# Web Based Remote Controlling and Condition Monitoring of the Heavy Machineries

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*Abstract* - **The future of global development is mandatorily directed towards complete use of heavy machineries located at different location which run unmanned, automated, using artificial intelligence, and ability to diagnose errors and self-repair. This paper deals with the concept of building a custom WEB application for controlling and monitoring these machineries by providing flexibility in operation from any remote location, ensuring platform independence and low cost due to use of Open Source Architecture. Although this technology is not yet mature enough for a complete exclusion of manual control and maintenance. The Internet that we know today has become so advanced that every information is available at your fingertips. Maintenance of machine components also called as condition monitoring is currently done integrating the electronic computational power and compatible measurement hardware. Software like LabVIEW and MATLAB bridge the gap between computer and the measuring hardware. With this concept remote operation and maintenance of heavy machineries is possible in near future there by competing with various factors like human inaccessibility, environmental factors etc.**

*Keywords* - **Internet, Condition Monitoring, Maintenance, Heavy Machineries**

## I. INTRODUCTION

Machine maintenance is a very crucial work every industry needs to carry out on periodic basis. One man operation, control and maintenance of heavy machinery is a tedious task. For successful and smooth running of the machines regular servicing is mandatory. Condition monitoring is one such method of machine maintenance where in the fault in machines is diagnosed by vibration signatures. Vibration signature analysis is one of the significant steps in maintenance engineering. This has been now become the priority task in condition based monitoring of any mechanical system. Mechanical system comprises of various moving and non-moving links which have sliding, reciprocating or rotary motions. Due to these motions among the relative machine parts there arises huge amount of vibrations. These vibrations if not rectified initially may lead to fatal machine failures and can hamper the productivity of any industry. Various tools are developed to identify these vibrations of the machineries. It is possible that some machineries may be required to operate at locations where there can be extreme weather conditions and a human access to such locations is only possible by risking his life. This paper describes what is condition monitoring and illustrates the concept on how heavy machines can be controlled unmanned remotely implementing the power of internet.

## II. WHAT IS CONDITION MONITORING?

Condition monitoring is the process of determining the condition of machinery while in operation [1]. Condition Monitoring (CM) became well-known in the 1960's and since then this technology has been rapidly developing, especially in the last two decades with the advent of high speed computers, internet and reliable sensors [2]. Even the operating cost of all the hardware and associated software has reduced considerably.

The ways to an effective condition monitoring system incorporates:

1. Recognizing the expected sound pattern.
2. Step by step instructions to transform it from Analog to Digital.
3. How this knowledge can be applied.

Effectively utilizing this project empowers the repair of problems of key components preceding failure. Condition monitoring not just guide engineers and plant personnel to diminish the likelihood of disastrous failures, but additionally permits them to request parts ahead of time, and plan different repairs amid the downtime.

## III. CONCEPT

The evolution of humans lead to many inventions. The Stone Age saw the tools being made out of stones. The problems faced were mainly in the shaping of materials using stone tools. This lead to invention of metal tools in the Bronze Age and Iron Age. In the early days of this era the difficulties were in production and shaping of complex components. With the improving skill of metal working application of metals in structures, simple machines etc. increased progressively. With machines in hand many tasks were carried out smoothly without much effort. Although some laborious tasks required huge machines to complete them. This was only possible by integrating the material knowledge and application knowledge with some simple machine components to perform the task. With the innovation of heavy machineries there came the task of regular servicing and maintenance. Condition monitoring thereby evolved as one of the method of maintaining machine components by knowing the machine condition.

Web based remote monitoring provides the most convenient and affordable method available today for remotely monitoring data of any sort over large areas [3]. Thus this concept can be implemented for remotely monitoring machineries of any sort over large areas.

Unlike systems using traditional computer equipment and dedicated communications networks, web based systems combine with mobile phone and satellite technology to use publicly available infrastructure to provide access to the machines easily, cost effectively and securely.

These systems use conventional web browsers and third party communications infrastructure, along with all the computer hardware and software that are needed. Just using the power of web the machines can be linked to the personal computer.

Akhil Deshpande et al [4] have described how a CNC machine can be controlled and operated remotely. Applying the similar concept heavy machineries can be controlled operated and maintained remotely.

The concept here is divided into two important sections namely:

1. Controlling of machines: Here the operation of the machines is done using a remote control system. In this the command for every operation of the machines is sent to the system located at the remote location through the internet digitally. These digital commands are the digital signals transmitted from the office network.

At the remote locations these signals are processed and converted into analog signals in the control unit using Analog to Digital Converter (ADC). These analog signals then actuate the mechanisms in the machines

thereby making the machines work.

2. Maintenance using Condition Monitoring: When machines operate they produce tremendous vibrations due to various moving parts within it like gears, rotors, sliders etc. These parts have their own natural frequency. When the natural frequency of these parts match with the frequency of the overall machine causes the machine to vibrate. Faulty components create high amplitude vibrations in the machine. These vibrations are analysed using the technique of Condition Monitoring. Here accelerometers are mounted at key locations on the machine which sense the vibrations. Vibrations are analog signals in nature. The accelerometers are connected to a Data Acquisition System (DAS) which convert them to digital signals. These digital signals are transmitted through internet from remote locations which are received at the user end through office network. The user at the other end can analyse these signals using either MATLAB or LabVIEW software and can thereby maintain the machines sitting remotely.

## IV. HOW INTERNET AIDS IN REMOTE CONTROL AND MAINTENANCE OF MACHINES?

Today the most prevalent and most basic method for conveying is the web. It permits clients to hunt, search, recover, spread and offer data remotely. It really gives worldwide availability and the capacity to effectively remotely control from any point on Earth. The idea of establishment of Web based tele-control is in light of straightforwardness and has minimal effort of advancement and sending.

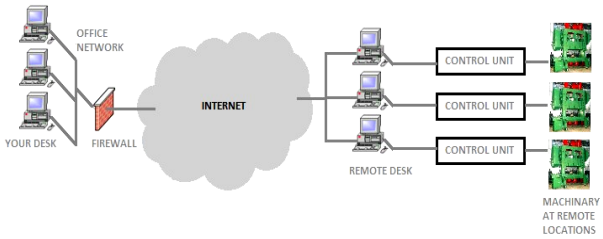


**Fig. 1** Schematic Diagram of Remote Control of Machines.

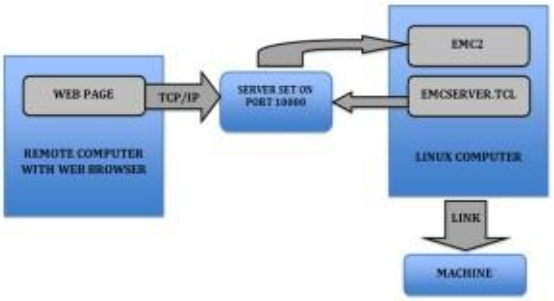


**Fig. 2** Schematic Representation of WEB Control of Machine [5]

Fig. 1 and 2, demonstrates a chart of the created idea of web control. The idea comprises of the created Web application that is gotten to from the PC that is joined with the web by means of a TCP/IP convention. Constant correspondence with the server is given utilizing attachment programming. Server advances solicitations to the EMC2 control unit [6] that is physically joined with the machine device. The use of open source gives the adaptability. Since the control unit's capacities are accessible remotely for usage in a Web application, it is conceivable to straightforwardly control the control unit as compared to controlling the local PC on which the control unit is introduced.

### *A. Design Considerations*

Taking into account the research work of Lee et al. [7], preparatory examinations concerning the remote control of the machine were undertaken utilizing commercial off-the-shelve (COTS) remote control programs, for example, NetOp, VNC, and Telnet. There were a few shortcomings with respect to the remote control programming in its present setup to completely control the machine operation. These shortcomings lead to recognizable proof of the accompanying key necessities which were considered into the last outline of the remote control setup.

### *B. Conceptual Framework*

Web pages installed with Java applets give an interface for remote operation of the machine as a feature of the proposed Internet based control and operation of heavy machines as shown in fig. 3. As Java is web and user friendly, all that a remote client requires is a

Java-empowered web program and Internet association to utilize the framework. Utilizing the web interface, the approved remote customers give machining parameters which are transferred to the web server utilizing the CGI.

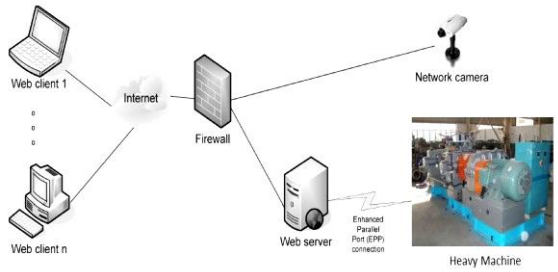


**Fig. 3** Conceptual framework outlining the various components (subsystems) and their interaction in the proposed web-based manufacturing system [8].

The machining parameters after coming to the server (center level) constitute a sections program which is put away in work record booked for execution of task by the heavy machine say ground boring machine. The ground penetrating machine is a machining's representation process, which is controlled by the server by means of the upgraded parallel port.

The machining procedure is checked by the system camera, which is a center's piece level giving continuous criticism to the remote clients. Clients can further work together on item plan on the other hand different issues by method for a visit room facilitated by the web server.

In tending to security issues relating to the online assembling framework, the firewall is the primary line of safeguard in limiting unapproved access to the server and the heavy machine. Notwithstanding this, the web server confirms clients before allowing consent to submit employments, screen the machining process or take an interest in virtual exchange. At last all contact based correspondence between the customers and the server is extended TLS in this way guaranteeing classification, information trustworthiness and server verification.

The Server for Internet-based Secured Manufacturing (Sisman) which has the online manufacturing framework has been arranged to run the Red Hat Linux working framework, Apache web server and Iptables firewall. Sisman has additionally been enlisted on USP's space name server. Moreover associations beginning from outside USPNet foreordained to port 80 (HTTP) and port 443 (HTTPS) on Sisman were permitted to go through USPNet's firewall.

### *C. Advantages of Remote Controlling and Maintenance of Heavy Machines*

The following are the few advantages of having remotely located heavy machines.

- Remote operation is advantageous for operations required at locations inaccessible to humans.

- The technique can prove cost effective as the cost incurred in deputing a person every time to remote location is very high.

- The World Wide Web is one of the readily available channel for accessing anything anywhere so controlling a heavy machine at remote locations becomes easier.

- Multiple inputs from n number of clients can be given to any machine from anywhere thus increasing productivity rate.

### *D. Limitations of Remote Controlling and Maintenance of Heavy Machines*

The following are the few limitations of having remotely located heavy machines.

- Up-front investment required for a solution of setting up of remote machinery is larger due to development costs.

- Cultural acceptance is an issue as all the countries around the globe have their own national standards and very few of them follow international standards.

- Due to a very small percentage involvement of manual labour, the chances of human error occurring at the input location

may incur huge loss at output location.

- Technology issues that play a factor include whether the existing technology infrastructure can accomplish the training goals, whether additional tech expenditures can be justified, and whether compatibility of all software and hardware can be achieved.

## V. CONCLUSIONS

Web based tele-operation of heavy machinery frameworks is not another idea as is exhibited by the variety of such applications springing up on the Internet. These applications radiating from diverse philosophies have changed central focuses in tending to diverse issues. For example, none of the examination talked about in the writing survey give definite thought of security issues in conveying over the Internet. The paper explains how one can have a remote controlling and maintenance of machines setup with all network security in place. This technique if implemented can change the face of our globe. Globalization will gain its true meaning with all the nook and corner of the world interconnected.

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