iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** IV **Month of publication:** April 2016

DOI:

www.ijraset.com

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Volume 4 Issue IV, April 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Installation of PLC and HMI in Lever SPM

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Abstract: ***The machinery should be up to date to supply the high quality product in market for to maintain the user (market) requirement. This project work is based on the up gradation of the LEVER SPM (Special Purpose Machine). A LEVER SPM is any of various power tools or machine tools used for various operations like DRILING, CHAMFERING, TAPPING. Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. Chamfering is terms used in parts fabrication; describe processes for finishing machined parts. Chamfering means to make a bevel, groove or furrow. Tapping is a process for producing internal threads using a tool (tap) that has teeth on its periphery to cut threads in a predrilled hole. The two common thread series used in industry are the coarse and fine series, specified as UNC and UNF.***

The main objectives of our project are:

1. To improve the quality of the product.

2. To reduce the cycle time of machine.

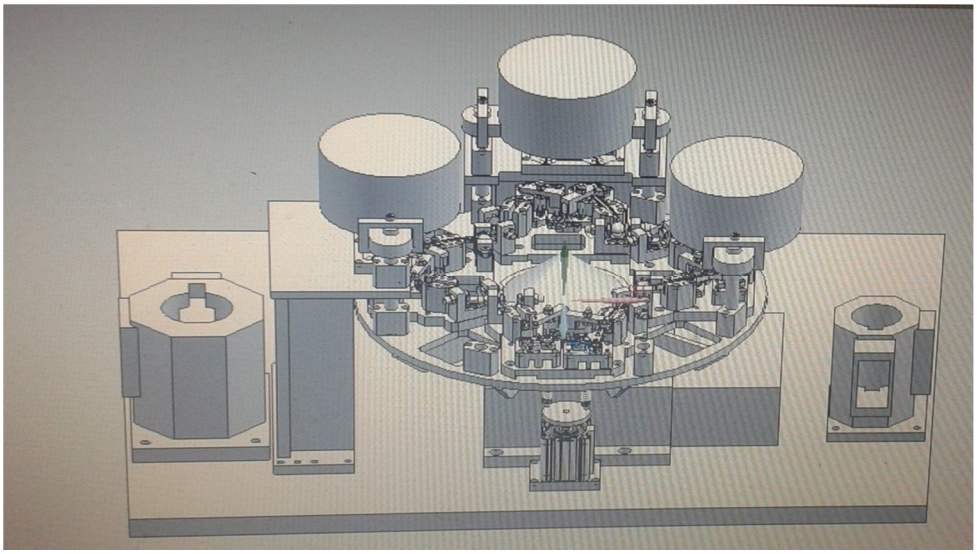
3. To reduce the maintenance cost of LEVER SPM`.

With the help of Mitsubishi PLC and Servo System we meet our objectives.

Keywords: LEVER SPM, Drilling, Chamfering, Tapping, Mitsubishi PLC, Servo system.

I. INTRODUCTION

The project is to upgrade a LEVER SPECIAL PURPOSE MACHINE (SPM). LEVER SPM is the machine which performs the DRILLING, CHAMFERING & TAPPING processes. The TAPPING process in LEVER is mainly done for finishing purpose and minimize extra unwanted burr in LEVER. Electronic up gradation is based on PLC programming. Electronic up gradation is based on PLC programming.



II. BACKGROUND

Considering the fact that the machines having older designs need more maintenance and hence the machines need up gradation in order to improve production , speed, quality of the product, reduce maintenance time and cost.

PLC(Programmable Logic Controller) is a digital computer used for the automation of electromechanical process, such as control of machinery on factory lines. These PLCs were programmed in ladder logic which is strongly resembles a schematic diagram of relay logic. A formal PLC definition comes from the National Manufactures Association,

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"A PLC is a digitally operated electronic system, designed for use on an industrial environment which uses a programmable memory for the internal storage of user oriented instruction for implementing specific function such as logic, sequencing, timing and arithmetic to control, through digital or analog inputs and output, various types of machines or process."

A. Disadvantages of current system

1) System is currently operating on basis of MTC (Machine Tool Control) which is very complicated to replace and upgrade.
2) As it is not cost efficient also, PLC is used for ease of controlling.
3) The system is also not up to the latest technology trending in the market.

B. Need of up gradation:-

1) Need for this arises because of basic reason of high complexity due to large number of discrete boards controlling the system. Thus fault detection and correction becomes difficult.
2) One of the reasons for up-gradation is to implement current system using PLC.

III. PROPOSED METHODLOGY

With the up-gradation of the system using a PLC, the product quality as well as the product manufacturing rate can also be improved. The idea is making a special purpose machine which has a highly rectified operating system being operated by the various functions and to develop a process system for improving quality and production and reducing time.

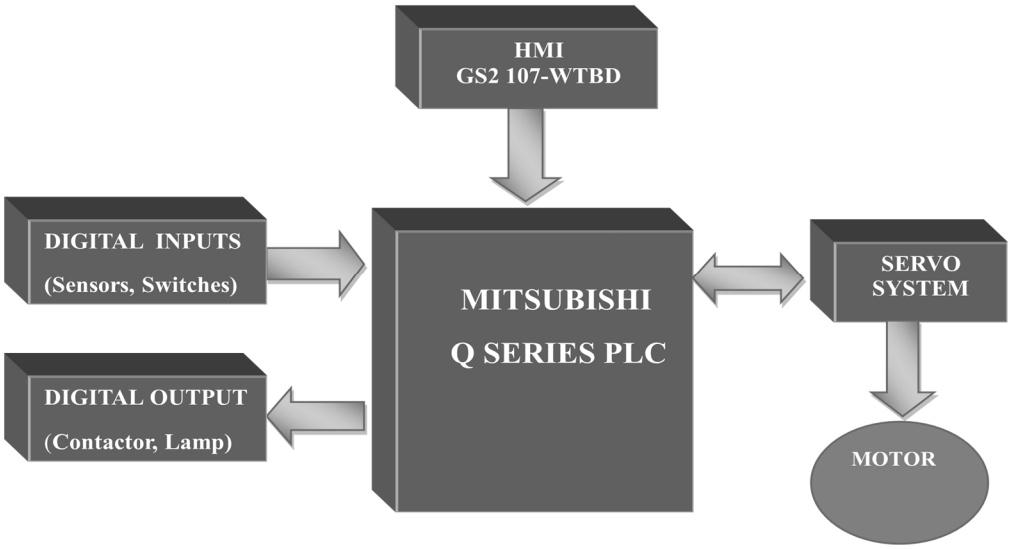
Programs to control machine operation are typically stored in battery backed up or non volatile memory. A PLC is an example of hard real time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

IV. BLOCK DIAGRAM

A control panel contain main device as CPU which controls all PLC system. Input is given to system by digital input module block and the output is taken from output module. Along with the CPU block there is motion control and input, output modules. Servo amplifier is controlled by motion control block and output from servo amplifier is feed to servo motor and given back to motion control block.

MITSUBISHI GS2 107-WTBD HMI is connected to MITSUBISHI PLC via Q BUS interface which resulting too easy and quick installation. Input of PLC contains Push buttons, level switches, Pressure sensors from which we perform different controlling operation.

The input/output arrangements may be built into a simple PLC or the PLC may have external I/O modules attached to a computer network that plugs into the PLC. Output side contains o/p relays some amount time to change the signal level at o/p side to the processor data by the processor.

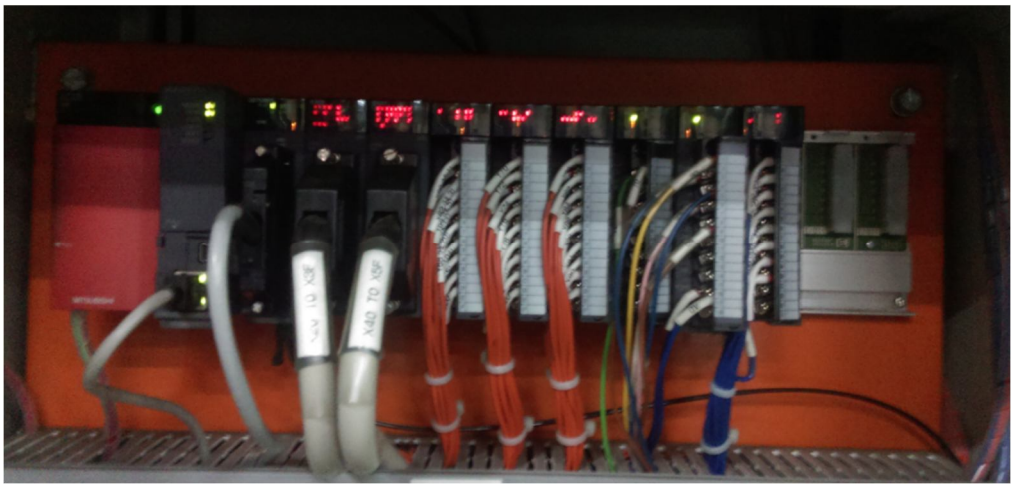


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Volume 4 Issue IV, April 2016
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A. MITSUBISHI Q01 PLC

A PLC is a digitally operated electronic system, designed for use on an industrial environment which uses a programmable memory for the internal storage of user oriented instruction for implementing specific function such as logic, sequencing, timing and arithmetic to control, through digital or analog inputs and output, various types of machines or process.



1) Input unit can be any of several different types depending on input signals expected as described above.
   a) The input section can accept discrete or analog signals of various voltage and current levels.
   b) Present day controllers offer discrete signal inputs of both AC and DC voltages from TTL to 250 VDC and from 5 to 250 VAC.
   c) Analog input units can accept input levels such as ±10 VDC, ±5 VDC and 4-20 ma current loop values.
   d) Discrete input units present each input to the CPU as a single 1 or 0 while analog input units contain analog to digital conversion circuitry and present the input voltage to the CPU as binary number normalized to the maximum count available from the unit.
   e) The number of bits representing the input voltage or current depends upon the resolution of the unit.
   f) This number generally contains a defined number of magnitude bits and a sign bit.
   g) Register input units present the word input to the CPU as it is received (Binary or BCD).

2) Output unit operate much the same as the input units with the exception that the unit is either sinking (supplying a ground) or sourcing (providing a voltage) discrete voltages or sourcing analog voltage or current.
   a) These output signals are presented as directed by the CPU. The output circuit of discrete units can be transistors for TTL and higher DC voltage or Triacs for AC voltage outputs.
   b) For higher current applications and situations where a physical contact closure is required, mechanical relay contacts are available.
   c) These higher currents, however, are generally limited to about 2-3 amperes.
   d) The analog output units have internal circuitry which performs the digital to analog conversion and generates the variable voltage or current output.

3) Programming device used to enter the desired program that will determine the sequence of operation and control of process equipment or driven machine.

B. HMI MITSUBISHI GS2 107-WTBD:

MITSUBISHI GS2 107-WTBD HMI can be directly connected to the MITSUBISHI PLC via serial interface resulting in easy and quick installation. It also replaces the conventional push button panel and wiring. MITSUBISHI introduce this series of touch screen terminals for effective communication between operator and machine.

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C. Servo Motor

Servo motor is a special type of motor which is automatically operated up to certain limit for a given command with help of error-sensing feedback to correct the performance. The main reason behind using a servo is that it provides angular precision, i.e. it will only rotate as much we want and then stop and wait for next signal to take further action. This is unlike a normal electrical motor which starts rotating as and when power is applied to it and the rotation continues until we switch off the power. We cannot control the rotational progress of electrical motor; but we can only control the speed of rotation and can turn it ON and OFF.



D. Servo Amplifier

A servo drive is a special electronic amplifier used to power electric servomechanisms. A servo drive monitors the feedback signal from the servomechanism and continually adjusts for deviation from expected behavior. Servo drive receives a command signal from a control system, amplifies the signal, and transmits electric current to a servo motor in order to produce motion proportional to the command signal. Typically the command signal represents a desired velocity, but can also represent a desired torque or position.



V. SOFTWARE IMPLEMENTATION

A. PLC Ladder

1) Every PLC has associated programming software that allows the user to enter a program into the PLC.

2) Software used today is Windows based, and can be run on any PC.

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3) Different products may require different software.

4) In this project PLC used is Mitsubishi. For this PLC GX-DEVELOPER software is used.

Early PLC's were designed to replace relay logic systems. These PLC's were programmed

In ladder logic, which strongly resembles a schematic diagram of relay logic. This program notation was chosen to reduce training demands for the existing technicians. Other early PLC's used a form of instruction list programming based on stack based logic solver.

GX Developer is the standard programming software for all MELSEC PLC series and combines all functions of MELSEC with the user guidance of Microsoft windows. With this software we can comfortably create PLC programs alternatively in the form of ladder diagrams or instruction lists. GX Developer can be run under MS windows, XP and VISTA.

B. NX 7.5

NX, formerly known as NX Unigraphics or usually just U-G, is an advanced high-end CAD/CAM/CAE software package originally developed by Unigraphics, but since 2007 by Siemens PLM Software.

It is used, among other tasks, for:

1) Design (parametric and direct solid/surface modeling)

2) Engineering analysis (static, dynamic, electro-magnetic, thermal, using the Finite Element Method, and fluid using the finite volume method).

3) Manufacturing finished design by using included machining modules.

NX is a direct competitor to CATIA, Creo, and Solid works.

VI. RESULTS



Fig. LEVER before & after furnishing

A. Advantages of up gradation

1) Cycle time is reduced.

2) Quality of the product is improved.

3) Cost is reduced

VII. ADVANTAGES

A. Reduced space: PLC is a solid state device and hence extremely compact compared to hard wired controller.

B. Energy saving: Power required by PLC is less as compared to the equivalent relay logic board.

C. Re-programmability: PLC can be re-programmed by using programming device.

D. Re-usability: PLC can be re-used for other applications.

E. Easy troubleshooting: Indicator lights are used provided at major diagnostic points to simplify trouble shooting.

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F. Greater reliability and lifetime: PLC consists of static devices hence less number of parts reduces wear and tear and hence less down time of machine.

VIII. APPLICATIONS

A. The purpose of the PLC is to control and implement the operations of drilling, chamfering & tapping on LEVER.

B. Also we can add the facility of LAN connection to control other PLC s from the Remote Controlling Station using LAN Technology like Ethernet. Instead of providing different controlling stations for different machines, same remote control station can be used to operate distributed machine.

C. PLC can be used in batch processing system, where the same product is to be manufactured over and over again in the same cycle.

IX. CONCLUSION

A. Earlier ,three different systems were required for the above mentioned operations but now as a single system performs all the operations, power required is reduced to a great extent.

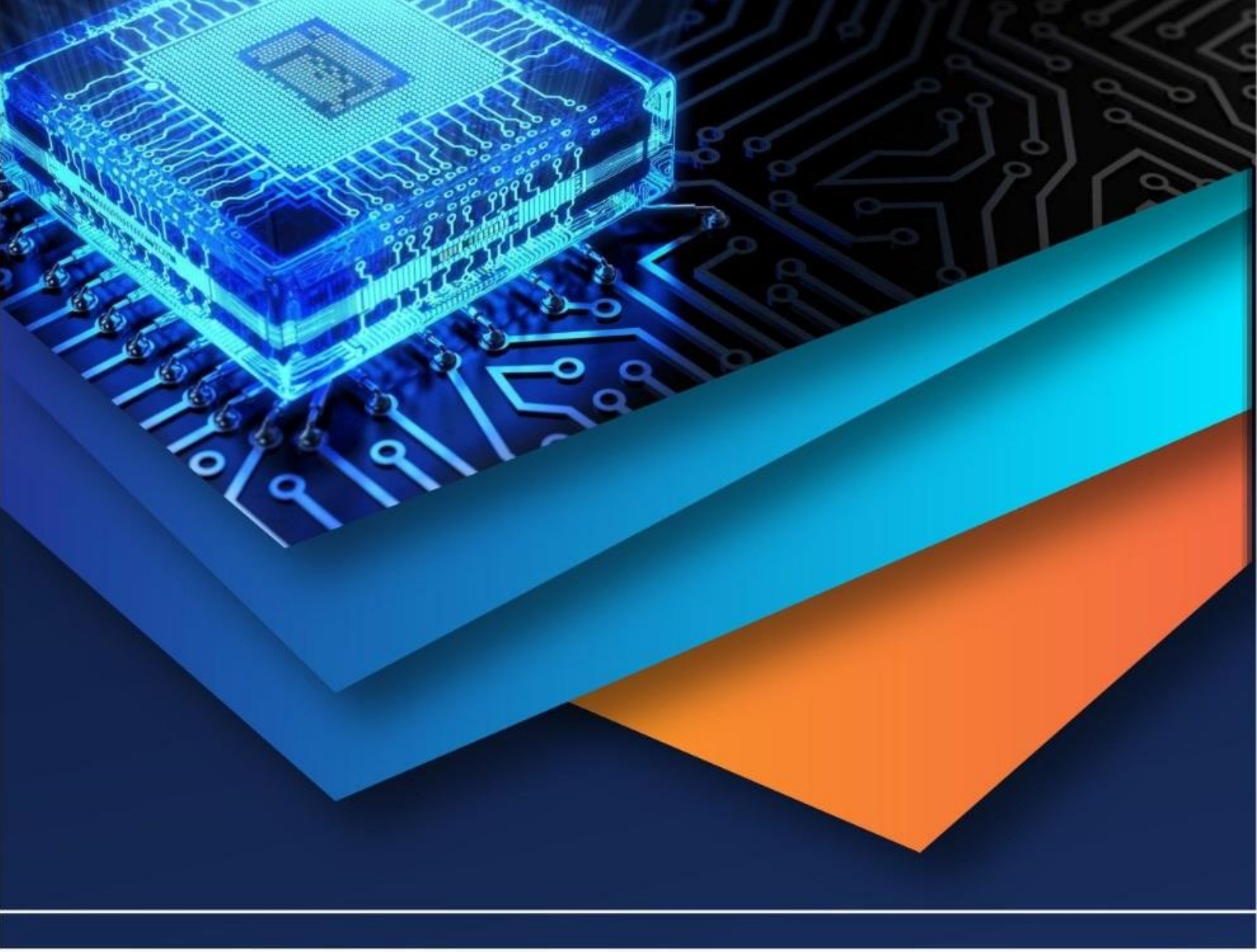
B. Hence, this system can be used as device performing multiple operations such as Drilling , Chamfering and Tapping.

C. Also, productivity increases as many such units can be made simultaneously in less time**.**

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