A PROJECT REPORT

ON

"AUTOMATED LUBRICATION SYSTEM"

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In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING

IN

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UNDER THE GUIDANCE

Of

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APPROVAL OF DISSERTATION

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CHAPTER 1

INTRODUCTION

➢ AUTOMATION

"Automation" or "Automatic control", is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated.

The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision.

The term "Automation", inspired by the earlier word automatic (coming from "Automaton"), was not widely used before 1947, when Ford established an automation department. It was during this time that industry was rapidly adopting feedback controllers, which were introduced in the 1930s.

Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques.

Fig. 1.1

CHAPTER 2

HISTORY

Before the days of the PLC the only way to control machinery was through the use of relays. Relays work by utilizing a coil that, when energized, creates a magnetic force to effectively pull a switch to the ON or OFF position. When the relay is de-energized, the switch releases and returns the device to its standard ON or OFF position. So, for example, if I wanted to control whether a motor was ON or OFF, I could attach a relay between the power source and the motor. Then I could control when the motor is getting power by either energizing or de-energizing the relay. Without power, of course, the motor would not run, thus I am controlling the motor. This type of relay is known as a power relay. There could be several motors in one factory that need to be controlled, so what do you do? You add lots of power relays. So factories started to amass electrical cabinets full of power relays. But wait, what switches the coils in the power relays ON and OFF before the power relay turns the motor ON, and what if I want to control that? What do you do? More relays. These relays are known as control relays because they control the relays that control the switch that turns the motor ON and OFF. I could keep going, but I think you get the picture of how machines were controlled pre-PLC, and, more importantly, I think you start to see some of the problems with this system of electromechanical control via relays.

Fig.2.1

"So thereby invented the First **Programmable Logic Controller (PLC)**, started as a consultation project for the General Electric Company in 1968, thus the **PLC History** was born."

"Dick Morley. Richard (Dick) Morley"

"Dick Morley. Richard (Dick) Morley" was considered the **"Father"** of the programmable logic controller (PLC) since he was involved with the production of the first PLC for General Motors, the **Modicon**, at Bedford and Associates in **1968**. The Modicon brand of PLC is now owned by Schneider Electric."

Morley had a pretty clear picture of what he wanted this programmable controller to look like:

- ➢ No interrupts for processing
- ➢ Direct mapping into memory
- ➢ No software handling of the repetitious chores
- ➢ Slow (a mistake which Morley later realized)
- ➢ A rugged design that really worked
- ➢ Language (ladder logic came a few months later)

Morley took that memo to the team at Bedford, including Mike Greenberg, Jonas Landau and Tom Boissevain. Together, they worked on designing the unit that would be modular and rugged, using no interrupts. They called it the 084, since it was the 84th project for Bedford and Associates.

The mechanical and thermal design of the 084 made it stand apart from anything else any other company currently offered. It could withstand physical abuse, had no air inside and transferred air out through big metal fins so that no dirty air got inside to the electronics, meaning the device didn't have to be in a sealed cabinet.

The first PLC can be traced back to 1968 when Bedford Associates, a company in Bedford, MA, developed a device called a Modular Digital Controller for General Motors (GM). The MODICON, as it was known, was developed to help GM eliminate traditional relay-based machine control systems. Because relays are mechanical devices, they have limited lifetimes. They are also cumbersome, especially in large applications where thousands of them may exist. With so many relays to work with, wiring and troubleshooting could be quite complicated.

Since the MODICON was an electronic device, not a mechanical one, it was perfect for GM's requirements, as well as for many other manufacturers and users of control equipment. With less wiring, simpler troubleshooting, and easy programming, PLC technology caught on quickly

.

PLCs are often defined as miniature industrial computers that contain hardware and software that is used to perform control functions. A PLC consists of two basic sections: the central processing unit (CPU) and the input/output interface system. The CPU, which controls all PLC activity, can further be broken down into the processor and memory system. The input/output system is physically connected to field devices (e.g., switches, sensors, etc.) and provides the interface between the CPU and the information providers (inputs) and controllable devices (outputs).

PLCs can be divided into at least three categories:

'**Full-size**, for top level applications requiring fast program execution with very short instruction cycle times. They are capable of supporting several CPUs for multiprocessing to provide more processing power. They offer the TCP/IP communication capability over general purpose networks to the supervisory workstations, and support field bus data transmission with equipment controllers.

'**Middle-size**, intended for industrial automated systems of medium power. They offer a large choice of analog and digital input/output modules. They are usually connected to a field bus on one side and to the equipment on the other side; their speed is not an important parameter, the amount of data transferred is small and the average price per function is low.

'**Small** or **micro-size**, for direct interface with sensors and actuators. They are very simple electrically and mechanically and are sometimes integrated with the intelligent sensor itself, they are characterized by short reaction times and they transfer a small amount of data.

CHAPTER 3

"PLC"

A programmable logic controller (PLC), or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

They were first developed in the automobile industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays and timers. Since then they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

➢ **FEATURES OF PLC:**

PLC control system is that it regards PLC as control key component, utilize special I/O module to form hardware of control system with a small amount of measurement and peripheral circuit, to realize control to the whole system through programming.

1. High Reliability

Strong anti-interference quality and very high reliability are the most important features of PLC. In order to make PLC work stably in strong interferential circumstance. Many techniques are applied in PLC. Software control instead of relay control mode can decrease faults which are brought about by original electric contact spot outside working badly. Industrial grade components made by advance processing technology can resist interferences, and self-diagnosis measures of watchdog circuit for protecting memory can improve performance of PLC greatly.

2. Good Flexibility

There are several programming languages for PLC including ladder diagram, SFC, STL, ST and so on. If operator can master only one of programming languages, he can operate PLC well. Every who want to use PLC has a good choice. Based on engineering

practice, capacity and function can be expanded by expanding number of module, so PLC has a good flexibility.

3. Quality of Strong Easy-Operating

It is very easy to edit and modify program for PLC by computer offline or online. It is very easy to find out where the fault lie by displaying the information of fault and function of Self Diagnosing Function, and all these make maintenance and repair for PLC easier. It is very easy to configure PLC because of modularization, standardization, serialization of PLC.

➢ BLOCK DIAGRAM :

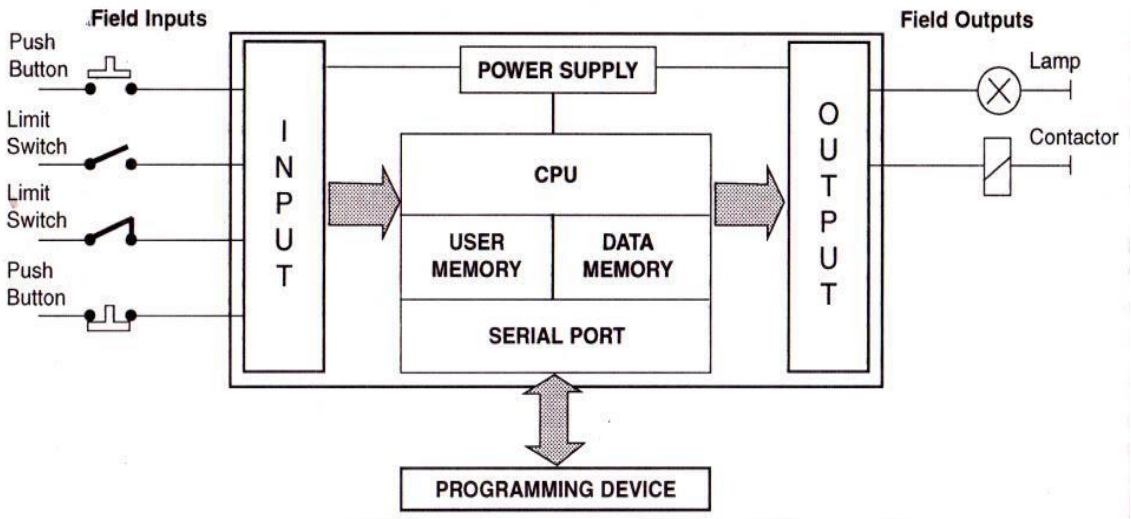

Fig. 3.1

A simplified block diagram of a PLC shown in above Fig. It has three major units/sections.

• I/O (Input/Output) Modules.

• CPU (Central Processing Units).

• Programmer/Monitor.

The input section converts the field signals supplied by input devices/sensors to logic-level signals that the PLC's CPU can read. The Processor Section reads these inputs, Processes the signal, and prepares the output signals.

The output section converts the logic level output signals coming from processor section to high level signals and used to actuate various output field devices.

The programmer/monitor is used to enter the user's program into memory and to monitor the execution of the program.

1) I/O Section:

The I/O sections establish the interfacing between physical devices in the real world outside the PLC and the digital arena inside the PLC.

The input module has bank of terminals for physically connecting input devices, like push buttons, limit switches etc. to a PLC. the role of an input module is to translate signals from input devices into a form that the PLC's CPU can understand.

The Output module also has bank of terminals that physically connect output devices like solenoids, motor starters, indicating lamps etc. to a PLC. The role of an output module is to translate signals from the PLC's CPU into a form that the output device can use.

The tasks of the I/O section can be classified as:

- **Conditioning**
- **Isolation**
- **Termination**
- **Indication**

An electronic system for connecting I/O modules to remotely located I/O devices can be added if needed. The actual operating process under PLC Control can be thousands of feet from the CPU and its I/O modules.

2) CPU Section:

The Central Processing Unit, the brain of the system is the control portion of the PLC. It has three Subparts.

Memory System

Processor

Power Supply

- **Memory System:**

The memory is the area of the CPU in which data and information is stored and retrieved. The total memory area can be subdivided into the following four Sections.

- **I/O Image Memory:**

The input image memory consists of memory locations used to hold the ON or OFF states of each input field devices, in the input status file.

The output status file consists of memory locations that stores the ON or OFF states of hardware output devices in the field. Data is stored in the output status file as a result of solving user program and is waiting to be transferred to the output module's switching device.

- **Data Memory:**

It is used to store numerical data required in math calculation, bar code data etc.

- **User Memory:**

It contains user's application program.

- **Executive Memory:**

It is used to store an executive program or system software. An operating system of the PLC is a special program that controls the action of CPU and consequently the execution of the user's program. A PLC operating systems designed to scan image memory, interprets the instruction of user's program stored in main memory, and executes the user's application program the operating system is supplied by the PLC manufacturer and is permanently held in memory.

- **Processor:**

The processor, the heart of CPU is the computerized part of the CPU in the form of Microprocessor / Micro controller chip. It supervises all operation in the system and performs all tasks necessary to fulfil the PLC function.

It reads the information i.e. status of externally connected input devices with input module.

It stores this information in memory for later use.

It carries out mathematical and logic operations as specified in application program.

After solving the user's program, it writes the result values in the memory.

It sends data out to external devices like output module, so as to actuate field hardware.

It performs peripheral and external device communication.
It performs self-diagnostics.

- **Power Supply:**

The power supply provides power to memory system, processor and I/O Modules.
It converts the higher level AC line Voltage to various operational DC values for electronic circuitry.

3) Programmer/Monitor:

The Programmer/Monitor (PM) is a device used to communicate with the circuits of the PLC. The programming unit allows the engineer/technicians to enter the edit the program to be executed.

In its simplest form it can be hand-held device with membrane keypad for program entry, and a display device (LED or LCD) for viewing program steps of functions.

More advanced systems employ a separate industrial terminal or personal computers with type-writer type keyboard and CRT monitors. With the help of proprietary software, it allows programmer to write, view and edit the program and download it into the PLC. It also allows user to monitor the PLC as it is running the program. With this monitoring systems, such things as internal coils, registers, timers and other items not visible externally can be monitored to determine proper operation. Also, internal register data can be altered, if required. To fine tune program operation while debugging .communication between PM and PLC is done via a cable connected to a special programming port on PLC. Connection to the personal computer can be through a serial port or from a dedicated card installed in the computer.

➢ DIFFERENT ASSEMBLY IN PLC :

• Processor or Central Processing Unit (CPU);
• Rack or Mounting;
• Input Assembly;
• Output Assembly;
• Power Supply;
• Programming Unit, Device, or PC/Software

We will start with explaining the physical components you see when looking at a PLC system and then explore what goes on inside each part, and how the components relate to each other.

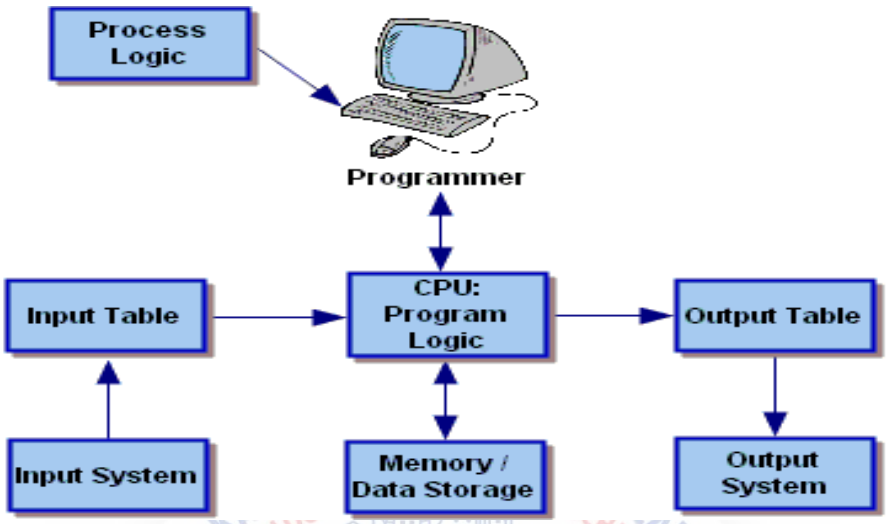

Fig. 3.2

- **Rack Assembly:**

Most medium to large PLC systems are assembled such that the individual components – CPU, Input/Output, Power Supply – are modules that are held together within a rack.
In smaller PLC systems – all of these components may be contained in a single housing or "brick" – these smaller systems are sometimes referred to as "bricks" or "shoebox" PLCs.

- **Power Supply:**

The power supply provides power for the PLC system. The power supply provides internal DC current to operate the processor logic circuitry and input/output assemblies. Common power levels used are 24V DC or 120 VAC.

- **Processor (CPU) :**

The processor, central processing unit, or CPU is the "brain" of the PLC. The size and type of CPU will determine things like: the programming functions available, size of the application logic available, amount of memory available, and processing speed. Understanding the CPU can be a complex subject and we will tackle that in other articles.

- **Input/output Assembly:**

Inputs carry signals from the process into the controller, they can be input switches, pressure sensors, operator inputs, etc. These are like the senses and sensors of the PLC.

Outputs are the devices that the PLC uses to send changes out to the world. These are the actuator the PLC can change to adjust or control the process – motors, lights, relays, pumps, etc.

Many types of inputs and outputs can be connected to a PLC, and they can all be divided into two large groups – analog and digital. Digital inputs and outputs are those that operate due to a discrete or binary change – on/off, yes/no. Analog inputs and outputs change continuously over a variable range – pressure, temperature, potentiometer.

- **Programming Device:**

The PLC is programmed using a specialty programmer or software on a computer that can load and change the logic inside. Most modern PLCs are programmed using software on a PC or laptop computer. Older systems used a custom programming device.

➢ MODULES IN PLC :

- **VACANT RACK :**

Fig.3.3

- **POWER SUPPLY :**

Fig. 3.4

The power supply (PS) section gets its input power from an external 120VAC or 240VAC source (line voltage), which is usually fused and fed through a control relay and filter external to the PS. In addition, the PS has its own integral AC input fuse.

- **INPUT MODULE :**

Fig. 3.5

It receives the peripheral sensing unit's signal and provides signal conditioning, termination, isolation and/or indication for that signal's state

- **OUTPUT MODULE :**

The output module transmits discrete or Analog signals to activate various devices such as hydraulic actuators, solenoids, motor starters, and displays the status (through the use of LEDs) of the connected output points.

- **RACK FILLED WITH INPUT / OUTPUT MODULES :**

Fig. 3.6

"NOW THIS IS HOW THE ACTUAL "PLC" LOOKS LIKE AFTER PUTTING ALL THE MODULES IN THE RACK & THE SAME HARDWARE OF "PLC" IS USED IN THE INDUSTRIES MANUFACTURED BY SIEMENS."

Fig. 3.7

PLC HARDWARE

➢ SCAN CYCLE OF PLC :

PLCs operate by continually scanning programs and repeat this process many times per second. When a PLC starts, it runs checks on the hardware and software for faults, also called a self-test. If there are no problems, then the PLC will start the scan cycle. The scan cycle consists of three steps: input scan, executing program(s), and output scan.

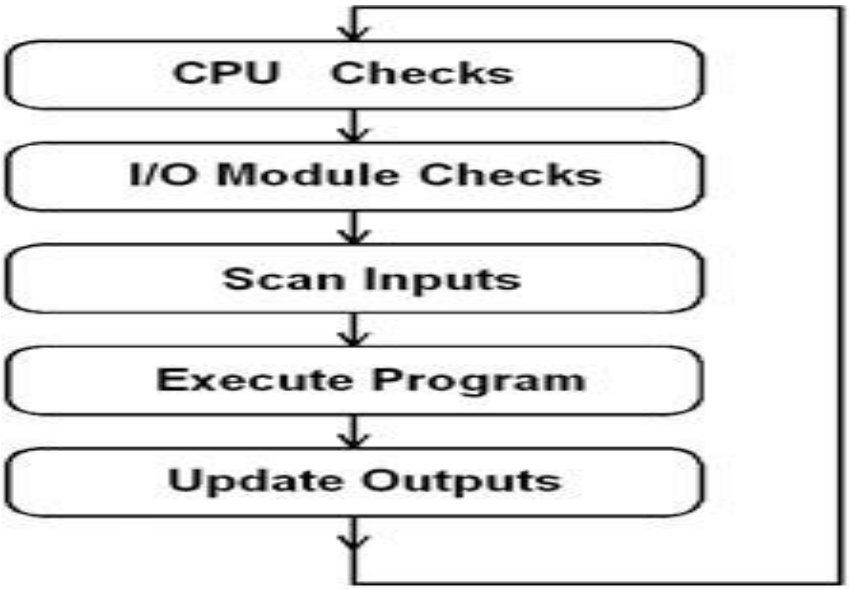

Fig. 3.8

Input Scan:

A simple way of looking at this is the PLC takes a snapshot of the inputs and solves the logic. The PLC looks at each input card to determine if it is ON or OFF and saves this information in a data table for use in the next step. This makes the process faster and avoids cases where an input changes from the start to the end of the program.

Execute Program (or Logic Execution):

The PLC executes a program one instruction at a time using only the memory copy of the inputs the ladder logic program. For example, the program has the first input as ON. Since the PLC knows which inputs are ON/OFF from the previous step, it will be able to decide whether the first output should be turned ON.

Output Scan:

When the ladder scan completes, the outputs are updated using the temporary values in memory. The PLC updates the status of the outputs based on which inputs were ON during the first step and the results of executing a program during the second step. The PLC now restarts the process by starting a self-check for faults

CHAPTER 4

"SCADA"

(Supervisory Control **and D**ata **A**cquisition**)**

- **WHAT IS SCADA?**

Supervisory Control and Data Acquisition (SCADA) is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers and discrete PID controllers to interface to the process plant or machinery. The operator interfaces which enable monitoring and the issuing of process commands, such as controller set point changes, are handled through the SCADA supervisory computer system. However, the real-time control logic or controller calculations are performed by networked modules which connect to the field sensors and actuators.

The SCADA concept was developed as a universal means of remote access to a variety of local control modules, which could be from different manufacturers allowing access through standard automation protocols. In practice, large SCADA systems have grown to become very similar to distributed control systems in function, but using multiple means of interfacing with the plant. They can control large-scale processes that can include multiple sites, and work over large distances. It is one of the most commonly-used types of industrial control systems; however there are concerns about SCADA systems being vulnerable to cyber warfare / cyber terrorism attacks.

➢ FEATURES OF SCADA :

- **DYNAMIC PROCESS GRAPHIC :**

Mimics the entire process on a screen.

- **REAL TIME AND HISTORICAL TREND :**

The trend play very important role in the process operation. If your batch fails or the plant trips, you can simply go to the historical trend data and do the analysis. You can have better look of the parameters through the trend.

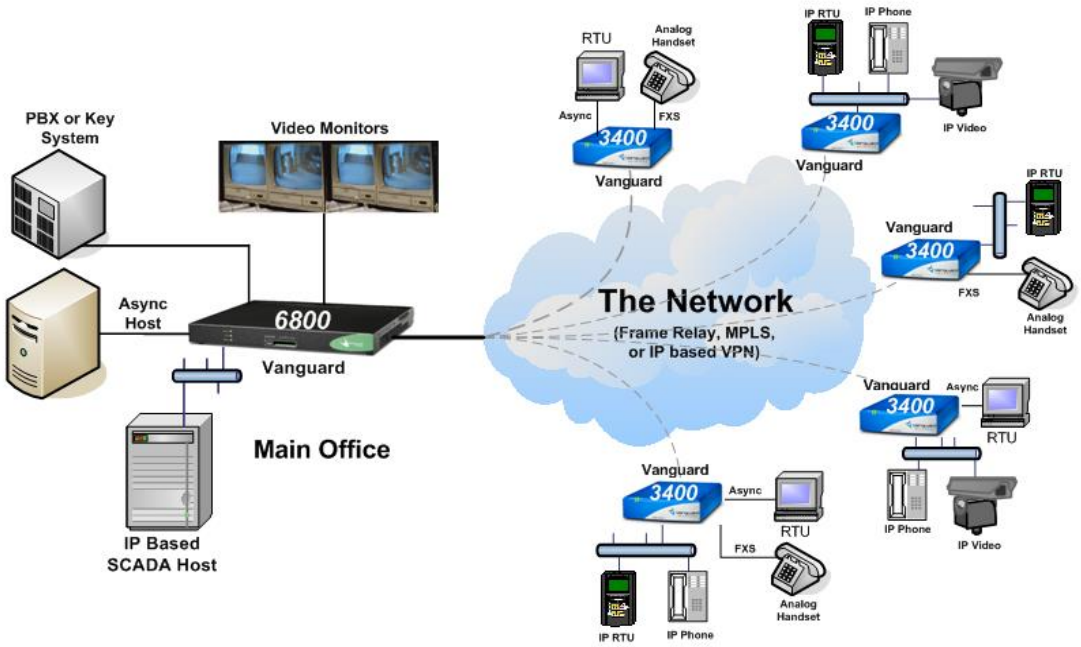

Fig.4.1

- **ALARMS :**

Have a critical role in automation scada supports 4types of alarms like LOLO, LO, HI, HIHI.

- **DEAD BAND :**

Value of dead band defines the range after which a high low alarm condition returns to normal.

- **RECIPE MANAGEMENT :**

When you have different products to manufacture, you just have to load the recipe of the particular product.

- **SECURITY :**

One can allocate certain facilities or features to the operator, process people, engineering dept. the operator, process people, engineering dept. and maintenance dept. and maintenance dept.

- **DATABASE CONNECTIVITY :**

Most manufacturing units go for enterprise resource management or management information system as data plays a very important role in the business cycle.

- **APPLICATIONS OF SCADA :**

SCADA is widely used in different areas from chemical, gas, water, communications and power systems. The list of applications of SCADA can be listed as follows :

1. Electric power generation, transmission and distribution: Electric utilities use SCADA systems to detect current flow and line voltage, to monitor the operation of circuit breakers, and to take sections of the power grid online or offline.

2. Water, Waste Water Utilities and Sewage: State and municipal water utilities use SCADA to monitor and regulate water flow, reservoir levels, pipe pressure and other factors.

3. Buildings, facilities and environments: Facility managers use SCADA to control HVAC, refrigeration units, lighting and entry systems.

4. Oil and Gas Trans & Distributions.

5. Wind Power Generation.

6. Communication Networks.

7. Industrial Plans and Process Control.

8. Production Department.

9. Quality Department.

10. Maintenance Department.

11. Enterprises Information.

12. Engineering Department.

13. Manufacturing Department.

14. Home Automation.

15. Distribution Stations

- **SCADA CONTROL ROOM OF THE PLANT :**

Fig. 4.2

- **ADVANTAGES :**

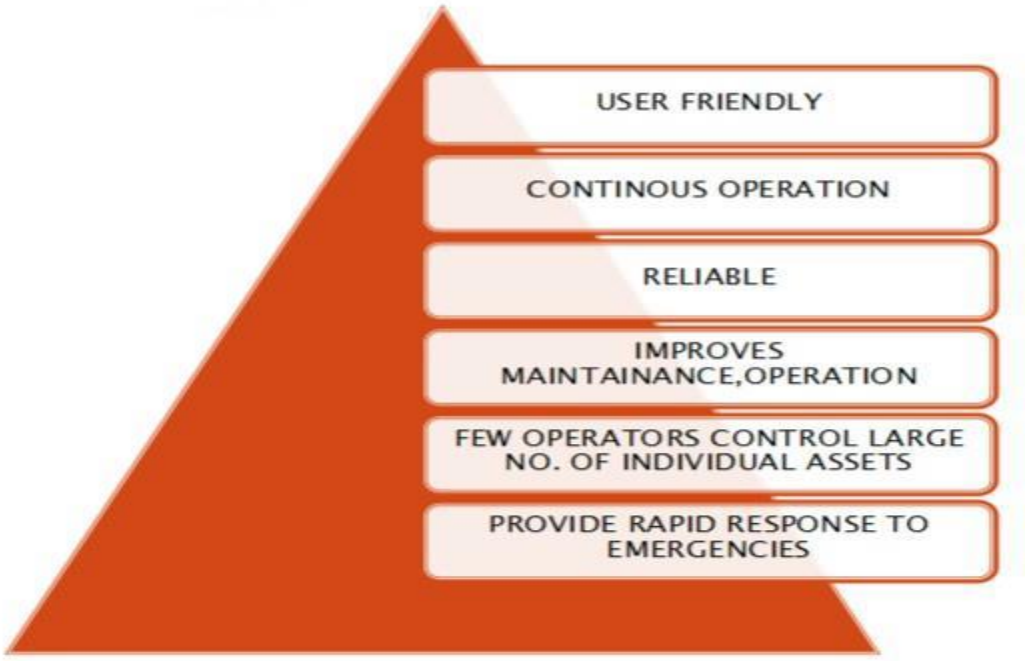

Fig. 4.3

- **SHOTCOMINGS :**

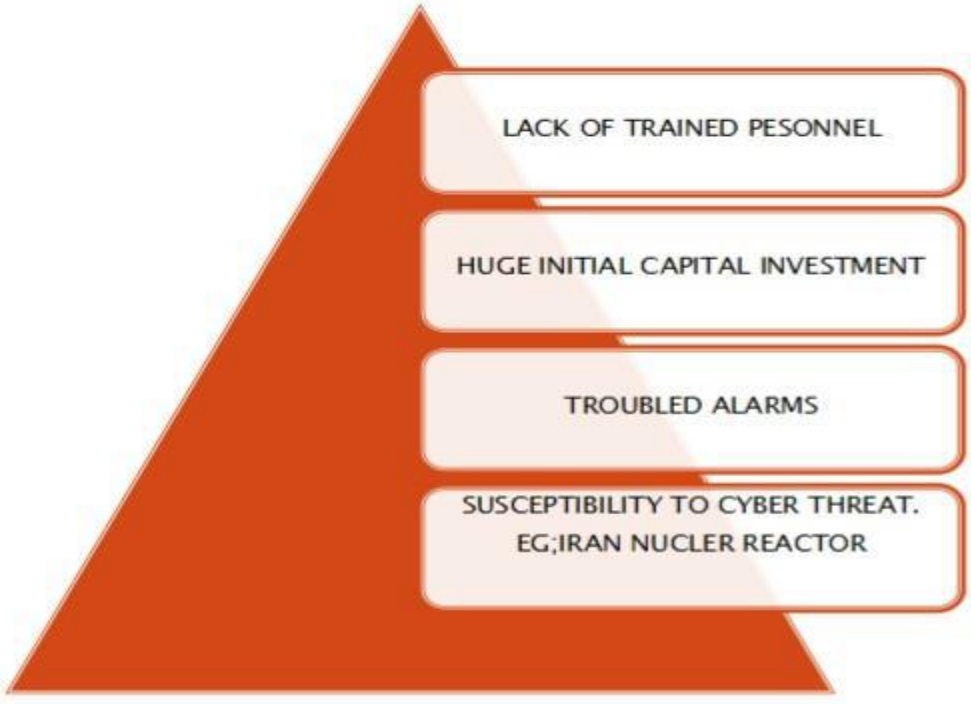

Fig. 4.4

CHAPTER 5

PROBLEM STATEMENT

Nowadays, the usage of lubricant in industry has become dominant because of high production demands. Since the purchase and disposal of lubricant is becoming increasingly expensive, lubricant reused is a viable option for cost reduction. The used lubricant from the machine will be sold to the supplier with approximately rm75 per barrel which is equivalent to 200 liter of used lubricant. In one of the automotive company, lubricant used at the cnc machine can be reused. However, as the chips and lubricants flow out together, both of them disposed which clearly is a waste of company. The initiative to reuse the lubricant would reduce the lubricant cost spend by isolating both chips and lubricant hence reduce reduce the environment pollution. This study aimed to propose a segregation concept of chips and lubricants at cnc machine through autonomus maintenance concept. Based on the analysis conducted, the root cause of the problem is the chips and the lubricant flow out together. After generating few ideas of segregation concept, the final design was selected which then constructed.

CHAPTER 6

LITERATURE SURVEY

PAPER 1

DESIGN AND FABRICATION OF AUTONOMOUS LUBRICATION OF CHAIN

International Journal of Latest Engineering Research and Applications (IJLERA)

Volume – 01, Issue – 02, May – 2016, PP – 05-13

- **ABSTRACT:**

Automated chain lubrication systems provide an exact metered quantity of lubricant and apply it reliably to the chain where it is required. Despite new types of material and advanced technology, many chains still require lubrication. Optimum lubrication reduces friction and subsequent wear on chains. The largest relative movement of all chains occurs between the link plate and the chain stud, and it is here where considerable forces are present. Insufficient lubrication of this area will result in premature wear and chain failure. The consequence is expensive production downtime. Precise and efficient lubrication is a prerequisite for trouble-free operation and long life of the chain. Modern automated chain lubrication systems apply precisely metered quantities of lubricant to the chain, exactly where it is needed – while the chain is in operation. Proper metering keeps the lubricant quantity to a minimum, yet ensures sufficient amounts, thus reducing the impact on your budget and, of course, the environment! minimizes chain wear and noise levels. The life span of chains can often be increased by ten times and more.

- **INTRODUCTION**

In many plants, maintenance departments are downsizing, yet there are still the same number of productions machines and lubrication points that require manual lubrication. Due to competitive demands, most industries are under increased pressure to be more efficient and improve “uptime”. Increased regulations that focus on the environment and safety (lock-out and tag-out requirements) require plant

maintenance managers and personnel to follow time-consuming procedures. With more than 100years experience in lubrication equipment and systems, Lincoln has the unique capability and system solutions to address these important issues. These universal challenges will not go away. Manual lubrication is not consistent with “pro-active” maintenance strategies and lowering overall cost. Grease is semi solid lubricant. It generally consists of a soap emulsified with mineral or vegetable oil. The characteristic feature of greases is that they possess a high initial viscosity, which upon the application of shear, drops to give the effect of an oil lubricated bearing of approximately the same viscosity as the base oil used in the grease. This change in viscosity is called 'Thixotropy'. Grease is sometimes used to describe lubricating materials that are simply soft solids or high viscosity liquids, but these materials do not exhibit the shear-thinning (Thixotropic) properties characteristics of the classical grease. For example petroleum jellies such as Vaseline are not generally classified as greases.

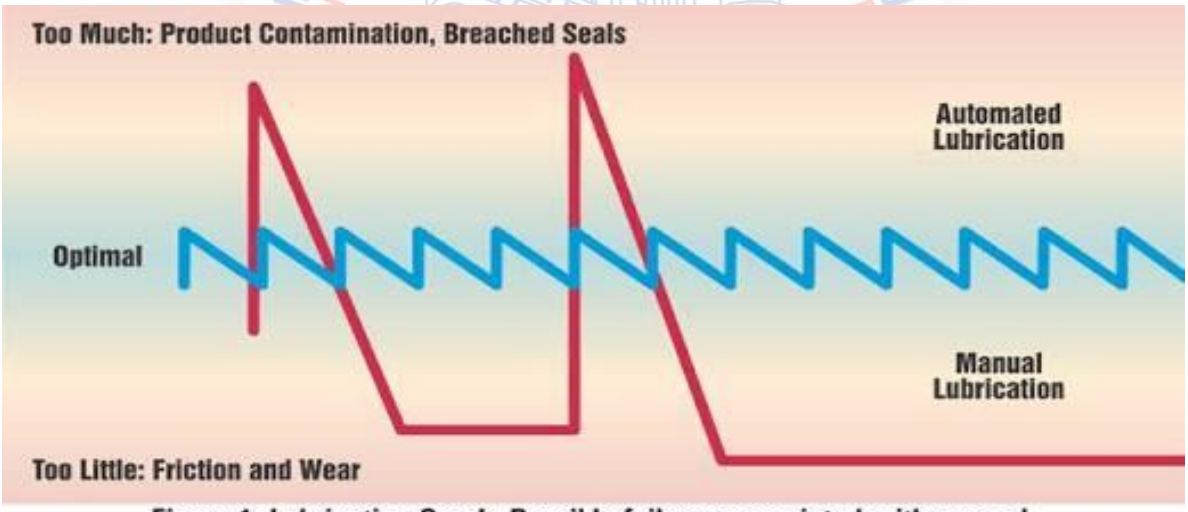

Figure 1. Lubrication Graph. Possible failures associated with manual lubrication that is not performed every day, or several times per day.

There are lots of problems with manual greasing such as

- There is excessive loss of grease.
- Equipment getting harmed due to over greasing.
- Excess time lost in lubrication.
- Requiring variable labors.

➢ LITERATURE SURVEY

There are many surveys done on lubrication systems but this AUTONOMOUS SELF LUBRICATION SYSTEM holds its own importance as the idea of lubrication on the intricate parts which cannot be lubricated manually are made to lubricate through this system. There are many surveys done under the topic of lubrication out of which some of them are:

A COMPARATIVE STUDY OF MANUAL LUBRICATION AND AUTOMATIC LUBRICATION done by Elakkiya /Asst. Prof A. Anita/ Asst. Prof Dept. of Electronics and instrumentation Engineering Dept. of Electronics and instrumentation Engineering Jeppiar Engineering College, Chennai, Tamil Nadu Jeppiaar Engineering College, Chennai, Tamil Nadu in which a comparison of the automatic and manual lubrication was done and the survey concluded as Frequent lubrication run time is eliminated and pump motor energy consumption is considerably reduced by appropriate material of stator core material winding. Motor overloading is reduced by using thermal relay which has high sensitivity. A complete literature survey on DESIGNING AND MANUFACTURING AN AUTOMATED LUBRICATION CONTROL SYSTEM IN CNC MACHINE TOOL GUIDEWAYS FOR MORE PRECISE MACHINING AND LESS OIL CONSUMPTION by Mahdi Sparham & Ahmed A. D. Sarhan & N. A. Mardi & the conclusion was made as In this research work, a newly designed automated lubrication control system for CNC machine tool guide ways was introduced for more precise machining and less oil consumption. It is a novel approach in machining technology in that the ideal lubrication condition during machining could be identified via temperature signals from sensitive sensors installed in the machine tool's guide ways. Temperature signals reflect the friction, wear, and loading conditions. Nevertheless, the temperature sensor signals are found to be implicated in periodic fluctuations such that once the temperature reaches a preset critical value, the temperature sensor signals fluctuate around that critical temperature up and down repeatedly in a very short time, misleading the controller. In each fluctuation cycle, the controller sends a wrong command signal for oil injection which leads to higher, unnecessary oil consumption.

➢ DESIGN PROCEDURAL OF AUTONOMOUS CHAIN LUBRICATION SYSTEM

The auto chain lubrication system was designed and modeled virtually on the basis of lubricating the components of a roller chain and the machine components and to come up with a new proposed system to eliminate the manual process so used till date.

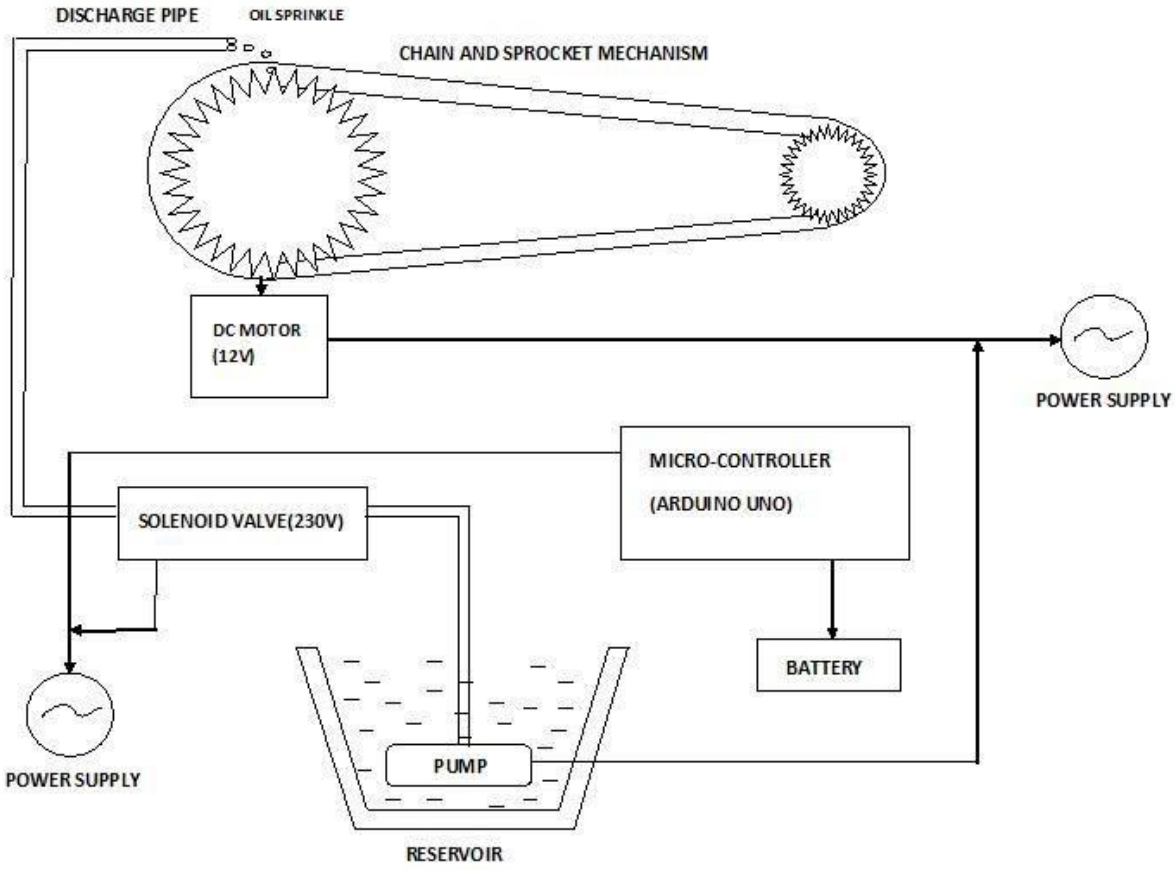

Fig.6.1

PAPER 2

Comparative Study of Manual Lubrication and Automatic Lubrication

T.Elakkiya Int. Journal of Engineering Research and Applications

ISSN: 2248-9622, Vol. 5, Issue 2, (Part -4) February 2015, pp.16-20

➢ ABSTRACT

Lubrication is the process or technique employed to reduce the wear of one or both surface in close proximity. Most of the bear lubrication fail due to the too much or too less grease injected using manual lubrication. So, to replace the manual lubrication discrete wiring employed in lubrication system in heavy machines using PLC. The PLC's can be used to overcome the shortcomings PLC is mainly used to reduce the labor cost, power consumption, complication in circuits.

➢ INTRODUCTION

Lubrication describes the phenomenon of reduction of wear occurs without human intervention. The science of friction, lubrication and wear is called tribology. Adequate lubrication allows smooth continuous operation of equipment, with only mild wear, and without excessive stresses or seizures at bearings. When lubrication breaks down, metal or other components can rub destructively over each other, causing destructive damage, heat, and failure. Automation is the use of various control systems for operating equipment such as machinery, steering of heavy machines. This involves the automation in lubrication system of a crawler system deployed in heavy excavator machine. The biggest benefit of the automation is that it saves labor. However, it is also used to save energy and materials and to improve quality, accuracy, precision. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronics in integration with computers.

➢ SURVEY ON AUTOMATIC LUBRICATION

In today's industrial environment, improper lubrication plays the major role. Improper lubrication scenarios include the contamination of the lubricant by replacements and repair, excess lubricant and labor for inefficient manual practice. Some of the indirect, but very real costs are downtime or lost production; product spoilage due to excess lubricant; environmental, safety or housekeeping issues; and excess energy consumption. While grease guns and manual lubrication seem to get the job done for many maintenance operations, their benefits often cannot compare to those provided by an automated lubrication system in terms of productivity, environmental issues and worker safety. An automated lubrication system helps to prevent bearing failure by providing the right amount of the right (fresh, clean) lubricant at the right time to the right place.

Bousu Sch of Electr. Eng. &Autom., Henan Polytech. Univ., Jiaozuo, China Li Wang discussed a special lubrication system is needed to ensure normal operation and prolong service life of the large machinery. In traditional centralized lubrication system, lubrication faults are easy to occur for many shortcomings such as poor generality, low measurement precision, inaccurate diagnosis of leakage and blockage. The practical systems cannot meet the requirements of a reasonable lubrication. This paper describes the structure planning of the lubrication system, technology of quantitative lubrication, online monitoring of pressure and temperature. A centralized lubrication system with distributed structure is put forward, which is composed of monitoring master, main control cabinet and lubricating terminals. The point-by-point lubrication and detection can be achieved in this system. The detection methods of oil pressure, flow and temperature are studied and reliable digital detection schemes were discussed. This system has been successfully applied in industrial field and the lubrication performance gets obvious improvement.

➢ AUTOMATIC LUBRICATION

PLC is mainly used to reduce the power consumption due to discrete wiring system, cost effectiveness is achieved. The lubrication system consists of 6 crawlers divided into 3 sections containing 2 crawlers each. When 1 of the

crawlers moves for 20 minutes the PLC checks for 25 bar pressure and activates the end switch grease tank empty, pressure release. As the pressure increases the pressure switch switches from one position to another to the changeover unit. The annunciation involves checking the critical situation that was not dealt in conventional systems. Later the discrete wiring came into existence but this wiring system lead to complication such as maintenance, power consumption. In the discrete wiring system two modes of operation namely auto and continuous.

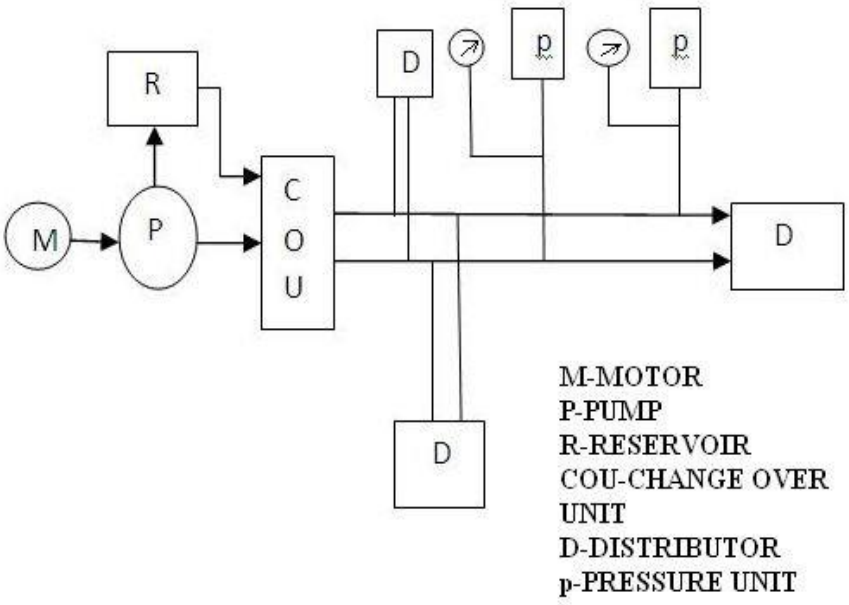

Fig.6.2 Basic block diagram for lubrication

The crawler is ON the delay timer is set there is separate wiring for safety measures such as pump overload, the grease tank empty, pressure releases. When there is a continuous current flow in the above mentioned wirings and the pressure in the dual lines increase the end switch is activated. The activated end switch triggers the changeover unit from position 1 to position 2 or vice versa. As the grease moves into the dual lines, the pressure gradually increases and it is detected by the end switch. The end switches severs the pressure sensor which detect the pressure in dual line.

PAPER 3

International Journal of Engineering Technology, Management and Applied Sciences

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REVIEW OF AUTOMATIC LUBRICATION SYSTEM

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➢ ABSTRACT

This project deals with the review of automatic lubrication system which is based on the hydraulic. The conventional lubrication system consists of manual providing of lubrication, the system usually time consuming so downtime is more. So the automatic lubrication system providing the lubrication to the lathe machine or any other machine which reduces the manpower requirement for system lubrication. Also take careness of automatic lubrication system is better than conventional lubrication. The project report also explains the components which are used to manufacture of PLC & SCADA based automatic lubrication system.

➢ INTRODUCTION

In many plants, maintenance departments are downsizing, yet there are still the same number of productions machines and lubrication points that require manual lubrication. Due to competitive demands, most industries are under increased pressure to be more efficient and improve "uptime". Increased regulations that focus on the environment and safety (lock-out and tag-out requirements) require plant maintenance managers and personnel to follow time-consuming procedures. With more than 100years experience in lubrication equipment and systems, Lincoln has the unique capability and system solutions to address these important issues. These universal challenges will not go away. Manual lubrication is not consistent with "pro-active" maintenance strategies and lowering overall cost.

Grease is semi solid lubricant. It generally consists of a soap emulsified with mineral or vegetable oil. The characteristic feature of greases is that they possess a high initial viscosity, which upon the application of shear, drops to give the effect of an oil-lubricated bearing of approximately the same viscosity as the base oil used in the grease. This change in viscosity is called 'Thixotropy'. Grease is sometimes used to describe lubricating materials that are simply soft solids or high viscosity liquids, but these materials do not exhibit the shear-thinning (Thixotropic) properties characteristics of the classical grease. For example petroleum jellies such as Vaseline are not generally classified asgreases.

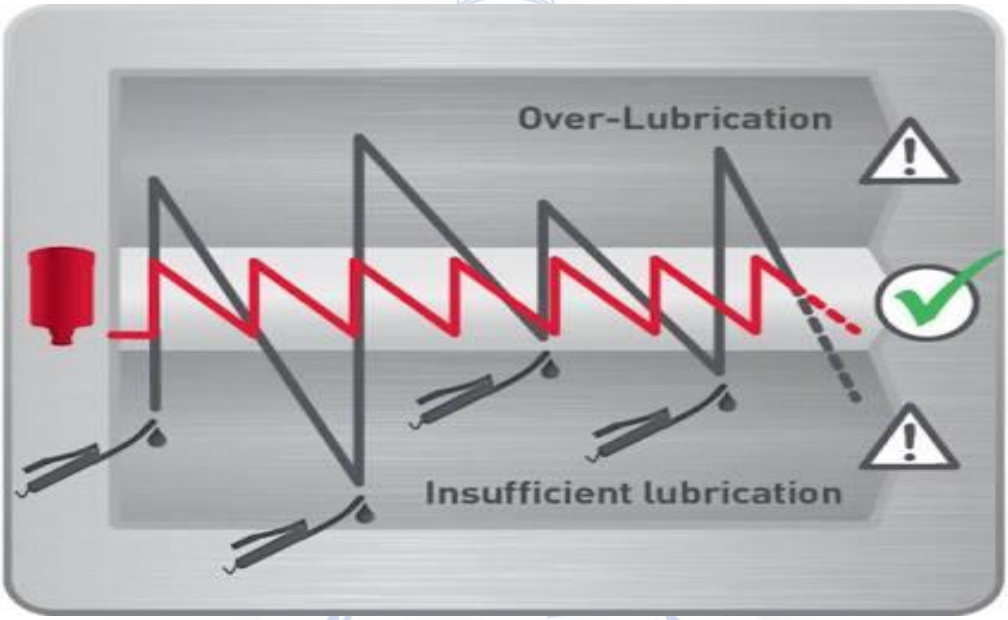


Fig.6.3

CHAPTER 7
METHODOLOGY

This is the following methods suggested by our group...

1. Automated chain lubrication systems provide an exact metered quantity of lubricant and apply it reliably to the chain where it is required. Despite new types of material and advanced technology, many chains still require lubrication. Optimum lubrication reduces friction and subsequent wear on chains. Precise and efficient lubrication is a prerequisite for trouble-free operation and long life of the chain. Modern automated chain lubrication systems apply precisely metered quantities of lubricant to the chain, exactly where it is needed – while the chain is in operation.

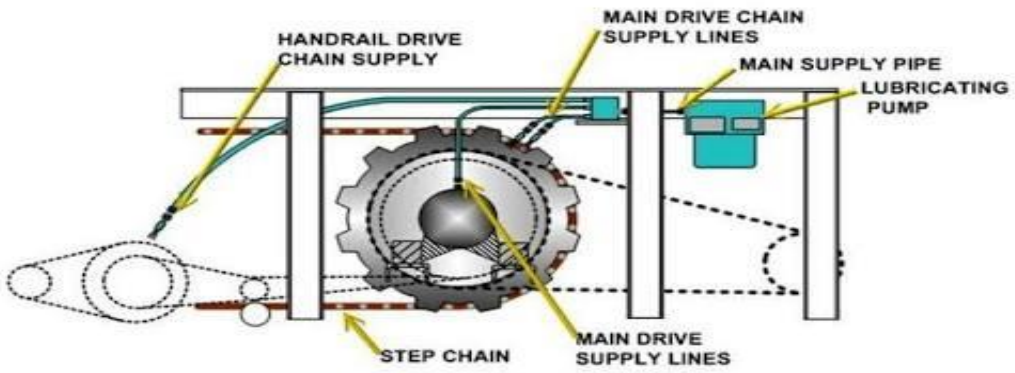


Fig.

2. The main components of automatic lubrication system are motorized pump, metering cartridge, manifolds, tubing and fittings with the help of this components we have designed the circuit layout of automatic lubrication system for this machine.

This is two way drilling and one way reaming machine there are two spindles for drilling and one spindle for reaming. This machine is beneficial for work shop where drilling and reaming perform simultaneously on job. The motor used for drilling and reaming is of 3 HP three phase induction motor.

The job operated on this machine is a Valve Guide which is a cylindrical piece of metal, pressed or integrally cast into the cylinder head, with the valve reciprocating inside it. It is

used in the cylinder head of the ships, it is the sleeve that valve moves up and down in and keeping it moving in an in and out motion.

With the help of machine layout, flow diagram for automatic lubrication system is designed. There are six lubricating points on this machine for which this system is designed.

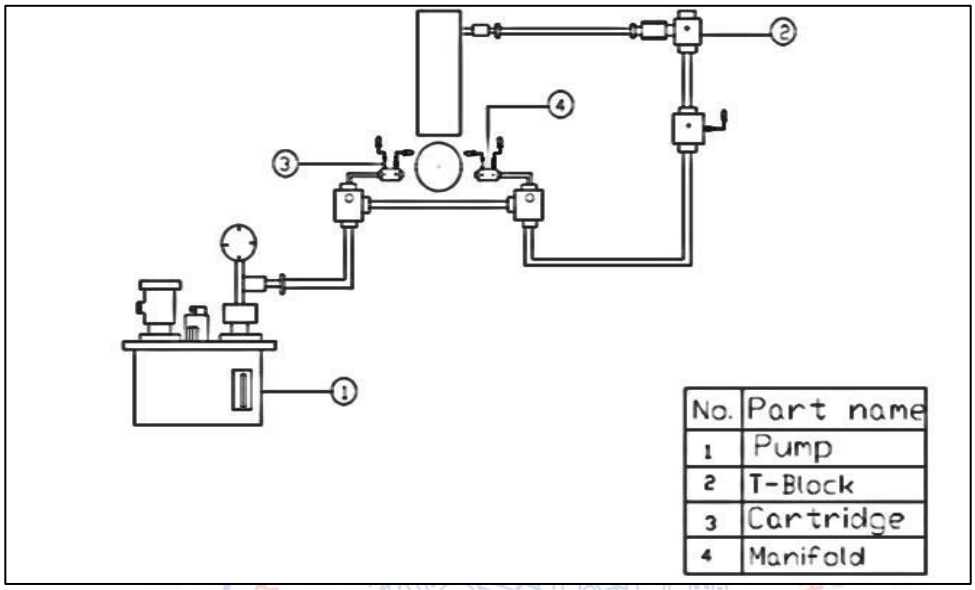


Fig.

3. We are preferred this method. Lubrication is the process or technique employed to reduce the wear of one or both surface in close proximity. Most of the bear lubrication fail due to the too much or too less grease injected using manual lubrication. So, to replace the manual lubrication discrete wiring employed in lubrication system in heavy machines using PLC. The PLC's can be used to overcome the shortcomings PLC is mainly used to reduce the labor cost, power consumption, complication in circuits.

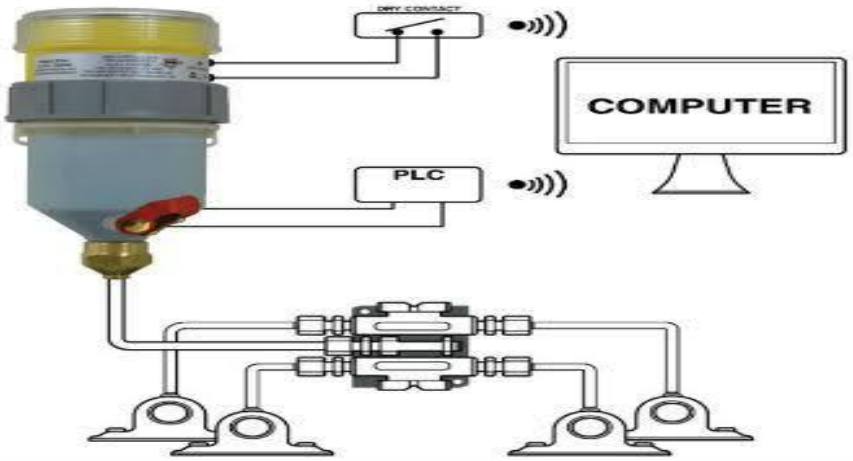


Fig.

CHAPTER 8

ABOUT PROJECT

➢ AUTOMATED LUBRICATION SYSTEM

In this system, the pump with reservoir is connected to the CNC machine with the valve and fittings. In this CNC machine, the machining of work piece is done due to which heating take place, which results into poor machining of the work piece. To avoid poor performance of machine, the lubrication is provided to the CNC machine after the heating temperature goes beyond the set value. When the temperature rises above set value indication is provided by the machine by blinking the warning bulb which turns red. These indication signals are sent to the pump and the pump is switched ON. The pump starts pumping the lubricant from reservoir to the CNC machine through distributor valve. As soon as the temperature falls below the set value, thereafter the pump remains active for a while so that temperature does not rise again instantaneously. As the temperature falls the warning bulb of the CNC machine also turns green which indicate the machine is safe from further heating. The reservoir gets filled up automatically or by manually by pressing the refill switch. This is how the cycle goes on inside this system whenever the temperature rises.

➢ BENEFITS:

- All critical components are lubricated, regardless of location or ease of access
- Lubrication occurs while the machinery is in operation causing the lubricant to be distributed.
- Proper lubrication of critical components ensures safe operation of the machinery.
- Less wear on the components means extended component life, fewer breakdowns.
- Measured lubrication amounts means no wasted lubricant
- Safety - no climbing around machinery or inaccessible areas (gases, exhaust, confined spaces)
- Lower energy consumption due to less friction.
- Increased overall productivity resulting from increase in machine availability.

- Maintenance benefits

  - Reduces labour costs.
  - Extends repair intervals.
  - Eliminates over- and under-greasing.

- Operational benefits

  - Increases equipment reliability.
  - Reduces unplanned downtime.
  - Improves equipment profitability.

- Safety benefits

  - Eliminates manual lubrication of dangerous, difficult-to-access points.
  - Reduces risk of slips and falls through precision lubrication.

- **COMPONENTS:**

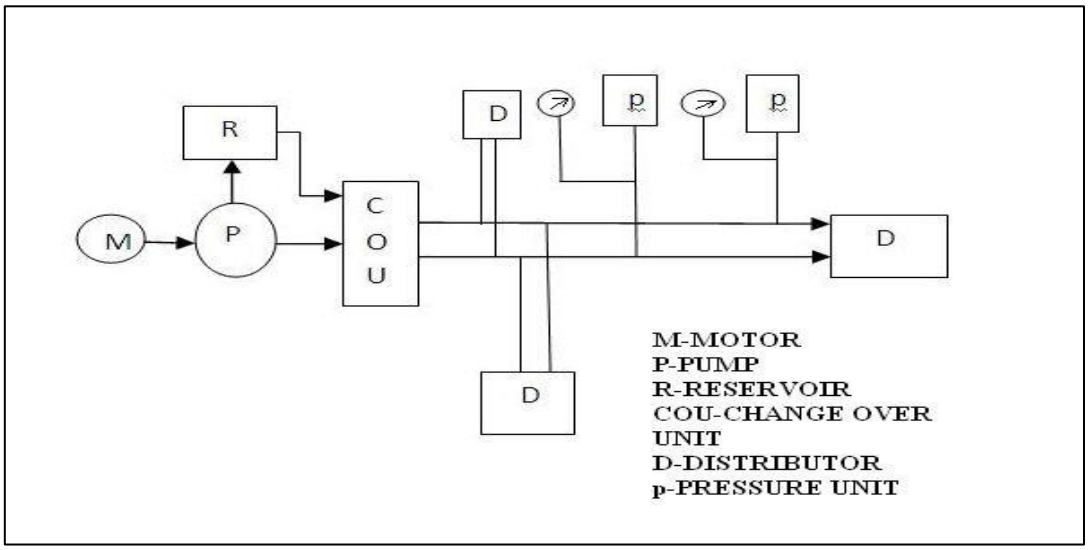


Fig.

- **PLC:**

A **programmable logic controller** (**PLC**), or **programmable controller** is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity

that requires high reliability control and ease of programming and process fault diagnosis.

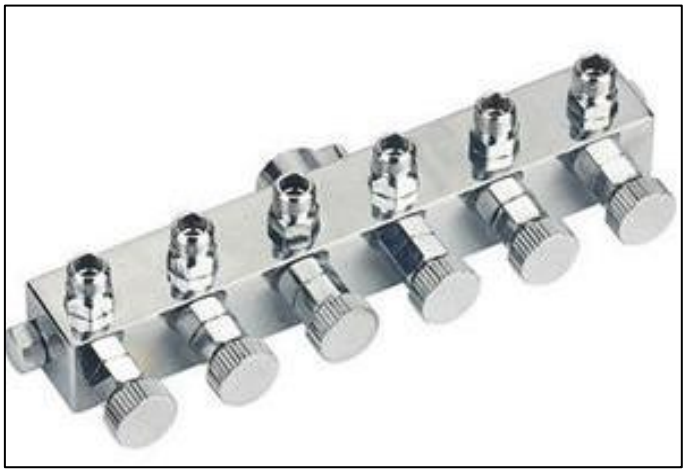
- **SCADA:**

The SCADA concept was developed as a universal means of remote access to a variety of local control modules, which could be from different manufacturers allowing access through standard automation protocols. In practice, large SCADA systems have grown to become very similar to distributed control systems in function, but using multiple means of interfacing with the plant.

- **GEAR PUMP WITH RESERVOIR:**

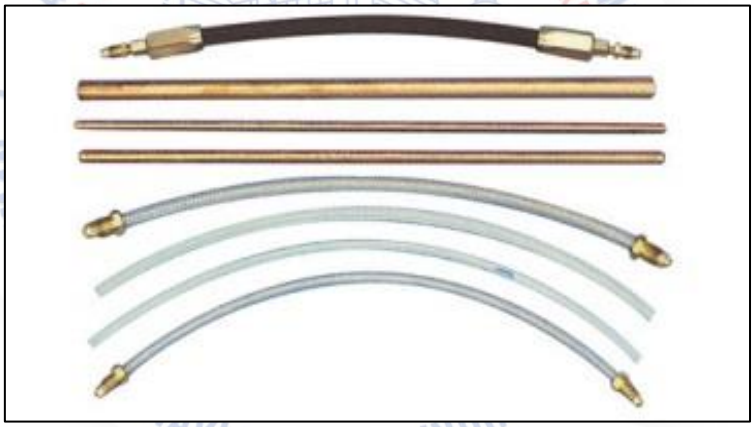
Gear pumps are also widely used in chemical installations to pump high viscosity fluids. There are two main variations; external gear pumps which use two external spur gears, and internal gear pumps which use external and internal spur gears (internal spur gear teeth face inwards, see below). Gear pumps are positive displacement (or fixed displacement), meaning they pump a constant amount of fluid for each revolution. Some gear pumps are designed to function as either a motor or a pump.

- **DISTRIBUTOR VALVE:**



They allow fluid flow into different paths from one or more sources. They usually consist of a spool inside a cylinder which is mechanically or electrically controlled. The movement of the spool restricts or permits the flow, thus it controls the fluid flow.

- **SUPPLY LINE:**



Line that connects the pump to the distributor valve. The lubricant is pumped through this. Tubing and fittings are basic accessories for the lubrication system.These are from the pump to the manifold and from the manifold to the lubrication point with in between metering cartridges tubing are required.for ejecting oil into the lubrication points, fittings are essential part of various threads.tubings we have used are of 4 mm and 6 mm. 4 mm tube is used for metering cartridge and 6 mm tube is considered as a main pipe.Some fittings used for this system are as follows.

- **FEED LINES:**

Line that connects the distributor valve or metering valves or injectors to the application points. The lubricant is pumped through this.

CHAPTER 9

PROJECT WORK

In this project ("PLC Programming & SCADA Representation for AUTOMATIC LUBRICATION SYSTEM") there are three stages on which the whole process are depending / working. Those three stages are shown below:

- **STAGES:**

  - **"SENSING THE TEMPERATURE"**

Let we understand each process one by one and will try to get then that how they are working. Sensing the temperature:-initially the operator working on lathe machine during the process the temperature of job attains valve beyond the set limit then this temperature is now sensed by a thermocouple, after sensing the temperature then the control unit sends the signal to pump to start providing the lubrication on lathe machine.

  - **"PROVIDE LUBRICATION"**

When the job attains the temperature above the set temperature, then the thermocouple senses the temperature & sends the signal to pump through relay then the relay sends on the signal to pump. Now the pump starts working & provides the lubrication to the lathe machine through the distributor valve. the function of distributor valve is to distribute the lubrication to various lathe machine in an industry, where the temperature exceeds. The pump is connected to a reservoir to supply the oil. The reservoir is having lubricated oil.

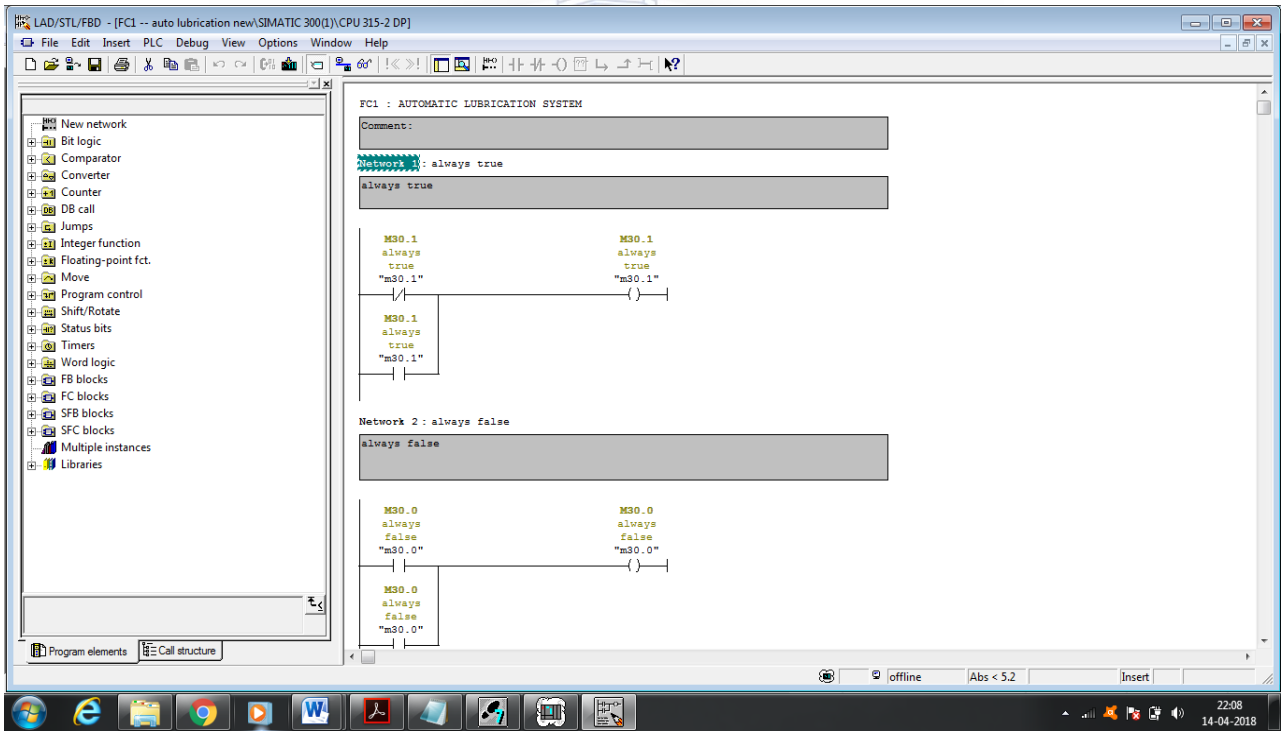
  - **"STOP THE LUBRICATION"**

When the temperature is maintained on the lathe machine, then the control unit sends the signal to pump through relay. The relay then sends off signal to pump now the pump stops working. There is a pressure gauge provided on a pump unit to know the pressure gauge provided on pump unit to know the pressure of lubrication oil. Again when the temperature rises above the set value, then the thermocouple sense the temperature and the control unit turns on the pump.

➢ AT STARTING:

In this **Automated Lubrication System** we have made the program in the **"Siemens Sematic Manager S7"** PC software in the form of Ladder Diagram which the help of which we give the command to the system in the setup of that particular operation like if we want to supply the lubrication to the bearing and we need to fill the reservoir and also for the temperature controlling. So before starting the process we need all the related process of safety maintenance should be done at the correct time.

Have a look of the Screen Shots of the Ladder Programming of **Automatic Lubrication System** made on the **"Siemens Siematic Manager S7"** software :



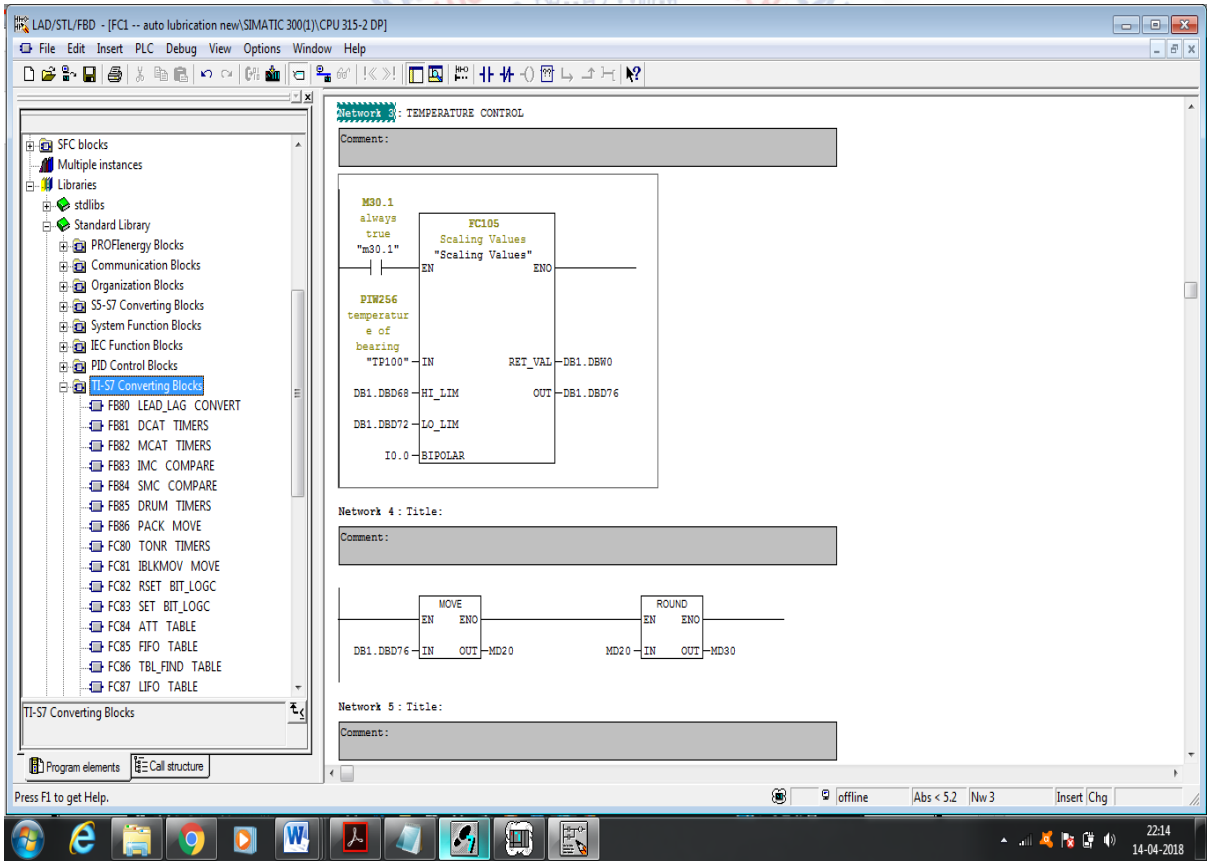
The functionality of this program is simply to take the status of one input and invert it to one output. So that your first logic program will function :

- If the input is 0 or FALSE; then the output will be 1 or TRUE.
- If the input is 1 or TRUE; then the output will be 0 or FALSE.

The Screen Shot of the system is showing the Rungs of Ladder Programming as the first Rung is having a normally closed which is giving the output to the “pump” followed by the latching as shown in the picture. Like that second Rungs are having normally open followed by the latching.

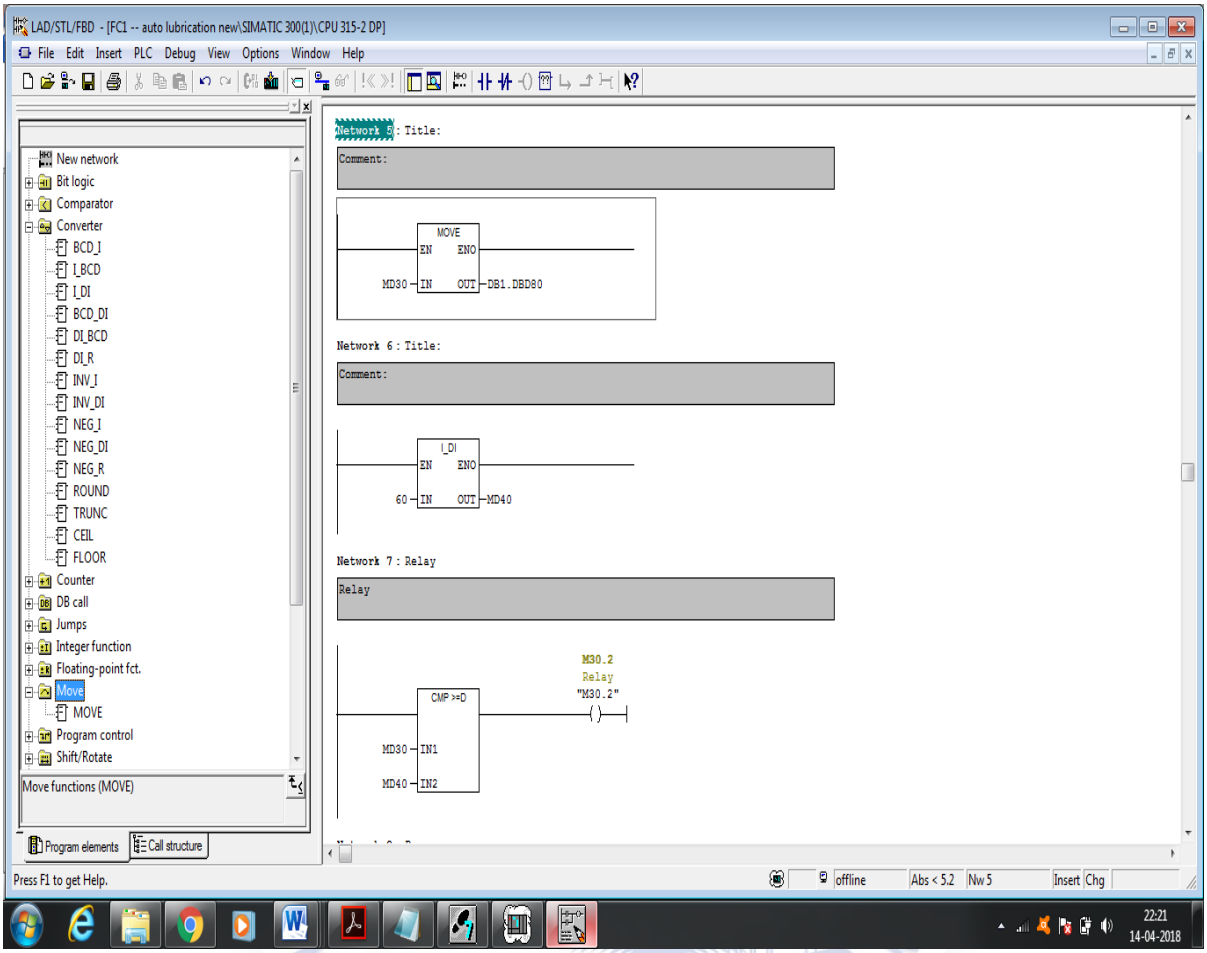
In our project we are controlling the temperature of lubricant by scaling programming in ladder logic. The controller are needed in the process because we have to put a particular temperature for the different application factor, once the temperature is reduced pump is turn off.

Since we have understood and made the Ladder programming for the scaling programming and for giving command to the system to control the lubricant temperature by the relay we have also made the programming the same. So the Screen Shot for that particular programming is shown:



In this particular screen shot we are seen that the scaling value which is output to the relay is move from data block DB to MD double word and then it is then round off to the block MD30.

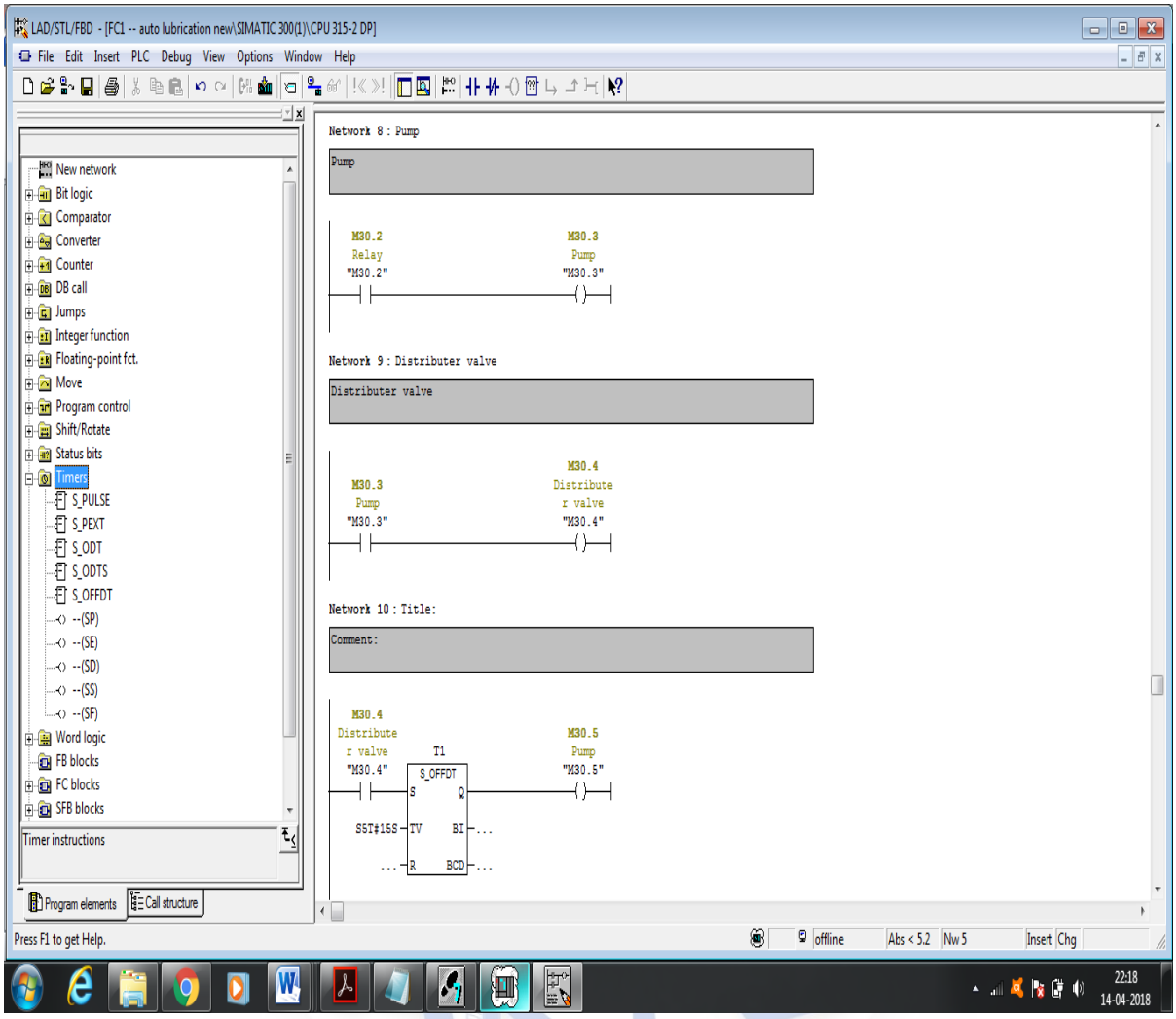
Have a look of the Screen Shots of the Ladder Programming made on the **"Siemens Siematic Manager S7"** software :



This particular screen shot gives the info about how the round off value to move to data block DB as it is single integer,often it is double integer in I_DI block, and so it is on the relay for the operation.

There is a comparater for comparison of original value to the set value and functioning of the relay is starts.

Have a look of the Screen Shots of the Ladder Programming made on the **"Siemens Siematic ManagerS7"**software:



In this particular screen shot it is seen that the relay will on the pump, as the pump on the lubricant is supply to the distributive valve where it is supplied to the lubrication needed area.

The last ring of the ladder block shows that the there is off delay timer (S_OOFDT) which has a function to remain the pump switch on to a particular time even the temperature goes below the set temperature, and the cycle will remain continuo as the temperature increases.

CHAPTER 10

SCADA REPRESENTATION

➢ SCADA REPRESENTATION FOR AUTOMATED LUBRICATION SYSTEM

After having a brief discussion of the PLC section in the **"PLC PROGRAMMING & SCADA REPRESENTATION FOR AUTOMATED LUBRICATION SYSTEM"** now we have to work on the SCADA Software which is more important now a day. And in the whole process the programming or representation of SCADA is difficult than programming of PLC.

In the market we do have so many companies which manufacture the software of SCADA and those SCADA software's are:

- **ROCKWELL AUTOMATIONS**
- **MODICON SCHNEIDER ELECTRIC**
- **ASTRA**
- **WINCC**
- **WONDERWARE IN-TOUCH**
- **FANUC**
- **I-FIX HMI/SCADA SOFTWARE**

These are the short listed most popular SCADA manufacturing companies and the names of their software from which we are using "WONDERWARE INTOUCH" which is widely used because of its simplicity and is easy to understand and the designing of mechanism in this particular software is quite easy and the representations looks better and we have multi numbers of animation choices for any type of constructions.

In the SCADA representation section we have linked our Ladder Programming of PLC with this WONDERWARE INTOUCH SCADA Software and got the desired output in a beautiful manner. In the software we get to see the working process on the display itself.

In the next section we will see the exact representation for our project i.e. “PLC Programming & SCADA Representation for AUTOMATED LUBRICATION SYSTEM”.

Have a look of the Screen Shots of the SCADA representation of the “PLC Programming & SCADA Representation for **“AUTOMATED LUBRICATION SYSTEM”** on the **“WONDERWARE INTOUCH”** software:

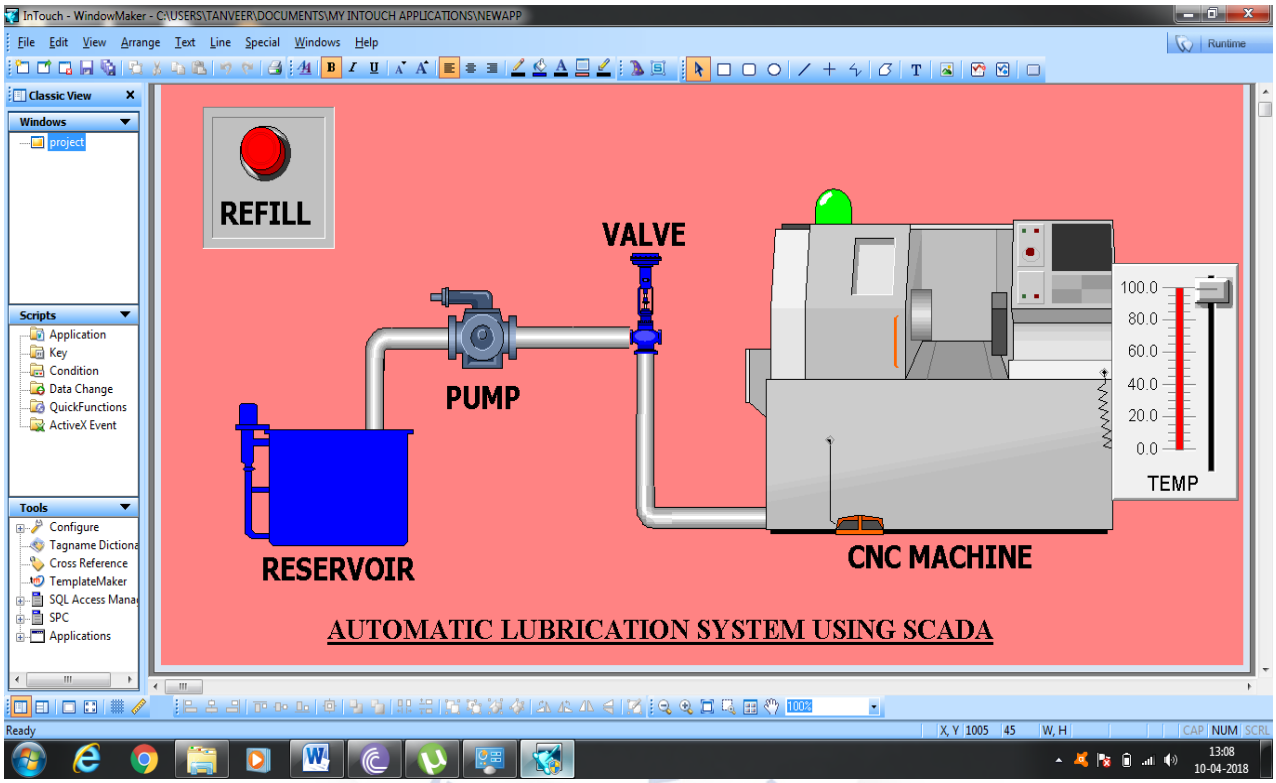


Fig. 10.1

The picture of screen shot is showing the exact representation on SCADA screen where we can see there a reservoir tank at the left side from where lubricant is supplied to CNC machine via pump and distributor valve. The red slider block on the right side of the screen is representing temperature for sliding the slider to represent changes in temperature and the small indicator lamp on the machine indicates warning.

Hence we have completed our project of **“PLC PROGRAMMING AND SCADA REPRESENTATION FOR AUTOMATED LUBRICATION SYSTEM.”**

CHAPTER 11
CONCLUSION

Hereby we conclude that, the most important of automation in today's world where critical processes from nuclear to aerospace are handled tirelessly with the help of control system requiring minimal human intervention. To have proper knowledge of automation one should have deep insight in its different components. Here in this project we tried to throw light on basic architecture with the help of PLC, SCADA, HMI and Implementing the design in software simulation environment showing how a food processing plant can be made. Supervisory Control and Data Acquisition is real time industrial process control system used to centrally monitor and control remote or local industrial equipment such as motors, valves, pumps, relays, etc.