PREVENTIVE MAINTENANCE FOR COMPUTER SYSTEMS AND USERS' PROTECTION - CONCEPTS AND ISSUES

Akazue, M.I.

Mathematics and Computer Science Department, Delta State University, Abraka, Nigeria.
glory_ify@yahoo.com

ABSTRACT

Performing preventive maintenance activities for the computer is not optional especially when it involves the protection of the end-users. The computer is a sensitive and delicate device that needs adequate time and attention to make it work properly. In this paper, the concept and issues on how to prolong the life span of the system, that is, the way to make the system last long and function well, with the knowledge of preventive maintenance scheme were elicited. Good information via document review and research site visits on how preventive maintenance scheme play a key part to users, details on how maintenance work, the common and effective production and procedures that can be used to maintain the health of one's computer, the various safety measures that should apply when working with system components and proper disposal procedures for replaceable components, as well as some environment issues that will be useful to computer owners and users were discussed. Also, how computer keyboards serve as reservoirs for transmitting microorganisms, the different infections on computer keyboards and the dangers of these infections to human health were elicited. It was concluded that, preventive maintenance is necessary for computer user's protection against microorganisms.

Keywords: Computer system, Preventive maintenance, safety measures, disposal procedures, environmental issues, keyboard infections

INTRODUCTION

The computer is an important devise for storage and processing of information. Information stored in the computer might be handy even to sick individuals who are unable to attend meetings (Tetz *et al.,* 2001; IAPA, 2007). This underscores the need for adequate maintenance of the computer (Tetz *et al.,* 2001). The chance of system failure and minimized repair cost can only be possible when the purpose of various types of preventive maintenance products and procedures and their usage is identified. Cleaning and maintenance is required for all components of the system because dust accumulates almost everywhere and affects the efficient working of the components. According to Hartmann *et al* (2004), some components require regular maintenance like the CD-ROM drive, Mouse, Hard Disk drive, Keyboard, Monitor, Power supply and Printer.

Transmission of micro organisms from computer keyboard is often passed from hand to hand or hand to nose or eye contact (Man *et al.,* 2002). People with lowered immunity or those with open cuts or scrapes may fall prey easily (Dancer, 2008; Rutala *et al.,* 2006). Currently with the large number of Internet surfers and computer laboratory users, there is a growing concern that some mycotic infections may be transmitted via contact with a publicly used keyboard that has been infected by an infected individual (Rutala *et al.,* 2006; Lu *et al.,* 2009; David *et al., 2012)*.

Some of these keyboard infections are Mycosis. Infections like ringworm or dermatophyte, Tuberculosis from coughing and sneezing, opportunistic mycosis (Schultz *et al.,* 2003) and Aspergillus spores have been detected to have 100% incidence in most computer labs, and so we are constantly exposed to them (Rutala *et al.,* 2006).

Such infections are transmitted in the dust and

air of cybercafés, schools and hospital wards or rooms of persons suffering from infectious diseases. In practice, most microbes (such as tubercle bacilli, pneumococci and staphylococci) can appear on keyboard in the droplets of saliva and mucus produced by coughing, sneezing, talking and laughing, but survival depends on environmental conditions of where the keyboard is placed and possible spills and substance that feed the bacteria that are transferred to the crevices of the keyboard. In a place where there is a lot of people moving in and out, such as a hospital or office, there is likely to be a good number of people that are sick, and through them comes the new bacteria that will eventually settle on the keyboard through the air or from physical contact. Therefore performing preventive maintenance activities for the computer is not optional to ensuring the smooth functioning of the computer and to preventing frequent problems such as transmitting of infections (Hardy *et al.,* 2006). The computer is a sensitive and delicate device that needs adequate time and attention to make it work properly. Thus, the life span of the system can last long and function well with the knowledge of preventive maintenance scheme for computer systems as well as preventing the spread of harmful micro-organisms (Pittet *et al.,* 2006; Hota, 2004; Harris, 2008).

This paper examined how preventive maintenance scheme play a key part to computer users. It elicited in details how maintenance works, the common and effective procedures that can be used to maintain the health of a computer; the various safety measures that can be applied when working with system components, how computer keyboards serve as reservoirs for transmitting microorganisms, the different infections on computer keyboards and the dangers of these infections to human health. The paper also highlighted the proper disposal procedures for replaceable components as well as some environmental issues that might affect the computer user.

METHODOLOGY

The fact-finding techniques used in information gathering were document review as well as research and site visit which entailed exploring the Internet to search for information. The information gathered from these techniques was used in eliciting concepts and issues on preventive maintenance.

The following general rules should be noted to ensure the smooth running of the computer and eventual protection of the computer users:

- The power supply should be Switch off and all cables removed before working on the computer.
- Wires and connections should be checked for wear and tear
- Disconnect all peripherals and cleaned regularly.
- Vacuum-clean the CPU at regular intervals.
- Check the voltage of all power supply equipment to see if it falls within the prescribed limit.
- When liquid cleaners are used to clean a component, ensure that the component is dry before it is connected to the computer.
- There should be no smoking near system unit because the gunk from smoke accumulates on the mouse ball and rollers and thus affects the performance of the drive head adversely.

Nevertheless, when it comes to preventive maintenance, different tools and methods may be required for different components, yet, some tools are commonly used like the liquid cleansing compounds, a vacuum cleaner, uninterrupted power supply (UPS), and suppressors. Software utilities, such as disk defragmenter and scan disk can be used for maintaining floppy disk and hard disks. A typical maintenance schedule is illustrated in the Table1.0

Table 1.0: A typical maintenance schedule

Component	Frequency	Maintenance Action
Mouse	Weekly	The mouse ball and roller should be clean
Keyboard	weekly	The keyboard should be Vacuum cleaned
Monitor	Monthly	A lint-free software is used to clean the monitor
System unit	Every 6months	Vacuum clean the system unit
Floppy disk drive	Every 6months	Clean using the floppy drive cleansing kit

The tools used to maintain computer components can be classified into Hardware Utilities and Software Utilities as shown in figure1.0 and Figure 2.0

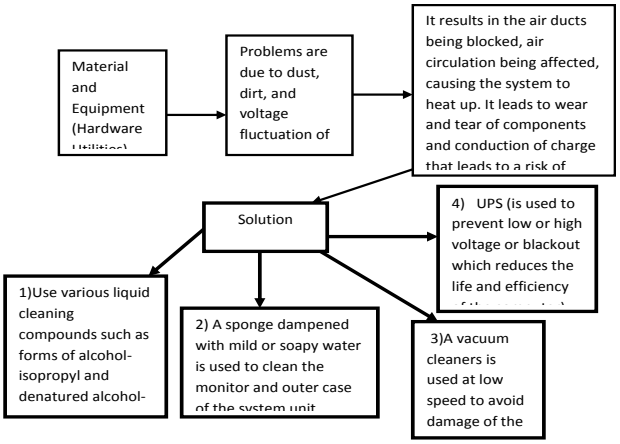

Figure 1.0: Use of Hardware Utilities tools

However, the choice of selecting utility from various third-party utilities to assess and fix disk problems, must match the Operating System of the computer.

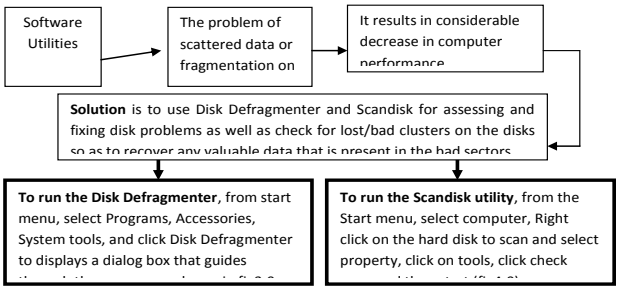

Figure 2.0: Use of Software Utilities tool

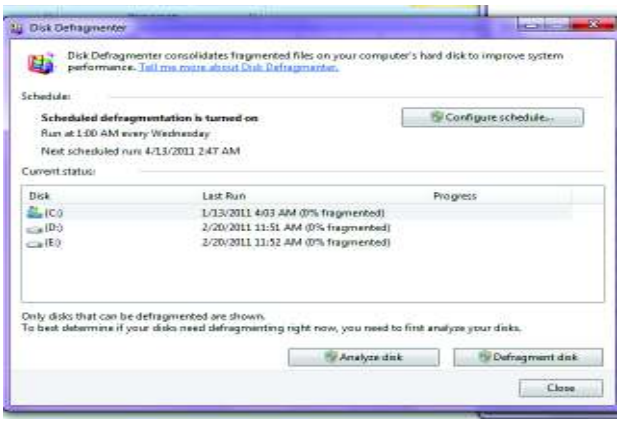

Figure 3.0: Disk Defragmenter

Figure 4.0: Scandisk utility

PREVENTIVE MAINTENANCE PROCEDURES

Computer maintenance can be of preventive and corrective type. The first is done in order to keep away system problems that have to do with data backup, hardware maintenance, viruses detection and file system corruption. Many people forget to perform preventive maintenance activities, and, on the long term, this is the main cause for total collapse in any computer system (Jack, 2011). Timely execution of this type of maintenance is essential to avoid spending enormous sums of money on new components or repair services later on (Oke and Charles-Owaba, 2006). Additionally, preventive maintenance can be efficient, not only in financial terms but also in terms of time. It necessitates less time than troubleshooting and repair procedures and can protect your data against major loss (Canek and Rodrigo, 2008; Xiaojun *et al.,* 2010).

In Table 2.0, all computer components that require preventive maintenance and the methods and procedures to clean and maintain these components are enumerated. In other words, problems, procedures and devices for preventive maintenance within the computing environment, including people, hardware, and the surrounding workspace are discussed in Table 2.0.

Table 2.0. Procedures of cleaning computer components (source: Tetz *et al.*, 2001; Xiaojun et al., 2010; Shakeel *et al.*, 2011)

Component	problem	Solution (Procedure and devices)
Mouse	when the mouse ball and/or rollers gather dirt, it affects cursor movement	*Disconnect the mouse *bring out the ball by opening the mouse ball cover from the bottom of the mouse. *Wash the ball in soapy water. *Use a cotton swab dipped in isopropyl alcohol to remove the dirt on the rollers. *Dry the rollers and ball well with a neat cloth before fixing the ball and the mouse ball cover. *Connect the mouse to the computer.
Keyboard	When the keyboard gathers dust and dirt, they may cause the keys to stick when pressed as well as result in incorrect characters being displayed on the screen. Liquids (such as tea or drinks) that are spilled on the keyboard can also cause a short circuit in it.	*Disconnect the keyboard from the computer. *Remove the key tops from the keyboard and use a vacuum cleaner to blow the dust. *Clean the key tops using a cotton swab dipped in denatured alcohol or spray cleaner. *Dry the key tops and put them back on the keyboard *Connect the keyboard to the computer *Ensure that the keyboard is covered when not in use * Use Nisin clean which can stop the spread of bacteria and fungi
Printer	Dust particles and bits of paper accumulate inside the printer while printing and this produces electrical charge that might damage the printer components as well as cause mechanical wear and tear to its components.	*Insert papers with clean edges and ensure that they are stacked evenly in the printer tray. *The printer should be vacuum-clean whenever it's opened for repair and tweezers should be used to remove bits of paper stuck in it.

Drives	Drives gather dust over time even though they are fixed inside the system unit. This dirt makes the drive head to be corrupt resulting in difficulty in accessing the drives.	*Put a few drops of isopropyl alcohol in the access hole of the cleaning disk. *Insert the cleaning disk in the floppy drive. The disk spins over the head and cleans it. Ensure that the floppy drive cover is in place to reduce the accumulation of dirt. * CD-ROM drive can be cleaned by using a CD lens
High-voltage equipment	Power supply unit CRT monitor	*Ensure that the main power is switched off when cleaning. Also, allow the PSU to cool before you start working on it * Be very careful when handling the CRT, as this static charge can be fatal. *To discharge a CRT, a flat screwdriver with a well-insulated handle and a piece of metal wire is needed. *Tie one end of the wire to the metal part of the screwdriver and the other end to the frame of the monitor. Then, Touch the metal end of the screwdriver under the anode boot of the monitor. A flash and a loud popping sound will indicate that the monitor has been discharged.
Electrostatic Discharge (ESD) - People who walk around a computer are the major causes of ESD because they carry dust and dirt along with their shoes.	Computer components (such as chips) can be damaged by an ESD, which might be as low as 10 volts. Dirt and dryness contribute to ESD since they both hold this charge.	*Avoid wearing of jewelry as metals are conductors of electricity. *Do not wear clothes made of synthetic material as this material is a good conductor of charge. *Wear shoes with rubber soles to get rid of static charge. *Ensure that the carpets are dust-free.

DISPOSAL OF COMPONENTS

There are special disposal procedures that comply with environmental guidelines. Every computer component has a life span after which it needs to be replaced (Cavalier *et al.,* 1996). Once a component is replaced, there is need to know how to dispose of it. Obviously, all of these components cannot be dumped anyhow, since some components, such as CRTs, batteries, wiring, and toner cartridges, contain harmful chemicals. Monitors contain heavy metals, such as lead and mercury. These chemicals will seep into the water table and contaminate our drinking water, resulting in adverse effects on the central nervous system of human beings and animals and plant tissues Cavalier *et al.,* 1996). These chemicals also have adverse effects on the environment and laws have been made that prevent people from dumping computers and monitors in landfills. The disposal mechanisms for some hazardous components: batteries, CRTs, and toner kits/cartridges are discussed.

Batteries

Batteries contain metals, such as nickel and cadmium, which are environmentally harmful and so proper recycling or disposal of the nickel-cadmium batteries need to be ensured. Batteries can be returned to the vendors for proper disposal. Detailed information on the Battery Act can be obtained by visiting www.epa.gov/epaoswer/hazwaste/ state/ policy/pl104.text. These rules are followed when disposing of your used batteries.

CRTs

CRTs contain harmful chemicals and thus cannot be dumped in landfills. Old monitors that are still in working condition can be donated to schools and churches. However, if the monitor is damaged and is not in working order, companies that buy monitors for spare parts or melt them for scrap metal can be contacted.

Toner kits/cartridges

Vendors often take the old toner kits and cartridges when a new one is bought. These vendors will then pass the toner kits/cartridges back to the manufacturers, who recycle them. Alternatively, the manufacturer or the environmental regulatory office can be contacted for instructions on how to dispose the toner kits and cartridges.

Ergonomics

Computers are of immense benefit in more ways than can be counted, but they can cause health problems. Thus, ergonomics defines a set of standards to reduce or prevent Repetitive Strain Injuries (RSI). RSI basically affects the muscles and the tendons in the neck, shoulders, arms, wrists, and fingers due to repetitive movements or incorrect body posture. Other complications that can arise due to RSI are Carpel Tunnel Syndrome and tendonitis. Thus do not ignore the body signals' warnings.

DISCUSSION

Fusarium are known to cause skin infections whose symptoms are similar to those of leprosy (Hartman *et al.,* 2004). Aspergillus cause

pulmonary infections in immune–compromised individuals while Penicillum are mainly fungi isolates from keyboards in hospitals and health centres, causing secondary infections in low immune compromised individuals (Hota, 2004; Dancer, 2008; Poulter, 2008). These various fungi isolated from the keyboards computer laboratory are also harmful microorganisms (Shakeel *et al.,* 2011). This raises the concern that contact with contaminated computer keyboards will serve as a mechanism for contaminating the hands of its users, thereby leading to cross-contamination of customers or users.

Therefore conscious effort should be made to reduce hand to mouth contact while browsing. Food should generally not be consumed in front of or on top of a keyboard because it will produce ample food source of bacteria and fungi. This will help limit the spread of germs between the keyboard and other environments that one's hand will come into contact with. A commercial keyboard cleaner such as the Clorox wipes, which eliminates 100% of the bacteria (Rutala *et al.,* 2006) is occasionally recommended for use to disinfect the keyboard. To clean the cervices of keyboard without disassembling, it is best to flip it upside down and then use a can of compressed air to dislodge food and dust particles that may be residing under the keys. The needed tools are: Lint free cloth, dry cloth or duster, suitable cleaning fluid (isopropyl alcohol), cotton buds, and can of compressed air.

These theories were applied to two controlled computer systems in a Cybercafé and after a period of six months, the system was found to perform better than the other computer systems. Also, the controlled system's keyboard tested free of microorganism while the other keyboards tested showed traces of microorganism infection.

CONCLUSION

A one step taken to prevent systems from damaging will prolong the life span of the system thereby preventing the system from malfunctioning and at the same time, providing a better state of performance. Individuals can carry out preventive maintenance on their computer system without fear of making mistakes. Also, preventive maintenance will surely play a key part in Banks, Café and other firms and industries that make use of computer to perform operations. Preventive maintenance will not only keep our computers healthy but will also protect end-users from keyboard infections. However, dirt and dust cannot be totally eradicated from the environment and so, no computer system will be completely free of dirt.

REFERENCES

Canek, J. and Rodrigo, P. (2008). Optimal maintenance service contract negotiation with aging equipment. *European Journal of Operational Research* **189:** 387–398.

Cavalier, P. M. and Knapp, M. G. (1996). Reducing Preventive Maintenance cost error caused by uncertainty. *Journal of Quality in Maintenance Engineering* **2 (3):** 21- 36.

Dancer, S.J. (2008). Importance of the environment in methicillin-resistant Staphylococcus aureus acquisition: the case for hospital cleaning. *Lancet Infectious Diseases* **8(2):**101-113.

David, J. W. and William, A. R. (2012). Self disinfecting Surfaces *Infection Control and Hospital Epidemiology* ***33 (1): 10-13.***

Hardy, K.J., Oppenheim, B.A., Gossain, S., Gao, F. and Hawkey, P.M (2006). A study of the relationship between environmental contamination with methicillin-resistant Staphylococcus aureus (MRSA) and patients' acquisition of MRSA. *Infection Control and Hospital Epidemiology* **27(2):**127-132.

Harris, A.D. (2008). How important is the environment in the emergence of nosocomial antimicrobial-resistant bacteria? *Clinical Infectious Diseases* **46(5):** 686-688.

Hartmann, B., Benson, M., Junger, A., Quinzio, L., Rohrig, R. and Fengler, B (2004). Computer keyboard and mouse as a reservoir of pathogens in an intensive care unit. *Journal of Clinical Monitoring and Computing* **18(1):** 7-12

Hota, B (2004). Contamination, disinfection, and cross-colonization: are hospital sur-

faces reservoirs for nosocomial infection? *Clinical Infectious Diseases* **39(8):**1182-1189.

IAPA (2007). Preventive Maintenance, Industrial Accident Prevention Association, www.iapa.ca/pdf/prevent.pdf. Available online January 2011

Jack, W. (2011). What Does Computer Mainenance Mean? http://www.journalarticles.info/computers/what-does-computer-mainenance-mean.html. visited online 18 April, 2011

Lu, P.L., Siu, L.K., Chen, T.C., Ma, L., Chiang, W.G. and Chen, Y.H. (2009). Methicillin-resistant Staphylococcus aureus and Acinetobacter baumannii on computer interface surfaces of hospital wards and association with clinical isolates. *BMC Infectious Diseases* **9(1):**164.

Man, G.S., Olapoju, M., Chadwick, M.V., Vuddamalay, P., Hall, A.V.and Edwards, A, (2002). Bacterial contamination of ward-based computer terminals. *Journal of Hospital Infection* **52(4):**314-315.

Oke, S.A. and Charles-Owaba, O.E. (2006). An approach for evaluating the preventive maintenance scheduling cost. *International Journal of Quality and Reliability Management* **23 (7):** 847-879.

Pittet, D., Allegranzi, B., Sax, H., Dharan, S., Pessoa-Silva, C.L., Donaldson, L. and Boyce, J.M. (2006). Evidence-based model for hand transmission during patient care and the role of improved practices. *Lancet Infectious Diseases* **6 (10):** 641-652.

Rutala, W.A., White, M.S., Gergen, M.F. and Weber, D.J. (2006). Bacterial contamination of keyboards: Efficacy and Functional impact of Disinfectants. *Infection Control and Hospital Epidemiology* **27(4):** 372-377.

Schultz, M., Gill, J., Zubairi, S., Huber, R. and Gordin, F. (2003). Bacterial contamination of computer keyboards in a teaching hospital. *Infection Control and Hospital Epidemiology* **24(4):** 302-303.

Poulter, S. (2008). How your computer keyboard is FIVE TIMES dirtier than your toilet seat - and could even give you 'qwerty tummy'. http://www.dailymail.co.uk/health/article-563110/How-keyboard-FIVE-TIMES-dirtier-toilet-seat--qwerty-tummy.html#ixzz1kqgOX5S1

Shakeel, M A., Prashanthy, P. R., Irram, A. H., Monica, M. and Yadav, R. (2011). Microbial contamination of laptop/ keyboards in dental settings. *International Journal of Public Health Dentistry* 2 (2): 4-6.

Tetz, E.D., Glen, E., Clarke, J. P., Angshuman, C., Meeta, G., Mridula, P. and Rashim, M. (2001). *A+ Certification Bible* . Hungry Minds, Inc publishers. New York www.hungryminds.com

Ziaojun, Z., Zhiqiang, L. and Lifeng, X. (2010). A dynamic opportunistic preventive maintenance policy for multi-unit series systems with intermediate buffers. *International Journal of Industrial and Systems Engineering* ***6 (3):*** *276 - 288*