International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

http://ijpsat.ijsht-journals.org
Vol. 23 No. 2 November 2020, pp. 523-532

Making Modeling Control System of the Use of Electrical Energy in a Flight Engineering Department Building STPI Curug - Tangerang

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Politeknik Penerbangan Indonesia

Abstrac – Daily activities cannot be separated from electrical energy. This energy is obtained from the state electricity provider, namely PLN, which has been distributed from the generator. The STPI Aviation Engineering Building is one of the consumers, in daily use the need for electrical energy cannot be controlled because the control of energy use is manual. Electrical energy that is not used properly will result in increased financing. For this reason, a control system for electricity use is made. This system is limited to monitoring the use of special sockets that serve large loads, namely air conditioning (AC = Air conditioner). This control is carried out from the observation of centralized control, namely the security post. Through the media, a small PLC will control the area of the room or floor that is monitored in the use of electrical energy. ***A MANUFACTURE OF CONTROL SYSTEM MODELING OF ELECTRICAL ENERGY USE IN A FLIGHT ENGINEERING DEPARTMENT BUILDING, STPI CURUG - TANGERANG.***

Keyword – Controller System, Modelling System

I. INTRODUCTION

In the development of the use of electrical energy, it is very broad and comprehensive as an important activity in everyday life. It is also inseparable from the use of electrical energy in the aviation department building. This building consumes power for use as lighting, air conditioning (Air Conditioner), power outlets with several power stand by points. In operation and utilization, generally in the campus environment, the use of self-service (self-service) often occurs inefficient energy use due to accidentally forgetting to turn off the electrical energy used. Sometimes the floor rooms can escape observation after the use of the space is complete.

For this reason, a centralized control arrangement is needed so that the utilization of electrical energy can be efficient and efficient. Initial indication and monitoring of the use of electricity that has been used is done by observing CCTV. CCTV is generally concentrated in the corner of the room with thorough observation. So that if at the time of the room or building area there is a light or electrical energy is on, it can be turned off centrally.

It is hoped that by ***making a Modeling Control System for the Use of Electrical Energy in the Building of the Aviation Engineering Department at STPI Curug Tangerang.*** After making this equipment, it can become a media trainer for STPI cadets and cadets.

II. GENERAL RULES

On the basis of this theory discusses the basic circuit planning concept of controllers. The application taken is a basic application that is easy to understand and can be implemented. The main components used are magnetic contactors and relays.

Sequential work sequence (Squence Control) is a control technique used to regulate an operation that is interrelated, connected or planned. This control has three categories. The categories are as follows:

a) The system carries out the next sequence if the previously determined conditions are met *(conditional control)*.
b) The system executes the next sequence when it reaches the predetermined time *(time schedule control)*.
c) Systems where execution time or time *intervals* are not important, only the *predetermined sequence* of operations is important *(executive control).*

Control circuits usually consist of:

a) The part that receives information for the process / *plant* before being given to the *controller*.
b) *Sequential Controller.*
c) The part that processes information from the *controller* output.

In general, a sequential work circuit uses the main components, namely a relay or magnetic contactor. The working system in the big picture is a maghnet switch that works based on commands on the coil which will actuate the main contacts and auxiliary contacts contained in these components. Commonly used voltages adjusting the controller action. The controller has a low voltage while those who will perform the main action use large voltages and currents. In a sequential work series, it has 2 series or only one series as needed. The first circuit is a controller circuit while the other circuit is a power circuit.

1.1 Work Chart of the Overall Research System

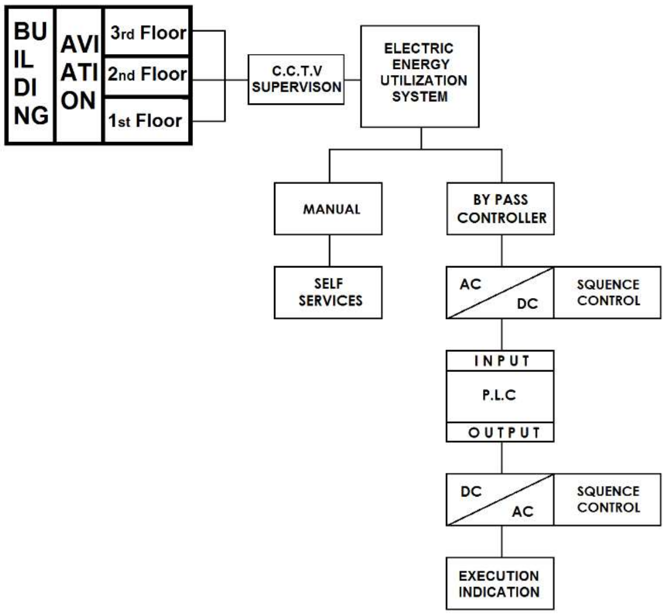


Figure 1.1. Image of the whole research work system

Table 1.1 Information Descriptors

NO	PART	UNDERSTANDING	INFORMATION
1	TEKPEN (Aeronautical Engineering) Building, 3rd, 2nd, 1st Floor.	s a place to conduct research and observation of work objects. The container used is an aeronautical engineering building on the 3rd, 2nd, and 1st floors referring to the abstraction.	
2	CCTV monitoring indicator	The process will be carried out based on initial observation via CCTV (Closed Circuit Television).	
3	Utilization of electrical energy load of AC room	Utilization of electrical energy load room air conditioning.	

4	Manual	Treatment conditions without using a controller	
5	Self Service	A condition that intends to serve oneself.	
6	Monitor on socket	A measuring instrument or indicator placed on the object of research.	
7	AC to DC Sequence Control Input	The circuit section before entering the PLC (Programmable Logic Controller) input section	
8	PLC (Programmable Logic Controller)	A compact unit that is in control of the entire system	
9	DC to AC Sequence Control Input	The part of the PLC (Programmable Logic Controller) output circuit will then become input at the final execution	
10	Indikator Eksekusi	A reference to the end result of the system implementation	

1.2 Overall Work Flow Diagram Conditions Before Control

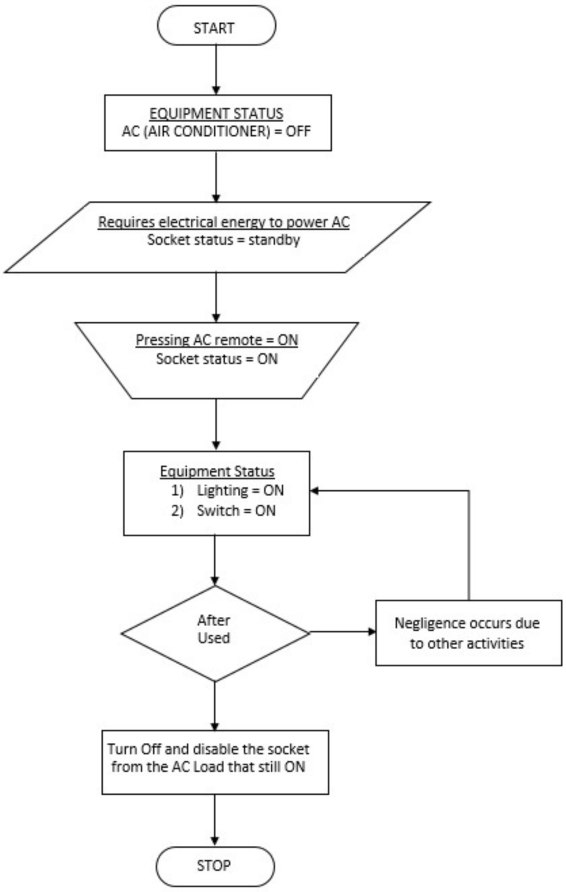
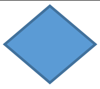


Figure 1.2. Flowchart Before Control

In general use of electrical energy in a room, users will perform self-service (take direct action) by pressing the ON switch on the socket and then pressing the remote ON to turn on the room air conditioner. Conversely, after use, press the remote OFF to turn off the room air conditioner and ideally turn off the socket switch for more safety. However, generally due to activity and other negligence, forget to turn off before leaving the room so that the electrical energy is still on.

Table 1.2. Description of the Flowchart Process

NO	SYMBOL	INFORMATION
1		Termination. Information begins and ends a flow chart.
2		Process. Activities to process information or input.
3		Data. Contains data information or introductory declarations.

4		Operation Manual. Activities provide input work processes directly without using a controlled system.
5		Choice of decisions. An option that will be implemented according to the input being processed.

1.3 Overall Work Flow Diagram Conditions After Control

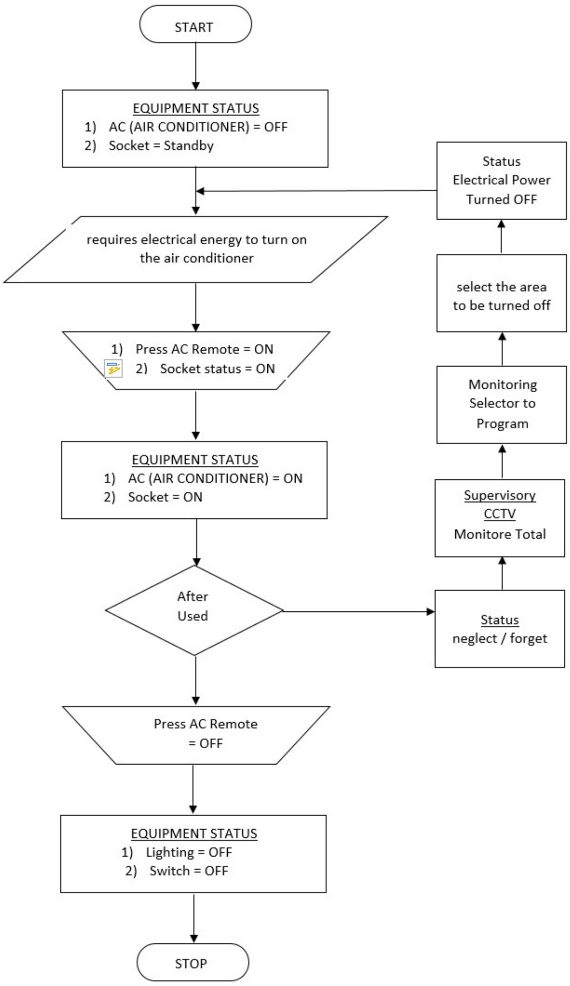


Figure 1.3. Flowchart of Condition After Control

In general use of electrical energy in a room, users will perform self-service (take direct action) by pressing the ON switch on the socket and then pressing the remote ON to turn on the room air conditioner. Conversely, after use, press the remote OFF to turn off the room air conditioner and ideally turn off the socket switch for more safety. However, generally due to activity and other negligence, forget to turn off before leaving the room so that the electrical energy is still on.

In the desired condition, an equipment is made that functions to control the condition of negligence that occurs so that an undesirable condition will not occur. Use of electrical energy responsibly and more efficiently. Negligence in use is corrected by turning off the electrical energy flowing in the room AC socket which has been adjusted.

The main monitoring is on CCTV monitoring and the electrical panels that have been made to provide an indication of the electricity consumption of the object for which control action will be taken. The controller has 2 modes, namely monitor and program, for monitor mode it only observes the use of electrical energy and for the program method it will take control actions on the object to be controlled.

1.4 Tool Making Planning

The planning for making the equipment in question includes several stages, the first steps are making an algorithm and a step to determine the number of I / O to be used. This I / O determines the type of PLC that will be used.

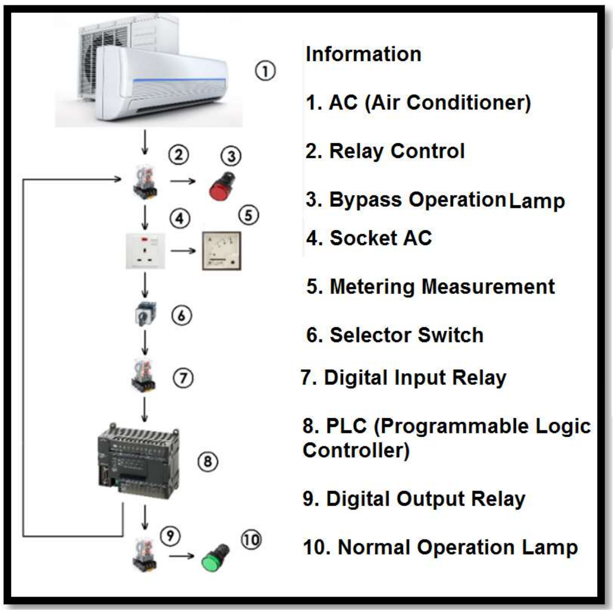


Figure 1.4. Planning illustration images

Table 1.4. Captions from the planning illustrations

NO	NAME	INFORMATION
1	AC (Air Conditioner)	an equipment that functions as an air conditioner. Is the main subject in control of use.

2	Control Relay	a tool that functions as a maghnet switch and is a system change from manual to by pass. Is the final actuation component in this control system.
3	Bypass operation light	Indicator light that shows the status of the condition.
4	AC socket	source of electrical energy for air conditioning and become the object of control.
5	Panel meter	Current indicator used by AC.
6	Selector Switch	Monitor operation selector switch to control bypass.
7	Digital relay input	Relays that are used as a voltage conversion are used by PLCs as their input source.
8	PLC stands for Programmable Logic Controller.	A programmable control module as the main processor in the work sequence that is made.
9	Digital relay output	Relays that are used as voltage conversions are used by PLCs as a result of the process output being carried out.
10	Normal operation light	Indicator lights are used to inform the actual state of the condition.

III. FORMULAS AND EQUATIONS

In making this successive work circuit planning using a contactor or relay. These needs are categorized into several technical specification requirements which become references. In this sequential work circuit PLC input uses a relay and for output uses a relay. This type of PLC uses a digital input and a digital output.

There are 3 classrooms in the aeronautical engineering building which refer to the mains (dial contact). For protection of overcurrent and short circuit, an MCB with a special reference power from the load in the form of I nominal AC (Air Conditioner) is used. For current monitored loads used with the following power:

2 PK (PK = Pferdestarke = Power Horse) konversion in watt ....(1)

(0,75w X 2 = 1.500w) ....(2)

This load requires an overcurrent protection and a short circuit with the approximate value of the formula for finding the safety current

$P_{(power)} = V \; x \; I$ ....(3)

$V_{(voltage)} = \frac{P}{I}$ ....(4)

$I_{(Current)} = \frac{P}{V}$ ....(5)

Information :

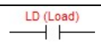
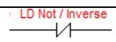
P = Unit electric power in watt...(3)

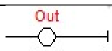
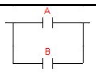
V = Unit voltage in volt (V) ....(4)

I = Unit electric current in ampere (A) ....(5)

The program logic used is the use of a ladder diagram which uses the following logic:

Table 2.1. Captions from the planning illustrations

No	Symbol	Mention	Status	Equation	Information
1		Ld (Load)	NO (Normally Open)	"0"	OFF
2		Ld Not / Inverse	NC (Normal Ly Close)	"1"	ON

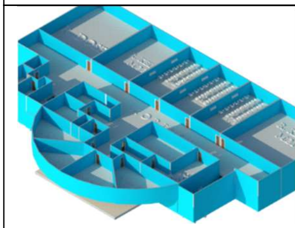
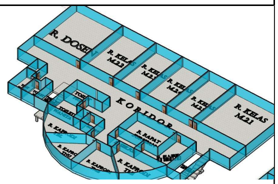
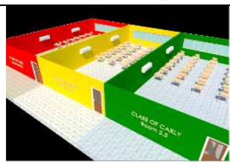
3		Out	It depends on input and work process		
4		And	The output will be 1 if A and B have logic 1	Q=AxB	
5		OR	The output will be 1 if A or B has logic 1	Q=A+B	

IV. Implementation of Observations

4.1. Planning for Building Observation Building Modeling.

In the making of modeling, 3 floors of the building plan were actually redrawn. The research concentration is on the second floor using room 2.3; room 2.4; Room 2.5 This room is drawn in complete detail with furniture such as tables, chairs, writing pads, and lecturers' desks. Monitoring in this building is the use of AC (Air Conditioner) which is placed in each room. In real use, 2 AC with 2 separate sockets are used. In this study, only one model represents the control that will be used.

Table 3.1 Actual Situation of Aeronautical Engineering Building

Aeronautical Engineering Building	Aeronautical Engineering Building
	
Class Room M2.2	Class Room M2.3
	
Class Room M2.5	Class Room M.2.4
	
Floor Building Drawing Design 2 By rendering	Floor Building Drawing Design 2 No rendering
	
	

4.2. Load Power Calculations

The number of outlets per room that will be monitored in this modeling is 1 unit for one room. This unit will represent the real system and if it is to be applied in real terms, the number of sockets to be used can be adjusted accordingly.

Power monitored .... $P = 1.500$ w .... (3)
Voltage ....$V = 220$ Vac ....(4)
Current ....$I = 6,8$ Amp .... (5)

According to calculations, it is known that the monitored power is 1,500 watts, so the safety is around 6.8 Amp or according to products on the market is 8 Amp.

$$6,8 \text{ A} = (1.500 \text{ W})/(220 \text{ V})$$

In this circuit, to control each outlet, it is equipped with each selekter which becomes the DI of the PLC. The control of these three selector switches is carried out by one main selector which gives the monitor mode to bypass / program mode.

4.3. Planning Making Sequential Work Circuits

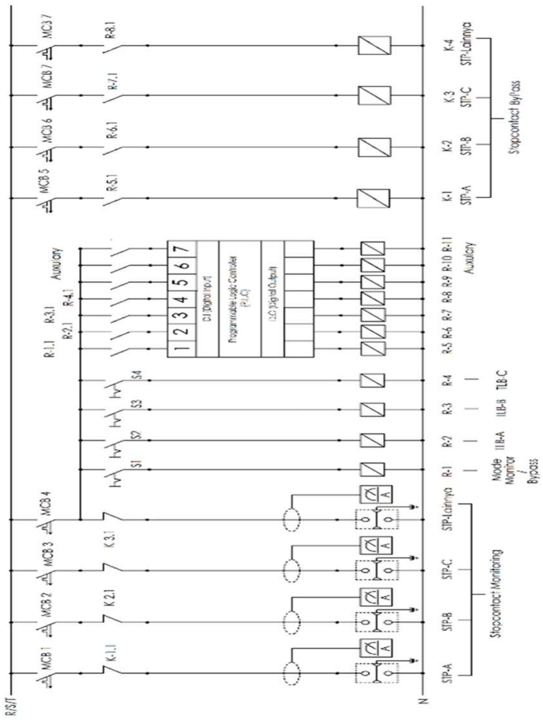


Figure 3.3. Draw Sequence Control

Table 3.3. Table Description of Electrical Components

NO	COMPONENT	AMOUNT	INFORMATION	FUNCTION
1	MCB 1-3	3 pc	@8 Amp	Power outlet safety guard 1. Class Alfa 2. Bravo class 3. Carly's class
2	MCB 4-8	5 pc	@2 Amp	Control circuit safety
3	Amp Meter 1-3	3 pc	Load information indicator is used	As a meter panel on the currents flowing in each classroom.
4	Amp Meter 4	1 pc		As a meter panel on the current flowing in the control circuit
5	Selektor Switch 1	1 pc		As a monitor mode selector to program by pass mode
6	Selektor Switch 2-4	3 pc		As a manual bypass control action
7	Relay R.1	1 pc		For DI information on the PLC
8	Relay R.2 – R.4	3 pc		As DI information on the PLC for the monitored classroom
9	Relay R.5 – R.7	3 pc		As DO information on the PLC for classrooms being monitored
10	PLC	1 Unit		As the main control of the whole process

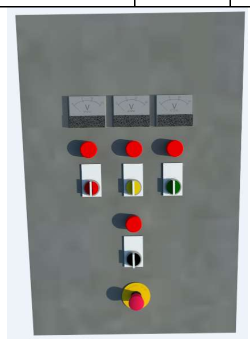


Figure 3.3.1.A. Panel Position of the Controller Panel Section

Figure 3.3.1.B. PLC Inner Position Panel

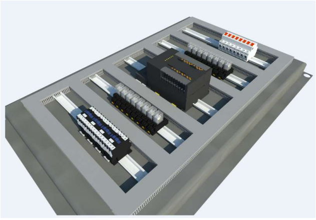


Figure 3.3.1.C. Inside Position Panel ISO Metrics View

Figure 3.3.1.D Panel Inside Position Overall View

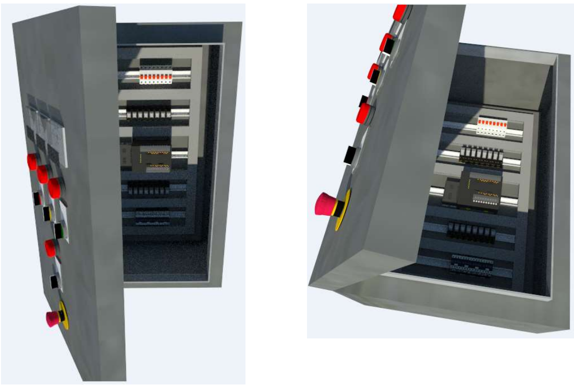


Figure 3.3.1.E. PLC position in the Panel

3.4 PLC Programming Planning

There are several languages in PLC programming that are commonly used, namely using ladder diagrams, statement lists or function blocks. The three of them will appear together if one is done. Input and output in programming are adjusted according to the addressing of the series or type of PLC used.In making the planning software that will be used in this study is a PLC with the type of PLC OMRON CP1E-N20. By using the lader language. In the language the ladder below the left position represents input and the position represents output. The reading method starts from left to right. Explanation of information from the ladder in the form of addressing the inputs and outputs is conveyed to make it easier to implement and monitor the working program.

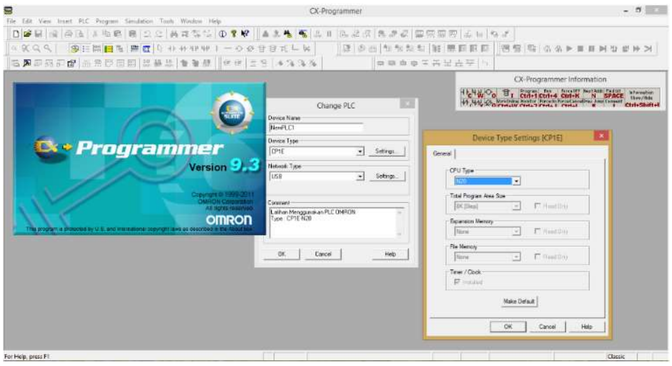


Figure 3.4.A. **Appearanc**e of CX Programmer Software Version 9.3

Table 3.4.A. Status Ladder Diagram

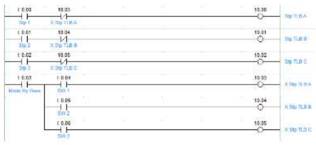
STATUS LADDER OFFLINE	STATUS LADDER ONLINE
	

Table 3.4.B. Statement List Program

RUNG	STEP	INSTRUCTION	OPERAND	COMMENT
0	0	LD	0.00	STP 1
	1	AND NOT	10.03	X STP TLB A
	2	OUT	10.00	STP TLB A
1	3	LD	0.01	STP 2
	4	AND NOT	10.04	X STP TLB B
	5	OUT	10.01	STP TLB B
2	6	LD	0.02	STP 3
	7	AND NOT	10.05	X STP TLB C
	8	OUT	10.02	STP TLB C
3	9	LD	0.03	MODE BY PASS
	10	OUT	TR0	
	11	AND	0.04	SW 1
	12	OUT	10.03	X STP TLB A
	13	LD	TR0	
	14	AND	0.05	SW 2
	15	OUT	10.04	X STP TLB B

	16	LD	TR0	
	17	AND	0.06	SW 3
	18	OUT	10.05	X STP TLB C

3.4. HMI Modeling Program Development Planning

In this simulation using the Omron HMI with the CX Designer program. I / O adjusted to the CX Programmer's reference. Version used 3.2. In making this HMI, the initial display is in the form of information on the use of plans in existing programs.

HMI Interface Design. HMI should be easy to understand for operators who are not in their field so that they become accustomed to operating a system (Polakow, 2008).

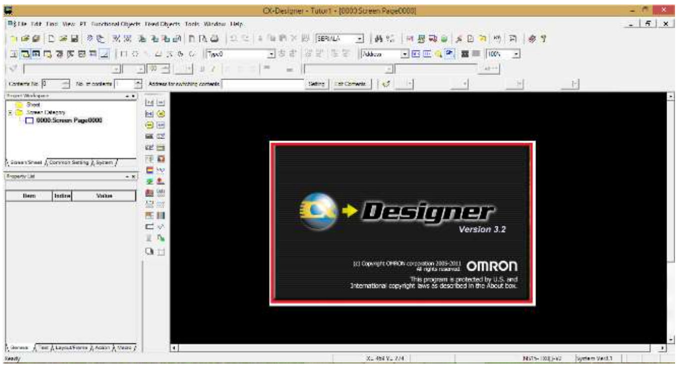


Figure 3.4.A. Work Online Simulator

Figure 3.4.B. Classroom Model

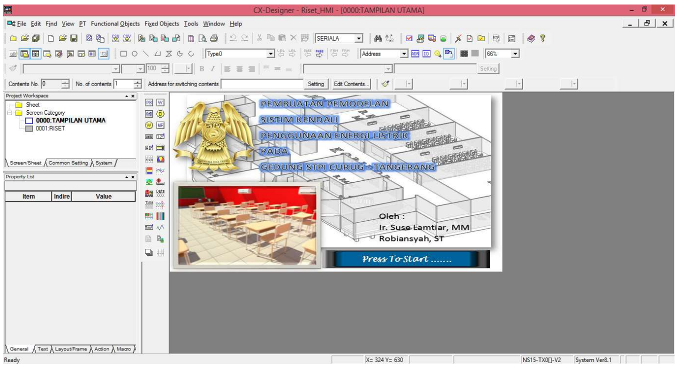


Figure 3.4.C. Initial Display Before Operation

The initial display contains the title of the modeling program to be operated. Then after pressing Press To Start .... Then the screen will move to the next screen in the form of a control screen. This control screen is modeled on an electrical panel that will perform regulatory actions in the monitored classroom. For this, the screen modeled as a reference is 3 rooms Alfa, Bravo, and Carly with 3 color variant models to understand the operation.

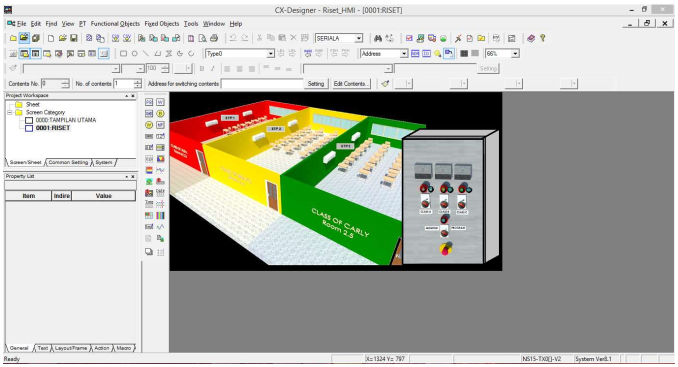


Figure 3.4.D. Main Display Virtual Operable Panel

V. Conclusion

In using electrical energy efficiently requires a precise and accurate observation system so that it will give orders to controllers that have been designed. Determination of the correct input parameters is very important in the process of controlling this electrical energy. The use of PLC in this study has gone through a series of simulations and applications with ideas based on observations of daily activities in the Indonesian aeronautical engineering building.

Cadets as subject actors in the input and the object is the use of electrical energy which they can freely use directly. Negligence occurs when they leave the room without turning off the use of electrical energy, so it can be eliminated by the addition of an electrical energy control system using a PLC (Programmable Logic Control). It is hoped that this control system will be a solution to problems that often occur in aeronautical engineering buildings so that the use of electrical energy becomes more efficient.

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