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PLC Using Renesas Controller

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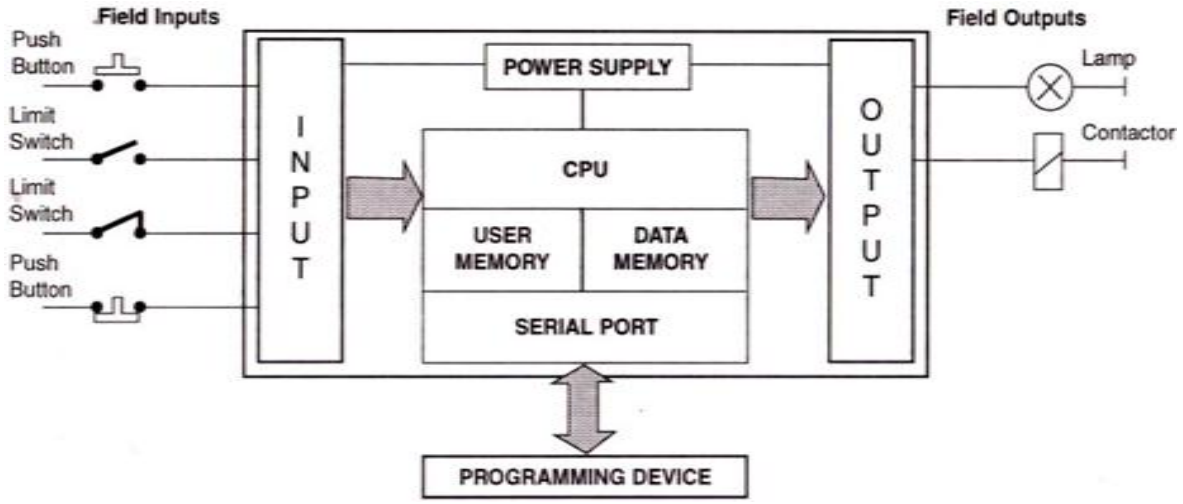
Abstract: Programmable Logic Controllers (PLCs) are used to control industrial machinery such as AC servos, general-purpose inverters, and sensors. They are widely used in factory automation systems for manufacturing and processing lines, machine tools, and industrial robots. Peripheral units of module type PLC include a variety of products to match the specific requirements from end users, while the proliferation of development resources has become an issue. To solve this problem, Renesas overs a peripheral unit platform based on the RX Family, which covers a broad performance range (32MHz to 240MHz) and a multitude of peripheral functions. This helps reduce the amount of development resources needed. For block type PLC, RX64M product provides a one chip solution with large capacity RAM, Ethernet, USB, SDCard I/O integrated, leading to both performance rise and BOM size reduction.

Keywords: PLC, Renesas, RL78, RAM, RX Family.

I. INTRODUCTION

PLC invention was in response to the requirements of the American automotive manufacturing industry. Relay systems at the time tended to fail and create delays. Engineers then had to troubleshoot a whole wall of relays to find and fix the problem. Also, a process of updating such facilities was very time to consume and expensive, as technicians needed to separately and manually rewire every relay. The purpose of a PLC was to directly replace electromechanical parts as logic elements, substituting it by a solid-state digital computer with a saved program, able to imitate the interconnection of many relays to perform several logical tasks. The basic PLC must be adequately flexible and configurable to meet the diverse needs of different applications. All PLCs have the same essential components. These elements work together to bring input information into the PLC from the plant, process that information, and send output information back out to a plant. The components are input and output modules (I/O), central processing unit (CPU or processor), co-processor modules, power supply and peripheral devices



The following figure shows the basic block diagram of PLC which has following main blocks as,

1. Input/output modules
2. CPU
3. Power Supply

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4. Programming Device

1.Basic Block Diagram

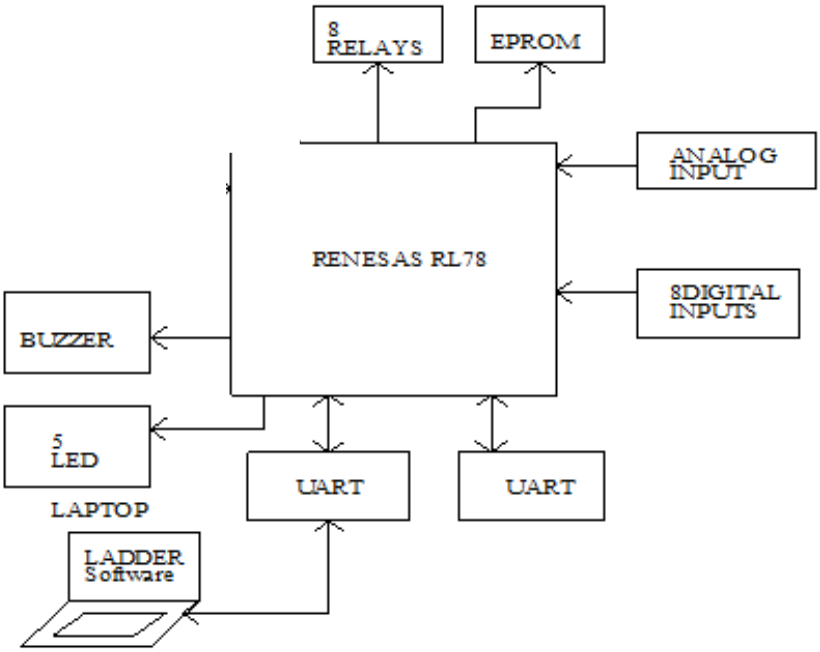

Fig 4.1: Basic Block Diagram

II. BLOCK DIAGRAM DESCRIPTION:

2.1 RENESAS RL78:
RL78 microcontrollers greatly improve power efficiency with industry-leading low power consumption at 45.5 µA/MHz consumption during normal operation and 0.57 µA/MHz during clock operation. Built-in features such as a high-precision (±1%) high-speed on-chip oscillator, background operation data flash capable of 1 million rewrites, temperature sensor, and interface ports for multiple power supplies help reduce system costs and size.

2.2 RELAYS:
The Single Pole Double Throw SPDT relay is sort of useful in certain applications due to its internal configuration. It has one common terminal and a couple of contacts in 2 different configurations: one are often Normally Closed and therefore the opposite one is opened or it are often Normally Open and the other one closed. So basically, you will see the SPDT relay as how of switching between 2 circuits: when there is no voltage applied to the coil one circuit "receives" current, the other one doesn't and when the coil gets energised the other is occurring.

2.3 EEPROM:
EEPROM stands for electrically erasable programmable ROM and may be a sort of non-volatile memory utilized in computers, integrated in microcontrollers and other electronic devices to store relatively small amounts of data but allowing individual bytes to be erased and reprogrammed. Originally, EEPROMs were limited to single byte operations, which made them slower, but modern EEPROMs allow multi-byte page operations. An EEPROM features a limited life for erasing and reprogramming, now reaching 1,000,000 operations in modern EEPROMs.

2.4 INPUT:
There are Both type of inputs such as analog and digital.

2.5 UART:
A universal asynchronous receiver-transmitter may be a hardware device for asynchronous serial communication during which the info format and transmission speeds are configurable. The electric signaling levels and methods are handled by a driver circuit external to the UART. A UART is typically a private (or a part of an) microcircuit (IC) used for serial communications over a computer or peripheral interface . One or more UART peripherals are commonly integrated in microcontroller chips.

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2.6 LED AND BUZZER:

LED and Buzzer are used for indication purpose.

III. WORKING

The input supply is taken which is 230V,50HZ AC Supply which is connected to the mains. TheAC Supply is converted into DC with the help of full bridge inverter using diode which is having current rating of 6A. To get pure DC supply is filtered with help of 100µf & 50V filter capacitor using voltage regulated IC7812.The renesas microcontroller requires 15 to 16V DC supply. It has maximum 12 inputs. Here in these projects there are 8 relays, 2 indicator lamps, DC motor And Buzzer are used as load. The rating of relay is 12V , 200mA. Here we use SPDT relay for switching purpose. The LED & BUZZER are used for indication purpose. The load is connected to the NO & supply voltage to the load is given through pole. The device connected to NO will be off when relay has no power & will turn ON when the relay receives power. This load is operates using the Boolean expression implemented with the help of logic gates such as OR, AND, NAND, NOR, etc.

IV. SOFTWARE REQUIREMENTS

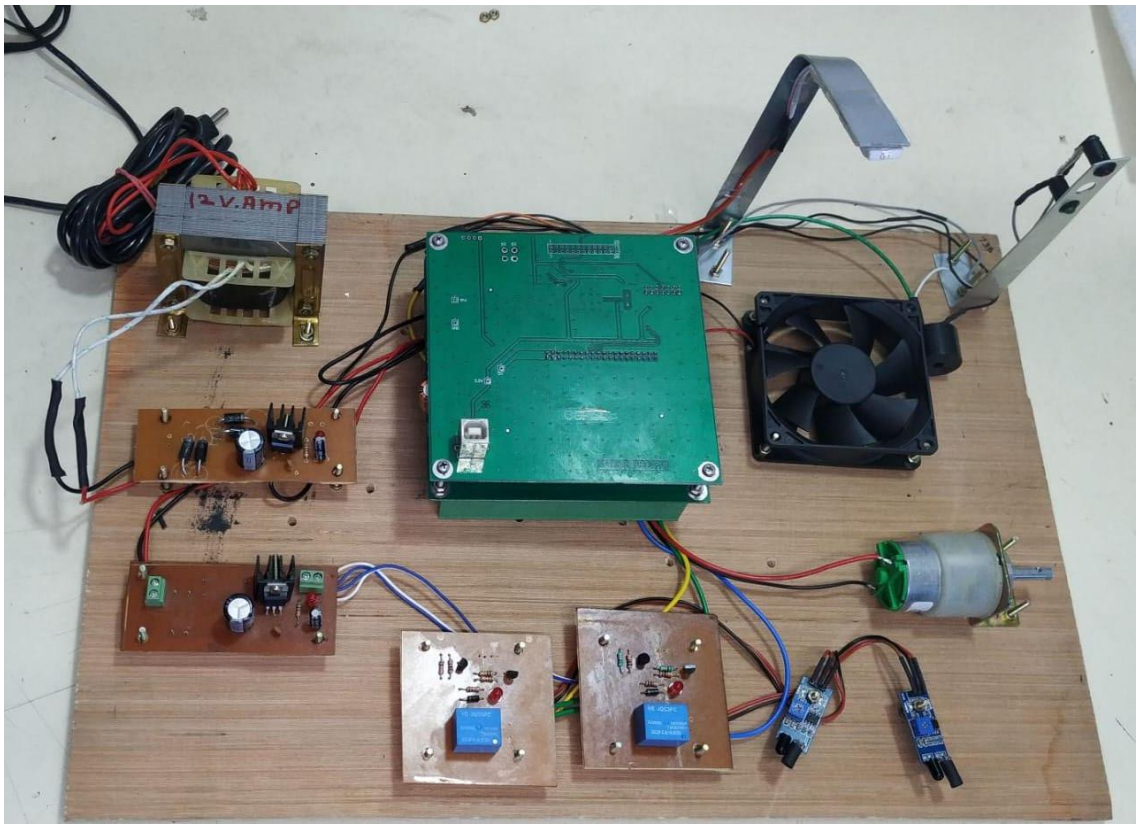
4.1 ORCAD:

This document introduces you to a set of computer programs that are wont to design electronic circuits. Cadence ORCAD PCB Designer with P Spice comprises three main applications capture. It offers great flexibility compared with a standard pencil and paper drawing, as design changes are often incorporated and errors corrected quickly and simply.

4.2 ALTIUM:

Altium Designer may be a software package which allows electronic circuit designers to style, draw and simulate electronic circuit boards. Altium may be a vastly complex software design suite and these notes are designed to introduce the user to the elemental principles and tools used throughout the package.

V. HARDWARE



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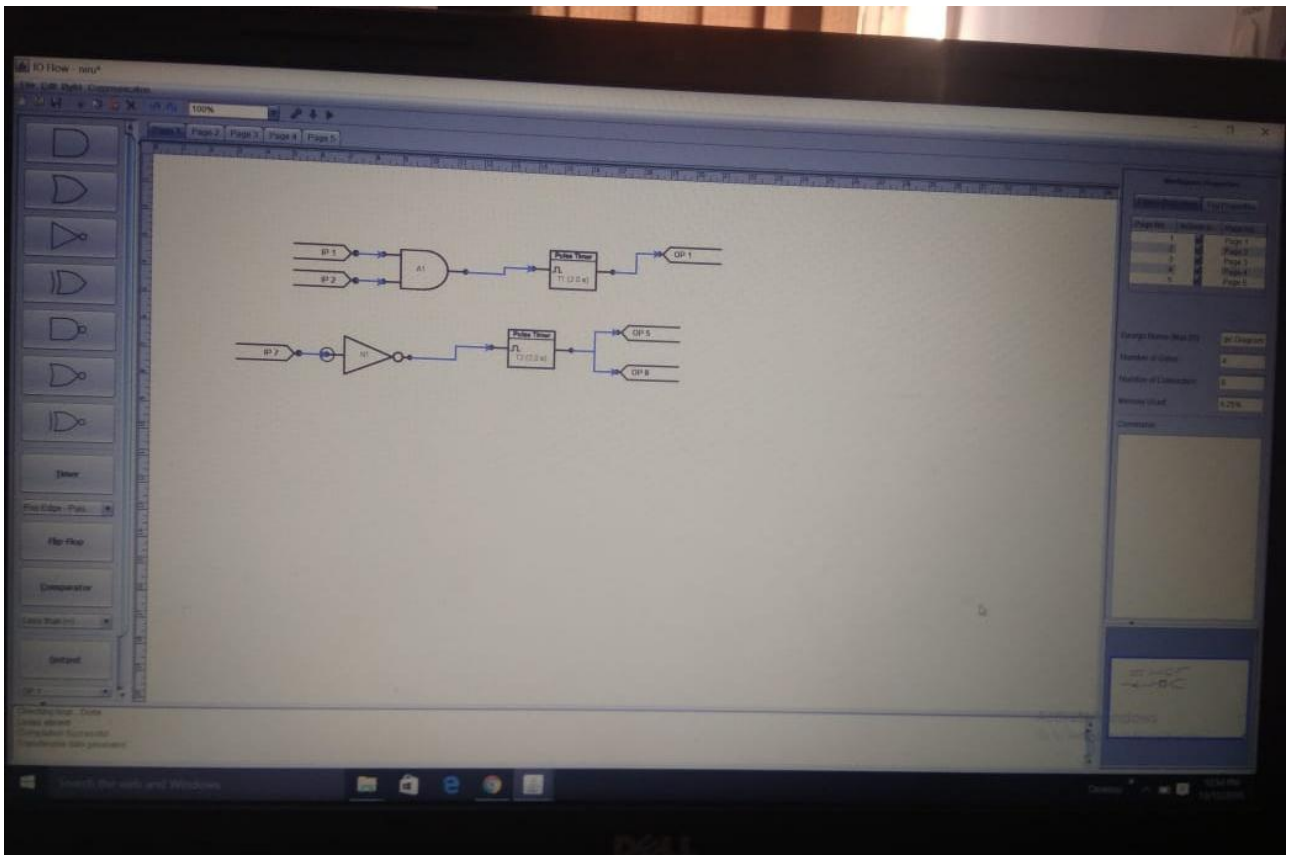
VI. SOFTWARE



VII. CONCLUSION

Compared to commercially available products as a teaching point of view. It is considered that this platform has an impact in the automation where PLC is the part of system and so student can understand heart of the system. The source codes of Easy Ladder are open to student so that everyone makes their own small PLC using editing the codes. Also, the authors consider that this system is a platform on which a more powerful PLC can be developed in future. The results of the application of our approach to education have been excellent both in terms of student's motivation and knowledge.

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