# **Computer Application for Maintenance Planning and Scheduling**

## of Industrial Plant

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#### Abstract

Plant maintenance involves all activities carried out on a machine to ensure a zero downtime of operation. Maintenance activities vary from one industry to the other but the basic maintenance activities are mainly to ensure continuous operations of equipment, plant and machineries.

Over the past few decades, the various industrial work activities and maintenance operations are performed without a concrete plan (schedule) or are performed via manual paper work. Industrial operations are usually complex and recurrent activities. Analysis has shown that lack or insufficient maintenance coordination, has accounted for the poor performances and inefficiencies of many industries. Thus, it is pertinent to deduce a planned maintenance organizer or a computer aided design for the planning and scheduling of industrial work activities. This becomes important as computer has revolutionalized industrial activities with the development of modern high level computer programming languages such as visual basic by Microsoft among others.

#### 1. Introduction

1.1

Plant maintenance involves all activities carried out on a machine to ensure a zero downtime of operation. It involves all activities carried out to prevent operation stoppages or downtimes in industries due to equipments and facilities failure or to minimize downtimes as much as possible.

Maintenance planning and scheduling is often viewed as the centre of industrial maintenance management, since other processes such as preventive maintenance, root cause analysis (RCA), inventories record management, and other processes are dependent on the planning and scheduling process to work.

- Reasons for Planning and Scheduling Maintenance Operations:
- It enhances work efficiency since operations can be easily delegated among employees.
- It assures the optimum availability of installed equipment for production or service.
- It ensures operational readiness of all equipment required for emergency use at all times such as standby units, fire fighting, rescue units etc.
- It enhances maximum possible return on investment.
- It ensures the safety of personnel.

#### 2. Design Analysis

The Program is design with the compiler, Microsoft Visual Studio 2008, version 9.0.21022.8 RTM © 2007, Microsoft Corporation. It is sectioned into modules. Each of the modules provides specific functions and features that when combined together, becomes an outstanding maintenance management system.

### 3. Function of Each Program Module

### • THE LOGIN WINDOW

It controls the relative access of the engineer and other staffs as the engineer can access all the modules unlike the

other staffs that have no access to the scheduler and the work permit.

🖳 Login			
Staff ID			
Password			
	Login	Cancel	

Figure 1: Login Interface

• HOME PAGE

The home page has buttons associated with the modules. It also has four separate data grid tables, showing a summary of the day's planned scheduled, equipments history, inventory records and work permit records. This is aimed at presenting a first hand view of activities to be performed and stock levels at the first look of the program.

Maintainance Planner			Toda	y's Sched	lule					Equi	pments Rec	ords	
Planner		Task ID	Task Type	Task Priority	Personnel 1	Personnel 2			Equipment ID	Description	Manufacturer	Model Number	Senal Numb
Work Request	► *	201074-1722846	Strainers Cleaning	1	Wasiu	HamzaT	F	*					
Parts and Inventory							3						
Equipments Record													
Work Permits	4	m			8			٠ [	m				
Safety	_		Inve	ntory Reco			(c = c			× <b>V</b>	Vork Permit	S	
Management		Part ID	Description	Manufacturer	Quantity in Stock	Storage Location			Permit ID	Date	Location	Floor/Department	Work perfromed
Employees Record	► *						+	*					
lients Record							1						
sonal Organizer													

Figure 2: Home Page Interface

• MAINTENANCE PLANNER MODULE

This is used to create planned maintenance type tasks. The Engineer is able to schedule maintenance operations to be performed on plants through this module. Also, the personnel to carryout the maintenance operations and can likewise give appropriate safety instructions for successful performance through this module.



Maintainance Planner				
	Look Up View Detailed View			
Maintainance	Save Changes			
New Schedule	Task Task ID	Work Requested By	Task Instructions	
Maintenance Report	Task Details	Estimated Down Time		
	Task Priority -			
	Scheduling Date 17 March 2010	Machine Assignment Machine Name	-	
	Scheduled Start 17 March 2010	Client Name	Other Instructions	
	Scheduled End		·	
	Start Time 12:00 AM	Safety Instructions		
	Personnel Assignments	·	-	
	· · · · ·	Classification		
		Classification Assignments	Completeion Details	
			17 March 2010 💷 🖛	
	Page and Labor Assignments		Completion Approved By	
Cancel	Parts Assignments	Labour Assignments	Complete	

Figure 3: Maintenance Planner Module

Similarly, parts and labour required to carryout the task can be assigned through the parts and labour assignment button as shown above.

🖳 part Search		
Task ID	201094-460443	
Part ID	1	-
Description		~
Quantity Needed	0	
	Add	Done

Figure 4: Add Part Interface

• WORK REQUEST MODULE

🖳 Work Request				
WORK ORDERS ANI	D REQUESTS			
	Look Up View Detailed View Scheduling	and Status		
Maintainance	Work Request ID		Estimated Down Time Need	led
New Work Order				
	Brief Description of Work to Perform			<u>^</u>
Print Entire Work Order				
				*
	Work Requested By	•	Request Date	08 April 2010 🗐 🗸
	Classification Production Equip	oment 👻		
			Safety Instruction	•
	Equipment	•		
	Work Type			
	Imminent Danger	<ul> <li>Safety Hazard</li> </ul>	Safety Concern	<ul> <li>Standard Work Order</li> </ul>
	Work To Be Performed and Why it Sh	ould Be Performed		
Cancel				
Carlos				

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The work request often include elements that help the management to know exactly what the staffs wishes to order, including what work to embark upon, equipment required, scheduling and completion information among others. Figure 5: Work Orders and Report Module

Details of completed work order will automatically save to the data grid table and can be printed when required.

### (v) PARTS AND INVENTORY RECORDS MODULE

Here, part information such as description, manufacturer, part number, etc are recorded. It is also possible to setup stock levels for the inventory items as well as storage locations.

Parts and Inventory				
Lookup View	Details View			
Inventory Apply Cha	nges			
Add New Part				
Print_Inventory Part ID	1235	Specifications	Length 210	
			Width 70 Appearance 3D	
Description	Washers	^		
		-		
Manufactu	er CATS EQUIPMENTS	-		
Part Numbe	r 222	Quantity in Stock	K (80)	
Primary Ver	dor CATS	<ul> <li>Minimum Level</li> </ul>	10	
Storage Lo	ware HOUSE	<ul> <li>Maximum Level</li> </ul>	100	
Classificatio	n CRUCIAL	Reorder Qty	50	
Classificatio	CROCIAE	Unit Type		
Equipment	Strainer Cleaning Machine			
Lapage 100 B	State Ceating Machine	<ul> <li>Unit Price</li> </ul>	N30.000	
Cancel				

Figure 6: Parts and Inventory Module

• EQUIPMENTS RECORD MODULE



The Equipments Record Module is where information on equipments and other assets are recorded. Information such as asset numbers, warranty information, leasing information, etc, can be maintained.

equipment					× 1
	Look-up View Detailed View Equipme	nt Log			
Equipments					
Add Equipment	Reference ID	123a	Building	Workshop	
Print Equipments	Description	MILLING MACHINE	Room	2	
Print Equipment Notes					
FILL EQUIPMENT NOTES	Manufacturer	CAT GERMANY	Account		
	Model Number	243158NCAG			
			Classification	Major Works	
	Serial Number	5674235689F			
	Assigned to	Heavy Duty Work	Vendor	Lubcon	
	Location	Warehouse	Meter Reading	1	
	Safety Instruction	Weekly Lubrication	Meter Type		
					H
Cancel					

Figure 7: Equipments Record Module

#### • WORK PERMIT MODULE

The permit contains such information as permit identification, date issued, building where work is to the performed, permit expiration date and a column for management approval among others.

🖳 Work Permit ( form )								
Permit ID	123					Work to do	Refil of Air-Conditioner gases	
Date Issued	09	April	2010		-			
Building	Main E	Building	1			-		
-		-						
Floor and Department	2nd flo	or and	Adminnitratio	'n				
Start Date	09	April	2010					
Start Date	09 .	Abui	2010		÷			
	09		2010		_			
Permit Expiration Date	09 .	April	2010		·			
Approval								
Permit Requested By	Hamz	at A/C	la		-			
Safety Officer	ATTA	AH / S/	AFETYOFFIC	ER	-			
			-		_			
Print				Cancel				

Figure 8: Work Permit Module

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Accident Report	
	ACCIDENT REPORT
	File Accidents
Reports	General Medical Details Causes Action-Review Investigation
Accident Report	
	Report ID Employee Information
	Name Age
Witness Report	Sex Hire Date 09 April 2010
	Postion/Job Title
	holdent Details Type of Accident First Aid   Date of Incident 09 April 2010   Name of Witness
	Work Status Returned Time of Incident Nature of Injurios
	Nature of Damage Personal Date Reported 09 April 2010 - Estimated Cost of Damage
	Nature of Damage Personal Date Reported 00 Peril 2010 C Estimated Cost of Damage
	Equipment Damage Specific Location of Damage
	Where any specific job procedures involved?
	Who made the job assignment?
	What Instruction did the employee received before starting work?
	This installation do the enployee received basis against rock ?
Cancel	

Figure 9: Accident Report

GENERAL VOIC         GENERAL VOIC         GENERAL VOIC         GENERAL VOIC         General voic         General voic         Main Duilding         John Duilding         Const TO PERFORM         Roll of Ar Commission associations         Const TO PERFORM         Const To Pe	HotPermitViewer		Find   Next
ATE       09 April 2010         SNATION       Main Building         SNATION       Data Back and Administration         SNATION       Data Back         SNATIONS       Data			Find   Next
SCRETION   Main Duilding   Data Base and Administration   SCRETT OF SCRETT   SCRETT OF SCRETT   SCRETT OF SCRETT   SCRETT DATA Conditions asso   TATT TIME   OP April 2010   SCRETT SCRETT   SCRETT SCRETT   SCRETT SCRETT   OP April 2010   SCRETT SCRETT   SCRETT SCRETT SCRETT   SCRETT SCRET		GENERAL WORK PERMIT	<mark></mark>
Description   Description </td <td>DATE</td> <td>09 April 2010</td> <td></td>	DATE	09 April 2010	
	YORK INN	Main Building	
Refl of Ak-Conditions gass         TART TIME       09 April 2010         COMPLETED       09 April 2010         Start Time       09 Apr	EPOR AMENT	2nd floor and Administration	
DART TIME       DB April 2010         COMPLETED	VORK TO PERFORM		
COMPLETED	Refil of Air-Conditione	r gases	
EXPERSION DEPARTMENT OF LEE OFFICE OFFI	TART TIME 09 .	April 2010	
In Stark  In St	ERMIT EXPIRES	09 April 2010	
	he precautions listed his work.	below have been completed. Permission is therefore granted for	
	ermit Requested By		
	NAME	Hamzat A/Ca	
APPROVAL  ANE     ATTAH / SAFETY OFFICER	BIGNATURE		
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CINETURE	afety Supervisor		
CINETURE			
The population of the second s		ATTAH / SAFETY OFFICER	
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There is not source to be a set of the set o			
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Surrounding floors have been swept clean and, if combustible, wet down. Sourcounding floors have been relocated 35 feet from the operation and the remainder All combustibles have been relocated 35 feet from the operation and the remainder All floor and well dualide of the set of this of the set of the set of the set of the set of the All floor and well dualide.			
and the second s			
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	, All floor and wall op	Jards or flame proofed curtine or covers (not ordinary tarpauline). enings within 35 feet of the operations have been tighly covered.	

Figure 10: General Work Permit Report

## • EMPLOYEES RECORD MODULE

Efficient maintenance planning also involves keeping an appropriate employee record. This information is properly documented in the database.



- Add New Con	tact								
Staff ID	2010215-48	301491				Upload Pict	ture		
Name									
Position	_			-					
Address				~		Browse	Cancel		
, daress				_					
					E-Mail			_	
State				_	Job Security	_			
City									
					Pay Rate				
Phone	_			_					
					Hire Date	31 May	2010	(iii	
Marital Status	Single	-							
Sex	Male	-			Next of Kin				
					Name				
Date Of Birth	31 May	2010	-						
				~	Relationship				
Notes									
					Phone Number			_	
	_			-					
	Submit C	Ther Docur	nents			Next		Reset	

Figure 11: Employees' Contact Module

## 4. Conclusion

Effectively planning for future actions help in achieving goals in the most efficient and effective manner. It minimizes costs and reduces risk and missing opportunities. It can also increase the competitive edge of an organization.

## References

Umar M. Al-Turk, (2009), Handbook of Maintenance Management and Engineering, Springer London, (accessed on 20/04/2010), Available online at http://SpringerLink-Book Chapter.htm

Maintenance planning and scheduling article, book and invent information, (accessed on 20/04/2010), Available online at

http://Maintenance planning and scheduling article, book and event information.htm

Maintenance software, (accessed on 10/11/2009), Available online at

http://www.bigfootcmms.com/product/features.html

Maintenance Coordinator, Simplicity Software Technologies Inc, (Accessed on 10/11/2009), Available online at http://www.cordinator/maintenance\_coord.htm