

MODELLING AND CONTROL OF VARIABLE FREQUENCY DRIVE USING PLC AND MATLAB APPROACH

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Abstract - Variable frequency drives (VFD) are widely used in industrial facilities, however, dynamic models for VFD-motor systems suitable for power system dynamic studies are not available. In this paper, a generic VFD-motor system modelling technique is proposed for the case that VFDs are able to ride through the fault. Programmable Logic Controller (PLC) - based controller is one of the control device used in industrial automation drive applications, the important aspect is to control speed of an induction motor in the presence of variable load through Image Acquisition. The plant model in this project is developed using MATLAB/Simulink and the aim is to simulate and analyze the appropriate control technique suitable for implementation onto the PLC to perform real-time implementation of the VSD (variable speed drive) control.

Key Words: Automation, Simulation, Modelling variable speed drive, PLC-Based controller, Induction motor..

1. INTRODUCTION: Simplification of engineering and precise control of manufacturing process can result in significant cost savings. The most cost-effective way, which can pay big dividends in the long run, is flexible automation, a planned approach towards integrated control systems. It requires a conscious effort on the part of plant managers to identify areas where automation can result in better deployment utilization of human resources and savings in man-hours, down time. In order to test developed PLC (Programmable Logic Controller) control programs several measures can be adopted. One can use scale models, batteries of led's and switches and Human Machine Interfaces (HMI), Supervisory Control and Data Acquisition (SCADA) systems or simulation tools. However, each of these approaches presents advantages and problems [1-3]. Automation need not be high ended and too sophisticated; it is the phased, step-by-step effort to automate, employing control systems tailored to one's specific requirements that achieves the most attractive results. That is where Industrial electronics has been a breakthrough in the field of automation and control techniques.

1.1 BLOCK DIAGRAM:

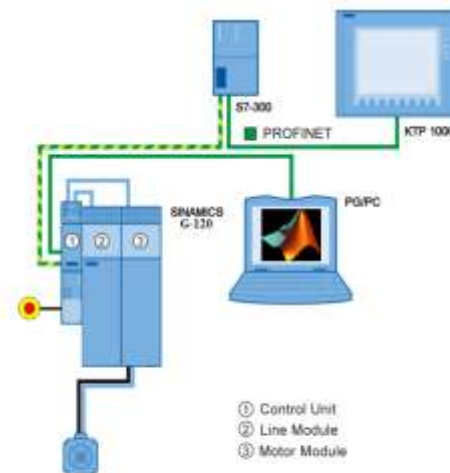


Fig.1. Block Diagram of Project

☑ In this block diagram shown our project. In this first single phase power supply connect with SMPS and SMPS is convert 230V AC to 24V DC and its 24V given in Delta PLC for power of PLC.

☑ Here we have MATLAB software with the help of coding we create the obstacles on the face by using the MATLAB video player and it helps to Recognize the face.

☑ When the Number of obstacles is high the signal will send to the interface that we use is KEPSERVER or we can use MODBUS.

☑ The KEPSERVER is used to communicate the MATLAB with PLC. We use TIA portal i.e. software of PLC and by coding we communicate these.

☑ We can communicate the PLC with DRIVE manually and by face acquisition also.

☑ This above connection we control load by Manually and Automatically

1.2 Circuit Diagram & Analysis:

- By using PLC and MATLAB Controlling System, we can operate our DRIVE and control the INDUCTION MOTOR, by using this method we can have power controlling, power safety, security, fault findings etc.
- We know about all problem solution and controlling is much difficult in developed country. That's way we need some intelligent control system for these problem solved in our city
- That's why for this problem I can use best power management using PLC and MATLAB Controlling System.

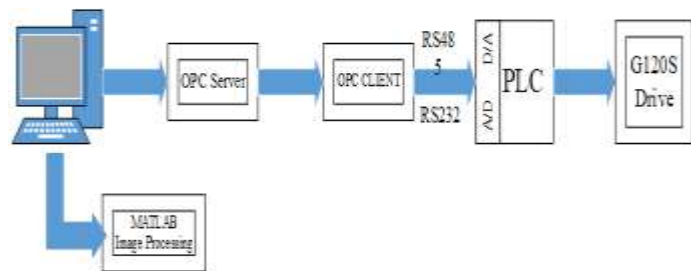


Fig.2. Overall Circuit Diagram of Hardware

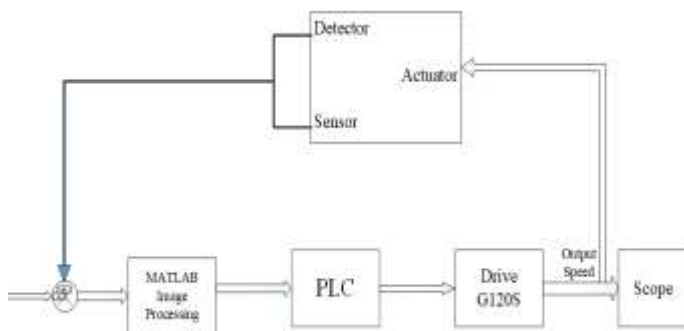


Fig. 3. PLC Program and Industrial Process interaction.

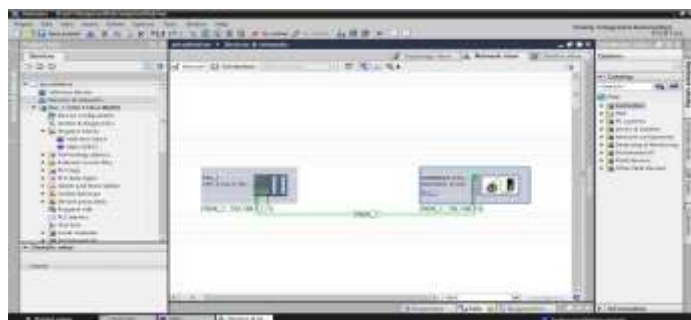


Fig.4. PLC and G-120S (Drive) Commissioning

2. PLC MODELING:

- A PLC is basically composed by power supply, control program and working memories, input/output circuits and a central control unit. PLCs are the most suitable and widely used technology in nowadays-industrial processes. A PLC can be seen as an integrated circuit that

consists of logic elements with an interconnection pattern, parts of which are user programmable [7].

- The PLC modelling issue can be reduced to the emulation of the PLC control program. The PLC control program is cyclically executed in the following way: The central control unit copies the state of the industrial process (PLC input circuits) into the internal working memory area, then executes the PLC control program stored in the control program memory area, and finally acts over the industrial process by transmitting its control actions through the output circuits to the industrial process actuators. The proposed methodology approach will consider that the PLC is essentially modelled by emulating its control program, which interacts with the controlled industrial process itself, as presented in Fig. 5.

- The PLC control program will generate outputs that will be the inputs of the industrial process, as the outputs of the industrial process will be the inputs of the PLC control program.

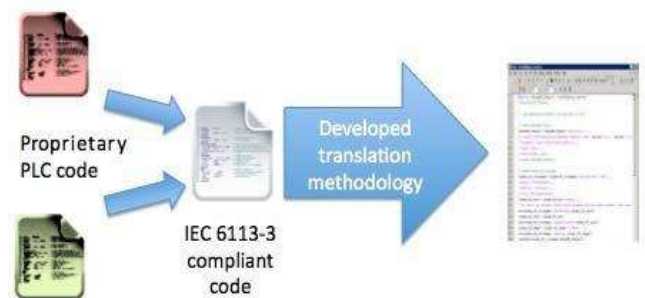


Fig.5. Program and Industrial Process interaction.

3. Hardware Model :



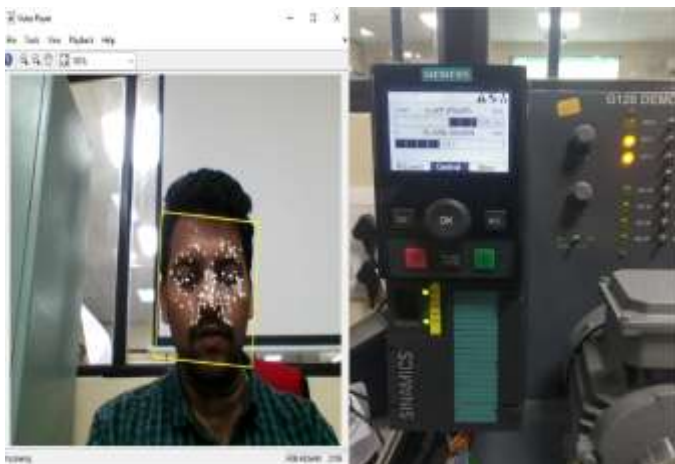


Fig. 6. Image Acquisition with Drive.

Table -1: No. of Obstacles and Speed of Drive

Sno:	Number of Obstacles:	Speed of Drive:
1	300	193
2	266	460
3	245	500
4	210	520
5	202	526
6	151	1154
7	148	1350
8	140	1500

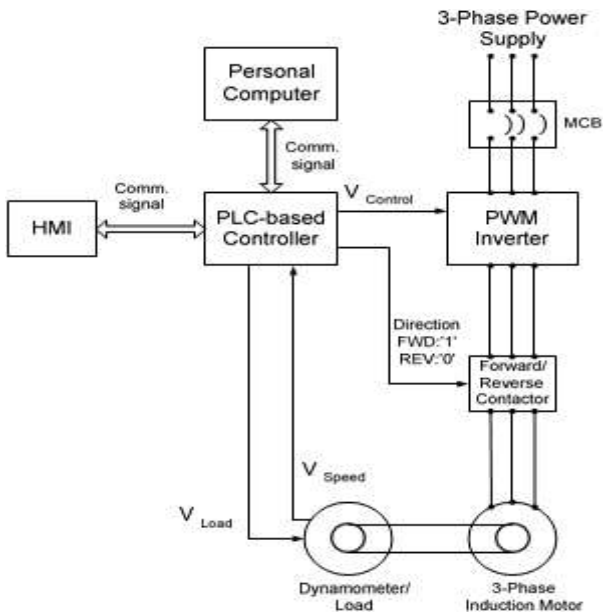
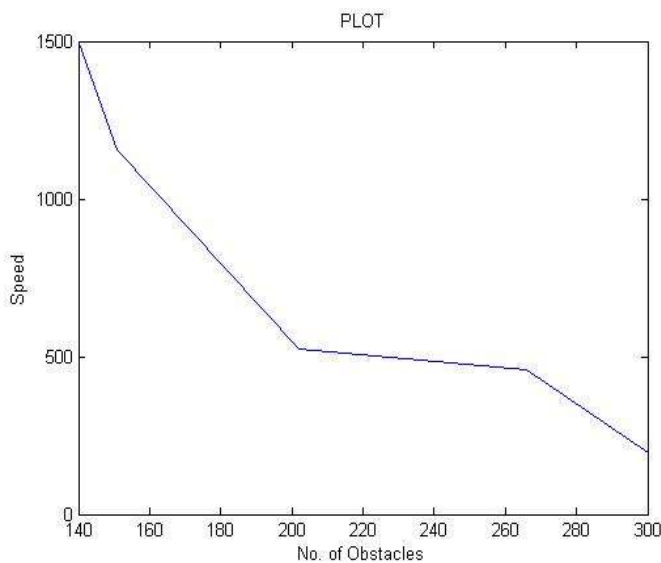


Fig -7: Physical system layout with HMI, PLC, PWM inverter, induction motor and load

- By Image Acquisition we can run the induction motor by G-120 Drive by commissioning of S7-300(PLC) and MATLAB

Results in Stater Software:

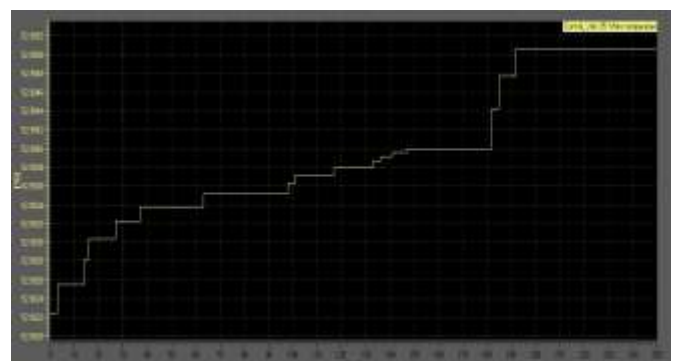


Fig.8. Induction Motor Temperature

Chart: Plot between Speed and No. of Obstacles in MATLAB

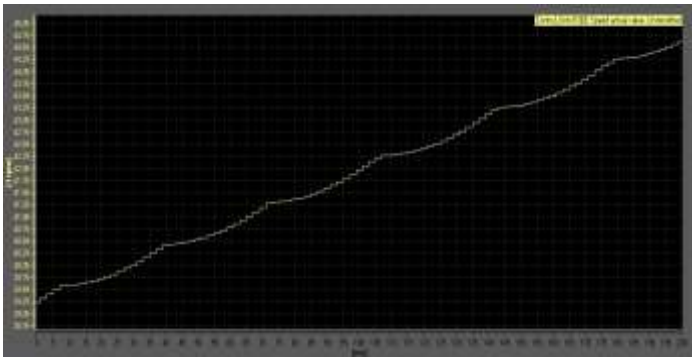


Fig.9. Speed Actual Value of Induction Motor

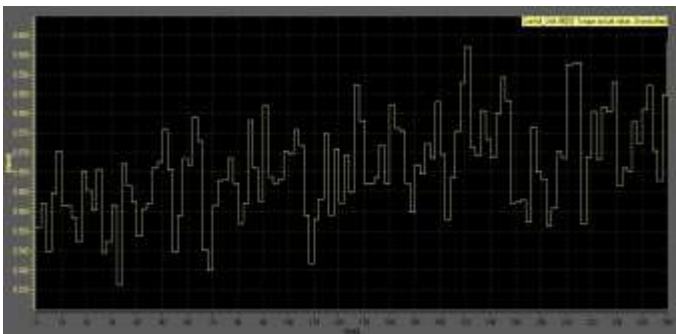


Fig.10. Torque Actual Value of the Induction Motor



Fig.11. Energy Balance of the Induction Motor

translation and shows the output as time as simulation runs.

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4. Conclusions and Remarks:

- By using this methodology we can control the Drive for a particular automation which will be helpful for the manufacturing industries and it can be used any of the logic used in PLC.
- By this technique we can control the Anti power thief activity, power safety, security, fault findings etc.
- The advantages of a simulated PLC program with a simulated model, within the Matlab/Simulink environment, stands to greatly broaden the testing possibilities and strengthen PLC control teaching process as a whole.
- This translation methodology is not only suitable for teaching but also for testing PLC controlled industrial processes. The developed methodology translates PLC control program into Matlab/Simulink compatible m-file, containing the correspondent PLC control program