTIFICATION OF ORIGINALITY

This is to certify that I am held responsible for the work submitted in this project, that the original work is my own except citations included in this project as stated in the references section and that the original work contained herein have not been undertaken or done by unspecified sources.

_____

Mohd Harizhilmi bin Nasaruddin

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The author would like to express his gratitude to his FYP supervisor, Mr Saipunidzam Mahamad for his guidance in helping to complete the author's Final Year Project. He have been working hard along with the author by spending his quality time and effort in assessing and improving the project. His comments and assessments have been very constructive in making the project as complete as possible.

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ABSTRACT

Flexible Intermediate Bulk Container (FIBC) has been widely used in various industries environment. The long-lasting and cost efficient properties of FIBC made it a preference by companies to use them in daily operation and storage. The blooming of the oil and gas industries includes the FIBC manufacturing industry to grow as well. Because of high demand of this type of container, the manufacturers must adhere to the requirements by different companies while keeping production as accurate as possible. Therefore this project aims to develop a mobile application that will act as a tool to help the manufacturers in calculating the cost and materials required to ensure their production goes smoothly and delivers on time.

LIST OF FIGURES

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CHAPTER 1
INTRODUCTION

1.0 Introduction

1.1 Background of study

There are many specifications of the Flexible Intermediate Bulk Container (FIBC). Different company would need different type of FIBC in terms of the size, shape and properties. Therefore, different specifications would need different amount of materials used and different cost incurred. This kind of container has been widely used in the industries as packaging for storing materials such as hazardous or non-hazardous chemicals, minerals, food supplies and fertilizer. FIBC is made of woven polymer known as the polypropylene with square or rectangular base, either with discharge outlets or just plain bottom (FIBCA). FIBC is cost effective and long lasting for long distance transportation and storage under extreme conditions. Despite the popular uses of the FIBC in the industry, there are rather less Android based application available to aid manufacturers to calculate the costing of each type of bag. The advantage of having the FIBC mobile application would help manufacturers to provide on-the-spot information while meeting clients instead of relying on immobile standalone application. Hence, the author believe that using the Android platform and make the application usable on mobile phones would provide much more immediate feedback and user friendliness to the users. Therefore, the project aims to deliver a software that can carry out a precise cost calculation.

Immediate feedback is defined as one is able to respond immediately to a message, making it possible to check the message's interpretation (Deursen and Pieterson, 2006). The application to be develop must be able to deliver the output immediately to the user while showing each specification details. Meanwhile, user friendliness is defined as the ability of the users to operate the system easily and without relying unnecessarily on technical expertise (Liu and Louvieris, 2006). Therefore, we aim to make the software less technical in terms of the interfaces and design so it is easy for the user to operate the software.

The rest of the introductory chapter is arranged as follows: the next sections is the problem statement of this project. Then, the objectives of the study will be stated, followed by the scope of study.

1.2 Problem statement

The manufacturers of FIBC would need to fulfil all of the specifications while maintaining high quality of production for various types of FIBC. The manufacturers also required to calculate the cost as soon as possible with the most accurate pricing to make profit. The manufacturers would also need to calculate how much materials are needed to control their supply inventory to have enough supplies for production. With the various types of FIBC orders each month, the calculation would get tedious and mistakes would mostly happen.

1.3 Objective

There are a few objectives that will be accomplished by this study:

- Develop an Android-based mobile application that is able to calculate the amount and cost of material needed for different type of FIBC
- Contain at least 10 types of FIBC specification

1.4 Project Scope

This study aims to develop the proposed system based on data provided by one of the FIBC manufacturer which will be interviewed. The targeted user of this research is also the employees from the FIBC manufacturing industry.

CHAPTER 2

LITERATURE REVIEW

2.0 Literature review

2.1 Biodegradation of polymer

Flexible intermediate bulk container (FIBC) is made up of polypropylene and polyethylene. Therefore, there are concerns on the implications of the accumulation of these polymers in the environment. Biodegradation is defined as the breakdown of a substance to smaller products (Aislabie & Lloyd-Jones, 1995). One of the concerns is that these polymers are one of the main causes to the pollution of the environment due to their inert state to biodegradation. A study shows that pre-treated polymers degrade more easily than untreated polymers (Arutchelvi et al., 2008). The study also concluded that degradation is also easily achieved with starch and cellulose blended polymers (Arutchelvi et al).

2.2 Safety strategy against potential hazards due to the handling of powders in a blending unit

A study by Jaeger (2001) focuses on the strategy or safety measures to prevent hazards due to handling of powders in a blending unit. The research is relevant with this study as FIBC is also used to contain powders in the industry. It is stated that explosion may occur when dusts are produced, stored or processed in a plant and these materials are present as a mixture in air (Jaeger). Explosion will occur when these 3 elements are present: fuel or flammable materials in sufficient quantity, air and effective ignition source. It is found that electrostatic is also an effective ignition source. This matter is relevant to this study where materials are filled and discharged from the FIBC container which may cause electrostatic between the surface of the container and the powder. According to Jaeger, the FIBC bags must adhere to certain requirements to prevent dust explosion from happening. Some of the requirements are that any inner polyethylene (PE) coating must not be thicker than 20-30 µm, the basic material of the

bag must contain conductive materials and label the bags if grounding is needed during filling or discharging (Jaegar).

2.3 Reusing or recycling FIBCs: Some guidelines and cautions

This document emphasizes on guidelines and cautions on using reused or recycled FIBCs. Jones (n.d.) stated that Flexible Intermediate Bulk Container Association (FIBCA) does not endorse reusing FIBC. Many users buy second-hand FIBC from brokers. Brokers collected the FIBCs from the original users to reduce the disposal costs without knowing what material contained by the FIBC before. The brokers will then inspect and clean the FIBC before selling them at lower price. It is mentioned that even the bags are cleaned, the residue from the previous material may still be present even after cleaning (FIBCA). Some materials such as hazardous substances would create a long term contamination which is irremovable. It is also stated that FIBCs that have been in contact with hazardous materials cannot be recycled. Therefore, respective users must use a lined FIBC to handle those hazardous materials so that the liner can be removed along with the material residue before recycling.

CHAPTER 3

METHODOLOGY

3.0 Methodology

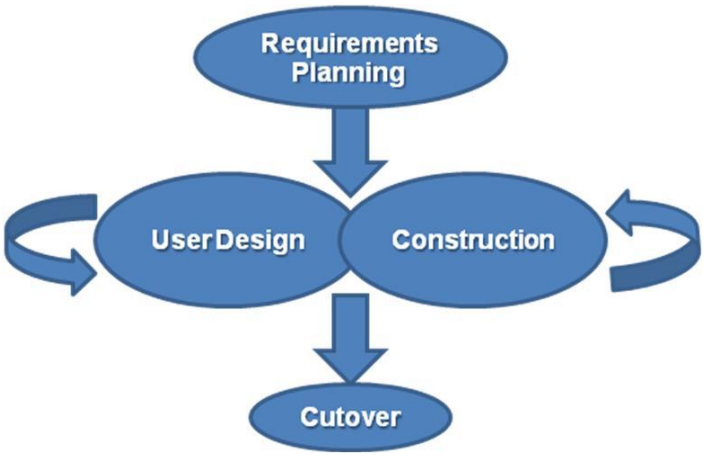

Figure 3.1 Rapid Application Development model

The development of the proposed system will be carry out using the Rapid Application Development (RAD) method. Therefore, the rest of this chapter will be arranged as follows: Requirements planning, user design & construction and cutover phase.

3.1 Requirements planning phase

The functional requirements of the proposed system will be collected from the future user of the system. Our sample respondent for the requirement gathering is none other than the personnel in charge of the FIBC manufacturing from related industry. The system will be customized to suit the respondent requirements.

The author will be in touch with the sample through phone interview and primary source referencing. The sample will be asked with relevant questions about the requirements that are imperative to be implement in the system.

The author will also need to refer to the documents from the company as input data and primary source for the system. Therefore, the company would need to share their specification document to be implemented in the system.

3.2 User Design & Construction phase

By having the sample to answer the questionnaire, the author would have a starting point on how to develop the system. Then, the system will be improved from time to time during this phase. The author will be interacting frequently with the user to completely cover the requirements needed for the system and develop models such as UML diagrams to match user requirements. It is expected that this phase will requires a lot of coding process and prototype developments. These prototypes will be released as beta version and be tested by our sample in their environment.

3.3 Cutover phase

Cutover phase in RAD method is the last phase where the system is expected to be complete. Final testing will be done by our sample to find any bugs, defects or failures while operation. If the test is successful, the system will then be released and implemented for use and future updates and maintenance will be made as fit.

3.4 System architecture

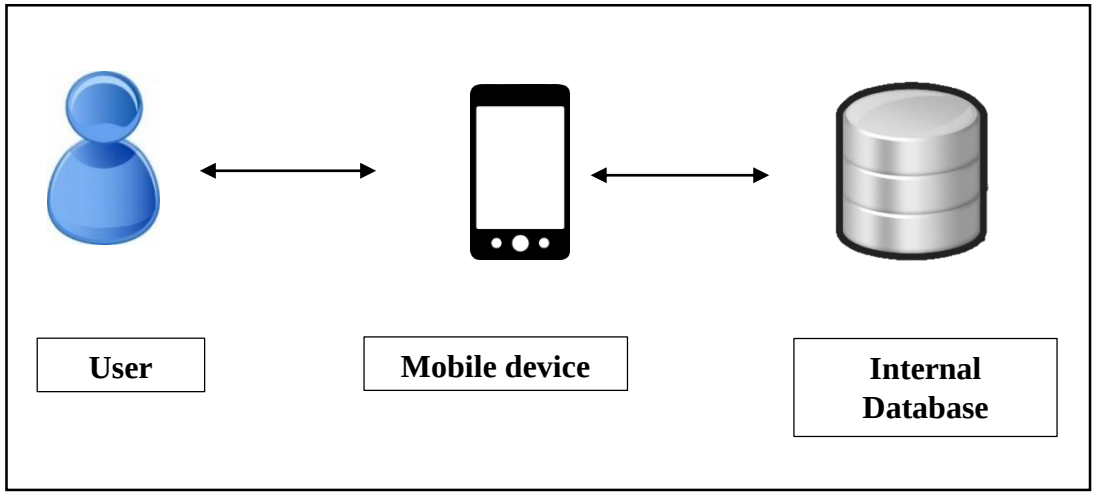

Figure 3.2 FIBC Autospecs system architecture

Figure 3.2 shows the system architecture of the proposed system. There are 3 components in the architecture, which are the user, mobile device and internal database. The user acts as the input provider for the system. The user will enter some inputs required for the system to calculate and perform its proposed functions. The mobile device is the platform for the system to function. For this particular research, the mobile device is an Android-based device. The mobile device will provide the interface for the user to interact with the application. The device is mobile so that the application can be accessed at anywhere as the software does not need internet connection to operate. The internal database will store the data for the specification and pricing of the FIBC bulk bag. The database is separated from the application, therefore any updates on the pricing will only affect the database, not the application itself, which result in a smaller size of update patch.

3.5 Use case diagram

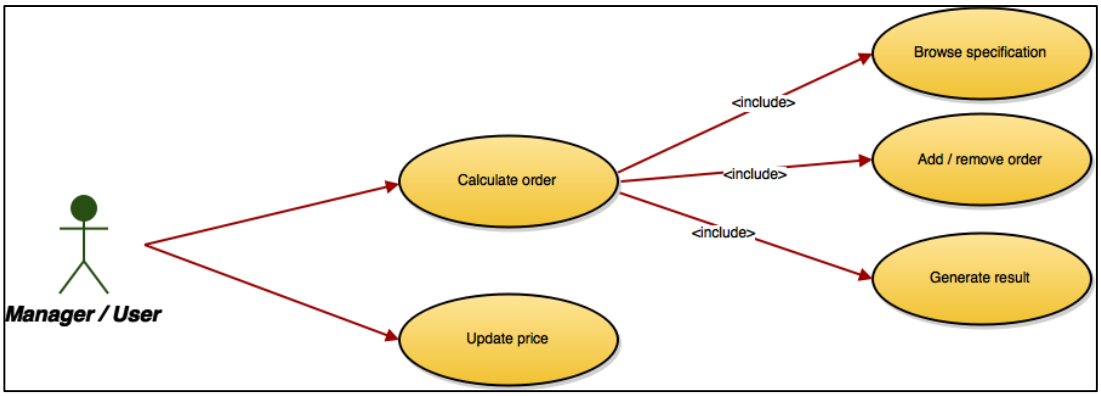

Figure 3.3 Use case diagram for FIBC Autospecs

Figure 3 shows the use case diagram for FIBC Autospecs. Only one actor will be interacting with the application which is the manager or user. This system has two main use cases which are calculate order and update prices. From Calculate Order use case, the user then can browse specifications of FIBC, add or remove order from list and then generate final result of calculation. The user can also update the raw material price under the Update Price use case.

3.6 Activity diagram

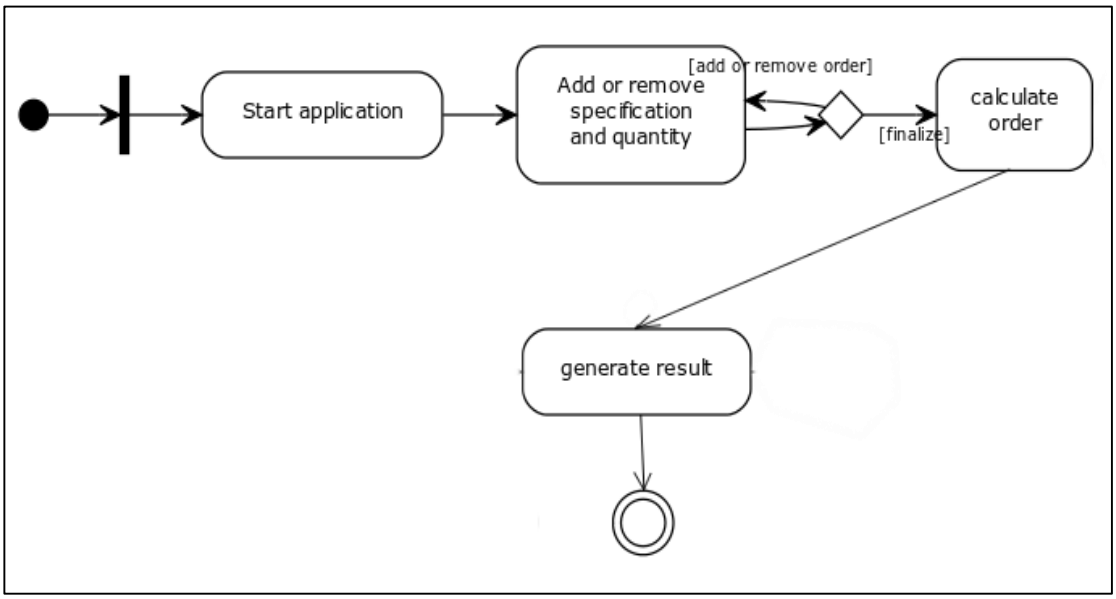

Figure 3.4 Activity diagram for Calculate Order use case

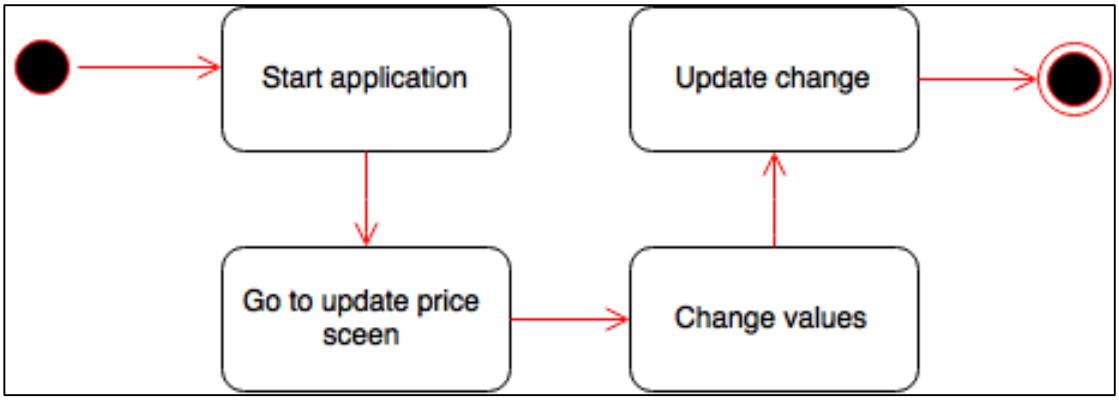

Figure 3.5 Activity diagram for Update Price use case

Figure 3.4 shows the activity diagram for the Calculate Order use case. Firstly, the application will be opened on the mobile device. The user then will choose to add specification and quantity to be calculated. The user then may choose to add more specifications to the list before finalizing the lists. Once the list is finalized, the system will then calculate the material and cost needed for each specification and the total sum. From this output, the user would then have a benchmark value on how to price the containers and how much materials to be available in the inventory based on the projected cost and material.

Figure 3.5 shows the Update Price activity diagram. The user will start the application, then click a button to navigate to the Update Price screen. Next, the user may change any desired values in their respective text field. Once all values changed, the user need to click on Update Changes button to store the latest values to be used in the calculations.

3.7 Database design

Specification
spec_name
fabric80lamin_used
fabric72lamin_used
fabric45lamin_used
fabric40lamin_used
fabric72_used
fabric48_used
fabric58_used
ribbon20mm_used
fabric80_used
pocket_used
rope8mm_used
protector_used
liner_used
yarn_used
webbing100mm_used
webbing80mm_used
webbing50mm_used
label_used

Figure 3.6 Database for specification

Material
fabric72_nl_metre
fabric72_lamin_metre
lightduty48_metre
ribbon_20mm
webbing_50mm
webbing_80mm
webbing_100mm
rope
liner
label
yarn_2ply
pocket_8
pocket_14
fabric_nl_inch
fabric_lamin_inch
lightduty_inch
protector

Figure 3.7 Database for component price

Figure 3.6 and Figure 3.7 shows the design of the database for the application. The database consisted of 2 categories, which are the specification and material. The specification database is used to store detailed values of component used. Meanwhile, the material database is used to store the price of each component. These two inputs will result in the cost of manufacturing a unit of container for a particular specification. The purpose of segmenting the variables into different database is to be able to make changes to the values of the variables without disrupting the coding of the application itself. This method is also used to ensure information that are confidential is secure by separating the variables from the application.

3.7 Gantt Chart and milestones

Project stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.0 Project proposal														
1.1 Literature review matrix		M												
2.0 Requirement planning														
2.1 Prepare questionnaire														
2.2 Conduct interview														
2.3 Produce functional requirements for system						M								
3.0 User design and construction														
3.1 Create UML diagrams								M						
3.2 Build the application (coding, bug fixing)														

Project stage	15	16	17	18	19	20	21	22	23	24	25	26
3.0 User design and construction												
3.1 Create UML diagrams												
3.2 Build the application (coding, bug fixing)		M			M			M				
4.0 Cut over												
4.1 Testing of application										M		
4.2 Releasing final version and implementation												M

M = Milestone / Key deliverable

CHAPTER 4

RESULT AND DISCUSSION

4.0 Result and discussion

4.1 Summary of phone interview

The data collection is done using the phone interview method because of time and distance constraint. The following section summarizes the interview session with the respondent.

The respondent is asked with several questions pertaining to their experience with Android application, use of smart phones and their business operation (refer to Appendix). It is reported that the sample respondent relies on Android smartphone every day in their working life to communicate through messaging application, to surf the social media and make phone calls. The respondent working area is mostly outside of the office, therefore mobility and immediate response is really important. It is concluded that the respondent is familiar with Android devices.

The respondent is then asked about their company operation. Their company is a manufacturer of FIBC container for use in various kind of environment. Based on their sales in 2014, it is reported that the company receives an average of 15,000 order of containers from different companies per month. Therefore, the employees will have to calculate how much materials and cost needed that month for manufacturing operation. With the result of the calculation, the company then will have to plan on how to procure the supplies, arrange their workforce and produce the purchase orders and invoices. The calculation is currently done manually on the spreadsheet software, therefore it is tedious to ensure that the calculation is precise to make their planning successful.

The respondent also mentioned that having an application in their mobile phone to aid their calculation is mostly recommended because of their working style. The employee

would need to meet with clients frequently to discuss about the pricing and change of orders, therefore having an application to generate the calculation result on the spot is very helpful to the clients.

These are the obtained core functionalities requirement of the FIBC Autospecs:

No	Requirements
FA-01	Produces these outputs after calculating all specification: - Amount of material needed - Material cost (RM) - Total cost (RM)
FA-02	Contains these company specifications: - BASF - BP Amoco - Etilinas 1.2MT - Etilinas (Local White) - Kaneka 1.0 - KMC Scomi - Lynas A1 - Lynas B1 - Lynas C - Lynas D - PFK - Tioxide - Toray
FA-03	Orders can be add/remove
FA-04	Refresh button must reset all inputs, textboxes, variables
FA-05	Price of material can be changed frequently without disrupting the application coding

4.2 System interface

The system interface and functions was developed using HTML, Javascript and CSS and then converted into Android package using Adobe PhoneGap. Figure 4 shows the interface screen shots of the application from an android device.

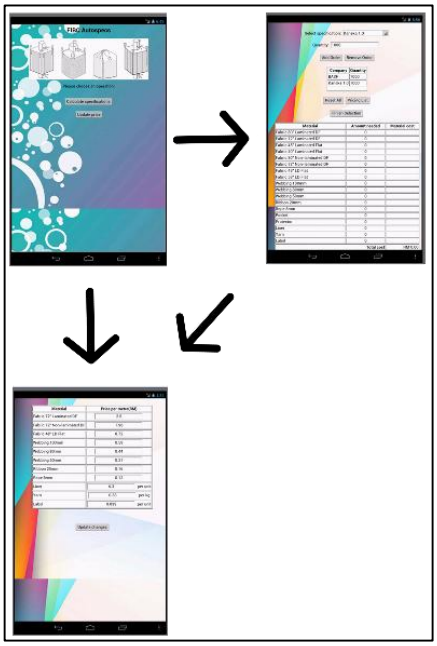

Figure 4.1 FIBC Autospecs Interface Screenshots

When starting the application, the user will be navigated to the home screen. From there, the user then can select either Calculate Order or Update Price. In the Calculate Order screen, the user can start filling all the required inputs such as specification type and quantity. Many specification can be added to the list but with a maximum of 11 orders. Once the user finished entering the desired items, the application will calculate the cost and amount of materials needed for producing all of the items. The users can also go to the Update Price screen by pressing the Pricing List button without going back to the home screen.

The Update Price screen enables user to view the current raw material prices and make changes as needed. The users may type in new prices in respective text field and press Update Changes to store the new prices in the local storage. Then, the new values will

be retained permanently and used in the next calculation until the prices are changed again.

4.3 System testing

System testing is divided into two parts, which are the developer testing and user testing. The application needs to be tested to match the system requirements stated in the by the sample during the requirement planning stage. Below is the two parts involved:

(a) Developer Testing

The developer needs to test the application that deals with each type of specification. Each specification is tested as input for the application to calculate. The result must be displayed to dictate that the functions are working properly. The developer also need to test the updating function so the price changes made will be retained and used by the application. The application interface is also tested so that it can be view on different Android devices in terms of size and capability.

(b) User Testing

The most completed version of the application had been released and installed on the sample's device, which is the factory manager of an FIBC manufacturing company. The testing was conducted occasionally through face to face and phone interview. The sample must test the application in terms of the accuracy of the price calculation. Each specification is calculated and then the final result is compared to the sample's price benchmark and experience. The sample also need to test the application interface, whether it conforms their preference or not.

<u>Accuracy of system</u>

The system calculation result is found to be acceptable and matches well with the document from the sample company. The amount of materials and cost generated was within their benchmark range and can be rely on. All 13 specification was tested and the result was satisfying and fit with their reference document and experience.

System interface

The sample commented on the system interface during the interview session. It is mentioned that the interface was simple and neat. The number of screen is low, therefore making it easier to navigate through. It is also said that improvements to the interface is encouraged, but keep the simplicity elements.

CHAPTER 5
CONCLUSION AND FUTURE RECOMMENDATION

5.0 Conclusion

FIBC Autospecs is an application that will aid manufacturers of FIBC to calculate the cost and materials needed to manufacture the FIBCs. With the application available in the mobile platform, the users would be able to work better even when working outside of the office. Users would rely less on the office computers or spreadsheet software to access the specifications which is immobile. It is also beneficial to have the application on mobile platform as the employees are working using their smart phones on daily basis as discussed in Chapter 4.

5.1 Future Recommendation

Improvement is a must to keep the application relevant to the business environment. The application may still be improved to suit the users and to accommodate with any future changes in the specifications and pricing calculations. These are the functions that could be implemented in the application by future developers:

- Generate PDF file, add print functions to wireless printer
- Orders can be saved in the database, connect the application with database set up in the office/cloud

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Appendices

Appendix 1

Interview questions:

1. **What does your company business is all about?**
   We are the manufacturer of FIBC bags used in the industries for storage and transportation in land and offshores. Our products are long-lasting, able to withstand extreme weather and cost effective for mass production.

2. **How much FIBC orders do your company received monthly?**
   According to our last year sale (2014), we reached about 15,000 orders average per month. 20,000 orders was the highest recorded.

3. **Do you own a smart phone? What type of smart phone?**
   Yes, I do have a Samsung S2 phone.

4. **What purposes do you use smart phone for?**
   I mainly use the smart phones for communicating through messaging and phone calls. We also have a WhatsApp group for all of our employees. I also use them for Facebook.

5. **How do you calculate the cost needed and materials to be in supply to produce for that particular month?**
   We calculated everything in our UBS System and Excel spreadsheets for the orders and materials details on our office computers. The prices frequently changes from month to month, but we have our benchmark or range of prices so that we can estimate better on our sales price.

6. **Would you like a mobile phone application installed in your smart hone that can help you to do the calculations?**
   Yes, this is very much recommended as I am always working outside of the office meeting clients, therefore I need a tool to help me to get the pricing

results on the spot without having to respond later to the clients. This is beneficial for our company and our clients.

Appendix 2

Specification of FIBC bag example:

SUJPLAS SDN BHD

PRODUCT SPECIFICATION

TITLE: SPEC BAG TIOXIDE

PS NO:	QA-PS-BAG-015
REVISION	0
DATE	18/10/2004
PAGE	1 OF 3

Type	Material	Size	Colour	Laminat	Cut Size		Remark
					Widht	Length	
Body	PP(H/D)	36" X 36" X 1200MM	White	No	72"DF	51"	
Top Spout	PP(L/D)	Circum.56" X 23"	White	Yes	25"	59"	Lipatan luar
Ribbon Top Spout	PP	20MM X 1200MM	Other	No	20MM	1200MM	
Top Panel	PP(H/D)	36" X 36"	White	No	40"	40"	
Webbing	PP	80MM X 39"	Beige	No	80MM	39"	Marking Webbing 10"
Loop		9.5" (Double)					Double
Patching	PP(H/D)	5" X 11"	White	No	5"	11"	8pcs
Perimeter	PP	50MM X 144"	White	No	50MM	152"	
Pocket	PE	5" X 7"	Trans.				
Label		Sujplas					
Logo		No printing					
Bottom Panel	PP(H/D)	36" X 36"	White	Yes	40"	40"	Starcut
Bottom Spout	PP(L/D)	Circum.60" X 21"	White	Yes	23"	63"	Lipatan luar
Ribbon Bottom Spout	PP	20MM X 1200MM	White				
Bottom Rope		8MM X 1800MM	White		8MM	1800MM	
Liner	PE	No					
Yarn		2PLY					

REMARK	PREPARED BY	REVIEWED BY	APPROVED BY
	MUHAIZAR	SYUKRI	HAMKA