STUDY OF INDUSTRIAL AUTOMATION WITH MECHATRONIC SYSTEM USING VARIOUS TECHNOLOGY EMBEDDED

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Abstract

In the modern world, speed is the most decisive factor between winning and losing. This *faster is better* rule impacts modern industry in a huge way.

In today's modern digital era, software based systems are becoming an indispensable component in industrial world. During the industrial progression, human civilization has experienced numerous industrial revolutions. Now the world is undergoing Hi tech industrial revolution with information technology having automation, digitization computer network and artificial intelligence as its main factors. Mechatronics is a new developing technology in the evolutionary procedure of contemporary engineering strategy.

Mechatronics with operative real time software plays a vital role in any application that has a very great potential in system development. To accomplish high Precision manufacturing, software based systems are extensively used to automate numerous processes.

1. Introduction

Today, the Mechatronics with embedded technology is getting widespread in all industrial applications. All Industries are targeting to focus on digital industrial unit. In order to get digital industrial unit, the application of electronics and software is a essential for all industries to streamline the products, processes and technologies.

The software based system comprises of diverse hardware and software units for retrieving the real time data and manufacturing the requisite outputs. Assimilating the hardware units with software units in the real time situation is not an easy task , it depends on several factors such as voltage, software logics, Technical system, Control and communication system, Software Control signal , technical system , design factors, etc.

An automated system consists of three basic elements.

1. Power to accomplish the process and operate the system
2. A program of instructions to direct the process, and
3. A control system to activate the instructions.

Advanced automation functions

Advanced automation functions include the following.

1. Safety monitoring
2. Maintenance and repair diagnostics.
3. Error detection and recovery.

(**MECHA**nics - elec**TRONICS**)

The combination of mechanical and electronic systems. Embracing robotics, industrial control systems and human interfaces in numerous disciplines, mechatronics is a major step beyond "electromechanical"

Mechatronics is *"Putting intelligence onto a physical system"*
- A basic mechanical structure which generates a certain carrying behavior or movement.
- Sensors collecting information on the system or the environment.
- Processors evaluating the information and generating correcting variables according to certain rules.
- Actuators in which the correcting variables are converted into forces, movements, electrical voltages or other quantities which act on the basic system or its environment.

Components of Mechatronic system
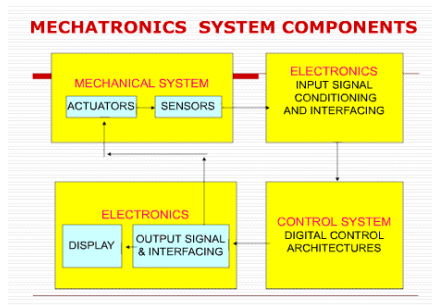
- Electro-mechanics (electro pneumatics, electro hydraulic)
- Mechanics Software (Animated motion)
- Electronic Software (PLC, PC)
- Mechatronic system (System theory)

Scope

As Mechatronics is the new emerging technology in today's Scenario, it is spreading its wings in every sphere of life whether it is a Defence, industry, medical field, automotive, robotics and many others. Therefore this study offers great scope for the future aspiring researchers who wants to research in the same and make life easier in industries and also to get optimum efficiency and good products.

Technical Overview

Several mechatronic engineers' work with the electronic instrumentation and computer control systems as nearly all machinery relies on them for effective and consistent operation. Automatic systems monitor works for plants to detect leaks and faults if any, and help the plant to operate all the year round. Mechatronic engineers construct and design these systems and require proficiency in computing and electronics, core mechanical engineering, and the talent to bring these together to create working systems that is matches the safety and reliability levels.

Mechatronic engineers also play a significant role in project engineering, reliability engineering and power engineering where their cross-disciplinary skills gives them an upper hand on mechanical or electrical engineers. Mechatronic engineers are capable of working with electrical and mechanical systems simultaneously and can recognize and resolve glitches that cross restraint borders. Mechatronic engineering, encompasses wide collaboration with people working in more traditional engineering branches.
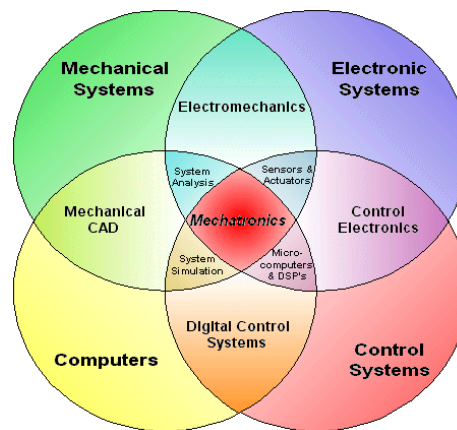
2. Description of the System.

A. Overview of the entire system [11].

The System was controlled on emerging technologies, but the base was the control system which require various tools or technology. These technologies were used in combination with each other ie. emmbedded with each other to perform the desire task. This task may be Automatic, Semi – Automatic or Manual, based on requirement and need.

The Technologies are Pneumatic, Hydraulic, PLC, Sensorics, Mechatronics and Robotics, apart from that Electric & Electronic controls and many more.

In Mechatronics (mMS kit) there are three stations namely Magazine station, Processing station with Pneumatic press unit and Storage station having Cartesian Robot.

The word mMS stands for Modular Mechatronic System. Basically the process of an Automation plant is divided into three steps, the Raw material is fed from Magazine and tested on testing bench equipped with various sensors. Then it is shifted to press unit where it is assembled with another part, and picked by handling robot to place it in storage rack for packaging, which is the final product.

The details of the system are in three steps.

1. Magazine Station
2. Processing Station
3. Storage Station

Station 1 – mMS – Magazine Station

The Magazine station consists of

- 2 separating magazine
- Long conveyor belt
- Testing unit
- Control panel
- Maintenance unit
- Electrical supply with signal processing
  - Main switch on the multiple output socket
  - Power supply (24VDC)
  - Emergency stop relay
  - Profibus coupler
- PLC

Station – 2 – mMS – Processing Station with pneumatic press

The Processing station consists of

- Pneumatic press
- Portal
- Handling device
- Turning unit
- Pins unit
- Control panel
- Short conveyor belt
- Electrical supply with signal processing
  - Power supply (24VDC)
  - Emergency stop relay
  - Profibus coupler
- PLC

Station – 3 – mMS – Storage Station

The Storage Station consists of

- High bay racking
- Cartesian robot
- Handling device
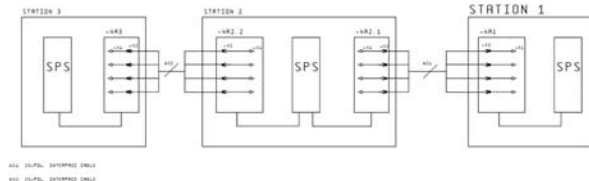- Maintenance unit
- Control panel
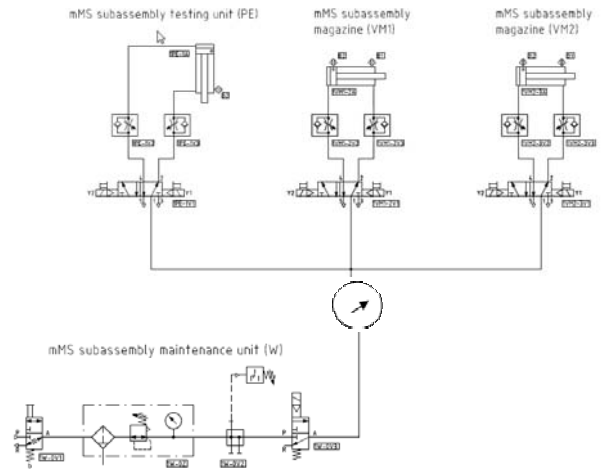
Main switch on multiple output socket

- Power supply

Emergency stop relay

- Terminating plug on the transfer module
- Profibus coupler

Electrical Circuit diagram

3. Pneumatic connection :

4. Results and evaluation

The entire system is controlled using Electro–Pneumatic control, PLC and Sensors to increase the efficiency.

The operation can be done in Manual as well as Auto. It is helpful to all Industries for increasing efficiency.

5. Conclusions and further work -

The Entire Sysytem for industrial automation is useful for increasing Productivity.

The further work is to implement the system using Internet & RFID. This will enhance the effectiveness, precision and accuracy.

References

1. Process Measurement and Analysis, Third Edition by Bela G. Liptak.
2. Project Manual, Pneumatic control technology by Bosch Rexroth AG, Didactic Maria-Theresien-Straße 23 97816 Lohr am Main, Germany.
3. Project Manual, Electro-Pneumatic control technology by Bosch Rexroth AG Didactic Maria-Theresien-Straße 23 97816 Lohr am Main, Germany.
4. García-Guzmán, J., Villa-López, F.H., Silva-Del-Rosario, F.H., Ramírez-Ramírez, A., Vélez Enríquez, J.,Álvarez-Sánchez, E.J. Virtual environment for remote access and automation of an AC motor in a web-based laboratory. *Procedia Technology* 2012; 3: 224-234.
5. Farah Helúe Villa-López, Jesús García-Guzmán*, Jorge Vélez Enríquez, Simón Leal-Ortíz and Alfredo Ramírez-Ramírez. Electro-pneumatic system for industrial automation: a remote experiment within a web-based learning environment.
6. Simulation Software for Designing Circuits, Fluidsim P By Festo Controls, Germany.
7. Dipl Ing Rolf Balla, The Pneumatic Trainer Vol 2 Bosch Rexroth AG Didactic Maria-Theresien-Straße 23 97816 Lohr am Main, Germany.
8. PLC Training Manual IndraLogic Basic published by Bosch Rexroth AG, Service Automation. PO. Box 1357, 97803, Lohr, Germany.
9. PLC Operation & Programming guide with Rexroth Indra works engineering 07vrs, Published by Bosch Rexroth AG, PO. Box 1357, 97803, Lohr, Germany.
10. PLC Programming with Rexroth IndraLogic 1.0 published by Bosch Rexroth AG P.O. Box 11 62 • D-64701 Erbach. Rexroth IndraControl L20, Bosch Rexroth AG, Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main.
11. Project Manual, Mechatronics 4.0 by Bosch Rexroth AG Didactic Maria-Theresien-Straße 23 97816 Lohr am Main, Germany.
12. G. Prede, D. Scholz, Electro-Pneumatics Basic Level Edition: 01/2002 by Festo Controls, Germany.