MODIFYING RELAY LOGIC OF az11 MACHINE(HORIZONTAL MILLING MACHINE)TO PLC LOGIC

M.Divya[*1] ,S.Dharani*[2],S.Banumathi.*[3]

Department of Electrical and Electronics Engineering

M.Kumarasamy College of Engineering, Karur- 639 113,Tamilnadu, India

Abstract

The proposal of PLC logic is made for az11 machine. Designed to withstand vibrations, temperature humidity and noise of the machine. Inputs and outputs interfacing already inside the controller. PLC's are easily programmed and have an easily understandable programming language. It uses s7300 processor Existing system is complex relay logic and difficult with changes occur, hold-up time is idefinite,usally long .In this project az11 machine is converted a simple operating machine and also with easy replacement of program when any fault occurred in the system.

Keywords:*s7300 processor, PLC logic,az11machine.*

I. INTRODUCTION

Az11 machine also know as horizontal milling machine is a heavy-duty industrial machine. This machine tool is used for both boring (drilling) and cutting purpose. Boring operation is commonly preferred because we can correct hole size or alignment. Milling refer to a rotating cutter which has five axes in it. Namely: X-axis(horizontal),Y-axis (vertical),Z-axis (parallel to spindle),W-axis(outer axis parallel to z-axis) and B-axis (table axis). With the advent of new technologies, the functionality of conventional az11 machine can be enhanced by replacing the burden of cabled connection with the help of PLC control techniques. The goal of this is to identify the faults easily. It brings flexibility to the operation and also reduces the breakdown time, clutch controls and easily identify the faults. It enhances maximum automation at minimum cost saves installation space. Few objectives that are also achieved during the operation of machine are:

Implementation of interfacing of different electrical and mechanical components with PLC.

Interfacing of different motor with different operating voltages with PLC.

This design reduces continuous monitoring by man force and also saves time.

This project presents automation of az11 machine by replacing complex wire connections with PLC technique. Now a days, in most industries automation plays an important role which reduces cost, human interface and increases safety in working conditions. this project describes about automation using PLC which result in the reduction of work force, number of contactors, saves time and energy.

II. SYSTEM STRUCTURE

2.1 PLC AUTOMATION

A Programmable Logic Controller, or PLC, is more or less a small computer with an operating system . This OS is highly specialized and optimized at the time of their occurrence to handle incoming events in real time. The PLC has input lines connected to notify of events (such as temperature above/below a certain level, liquid level reached, etc.), and output.

2.2 PLC BLOCK DIAGRAM:
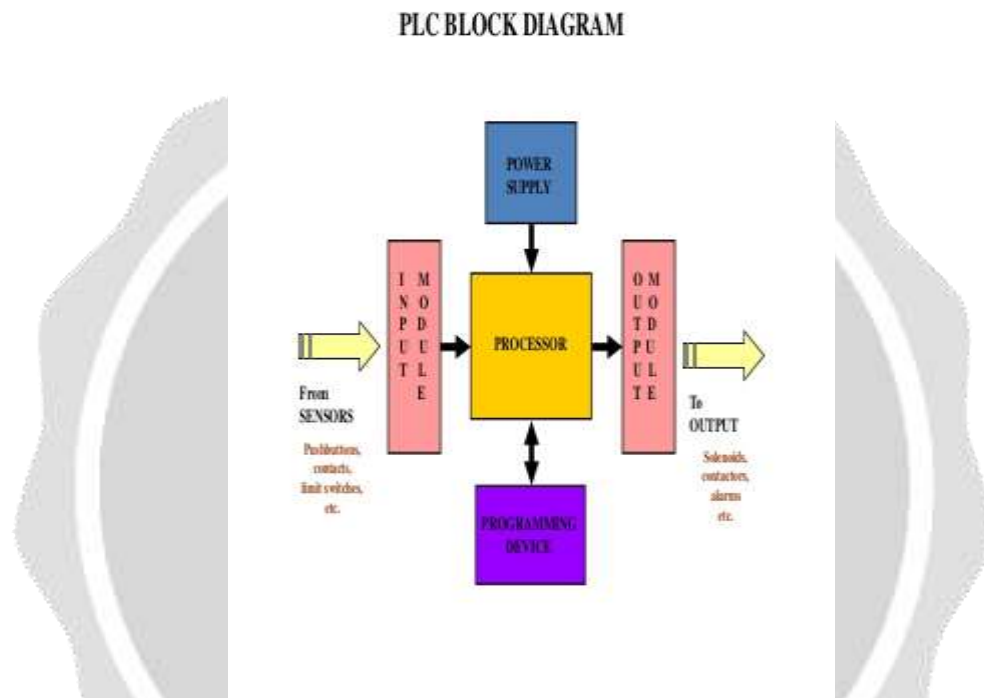
Fig.1 PLC BLOCK DIAGRAM

2.3 MAJOR COMPONENTS IN PLC

i) power supply:

The power supply gives voltage required to run the PLC primary components. The power supply gives supply to internal DC current to operate the processor logic circuitry and input/output assemblies. 24V DC (or) 120V AC are power levels.

ii) i/o modules:

Input carries signals into the controller from the process. The actuator is the output modules, the PLC can change to adjust (or) control the process. E.g.: Moors, lights, relays, pump, etc. Both i/o modules provide signal conversation and isolation within the PLC between the internal logic-level signals high level signal of the field.

iii) **Processor:**

It provides intelligence to control and manage the entire PLC system's activities. Only the central processing unit (CPU) is the processor. CPU is the PLC's "brain" . The size and type of CPU will determine the available programming functions, the size of available application logic, amount of available memory and processing speed.

iv) **Programming device:**

It is used to enter the desired program which will determine the process equipment (or) driven machine sequence of operation and control. The PLC is programmed using a programmer specially designed to load and change the logic inside. Most modern PLCs are software programmed on a PC .

III .RELAY CONCEPT IN PLC

A relay is an electromagnetic switch operated by a relatively small electric current that under faulty condition can turn ON/OFF a much larger electric current.

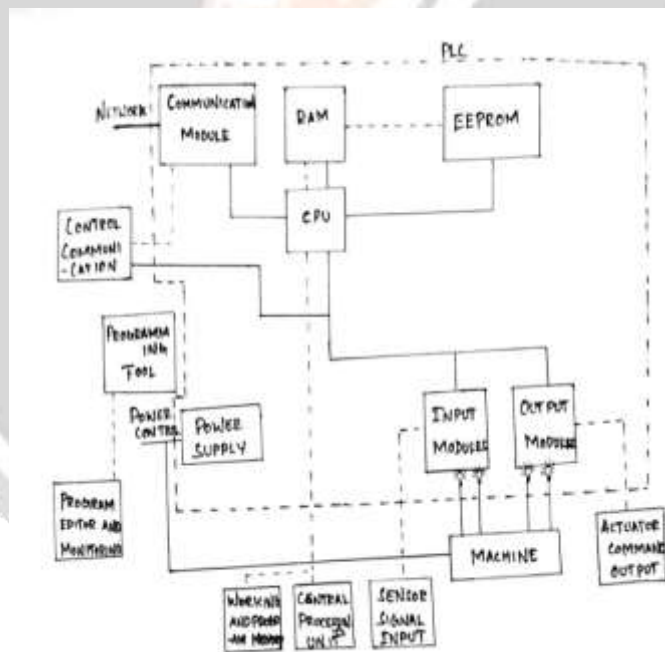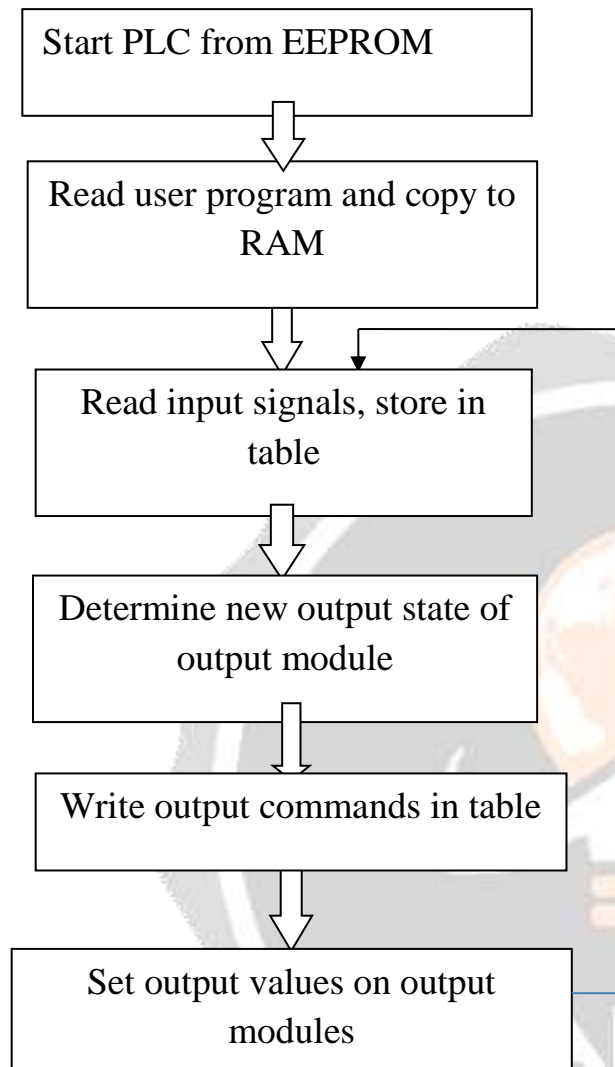### 3.1 PLC REPLACING ELECTRIC CIRCIUT RELAY:

Fig.2. INTERNAL WORKING OF PLC

3.2 PROCESSING CYCLE OF PLC

It's very simple to operate a PLC. The processor makes decisions based on a user written logic ladder program. the PLC must communicate with the different field devices it is tasked with monitoring and controlling in order to use the program properly.

```
┌──────────────────────────────────┐
│     Start PLC from EEPROM        │
└──────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────┐
│   Read user program and copy to  │
│              RAM                 │
└──────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────┐
│    Read input signals, store in  │
│              table               │
└──────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────┐
│   Determine new output state of  │
│          output module           │
└──────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────┐
│   Write output commands in table │
└──────────────────────────────────┘
                 │
                 ▼
┌──────────────────────────────────┐
│    Set output values on output   │
│             modules              │
└──────────────────────────────────┘
```

Fig.3.FL0W CHART OF PROCESSING CYCLE OF PLC

 3.3 OPERATION SEQUENCE

i)Self Test:

Testing of its own hardware and software for faults.

ii) Input scan:

If there is no problem in the system, PLC will copy their values in the memory.

iii) Logic solve (or) scan:

 ladder logic program is solved using input and outputs are updated.

iv)Output scan:

The output are updated in memory while solving logic, it is updated in temporary memory.

3.4 PROGRAMING LANGUAGES OF PLC:

Common languages in PLC programming are :

Ladder Logic

Functional Block Diagram

Sequence Function Chart
Boolean Mnemonics

3.5 LADDER LOGIC

Ladder logic is the commonly used programming language for PLC .It is suited to express combinational logic circuit.

The ladder logic symbol represents these main elements :
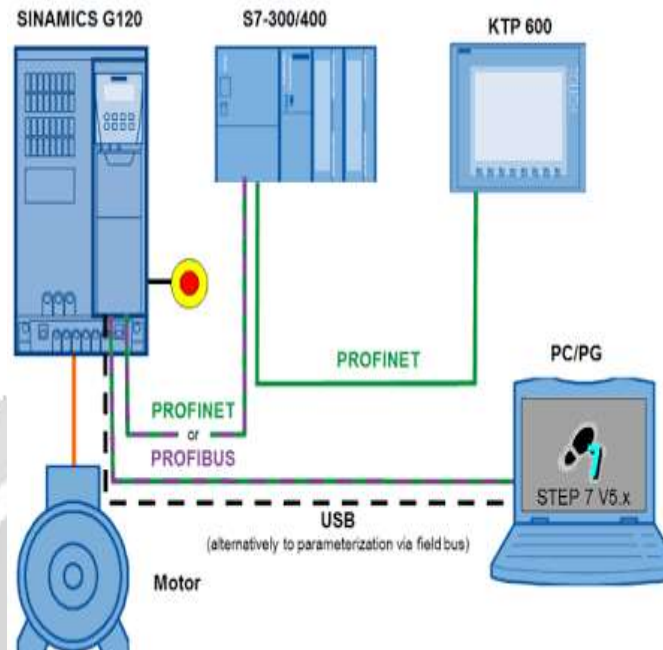
Make contact:

Break contact:

Relay coil:

VI   SIMATIC S7-300 PROCESSOR:

Az11 machine uses an advanced control system(i.e. PLC automation) using   S7 300 processor.

The input to the processor is given by two ways: Memory card and Flash card. The SIMATIC S7-300 is used in many applications worldwide and has been proven successful million of times.

4.1 COMPONENTS USED:

Fig.4. COMPONENTS OF S7 300 PROCESSOR

Control of coolant motor is considered an example over here. In order to control the conveyor belt, you will need the components shown: Power supply for the control components.

CPU 312C with integrated input and output module..

Momentary contact switch..

PC Adapter USB for connecting the PC with the CPU312C.

4.2 VARIABLE FREQUENCY DRIVE (VFD)

The feed motor which is used to move /run the axes at the required speed rate is done with the help of electromagnetic clutches. The flow of mechanical power is controlled by the clutch. These clutches are used for smooth starting of the machine.

It is operated manually and driven when shifting the gear. In order to eliminate the manual operation VFD is being employed. VFD is employed to control AC induction motor, speed and torque. By this, the motor running speed range is extended from zero speed to above motor speed in order to improve the efficiency. In cases, where motor needs lower capacity, the VFD can reduce motor speed in order to save energy.

V CONCLUSION

This project comprises of wide range of control operations of az11 machine which as being modified and controlled with the help of PLC automatic . PLCs are evolving and remain the best option for a variety of applications for industrial automation. Today the PLCs are used in a single machine for control and automation work and it increases the production (or) testing process in a factory to the full auto machine. By this project, the fault occurrence at any part of the system is being identified and necessary control measures are taken accordingly, breakdown time is reduced and also enhances maximum automation.

REFERCENCE

[1] loannides M.G., "Design and Implementation of PLC-Based Monitoring Control System for Induction Motor", IEEE Transactions On Energy Conversion, vol. 19, No.3, pp. 469 - 476, September 2004.

[2] loannides M. G., et. aI., "Implementation of scalar control scheme for variable frequency induction motor actuator system", Sensors and Actuators A: Physical, ScienceDirect, vol. 106, Issues 1-3, pp. 306- 309, September 2003.

[3]M. E. H. Benbouzid, "A review of induction motors signature analysis as a medium for faults detection," IEEE Trans. Ind. Electron., vol. 47, pp. 984-993, 2000.

[4] X. L. X. Li, S. Munigala, and Q.-A. Z. Q.-A. Zeng, "Design and Implementation of a Wireless Programmable Logic Controller System," Electr. Control Eng. (ICECE), 2010 Int. Con/., 201O.

[5] A. F. Kheiralla, O. Siddig, A. A. E. Mokhtar, M. Esameldeen, and O. Addalla, "Design and Development of a Low Cost Programmable Logic Controller Workbench for Education Purposes," in International Conference on Engineering Education - ICEE 2007, 2007, pp. 1-6.

[6] R. Zhen, H. Meng, X. L. Wu, 1. Li, and S. M. Liu, "Exploration on a New System of PLC Three-Dimensional Teaching," Adv. Mater. Res., vol. 271-273, pp. 1231-1234, luI. 2011.