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Freight elevators controlling four floors with Zelio PLC SR3B261FU and VSD ATV71Lift for Saving Energy Universitas PGRI Semarang

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Abstract
In designing the program using the freight elevator control function block diagram (FBD) of Zelio Soft 2 schneider electric. If the simulation is produced according to design the program results can be downloaded into a Zelio smart relay SR3B261FU type. In the design used four key objectives in accordance with the purpose of positioning the floor or desired. To move the elevator up or down just used an electric motor which can rotate forward and reverse. Power circuit serves as an interface between PLC Zelio motor and the motor lift door. The length of time the elevator doors open when the lift stop is 2 seconds, and the length of the door shut again within 5 seconds. In the design of the power circuit device uses VSD (variable speed drive) which serves to regulate the speed of the motor of the elevator, so when almost reached certain goals lift running slower and stop right at the destination floor. VSD in addition serves to adjust the speed of the motor, it also serves for braking the motor of the elevator. VSD is used to set the motor forward and reverse rotation alternately. Programs that have been created can be simulated in advance before being downloaded into the Zelio PLC device, so that errors can be known from the beginning of the program. The use of PLC and VSD generate electric power saving in the use of the lift.

Keywords: Zelio PLC, FBD Program, VSD

1. Introduction
In the face of the Era of technological development, technology plays a very important, especially buildings that have a lot of raised floor in need of transportation to move from one floor to another. The aim is to facilitate the activities that they require an efficient ladder, man created a tool called lift. The elevator is widely used in offices, malls, and hospitality. Universitas PGRI Semarang is a campus that has a multi-storey building, that used a tool of transportation between floors right vertical efficiently. It will be a challenge for industry experts elevator or lift in developing technology elevator equipment, especially in the elevator control system. Lift using the engine power to be able to move between floors in a high rise building over three floors. In addition it is commonly used as a means of transportation escalator inside the building. The greater the number of floors or the higher the building, the elevator control system is becoming increasingly complex. The lift in order to work well using sensors, actuators and control system that serves to control the performance of the lift. Lift installation work is part of a building mechanical works. The more the number of floors that is served has a tendency to increasingly complex control system. The elevator is a mechatronic system that consists of several sensors, actuators and a control system which controls operation of the lift. Design ME (Mechanical-Electrical) a multi-storey buildings, often involving the design of this vertical transportation equipment.
For people who live in big cities and buildings, elevators have become an integral part in the lives of the faithful to do the job. The elevator used to lift or lower goods or persons. Model hydraulic lift and brace are two types of lifts or elevators in use today. The main design by considering the traction motor or hydraulic systems, the number of people or goods, and frequency of use. The elevator is designed using the programmable logic controller with a Hall Effect sensor, with the aim to determine the position of the lift [10].
PLC can be used to replace conventional elevator systems, making it energy efficient electrical and function automatically, safe and reliable. lift system using a variety of functions from the PLC, to create the interlock function to the PLC program. The lifts were used as a means of vertical transport for lifting loads of potential energy, is in need of start and stop modes. Traditional relay control techniques were replaced by PLC control method, which can gradually replace the DC speed control system into AC speed regulation. By developing a system of lifts, safety has become more important. Except to place a limit switch and the necessary self-locking program into several main drive circuit, this program also must be equipped with safety procedures [11].
Zelio PLC is a group of Schneider Electric. A PLC (Programmable Logic Controller) is in principle a digital computer used for control in an industrial process. In contrast to regular computers, the PLC is designed as a tool of control that has many advantages when compared to conventional control device, for example, the number of input and output lines, can work at higher temperatures, immunity to electrical noise, and resistance to vibration. PLC programs are stored in a memory that is not easily lost. PLC is a control device whose output can be produced in response to an input in a limited time span. PLC was created to replace the conventional control system, which still uses hundreds or thousands of relays, timers [9].

2. Methodology
2.1 System Lift
To design the lift prior to implementation on the ground in

need of a lift control simulation and visualization. This is due to a number of floors in a building, so that the lift has been designed to reach the floor of its target more quickly. It will be a challenge for experts in developing technology lift elevator equipment, especially in the control system. The general requirement lift / elevator is as follows:

- Building over 3 floors must be equipped with a lift.
- If using traction system, the minimum dimensions of the cable digunkan 12 mm.
- The number of cable at least 3 pieces.
- Bearer beams of steel / concrete.
- Rel lift of steel materials.
- When operating the elevator room should be sealed.
- Inlets only one elevator can not be more.
- Distance edge cabin lift the edges of the floor up to 4 cm.
- Each lift must have a motor and control panel it self.
- Basic lift shafts must have a watertight foundation.
- The automatic doors.
- Clear control panel on the cabin.
- The engine room lift has a minimum height of 2.1 m, protected from lightning, water, fire.

Lift by function can be divided into four, namely:

a) The passenger lifts, (passanger elevators) used to transport human beings.
b) Freight elevators are used to transport goods.
c) Dumb waiters.
d) Lift the fire department (usually serves at once as a freight elevator).

Fig 1: Freight elevators.

Lifts or elevators use part of the building volume which will determine the efficiency of the building. Elevator service quality criteria are:

a. Time to wait (interval, waiting time).
b. The carrying capacity (Handling Capacity).
c. The travel time back and forth lift (round trip time).

Waiting time equal to the time traveling back and forth divided by the number of lifts. The waiting time is also very variable terantung types of buildings. As an example

- Office 25-45 seconds.
- Flat 50-120 seconds.
- Hotel 40-70 seconds.
- Dormitory 60-80 seconds.

The minimum wait time is equal to the discharge time the elevator or lift capacity x 1.5 seconds per passenger. Lift carrying capacity depends on the capacity and frequency of loads too. Standard haulage lift measured for a period of 5 minutes rush hours (rush-hour hour). Haulage 1 lift in 5 minutes is:

$$M = (5 \times 60 \times m) / w \text{ or } M = (5 \times 60 \times m) / T \qquad (1)$$

Where

m = lift capacity (people) and a carrying capacity of 75 kg / person

w = Time to wait (waitingtime / interval) in seconds (T / N).

Round Trip Time can be measured approach, because the elevator ride every floor certainly would not be up to speed lift capability itself and on the elevator ride non-stop, new capabilities speed is reached after the lift moving some first floor. Time travel back and forth elevator consists of:

- Sign lift on the ground floor of 1.5 m sec.
- The elevator doors close again 2 seconds.
- The elevator doors open on each floor level (n-1) 2 seconds.
- Leaving the elevator on each floor in the first zone as much as (n-1) floor is [(N-1) × m / (n-1) x 1.5 seconds] 1.5 m sec
- The elevator door closed back in on each floor level is (n-2) 2 seconds.
- The trip back and forth in the first zone is (2 (n-1) h) / s second.
- The door opened on the ground floor of 2 seconds.

2.2 Elevator Control System

In designing the freight elevator control simulation using the program function block diagram (FBD) of Zelio Soft 2 schneider electric. If the simulation is produced according to design the program results can be downloaded in to a Zelio smart relay SR3B261FU type. The design simulation freight elevator controllers are used to transport goods on a four-storey building is shown in the figure 2.

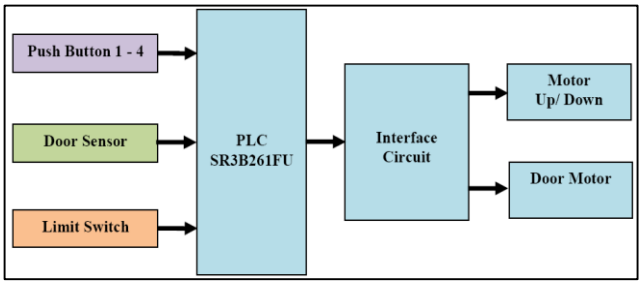

Fig 2: Block diagram of the design of the freight elevator controller.

In the design used four key objectives in accordance with the purpose of positioning the floor or desired. Limit switches the sensor limits for each floor, while the door sensor serves to provide information on the motor door when the elevator stopped at a specific destination. To move the elevator up or down just used an electric motor which can rotate forward and reverse. Power circuit serves as an interface between PLC Zelio motor and the motor lift door.

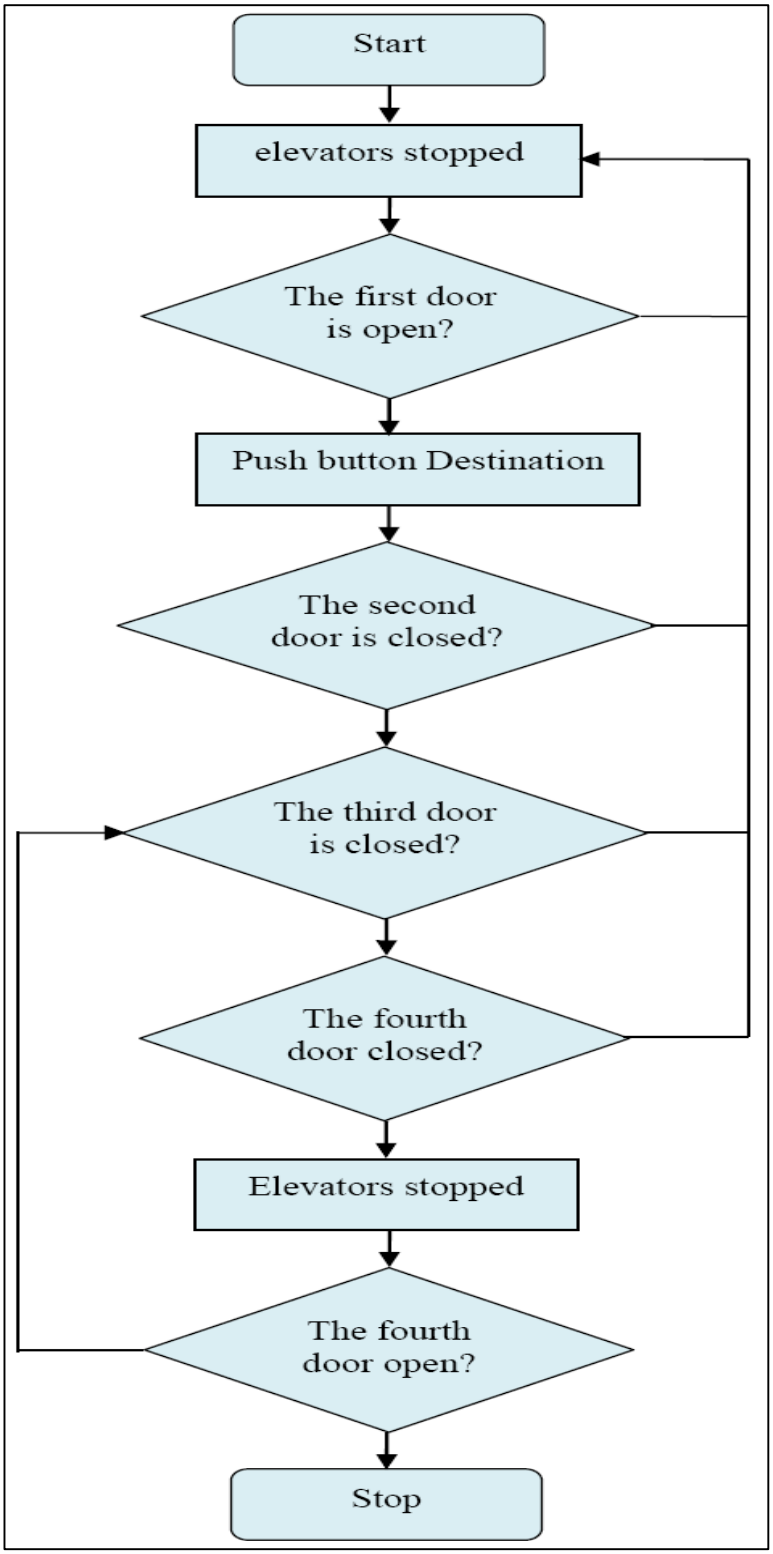

Fig 3: Flowchart programming elevators.

3. Results and Discussion

In this sumulasi program demonstrated the use of four key objectives (I1 - I4), four sensor limit switch (I5 - I8). For door sensor is shown using four sensors (IA - ID). At the time of initial conditions or stopped on the 1st floor, the motor of the elevator and the door motor controller has not received intimation of the AND gate.

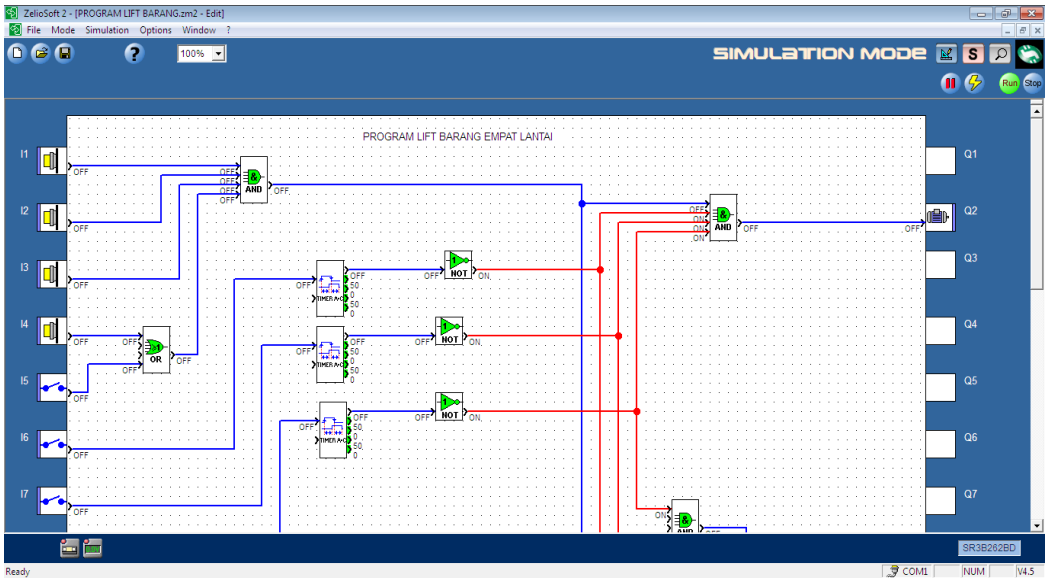

Fig 4: Program elevator stopped on the first floor.

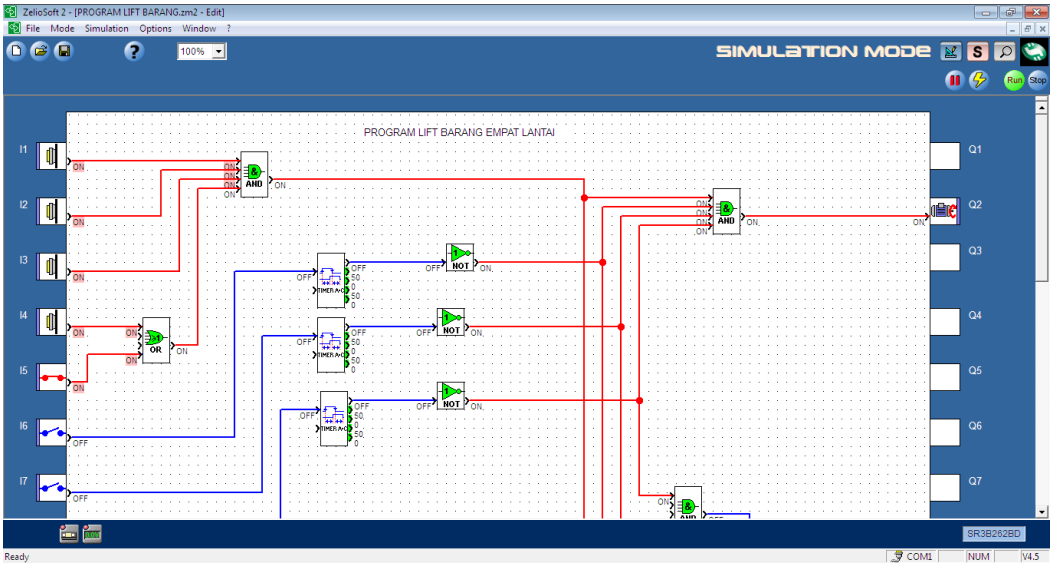

Fig 5: Program elevator stopped on the fourth floor.

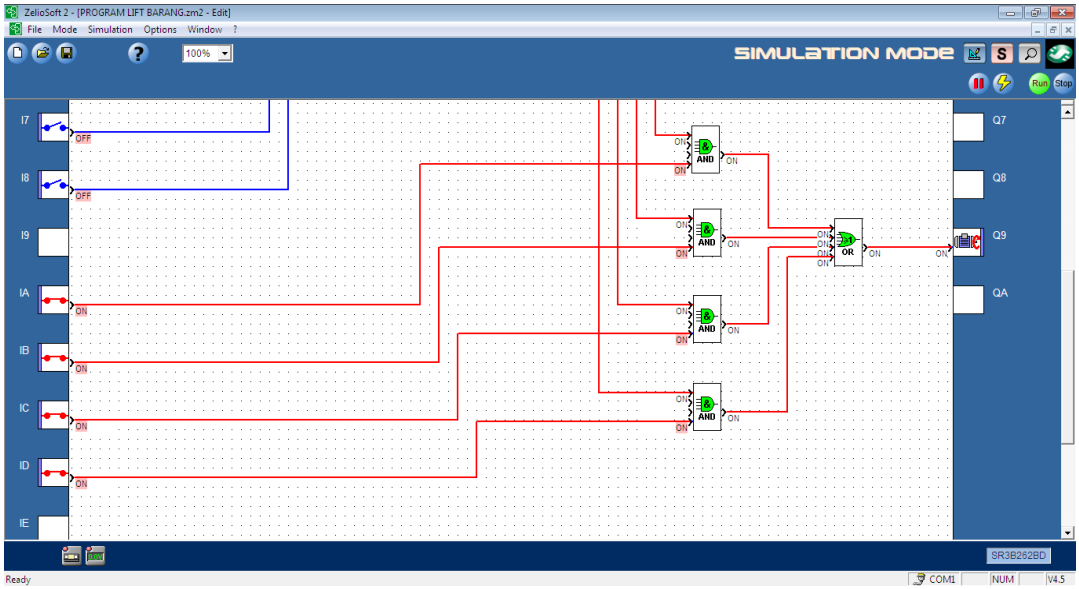

Fig 6: The program opens the door lift on the fourth floor.

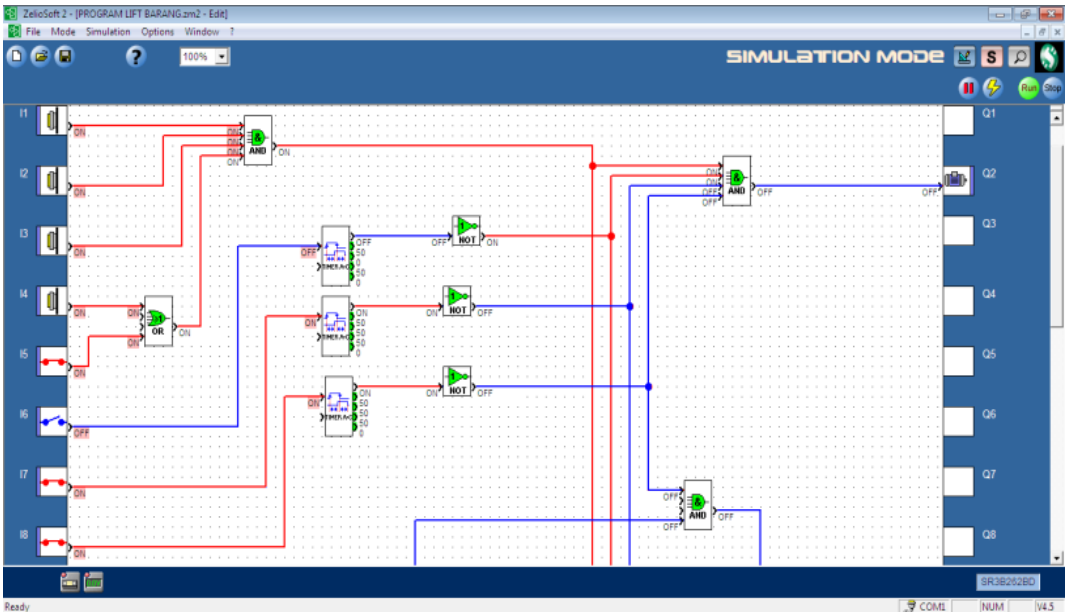

Fig 7: Program the elevator stopped on the second floor.

The lift doors on the 4th floor will be opened when the door sensor gives a signal (logic 1) at the gate, so that the output of the AND gate will give a cue to the motor of the door. The length of time the elevator doors open when the lift stop is 2 seconds, and the length of the door shut again within 5 seconds. Destination button can be used on every floor as the elevator doors are closed, because the door sensor will provide cues (logic 0) when the elevator door is still open.

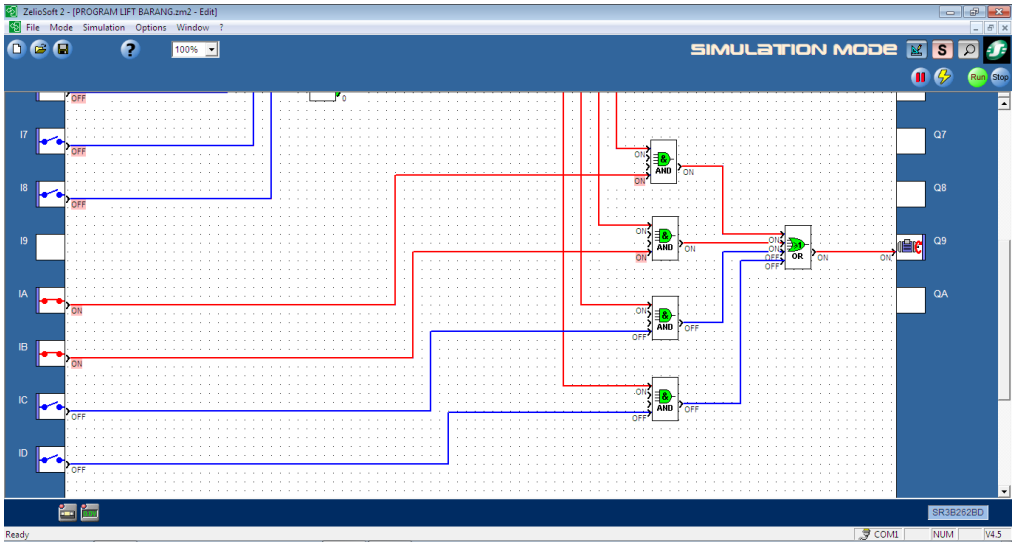

Fig 8: Program lift open the door on the 2nd floor.

Fig 9: Power circuit

In the design of the power circuit device uses VSD (variable speed drive) which serves to regulate the speed of the motor of the elevator, so when almost reached certain goals lift running slower and stop right at the destination floor. VSD in addition serves to adjust the speed of the motor, it also serves for braking the motor of the elevator. VSD is used to set the motor forward and reverse rotation alternately. As the VSD control center and other devices are PLC Zelio SR3B261FU.

4. Conclusion

Use of the program FBD (Function Block Diagram) Zelio Soft 2 controller facilitates the design of the freight elevator four floors. Programs that have been created can be simulated in advance before being downloaded into the Zelio PLC device, so that errors can be known from the beginning of the

program. Use of VSD in the implementation of four floors goods lift controller is able to save electrical energy consumption, in the process of setting up the motor of the elevator. Use of sensor limits (limit switch) and an infrared sensor able to provide information to the PLC Zelio, the process stops and open the elevator door. The need for the development of the elevator control by using a monitoring system, so that the occurrence of damage to the device and failure of the control process can be immediately known.

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