

Real-Time Monitoring of Computer Resources with Predictive Intelligence and Analytics

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Abstract - Conventional monitoring methods for computer hardware and software resources are inefficient and time consuming. In addition, such method lacks the ability to report and notify in a real-time manner, hence increasing some possible risks. This paper presents the development and implementation of a real-time monitoring system for computer resources cable of providing reports such as current computer state and system failure or error. The system is also designed to give some recommendations and useful analytics. Monitoring as a service provides a hassle-free solution for computer resources management. The system was evaluated based on its functionality, reliability, usability, efficiency, maintainability and portability. Overall, the results indicate the feasibility and effectivity of the system for this specific application.

Keywords - Predictive intelligence; Real-time monitoring; Service report; Predictive Analytics; Monitoring of computer resources.

I. INTRODUCTION

Monitoring of Computer Resources plays a big role in terms of maintenance report or services. Technical staff indicate all necessary findings, action taken and recommendation about the problem of computer for proper maintenance report and services [1]. In addition, the Information Technology Services Department documents all actions or activities of the technical staff. Moreover, the computer custodian will help to document all including inventory of all computers inside the computer laboratory.

This paper presents the design, development and implementation of Real-time monitoring of Computer Resources with predictive intelligence and analytics for Information Technology Services (ITS) [14]. It is a case-based service maintenance request/ reporting system with predictive intelligence and analytics to monitor hardware failure and suggest recommendation. This system or program is used to document all transactions made by the maintenance. Thus, this work is to help and improve the service maintenance and the quick action of the technical staff [17]. Using this, the staff on different department was fill up the forms and state all information about the problems of their computer, send it to the office of the ITS department for clarification, verification. Based on the report, the technical staff will search the suggested built – in solution to the problems indicated in the new application software, then serve the service maintenance report to the concern department [13].

Prior to the implementation of the system, interviews from key persons in the company was conducted to clarify some procedures, or documents needed for the project. Furthermore, historical data from the company relevant to the system is also used as an input to the process. The system was evaluated utilizing ISO 9126 of software

evaluation criterion namely: Functionality, Reliability, Usability, Efficiently, Maintainability and Portability.

The paper is organized as follows. Section 2 introduces those related technologies that is used for system development. In Section 3 describes how the system was developed. Section 4 shows the output of the system. System evaluation is discussed in Section 5. Conclusion is provided in Section 6.

II. RELATED TECHNOLOGY

A. Monitoring as a Service

Monitoring as a service is to provide essential real-time information for effective and efficient network application quality of service monitoring [11]. The real-time management is the actual monitoring of the performance of the computer [10]. Real-time management is to determine, monitor the status of the computer online [14]. The technical staff is assign for the maintenance and monitored the different activity of the client. Using service request/service report form, the client or department had fill-up the request form and include all information details of the problem. There is a different component for the real time management and monitoring of computer resources, these components are; (a) software, (b) hardware and (c) network, to manage the real-time monitoring of computer resources [2], it is also to connect other people maybe it is political, social economical etc. [3].

In this study, the researchers develop a real-time monitoring of computer resources covering a hardware failure with the software and network communication [21]. Develop a case-based service maintenance request/ reporting system, and use predictive intelligence and analytics to monitor system failure and suggest recommendation. In computer hardware problems reported

by the client with complete details had to view in the homepage of the programs, the function of the maintenance staff or computer technician is to verify what the problems is [13][21]. Using this system, the predictive intelligence and analytics had to predict the present and future graphical presentation of percentage of failure per year. The suggested solution and recommendation recorded earlier from the experience of veteran's computer technician or IT specialist has the big help for the maintenance on duty. The suggested solution had to apply the step by step procedure of trouble shooting guide to the computer with hardware problem [4].

Computer programs and systems software relating to one or more aspects of the study described based on the needs or function. Additional, the features and advantages through the techniques of the present study considered as part of the invention [5]. In this study states that the computer had a different problem in terms of hardware, software and network connection encountered by the clients or different department [3]. The example of computer problems like corrupted application and operating system error.

B. Predictive Intelligence and Analytics

In the real-time management of the computer resources, network is the most important facilities and the main circuit of the study to become a successful to determine the computer problems received by the system or server. In this study, network is the communication tool of the computer user to communicate the Information Technology Services department to report using service request/report form and or service maintenance request form [12]. In service maintenance request indicates all details about the computer problem reported by client or user in different department, and all reported system failure received and recorded it automatically to the server for documentation [6]. In network facilities, the monitoring of computer program or system program detected if they had disconnected device or devices because of the IP address indicated each computer inside the computer laboratory [15]. Using the network devices, the software development of the study was able to detect some problems in the network [7].

Predictive intelligence has focuses on the system failure of the computer; it is the hardware components and network communication problems of computing device [16] [20]. There are some cases of predictive analytics in computer hardware and software with network problems in this research topic had to implement the step by step procedure of applying the method of trouble shooting and updating the software installed on a computing device [8]. Transmitting or detecting some problems or an incident report to a the server and that is the repository of system information for a computer including a plurality of disparate computing devices [23], the incident report describing a problem identified by the computing device and involving software installed on the computing device, the incident report including system information describing configuration of

the software on the computing device; receiving from the server system at least one software update recommendation in response to the transmitted incident report, the recommendation based on information from the repository of system information and the problem described in the incident report, the recommendation including update information pertaining to at least one software update associated with the recommendation, the update information identifying an estimated time duration for deploying the software update, the estimated time duration based on statistical data from previous deployments of software updates on computing devices in the system, the estimated time duration including one or more time duration phases associated with the update recommendation [9].

III. SYSTEM DEVELOPMENT

A. Methods of Research

This study focuses on the opinion of all respondent for the Real – Time Monitoring of Computer Resources with Predictive Intelligence and Analytics. The sequence analysis algorithms is to summarize frequent sequences or episodes in data, such as a series of problems received and detected by means of predictive intelligence using real-time monitoring of computer resources, or a series of log events or activity preceding in terms of machine maintenance.

The sequence analysis algorithm was involving to the process of detecting and receiving computer resources problems using service maintenance request and report from the client or department. First, the client or department user had encounter a computer problem, he/she open the new application software which is Real – Time Monitoring of computer Resources with Predictive Intelligence and Analytics or to request a service maintenance to gather the said problems, fill up the form first and indicate all information details and complaint of what the system errors or problems have. Second, the system verifies the problems and using predictive intelligence with embedded solution, the real-time monitoring had given a possible solution and apply the step by step procedure if possible. Third, SQL Server Data Mining includes the algorithm types for the process of service maintenance report/request by means of recording all the activity problems of computer. In this algorithms predict one or more device or devices and components disconnected such mouse, keyboard and LAN cables for network communication and record it automatically in the database and from the inventory. In the process of recording of all activity of computers, Fourth, using predictive intelligence and analytics, the system has created a history or a summary of all computers reported and detected in chart details.

In this study the predictive analytics involves a variety of statistical techniques from predictive modeling, machine learning, and data mining that analyze current and historical

facts to make predictions about future or otherwise unknown events.

B. System Architecture

Figure 1 illustrates the flow of operation of proposed system. All transaction or activities in this new application had seen and will started in account manager to open the real-time monitoring system, they had two ways of to obtain the problem of the computer; (1) system error, this new application software detect the system error of the computer inside the laboratory using predictive intelligence and analytics, (2) computer problems, the clients report the computer problems to the ITS department using A Real-Time Monitoring of Computer Resources with Predictive Intelligence and Analytics. The client had to fil-up first the service request form, indicate all problems concern and send it for the immediate action. The maintenance verifies the received service request and the detected system error using predictive intelligence with analytics. Using this new application, all indicated problems had always search to view the suggested possible solution. After he get the possible solution to the problem encounter, try to apply it,

assess it for the quick action and make a final report indicated the action taken, finding and recommendation based on the observation of the technical staff for the documentation.

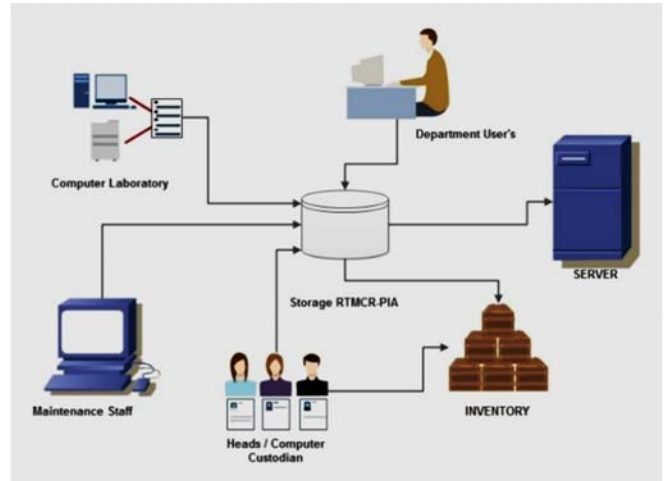


Figure 1. System Architecture

C. Use Case Diagram

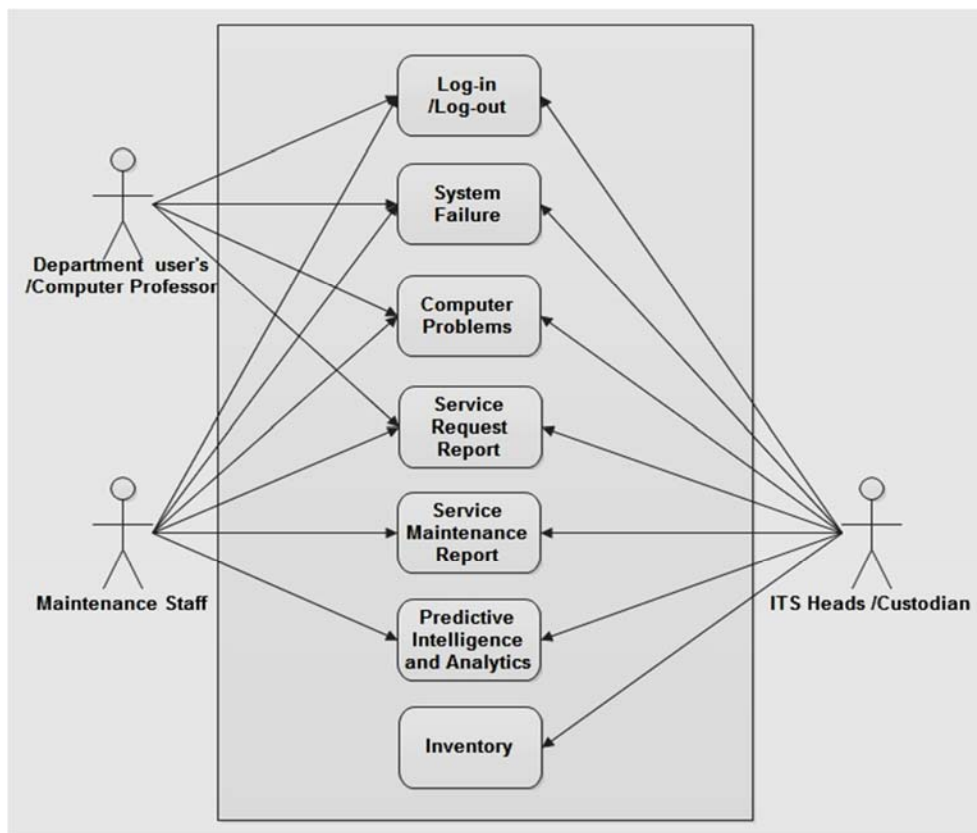


Figure 2. Use Case Diagram

In this diagram shows the three (3) actors; the first actor is the client, this is department staff, secretary and computer teacher, the person who report the system errors, hardware failure, software and other problems; The second (2) actor is the maintenance staff, the person to monitor the reported system failure and computer problems, it is also to view and verify the service maintenance report/request and predictive intelligence; The third (3) actor is the Admin or IT head and computer custodian, this actors has the full access to the system, it can open, edit, delete and search of the new application software to gather all activities, documentation about the system failure, service request/report and predictive intelligence and analytics including inventory.

D. Context Flow of the System

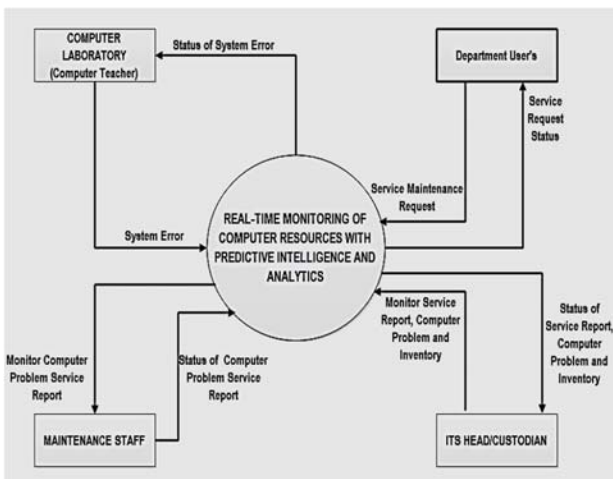


Figure 3. Context flow of Real-Time Monitoring of Computer Resources with Predictive Intelligence and analytics System

Figure 3 shows the context flow of the system. This diagram indicated the framework of different users connected to Real – Time Monitoring of Computer Resources with Predictive Intelligence and Analytics. The computer teacher had to report the computer problems encountered using a Real –Time Monitoring of Computer Resources. The department users are the person to send a service request for their computer problems and indicates all information to the ITS department. The ITS heads and computer custodian of the department had the full access to the system to monitor the different activities, maintenance report, including the inventory. All system error or computer problems are recorded into the database of the system or server. The maintenance staff had to monitor and view the reported problems.

In this diagram shows that the real-time monitoring of computer resources with predictive intelligence and analytics has process and connected all users for the savings, receiving, viewing and monitoring of all transaction directly in the system.

IV. SYSTEM OUTPUT

A. Real-Time Monitoring Management

To monitor the Real-Time Monitoring of computer Resources, the system provided a module. The system will help the technical people to documents or records all reported problems from the client or department, it is also used to help the ITS department to predict the possible total number of defective items per year and the percentage of reported problems for the analytics. Also, it will generate a summary of computer problems and inventory report of all devices.

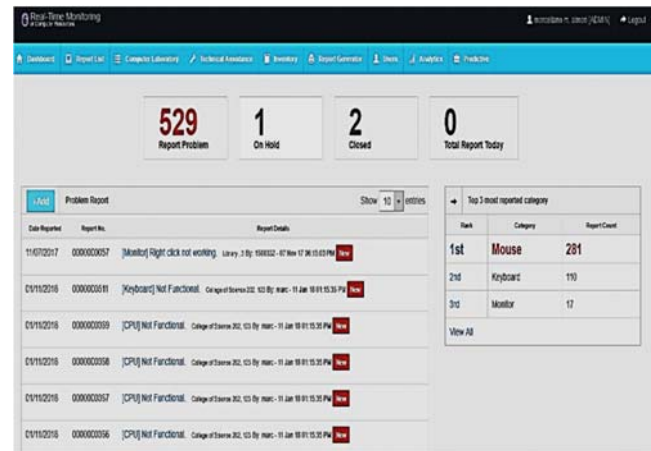


Figure 4. Home Page of the Program

In figure 4 is the online real-time monitoring of computer resources home page of the program to monitor the reported problems per day, total number of reported not to serve. In this figure, the red button new is the indicator of new reported problems. The report and the total number of reported problems needs for the service, on hold is for the verification process, closed transaction is for the finish transaction which means the process had done and also showed the total number of reported problems per day.

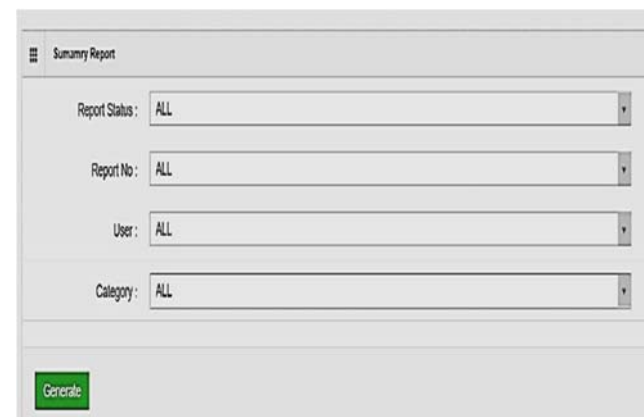


Figure 5. Summary Report Generator

It is to generate the summary of all reported problems per items/category.



Figure 6. Inventory Report Generator

It is use generate the summary of Inventory of all recorded devices or computer hardware inventory.

In this figure 5 & 6 is the Report Generator for the summary of all reported problems documented as a result or recorded items stored in the system and the inventory of all computer devices. In this report generator is the for the documentation of Information Technology Services in Figure 4 for summary report and Figure 5 for inventory report.

Figure 7 lists monitored reported problems including action taken and recommendation if possible for the documentation. In figure 8 shows the status of recorded computers using IP address for identification if it is ON or OFF the device.

Report No.	Date	User ID	Contact No.	Location	Room	PC No.	Category	Problem	Urgent	Status/Stage	Action
1	2016-06-11 13 15 25	marc	85324	College of Science	202	173	Mouse	Not Functional	No		View
2	2016-10-11 13 15 25	marc	85324	College of Science	202	173	Mouse	Not Functional	No		View
3	2016-06-11 13 15 25	marc	85324	College of Science	202	173	Mouse	Not Functional	No		View
4	2016-10-11 13 15 25	marc	85324	College of Science	202	173	CPU	Not Functional	No		View
5	2016-06-11 13 15 25	marc	85324	College of Science	202	173	Keyboard	Not Functional	No		View
7	2016-05-11 13 15 25	benyambao	85322	College of Science	201	123	Mouse	Not Working	No		View

Figure 7. Report List

Shows the list of reported computer problems

Location	Terminal No.	IP Address	Keyboard	Mouse	Monitor	CPU Fan	Processor	Disk	Status
EVISAD	12	192.168.89.82	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	161	192.168.87.101	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	164	192.168.87.104	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	162	192.168.87.102	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	165	192.168.87.106	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	163	192.168.87.103	OFF	OK	OK	OK	OK	OK	GOOD
COMPUTER LAB 3	165	192.168.87.105	OFF	OK	OK	OK	OK	OK	GOOD

Figure 8. Computer Status

This figure shows the status of recorded computers if it is ON or OFF.

B. Predictive Intelligence and Analytics

The Predictive Intelligence and Analytics is the new program to determine the percentage of reported system failure and the possible number of defective units or items per year. In Figure 9 is the home page of the Predictive Intelligence per year, per category and number of items to predict. In figure 10 is the analytical graph per category and the percentage of defective items per months in one year of statistical analysis.

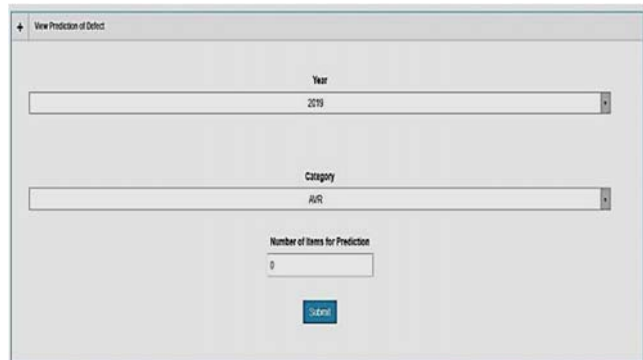


Figure 9. Predictive Intelligence home page

In this homepage of the prediction shows the year and category to predict the possible defective items/category per year.

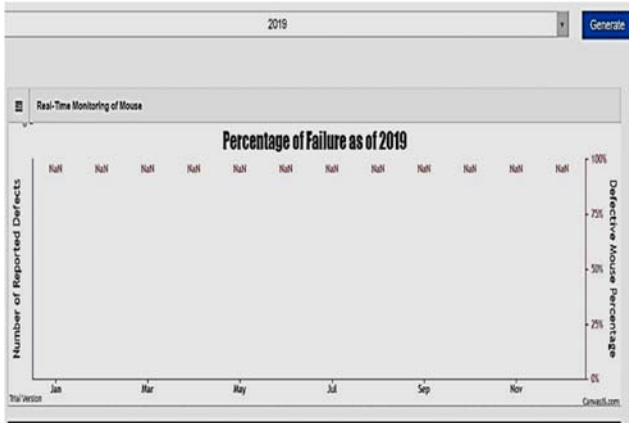


Figure 10. Real-Time Monitoring Analysis Home Page

This is the homepage of statistical chart for the Analytics.

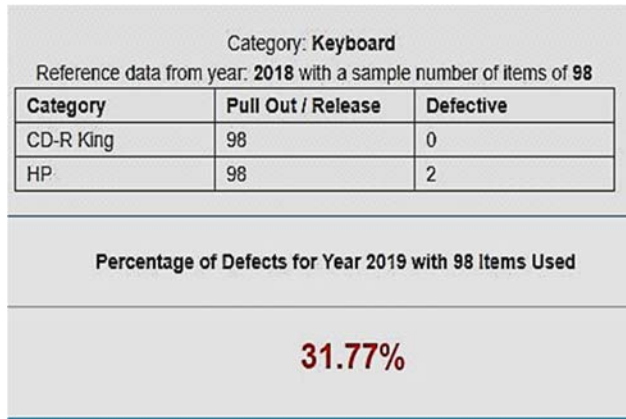


Figure 11. Predictive Intelligence result from 2018 reference data

This is the result of predictive intelligence with 98 pcs of keyboard in 2018.

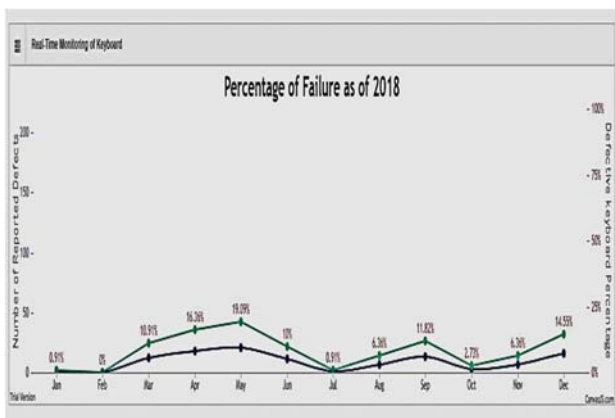


Figure 12. Percentage of Failure Result

This is the graph of percentage of failure category.

In figure 11 shows the predictive intelligence with 98 items released or installed in computer laboratory, after a year of service of keyboard, the result is 2 possible of defective items. This is result of an algorithm in the process of from the historical data of current and future analysis. In figure 12 shows the result of the percentage of failure from January to December 2018. It is the graphical presentation of the percentage of defective items or a summary of reported problems using service maintenance report.

V. SYTEM EVALUATION

The system was evaluated utilizing ISO 9126 of software evaluation criterion namely: Functionality, Reliability, Usability, Efficiently and Maintainability. in table 3 is the summary of the evaluation result based on survey questions with ISO 9126 standard format. In this table indicate the overall weighted mean in all indicators and descriptive meaning. The overall weighted mean for functionality is 4.14 is the highest and 3.82 is the lowest and the overall weighted mean is 3.97 and the descriptive meaning is moderately agree, which mean the real-time monitoring of computer resources with predictive intelligence and analytics has moderately agree in all characteristics as a result.

TABLE III. SUMMARY OF EVALUATION RESULT

INDICATORS	OVERALL MEAN	DESCRIPTIVE MEANING
FUNCTIONALITY	4.14	Moderately Agree
RELIABILITY	3.82	Moderately Agree
USABILITY	4.03	Moderately Agree
EFFICIENCY	3.92	Moderately Agree
MAINTAINABILITY	3.92	Moderately Agree
Overall Mean	3.97	Moderately Agree

VI. CONCLUSION

We conclude that the real-time monitoring of computer resources was realized and found to be capable of monitoring the reported computer problems, system errors and hardware failure from the clients and view the status of computer hardware inside the laboratory if it is ON & OFF or they have disconnected hardware components or devices. The researchers conclude that the development of the case based service and maintenance request and report had easy to view the information details of the maintenance request and reported problems. Using the technical assistance button from the built-in trouble shooting guide or solution, the maintenance staff has a great idea to resolve the computer problem. Lastly, the predictive intelligence and analytics had to know the present and future possible numbers or percentage of defective items per year for the new items or

components in the inventory list and to view the percentage of the reported units/items for the statistical analytics of the system.

Based on the above summary and conclusion, the recommendation is made: Formulation of new policies and procedure for the enhancement of the online monitoring of Computer resources with predictive intelligence and analytics to store all data using cloud computing for the back-up of all the important documents. Conduct of periodical evaluation of the program. And undertake a follow – up study to determine the improvements made after this study was conducted.

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