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Study and Analysis of the Shop Floor Management Information System to Optimize Productivity in the Metal Process Industry

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Abstract

One of the promising technologies flourishing in the metal processing industry to accelerate value creation and minimize losses is the Shop Floor Management System (SFM). This technology will be a breakthrough specifically for the continuous metal processing industry such as steel plants. The SFM system is a response to the following requirements of the metal processing industry: increasing volumes and logistical complications have forced shop floor activities to be computerized online, and the shop supervisor can react swiftly and decisively. The proposed system eliminates difficulties and meets the need by giving dependable and complete information. Real-time data reports are valuable. The SFM system can be used by shop supervisors and senior management to monitor the system and take appropriate corrective action based on the data entered into the computers. It considerably reduces the amount of time spent on administrative tasks. All aspects of SFM not covered here will be added to the system. Due to the intricacy of the actual system, the current computerized system is part of a larger system that is being built. The newly developed technology speeds up data processing and boosts output. Every transaction is updated and handled as soon as possible. The interfaces are easy to use and provide online help messages, so any end-user can figure out how to use them. An integrated system operating on a UNIX Environment is ideal because of its multi-user nature. Oracle is versatile and portable, making it simple to create applications. As a result, Oracle on the UNIX operating system will be used in the current paper.

Keywords: *Integrated System, Metal Process Industry, Oracle, Shop Floor Management System (SFM), Unix Environment*

1.0 Introduction

The huge marketing demand for steel in the new age industries has accelerated bulk production which on the other end leads to a lot of mismanagement at the production shop floor such as overproduction and errors in production leading to reworking and transit time. The paradigm solution for the above problem is the implementation of the SFM technique on the production floor. SFM means developing and managing the shop floor operations, equipment, inventory, and workers. In other terms, it is responsible for main two key resources: man, and machine. The company's resources must be utilized and managed efficiently for them to be profitable. SFM mainly consists of two main modules i.e. labour utilization and machine utilization. Labour Utilization deals with managing direct manpower utilization. Labour is classified into two categories direct and indirect. Direct labourers are individuals who are directly involved in the production process. Indirect labourers are people

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who assist with manufacturing in a non-direct way. Because they are the ones who are directly involved in the production, direct labour will be the focus of any organization. As a result, it's critical to keep track of how much time they spend on their shifts to determine the department's productivity. These facts are recorded in a crucial document known as the time docket[1].

Each employee fills out a time docket that describes how much time he spent throughout his shift. If somebody is idle for a variety of reasons, he must explain why he is inactive. The shop supervisors will coordinate this paper. The term machine utilization" refers to the use of machinery. Its main goal is to achieve optimum efficiency[1,2]. When an employee completes some operations on a part, he must account for each operation by matching it to a work order and the machine on which it was completed. The machine time docket is updated with these facts. The idle period of the machine must be accounted for using the proper idle code if the machine is idle. Every machine in every work center will run for a set amount of time. Using the number of hours, the machine has been used as input, the "MACHINE UTILIZATION" sub-module should be generated that examines the number of hours the machine has not been used and why. The SFM module necessarily consists of the fixed data and transactions taking place daily. The fixed data comprises the facilities like manpower availability and machine availability[3].

Shop Floor Management is one of the important parts of the Manufacture Resource Planning (MRP- II). The data collected on shop floors can direct the managers to efficiently utilize the manpower and machine resources and optimize their performance. Data collected on shop floors can be useful for other modules in an integrated system and also can help us arrive at various answers normally required by managers with the help of inquiries and reports. An INTEGRATED SYSTEM in UNIX ENVIRONMENT is ideal due to its MULTI-USER nature. ORACLE is flexible and application development is easy and is also portable[4]. Hence ORACLE ON UNIX OPERATING SYSTEM is chosen for the current paper. It is an online computerized system that saves time and gives up minute information. The labor and machine data manufacturing industry is vital for the various online inquiry reports are to be produced which helps the management to make decisions[5].

2.0 Problem Statement and Selection of Software

The problem is to develop a Management Information System for the shop floor. The data collected in Shop Floors can direct the managers to efficiently utilize manpower and machine resources and optimize the performances, Online inquiries and reports are very important for the supervisor as well as for the top management to know the progress of the job, work details of the particular employee, etc. Hence various online inquiries and weekly and monthly reports are to be prepared through which the performance and efficiency of the employee, department, and finally the industry an as whole can be improved. The Shop Floor Management system enhances the shop supervisor, and top management to monitor the system effectively and also to take appropriate corrective action based on the information fed into the computers. It reduces administrative time considerably.

ORACLE ON UNIX OPERATING SYSTEM is chosen for the current paper. As the old system is an INTEGRATED SYSTEM on UNIX ENVIRONMENT is ideal due to its MULTI-USER nature. This results in postponing of entries and may cause disturbance to regular work. The oracle system is flexible and application development is easy and it is also portable. One advantage of using this database is that they believe in customer satisfaction. For example, the Oracle databases are backward compatible. This allows up-gradation of business to their systems without a complete overhaul of their database system. It provides efficient and low- cost updates. This database is used in all corporation-level applications. It dominates the banking industry. This is primarily due to Oracle's functionality. Oracle is a database that delivers excellent performance when challenged with demanding tasks. They have four properties that are atomicity, consistency, isolation, and durability.

All four of these properties are very well maintained by Oracle databases, thus providing a reliable and competent database system.

3.0 System Analysis

i. Software Requirements

: OPERATING ENVIRONMENT: HP-UX 9.0
RDBMS PACKAGE: ORACLE 7.0 TOOLS
SQL*PLUS V3.1
SQL*FORMS V3.0 PRO C SQL*LOADER V7.0
SQL*REPORTWRITER V1.1 PRO*C
PL/SQL

ii. Hardware Requirements

HARDWARE: HP-9000/807(G30)
PROCESSOR 68030
CLOCK SPEED: 48 MHz MEMORY (RAM): 16 MB
DISK SPACE: 300 MB*3
TERMINALS: MINIMUM 2 NOS.
CARTRIDGE TAPE DRIVE: 525 MB
(ONE) SPOOL TAPE DRIVE: 1600 BPI (ONE)
PRINTER: 900 LPM LINE PRINTER

iii. The System was developed

HCL-HP 9000 System Configuration
SYSTEM: HP-9000/807 (G30) 64 USER

iv. Software

OPERATING SYSTEM: HP-UX9.0 PC - LINK
COBOL COMPILER
C/ ANSI-C COMPILER ETHERNET S/W TCP/ IP SUPER SORT/ MERGE

v. Oracle V 7.0 Engine with the following

EXPORT / IMPORT
-SQL LOADER
TPO (Transaction Processing Operation)
PL/SQL
SQL*NET
SQL PLUS
SQL FORMS -SQL REPORT WRITER
-SQL MENU
PRO C
PRO COBOL

vi. Hardware

CPU: HP-PA RISC CPU @ 48 MHz CACHE: 128 KB
FLOATING POINT PROCESSOR: I NO. RAM: 64 MB
MASS STORAGE: 1*2 GB
1*2 GB TOTAL: 4GB SCSI CONTROLLERS: 2 NO.
Cartridge Tape Drive (CTD) 525 MB: 1 NO.
Digital Audio Tape Drive (DAT) 2 GB: 1 NO. Spool Tape Drive (STD) 1600 BPI: 1 NO.
LINE PRINTER 900 LPM: 2 NO.
CONSOLE: 1 NO.
TERMINALS: 32 NOS.
1.2 MB FLOPPY DISK DRIVE (THRU PC/AT): 1 NO. ETHERNET LAN INTERFACE: 1NO.

4.0 Software Description

To report on work in progress, shop floor control systems often assess the state of the supplies, machine usage, workers, and other resources. Additionally, they make it possible for the plant to accurately manage its processes, resources, and operations. With an interactive, real-time Shop Floor Control system, this data may be very helpful to factory owners, managers, and even workers for optimizing overall shop floor operations. Developed Shop Floor management system's data collection and reporting on labor, job progress, and production time to help boost worker productivity by cutting down on throughput and cycle times. Real-time Shop Floor Control benefits operators themselves in addition to providing supervisors with information on worker productivity. The software's user interface is quite friendly; Operators can set, reach, and surpass their targets and goals when given access to their work process. Shop floor management systems assist in identifying hazards and vulnerabilities in the work environment, from equipment and technology problems to difficulties with workers or labor. All machines and departments are assigned codes in line with a standard nomenclature, and all invoices and reports are produced using the appropriate codes to produce data for decision-making. The input data is physically acquired on the shop floor. These data will be the system's input, and they will be used to generate the outputs.

5.0 Implementation and Testing

The last and most important stage is the implementation phase. This covers user acculturation, system evaluation,

and the efficient implementation of the intended system. The created system is put to the test by the user before being modified to satisfy their particular needs. Putting the intended system to the test with various sorts of data is what the testing step comprises. Data is prepared for in-depth testing, which is followed by testing using the data. When errors arise during testing, they are documented and corrected. The solutions are written down for future reference. The users are then trained on how to operate the designed systems. Both software and hardware security are designed to work smoothly in the built system in the future[4]. Following the system testing, the implementation stage verifies that the system functions correctly and efficiently before any live operations are carried out. Testing is always critical to the system's success. System testing presupposes that if all of the system's components are valid and functional, the goal will be met. The system is put through a series of tests, including online response, stress, volume, recovery, and security, as well as usability. Before the proposed system is ready for user acceptability testing, it goes through a set of tests.

5.1 Unit Testing

Unit testing focuses on the smallest unit of the software design module for verification. This is also referred to as "Module Testing." The SFM system's modules are examined individually. Testing will take place throughout the programming stage itself. Each module is determined to be performing successfully to the intended output after the testing phase.

5.2 Integration Testing

Data can be lost across interfaces; one module may exert an adverse effort on another, and sub-functions may not generate the expected principal function when combined. Integration testing is a methodical approach to building the program structure while also executing tests to find interface issues. Its goal is to create a program structure out of unit-tested modules. Each module is merged and tested as a whole. Because the enormous stretches of the entire software make it impossible to isolate problems, correction is limited here. All mistakes discovered during integration testing are fixed for the next level of testing.

5.3 Validation Testing

Integration testing is completed. The software has been completely constructed as a whole package, interfacing flaws have already been discovered and rectified, and the validation test has begun. Validation can be described in a variety of ways, but a simple explanation is that it occurs when software performs as the client would reasonably anticipate. One of the two possible conditions exits after the validation test is completed.

- The function specification is accepted.
- A deviation from the specification is uncovered and a deficiency list is proposed.

5.4 Output Testing

The output testing process begins when the validation testing is completed. Users test the output generated or displayed by the system under investigation for their requirements. The output format is divided into two categories: screen and printed. The output format on the screen is verified to be correct since it was designed according to user requirements during the systems design process. The user-specified requirements are met by the output generated. As a result, no system correction is performed during output testing.

6.0 User Acceptance Testing

User approval is the most important aspect of the system's success. The system under consideration is put to the test for user acceptance by staying in contact with user needs throughout the development process and making adjustments only when necessary. Various sorts of test data were used in the surpassing testing. In system testing, the creation of test data is critical. It is tested utilizing that test data while putting together the test data. The top testing stages are used to repair any test data mistakes that are discovered throughout testing. Corrections are also documented for future occasions. After the system has been successfully implemented, the creator must train the user. The system manuals are delivered to the user once the user has been trained to run the developed system. Users are taught how to operate the designed system here. Security, which involves both hardware and software, is designed to work well in the future.

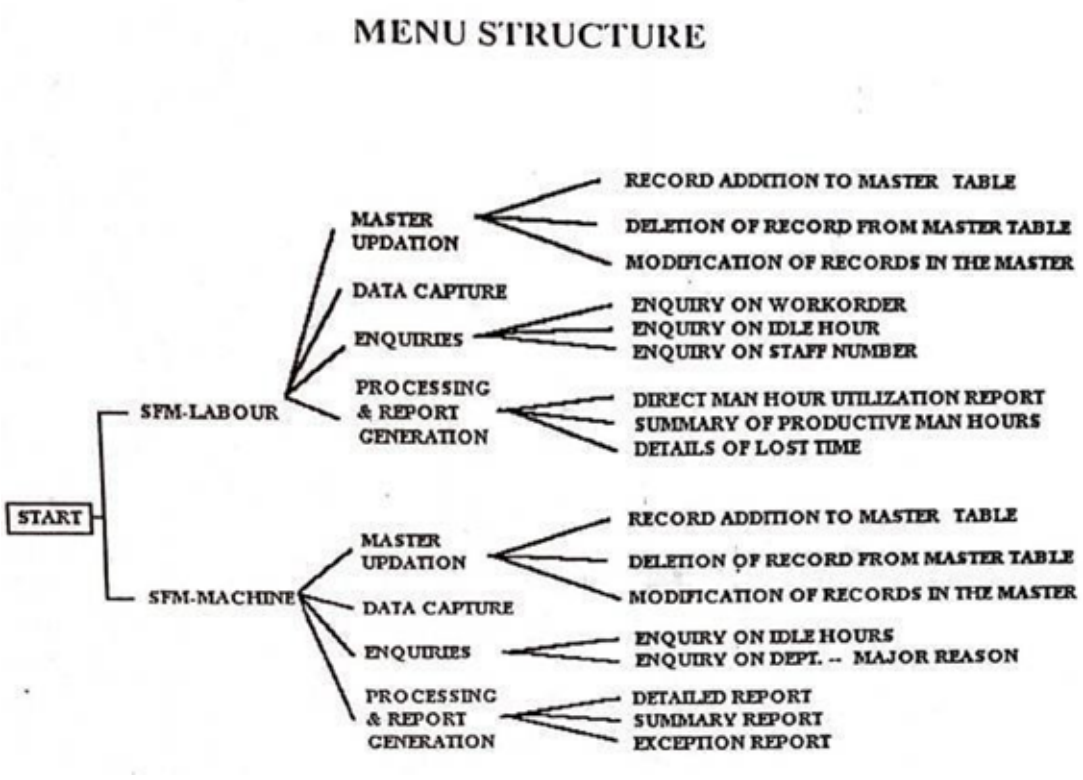

Figure 1. Menu structure of shop floor management system.

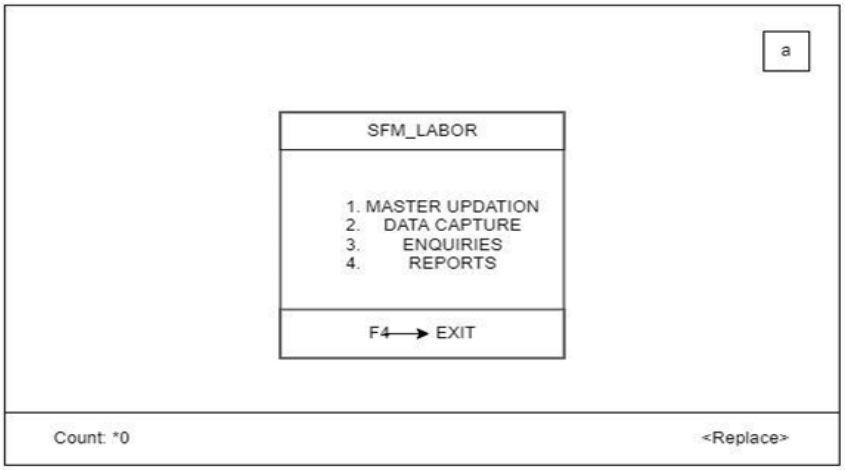

Figure 2. Labour system

Implementation is the process of converting a new and improved system into an execution system design. It is the most important step in achieving a successful new system because it usually necessitates a lot of work in the user area. As a result, it should be meticulously planned and monitored. The user must be educated and trained, and the system must be tested as part of the installation.

The menu above (Figure 2) offers four choices. The master tables are updated using option 1. Option 2 is used to input time docket transactions; by choosing this option, online data may be collected. For responding to online inquiries, utilize option 3. The monthly report is chosen using option 4.

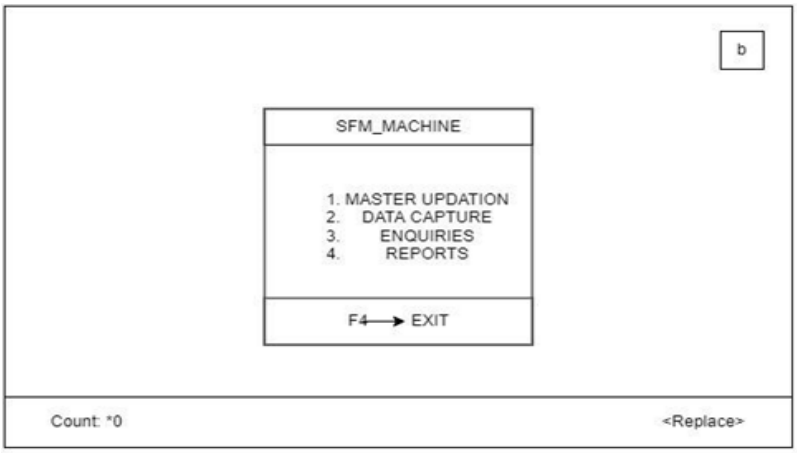

Figure 3. Machine system.

DIVISION AIRCRAFT

						BOOKED HRS BOOKED HRS														
			EFFECTIVE			EXCLDG OT. DURING OT.				YELD										
DEPT NO	NAME	TOTAL STGH/OSN	DL STGH	AVBLE HOURS	OVER TIME HOURS	W.O	INS	W.O	OTH	PRD	OVR	ABSENT EEISM	SHIFT SHORT HOURS	OUTSTATION	ON SUP	LOST TIME	IDO	MISC	REP HRS	UAC USH	HRS DN
1320	EXPORT MACHINE	85	85	17680		12936/73.2%	360/2.0%			152	156	2953/16.7%	419			732		280/1.6%	1902	3	1224
1321	MACHINE SHOP	143	143	29744		21825/73.4%				152	152	6555/22%	529	8		244	208	375/1.3%	4049	14	2688
1322	SHEET METAL	141	141	29328		21008/71.6%	172/0.65			148	150	5731/19.3%	264			2149		4	4213	32	164
1323	WELDING	34	34	7072	52/0.7%	3596/50.9%		52/0.7%		105	105	1164/16.5%				2312			8739		280
1325	PLASTICS	54	54	11232	229/2.0%	9412/83.8%		229/2%		174	174	1077/9.6%	83	226		397		36/0.3%	902	2	232
1326	PROCESS SHOP	50	50	10400		8001/76.9%				160	160	1746/16.8%	122	352		178		1	1199	21	664
1327	HEAT TREAT SHOP	18	18	3744		2490/64.9%				135	135	1190/31.8%	72			52			789		416
1329	TANK SHOP	100	100	20800		1487/7.2%				14	14	4015/19.3%		712		14578		8	4029	1	32
1330	COMPOSITE DROP SHOP	3	3	624								183/29.3%		16		425			22		168
1371	NC MACHINE SHOP	47	47	9776		7252/74.2%	120/1.2%			154	156	1761/18.0%	522			118		3	640	1	1184
1372	NC PIPE BENDING	10	10	2080	3/0.1%	1407/67.7%		3/0.2%		140	140	501/24.1%				172			372		136
1376	HONEY COMB SHOP	13	13	2704		1647/60.9%				126	126	306/11.3%	93			498	160		31		312
	SUB TOTAL	698	698	145184	294/0.2%	91001/62.7%	652/0.4%	284/0.2%		130	131	27182/18.7%	2104	1314		21855	368	707/0.5%	19021	74	8960

Figure 4. Summary of man-hour utilization.

The menu above (Figure 3) offers four choices. The master tables are updated using Option 1. Option 2 is used to input machine transactions; by choosing this option, online data can be collected. For responding to online inquiries, utilize option 3. The monthly report is chosen using option 4.

The summary of direct man-hour utilization was obtained by analyzing the data of an Export machine shop in a reputed organization and this analysis was done by an organization server using the Oracle concept.

7.0 Conclusion

The design and implementation of the SHOP FLOOR MANAGEMENT SYSTEM (SFM) will bring positivity within the stressed labor who operate on the steel production floor due to the scientific way of design and implementation of the labor routine leading to improvised productivity with reduced human error. The paper focuses on the SFM which has been developed for the present requirements: Online computerization of the

shop floor procedures has been necessitated by increasing volumes and logistical complexities online information gives the shop supervisor the flexibility to act decisively and on time. The data was gathered on the shop floor of a machine shop that produces a range of items. The chosen system dispenses with the problems and meets the need by providing reliable and comprehensive information.

The developed system dispenses with the problems and meets the need by providing reliable and comprehensive information. Reports generated with live data have proved to be informative. The system is to be extended to cover all other aspects of SFM which are not considered here. Since the actual system is complex, the present computerized system forms part of a large system being developed. The newly created system requires less processing time and increases productivity. All transactions are promptly updated and handled. Because the screens include online help instructions and are user-friendly, any end-user may quickly get familiar with how to utilize them. Because it was created using the ORACLE RDBMS, it has all of the security characteristics of a relational database. The SFM module is meant to be very adaptable and portable, allowing any future requirements to be easily added to the module without causing design issues.

The designed system has achieved the following objectives:

- It simplifies the operation.
- It reduces the processing time and increases productivity of the steel process industry.
- Each transaction is updated and processed immediately.
- User-friendly screens to enter the data and enquire about the data tables.
- Online help message to operate the system.
- The intermittent user can easily access the system without much of a problem.
- Provide hardware and software securities.
- Portable and flexible for further enhancement.

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