



## ENT 600

### BLUEPRINT



اوتورسيٲى تيكنولوٲى مارا  
UNIVERSITI  
TEKNOLOGI  
MARA

### DRONE X-RAY

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Semester : 10  
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Diagnose On Air



## Table of Contents

<b>CHAPTER 1</b> .....	5
<b>1.0 PRODUCT DESCRIPTION</b> .....	5
1.1 Introduction.....	5
1.2 Purpose of Development .....	5
1.3 Product Concept.....	6
1.4 Applications .....	6
1.4.1 Functions .....	6
1.5 Unique Features .....	7
1.5.1 Picture Descriptions .....	8
<b>CHAPTER 2</b> .....	10
<b>2.0 TECHNOLOGY DESCRIPTION</b> .....	10
2.1 Overview of Drone X-Ray .....	10
2.1.2 Blade / Propeller (B).....	11
2.1.3 Camera (C) .....	12
2.1.4 X-ray Tube (D) .....	12
2.2 Overview of Remote Control.....	13
2.2.1 Smartphones (A) .....	14
2.2.2 Touch Screen Control Panel (Mobile Apps) (B) .....	14
2.2.3 Movement Controller (C & D) .....	14
2.2.4 Exposure Button (E).....	15
2.2.5 Exposure Indicator (F).....	15
2.3 Overview of Receptor Plate / Image Receptor .....	16
2.3.1 Digital Image receptor/ receptor plate (A) .....	16
<b>CHAPTER 3</b> .....	17
<b>3.0 MARKET RESEARCH AND ANALYSIS</b> .....	17



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3.1 Target Market .....	17
3.2 Market Size and Market Share .....	17
3.3 Competition and Competitive Edges.....	17
3.4 Estimation Cost per Unit .....	18
3.5 Selling Price.....	18
3.6 Marketing Strategies.....	19
3.6.1 Product.....	19
3.6.2 Price.....	19
3.6.3 Place / Distribution .....	19
3.6.4 Promotion.....	19
<b>CHAPTER 4.....</b>	<b>20</b>
<b>4.0 FINANCIAL PLAN .....</b>	<b>20</b>
4.1 Start-Up Cost.....	20
4.2 Working Capital (4 months) .....	21
4.3 Cost of Component per Prototype.....	22
<b>CHAPTER 5.....</b>	<b>23</b>
<b>5.0 MANAGEMENT TEAM .....</b>	<b>23</b>
5.1 Team Members .....	23
5.2 Position and Duties.....	24
1. Accomplishes business development activities by researching and developing marketing opportunities and sales plans.....	27
5.3 Management Compensation and Ownership .....	29
<b>CHAPTER 6.....</b>	<b>30</b>
<b>6.0 PROJECT MILESTONES .....</b>	<b>30</b>
6.1 Flow chart Project Design Planning .....	30
6.2 Project Schedule .....	32
<b>CHAPTER 7.....</b>	<b>33</b>
<b>7.0 CONCLUSION .....</b>	<b>33</b>

Company's Logo



Grab Tech Sdn.Bhd.

Product Label/ Product Name





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## CHAPTER 1

### 1.0 PRODUCT DESCRIPTION

#### 1.1 Introduction

X-Ray examinations are widely used in health sectors as a tool to help doctors to diagnose a disease. Due to the importance of x-ray examination and high demand towards the patients, x-ray machine should be flexible to ease the radiographer to perform the best radiograph. The current mobile x-ray machine is heavy and bulky to handle and sometimes can injure the radiographer due to non-ergonomic posture when handling the x-ray machine. *This product is suitable in preventing radiographers exposed to possible injury and unsafe environment.*

#### 1.2 Purpose of Development

- To reduce the possible injuries among radiographers due to handling a heavy and bulky machine which can cause non-ergonomic posture while handling a mobile x-ray.
- Space saving due to the compact size of the machine.
- To avoid difficulties to move around the wards and emergency department which are equipped with other trolleys and machines.
- To avoid possible cross-infection between radiographers and high-risk patients such as MERS-CoV, Tuberculosis, HIV and many more.
- To keep a safe distance between radiographers and high risk / hazardous patients.
- Time-saving as radiographers does not need to push heavy mobile x-ray which is difficult to handle.



## **1.3 Product Concept**

- First mini x-ray with flying capability which is based on drone concept.
- The product is operated using a remote control which is attached to a smartphone.
- Directly expose the radiation by pressing the exposure button on the controller.
- Equipped with high-resolution camera.

## **1.4 Applications**

This product is really helpful in the health sectors. By flying this device to the isolation ward, radiographers can save energy and time rather than handling the heavy and bulky x-ray machine. Radiographer also can keep a safe distance between radiographer and patients and at the same time prevent from getting an infection that may harm the radiographers.

### **1.4.1 Functions**

- Heavy duty drone with powerful a blade – to carry an x-ray tube.
- High-resolution camera – to monitor patients at any pathway of the drone.
- X-ray apps in smartphones – to control the exposure factors and to adjust the collimation beam.
- Remote control – to control a drone movement, position the x-ray tube towards patients and exposed an x-ray.
- Lightweight digital image receptor – once the patient had been exposed, the image obtained by the receptor will be directly reviewed in the smartphone.



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## 1.5 Unique Features

- Heavy duty drone - allow to carry x-ray tube.
- Powerful blade - allow the device to fly with the x-ray tube.
- Lightweight x-ray tube with carbon nanotube technology.
- Remote control with smartphones attached.
- Hi-tech built-in apps in smartphones- to control the x-ray exposure.
- High-resolution camera- to monitor the patients and include night view to allow device travel at night.
- GPS receivers - allows for some smart GPS drone navigation features that include position hold which maintains the position at a fixed altitude and location. Also allows controlling the drone within 1 km distance.

### 1.5.1 Picture Descriptions



Front View



Back View





Bottom View

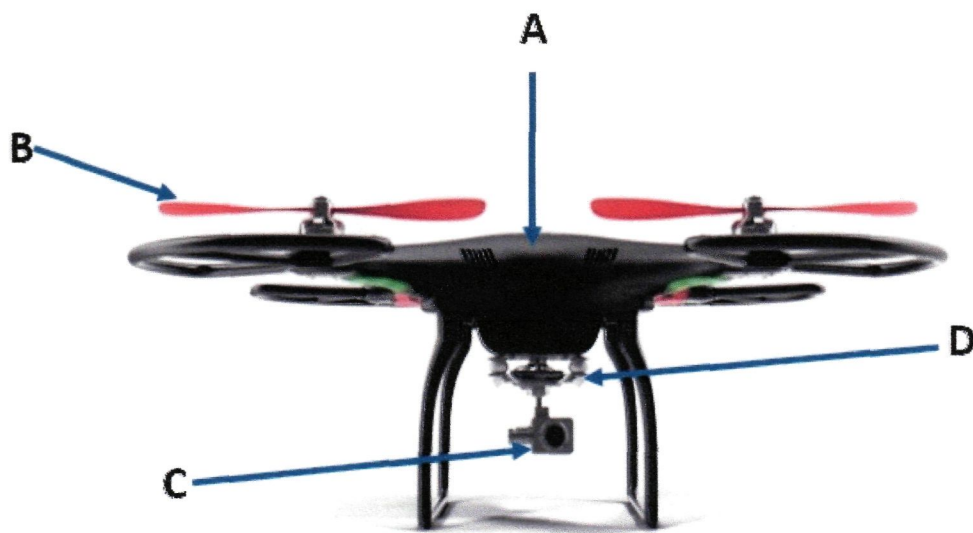


Side View

## CHAPTER 2

### 2.0 TECHNOLOGY DESCRIPTION

#### 2.1 Overview of Drone X-Ray



LABEL	DEVICE
A	Body of drone
B	Powerful blade/ propeller
C	High resolution camera
D	Mini X-ray tube

Size: 50cm (length) x 50cm (width) x 20cm (height)

Weight: 3.8kg



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### 2.1.1 Body of Drone (A)

#### Description

Body of the drone is made of high quality of material to support the part that assembles to the drone.

#### Specification

- Material: high grade carbon fiber- 30% fiber charged nylon plastic parts.
- Foam to isolate the internal center from the engine vibrations.
- Size: 50cm (length) x 50cm (width) x 30cm (height).
- Water resistant.

*T. Lypolier?*

### 2.1.2 Blade / Propeller (B)

#### Description

Propeller for this drone must be powerful enough to fly the drone that carries the x-ray tube which needs stability while flying.

#### Specification

- Material: tempered steel propeller shaft.
- Self-lubricating bronze bearing.
- Size: 13cm x 13cm (includes space for propeller).



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### 2.1.3 Camera (C)

#### **Description**

The camera is important to guide the radiographer at the pathway of the drone to the ward or desired destination. It is also used to monitor the patient's position before performing the x-ray examination.

#### **Specification**

- High resolution
- HD camera
- Wide angle lens: 92° diagonal
- H264 encoding base profile
- Night view
- Size : 6cm x 6cm

### 2.1.4 X-ray Tube (D)

#### **Description**

The x-ray tube is the main part to perform an x-ray examination. The tube must be lightweight, so that, it can travel with the drone.

#### **Specification**

- Size: 20cm (length) x 10cm (width)
- Weight: 2.5kg
- Material: carbon nanotubes (makes the tube more lightweight)
- Maximum tube voltage: 120kV
- Maximum tube current: 100mA
- X-ray tube focal spot: 0.7mm

## 2.2 Overview of Remote Control



LABEL	DESCRIPTION
A	Smartphones
B	Touchscreen control panel (mobile apps)
C	Front / Reverse
D	Right / Left
E	Exposure Button
F	X –ray exposure indicator

Size: 25cm (length) x 15cm (height)

Weight: 450g



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### 2.2.1 Smartphones (A)

#### Description

Smartphone is used as a monitor and control panel of a drone.

#### Specification

- Same as usual smartphones at current market

### 2.2.2 Touch Screen Control Panel (Mobile Apps) (B)

#### Description

The control panel allows the radiographer to adjust the exposure factor, collimation beam and other settings needed.

#### Specification

- License: one-time purchase
- Touch screen adjustment
- HD screen

### 2.2.3 Movement Controller (C & D)

#### Description

- Movement controller that allows the drone to move or fly anywhere.
- Fly up to 1km distance
- C is to move forward and reverse
- D is to move to the right or left.



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## **2.2.4 Exposure Button (E)**

### **Description**

Exposure button is functioning as a switch/ button that allows radiation being exposed.

### **Specification**

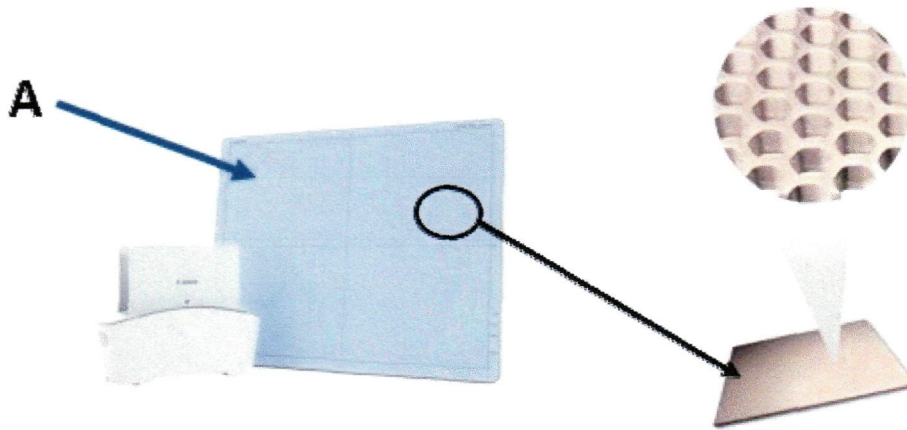
- Size : 5cm x 2cm
- Material : plastic fiber

## **2.2.5 Exposure Indicator (F)**

### **Description**

It is functioning as an indicator when radiation is exposed. Once radiation is exposed, the indicator light will be on.

## 2.3 Overview of Receptor Plate / Image Receptor



LABEL	DESCRIPTION
A	Image receptor/ receptor plate

### 2.3.1 Digital Image receptor/ receptor plate (A)

#### Description

The digital image receptor is a plate that will record all the x-ray detail after being exposed by the x-ray. The image will directly be reviewed on the smartphone. The plate is reusable. Thus, radiographers do not need to bring a number of cassettes according to the number of patients that need to be x-ray.

#### Specification

- Material: fused fiber optic faceplate for lightweight plate.
- Wireless connection to the x-ray tube.
- Size: 43cm (length) x 36cm (width) x 3cm (thickness).
- Weight: 1.5kg.





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## CHAPTER 3

### 3.0 MARKET RESEARCH AND ANALYSIS

#### 3.1 Target Market

Target markets for drone x-ray are for government and private hospitals in Malaysia.

#### 3.2 Market Size and Market Share

- More than 90 government hospitals provide mobile x-ray services.
- More than 120 non-government hospitals or private hospitals provide mobile x-ray services.
- Total of 210 hospitals in Malaysia. Estimated about 5 units will be bought either in government or private hospitals.
- Estimated of hospitals buying this machine (3%) =5 units

From the number of hospitals that are buying, the estimate sales forecast

=5 units x RM 60, 342.72

=RM 30, 1713.60

#### 3.3 Competition and Competitive Edges

There is no competition because there is no drone x-ray available in the market either in Malaysia or any country in the world. This is the first high technology and lightest weight of x-ray mobile in the market. However, conventional mobile x-ray can be considered as the nearest competitor.



### 3.4 Estimation Cost per Unit

Components	RM/unit	UNITS	RM
X-ray Tube	5323.00	1	5,323.00
Drone unit with remote control	3157.00	1	3,157.00
Smartphone	2300.00	1	2,300.00
Image plate detector	3000.00	3	9,000.00
Software license	5000.00	1	5,000.00
<b>Total Cost</b>			<b>24,780.00</b>

### 3.5 Selling Price

- Cost to produce product = RM24,780
- Estimated selling price
  - =RM 24,780.00 + (RM 24,780.00 x 0.5)
  - =RM 37,170



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## **3.6 Marketing Strategies**

### **3.6.1 Product**

- The first flying mobile x-ray introduced to the world.
- It so lightweight and help to maintain an ergonomic posture of the radiographer. Radiographer does not need to push heavy weight mobile x-ray.
- It comes together with a lightweight digital image receptor to record the image once the patient is exposed. This image receptor is reusable.

### **3.6.2 Price**

- The price is very affordable compared to the other mobile x-ray.

### **3.6.3 Place / Distribution**

- This drone x-ray can be used in all hospitals that provide mobile x-ray.
- This product is targeted to provide mobile x-ray in the isolation room. Compared to conventional mobile x-ray, drone x-ray can be performing with lesser time contact with the patient. It also can keep a safe distance between the radiographers and the patients.

### **3.6.4 Promotion**

- To promote this product, we will provide a talk about this product directly to the hospitals that provide mobile x-ray. Besides, we will provide flyers to promote this product.
- We target to join any exhibition that related to medical equipment.



## CHAPTER 4

### 4.0 FINANCIAL PLAN

#### 4.1 Start-Up Cost

ONE TIME START-UP COSTS	RM
Business fixtures and equipment	1,500
Machineries/Equipment	2,000
Basic Renovation	5,000
Legal and professional fees	500
Licenses and permit	200
Insurance	500
Contingencies (4%)	388
<b>A. Total one-time start-up costs</b>	<b>RM 10,088</b>



## 4.2 Working Capital (4 months)

4 MONTHS EXPENSES	RM
Salaries and wages (5 Person) RM 2500 x 5	12,500
Rent	1,000
Utilities	1,000
Office supplies	500
Marketing	1,000
Miscellaneous	1,000
a. Total monthly working capital required	17,000
A. Total 4 months expenses (ax4)	RM 85,000

### 4.3 Cost of Component per Prototype

Components	RM/unit	UNITS	RM
X-ray Tube	5323.00	1	5,323.00
Drone unit with remote control	3157.00	1	3,157.00
Smartphone	2300.00	1	2,300.00
Image plate detector	3000.00	3	9,000.00
software license	5000.00	1	5,000.00
<b>Total Cost Per Prototype</b>			<b>24,780.00</b>
<b>C. Total Cost of Prototype x 5 Quantity</b>			<b>RM 123,900.00</b>

$$\begin{aligned}
 \text{Total Cost (4 Months)} &= \text{Total Cost A} + \text{Total Cost B} + \text{Total Cost C} \\
 &= \text{RM } 10,088 + \text{RM } 85,000 + \text{RM } 123,900 \\
 &= \underline{\underline{\text{RM } 218,988.00}}
 \end{aligned}$$

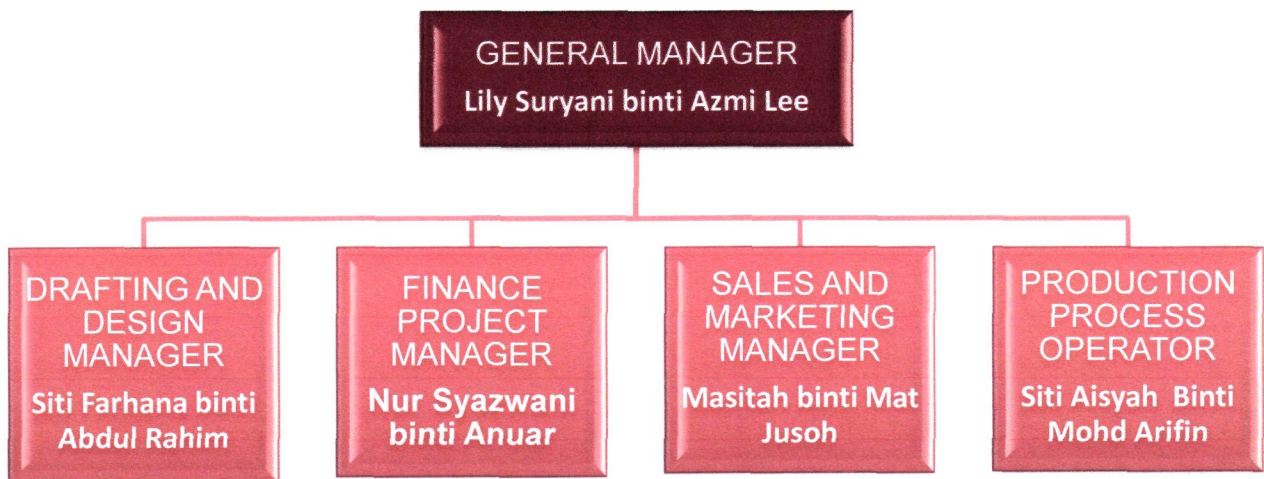
We are not able to bear all the cost. So that, Angel financing is an important sources in contribution in our capital.




## CHAPTER 5

### 5.0 MANAGEMENT TEAM


#### 5.1 Organization Chart



## 5.2 Position and Duties

Name / Position	Area of expertise/Responsibility
<p><b>General Manager</b></p>  <p>Lily Suryani binti Azmi Lee</p>	<p><b>EXPERTISE</b></p> <ul style="list-style-type: none"> <li>• Bachelor of Medical Imaging (Hons).</li> <li>• 12 years' experience as radiographer.</li> <li>• Has a forward planning and strategic thinking.</li> <li>• Good in solving problem and making decision.</li> <li>• Great communication and organization skills.</li> </ul> <p><b>RESPONSIBILITIES</b></p> <ol style="list-style-type: none"> <li>1. Administrative employees for the recruitment.</li> <li>2. Oversee daily operations of the business.</li> <li>3. Directing and delegating tasks such as accounting, paperwork and payroll.</li> <li>4. Ensure the creation and implementation of a strategy designed to grow the business.</li> <li>5. Coordinate the development of key performance goals for functions and direct reports.</li> <li>6. Provide direct management of key functional managers and executives in the business unit.</li> <li>7. Ensure the development of tactical programs to pursue targeted goals and objectives.</li> <li>8. Ensure overall delivery and quality of the units' offerings to the customers.</li> <li>9. Engage in key or targeted customer activities.</li> <li>10. Evaluate and decide upon key investments in equipment, infrastructure, and talent.</li> <li>11. Communicate strategy and results to the unit's employees.</li> </ol>



<p>Drafting and Design Engineer</p> 	<p><b>EXPERTISE</b></p> <ul style="list-style-type: none"> <li>• Bachelor of Medical Imaging (Hons).</li> <li>• 11 years' experience as radiographer.</li> <li>• Has a great creativity and able to think new ideas.</li> <li>• Has a great skills in computers.</li> <li>• Has excellent communication skills and technical writing.</li> </ul> <p><b>RESPONSIBILITIES</b></p> <ul style="list-style-type: none"> <li>• Taking a raw idea and turning it into a functional blueprint is the crux of the job.</li> <li>• Have great skills in computers since almost all of the work is now done using CAD programs.</li> <li>• Help with construction by creating plans and technical drawings of everything from architecture to mechanical instruments.</li> <li>• Drawings create guidelines, such as dimensions, calculations and weight restrictions, which workers use to plan and assemble products.</li> <li>• Able to use three dimensional (3D) modeling, perform construction estimating and work with specialized software.</li> <li>• Good communication skills to communicate with employees and the workers who will follow their designs.</li> <li>• Maintains quality design by enforcing the best quality design and resolving quality product.</li> </ul>
<p>Siti Farhana binti Abdul Rahim</p>	

Finance Project Manager



Nur Syazwani binti Anuar

**EXPERTISE**

- Bachelor of Medical Imaging (Hons).
- 7 years' experience as radiographer.
- Has a skilled thinking when making vitals decisions about the investments.
- Good people management and organizational skills.
- Has negotiation skills and able to influence others.

**RESPONSIBILITIES**

1. Interpreting financial information to managerial staff while recommending further courses of action.
2. Advising on investment activities and provide strategies that the company should take
3. Maintaining the financial health of the organization.
4. Provide financial reports and interpret financial information to managerial staff while recommending further courses of action.
5. Advise on investment activities and provide strategies that the company should take
6. Maintain the financial health of the organization.
7. Analyse costs, pricing, variable contributions, sales results and the company's actual performance compared to the business plans.
8. Conduct reviews and evaluations for cost-reduction opportunities.
9. Oversee operations of the finance department, set goals and objectives, and design a framework for these to be met.
10. Manage the preparation of the company's budget.
11. Be responsible for the efficient and timely preparation of the budget and regular financial reports ensuring that the agency operates within budget.

	<p>12. Develop and analyze financial reports to determine progress in achieving business objectives</p> <p>13. Plan and implement processes to improve efficiency and cost-effectiveness.</p>
<p>Sales and Marketing Manager</p>  <p>Masitah binti Mat Jusoh</p>	<p><b>EXPERTISE</b></p> <ul style="list-style-type: none"> <li>• Bachelor of Medical Imaging (Hons).</li> <li>• 11 years' experience as radiographer.</li> <li>• Has strong communication and motivation skills.</li> <li>• Has strategic planning abilities.</li> <li>• Able to remain calm under pressure.</li> </ul> <p><b>RESPONSIBILITIES</b></p> <ol style="list-style-type: none"> <li>1. Accomplishes business development activities by researching and developing marketing opportunities and sales plans.</li> <li>2. Develops and implements strategic marketing plans and sales plans and forecasts to achieve corporate objectives for products and services.</li> <li>3. Develops and manages sales/marketing operating budgets.</li> <li>4. Plans and oversees advertising and promotion activities including print, online, electronic media, and direct mail.</li> <li>5. Develops and recommends product positioning, packaging, and pricing strategy to produce the highest possible long-term market share.</li> <li>6. Achieves satisfactory profit/loss ratio and market share in relation to preset standards and industry and economic trends.</li> <li>7. Ensures effective control of marketing results, and takes corrective action to guarantee that achievement of marketing objectives falls within designated budgets.</li> </ol>

	<p>8. Oversees and evaluates market research and adjusts marketing strategy to meet changing market and competitive conditions.</p>
<p>Production Process Operator</p>  <p>Siti Aisyah Binti Mohd Arifin</p>	<p><b>EXPERTISE</b></p> <ul style="list-style-type: none"> <li>• Bachelor of Medical Imaging (Hons).</li> <li>• 6 year experience as radiographer.</li> <li>• Has great basic computer skills.</li> <li>• Has equipment troubleshooting abilities.</li> <li>• Good oral and written communication skills.</li> </ul> <p><b>RESPONSIBILITIES</b></p> <ol style="list-style-type: none"> <li>1. Provide oversight and direction in the operating unit in accordance with the organization's policies and procedures.</li> <li>2. Planning and organizing production schedules.</li> <li>3. Assessing project and resource requirements.</li> <li>4. Determining quality control standards.</li> <li>5. Overseeing production processes.</li> <li>6. Selecting, ordering and purchasing materials.</li> <li>7. Organizing the repair and routine maintenance of production equipment.</li> <li>8. Managed the operations to ensure it met all performance and financial objectives.</li> <li>9. Responsible for strategic planning for manufacturing operations, alignment of operating goals and integration of resources.</li> <li>10. Conduct continuous inspections of all key process points in the facility, to identify anything abnormal.</li> <li>11. Ensure that the products being produced under their supervision meet all specifications.</li> </ol>



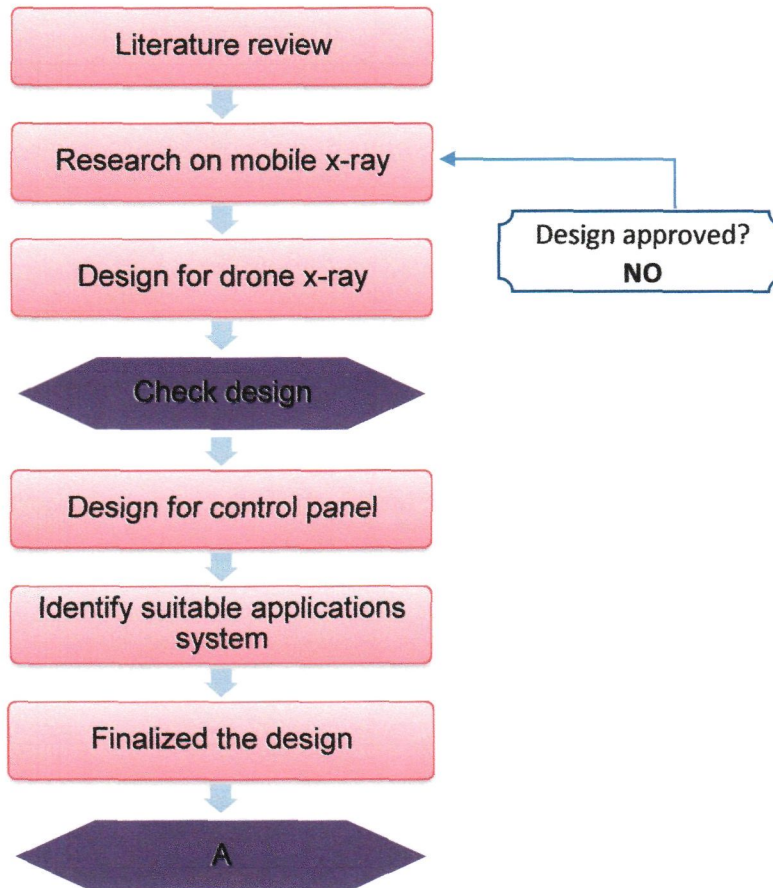
### 5.3 Management Compensation and Ownership

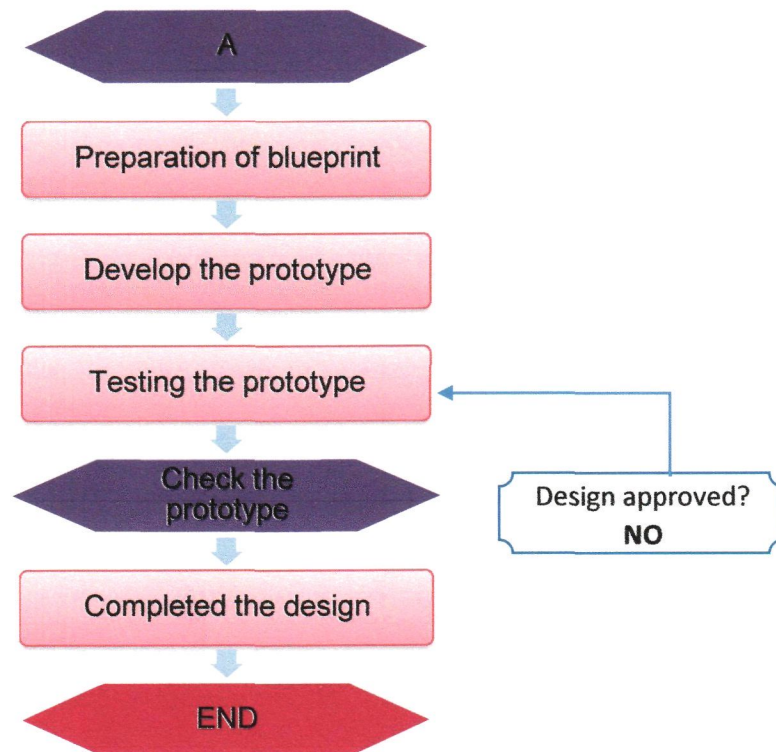
Names & Positions	Monthly salary
Drafting and Design Engineer	RM2,500
General Manager	RM2,500
Finance Project Manager	RM2,500
Production Process Operator	RM2,500
Sales and Marketing Manager	RM2,500

## CHAPTER 6

### 6.0 PROJECT MILESTONES

#### 6.1 Flow chart Project Design Planning







## 6.2 Project Schedule

Progress	Jan	Feb	Mac	April	Mei	Jun	July
Preparation of blueprint							
Application for fund							
Fund approval							
Ordering of material							
Completion of design and development							
Test of prototype							
Completion of prototype							
Documentation of prototype							
Starting of production							





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## CHAPTER 7

### 7.0 CONCLUSION

In conclusion, our company decided to proceed with this product after financial approval. This product should be applied with high technology. Thus, it needs more study and testing for fully functional and friendly useable. It supposedly uses high cost but has more benefits for the patient and radiographer. This product also improves the quality image with good safety levels among patient and staff.

This product will be made by our company. It also based on discussion and suggestion from our qualified manufacturing and biomechanical engineer. Therefore, our company decided to produce five units of drone x-ray for the first production.