CHAPTER 1
INTRODUCTION

1.1 Background of Study

Alarms are signals annunciated to the operator typically by an audible sound and by some form of visual indication on the operator display, both of which differs according to the alarm priority. Alarms are important in that they help the operator to monitor deviations from desired operating conditions which may lead to the hazardous situations. Alarms help the operator to maintain the plant within a safe operating environment. Alarm analysis and monitoring is one of the instrument engineer job scope. Alarm analysis and monitoring is very crucial to maintain the safety and performance of the plant. One of the infamous incidents that happen because of bad alarm monitoring procedure is the Texaco Refinery Milford Haven Explosion and Fire Incident. The disaster could have been avoided or controlled if the operator responds to the alarm according to the Standard Operating Procedure (SOP) effectively.

The main reasons for the employment of Alarm Monitoring and Analysis can be summarized as follows:

- Eliminate nuisance \ unnecessary alarms
- Improve safety, meet production demands and reduce plant trips
- Preventive Maintenance
- Monitor the condition of the plant
- Improve plant performance

1.2 Problem Statement

Alarm analysis and monitoring is one of the instrument engineer job scope. Alarm analysis and monitoring is very crucial to maintain the safety and performance of the plant [3]. To do the alarm analysis, a specified Alarm Analysis Server is required. The cost of the alarm analysis server with the software license is close to 50,000 USD [13]. During this world economic crisis, all industry is very much affected. The common way to get through this economic storm is to cut cost and maximize profit. The cost can be significantly reduced by maximizing the usage of any tools, or software that's readily available. Therefore, this project will aim to significantly reduce the costs by using any software and tools that is commonly available to do the alarm analysis and monitoring.

Usually the Alarm Monitoring Analysis server does not allow us to configure to specific details, more options cannot be added and less versatile. Open source is more versatile and more options can be added tailored to our needs.

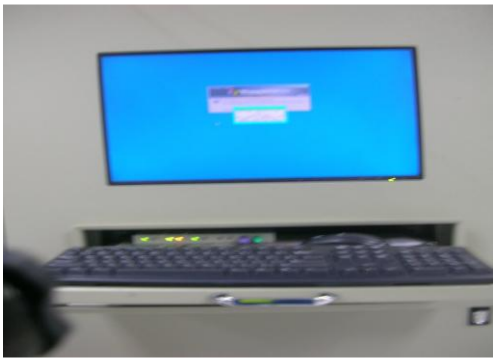


Figure 1: The server for the Alarm and Event Monitoring and Analysis

1.3 Objective and Scope of Study

The main objectives of this research are:

- To determine the flow of the alarm analysis and monitoring in the plant environment
- To design an alarm monitoring and analysis tool that is more simplified with significant reduced in the cost.
- To develop an alarm analysis method using the readily available software that can be modified to suite the needs at that particular time(open source)

1.4 Scope of Study

The scope of this study would be on the analyzing the current alarm analysis and monitoring systems and research for a suitable method to improve the existing alarm analysis and monitoring systems. This enhanced system will be created using familiar software like Microsoft Excel by also utilizing Visual Basic Language to modify the coding of Microsoft Excel.

The time frame given of two semesters starting from reading and understanding every journals or articles related to the topic. This is important to gather the current knowledge related to this research. Every research related to it will be studied and the results would be included in this report.

Finally, reliability test is conducted to ensure that the software works properly and produces the desired output. The benefits that would be gained at the end of this research would definitely be helpful to master the software used and utilize the software effectively to produce excellent output.

CHAPTER 2
LITERATURE REVIEW

2.1 Theory

Alarms are signals annunciated to the operator typically by an audible sound and by some form of visual indication on the operator display, both of which differs according to the alarm priority.

Alarms are important in that they help the operator to monitor deviations from desired operating conditions which may lead to the hazardous situations. Alarms help the operator to maintain the plant within a safe operating environment.

Alarm monitoring and analysis can eliminate the nuisance and unnecessary alarms. The alarm set point can be adjusted so that it is suitable to that particular operation and at the same time does not interfere the plant personnel with unnecessary alarms. This alarm monitoring and analysis can also improve the plant safety and reduce trips. The source of the alarm can be identified, analyzed and checked. Then the plant personnel can troubleshoot the source so that the plant can runs smoothly with reduced number of equipments failures and trips. Preventive maintenance can also be done smoothly, by forecasting (using the alarm monitoring and analysis system) which equipments that is need to be maintained or troubleshoot to avoid any major equipment or process failure.

The fundamental purpose of alarm annunciation is to alert the operator to deviations from normal operating conditions, i.e. abnormal operating situations. The ultimate objective is to prevent, or at least minimize, physical and economic loss through operator intervention in response to the condition that was alarmed. For most digital control system users, losses can result from situations that threaten environmental safety, personnel safety, equipment integrity, economy of operation, and product quality control as well as plant throughput. A key factor in operator response effectiveness is the speed and accuracy with which the operator can identify the alarms that require immediate action.

By default, the assignment of alarm trip points and alarm priorities constitute basic alarm management. Each individual alarm is designed to provide an alert when that process indication deviates from normal. The main problem with basic alarm management is that these features are static. The resultant alarm annunciation does not respond to changes in the mode of operation or the operating conditions.

When a major piece of process equipment like a charge pump, compressor, or fired heater shuts down, many alarms become unnecessary. These alarms are no longer independent exceptions from normal operation. They indicate, in that situation, secondary, non-critical effects and no longer provide the operator with important information. Similarly, during startup or shutdown of a process unit, many alarms are not meaningful. This is often the case because the static alarm conditions conflict with the required operating criteria for startup and shutdown.

In all cases of major equipment failure, startups, and shutdowns, the operator must search alarm annunciation displays and analyze which alarms are significant. This wastes valuable time when the operator needs to make important operating decisions and take swift action. If the resultant flood of alarms becomes too great for the operator to comprehend, then the basic alarm management system has failed as a system that allows the operator to respond quickly and accurately to the alarms that require immediate action. In such cases, the operator has virtually no chance to minimize, let alone prevent, a significant loss.

In short, one needs to extend the objectives of alarm management beyond the basic level. It is not sufficient to utilize multiple priority levels because priority itself is often dynamic. Likewise, alarm disabling based on unit association or suppressing audible annunciation based on priority do not provide dynamic, selective alarm annunciation. The solution must be an alarm management system that can dynamically filter the process alarms based on the current plant operation and conditions so that only the currently significant alarms are annunciated.

The fundamental purpose of dynamic alarm annunciation is to alert the operator to relevant abnormal operating situations. They include situations that have a necessary or possible operator response to insure:

- Personnel and Environmental Safety,
- Equipment Integrity,
- Product Quality Control.

The ultimate objectives are no different than the previous basic alarm annunciation management objectives. Dynamic alarm annunciation management focuses the operator’s attention by eliminating extraneous alarms, providing better recognition of critical problems, and insuring swifter, more accurate operator response.

2.2 The Need for Alarm Management

Alarm management is usually necessary in a process manufacturing environment that is controlled by an operator using a control system, such as a Distributed Control System, or DCS or a PLC, or Programmable Logic Controller. Such a system may have hundreds of individual alarms that up until very recently have probably been designed with only limited consideration of other alarms in the system. Since humans can only do one thing at a time and can pay attention to a limited number of things at a time, there needs to be a way to ensure that alarms are presented at a rate that can be assimilated by a human operator, particularly when the plant is upset or in an unusual condition. Alarms also need to be capable of directing the operator's attention to the most important problem that he or she needs to act upon, using a priority to indicate degree of importance or rank, for instance.

2.3 The Seven Steps To Alarm Management

Step 1: Create and Adopt an Alarm Philosophy

A comprehensive design and guideline document that makes it clear "exactly how to do alarms right."

Step 2: Alarm Performance Benchmarking

Analyze the alarm system to determine its strengths and deficiencies, and effectively map out a practical solution to improve it.

Step 3: "Bad Actor" Alarm Resolution

From experience, it is known that around half of the entire alarm load usually comes from a relatively few alarms. The methods for making them work properly are documented, and can be applied with minimum effort and maximum performance improvement.

Step 4: Alarm Documentation and Rationalization (D&R)

A full overhaul of the alarm system to ensure that each alarm complies with the alarm philosophy and the principles of good alarm management.

Step 5: Alarm System Audit and Enforcement

DCS alarm systems are notoriously easy to change and generally lack proper security. Methods are needed to ensure that the alarm system does not drift from its rationalized state.

Step 6: Real-Time Alarm Management

More advanced alarm management techniques are often needed to ensure that the alarm system properly supports, rather than hinders, the operator in all operating scenarios. These include Alarm Shelving, State-Based Alarming, and Alarm Flood Suppression technologies.

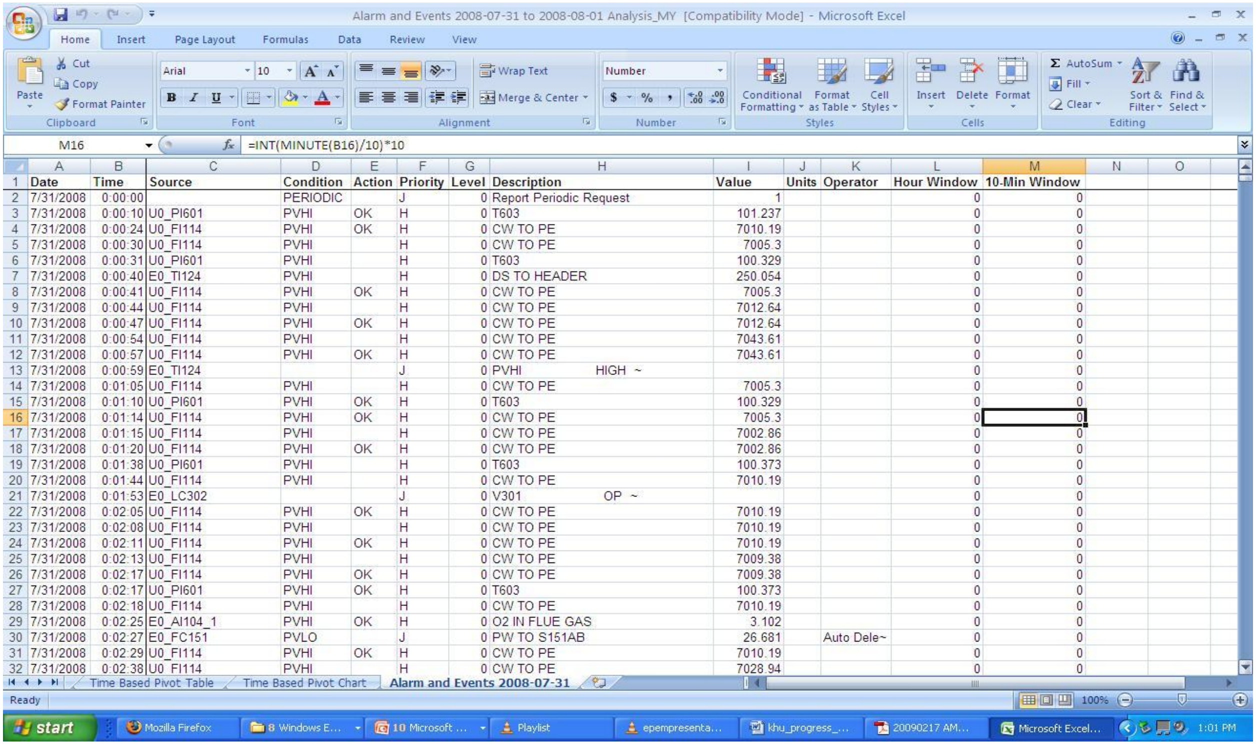
Step 7: Control and Maintain Alarm System Performance

Proper management of change and longer term analysis and KPI monitoring are needed, to ensure that the gains that have been achieved from performing the steps above do not dwindle away over time. Otherwise they will; the principle of "entropy" definitely applies to an alarm system.

Table 1: Plant Risk and Categorization. By Referring to the PETRONAS Technical Standard (PTS):

Average Alarm Rate in Steady-state Operation, per day	Average Alarm Rate in Steady-state Operation, per 10 minute period	Acceptability Categorization	Performance and Risk
X>1440	More than 10 alarms	Very likely to be unacceptable	Inefficient / High risk
720 < X < 1440	More than 5 but less than 10	Likely to be over-demanding	Medium performance and risk
288 < X < 720	More than 2 but less than 5	Possibly over-demanding	Medium performance and risk
144 < X < 288	1 or more but less than 2	Manageable	Medium performance and risk
X < 144	Less than 1 alarm	Very likely to be acceptable	Efficient / World Class, Low risk

For a plant in steady state or stable operation, the average alarm rate per 10 minutes will determine the following risks and categorization (from Engineering Equipment & Materials Users' Association (EEMUA) recommendation [2].)



	Date	Time	Source	Condition	Action	Priority	Level	Description	Value	Units	Operator	Hour Window	10-Min Window
2	7/31/2008	0:00:00		PERIODIC		J	0	Report Periodic Request	1			0	0
3	7/31/2008	0:00:10	U0_PI601	PVHI	OK	H	0	T603	101.237			0	0
4	7/31/2008	0:00:24	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
5	7/31/2008	0:00:30	U0_FI114	PVHI		H	0	CW TO PE	7005.3			0	0
6	7/31/2008	0:00:31	U0_PI601	PVHI		H	0	T603	100.329			0	0
7	7/31/2008	0:00:40	E0_TI124	PVHI		H	0	DS TO HEADER	250.054			0	0
8	7/31/2008	0:00:41	U0_FI114	PVHI	OK	H	0	CW TO PE	7005.3			0	0
9	7/31/2008	0:00:44	U0_FI114	PVHI		H	0	CW TO PE	7012.64			0	0
10	7/31/2008	0:00:47	U0_FI114	PVHI	OK	H	0	CW TO PE	7012.64			0	0
11	7/31/2008	0:00:54	U0_FI114	PVHI		H	0	CW TO PE	7043.61			0	0
12	7/31/2008	0:00:57	U0_FI114	PVHI	OK	H	0	CW TO PE	7043.61			0	0
13	7/31/2008	0:00:59	E0_TI124			J	0	PVHI HIGH ~				0	0
14	7/31/2008	0:01:05	U0_FI114	PVHI		H	0	CW TO PE	7005.3			0	0
15	7/31/2008	0:01:10	U0_PI601	PVHI	OK	H	0	T603	100.329			0	0
16	7/31/2008	0:01:14	U0_FI114	PVHI	OK	H	0	CW TO PE	7005.3			0	0
17	7/31/2008	0:01:15	U0_FI114	PVHI		H	0	CW TO PE	7002.86			0	0
18	7/31/2008	0:01:20	U0_FI114	PVHI	OK	H	0	CW TO PE	7002.86			0	0
19	7/31/2008	0:01:38	U0_PI601	PVHI		H	0	T603	100.373			0	0
20	7/31/2008	0:01:44	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
21	7/31/2008	0:01:53	E0_LC302			J	0	V301 OP ~				0	0
22	7/31/2008	0:02:05	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
23	7/31/2008	0:02:08	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
24	7/31/2008	0:02:11	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
25	7/31/2008	0:02:13	U0_FI114	PVHI		H	0	CW TO PE	7009.38			0	0
26	7/31/2008	0:02:17	U0_FI114	PVHI	OK	H	0	CW TO PE	7009.38			0	0
27	7/31/2008	0:02:17	U0_PI601	PVHI	OK	H	0	T603	100.373			0	0
28	7/31/2008	0:02:18	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
29	7/31/2008	0:02:25	E0_AI104_1	PVHI	OK	H	0	O2 IN FLUE GAS	3.102			0	0
30	7/31/2008	0:02:27	E0_FC151	PVLO		J	0	PW TO S151AB	26.681		Auto Dele~	0	0
31	7/31/2008	0:02:29	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
32	7/31/2008	0:02:38	U0_FI114	PVHI		H	0	CW TO PE	7028.94			0	0

Figure 2: Early Overview of Alarm analysis result display using the Microsoft Excel

Using the Microsoft Excel, this early overview of alarm analysis result can be obtained. It displays the instrument tag number, condition of the alarm (High or Low), description of the alarm, the value of the alarm and at what time the alarm is triggered.

2.4 Example of Alarm Types

Most frequent alarms:

Alarms from sources that produce the most alarm count. Top 20 such alarms can account for almost 50% of total alarm generation.

Chattering alarms:

Chattering alarms causes noise in alarm system and major contributor to operator overload. An alarm that transition into and out of alarm in a short amount of time

CHAPTER 3
METHODOLOGY

3.1 Procedure Identification

For this project, research will be conducted using the readily available software such as Microsoft Excel to Monitor and Analyze the Alarms. The data of the alarms was obtained from the Ethylene\Polyethylene (M) Sdn Bhd. Other software might be used for enhancement and make the system easy to be used. Research will also be conducted intensively on the internet and from the library. The results of the Alarm Analysis and Monitoring will be compared with the existing server in the Ethylene/Polyethylene (M) Sdn. Bhd.

3.2 Process Flow

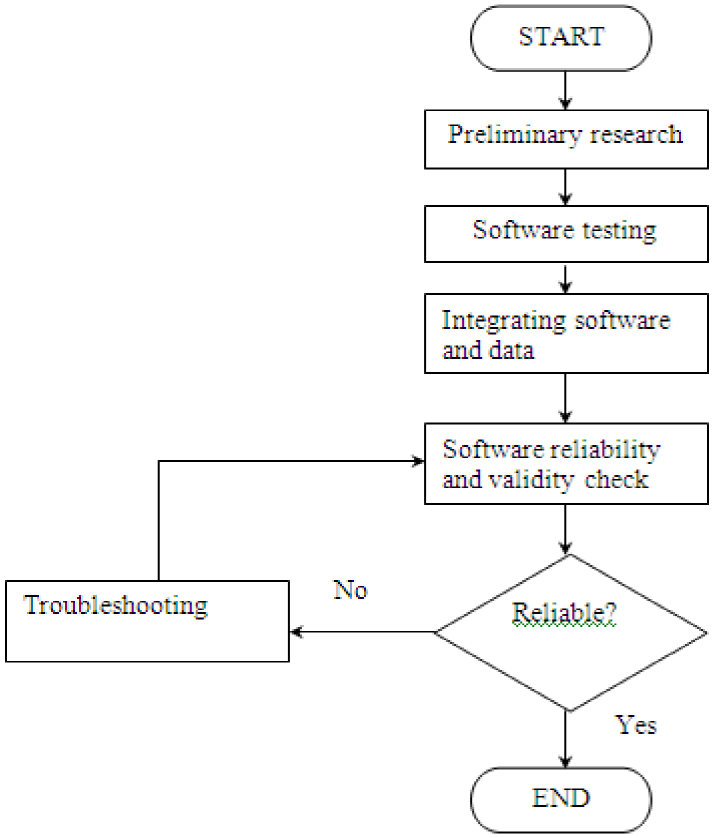


Figure 3: Flowchart of the Process Flow

Flowchart Explanation:

STEP 1: Preliminary research. A preliminary research is done by about the project by reading related journal or articles related to the topic.

STEP 2: Software testing. Every software used for this project is tested in order to master and familiarized with the software

STEP 3: Integrating software and data. The data obtained will be integrated with the software to perform the analysis.

STEP 4: Software reliability and validity check. The result obtained from the software is compared with the readily available analysis data. If the software is not reliable, troubleshooting is done to rectify any problems.

STEP 5: Project Documentations. Project documentations must be done effectively so that information about the project could be obtained easily and effectively.

3.3 Descriptions Of The Software And Tools Used

3.3.1 Microsoft Excel

Microsoft Excel (full name Microsoft Office Excel) is a spreadsheet-application written and distributed by Microsoft for Microsoft Windows and Mac OS X. It features calculation, graphing tools, pivot tables and a macro programming language called VBA (Visual Basic for Applications). It has been the most widely used spreadsheet application available for these platforms since version 5 in 1993. Excel is part of Microsoft Office.

Excel offers users the useful ability to write code using the programming language Visual Basic for Applications (VBA). Programmers write this code using an editor viewed separately from the spreadsheet. Manipulation of the spreadsheet entries is controlled using objects. With this code any function or subroutine that can be set up in a Basic- or Fortran-like language can be run using input taken from the spreadsheet proper, and the results of the code are instantaneously written to the spreadsheet or displayed on charts (graphs). The spreadsheet becomes an interface or window to the code, enabling easy interaction with the code and what it calculates.

The most common and easiest way to generate VBA code is by use of the macro recorder function that writes the code for the actions that the user carries out with mouse/keyboard. There is a relative/absolute toggle button that allows the user to switch between the two whilst recording a macro. Relative/absolute in this context means the relative to the start cell location or an absolute cell reference for example cell A1 (column A, row 1).

Certain features such as loop functions and screen prompts by their own properties cannot be recorded, but must be entered into the VBA module directly by the programmer. The macros can easily be activated using a button using the form menu, and advanced users can use user prompts to create an interactive program.

Although conceptually simple to understand (especially using a macro recorder), the combination of multiple steps under many different constraints/conditions requires a robust testing/quality control processes to gain regular/reliable/predictable results for the product to realize its benefits.

3.3.2 Visual Basic

Visual Basic (VB) is the third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model. VB is also considered a relatively easy to learn and use programming language, because of its graphical development features and BASIC heritage.

Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects. Scripting languages such as VBA and VBScript are syntactically similar to Visual Basic, but perform differently.

A programmer can put together an application using the components provided with Visual Basic itself. Programs written in Visual Basic can also use the Windows API, but doing so requires external function declarations.

The final release was version 6 in 1998. Microsoft's extended support ended in March 2008 and the designated successor was Visual Basic .NET (now known simply as Visual Basic).

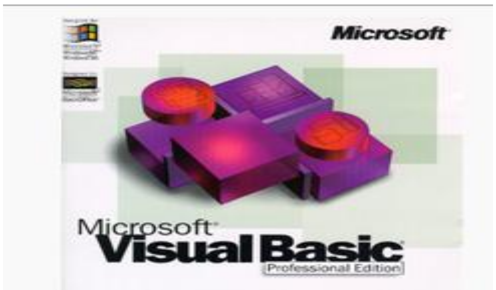


Figure 4: Microsoft Visual Basic Logo

3.3.3 Pivot table

A pivot table is a data summarization tool embedded in data visualization programs such as spreadsheets (e.g. Microsoft Excel, OpenOffice.org Calc, Lotus 1-2-3). Among other functions, they can automatically sort, count, and total the data stored in one table or spreadsheet and create a second table displaying the summarized data. Pivot tables are also useful for quickly creating cross tabs. The user sets up and changes the summary's structure by dragging and dropping fields graphically. This "rotation" or pivoting of the summary table gives the concept its name. The term pivot table is a generic phrase used by multiple vendors. However, the specific form PivotTable is a trademark of the Microsoft Corporation

In the book Pivot Table Data Crunching, authors Bill Jelen and Mike Alexander call Pito Salas the "father of pivot tables". While working on a concept for a new program which would eventually become Lotus Improv, Salas realized that spreadsheets have patterns of data. By designing a tool that could help the user recognize these patterns, one could quickly build advanced data models. With Improv, users could define and store sets of categories, then change views by dragging category names with the mouse. This core functionality would become the basis for pivot tables today. Pivot table history :

1991: Improv is released on the NeXT platform. A few months after the release of Improv, Brio Technology releases a standalone Mac implementation called DataPivot.

1992: Borland purchases the DataPivot technology and implements it in the release of their Quattro Pro spreadsheet.

1993: A Windows version of Improv is finally released. By this time, Microsoft Excel 5 is on the market with a new functionality called a 'PivotTable'.

1997: Microsoft makes serious enhancements to their pivot table functionality in Excel 97. These enhancements included: a new and improved PivotTable Wizard, the ability to create calculated fields, and new pivot cache objects that allow developers to code against pivot tables.

1999: Microsoft introduces Pivot Charts with the release of Excel 2000. Pivot Charts offer users a new way to graphically represent their pivot table data.

3.3.3.1 Explanation of a pivot table

For typical data entry and storage, data is usually flat, meaning that it consists of only columns and rows, as in the following example:

Table 2: Typical data entry

	A	B	C	D	E	F	G
1	**Region**	**Gender**	**Style**	**Ship Date**	**Units**	**Price**	**Cost**
2	East	Boy	Tee	1/31/2005	12	11.04	10.42
3	East	Boy	Golf	1/31/2005	12	13	12.6
4	East	Boy	Fancy	1/31/2005	12	11.96	11.74
5	East	Girl	Tee	1/31/2005	10	11.27	10.56
6	East	Girl	Golf	1/31/2005	10	12.12	11.95
7	East	Girl	Fancy	1/31/2005	10	13.74	13.33
8	West	Boy	Tee	1/31/2005	11	11.44	10.94
9	West	Boy	Golf	1/31/2005	11	12.63	11.73
10	West	Boy	Fancy	1/31/2005	11	12.06	11.51
11	West	Girl	Tee	1/31/2005	15	13.42	13.29
12	West	Girl	Golf	1/31/2005	15	11.48	10.67

While there is a lot of information stored in such data, it can be difficult to get summarized information. A pivot table can help quickly summarize the flat data, giving it depth, and get the desired information. The usage of a pivot table is extremely broad and depends on the situation. In the example here, what we need to know is "How many Units did we sell in each Region for every Ship Date”:

Table 3: The result after using Pivot Table

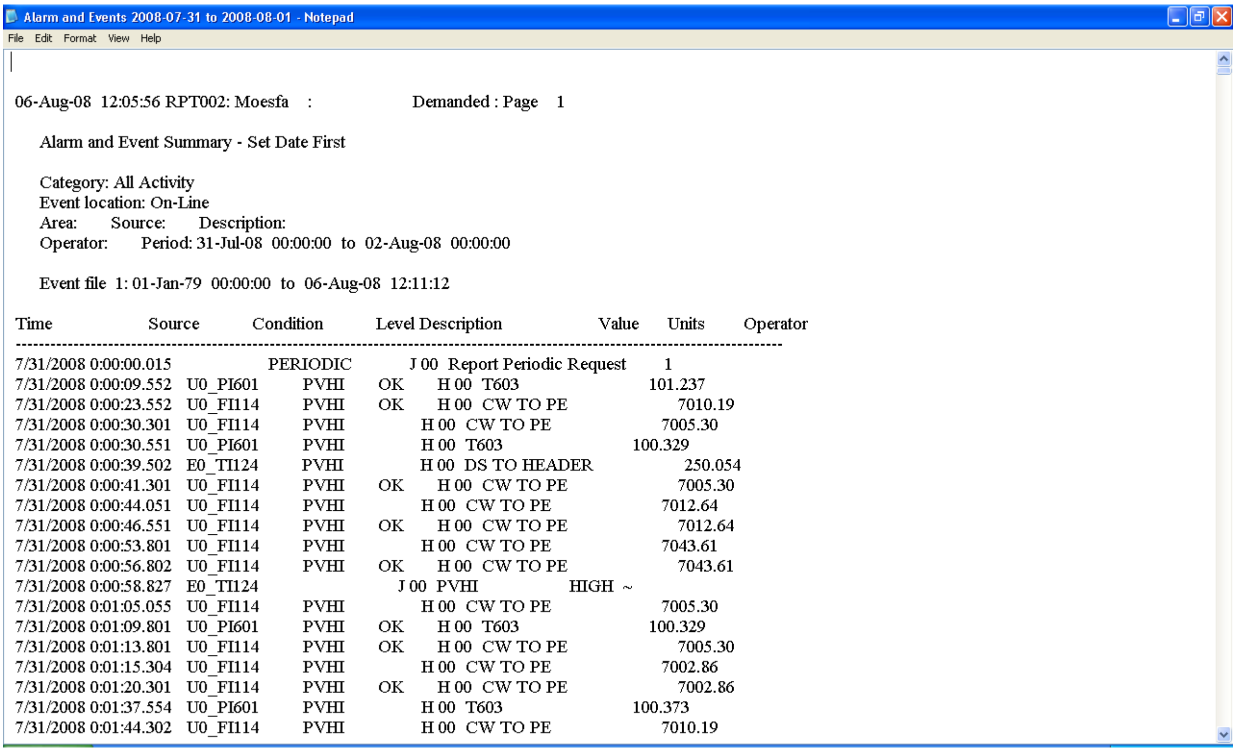
Sum of Units	Ship Date					
Region	1/31/2005	2/28/2005	3/31/2005	4/30/2005	5/31/2005	6/30/2005
East	66	80	102	116	127	125
North	96	117	138	151	154	156
South	123	141	157	178	191	202
West	78	97	117	136	150	157
(blank)						
Grand Total	363	435	514	581	622	640

\

A pivot table usually consists of row, column, and data (or fact) fields. In this case, the row is Ship Date, the column is Region, and the data we would like to see is Units. These fields were dragged onto the pivot table from a list of available fields. Pivot tables also allow several kinds of aggregations including: sum, average, standard deviation, count, etc. In this case, we wanted to see the total number of units shipped, so we used a sum aggregation.

CHAPTER 4

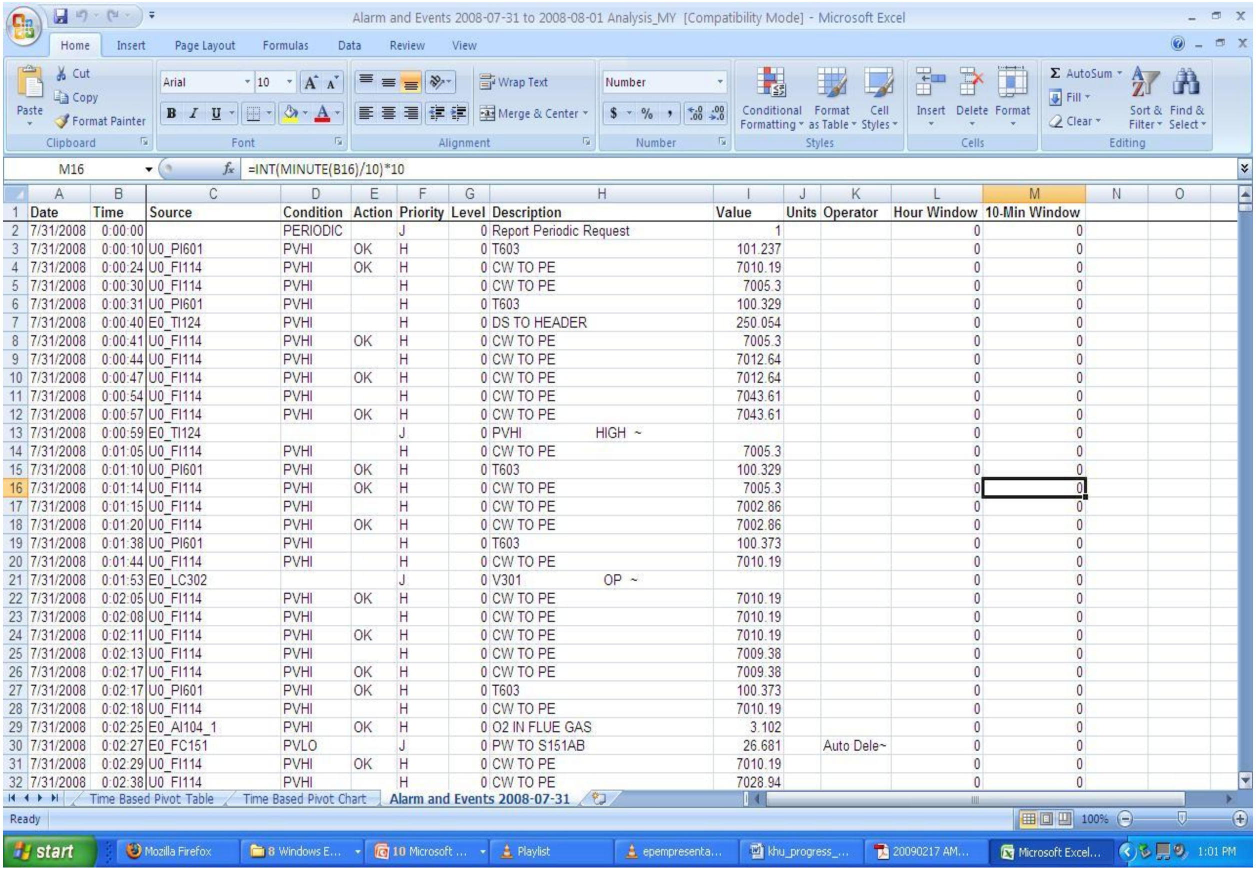
RESULTS AND DISCUSSION



```
Alarm and Events 2008-07-31 to 2008-08-01 - Notepad
File  Edit  Format  View  Help

06-Aug-08  12:05:56 RPT002: Moesfa    :                Demanded : Page    1

    Alarm and Event Summary - Set Date First

    Category: All Activity
    Event location: On-Line
    Area:      Source:      Description:
    Operator:      Period: 31-Jul-08  00:00:00  to  02-Aug-08  00:00:00

    Event file  1: 01-Jan-79  00:00:00  to  06-Aug-08  12:11:12

Time                 Source        Condition        Level Description          Value     Units     Operator
--------------------------------------------------------------------------------------------------------------
7/31/2008 0:00:00.015              PERIODIC        J 00  Report Periodic Request        1
7/31/2008 0:00:09.552  U0_PI601       PVHI     OK     H 00  T603                  101.237
7/31/2008 0:00:23.552  U0_FI114       PVHI     OK     H 00  CW TO PE                   7010.19
7/31/2008 0:00:30.301  U0_FI114       PVHI            H 00  CW TO PE                 7005.30
7/31/2008 0:00:30.551  U0_PI601       PVHI            H 00  T603                100.329
7/31/2008 0:00:39.502  E0_TI124       PVHI            H 00  DS TO HEADER               250.054
7/31/2008 0:00:41.301  U0_FI114       PVHI     OK     H 00  CW TO PE                   7005.30
7/31/2008 0:00:44.051  U0_FI114       PVHI            H 00  CW TO PE                 7012.64
7/31/2008 0:00:46.551  U0_FI114       PVHI     OK     H 00  CW TO PE                   7012.64
7/31/2008 0:00:53.801  U0_FI114       PVHI            H 00  CW TO PE                 7043.61
7/31/2008 0:00:56.802  U0_FI114       PVHI     OK     H 00  CW TO PE                   7043.61
7/31/2008 0:00:58.827  E0_TI124                    J 00  PVHI              HIGH ~
7/31/2008 0:01:05.055  U0_FI114       PVHI            H 00  CW TO PE                 7005.30
7/31/2008 0:01:09.801  U0_PI601       PVHI     OK     H 00  T603                  100.329
7/31/2008 0:01:13.801  U0_FI114       PVHI     OK     H 00  CW TO PE                   7005.30
7/31/2008 0:01:15.304  U0_FI114       PVHI            H 00  CW TO PE                 7002.86
7/31/2008 0:01:20.301  U0_FI114       PVHI     OK     H 00  CW TO PE                   7002.86
7/31/2008 0:01:37.554  U0_PI601       PVHI            H 00  T603                100.373
7/31/2008 0:01:44.302  U0_FI114       PVHI            H 00  CW TO PE                 7010.19
```

Figure 5: Raw data taken from the Main Server in the Ethylene (M) Sdn Bhd Plant Control Room

This section will briefly discuss the result achieved from the methodology for current progress. Figure 5 displays the raw data of the Alarm from the main server in the Ethylene (M) Sdn Bhd. This data will be sorted using the Microsoft Excel Pivot table options to produce crucial info about the alarm analysis with user friendly Graphical User Interface.

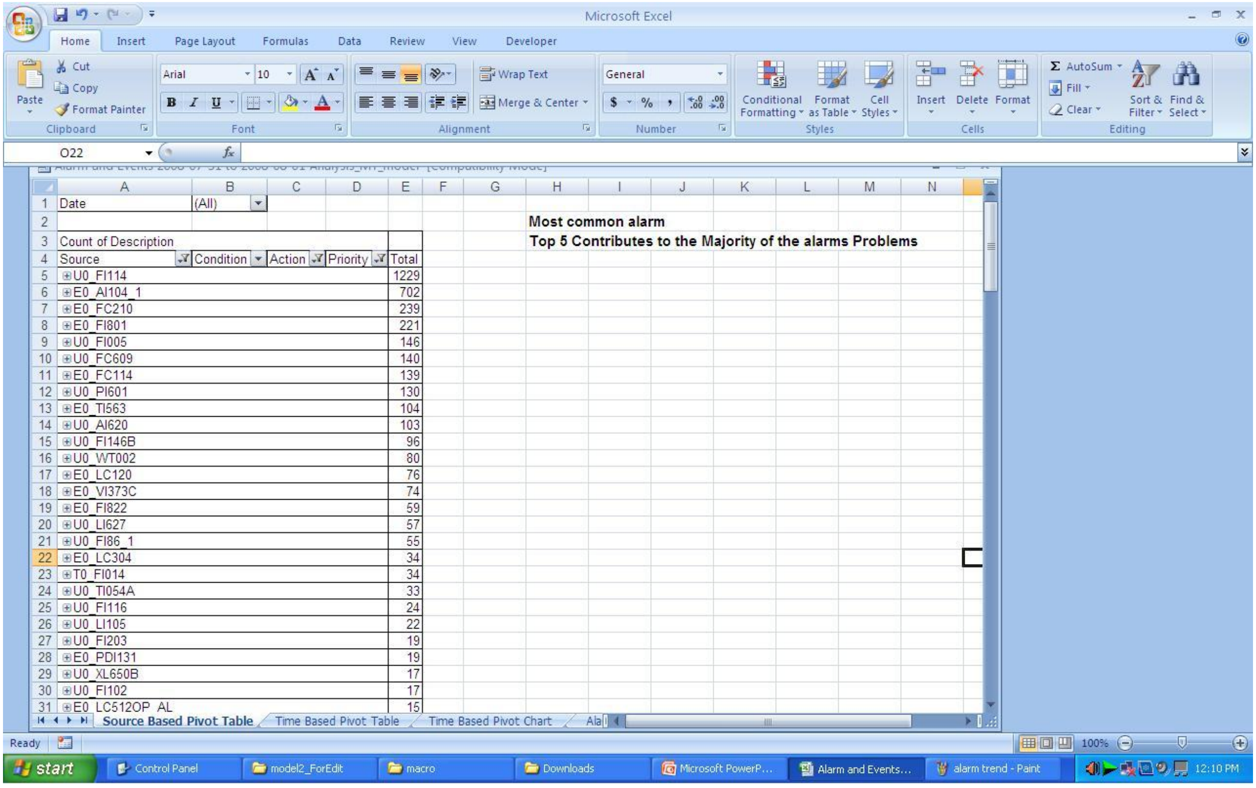


	Date	Time	Source	Condition	Action	Priority	Level	Description	Value	Units	Operator	Hour Window	10-Min Window
2	7/31/2008	0:00:00		PERIODIC		J	0	Report Periodic Request	1			0	0
3	7/31/2008	0:00:10	U0_PI601	PVHI	OK	H	0	T603	101.237			0	0
4	7/31/2008	0:00:24	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
5	7/31/2008	0:00:30	U0_FI114	PVHI		H	0	CW TO PE	7005.3			0	0
6	7/31/2008	0:00:31	U0_PI601	PVHI		H	0	T603	100.329			0	0
7	7/31/2008	0:00:40	E0_TI124	PVHI		H	0	DS TO HEADER	250.054			0	0
8	7/31/2008	0:00:41	U0_FI114	PVHI	OK	H	0	CW TO PE	7005.3			0	0
9	7/31/2008	0:00:44	U0_FI114	PVHI		H	0	CW TO PE	7012.64			0	0
10	7/31/2008	0:00:47	U0_FI114	PVHI	OK	H	0	CW TO PE	7012.64			0	0
11	7/31/2008	0:00:54	U0_FI114	PVHI		H	0	CW TO PE	7043.61			0	0
12	7/31/2008	0:00:57	U0_FI114	PVHI	OK	H	0	CW TO PE	7043.61			0	0
13	7/31/2008	0:00:59	E0_TI124			J	0	PVHI HIGH ~				0	0
14	7/31/2008	0:01:05	U0_FI114	PVHI		H	0	CW TO PE	7005.3			0	0
15	7/31/2008	0:01:10	U0_PI601	PVHI	OK	H	0	T603	100.329			0	0
16	7/31/2008	0:01:14	U0_FI114	PVHI	OK	H	0	CW TO PE	7005.3			0	0
17	7/31/2008	0:01:15	U0_FI114	PVHI		H	0	CW TO PE	7002.86			0	0
18	7/31/2008	0:01:20	U0_FI114	PVHI	OK	H	0	CW TO PE	7002.86			0	0
19	7/31/2008	0:01:38	U0_PI601	PVHI		H	0	T603	100.373			0	0
20	7/31/2008	0:01:44	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
21	7/31/2008	0:01:53	E0_LC302			J	0	V301 OP ~				0	0
22	7/31/2008	0:02:05	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
23	7/31/2008	0:02:08	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
24	7/31/2008	0:02:11	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
25	7/31/2008	0:02:13	U0_FI114	PVHI		H	0	CW TO PE	7009.38			0	0
26	7/31/2008	0:02:17	U0_FI114	PVHI	OK	H	0	CW TO PE	7009.38			0	0
27	7/31/2008	0:02:17	U0_PI601	PVHI	OK	H	0	T603	100.373			0	0
28	7/31/2008	0:02:18	U0_FI114	PVHI		H	0	CW TO PE	7010.19			0	0
29	7/31/2008	0:02:25	E0_AI104_1	PVHI	OK	H	0	O2 IN FLUE GAS	3.102			0	0
30	7/31/2008	0:02:27	E0_FC151	PVLO		J	0	PW TO S151AB	26.681		Auto Dele~	0	0
31	7/31/2008	0:02:29	U0_FI114	PVHI	OK	H	0	CW TO PE	7010.19			0	0
32	7/31/2008	0:02:38	U0_FI114	PVHI		H	0	CW TO PE	7028.94			0	0

Figure 6: Alarm and Events. Displays Instrument tag no with condition, description, value, time and date

(Generated by the author from the raw data using the Pivot Table option)

Figure 6 displays the instrument tag number, condition of the alarm (High or Low), description of the alarm; the value of the alarm and at what time the alarm is triggered



Source	Total
U0_FI114	1229
E0_AI104_1	702
E0_FC210	239
E0_FI801	221
U0_FI005	146
U0_FC609	140
E0_FC114	139
U0_PI601	130
E0_TI563	104
U0_AI620	103
U0_FI146B	96
U0_WT002	80
E0_LC120	76
E0_VI373C	74
E0_FI822	59
U0_LI627	57
U0_FI86_1	55
E0_LC304	34
T0_FI014	34
U0_TI054A	33
U0_FI116	24
U0_LI105	22
U0_FI203	19
E0_PDI131	19
U0_XL650B	17
U0_FI102	17
E0_LC512OP_AL	15

Figure 7: Source Based. Displays Instrument tag no. with total alarm counts (Generated by the author from the raw data, using the Pivot Table option)

Figure 7 displays instrument tag no. with total alarm counts. The analysis of the total alarm counts according to each tag no is very crucial and valuable because it can accounts up to 50% to 60% of the alarms problems. Most of the alarm problems can be rectified by analyzing and troubleshooting the top 5 of the alarm source.

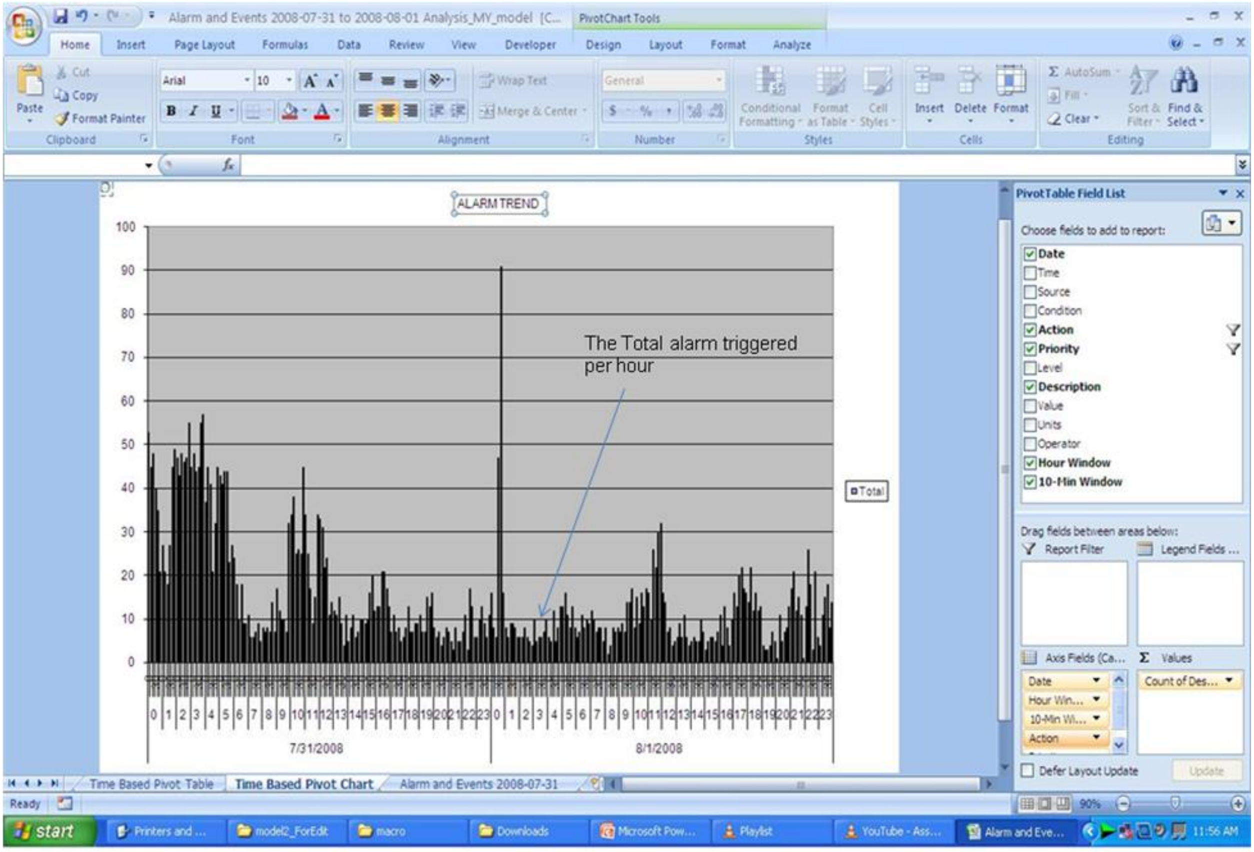


Figure 8: Time based Pivot Graph The graph shows the alarm counts on every hour

(Generated by the author from the raw data, using the Pivot Table option)

Figure 8 displays the graph that shows the alarm count on every hour for two days (7/10/2008 and 8/10/2008). The operator can monitor at which hour in specified days that produce the most alarm count.

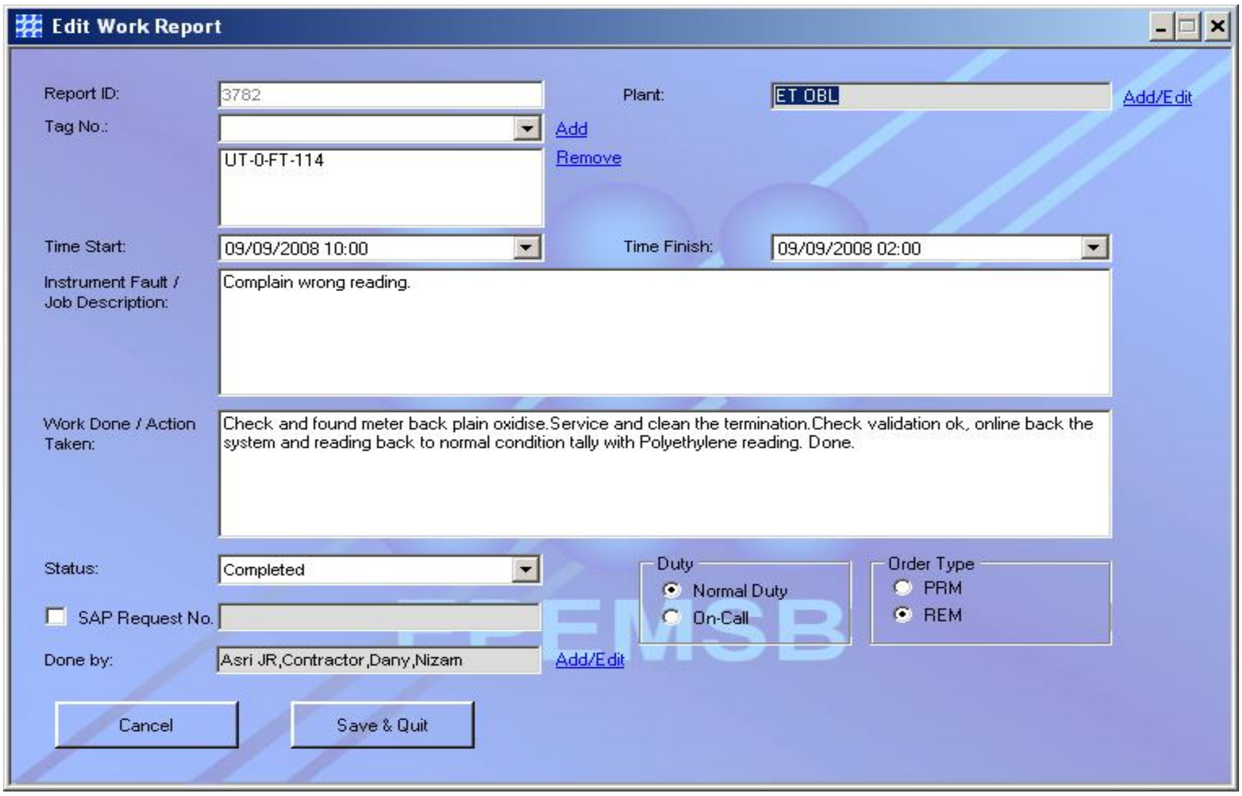


Figure 9: EPEMSB Daily Work Report

The EPEMSB Daily Work Report above in Figure 9 shows the status of the instrument with most common alarms, with the tag no of U0_FI\FT114. After a report is generated by the author, the instrument team agreed in a meeting to investigate the most common alarm problems caused by the instrument with the tag no of U0_FI\FT114 (Flow Transmitter). The instrument team founds out that the meter back plain is oxidize. After the termination of the instrument was serviced and cleaned, the reading of the instrument goes back to normal, and does not trigger the alarms.

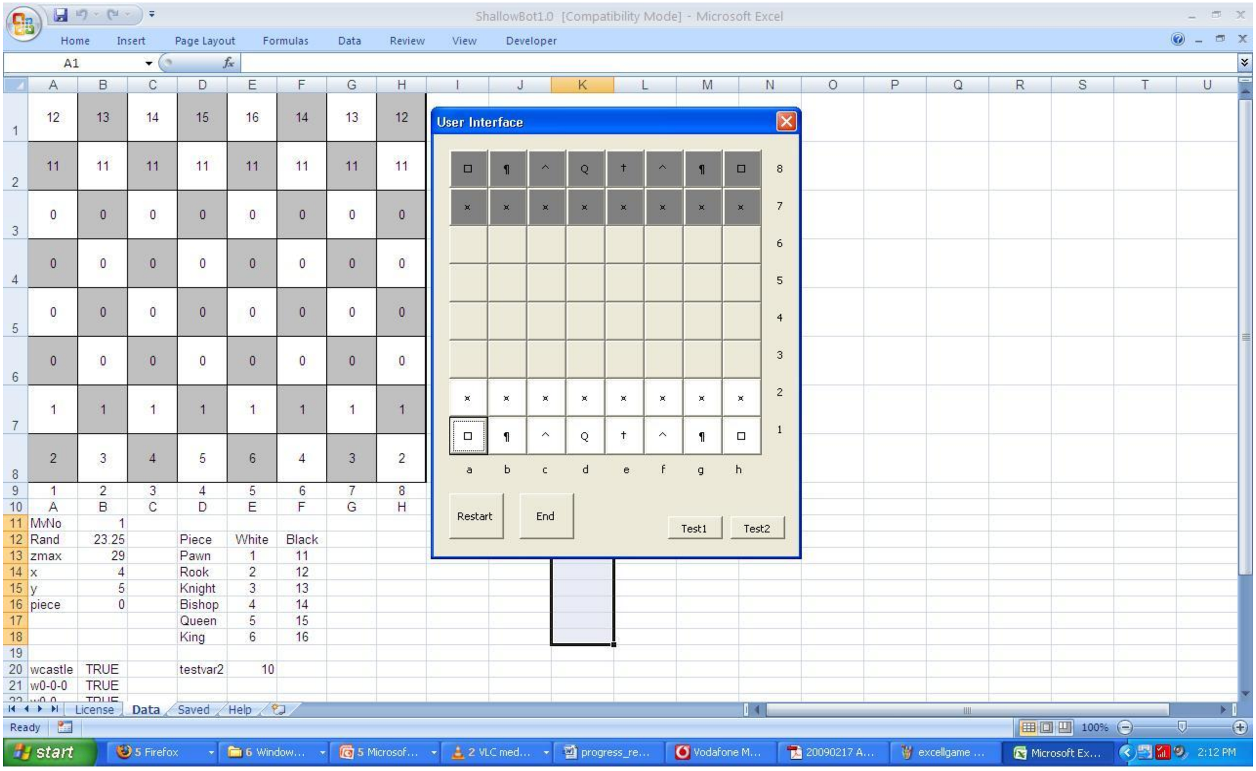


Figure 10: Sample of Chess Game GUI using Excel

The author applied the Graphical User Interface developed for the Excel Games, and integrates it with the alarms data to come out with User friendly software.

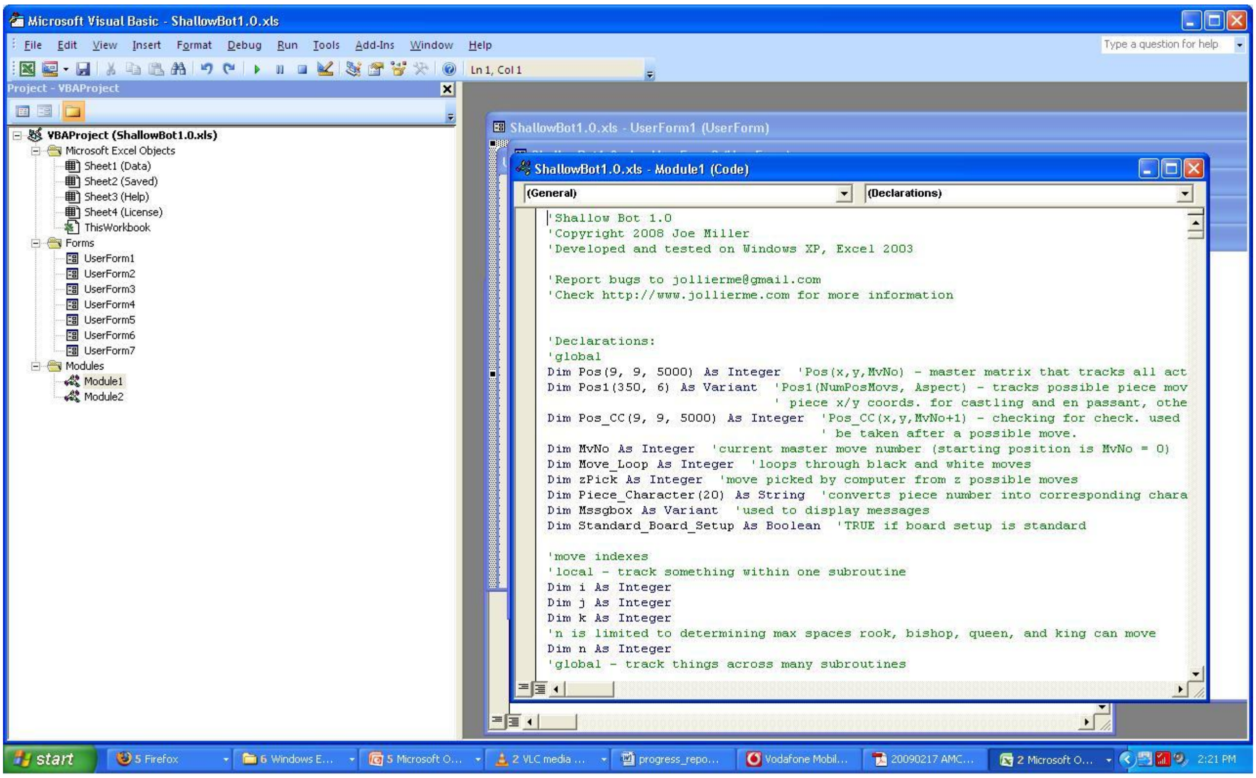


Figure 11: The code of the Excel Game

The coding of the Excel Games is modified to come out with the Graphical User interface of the software

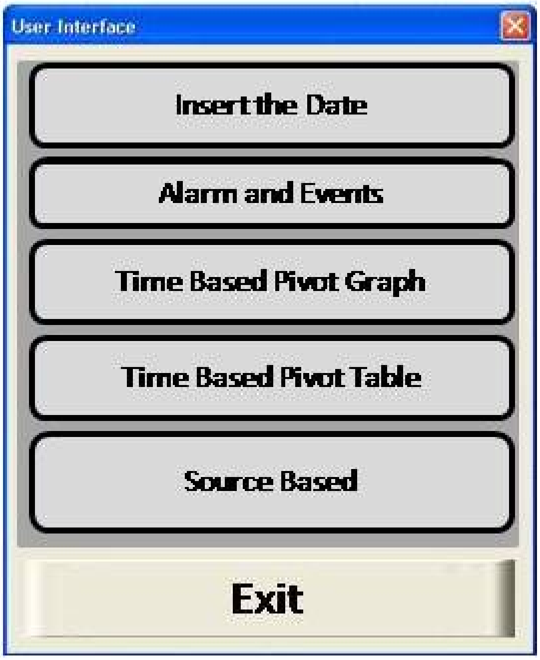


Figure 12: The Graphical User Interface (GUI)

The author applies the Graphical User Interface developed for the Excel Games, and integrates it with the alarms data to come out with User friendly software. The user can navigate through the options by using the GUI.

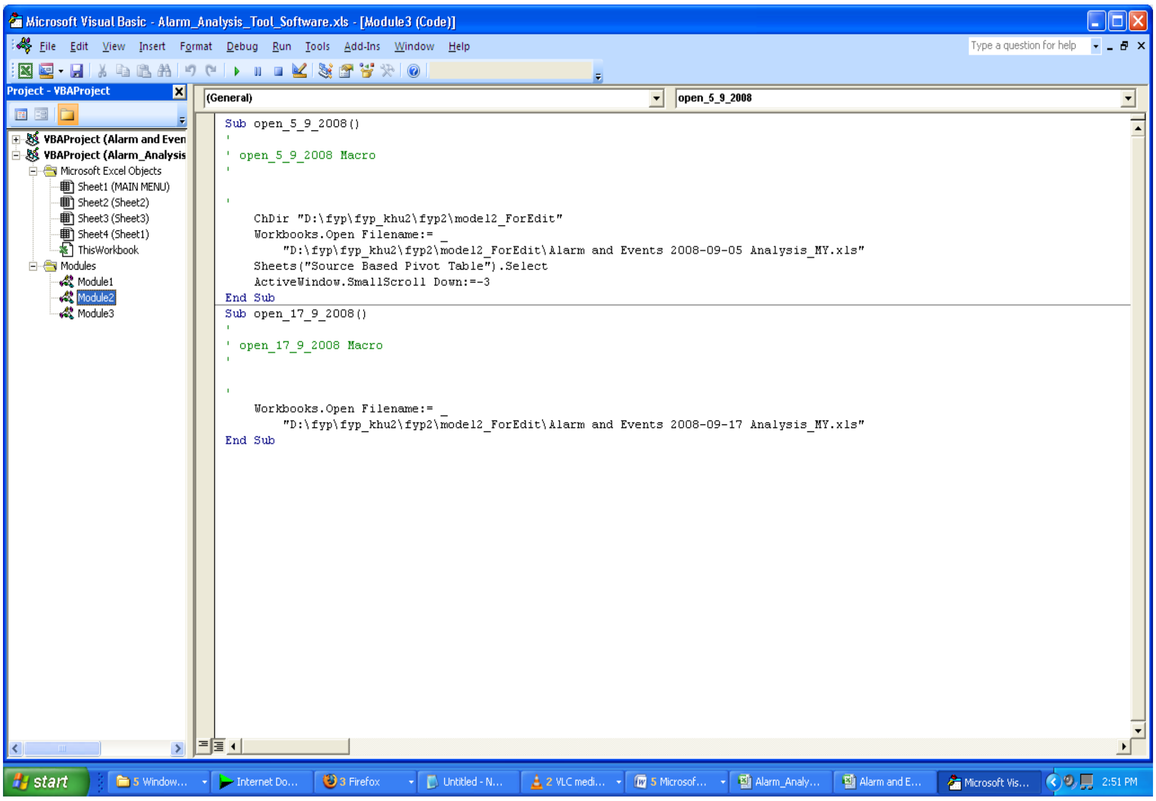


Figure 13: Some Visual Basic Coding to open up the Alarm Analysis display from the Graphical User Interface

The code to open up the Alarm Analysis display is generated using the Visual Basic for Application function in the Microsoft Excel. Figure 13 shows some Visual Basic coding to open up the Alarm Analysis display from the Graphical User Interface.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

From the research and software testing, a system will be developed for the Alarm Monitoring and Analysis System. Alarm analysis and monitoring is very crucial to maintain the safety and performance of the plant. During this world economic crisis, all industry is very much affected. The common way to get through this economic storm is to cut cost and maximize profit. The cost can be significantly reduced by maximizing the usage of any tools, or software that is readily available. Therefore, this project will aim to significantly reduce the costs by using any software and tools that is commonly available to do the alarm analysis and monitoring. By applying the Open source mode, the software will be more versatile and more options can be added tailored to our needs.

5.2 Recommendation

There are many types of alarm problems such as chattering alarms and standing alarms. This project only covers most common alarm that is contributed to the majority of the alarm problems. The project can be further developed to detect and analysis other types of alarm problems by detecting the patterns in the alarm data. Other than that, every other aspect of the project can be optimized or altered by taking into consideration that the project is design in an open source approach.

REFERENCES

[1] UTP Final Year Project Guideline,2009

[2] PETRONAS Group Technology Solution, Alarm Management Guideline

[3] Matrikon, Advanced Alarm Analysis and Rationalization Module

[4] EEMUA 191 Alarm Systems - A Guide to Design, Management and Procurement (1999) ISBN 0-85931-076-0

[5] Matrikon website http://www.ics-ltd.co.uk/Products/IMACXpertExcel.aspx

[6] Pivot Table Tutorial http://spreadsheets.about.com/b/2009/09/26/excel-2007-pivot-table-tutorial.htm

[7] Dynamic Alarm Management on an Ethylene Plant, http://www.prosys.com/UG95_DCS.pdf

[8] Microsoft Excel Macros Tutorial http://www.tutorialized.com/tutorials/MS-Excel/Macros/1

[9] Paul Cornell, 2003, "A Complete Guide to Pivot Tables: A Visual Approach"

[10] Jan Eric Larsson, Bengt Öhman, Antonio Calzada, Christer Nihlwing, Håkon Jokstad, Liv Iren Kristianssen, Jon Kvalem, and Morten Lind, 2006, "A Revival of the Alarm System: Making the Alarm List Useful During Incidents" Technical University of Denmark, Denmark

[11] F. Dahlstrand, 2000, "Methods for Alarm Reduction with Multilevel Flow Models of Industrial Processes, Licentiate thesis, Department of Information Technology, Lund University, Lund, Sweden

[12] Leslie D. Jensen, P.E., "Dynamic Alarm Management on an Ethylene Plant" ProSys GmbH Postfach 1125 vD-84479 Burghausen, Germany

[13] Event Alarm Purchase
http://www.eventalarm.com/purchase.htm

APPENDICES

APPENDIX I

PROJECT GANNT CHART

No.	Detail/ Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14
1	Project Preparation															
2	Project Consultation															
3	Submission of Progress Report				X											
4	Project Research															
5	Integrating Software and Data															
6	Submission of Draft Report									X						
7	Seminar															
8	Software reliability and Validity Check															
9	Submission of Final Report												X			
10	Oral Presentation															X

X Suggested milestone

Process

APPENDIX II

PHOTOGRAPH OF THE MAIN SERVER AND THE ALARM AND EVENT SERVER IN THE CONTROL ROOM

APPENDIX III

CLOSE UP PHOTOGRAPH OF THE ALARM AND EVENT SERVER IN THE CONTROL ROOM