POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

DEPARTMENT OF MECHANICAL ENGINEERING

REPORT OF FLY COLOUR DRONE

DJJ6143: PROJECT 2

JUN 2020

SUPERVISOR: PN.ISNURAINI BINTI KASSIM@ISMAIL

MEMBER	MATRIC NO
ZULHANIF BIN RUSLAN	08DMP18F1172
MUHAMMAD TAUFIK BIN AMIR HASSAN	08DKM18F1107

DECLARATION OF OWNERSHIP AND COPYRIGHT

TITLE: RESEARCH ON FLY COLOUR DRONE

SESSION: JUNE 2020

1. We, **1.ZULHANIF BIN RUSLAN (08DMP18F1172)**

2.MUHAMMAD TAUFIK BIN AMIR HASSAN (08DKM18F1107)

are the final year students of **Diploma in Mechanical Engineering , Department of Mechanical Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah**, located at **Persiaran Usahawan, 40150, Shah Alam, Selangor**. (After here will be referred to as 'the polytechnic').

2. We verify that **Fly Colour Drone** and its intellectual properties are our original work without plagiarism from any other sources. With application that have been approved with application no LY2020004880

3. We agree to release the project's intellectual properties to the above said polytechnic in order to fulfill the requirement of being awarded **Diploma in Mechanical Engineering**.

Prepared by,

1. ZULHANIF BIN RUSLAN
   (001227-10-0087)

   .....
2. MUHAMMAD TAUFIK BIN AMIR HASSAN
   (000815-12-0813)

   .....

In the presence of, Puan ISNURAINI BINTI ISMAIL@KASSIM as the project supervisor on 27 DECEMBER 2020

.....

ABSTRACT

A drone can be control at long distance using controller. The drone is used for missions that are too dangerous for humans to do the jobs or it can make the jobs become easier. Drone used for various such as scientific, agricultural, aerial photography, surveillance and others.

Nowadays, development is very rapid as is the work involved in high places. Many solutions to solve problems that humans are unable to do the work. By using the drone to do the jobs reach safely will be a solution and an efficient.

This study will focus on developing and design the drone with a painting capability which we attach on the drone to the work for painting jobs. The Fly Colour Drone is divided into drone thrust and painting mechanism. The drone is designed with six motors with 2kg thrust capability.

Hexacopter motor proposed to be used, with ability rotation up to 450kV and connect to painting mechanism attached with a 3D design plane. Spray gun that attaches with the drone will be supplied by using power supply from the ground.

The painting mechanism that attached to the drone are fully programming using arduino uno and the drone are manually controlled by human using flight controller PixRacer. The design process was aided by Inventor design computer software and load is calculated accordingly to the engineering requirement. This study is successfully designed, fabricated and tested in the actual field. As an improvement to achieve the next level is to program the drone to do the work on its own or known as autonomous without the need for a pilot to control the drone.

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CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

Demand in design a new technology and simple method to make an easy job especially at high places which at construction or any other place that human can't reach. There are several method that already design by a professional engineer. When it comes at combined all the technology are at the next level of finding a better solutions or better result.

Painting jobs at high places require a lot of equipment for a better work environment. By using ladder and scaffolding and so on. Drones are the fastest way and safety for painting jobs at places that can't be reach by a human.

Including drones in do paint jobs is one of the solutions to do the jobs as the spray gun is attach on the drone so people are no longer needed to reach at high place just control it manually or could be set as autonomous to the jobs.

1.2 PROBLEM STATEMENT

Problem statement Studies on Unmanned Aerial Vehicle (UAV) has been very active in recent decades, because of rapid advancement in design and flying technologies. This project aims at utilizing UAV as surveillance device for Colouring Contraction platform. We intend to develop a very small rotary UAV able to paint the wall at high contractions with safety by using UAV. As these platforms are situated at a rather remote area, the flight endurance for a UAV will be significance. One of the major drawbacks of quadrotor UAV is its high-energy consumption. The matter becomes worst during windy weather especially on the colouring contraction platform. To extend the operation time without increasing battery capacity, the aerodynamic performance of a drone becomes very important. The power consumption can be reduced by improving the designs of the UAV and its propeller to increase the overall thrust. Perform the following activities:

1. Most worker who do high-rise wall paint jobs are at high risk of falling.
2. The cost incurred for employees are high because of the work they do at high risk.
3. Required skilled and experienced staff to do the job.
4. It takes a long time to complete a high quality paint process.

1.3 OBJECTIVE

1. To design and develop a drone with paint capability.
2. To easer painting works at high building wall.

1.4 RESEARCH QUESTION

This study will answer the following research question:

1. Can this drone able to lift a painting mechanism stable while doing the painting work?
2. Can this drone do less energy consumption rather than using human energy?

1.5 SCOPE OF STUDY

1. Maximum payload should not exceed 5 kilogram.

Motor on our drone only can produce thrust around 6.6 kg and the thrust must be 50% more than the weight of the drone.

2. Drone usages are the building services and those are involved in painting jobs.

The drone is hard to control and use, so we limit the user to do a painting work at a certain high place only.

3. Used in a normal weather condition.

The drone can’t fly in bad weather conditions such as when during a heavy rain condition and also when there is strong winds. Bad weather condition make the drone damaged and wind is a well-known hazard because drones expend more electrical power while they fly into headwinds and can cause overheat-shortening their lifespan.

1.6 CHAPTER 1: SUMMARY

As conclusion, this problem that we face is something that we need to overcome with a new technology that can be used easily by the building services for painting jobs to get a better performance and less energy consumption. The objective for this project along with the importance of this project will allow to reduce a human energy by using a drone to do the paint jobs at high distance at can't be reach by a human even through there are many limitations. Further, this new design will be implemented as the long term use since it can be applied in any situation and condition.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

Building service painting has been involved throughout the decades. Technologies like drone (UAV) are used to help and solve a problem that happens in human daily life such as the painting jobs. In this era of globalization, various methods of simplify the paint jobs have been adopted. This has led to the need for design and develops a mechanism to make a painting jobs become more easer. Design a mechanism can be summarized as a method or a way to make it easier for painting jobs.

Design a mechanism that use for painting with air pump working that attaches on the lower part of the drone. The mechanism and the drone will be supplied with power that direct from the ground for a certain amount of time.

Drone painting will help to reduce the work force for human and enhance the performance to be more efficient, from a safety position, using controller UAV and the paint equipment that attaches direct to the drone for paint jobs at a higher position or places.

2.2 COMMERCIAL USES OF DRONE

Drone, in technological terms, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with on board sensor and GPS.

“Drones” can be classified on a different basis – say based on ‘usage‘ like Drones for Photography, Drones for aerial Mapping, Drones for Surveillance etc. However, the best classification of ‘Drones’ can be made on the basis of aerial platforms. Based on the type of aerial platform used, there are 4 major types of drones.

1) Multi Rotor Drones
2) Fixed Wing Drones
3) Single Rotor Helicopter
4) Fixed Wing Hybrid VTOL

Main areas of applications:

5) Search and rescue
6) Security
7) Inspections
8) Surveillance
9) Science & research
10) Aerial photography & video
11) Surveying & GIS (mapping)

1) Multi Rotor Drones

Multi Rotor drones are the most common types of drones which are used by professionals and hobbyists alike. They are used for most common applications like aerial photography, aerial video surveillance etc. Different types of products are available in this segment in the market – say multi-rotor drones for professional uses like aerial photography (whose price may range from RM2035.75 to RM12214.50) and there are lots of variants for hobby purposes like amateur drone racing, or leisure flying (price range from RM203.58 to RM1628.60). Out of all the 4 drone types (based on aerial platform), multi-rotor drones are the easiest to manufacture and they are the cheapest option available as well.

Figure 2.2.1

Multi-rotor drones can be further classified based on the number of rotors on the platform. They are Tricopter (3 rotors), Quadcopter (4 rotors), Hexacopter (6 rotors) and Octocopter (8 rotors). Out of these, Quadcopters are the most popular and widely used variant.

Although easy to manufacture and relatively cheap, multi-rotor drones have many downsides. The prominent ones being its limited flying time, limited endurance and speed. They are not suitable for large-scale projects like long distance aerial mapping or surveillance. The fundamental problem with the multicopters is they have to spend a huge portion of their energy (possibly from a battery source) just to fight gravity and stabilize themselves in the air. At present, most of the multi-rotor drones out there are capable of only a 20 to 30 minutes flying time (often with a minimal payload like a camera).

2) Fixed Wing Drones

Fixed Wing drones are entirely different in design and build to multi-rotor type drones. They use a ‘wing’ like the normal airplanes out there. Unlike multi-rotor drones, fixed wing type models never utilize energy to stay afloat on air (fixed wing types can’t stand still on the air) fighting gravity. Instead, they move forward on their set course or as set by the guide control (possibly a remote unit operated by a human) as long as their energy source permits.

Figure 2.2.2

Most fixed wing drones have an average flying time of a couple of hours. Gas engine powered drones can fly up to 16 hours or higher. Owing to their higher flying time and fuel efficiency, fixed wing drones are ideal for long distance operations (be it mapping or surveillance). But they cannot be used for aerial photography where the drone needs to be kept still on the air for a period of time.

The other downsides of fixed-wing drones are higher costs & skill training required in flying. It's not easy to put a fixed wing drone in the air. You either needs a 'runway' or a catapult launcher to set a fixed wing drone on its course in the air. A runway or a parachute or a net is again necessary to land them back in ground safely. On the other side, multi-rotor drones are cheap – anyone with a few hundred dollars to spare can buy a decent quadcopter. Flying a quadcopter doesn't require special training. You just take them to an open area and fly it. Guiding and controlling a quadcopter can be learned on the go.

3) Single Rotor Drones

Single rotor drones look very similar in design & structure to actual helicopters. Unlike a multi rotor drone, a single roter model has just one big sized rotor plus a small sized one on the tail of the drone to control its heading. Single rotor drones are much efficient than multi rotor versions. They have higher flying times and can even be powered by gas engines. In aerodynamics, the lower the count of rotors the lesser will be the spin of the object. And that's the big reason why quadcopters are more stable than octocopters. In that sense, single rotor drones are much efficient than multi-rotor drones.

Figure 2.2.3

However, these machines come with much higher complexity and operational risks. Their costs are also on the higher side. The large sized rotor blades often pose a risk (fatal injuries have been recorded from rc copter accidents) if the drone is mishandled or involves in an accident. Multi-rotor drones, often owing to their small rotor blades have never been involved in fatal accidents (though a scar on human body is likely). They also demand special training to fly them on air properly (though they may not need a runway or a catapult launcher to put them on air).

4) Hybrid VTOL

These are hybrid versions combining the benefits of Fixed wing models (higher flying time) with that of rotor based models (hover). This concept has been tested from around 1960's without much success. However, with the advent of new generation sensors (gyros and accelerometers), this concept has got some new life and direction

Figure 2.2.4

Hybrid VTOL's are a play of automation and manual gliding. A vertical lift is used to lift the drone up into the air from the ground. Gyros and accelerometers work in automated mode (autopilot concept) to keep the drone stabilized in the air. Remote based (or even programmed) manual control is used to guide the drone on the desired course. There are some versions of this hybrid fixed wing models available in the market. However, the most popular one is drone used in Amazon commercials (for its Prime delivery service).

2.3 PAYLOAD DRONE

Payload is the weight of drone or knows as UAV which it can carry, including any attachment or any other equipment or device and excluding the weight of the drone itself. Weight is one of the critical or major problems in designing the drone. The more weight require more powerful motor and it will shorten the flight time due requirement of the drone. The propeller thrust required also increase as it need to double the total weight and payload if the drone. A drone payload capacity is determined by several factors; the motor power, the propeller size and number, the type of battery, and the weight of the frame.

The common payload attached to a drone is cameras, radars, sensors, GPS. The amount of payload must be decided before set up a drone, as it will greatly affect the performance of the drone. Hoppy drones are manufactured for sport, taking photography and having fun while professional drone are made to carry payloads and other things that they are design for. Average payload capacity for hoppy drones is 0.3 to 2 kg while for professional drones are 20 to 220 kg.

2.4 SPRAY PAINTING

Spray painting is painting technique where a device sprays a coating (paint, ink, varnish, etc.) through the air onto a surface. The most common types employ compressed gas usually air to atomize and direct the paint particles. Spray guns evolved from airbrushes, and the two are usually distinguished. Airbrushes are hand-held and used instead of a brush for detailed work such as photo retouching, painting nails or fine art. Air gun spraying uses equipment that is generally larger. It is typically used for covering large surfaces with an even coating of liquid. Spray guns can be either automated or hand-held and have interchangeable heads to allow for different spray patterns.

Figure 2.4.1

2.5 TYPE OF NOZZLE AND SPRAY

This process occurs when paint is applied to an object through the use of an air-pressurized spray gun. The air gun has a nozzle, paint basin, and air compressor. When the trigger is pressed the paint mixes with the compressed air stream and is released in a fine spray.

Due to a wide range of nozzle shapes and sizes, the consistency of the paint can be varied. The shape of the workpiece and the desired paint consistency and pattern are important factors when choosing a nozzle. The three most common nozzles are the full cone, hollow cone, and flat stream. There are two types of air-gun spraying processes. In a manual operation method the air-gun sprayer is held by a skilled operator, about 6 to 10 inches (15–25 cm) from the object, and moved back and forth over the surface, each stroke overlapping the previous to ensure a

continuous coat. In an automatic process the gun head is attached to a mounting block and delivers the stream of paint from that position. The object being painted is usually placed on rollers or a turntable to ensure overall equal coverage of all sides.

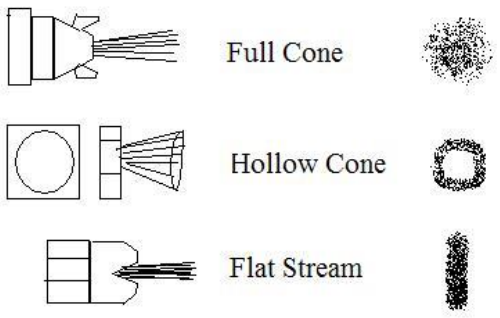


Figure 2.5.1

2.6 COMPRESSOR SPRAY GUNS WORK

The way an air compressor spray gun works will depend on the type of spray gun but will use similar principals. There are three main types of ways to feed a spray gun pressure, gravity, and suction. Each will use air injected into a coating to break it apart (atomize it) which is responsible for the quality of the finish achieve. The primary difference is how material is provided to the gun so that the air can be injected. For example a gravity gun uses a cup on top and when you pull the spray gun trigger the needle pulls back allowing the paint to flow due to gravity. Suction spray guns work by drawing a venturi over the paint drawing it through the fluid nozzle. Pressure fed spray guns use an external pot (pressure tank) which is pressurized forcing paint to the gun which air is then injected.

Figure 2.6.1 Compressor Water

2.7 CHAPTER 2: SUMMARY

As conclusion, this data and information allow us to choose the best way and method of making drone depends on the size, range and so on. Furthermore we also know the fastest method paint the wall or things that is paint with the help of the information about spray guns working system, type of nozzle and so on. Next technology such as drone paint capability is needed as there is high places which human can’t reach and at high construction which involve a paint work.

CHAPTER 3 METHODOLOGY

3.1 INTRODUCTION

At this chapter contain of activity for 15 weeks. It is represent by documentations of the work flow or process into Gantt chart and flow chart. The flow chart is used to analyse, documenting or managing process to make our project. As for Gantt chart, we can find out all of our progress and also when the activity is has done from it.

3.2 DESCRIPTION OF METHODOLOGY

The project is carried out in four stages (method) as follows:

Stage 1: Literature Review

This stage involves a literature review on the current status of drone available in market as well as the method of painting wall or building. All previous report and research based on spray gun with compressor type will be studied.

Stage 2: Design Process

The design process is started with identifying the needs and demand, problem definition, customer requirements, product specification, concept generation, concept evaluation and preliminary design. The research is focused on develop a drone which is equipped with a spray gun that attach to the drone and can do the painting jobs with low energy consumption.

Stage 3: Product Development

After component and design has been identified, assembly process is started.

Stage 4: Evaluation

Complete prototype will be tested and the performance will be evaluated .If fail modification and repair will be help and the test will be repeated until reach the project target

3.3 FLOW CHART

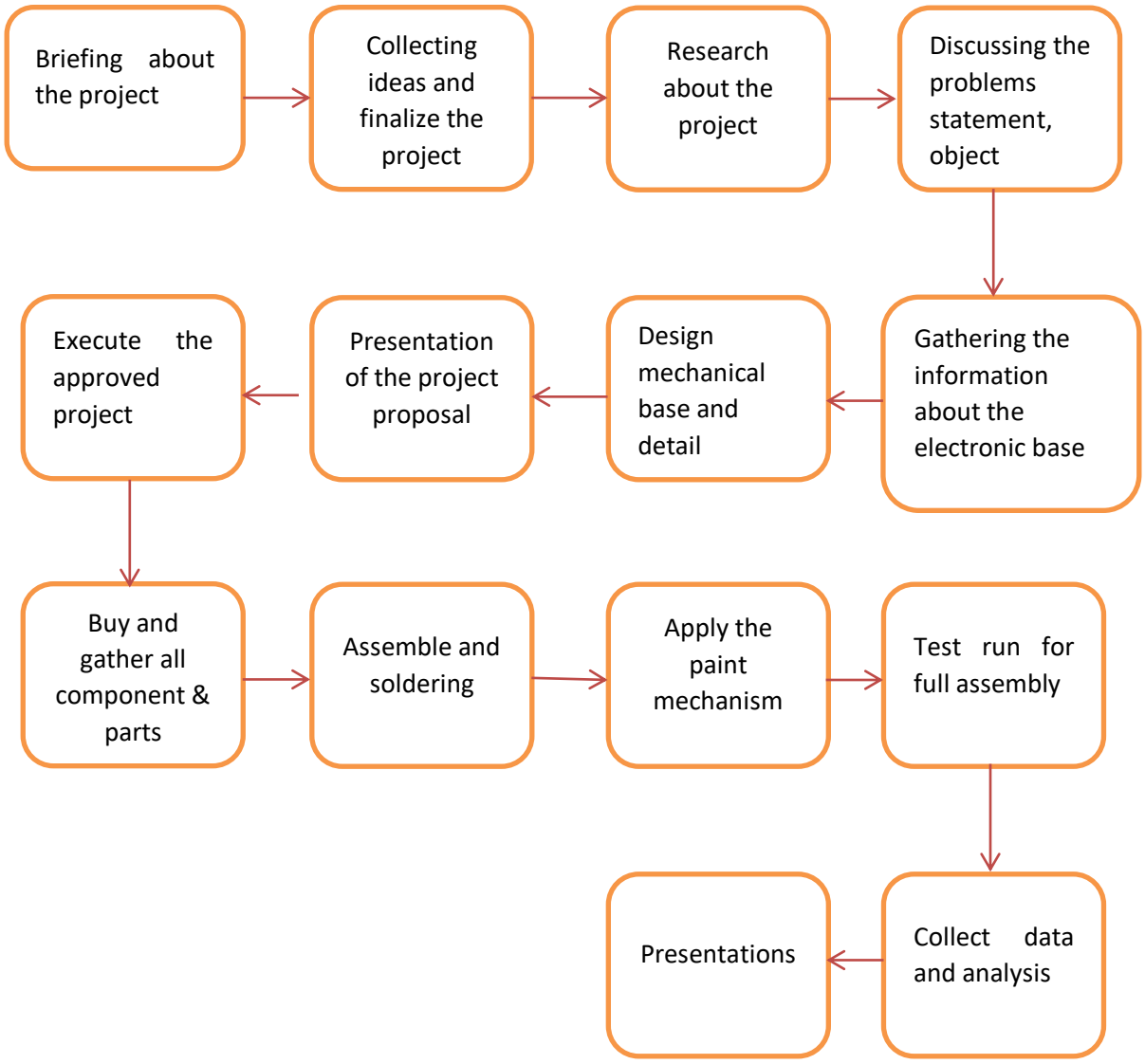


Chart 3.3.1

- **Briefing about the project**

In early semester 4 for December 2019 session, student from Mechanical Engineering Department Polytechnic of Sultan Salahuddin Abdul Aziz Shah has been briefed about the final year project(FYP) that will be carried out from semester 4 until the end of semester 5.

- **Collecting ideas and finalize the idea**

We collected some ideas for our project. We have listed 2 ideas for our final year project. The first idea for our project is drone for delivery use. We did not implement the idea as it had been in market. After having a lot of discussions, we choose second idea which is a drone with a paint capability.

- **Discussing the problems, objective and scope**

We determine all the problems and the needed of the drone with a paint capability. The objective is a guideline and project also should meet the right objective. As the scope is a limitation for this research.

- **Research about the project**

Research has been made through internet as platform for us. We get project information base on website that related to drone painting capability. Moreover, we also inspired this project from high demand which this service is needed to be developing to make the painting jobs easier. We also done a survey on the need of this type of drone and receive positive responses. Thus, we would like to innovate this Fly Colour Drone project.

- **Gathering the information about the electronic and mechanism base of the project**

All the electronic parts, mechanical part and components are listed and identified. We get all the information from our senior, and our member of team drone PSA who have experienced developing drone as final year project.

- **Design mechanical bas and detail drawing of the project**

  The design of mechanism for painting which includes a spray gun and air compressor and decide on how the mechanism will work. The spray gun are attached below the drone and supplied by a compressor machine on the ground so then the drone will less power consumption in load and save more energy. Then design will be illustrate in drawing by using CAD software which is Autodesk Inventor.

- **Calculation of the budget**

  Calculations of the budget on this project have been identified to be successful.

- **Presentation of the proposal`**

  The presentation will be help on week 14 during semester for to proceed weather the project is consider a good project that should be done for next semester which is semester 5.

- **Execute the approved project**

  Let say the proposal project is approved by the lecturers during the presentation, our member project have to proceed with the project for the next lever by following the step have been planned before the proposal been submit.

- **Buy and gather all the component & parts**

  We buy some of the components from our senior and some components from online shopping websites such as Lazada and at Hardware.

- **Assemble and soldering**

  The project is built within the base first. The body or the main structure of the drone is made of carbon fibre from Tarot FY690S body frame. This type of body or frame gives us more strength and stability of the drone. The completion of electronic components is needed in this drone for flight controller. The flight controller is the nerve center of the drone. NAZA M Lite flight controller is needed. This board very important which connect to Electronic Speed Controller (ESC) to send programmed information to motor and also to calibrate each of the motor as well. Model AT10 2.4GHz 12 channel Transmitter and R12DS Receiver must be used as a controller to control the drone and the mechanism. In mechanical aspect, 2kg thruster motor type is used for drone. This type of motor capable to uplift the drone since the frame body which carbon fiber are not heavy.

- **Applying the spray gun**

  For the painting mechanism spray gun will attached below the drone within the design that are fixed where the spray can will put in it by using 3D printing, the design for attached that fixed are design using inventor type of filament we use is 1.75mm ABS ABS filament is strong, ductile material with wear resistance and heat tolerance. Common 3D prints with ABS are Interlocking parts like gears, parts exposed to UV and heat like a car cup holder, or prototyping. The compressor will supply the air through the hose from the ground, the hose long about 10 meters. So the power consumption will be long.

- **Test run after full Assembly**

  After the assembly are completed, it must be test in order to achieve the objective of the project. If any failure happen, the drones need to be restored and do some upgrades are needed a line with the result of the test.

- **Data collection and analysis**

  After the completion of the drone, all the data must be record and collected. To get an absolute result, the experiment must be repeated 3 times.

- **Presentation**

  On semester 5 2020, we present our prototype in front a total panels. Each components and parts of the drone will be explain in detail.

3.4 PROJECT SERVEY

3.4.1 QUESTIONNAIRE

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

MECHANICAL ENGINEERING DEPARTMENT

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

QUESTIONNAIRE

A: Respondent Information

SECTION A: Demographic data of respondents

Age :_____

Occupation:_____

Gender :_____

SECTION B: Questionnaire

Please tick (/) your answer in the space provided.

NO	QUESTION	YES	NO
1	Does drone need to be developing and redesign for paint capability?		
2	Do you think that by develop a drone with painting capability can make a less work while doing painting jobs on the high place?		

3	By doing drone as platform for painting jobs, so then human no need to lift a or take a heavy equipment to reach the places which can't be reach by human for painting job. Are you agree with that?		
4	Does **'Fly Colour drone for painting jobs'** is needed?		

Thank you for your valuable response.

3.4.1 RESPONDENT RESPONSE CHART

An open survey is done for our project to determine the needed of Fly Colour Drone. From 56 respondents, the result is received, shown that this research should be developed. The data is represented in the pie chart below.

Pie Chart for Questionnaire Result

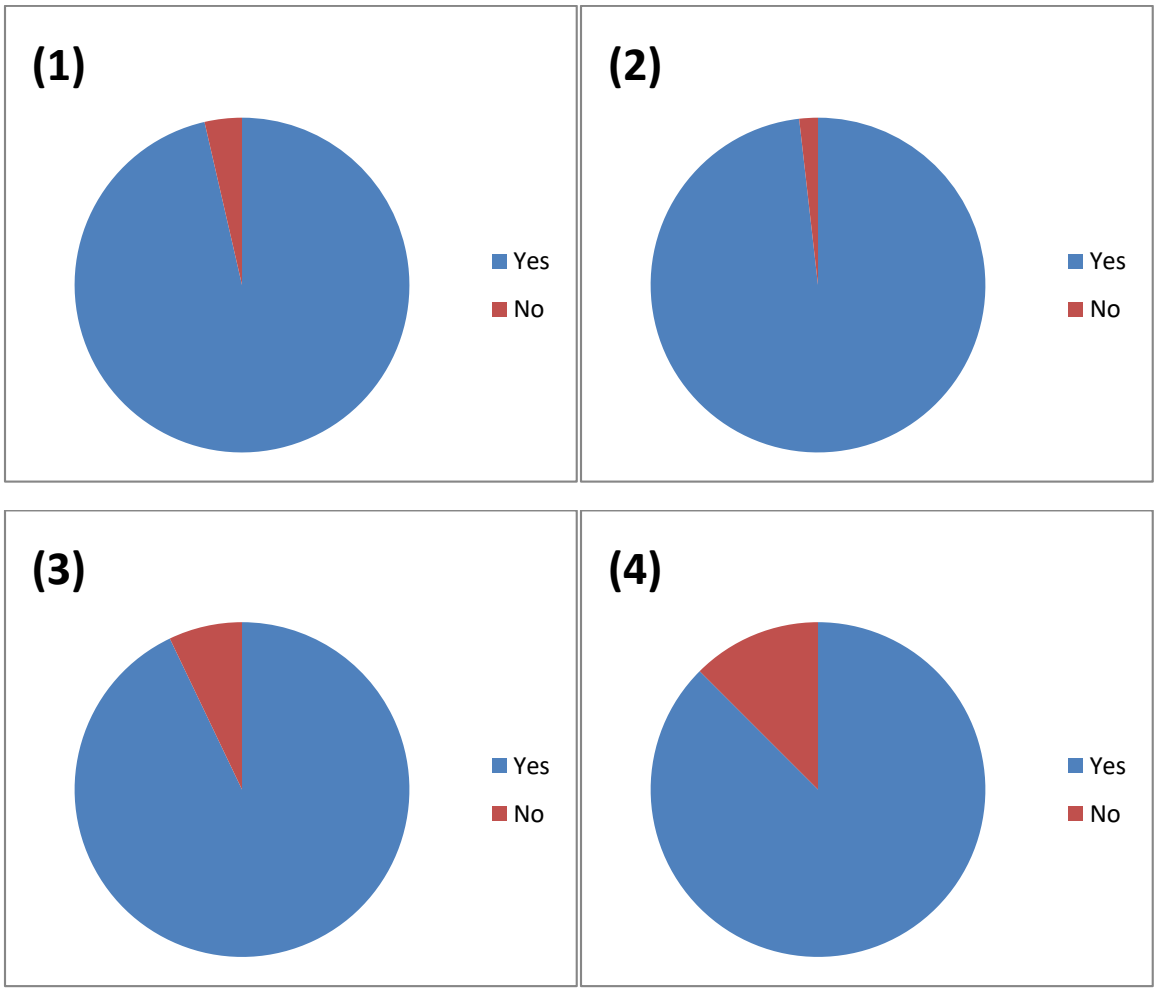
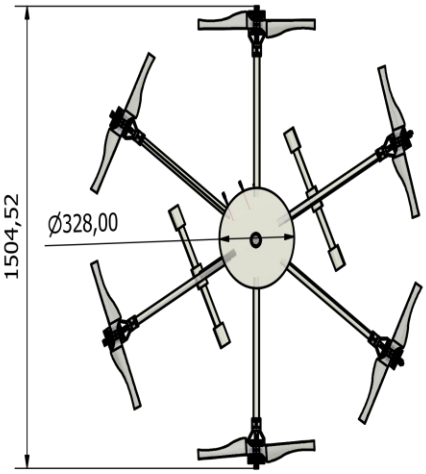


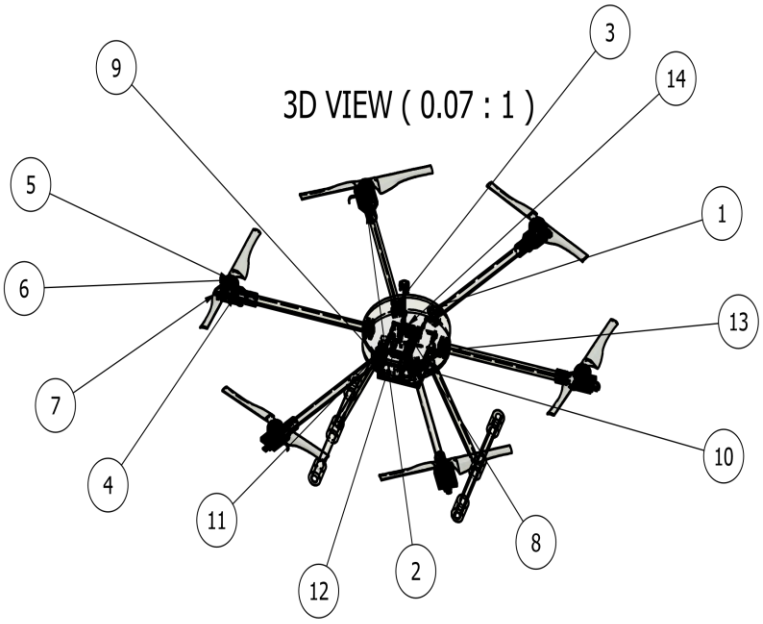
Chart 3.4.2

From the charts, about 93.75% of respondents agree that drone are needed to be develop for painting platform to make the jobs become more easier and safely.

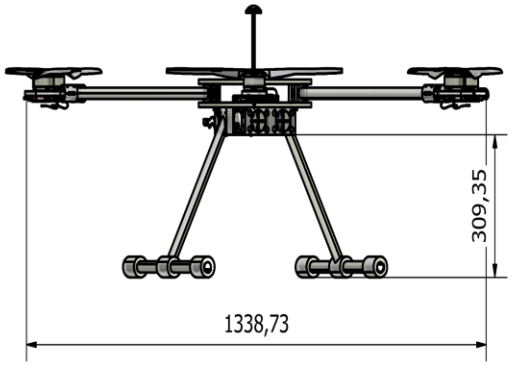
3.5 PRODUCT DESIGN



TOP VIEW (0.06 : 1)



PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	Centre Plate	
2	6	CF Arm	
3	12	Tube Clamp	
4	6	Motor Mount	
5	6	Tiger U7 Motor	
6	6	Prop_20_6_Twist	
7	6	Electronic Speed Controller	
8	1	PixRacer_Flight_Controller	
9	1	Dragon Link Receiver	
10	1	R7008SB Rx Receiver	
11	1	Battery Hanger	
12	2	6S Battery	
13	2	Landing Gear	
14	1	GPS with Stand	



FRONT VIEW (0.09 : 1)

Designed by	Checked by	Approved by	Date	Date	
T440s				17/3/2020	

Drone Assembly Main Part	Edition	Sheet
		1 / 1

Figure 3.5.1 AutoCAD view Drone Assembly

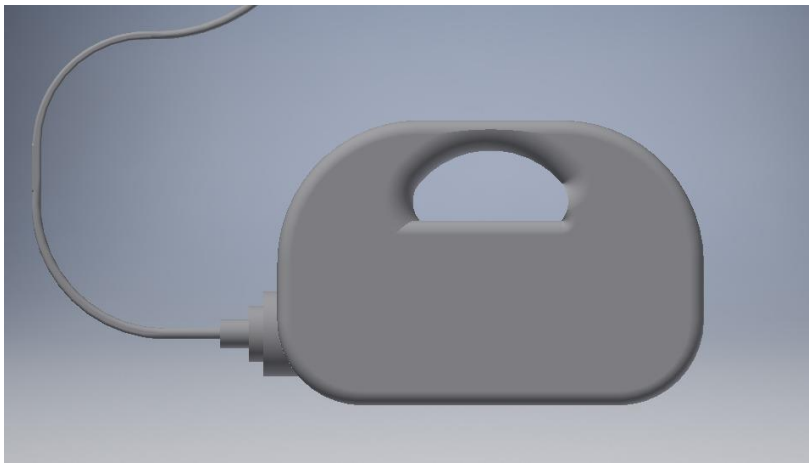


Figure 3.5.2 Paint Mechanism (Air compressor)

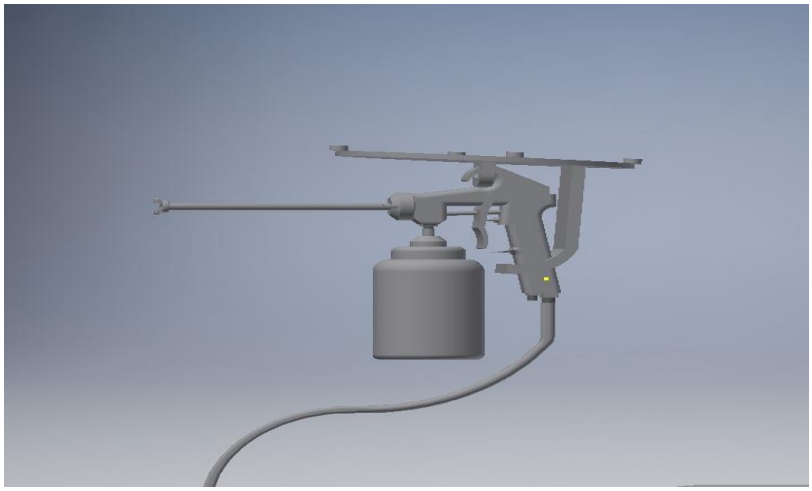


Figure 3.5.3 Paint Mechanism (Spray Gun)

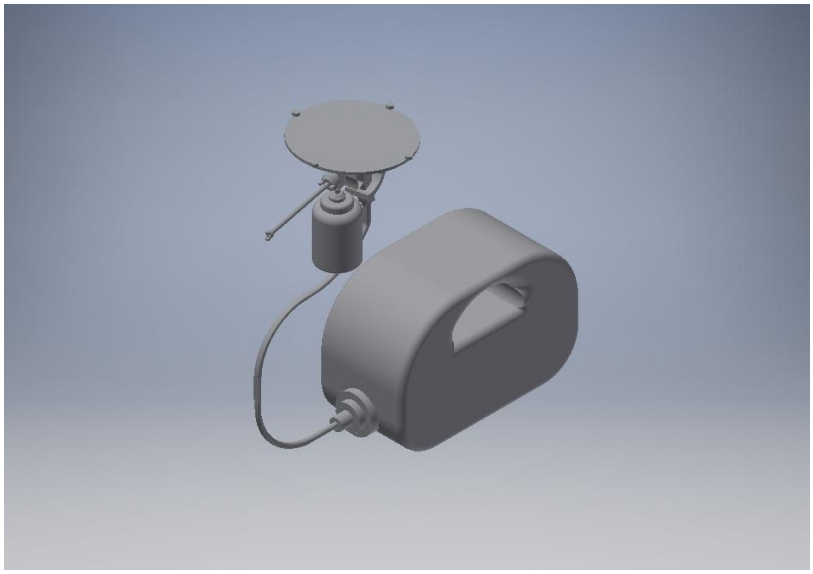


Figure 3.5.4 Full assembly part of mechanism painting

FINAL PRODUCT

Figure 3.5.5 Drone Fully Assembly

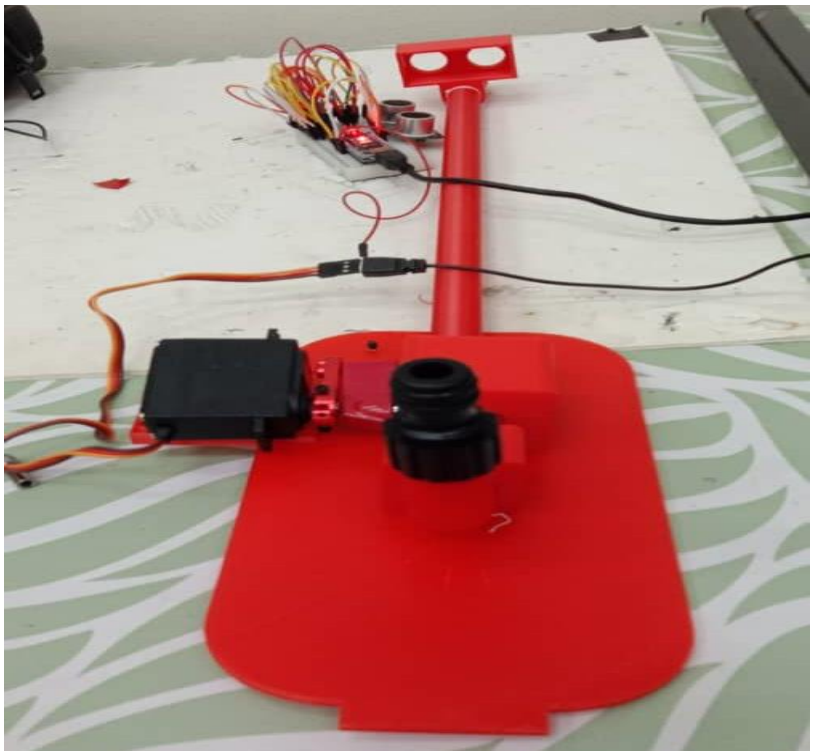


Figure 3.5.6 Mechanism Attach to the drone (3D printing)

Figure 3.5.7 Final Product

3.6 PROJECT OPERATIONAL PROCEDURE

1. **Drone fly to the location**
   The drone can fly up to 10 meter high above the ground to reach the place which human can't.

2. **Hold the altitude mode about the high**
   With PIXRacer Flight Controller, we can change the fligh mode to Altitude Mode. This mode helps to control the drone for stabilizer to maintain the positions.

3. **Start Spray**
   By using servo motor, the trigger will be pull so than the spray gun can start do it continuously control using flight controller 12 channel. To stop for spraying still the same but the servo will push for stop.

3.7 PROJECT GANTT CHART

project Activity	week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Briefing about the project														
Collecting ideas and finalize the ideas														
Discussing the problem, objective and scope														
Gathering the information about the electronic base of the project														
Research about the project														
Design mechanical base and detail drawing of the project														
Calculation of budget														
Presentation of the proposal														

Table 3.7.1 Gantt Chart Semester 4

Planning

Actual

Project Activity	week														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Plan For Selecting Material And Component															
Gather The Drone Part And Mechanism															
Combine The Drone(Soldering Electronic)															
Testing For Drone(Motor With ESC)															
Combine The Mechanism With Drone															
Testing Mechanism With The Drone															
Troubleshot And Upgrade The Project															
Actual Task With Collecting Data															
Writing Final Documentation/ Presentation Of The Project															

Table 3.7.2 Gantt Chart Semester 5

Planning

Actual

3.8 PROJECT BUDGET

NO.	Equipment / Material	Estimated Cost (RM)
1.	Carbon Fibre Tarot FY690s Frame	490.00
2.	Brushless Motor – 750KV (6)	392.00
3.	GemFan 1045 (10 inch) propeller (3 pair)	30.00
4.	Pixracer R15 Autopilot PX4 Flight Controller	255.60
5.	Electronic Speed Control (ESC) A30	90.00
6.	Salpido ATX 500W Power Supply	30.00
7.	Paint Zoom Electric Sprayer Gun	59.99
8.	High Pressure Air Hose	35.00
9.	High Quality Wire Silicone 14AWG	25.00
10.	Spraying Nozzle Extansion	16.99
11.	Paint	40.00
TOTAL		1464.58

Table 3.8.1 Table Budget

3.9 SUMMARY CHAPTER 3

As the conclusion, the methods implemented in this project are the first step that must be done in order to complete this project. The flow chart and gantt chart show of our activity from December 2019 until April 2020. Based on our research and information we get, a design that suitable for our drone to make it successfully fly and do the painting jobs by using spray gun that attached on the drone. A 360º servo motor that manage to pull the trigger of spray gun control using the flight controller 12 channel. The painting jobs can be do just using a drone without human power. The drones are control half by human and half of it control by itself through programing coding that be set.

CHAPTER 4: RESULTS AND ANALYSIS

4.1 INTRODUCTION

This chapter will discuss about the calculation and testing made throughout this project. This calculation of drone thrust, how much time to paint at certain area for painting mechanism system and average. This data are will be record and analyzed to determine the best result of this project.

4.2 DRONE THRUST CALCULATIONS

Drone frame = 600 g

Drone + Brushless motor + Electronics = 1600 g

Completed Drone + Mechanism + Payload = 300 g

List of payload

1. Spray gun (including frame that attached to the drone) = 300 g

All-Up-Weight(AUW) = (300)(2)

= 600g

Thrust needed for each motor =600 / 6

=100 g

XT-Xinte 5010-(750kV) Brushless motor + 1045 Gemfan propeller (10-inch, 4.5 pitch),

Trust for one motor = 1100g

4.3 ANALYSIS

4.3.1 HYPOTHESIS AND THEORY

The more less the drone carry the load, the more time the drone can perform to do the task. And the more amount of the battery capacity is increase the amount of time also can be estimated increase the time fly for the drone. This hypothesis supported by the time taken and measuring the area were paint during the task which is place the drone are fly also average of the high that drone can reach.

4.3.2 DATA COLLECTION FOR FIRST TASK

Time taken	30 minute
Litre liquid that being used	8100ml
Surface area being cat	(100×50)m^2
Average the high drone are fly	(10-50)m

Table 4.3.2

4.3.3 DATA COLLECTION FOR SECOND TASK

Time taken	36 minute
Liter liquid cat that being used	8100ml
Surface area being cat	(100×50)m^2
Average the high drone are fly	(10-50)m

Table 4.3.3

4.4 CHAPTER 4: SUMMARY

From the data that recorded, the best result can be obtained by estimated the battery capacity is increase for achieved more time to fly the drone, selecting the motor brushless with high rpm enabling the drone to carry more weight. Conclusion, after the projects has achieved the objective of this project done and fly up for the test run result. The data is very important to improve the project especially the mechanism that need for the better result in carrying load, time taken and accuracy.

CHAPTER 5 DISCUSSION AND CONCLUSION

5.1 INTRODUCTION

This chapter incorporates discussion plans, conclusions and improvements for this project. Analyzes were also made from data collected based on project tests. Therefore, a discussion of the problems that arise during the test, the data and analysis will be briefly in this chapter. In addition, the conclusions to be drawn are from discussion plans and improvements for future projects whether prototypes or actual projects.

5.2 DISCUSSION AND UPGRADE PLAN

From the data collected, the water pump should be selected at high pressure to make the output liquid that flow out though the nozzle will be at constant flow output. Hopefully, for the future project, this fly colour drone can accommodate multiple objects in one time and it will be easier to do the painting jobs. For example, building at high more than 100m could be reach, there will be easy for doing the painting jobs as well, drone can only accommodate around 3 kilogram of payload. It will not be enough to bring more weight attached to the drone. In addition, this drone may come up with a camera and screen monitor in the next project as it can make the drone pilot easier to see while controlling the drone. It is difficult to locate which area are not complete being spray without using a camera.

5.3 CONCLUSION

As we all know, technologies around the world are advancing with various functions of goodness that can facilitate the daily work of human beings. With our technology, the fly color drone (FCD) we hope to make it easier for users / employees to do the work.

We have been conducting many research on our project for 2 semesters to make our project success. There are indeed many projects that do the painting work, but not all projects can do the painting work on the high part at a more economical cost.

In conclusion, with more economical costs there are some shortcomings that need to be improved on the FCD. The full autonomous programming with the addition of cameras on the FCD can make it easier for users / employees to do painting work more efficiently. We hope that with this Fly Color Drone can facilitate the painting work on the high side while reducing the risk of accidents while working.

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[10]Water Pump and Pumping System Book by James B. Rishel

APPENDIX

POSTER

FLY COLOUR DRONE

Team Leader: Zulhanif Bin Ruslan
Institution : Politeknik Sultan Salahuddin Abdul Aziz Shah
Member Group: Muhammad Taufik B Amir Hassan
Institution : Politeknik Sultan Salahuddin Abdul Aziz Shah
Supervisor : Madam Isnuraini Binti Kassim@Ismail

DESCRIPTION OF INNOVATION

BACKGROUND > Demand in design a new technology for drone user are rapidly in many kind of innovation and huge potential.

IDEAS > To develop drone with new capability

PROBLEM STATEMENT >
1.Most worker who do high-rise wall paint jobs are at high risk of falling.
2.The cost incurred for employees are high.
3.Required skilled and experienced staff to do the jobs.

THE IMPACT OF INNOVATION

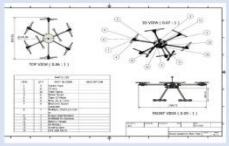
ADVANTAGES >
1.Huge potential in make the painting jobs become more easier.
2.Solution for overcome the risk jobs at high construction and more efficient.

POTENTIAL MARKET >Industries that related to high rise building services for painting jobs.

OBJECTIVE

1.To design and develop a drone with paint capability
2.To paint at a high level of building easily.

DIAGRAM OF DRONE MECHANISM



DRONE DIAGRAM

OPERATING FLOW CHART