

# Android Application for Accessing Bosch Rexroth PLC

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**Abstract:** Bosch Rexroth, as a global partner supports mechanical and plant engineering efforts around the world with its cutting-edge technology and unique industry knowledge. The power of Industry 4.0 is now becoming real and Bosch Rexroth assists machine builders and manufacturers make the vision of the Smart Factory into reality today. It is driving the next industrial revolution as a pioneer, lead operator and lead supplier of Industry 4.0 solutions. The connected automation in manufacturing results in faster and more flexible production process, greater efficiency of material and reduction of complexity and downtime.

The current method of being physically present at the machine to take any readings or to make any changes is time consuming and a tedious process. We are working on automating the process and creating a mobile application which effectively reduces the human presence at the location to take any readings and debug the error. The application utilizes the Mobile OS in conjunction with IoT to make all this possible.

**Keywords:** Android application, Bosch Rexroth PLC, MLPI library, MLPI-SDK, Mobile application for PLC, PLC.

## 1. Introduction

Industry 4.0 refers to the next leap in the industrial manufacturing that is being enabled through synergies that arise from the possible combinations of technological breakthroughs that has been achieved in last two decades. It has also been linked to the idea of fourth industrial revolution. This revolution is a kin to the first leap that manufacturing took through the advent of steam engine in the 18<sup>th</sup> century, or the second big chance that was brought about by electric power. After the last major overhaul that industry went through as a result of computerization and digitization of industrial systems.

Over the last couple of decades, there have been multiple technological advancements across some exciting fields that have immense potential to alter the way we live and work. These areas include Artificial Intelligence, Advanced Robotics, Business Intelligence powered by big data analytics, Nanotechnology, 3-D technology, Man-Machine interfaces or augmented reality and of course the Internet of Things. Interconnectivity of these technologies and their system is being enabled through high processing power coupled with

growing transmission speeds and network capacities. As each of these fields has individually evolved to solve specific problems, they have also concurrently been maturing over time to create possibilities for next level of growth and advancement by interacting with and supplementing each other.

We are looking at the future where the manufacturing facilities are automated, self-sustaining and do not need manual intervention at all, while being large scale and cost efficient at the same time. This can be visualized with an example of interconnected robotics system carrying on the manufacturing processes, through sensing data in real time. This data should be available through interconnectivity and access to the cloud and will help the system in solving problems through analysis and pattern recognition which self-learning machines can then use to identify anomalies and successively improve.



Fig. 1. Programmable Logic Controller

## 2. Development of Android Application Using MLPI SDK

Android Studio is software that is used to develop android applications for smart phones. With the aid of MLPI libraries, their SDK and android studio platform it becomes easier to develop applications for automation and data exchange in PLC. First a connection establishment is done and then the data exchange happens. For a successful communication to occur the IP address of the PLC is to be noted and entered and also the device and the smart phone should be in the same network.

The leap towards the new technology, Industry 4.0, brings in the concept of smart factories which emphasizes more on the

computerization and digitization of industrial systems.

#### A. MLPI Library

MLPI stands for Motion Logic Programming Interface. The Bosch Rexroth MLPI driver allows exchange of data with Bosch Rexroth devices which support the MLPI. MLPI is a programming interface supports in writing C/C++ and java applications that configure and run on a Bosch Rexroth devices which support the MLPI interface technology.

For the client to communicate with the server devices the driver needs the MLPI software library from Bosch Rexroth. The library file is named as "dllmpliwin32.dll". The permission to Read/Write the symbolic variables of the connected devices are given by the driver itself.

Also, to establish a secured communication between the connected devices the driver also allows the clients to choose an appropriate user and the password parameter.

With knowing the technologies, the present one which uses OCE has many advantages over the traditional Indra Works software. With the global market it makes one to do most of the work easily and more reliably. Hence OCE and the MLPI libraries are more advantageous over the old software which had all the functional modules embedded in it but was a wired procedure.

#### B. Android Operating System

The Android Inc. was founded in the year 2003, whose founders described the Project as having tremendous potential in developing smarter mobile devices that are more aware of its owner's location and preferences.

Initially Android OS was developed for cameras, however, after understanding the potential of the OS, it was later pitched in as a Mobile Operating system to rival Symbian OS and Windows OS.

After initial setbacks, Google Inc. acquired Android and the founders of Android joined Google as part of the acquisition. Google and device manufacturers such as HTC, Motorola and Samsung started developing a truly open source and comprehensive platform for mobile devices.

The growth in popularity, being open source and ease of usage both by developers and consumers created a new market for the OS. The OS is now implemented on several others devices such as PCs, TVs, Smart Watches, Gaming consoles and etc.

It was started with the "Cupcake" with the android version 1.5 and now trending is the "Android 10" with the android version 10.0. Over a period of time, OS has gone through many changes both functional and cosmetic.

### 3. Methodology

The design phase includes mainly the designing of the network, system interfaces and the security features. The proposed design is tested for performance and care is taken to overcome the drawbacks of the existing system.

An Ethernet cable is connected from the PLC's

communication port to the router and a Wi-Fi hotspot is created. The Wi-Fi on the Android mobile is to be turned on and select the Wi-Fi network to which the PLC's Ethernet port is connected. Now PLC and the User are in the same Wi-Fi network and hence are ready to communicate with each other.

The PLC uses the Ethernet LAN, SERCOS III or a Profibus mode of communication. Here, the communication between the PLC and the android mobile user is by using an Ethernet LAN cable. A successful communication is established when both the PLC and the android mobile are in the same network.

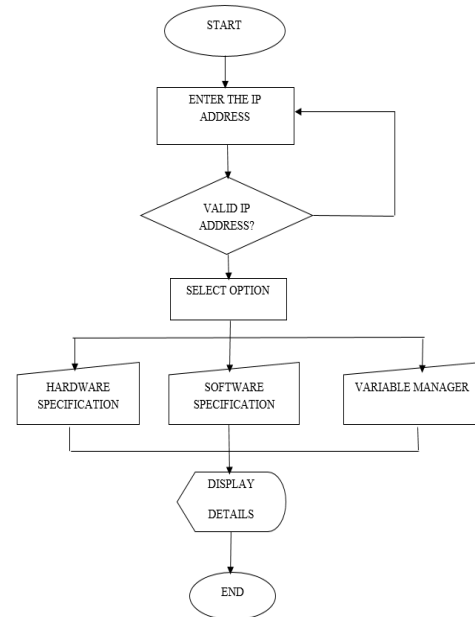


Fig. 2. Block Diagram

#### A. Connection establishment

The login page of the application is displayed after the splash screen disappears. The IP address is typed and start button is pressed. Then the connection is established if the IP address is correct. Listeners are created to display the status of the PLC on the click of the start button on this screen. If the IP address entered is wrong or if that field is left empty and the start button is clicked then the application displays an error message.

#### B. Hardware Specifications

This module will list the hardware specifications such as Serial number, MAC address and firmware version of the PLC when the user clicks on the Hardware Specification Button. The application sends a request to the PLC requesting it to send the Hardware Specifications. The PLC accepts the request and sends the required data back to the application. The application displays details of the Hardware Specification, the data sent by the PLC on the screen.

#### C. Software specifications

This module will list the software specification of the PLC. It displays the Controller Name, IP address, Subnet Mask, Gateway, CPU Load, CPU Load Max, Temperature, Operation

Hours, date & time and Memory when the software specification button is clicked. The application sends a request to the PLC for software specifications, when the request is accepted it sends the required data to be displayed on the application.

#### 4. Results

##### A. Evaluation Metric

MLPI library connects the mobile application and the PLC device wirelessly. The IP address of the PLC device is used to establish connection with the mobile application. It displays the attributes like PLC current display status, hardware specification and software specifications.

##### B. Experiments & Results

Android Studio software that is used to develop android applications for smart phone. With the aid of MLPI libraries, their SDK it becomes easier to develop applications for automation and data exchange in PLC.

First a connection establishment is done and then the data exchange happens. A successful communication occurs when the correct IP address of the PLC is entered. The device and the smart phone should be in the same network.

##### C. Summary of results

Android Studio is software that is used to develop android applications for smart phones. With the aid of MLPI libraries, their SDK and android studio platform it becomes easier to develop applications for automation and data exchange in PLC.

For a successful communication to occur the IP address of the PLC is to be noted and entered and also the device and the smart phone should be in the same network.

#### 5. Conclusion and Future Works

This project opens new opportunities for the developers to enhance the application to a further next level. Currently the application is developed for reading the variables of a PLC program. However, it can be extended to forcing the variables to a PLC program wirelessly.

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