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# Development of a PLC-based 4-level lift simulator as a learning medium for electric motor installation

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**Abstract.** The development of industrial automation requires learning media that are relevant to the needs of the world of work, particularly for mastering Programmable Logic Controllers (PLCs) in vocational education. This study aims to develop a four-storey lift simulator based on Omron CP1E PLC as a learning medium for the Electric Motor Installation subject in class XII TITL at SMK Negeri 5 Medan. The research method used the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The research population consisted of 31 students using a total sampling technique. Data were obtained from questionnaires validated by media and subject-matter experts, as well as from student responses. The results showed that the media received a feasibility score of 89.3% from media experts and 92.5% from subject matter experts, categorised as highly feasible, and a student response score of 88.3%, categorised as very good. These findings indicate that PLC-based lift simulators are effective in improving students' understanding, motivation, and practical skills in industrial automation systems. The study recommends further development by integrating IoT or HMI to more closely resemble real industrial systems.

## Introduction

Advances in science and technology have spurred the adoption of automation systems across various sectors of society. Various automated devices, such as lifts, door control systems, and other industrial control systems, have become an important part of activities in high-rise buildings, offices, and shopping centres (Lai et al., 2024; Perrucci et al., 2025; Sugihartini & Swisnandy, 2025). Such automation systems are generally controlled by Programmable Logic Controllers (PLCs), which are devices with programmable memory that automatically execute operational logic, time control, calculations, and other control functions in real time (Zhang, 2022). PLCs also play an important role in collecting sensor data to optimise system performance and minimise machine downtime (Saxena et al., 2023).

Within vocational education, especially the Electrical Installation Engineering (TITL) programme in SMK, PLC proficiency is a crucial competency for meeting Industry 4.0 workforce demands. Mastery of PLC not only improves students' ability to operate input and output devices but also strengthens their readiness to meet workplace demands (Akmal et al., 2025). In addition, the successful implementation of vocational curricula depends heavily on the relevance of learning to industry needs (Ahmad et al., 2024).

However, based on observations and interviews with teachers at SMK Negeri 5 Medan, the teaching of Electric Motor Installation remains heavily theoretical and lacks adequate PLC-based practical media. The limited number of PLC devices means that not all students have the opportunity to gain hands-on experience. This situation has resulted in a low level of student understanding of PLC programming concepts and their application in industrial automation systems, such as lift systems, as well as a decline in student motivation to learn (Jannah & Rondli, 2023). In fact, learning media plays an important role in attracting students' attention, clarifying material, and increasing motivation to learn (Dewi et al., 2024; Syufrijal, 2020; Wibawa, 2025). One form of effective learning media is a prototype, which is a small-scale functional model of a real system (Renaningtias & Apriliani, 2021). The use of prototype-based media allows students to gain a more realistic and contextual learning experience.

Research by Chumchuen et al. (2025) shows that PLC-based learning can improve student motivation, active participation, and practical skills. The Omron CP1E PLC used in this study can efficiently control digital and analogue inputs and outputs Setiawan & Aji (2022) and is supported by CX-Programmer v9.7 software, which facilitates control program design. However, previous studies have generally focused on digital simulation or conventional PLC control systems without developing physical prototypes that fully represent real industrial systems. Several studies on PLC-based lift systems emphasise the technical aspects of control systems but have not yet been optimally integrated as a medium for structured practical learning in vocational education (Puspitasari et al., 2020; Qianyu & Yukun, 2023). This condition indicates a theoretical gap in the need for learning media that integrate PLC mastery with practical experience in realistic industrial automation systems.

Unlike previous studies, this study developed a four-storey lift simulator based on an Omron CP1E PLC, equipped with up-down algorithms, automatic and manual door controls, and visual and auditory indicators. This simulator is designed as a practical learning medium that integrates hardware, software, and automation control systems as a whole, thus better representing real industrial lift systems. Thus, this study emphasises not only the technical aspects of control systems but also their pedagogical role as a medium for vocational learning.

Based on this background, the research questions are: (1) how to design a four-storey PLC-based lift simulator as a learning medium for Electric Motor Installation, and (2) how feasible it is and how students respond to the use of this simulator. The hypothesis of this study is that the developed PLC-based lift simulator is a viable learning medium and can improve students' understanding and motivation to learn. The purpose of this study is to develop an Omron CP1E PLC-based lift simulator and to assess its feasibility and student response to its use as a learning medium in vocational schools.

## Method

### Research Methods and Design

This study utilised R&D (Research and Development) research. It also employed the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. The approach combines quantitative and qualitative data to produce comprehensive results in learning media development. The ADDIE model was chosen because it offers systematic, flexible stages that are well-suited to developing technology-based learning media.

## Population and Sampling Techniques

This research was conducted at SMKN 5 Medan in the XII TITL class, which had 31 students, located at Jl. Timor No. 36, Gaharu, Kec. Medan Tim., Kota Medan, North Sumatra 20235, and was carried out from December 2023 to January 2024. Subject teachers act as learning facilitators, while students act as users of learning media. The pilot test had a sample size of 10 students.

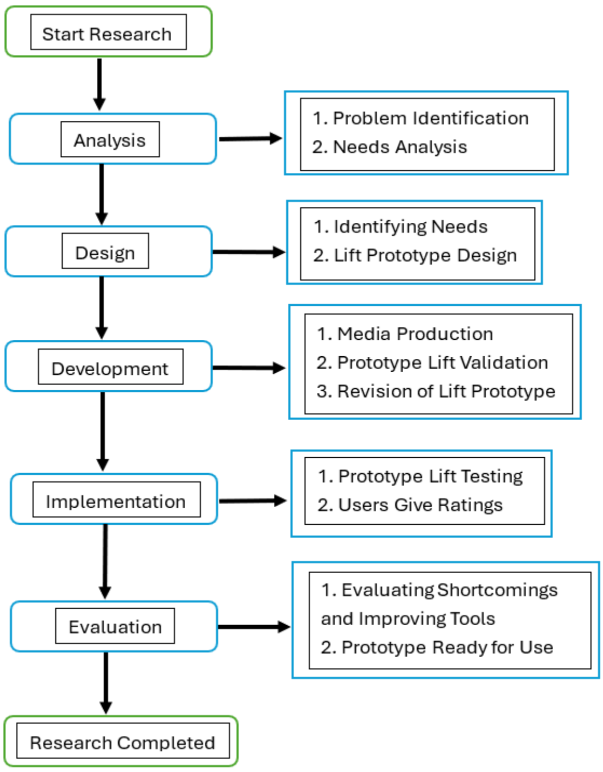


**Image 1**. Research Process Using the ADDIE Model

## Research Procedure

This study applied the ADDIE model. In the analysis stage, learning needs and field problems were identified. The design stage developed a PLC-based lift simulator. The development stage realized the design into a product. Implementation tested the simulator in the learning process. Evaluation was conducted through expert validation and measurement of student responses to assess the media's feasibility, effectiveness, and usability.

## Data Collection Techniques and Research Tools

**Table 1.** Data Collection Techniques and Research Instruments

| No. | Data Source | Collection Techniques | Instrument | Objective |
|---|---|---|---|---|
| 1. | Media Expert | Questionnaire | Media validation questionnaire | Assessing appearance, technical aspects, and learning |
| 2. | Subject Matter Expert | Questionnaire | Material validation questionnaire | Assessing aspects of instructional design and learning |

| No. | Data Source | Collection Techniques | Instrument | Objective |
|---|---|---|---|---|
| 3. | Student | Questionnaire | Student response questionnaire | Assessing aspects of design, operation, and usefulness. |
| 4. | Learning Process | Observation | Observation sheet | Observing the use of media in learning |

**Validity and Reliability Testing of Tools**

The validity of the instruments in this study was established through expert judgement, involving two subject-matter experts and one media expert. Validation was conducted to assess the suitability of indicators, clarity of language, and relevance of statements to the research objectives. The instrument's reliability was maintained through consistent indicators, uniform assessment scales, and consistent results across validators, making it feasible and reliable for research use.

**Data Analysis Techniques and Criteria**

This approach was chosen to enable the analysis results to describe both the numerical and descriptive aspects of learning media development (Adeoye et al., 2024). Qualitative analysis was used to interpret the results of observations, interviews, and input from media and subject matter experts to refine the simulator. Quantitative analysis was used to assess the suitability of the media and to analyze student responses from questionnaires. Qualitative data were converted into quantitative data using a four-level scale, namely highly suitable = 4, suitable = 3, moderately suitable = 2, and unsuitable = 1 (Andhany & Maysarah, 2023; Widana et al., 2023). A scale is used for user responses: very good = 4, good = 3, fairly good = 2, not very good = 1 (Akbari & Wiyatmono, 2023). The scores are then converted into percentages using a linear interpolation formula:

$$P = \frac{(X - X_{min})}{(X_{max} - X_{min})} \times 100\ \%$$

The percentage for each aspect is added up and averaged to obtain the media suitability percentage:

$$P_{suitability} = \frac{\sum_{i=1}^{n} P_i}{n}$$

The results of the calculations were interpreted based on predetermined eligibility criteria, and student responses were calculated using the same percentage formula as in Table 2.

**Product Specifications**

The product developed is a four-storey lift simulator based on PLC as a learning medium for installing electric motors. The simulator consists of a mechanical frame, drive motor, limit sensors, control panel, visual indicators, and automatic and manual door systems. The system is controlled by an Omron CP1E PLC programmed in CX-Programmer, enabling it to model the working principles of lifts in real-world settings during practical learning activities.

## Results and Discussion

Based on the literature review and the identified problems, the design of the learning media in this article went through several stages. These stages were integrated with the ADDIE model, which will be explained in more detail in the following discussion:

**Analysis**
The results of teacher observations and interviews indicate that learning remains theory-oriented, lacking adequate practical media support. The availability of PLC devices is very limited, so hands-on training is uneven. The school does not yet have PLC simulators that represent industrial automatic controls, such as lifts, so students' understanding and motivation have decreased significantly. Given these conditions, there is a need for learning media that bridge theory and practice, are interactive, and are relevant to industry (Prinanda, 2025). The Omron CP1E PLC was chosen because it is already used in schools and is commonly used in industry. The media developed is a four-level PLC-based lift simulator designed to help students understand the working principles of automatic systems, practise PLC programming, and improve their motivation and learning outcomes in the subject of Electric Motor Installation.

**Design**
The design planning stage is used to define the form and function of the PLC-based lift simulator before manufacturing begins. This stage involves designing integrated mechanical, electrical, and software systems to ensure the simulator meets its learning objectives.

**Mechanical Design**
On the mechanical side, a four-storey lift prototype was developed, equipped with a drive motor, limit switch, and control buttons on each floor. The design resembled a lift but was laboratory-scale. The frame construction began with preparing manual-sized sketches. Once the dimensions were determined, 1-metre-long angle iron was cut to form the main foundation. The structure consisted of four support pillars, each 1 metre high, 25 cm wide, and 20 cm long. The 20×50×40 cm control panel serves as both a support and a control housing for the PLC and power supply. The lift track is made of 2.5-inch PVC pipes that are installed. Skids, pull ropes, motors, and counterweights maintain stability during movement.

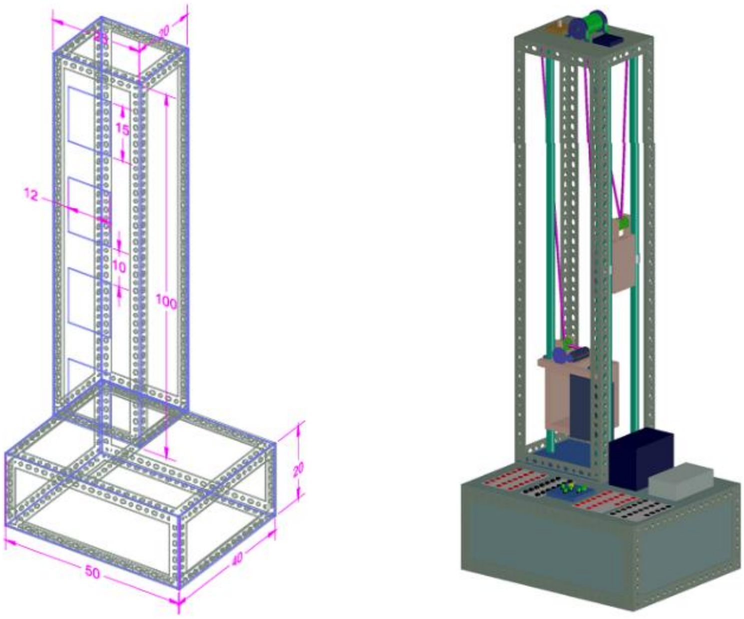


**Image 2.** Prototype Lift Size and Lift Track Construction

The lift cabin was constructed with dimensions of 15 cm high, 12 cm wide, and 12 cm long. The cabin design was first created manually, followed by the construction of the cabin frame. To ensure that the cabin was aligned with the lift floor door, a metal plate was installed at the rear of the cabin as a marker for the proximity sensor. The cabin's distance was adjusted based on the sensor reading, so it stopped right in front of the lift door.

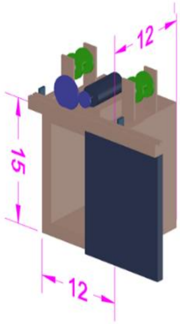


**Image 3.** Lift Cabin Size

The control panel is designed using plywood boards cut to the initial planned dimensions, with additional adjustments for data source and system connectivity requirements. Special holes are provided for installing the connector pin. The four-storey lift prototype control panel has 71 terminal ports, comprising 34 on the lift circuit and 37 on the PLC. The panel box serves as the centre for PLC and power supply integration, as well as for protecting electrical components. The installation stage includes control buttons, limit switches, sensors, indicators, bells, and lights. Position indicators are installed on each floor. Each floor is equipped with two indicator lights: a green light to indicate an active floor and a yellow light to indicate the cabin's standby position. The destination button and the door open-close button are installed inside the cabin. Floor call buttons numbered one to four are used to select the destination. Limit switches on the first and fourth floors serve to stop the motor at the upper and lower limits. A buzzer is placed in the cabin to signal the arrival of the lift.

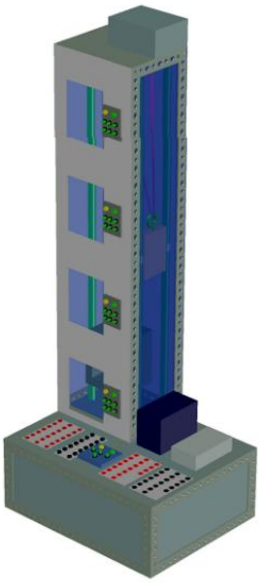

**Image 4.** 4-Level Lift Prototype Design

The drive motor in the lift cabin is located at the top of the main lift enclosure and uses a 12 VDC motor. This motor is equipped with rollers and ropes connected to the lift cabin. To open and close the doors, an additional 12 VDC motor is installed on the top side of the cabin. Both the main motor and the door motor are controlled by a speed controller that can be adjusted as needed. Changes in the direction of motor movement, both forward and reverse, are regulated using a relay.

**Electric Design**

Regarding electrical aspects, a wiring diagram was designed to connect the Omron CP1E PLC to all components, including motors, sensors, and indicators. The aim was to ensure the system could operate automatically based on the program created. This circuit is an automatic lift control system that uses the OMRON CP1E-N40 DRA PLC as its control centre.

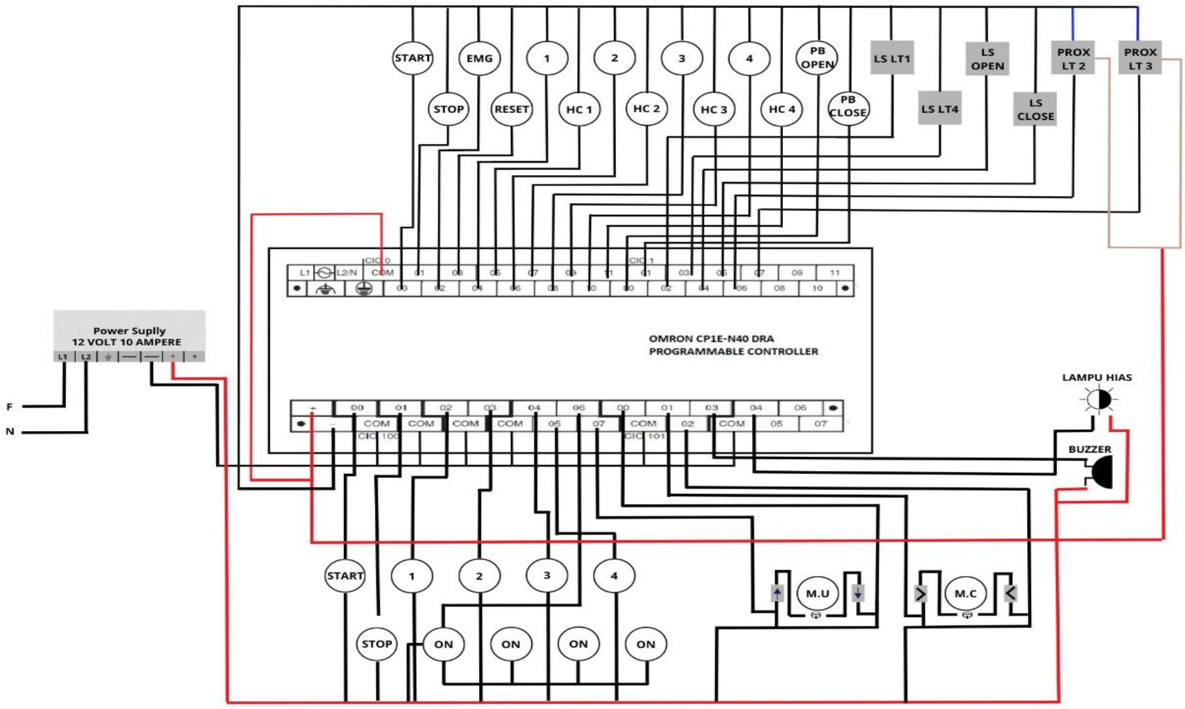


**Image 5.** Wiring Diagram

This system uses various input and output components interconnected to regulate the lift's movement and safety. The main power source is a 12-volt, 10-ampere power supply that supplies DC voltage to the circuit and PLC. This system is designed so that each commands entering the PLC are processed according to pre-programmed logic. Inputs and outputs are connected according to the PLC addresses to prevent errors in commands (Permatasari et al., 2023). Overall, this series demonstrates how an automatic lift system with PLC-based control operates safely, efficiently, and easily. The system is equipped with safety components, including emergency buttons, limit switches, and position sensors, to ensure safe lift operation. The design of this circuit is the core of the Omron CP1E-N40 DRA PLC-based four-storey lift simulator, integrating all inputs, controllers, and outputs for automatic and manual operation. Its main component is a 12V 10A power supply to the PLC and all control devices. This system has PLC inputs from START, STOP, and RESET buttons to control operations, as well as an emergency button (EMG) for safety. The system is also equipped with buttons for floors 1-4, OPEN/CLOSE buttons to control the doors, limit switches, and proximity sensors on each floor to detect the cabin's position. The system outputs include cabin and door drive motors, indicator lights, and audible alarms. The integration of all components enables the simulator to represent real lift operations safely and efficiently as a vocational learning medium. Naming inputs and outputs helps users understand the system's assembly and operation.

**Table 2.** Input and Output Naming

| No. | Input | Description | Output | Description |
|---|---|---|---|---|
| 1. | PB LT1 | Destination Button Floor 1 | M.UP | Upward drive motor |
| 2. | PB UP LT2 | Floor 2 Up button | M.DOWN | Drive motor Down |
| 3. | PB Down LT2 | Floor 2 Down button | M. OPEN | Lift door motor Open |
| 4. | PB LT3 | Floor 3 Destination Button | M. CLOSE | Lift door motor Close |
| 5. | PB UP LT3 | Floor 3 Up Button | BUZZER | Lift destination indicator |
| 6. | PB Down LT3 | Floor 3 Destination Button Down | I. LT1 | LT 1 indicator |
| 7. | PB LT 4 | Floor 4 Destination Button | I. LT2 | LT 2 indicator |
| 8. | PB HC LT1 | HC Button 1st Floor | I. LT3 | LT 3 indicator |
| 9. | PB HC UP LT2 | HC Button 2nd Floor Up | I. LT4 | LT 4 indicator |
| 10. | PB HC UP LT3 | HC Button 3rd Floor Up | LED LT1 | HC LT 1 indicator |
| 11. | PB HC LT 4 | HC Button 4th Floor | LED LT2 | HC LT 2 indicator |
| 12. | Ls LT1 | Limit switch Floor 1 | LED LT3 | HC LT 3 indicator |
| 13. | Ls LT4 | Floor 4 Limit Switch | LED LT 4 | HC LT 4 indicator |
| 14. | Proximity UP LT2 | Proximity 2nd floor Up | I. START | Start light indicator |
| 15. | Proximity Down LT2 | Proximity 2nd floor Down | I. STOP | Stop light indicator |
| 16. | Proximity UP LT3 | Proximity 3rd Floor Up | I. ON | ON light indicator |
| 17. | Proximity Down LT3 | Proximity 3rd Floor Down | I. Decoration | Decorative light indicator |
| 18. | Ls LT 4 | Floor 4 Limit Switch | | |
| 19. | Ls Open | Door open limit switch | | |
| 20. | LS Close | Door close limit switch | | |
| 21. | PB Emergency | Emergency button | | |
| 22. | PB Open | Door open button | | |
| 23. | PB Close | Door close button | | |
| 24. | PB START | System Activation Button | | |
| 25. | PB STOP | System Deactivation Button | | |
| 26. | PB RESET | System Reset Button | | |

The table explains the relationship between input and output components in the Omron CP1E-N40 DRA PLC-based four-level lift simulator. Each component has a specific role in controlling automatic lift operations. Inputs from push buttons, limit switches, and proximity sensors serve as signals to the PLC, while outputs control actuators and indicators. This relationship forms an integrated control system that efficiently represents the performance of a real lift.

**Software Design**

In terms of software, the programme logic was designed using CX-Programmer v9.7 software (Rosyady & Indriyanto, 2022). This programme is designed to control the lift's up-and-down movement, door operation, and floor indicators using an Omron CP1E PLC on a four-storey lift prototype. The staircase diagram serves as the main control system, regulating the lift's operation from receiving button signals to activating the motor and doors. Each floor button serves as input to the PLC, which determines the cabin's direction of movement. Limit switches detect the cabin's position and stop the motor when the destination is reached. The system then automatically operates the doors and indicators. Testing shows that all inputs and outputs work optimally. Interlock logic ensures that the motors do not move in opposite directions simultaneously, keeping lift operation safe, stable, and in accordance with the system design. There are several command stages to ensure the lift operates as intended. The algorithms for the 4-level lift are as follows:

### Door Open and Close Algorithm

When the lift is in standby mode, press the desired floor button, and the lift will move to that floor. When it reaches the destination floor and is detected by the limit switch or proximity sensor, the lift will stop automatically. After a few moments, the lift doors will open automatically. To close the doors, press the PB Close button; to open the doors manually, press PB Open. In Image 6, when the lift is in standby mode, the user selects the floor using PB Destination. The lift moves and stops automatically at the destination floor when the sensor detects its position. After a pause, the doors open automatically.

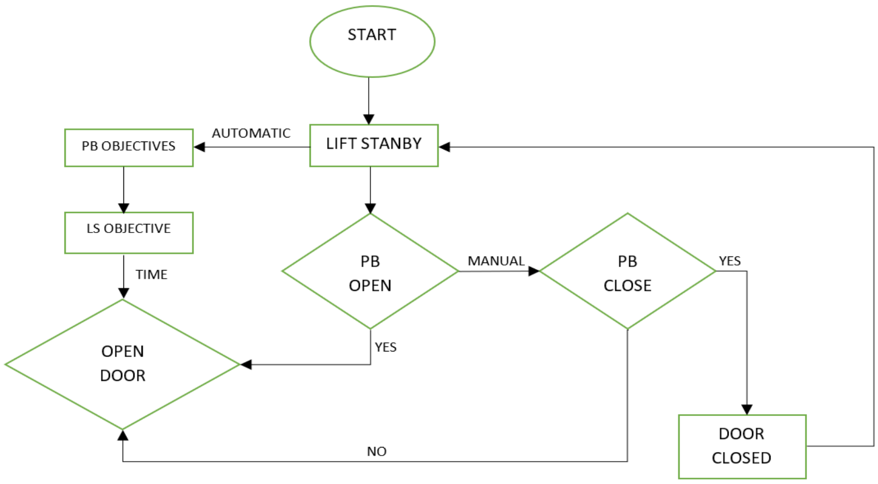


**Image 6.** Door Open and Close Algorithm

The doors can also be opened/closed manually using PB Open/Close. After the doors close, the system returns to standby for the next command. This algorithm demonstrates that the door opening and closing process can be performed automatically or manually with a safe and efficient control system (Sutrisno et al., 2022).

### Algorithm for Going Up and Down in a Lift

When the lift cabin is on the first floor (LT1), the LT1 indicator lights up because the limit switch is activated. When the LT2 destination button is pressed, the drive motor moves the cabin upward until it reaches LT2. After the sensor detects the cabin's position on that floor, the PLC stops the motor, activates the automatic door opening, turns on the LT2 indicator, and sounds a bell to signal arrival. To continue operation to the next floor, the user must press the PB Open and PB Close buttons as a system prerequisite. The same procedure applies to movements from LT2 to LT3 and from LT3 to LT4. Each arrival at the destination floor is signalled to the PLC, which stops the motor, opens the doors, and activates the indicator and buzzer. When moving from LT4 to LT3, LT3 to LT2, and LT2 to LT1, the system operates on a similar principle: the motor's rotation is adjusted to match the direction of movement. The entire process is controlled by ladder logic, ensuring the lift operates stably and safely, resembling a real industrial system.

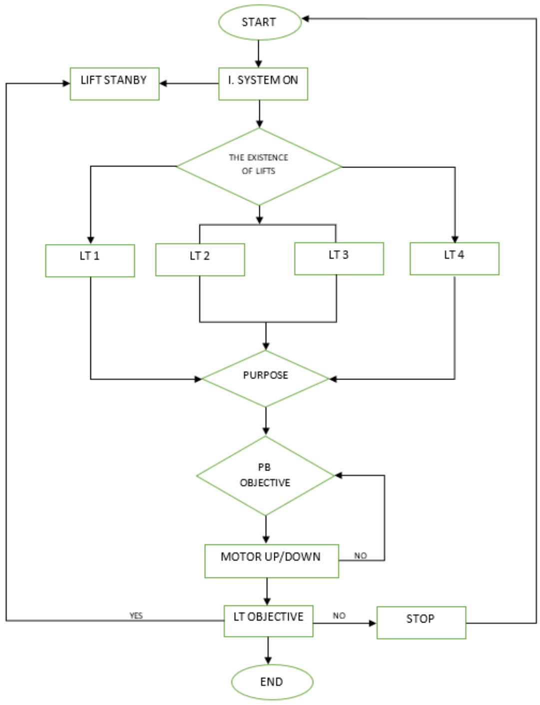


**Image 7.** Up and Down Lift Algorithm

The flow diagram in Image 7 illustrates the main control flow of a four-storey PLC-based lift, starting from the START condition to the receipt of the destination command. This flow is consistent with research by Khatun et al. (2025), Wang & Jiang (2021), and Jatmika et al. (2025). It also supports automatic lift dispatching using priority logic to optimise the system, which aligns with the direction selection mechanism based on call buttons and lift positions shown in the flowchart.

## Call and Destination Lift Algorithm

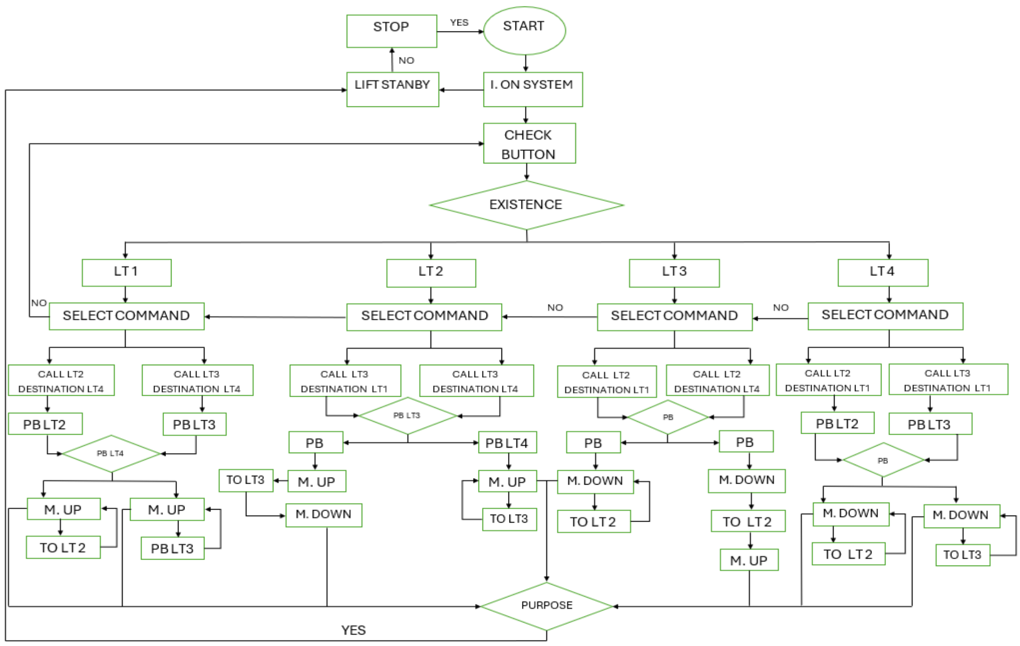


**Image 8.** Lift Caller and Destination Algorithm

The lift call and destination selection algorithm describes the mechanism of the system when a user calls a cabin from a floor and specifies the destination floor. When the lift is at LT1, the position indicator lights up to indicate the location of the cabin. If the call button from another floor is activated, the PLC controls the motor to move the cabin to that floor. Once the sensor or limit switch detects the cabin's presence on the destination floor, the system stops the motor and automatically opens the doors. Further movement is not permitted until the user presses the PB Open and PB Close buttons to close the doors. The lift then automatically continues its journey to the selected floor. This procedure applies to all directions of movement, both up and down. During operation, indicator lights and audible bells are active as information signals. Based on the flow diagram, the PLC adjusts the motor rotation direction, namely M.UP for destinations above and M.DOWN for destinations below. After reaching the destination floor, the system returns to standby mode, ensuring that lift operations are stable, safe, structured, realistic, and effective as a learning medium for PLC-based industrial control laboratories.

**Development**

The development stage aims to realise the design into a four-storey lift simulator based on Omron CP1E PLC as a learning medium. At this stage, the mechanical, electrical, and software designs are realised in a functional prototype by assembling motors, sensors, control buttons, indicator panels, and PLC-integrated lift frames. The program is developed using CX-Programmer 9.7 to regulate the movement of the cabin and automatic doors. Subsequently, functional testing, expert validation, revision, and media implementation are carried out. According to Puspitasari et al. (2020), PLC-based learning media, such as lift simulators, have been shown to improve vocational school students' practical skills and conceptual understanding of industrial automation. This is also reinforced by research (Qianyu & Yukun, 2023).

**Image 9.** General Construction of Lift Prototype

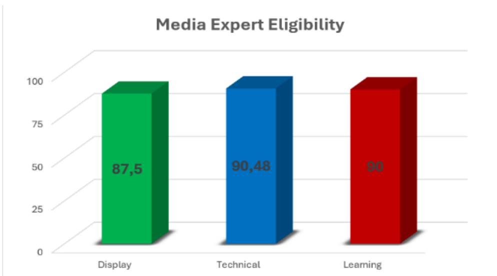


**Image 10.** Media Expert Eligibility

Based on the image above, the appearance aspect received a score of 87.5, technical aspect 90.48, and learning aspect 90, all of which are classified as very good, with the highest score in the technical aspect. This indicates that the developed media has an attractive appearance, good technical performance, and supports learning effectively.


**Image 11.** Subject Matter Expert Qualification

Overall, both experts rated the product highly suitable, with all scores above 85. The increase in scores from the first expert to the second indicates an improvement in the product's quality, particularly in design and learning content, making the media highly suitable for the learning process.

**Implementation**

The implementation stage was carried out after the four-storey PLC-based lift simulator was declared feasible by media and material experts. This stage aimed to test the use of media and to obtain students' responses on its effectiveness. The simulator was used in the Electric Motor Installation class XII TITL at SMK Negeri 5 Medan, with the teacher as the facilitator. Students operated the simulator based on worksheets to learn the PLC control system. Observations and questionnaires were used to assess understanding, skills, and media effectiveness prior to evaluation. The implementation results showed that using PLC-based lift simulators as practical tools improved vocational school students' logical thinking and programming skills by providing direct experience applying ladder logic and sensory systems (Rakhman et al., 2024; Sunarja & Maharani, 2023).

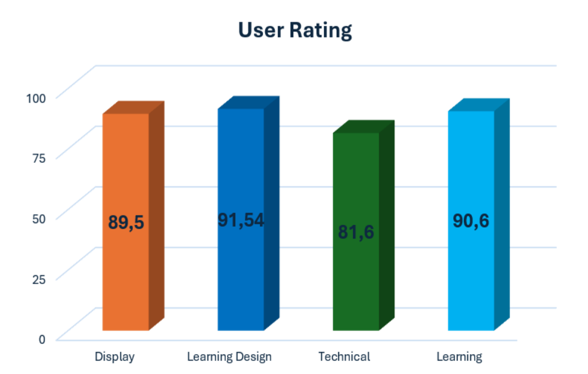


**Image 12.** User Rating

Based on the graph above, the Learning Design aspect received the highest score of 91.54, followed by Learning at 90.6. Appearance also received a good score of 89.5. However, Technical received the lowest score of 81.6, which indicates room for improvement in technical aspects. Overall, the quality of the design and learning is already very good, but the technical aspect needs improvement.

**Evaluation**

The evaluation stage was conducted after the Omron CP1E PLC-based four-storey lift simulator learning media were used in the classroom. This evaluation aimed to assess the suitability of the media and user responses based on direct usage experience. The assessment was conducted using two instruments: expert validation and student response questionnaires. The validation involved two subject matter experts and one media expert. The subject matter experts assessed the content's alignment with the basic competencies of the Electric Motor Installation subject, the accuracy of the concepts, and its relevance to industry needs. The media experts evaluated the tool's appearance, component clarity, ease of operation, and safety. The validation results showed a feasibility level of 92.5% among subject matter experts and 92.5% among media experts, which is classified as highly feasible. These findings indicate that the media have an attractive design, a stable system, and materials aligned with the learning objectives. In addition, the student questionnaire received an average score of 92.5% in the very good category. Students rated the media as easy to use, helpful in understanding PLC concepts, and enhancing learning interactivity. Overall, the evaluation proves that the media is effective and feasible for use as a practical tool in the Electric Motor Installation subject at SMK Negeri 5 Medan.

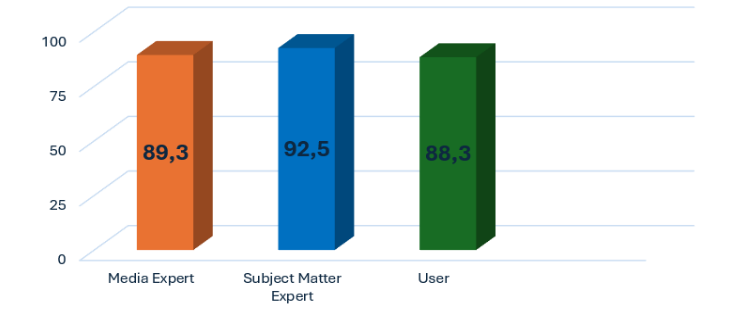


**Image 13.** Feasibility Results from Media Experts, Subject Matter Experts, and Users

The validation results from image 13 show that the developed learning media obtained a feasibility score of 89.3 from media experts and 92.5 from subject matter experts, categorised as 'Highly Feasible'. Student responses were also 'Very Good' with an average of 88.3, indicating that this simulator is easy to use, interesting, and helps students understand PLC-based automatic control systems.

**Research Limitations and Recommendations**

This study has limitations because the media trial involved only one Year 12 TITL class at one school, so the generalisability of the findings remains low. In addition, the effectiveness of the media has not been compared with other learning methods through a quantitative experimental approach. Therefore, further research is recommended that involves a broader sample, uses an experimental design, and statistically analyzes improvements in learning outcomes. The uniqueness of this study lies in the development of a four-storey lift simulator based on an Omron CP1E PLC, implemented as a physical prototype that represents a real industrial system and integrates mechanical, electrical, and programming aspects into the learning process. These findings are consistent with previous research, Puspitasari et al. (2020) and Qianyu & Yukun (2023), that PLC-based media can improve understanding of industrial automation concepts, but this study expands on these findings by presenting contextual learning media based on real lift systems, rather than just digital simulations or conventional PLC systems. Thus, this study makes a new contribution to the development of PLC learning media based on industrial prototypes that are more applicable and relevant to the needs of the world of work.

**Theoretical and Practical Impacts**

Theoretically, this study supports the idea that physical prototype-based learning media can enhance the effectiveness of vocational learning through contextual and experiential approaches. In practice, this PLC-based lift simulator can be used as standard learning media in vocational schools to improve PLC programming skills, understanding of automatic control systems, and students' readiness to enter the industrial world. This media can also serve as a reference for developing other industry-based PLC trainers.

## Conclusion

This study successfully developed a learning medium in the form of a four-storey lift simulator based on Omron CP1E PLC, which is used to support practical learning in the Electric Motor Installation subject at SMK Negeri 5 Medan. The development was carried out using the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The feasibility test results showed that the media obtained an average score of 89.3 from media experts and 92.5 from subject matter experts, categorised as highly feasible, as well as a student response of 88.3, categorised as very good. This shows that the developed simulator has an attractive appearance, is easy to use, and can improve students' understanding of PLC-based automatic control systems. Using this simulator, students gain an interactive, practical learning experience, not only understanding the theory but also directly practising the working principles of automation systems. The study's results show that this medium is effective in increasing students' learning motivation, conceptual understanding, and PLC programming skills. Thus, this simulator is deemed feasible and effective as an innovative, practical learning medium in electrical engineering and industrial automation. In the future, it is recommended to integrate IoT or HMI systems into this media to make it more closely resemble actual industrial systems and to test it in other vocational schools.

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