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Development of Application EasyGuide CXPRO Using Android Studio for Centralised Reference for OMRON PLC Programmer

Mohamad Azizan Mohamad Said[1]*

[1]Department of Electrical Engineering, Politeknik Mukah, KM 7.5 Jalan Oya, 96400, Mukah, Sarawak, Malaysia

*Corresponding author: azizan@pmu.edu.my
Please provide an **official organisation email** of the corresponding author

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Abstract

Toward Industrial Revolution (IR4.0), industrial automation is one of the most growing parts nowadays. Programmable Logic Controller (PLC) are one of the reliable controllers to operate industrial system weather in small, medium, or heavy industry. Omron PLC using CX Programmer software are one of the famous PLC Brand that applied as controller in various industries. EasyGuide CXPRO developed using android studio for centralized guidance and reference for programmer to develop PLC program. Currently, there are too many resources needed to access to find information or guidance for different topics in CX Programmer. By using EasyGuide CXPRO, all the information and reference are centralized and can be accessed in offline mode by considering when the programmer are troubleshooting program at rural area where has no internet accessed. As a result, all information and reference regarding CX Programmer can be easily accessed in one android application.

Keywords: - Programmable Logic Controller, OMRON CX programmer, android apps

1. Introduction

Programmable Logic Controller (PLC) are one of the most reliable controllers to be used as controller in industries (J. Y. Chen, Tai & G. C. Chen, 2017). Features such as scalability, performance, stability, reliability, data security, and integration with other systems should be considered when deciding a suitable controller. Focusing on OMRON PLC, EasyGuide CXPRO developed using android studio as a part of guidance and reference for programmers to develop PLC program. Using the apps, programmer is easily to refer the information regarding the CX Programmer. EasyGuide OMRON CX Programmer consists of technical specification, software interfacing, connection guide, programming guide and others.

While designing ladder diagrams, basic knowledge for every part of function block is very important. This knowledge will guide the programmer to select suitable routine and subroutine for the program development.

Basic knowledge of Programmable Logic Controller is very important to become a good PLC Programmer. A programmable logic controller (PLC) is a special form of microprocessor-based controller that uses programmable memory to store instruction and to implement function such as logic, sequencing, timing, counting, and arithmetic to control machines and processes (Bolton, 2015) as shown in Fig. 1.

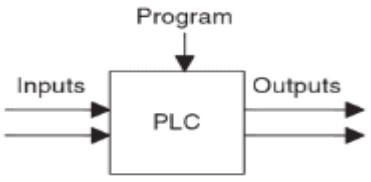


Fig. 1. Basic PLC structure

Currently, there are many diverse types of PLC such as modular, compact card-type PLC. Different types of PLC can also drive to different type of connection, programming language and capacity of memory. Even though they are diverse types of PLC brand, the structure of PLC is still the same. Typically, a PLC system has the basic functional components of processor unit, memory, power supply unit, input/output interface section, communications interface, and the programming device (Lashin, 2014) as shown in Fig. 2.

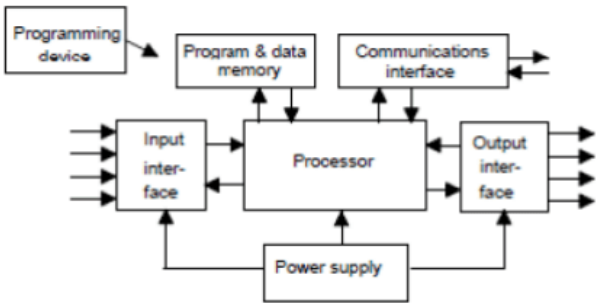


Fig. 2. PLC structure

Mobile and smart devices are very common today and becoming mandatory for everyone. One of the most common operating systems for these devices is Android (Kojo, 2021). Interactive study and interactive notes make learning easier (Agusty & Delianti, 2019). Every brand of PLC comes with their own software. For example, Siemens PLC uses TIA Portal as programming software, Mitsubishi PLC uses GX Works as programming software and Omron PLC use CX Programmer as programming software. Focusing on OMRON PLC, different models, and series will drive to different programming style.

CPM1/CPM1A The following memory areas can be used with the CPM1/CPM1A.

Data area		Words	Bits	Function
IR area[1]	Input area	IR 000 to IR 009 (10 words)	IR 00000 to IR 00915 (160 bits)	These bits are allocated to the external I/O terminals.
	Output area	IR 010 to IR 019 (10 words)	IR 01000 to IR 01915 (160 bits)	
	Work area	IR 200 to IR 231 (32 words)	IR 20000 to IR 23115 (512 bits)	Work bits can be freely used within the program.
SR area		SR 232 to SR 255 (24 words)	SR 23200 to SR 25515 (384 bits)	These bits serve specific functions such as flags and control bits.
TR area		---	TR 0 to TR 7 (8 bits)	These bits are used to temporarily store ON/OFF status at program branches.
HR area[2]		HR 00 to HR 19 (20 words)	HR 0000 to HR 1915 (320 bits)	These bits store data and retain their ON/OFF status when power is turned off, or operation starts or stops. They are used in the same way as work bits.
AR area[2]		AR 00 to AR 15 (16 words)	AR 0000 to AR 1515 (256 bits)	These bits serve specific functions such as flags and control bits.
LR area[1]		LR 00 to LR 15 (16 words)	LR 0000 to LR 1515 (256 bits)	Used for a 1:1 PC Link with another PC.
Timer/Counter area[2]		TC 000 to TC 127 (timer/counter numbers)[3]		Timers and counters use the TIM, TIMH(15), CNT and CNTR(12) instructions. The same numbers are used for both timers and counters.
DM area	Read/write[2]	DM 0000 to DM 0999 DM 1022 to DM 1023 (1,002 words)	---	DM area data can be accessed in word units only. Word values are retained when the power is turned off, or operation started or stopped. Read/write areas can be read and written freely within the program.
	Error log	DM 1000 to DM 1021 (22 words)	---	Used to store the time of occurrence and error code of errors that occur. These words can be used as ordinary read/write DM when the error log function is not being used.
	Read-only[4]	DM 6144 to DM 6599 (456 words)	---	Cannot be overwritten from program.
	PC Setup[4]	DM 6600 to DM 6655 (56 words)	---	Used to store various parameters that control PC operation.

Fig. 3. Memory areas OMRON PLC

2. Methodology

EasyGuide CXPRO are developed using android studio. The objective of development is to centralise all information, guidance, and reference for developing PLC program using software OMRON CX Programmer. All information and reference material are collected from various resources. The data and information then compiled and sorted.

2.1 Collect and Sorting Information Data

The process of collecting information data consists of referring to multiple resources. The two main references are the book from Bolton (2015) and manual data from manufacturer from OMRON. Information from the main sources has been simplified to minimise the time consuming for the user to find the selected information.

For example, when the user is confused on the data memory area, with simple click and selection, EasyGuide CXPRO will drive the user to the information needed.

2.2 Development of Android Studio Application

Android studio is one of the famous application development software. It is always the first choice among manufactures of TV consoles, gaming consoles, augmented reality system because it was open source and free (Craig & Gerber, 2015). Development of the EasyGuide CXPRO started with drafting the framework, sorting data, and designing interface system to make it user friendly.

Android Studio is an integrated development environment (IDE) for developing for the Android platform. It was announced on May 16, 2013, at the Google I/O conference by Google's Product Manager, Katherine Chou (Thamizharasi, 2016). Step for developing apps on android studio:

Step 1: Install Android Studio

Step 2: Open a New Project

1.Open Android Studio.
2. Under the "Quick Start" menu, select "Start a new Android Studio project."
3. On the "Create New Project" window that opens, name your project "HelloWorld".
4. If you choose to, set the company name as desired*. 5. Note where the project file location is and change it if desired.
6. Click "Next."
7. Make sure on that "Phone and Tablet" is the only box that is checked.
8. If you are planning to test the app on your phone, make sure the minimum SDK is below your phone's operating system level.
9. Click "Next."
10. Select "Blank Activity."
11. Click "Next."
12. Leave all of the Activity name fields as they are.
13. Click "Finish."

Step 3: Edit the Welcome Message in the Main Activity

1. Navigate to the activity_main.xml tab if it is not already open.

2. Make sure that the Design tab is open on the activity_main.xml display.
3. Click and drag the "Hello, world!" from the upper left corner of the phone display to the center of the screen.
4. In the project file system on the left side of the window, open the values folder.
5. In the values folder, double-click the strings.xml file.
6. In this file, find the line "Hello world!".
7. After the "Hello world!" message, add "Welcome to my app!"
8. Navigate back to the activity_main.xml tab. 9. Make sure that your centered text now reads "Hello world! Welcome to my app!"

Step 4: Add a Button to the Main Activity

1. Navigate to the Design tab of the activity_main.xml display.
2. In the Palette menu to the left of the phone display, find Button (under the heading Widgets).
3. Click and drag Button to be centered underneath your welcome message.
4. Make sure your button is still selected.
5. In the Properties menu (on the right side of the window), scroll down to find the field for "text."
6. Change the text from "New Button" to "Next Page."

Step 5: Create a Second Activity

1. At the top of the project's file system tree, right click on "app."
2. Navigate through to New > Activity > Blank Activity.
3. Change the name of this activity to "SecondActivity".
4. Click "Finish."
5. Make sure you are in the Design view of activity_second.xml.
6. Drag the text box in the upper left of the phone display down to the center as you did on the Main Activity.
7. With the text box still selected, find the "id" field in the Properties menu on the right, and set it to "text2".
8. Open strings.xml again.
9. Add a new line under "Hello world! Welcome to my app!" that reads "Welcome to the second page!".
10. Navigate back to activity_second.xml.
11. Select the text box again.
12. In the Properties pane, set the "text" field to "@string/second_page".
13. Make sure that the text box now reads "Welcome to the second page!" and is in the center of the screen in the phone display.

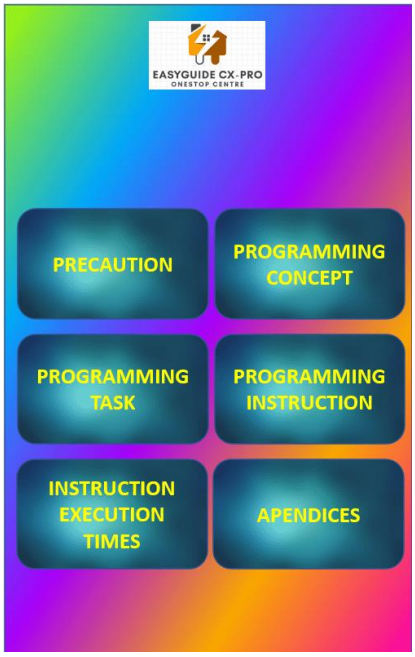
Step 6: Write the Button's "onClick" Method.

1. Select the MainActivity.java tab along the top of the work environment.
2. Add the following lines of code at the end of the onCreate method: Button button = (Button) findViewById(R.id.button); button.setOnClickListener(new View.onClickListener() { @Override public void onClick(View v) { goToSecondActivity(); }});
3. Add the following method to the bottom of the MainActivity class: private void goToSecondActivity() { Intent intent = new Intent(this, SecondActivity.class); startActivity(intent); }
4. Click the + next to import at the third line of MainActivity.java to expand the import statements.
5. Add the following to the end of the import statements if they are not already there: import android.content.Intent; import android.view.View; import android.widget.TextView;

Step 7: Test the Application

3. Result and Discussion

Development of EasyGuide CXPRO was extremely helpful as centralise reference for PLC Programmer especially for OMRON PLC Programmer. Once the application is installed on phone, it can be used whether in rural area that have no internet access. Interfacing that very user friendly make it more convenient to use nowadays.



Fug. 4. Main page EasyGuide CX-Pro

Fug. 5. Main page EasyGuide CX-Pro

4. Conclusion

The development of EasyGuide CXPRO is suitable for programmers at any level weather beginner, intermediate or advance. Users can easily and freely access the apps to find the solution and guidance to develop complete PLC program.

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