

AIRBUS A320 TRAINER EXTERIOR LIGHTS SYSTEM DEVELOPMENT DEVELOPMENT AS A PRACTICUM LEARNING SUPPORT

Guido Fantri Brilian*, Suseno, Gunawan Sakti

Politeknik Penerbangan Surabaya, Jemur Andayani I/73 Wonocolo Surabaya, East Java, Indonesia, 60236

**Corresponding Author. Email: guido.f.brllian@gmail.com*

ABSTRACT

Good aircraft performance is supported by several systems, namely: avionics, instruments, power plant and others. One of the important *systems is the exterior light system* which is used as lights that provide the function and use of indications on the aircraft and provide lighting when the aircraft flies at night, and can determine the position of the aircraft while in the air. Therefore, this research aims as material for developing insight and knowledge and skills for cadets of the Surabaya Aviation Polytechnic, especially in the field of *exterior light systems* to support aircraft safety. This research is based on the results of interviews conducted by researchers with *trainees on the exterior light system* of the Airbus A 320 to cadets who showed that the average response was very good, which This means that the trainee Trainer for the *exterior light system* using a miniature Airbus A320 is needed by cadets to support practicum learning. Data analysis was carried out by giving questionnaire form sheets to cadets who participated in the trainer Trainer testing technique. This study also used a miniature Airbus A320 aircraft equipped with LED lights with an Arduino Uno microcontroller which was given a 5v power supply, so as to maximize the performance of *the trainees* . From the results of the study, the results obtained from a comparison of the values of cadets when using *trainees* without using influential *trainees* , where the average value of cadets when learning *the exterior lights system* without using Trainers is 74.285 while the average value of cadets when learning *the exterior lights system* using Trainers is 93,095 .

Keywords : *Exterior Lights System, Trainer, Arduino Uno*

1. INTRODUCTION

Airplanes are a means of air transportation that can transport passengers or goods quickly and efficiently. Air transportation is increasingly in demand by the public because it is considered to have advantages including fast, safe, and efficient. This is the reason for the increasing demand for air transportation. With the increase in aircraft enthusiasts, it is also necessary to pay attention to the condition of the airworthiness of the aircraft itself. Good aircraft performance is of course also supported by several systems, namely: avionics, instruments, power plants and others. One of the important *systems is the exterior light system* which is used as lights that provide the function and use of indications on the aircraft and provide lighting when the aircraft flies at night, and can determine the position of the aircraft while in the air.

Each type of light in *the exterior light system* has an important role in aviation security and safety. Therefore, each *light* cannot replace the function of another *light* , this is important in carrying out practical learning in the electrical system course carried out by cadets, that the lack of *light* in *the*

trainee's exterior light system cannot be symbolized by using *a light* that other.

In previous studies there were teaching aids regarding *the exterior light system* which were used to support the learning of *exterior light system material* , but these props only provided indications for *anti-collision light, strobe light* and *navigation light* . Development of *trainee design exterior light system* which covers almost the entire *exterior light system* found on the Airbus A320 series aircraft, by being able to distinguish between *the exterior light system* which can be turned on when the aircraft is in flight condition and *the exterior light system* which is lit when the aircraft is on the *ground*.

Based on the results of interviews conducted by researchers with the Airbus A 320 *exterior light system trainees* to TPU 6 and TPU 7 cadets, it showed that the average response was very good, which means that the trainee Trainer for *the exterior light system* using a miniature Airbus is needed by cadets to support practicum learning

2. TRAINEER DESIGN

2.1 Traineer Design

Conceptual design is the first stage and the most important phase of a trainer design, especially *the exterior light system*. In this phase a trainer will be designed based on the concept of a design without precise calculations, in other words almost all parameters are determined based on the decisions of the manufacturing process and the selection technique of a design.



Picture 2. 2 Design Traineer

In order to develop a media trainer that can fulfill the research objectives, it is added:

1. Toggle *Switches* on the trainer, adjusted to those in *the control panel aircraft cockpits* . so that cadets can understand how to operate *the exterior lights on and off* the trainer.
2. Making a 3-dimensional prototype aircraft on the trainer so that cadets can see clearly the location and angle of light on the aircraft's *exterior light system* .
3. Representing *the exterior lights* on the Airbus A320 aircraft so that cadets can understand the types and functions of *exterior lights* in more detail and comprehensively

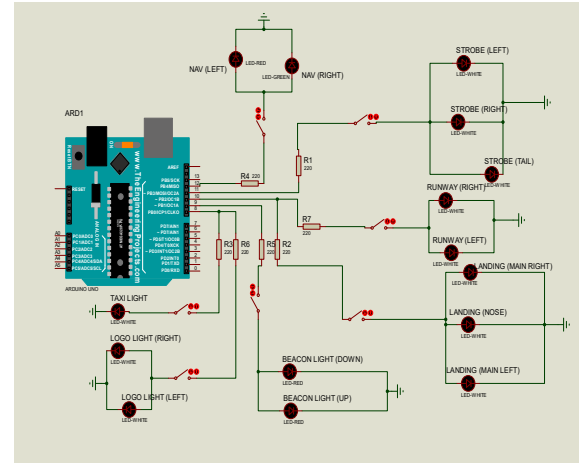
2.2 Traineer Wiring Design

Wiring diagram is a design or scheme that describes a series of electrical or electronic components in the form of simple symbols and component shapes. Wiring diagrams function to make it easier for someone to read and assemble components

2.3 Data Analysis Techniques

Data analysis will be carried out by giving multiple choice questionnaire forms to cadets participating in the trainer Traineer testing technique. A questionnaire form will be given before and after an introduction to the trainer and displays how the Traineer works with the aim of being able to measure

the level of knowledge of indications of the success of the Traineer in cadets. Each question in the questionnaire will be given 10 points which later the percentage of success will reach 100%. The results of the final points from the cadet's answers will be processed and a summary will be made in the form of a report on the percentage of the number of success indicators from the trainer. Questionnaire assessment format.



Picture 2. 1 Design Wiring Traineer

3. RESULTS AND DISCUSSION

In the results of testing *the trainee exterior lights system Airbus A320* using a miniature *Airbus A320* based on the Arduino Uno microcontroller This was obtained from a comparison of the results of the data obtained from the results of *trainee testing* related to the effect of using *the exterior lights system as a support for practicum learning in the electrical system course* . The comparison used is the absorption of understanding of the *electrical system material* especially in material *exterior lights system*. when using *the Airbus A320 traineer exterior lights system* compared not using *trainee* . For calculating quantitative data using formula *mean / average value* given between learning practicum using *the Airbus A320 exterior lights system trainees* and those who do not use *trainees* .

3.1 Learning Data Without a Trainer

Data was taken on Sunday 13 April 2023 with the following data:

Number of samples (all tpu level 2) : 42

Means =

$$\frac{60+70+70+80+70+80+90+80+60+70+60+80+60+60+70+90+100+70+80+60+70+80+50+70+60+60+70+80+70+100+100+70+70+70+80+80+100+50+90+80+70+90}{42}$$

$$= \frac{3120}{42}$$

$$= 74.285$$

From the calculation results, the average value of cadets when learning *the exterior light system is obtained* system without using props is 74.285.

3.2 Learning Data Using Trainers

Data was taken on Friday April 14 2023 with the following data:

The number of samples (all tpu level 2) : 42
Means =

$$\frac{80+90+80+100+90+100+100+90+70+100+80+90+90+100+100+100+100+80+100+70+90+100+60+100+90+80+80+100+100+100+100+90+80+90+90+100+100+90+100+80+80+100}{42}$$

$$= \frac{3910}{42}$$

$$= 93,095$$

From the calculation results, the average value of cadets when learning *the exterior light system using trainees* is 93,095.

Based on the results of a comparison of cadet scores when using *trainees* without using influential *trainees*. Where the average value of cadets when learning *the exterior lights system* without using Trainers is 74.285 while the average value of cadets when learning *the exterior lights system* using Trainers is 93.095.

3.3 Trainee Test Result Data

Research results on *trainee testing The exterior lights system* is obtained from testing what is *trainee exterior lights System* it can work according to the instructions or not, and in operation there are problems or not. the following data is obtained:

NO	DESIGN	CONDITIO N	RESULT S	NOTES
1	<i>Arduino</i> is given a power supply on a 5v 3a adapter	GOOD	IN ACCORDANCE	power according to capacity
2	<i>Navigation lights</i> can turn on according to the instructions when <i>the switch</i> is turned on.	GOOD	STEADY	<i>Light</i> is green, red and white
3	<i>The logo light</i> can light up according to the instructions that have been <i>input</i> on the arduino at the time of <i>switch-on</i>	GOOD	STEADY	<i>Light</i> is white
4	<i>The taxi light</i> can turn on according to the instructions that have been <i>input</i> on the arduino at the time of <i>switch-on</i>	GOOD	STEADY	<i>Light</i> is white
5	<i>The runway turn-off light</i> will turn on according to the instructions that have been <i>input</i> on the arduino when <i>the switch-on is on</i>	GOOD	STEADY	<i>Light</i> is white
6	<i>The landing light</i> can turn on according to the instructions that have been <i>input on</i> the arduino when <i>the switch is on</i>	GOOD	STEADY	<i>Light</i> is white
7	<i>The anti-collision light</i> will turn on according to the instructions that have been <i>input</i> on the arduino when <i>the switch is on</i>	GOOD	FLASH (45 flashes/Minute)	<i>Light</i> is red
8	<i>The strobe light</i> can turn on according to the instructions that have been <i>input on</i> the arduino when <i>the switch is on</i>	GOOD	FLASH (45 flashes/Minute)	<i>Light</i> is white
9	<i>The stand</i> on the miniature Airbus A320 can be moved smoothly.	GOOD	IN ACCORDANCE	Adjust according to the aircraft position

Table 3. 1 Trainee Test Result

in step 1 when arduino is given a power supply via a 5v adapter, the LED on the adapter will light up which serves as an indicator that the power supply has gone through the adapter and headed to arduino uno

in step 2 arduino is given a 5v power supply, then switch-on on switch navigation lights then lights the navigation lights of the aircraft will light up non-blinking and white on the tail, red on the left wing, and green on the right wing. In this Trainer, the LED lights are white, red and green. Which functions as direction information from an aircraft both ground, taxi and flight.

in steps 3 to 5 when arduino is given a 5v power supply, then switch-on then lights on the plane it will light up and not blink and be white, in this Trainer it is a white LED light. Which functions as an indicator for the crew and pilots and as lighting for both ground and taxi aircraft.

in step 6 when arduino is given a 5v power supply then switch-on, in this step the white led on the landing light lights up which serves as an indicator that there is movement on the landing gear. And when the lights go out it indicates there is no movement on the landing gear, for the landing gear to light up when the plane is about to land or take off.

in step 7 when arduino is given a 5v power supply then switch-on, this is the step to turn on the anti-collision light, the color of the light on the anti-collision light is red and flashing which is located on the upper fuselage and lower fuselage to indicate that there is movement on the plane.

in step 8 when the arduino is given a 5v power supply then switch-on, this is the step to turn on the Strobe light, the color of the light on the Strobe light is white and blinks which is located on the wing tip and tail to inform that an airplane is moving in that area.

In step 9 when the aircraft is on the ground, then Miniature Airbus A320 aircraft can be lowered using the holder stand and when the aircraft is in flight position, the miniature aircraft for the trainee can be positioned above using the stand holder for the trainee.



Picture 3. 1 Trainer Exterior Light Airbus A320

4. CONCLUSION

From the overall testing and measurement of the design, the conclusions can be drawn as follows:

1. With this teaching aid, learning on the exterior lights system makes it easier for cadets to understand the material presented so that the trainer is more effective when delivering exterior lights system material in electrical fundamentals courses rather than using learning without a trainee which requires cadets to imagine the positioning and how the lights are on. It is proven based on the results of a comparison of the values of cadets when using trainees without using influential trainees where the average value of cadets when learning the exterior lights system without using Trainers is 74.285 while the average value of cadets when learning the exterior lights system using Trainers is 93.095 which means can be categorized as very good.
2. This trainee uses a miniature aircraft equipped with LED lights with an Arduino Uno microcontroller that is given a 5v power supply, which can apply the position and state of the aircraft when operating several exterior lights on a real aircraft. In this Trainer design, Arduino is the main component that regulates the flicker of the anti-collision light and Strobe light, so that trainees work optimally.

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