University of Sindh Journal of Information and Communication Technology (USJICT)
Volume 2, Issue 2, April 2018
ISSN-E: 2523-1235, ISSN-P: 2521-5582
Website: http://sujo.usindh.edu.pk/index.php/USJICT/

Causes of Failure and Breakdown of Personal Computers in Nigeria

Francis A. U. Imouokhome [1], Moru Kehinde Desmond[2], Veronica I. Osubor[3]

[1]*Department of Computer Science, University of Benin, Nigeria,*
[2]*Robotics and Vision Department, University of Navarra, San Sebastian, Spain,*
[3]*Department of Computer Science, University of Benin, Nigeria*
Email: franc.imo@uniben.edu, dmoru@tecnun.es, viosubor@uniben.edu

Abstract: Breakdown of personal computers is a common problem experienced by many computer users in Nigeria. Breakdown could be due to anomalies in the functioning of some hardware components, conflicts in the execution of software elements, and/or negligence on the part of users and unskilled computer maintenance personnel. Failures or breakdowns impart differently on different users. A thorough understanding of the causes of failures and maintenance steps that users can carry out on their systems to avoid or reduce breakdowns are discussed in this paper. To identify major causes of breakdown, the survey method of data collection was adopted to elicit information from computer users who responded to questions contained in questionnaires administered to them. It was discovered from the analysis of the data that virus infection, unqualified maintenance technicians and local socio-economic/environmental factors are the major causes of computer breakdown in Nigeria.

Keywords: Breakdown, Virus, Technicians, ICT, Software Errors, Hardware Faults;

I. INTRODUCTION

Computers form an integral aspect in the realization of the objectives of Information and Communication Technology (ICT) practice in every country in the Globe. In fact, it forms the hub of all the activities in the ICT industry. The benefits of the usage of ICT tools in educational, industrial, commercial, political, and other institutions cannot be realized without the use of the computer. Computer is the engine dedicated to the processing of data (numeric, electronic signals, etc) into forms or formats that are useful to its generator and helps in the transmission of the generated data/information to intended users [1].

Computers were known in the past to be expensive but valuable devices affordable only by the privileged in the society. This is no longer the case in Nigeria where they are now found in almost every home just like the television, microwave oven, etc., and in both private and public offices and institutions where they are used mostly for entertainment, data analysis, information storage, educational purposes and internet browsing/surfing; therefore, the usage of personal computers is prevalent. Personal computers, like other electronic devices, at one time or another would develop fault, fail and may consequently malfunction or even become completely blank due to anomalies in the functioning of the hardware components or a conflict in the execution of its software elements. Malfunctioning of lower-level components of computer hardware according to [2] is referred to as a fault, while failure refers to the inability of a device to carry out the functions it was designed to perform. Faults, failures/breakdowns occur in both hardware and software components of a computer; therefore a thorough understanding of what they are, how they manifest and what a user can do to prevent many of the causes or their devastating effect when they occur, is very important to make the computers serviceable and reliable, and their use more interesting and impressive.

This paper presents various causes of breakdown of personal computers and advances feasible suggestions that would aid users in the use of their computers to avoid the costly experience of breakdown.

II. PROBLEM STATEMENT

The computer consists of many and varied components that are designed and fabricated to function in a collaborative manner in order for it to execute tasks correctly as a whole. With the passage of time, however, these components can develop faults unannounced. Unfortunately, component faults being often transient are difficult to diagnose because they do not occur in a consistent or pre-defined manner [3]. For example, the power pack converts the alternating current (AC) supplied to it from the electricity mains into direct current (DC), which it supplies to the various

components of the computer. Generation of noisy electric signals by this unit can lead to unexpected computer crash.

Computer hardware components usually generate heat when the system is in use; consequently, to prevent failure of the components or their total breakdown due to heat, fans are usually provided to help dissipate the heat generated. Although very useful in this regard, the fan also drives dirt and dust which accumulate and sometimes results in unexpected malfunctioning of the computer.

More devastating and long-lasting are faults associated with computer memory disks; especially where daily business routine or critical personal data are lost or corrupted in the process [4]. This kind of failure could be attributed to manufacturing errors [2]. For example, computer stores data in sections called sectors in its memory disks. Some disks are bought with bad sectors from the factories. Data stored in bad sectors are permanently lost. Irregular and unpredictable nature of the corruption of the data stored in the Random Access Memory (RAM) also contributes to indiscriminate system failures.

Some other hardware problems that can cause crashes may be more convoluted to make out and classify, and would require software diagnosis to identify them.

III. LITERATURE REVIEW

There is a dearth of literature on the reasons behind failures/breakdown of computers because the attention of most researchers is on performance of the system [5,6] and security of data [7]; neglecting this very important aspect – breakdowns or crashes of computers.

Computers can break down as a result of either software errors or hardware faults. Software errors may probably be more common, but hardware faults are more destructive and difficult to diagnose [8].

Although computers fail as a result of hardware faults, crashes also come from software dysfunction/failure or error in the operating system (OS) [8,9,10]. Apart from acting as an interface between the computer and its user, the OS is also an interface between the hardware and the applications software. It is also responsible for resource sharing among computer application programs. Due to these many functions of the OS, errors could develop in it any time. A programming error could cause the OS to try to access a memory cell using an incorrect address. This would cause the OS to repeatedly execute the same set of instructions, forcing it to enter into an infinite loop that results in computer “freeze” or "lock up" — a condition that renders the system unresponsive to input commands, thus needing a reset. When a bug allows a piece of data greater than what a memory buffer can accommodate to be written into the buffer, a problem called data "overflow" results. The "overflow" data overwrites the data in the memory and corrupts the state of the OS. This problem is not very common with the operating systems of modern computers because they are equipped with special boot mode which ensures the disablement of loading drivers that may cause errors. A driver error can cause an OS to crash, and can also cause the computer to be attacked by “cleverly written viruses or worms” [11]. Computer breakdown is also caused by the design complexities of present day software to meet with the complex needs of today’s society and human activities [12,13]. Lack of high-end computer hardware needed for some of the software also cause unexpected low performance of the computer. For example, software can fail intermittently when the processing power of the CPU and the available memory disk space are lower than a specified threshold especially when other applications are simultaneously running on the computer [2].

Computer systems under the influence of environmental negligence are most likely to face breakdown within a shorter period of time than expected. When the system is not being maintained and left unattended due to negligence and carelessness, breakdown of the system will be inevitable [14].

The crash in the cost of computers is a result of the low cost of the hardware components. Computers cloned with these inexpensive but unreliable components, software or spares break down very often because the components do not meet existing standards, and are not compatible with products from certified brands. It must also be noted that standardization has not met with success in the computer industry because of the rapidly growing developments in computer technology; consequently, existing standards quickly become obsolete [15,16].

IV. METHODOLOGY

The survey method, through the use of questionnaires, was adopted to collect data to determine the causes of computer breakdown in Nigeria. Questionnaires were distributed to a population of computer users in the University of Benin; Igbinedion University, Okada; Benson Idahosa University, Benin City; Ambrose Ali University, Ekpoma; Federal Polytechnic, Auchi; private and government establishments within Benin City and some Local Government Council offices within Edo State of Nigeria. These respondents form a very good representation of computer users in Nigeria because most of them are not just computer users but are knowledgeable in the theory behind computing. Out of a total of 235 questionnaires distributed, 228 were retrieved from respondents. Data/information gathered from respondents were used for the assessment of viable hardware and software challenges which most computer users face. The questionnaire comprises of five sections that address issues such as brand of computer used/owned, computer crash experience, unit of the computer affected,

cause(s) of the crash, and brand of computer to be recommended to potential users.

V. RESULTS AND DISCUSSION

Tables 1 - 5 show the various parameters that were considered to determine why computers breakdown, while Figures 1 – 5 are graphical representations of the data. The frequency column denotes the number of respondents to the options posed in the questionnaire, and the percentage of frequency is the frequency of each computer brand based on the total frequency of all brands. Three branded computers and others, as shown in Table 1, were considered in the survey.

Table 1: Percentage of brand of computer commonly used

BRAND OF COMPUTER	FREQUENCY	% FREQUENCY
HP/COMAPQ	104	45.61403509
DELL	27	11.84210526
TOSHIBA	12	5.263157895
OTHERS	85	37.28070175
TOTAL	228	100

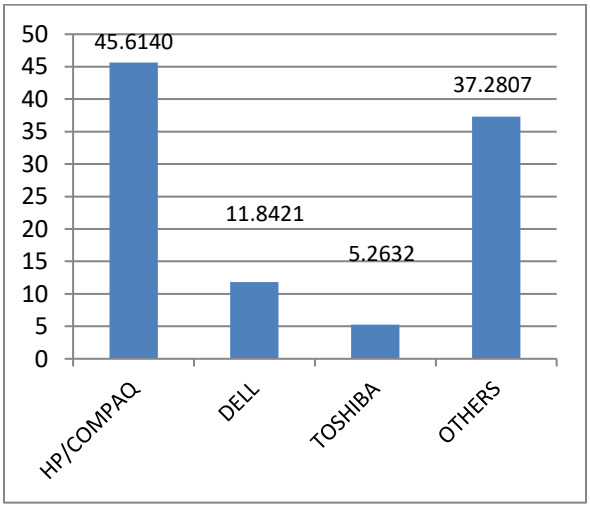

Figure 1: percentage of frequency chart.

Table 1 reveals that 46% of respondents reported to have used HP/Compaq systems; 12% have used Dell systems; 5% have used Toshiba systems, while respondents who have used other system brands account for 37%.

Table 2 shows that 96% of computer users have experienced computer breakdown at some point in time or another, while only 4% have not.

Table 2: Percentage of computer crash frequency

Has the computer system ever crashed?		
COMPUTER CRASH	**FREQUENCY**	**% FREQUENCY**
Yes	186	96.37305699
No	7	3.626943005
TOTAL	193	100

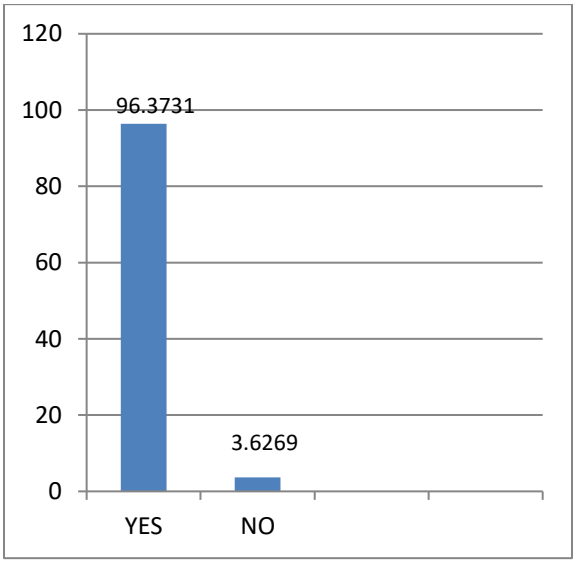

Figure 2: chart of percentage of computer system crash.

Table 3: Percentage of computer unit affected by crash

What unit of the computer was affected?		
HARDWARE AFFECTED	**FREQUENCY**	**% FREQUENCY**
HARD DISK	76	39.79057592
RAM	51	26.70157068
MOTHERBOARD	38	19.89528796
POWER PACK	26	13.61256545
TOTAL	191	100

Table 3 reveals that most computer crashes or breakdown are associated with the hard disk.

Table 4 shows that most computer crashes are a result of virus attack (accounting for 56.84% failure) and unqualified technicians who account for 29.47%, while the least cause is due to hardware components which account for 13.68% failure.

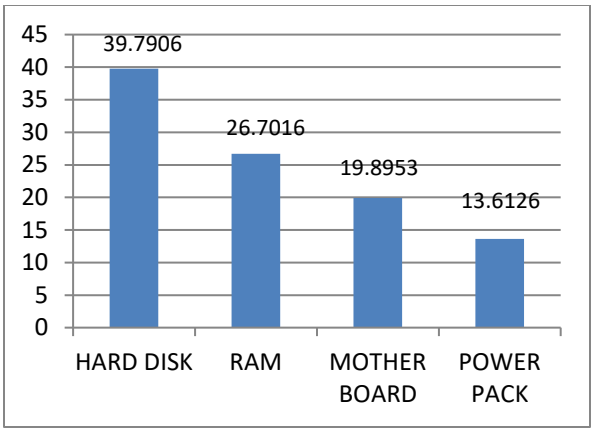

Figure 3 Percentage of frequency of computer unit affected by crash.

Table 4: Percentage of possible cause of crash

What was the cause of the crash?		
CAUSE	**FREQUENCY**	**% FREQUENCY**
VIRUS	54	56.84210526
TECHNICIAN	28	29.47368421
HARDWARE FAILURE	13	13.68421053
TOTAL	95	100

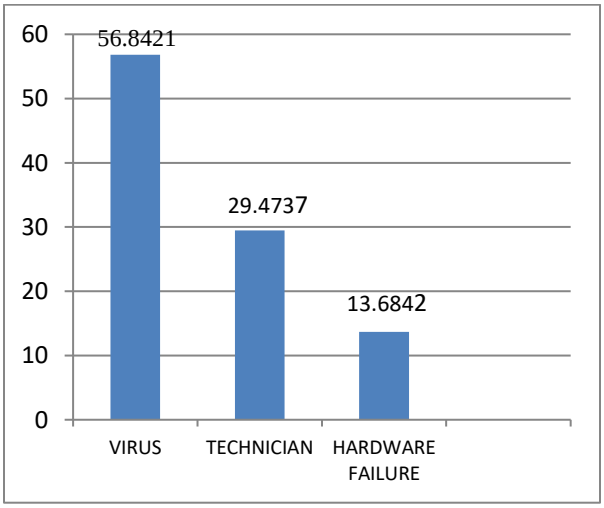

Figure 4: chart of percentage of frequency.

Table 5: Percentage of frequency of computer brand recommended.

Would you recommend this brand for a friend?		
BRAND RECOMMENDATION	**FREQUENCY**	**% FREQUENCY**
YES	36	37.5
NO	60	62.5
TOTAL	96	100

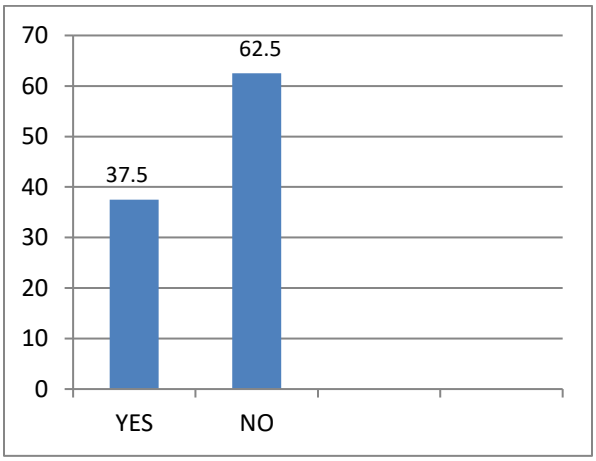

Figure 5: Percentage of frequency of possibility of recommending computer.

Table 5 shows that only 37.5% of respondents were disposed to recommend the type of computer they use to their friends, while 52.5% were not.
Each of figures 1 – 5 is a graphical representation of the data presented in Tables 1 – 5 respectively.

This analysis reveals that most computer systems crash as a result of virus attacks and their unskillful handling by incompetent maintenance technicians. Some programmers develop malicious programs (called virus) that cause computer breakdown. Some of these programs have been developed to bypass much antivirus software installed in computers as security measures. The virus programs attack systems especially through the Internet. Most people are affected here in Nigeria because most computer users rely on antivirus programs downloaded free from the Internet and installed on their computers. These are usually weak antivirus programs that are not able to detect attacks from even common viruses such as malware, ransom-ware, root-kits, trojans, etc. [14,17,18].

The skills of technicians also affect the functioning and performance of computer systems in Nigeria. Low-skilled

maintenance technicians resort to "trial and error" approach to troubleshoot and decipher or diagnose computer system problems. This approach is not professional and usually results in delay or inability of the technician to diagnose faults and determine their probable cause(s). This usually leads to the frustration of computer owners especially when in the process they lose their data in the system. This practice also leads to malfunctioning of computer systems, canibalisation of hardware components, which eventually renders the computer unserviceable.

Other common causes of computer breakdown in our environment include the following.

A. Inconsistent Power Supply

Computer systems are built to be powered with standard and constant electrical power. When the computer is powered with an alternative power supply that is inconsistent with the standard requirement, this can ruin the system circuitry and results to a system breakdown. This is very much prevalent in Nigeria where electricity power supply parameters like voltage and frequency are neither steady nor reliable. Computer users therefore resort to power their systems from alternative sources, especially from generators with voltages and frequencies not in tandem with the standard 230V and 50Hz respectively.

B. Mishandling of Hardware and Software

The use of all kinds of external storage devices is a great threat to the computer system. Admittance of all kinds of storage devices, such as the USB stick, external hard disks, etc, also result in system breakdown, because of the presence of ineffective security measure e.g. weak antivirus application, which renders the system vulnerable to virus attacks [19,20].

C. Tropical Conditions

Due to the tropical environmental conditions, which is typical of high temperature, computers built for temperate conditions do not survive in Nigeria as a result of the heat generated by the hardware components. The processors of computers built for the temperate regions tend to overheat in tropical environment, leading to the failure and consequent breakdown of the system. This is a challenge in the purchase of computers by users who are not at all or well informed about the environmental conditions for which the computers are built. Environmental factors/specifications should be considered when purchasing computers [21].

.

VI. CONCLUSION

It has been established from this study that computers breakdown as a result of three main causes, namely: virus attacks, unskilful handling of computers by technicians, and local socio-economic/environmental factors. Virus attacks predominantly affect the hard disk where data and programs are stored in the computer. Loss of data to virus infection is a very expensive experience to undergo. It is recommended that computer users should be well informed about the need to protect their computers against virus attacks by purchasing effective antivirus software. Regular scanning of the memory disks for virus infection is very needful to keep the data stored in the disks secured, and the system fit to perform creditably.

Technicians who maintain computers should endeavour to undergo formal trainings and workshops to equip them with adequate knowledge and skill to bring to bear in their jobs. Corporate bodies and governments should rise up to the challenge of lack of skilled personnel to handle the maintenance of computers. This could be by way of organizing seminars and workshops where computer maintenance personnel could receive regular training to improve on their skills. Service centres could also be established with qualified personnel to render maintenance services and professional advice to users of computer. Computer manufacturers should be mindful of the environmental conditions prevalent in various countries where they market their products.

To get the best from computers, users should also get rid of the accumulated dirt on their computer motherboard by use of little hand-held soft brushes. They also need to carry out regular defragmentation of data that are fragmented into bits or pieces in different sectors of the memory. This is a very important exercise to keep the system in full swing performance. Utilities to perform this are provided for in the operating system of every computer.

VII. REFERENCES

[1] R. F. Kahhat and E. D. Williams, "The importance of personal computers in developing countries: Case study of Peru," *IEEE International Symposium on Sustainable Systems and Technology (ISSST '09)*, held at Tempe, AZ, USA on18-20 May, 2009

[2] C.W. Johnson, Failure in Safety-Critical Systems: A Handbook of Accident and Incident Reporting, Glasgow University Press, Glasgow, Scotland, Oct. 2003, p. 52, ISBN 0-85261-784-4.

[3] R. Bakhshi, S. Kunche, and M. Pecht, "Intermittent Failures in Hardware and Software,".*Journal. Electronic Packaging, vol.* 136, Mar. 2014, pp. 011014-1 — 1014-5, http://electronicpackaging.asmedigitalcollection.asme.org/ doi:10.1115/1.4026639.

[4] A. Saad, A. Al Ghamdi, S. M. Hussaini, and A. K. Jilani, "Empirical Model using Expert System Techniques in Hardware Failure of a System during Backup of Data," International Journal of Computer

Science and Network Security, vol.13 no.2, Feb. 2013, pp. 53 – 59.

[5] J. Liedtke, "Improving IPC by Kernel Design," *Proc.14thACM Symp. On Operating Systems Principles, pp.175–188*. Dec., 1993, studyres.com/doc/4743492/the-performance-of-µ-kernel-based-systems.

[6] H. Härtig, M. Hohmuth, J. Liedtke, S. Schönberg and J.Wolter, "The Performance of µ-Kernel-Based Systems," *Proc.16thACM Symp. Operating Systems Principles (SOSP'97), Oct 5-8, 1997, Saint-Malo, France*. https://os.inf.tu-dresden.de/papers_ps/sosp97.pdf.

[7] L. Singaravelu, C. Pu, H. Härtig, and C. Helmuth, "Reducing TCB Complexity for Security-sensitive Applications: Three Case Studies," *Proc. 1st ACM SIGOPS/EuroSys European Conf. on Computer Systems, April. 2006, pp.161–174, Leuven Belgium*. dl.acm.org/citation.cfm?id=1217951.

[8] F. P. Buchholz and C. Shields, "Providing Process Origin Information to Aid in Computer Forensic Investigations," *Journal of Computer Security*, vol.12, no. 5, pp. 753-776, Sept. 2004 https://pdfs.semanticscholar.org/4cbe/681e892a6ee062c132c2587865bf2e7782c1.pdf

[9] E. E. Ogheneovo, "Software Dysfunction: Why Do Software Fail?," *Journal of Computer and Communications*, vol. 2, Mar. 2014, pp. 25-35. http://www.scirp.org/journal/jcc

http://dx.doi.org/10.4236/jcc.2014.26004

[10] F.A. Egbokhare, "Causes of Software/Information Technology Project Failures in Nigerian Software Development Organizations," *African Journal of Computing & ICT, vol.* 7, no. 2, June 2014, pp. 107-110. https://pdfs.semanticscholar.org/6d4f/317c129c4d5688bb6fd68e7cb98579a8ec69.pdf

[11] R. Lemos, "Device Drivers Filled with Flaws, Threaten Security," *Security Focus*, May 26, 2005. Available online: http://www.securityfocus.com/news/11189.

[12] K. M.Whitney and C. B. Daniels, "The Root Cause of Failure in Complex IT Projects: Complexity Itself," *Procedia Computer Science* vol. 20, 2013, pp. 325 – 330. doi: 10.1016/j.procs.2013.09.280

[13] J. Larus, "Spending Moore's Dividend," *Communications of the ACM (CACM)*, vol. 52, no. 5, pp. 62–69. May, 2009 https://www.microsoft.com/en-us/research/wp-content/uploads/2008/05/tr-2008-69.pdf

[14] A. H. Karp, "Enforce POLA on Processes to Control Viruses," *Communications of the ACM (CACM)*, vol. 46, no. 12, Dec., 2003, pp. 27–29. https://cacm.acm.org/magazines/2003/12/6658-enforce-pola-on-processes-to-control-viruses/fulltext

[15] A .Ozment, and S. E. Schechter, "Milk or Wine: Does Software Security Improve with Age?," *Proc.15thUSENIX Security Symp.*, July 3, 2006, *pp.93–104*. https://www.usenix.org/legacyurl/15th usenix-security-symposium-58

[16] M. Wilson and D. Howcroft, "Reconceptualising failure: Social Shaping Meets IS Research," *European Journal of Information Systems, vol.* 11, no. 4, 2002, pp. 236 – 250. DOI: 10.1057/palgrave.ejis.3000437.

[17] S.S. Oyelere and L.S. Oyelere, "Users' Perception of the Effects of Viruses on Computer systems – An Empirical Research," *African Journal of Computing & ICT*, vol. 8, no.1, Mar. 2015, pp.121-130.

[18] M.S. Yusuf, T.O. Onotehinwa, and E.O. Okon, "Productivity of Business Enterprises: Effect of Computer Virus Infection on Files," *International Journal of Computer Science and Mobile Computing*, vol. 6, no. 2, Feb. 2017, pp. 179 -193 http://www.ijcsmc.com/past_issues/volume_6_issue_2

[19] E. Pinheiro, W. D. Weberand, and L. A. Barroso, "Failure Trends in a Large Disk Drive Population," *Proceedings of the 5th USENIX Conference on File and Storage Technologies (FAST'07)*," San Jose, CA, US. Feb.13-16, 2007, pp. 17–29.

[20] H. U. Nwosu, C. C. Obieke, and A. J. Ameh, "Failure Analysis and Shock Protection of External Hard Disk Drive," *Nigerian Journal of Technology, vol.* 35, no. 4, Oct. 2016, pp. 855-865. http://dx.doi.org/10.4314/njt.v35i4.21

[21] B. Best, "The Effect of Heat on Processors: A Challenge To Computer Usage in Northern Nigeria Rural Colleges," *Journal of Global Research in Computer Science*, vol. 6, no. 1, 2015, pp. 1-6 http://www.rroij.com/open-access/pdfdownload.php?download=open-access/the-effect-of-heat-on-processors-a-challenge-to-computer-usage-in-northern-nigeria-rural-colleges.pdf&aid=60526