EasyChair Preprint

№ 5861

An Activity in Engineering a Minimal Computer.

Frank Appiah

June 23, 2021

An Activity in Engineering a Minimal Computer.

Frank Appiah[1] AKA FAEng PhD

Abstract. Engineering is an activity of designing a machine like the electronic machine. This is an attempt to propose the design of a minimal computer for storing, writing and calculating information.

Keywords. Storing, Writing, Calculating, Electronic Machine.

1 Introduction

In terms of computing, a computer is an electronic machine that has programs on it for storing, writing and calculating information. It allows the communication of information among people on the Internet. During my junior school era when I took a basic introduction to computer.

The *electronic machine* is made up of memory unit, Arithmetics logic unit, processor unit, input unit and output unit. The processor unit is made up of data path and control components.

The electronic machine operates on voltage where +5v means 1 and 0v means 0.

The 1 and 0 forms a binary representation of information stored in the memory unit of the computer. The job of the basic computer requires

[1] Kwame Nkrumah University of Science and Technology, Department of Computer Engineering, Kumasi, Ghana.

skills. The skill of the programmer or software developer makes the computer job as a writer, storer and calculator. A computer is a machine that can be programmed to carry out sequences of arithmetic or logical operations automatically. Modern computers can perform generic sets of operations known as programs. These programs enable computers to perform a wide range of tasks. A computer system is a "complete" computer that includes the hardware, operating system (main software), and peripheral equipment needed and used for "full" operation. This term may also refer to a group of computers that are linked and function together, such as a computer network or computer cluster.[Wikipedia]

Webopedia- A computer is a programmable machine. The two principal characteristics of a computer are: It responds to a specific set of instructions in a well-defined manner and it can execute a prerecorded list of instructions (a program).

Computing can be used as a term for the activity or skill of using or programming computers. The basic computer consists of monitor (with screen), keyboard, mouse, (with mouse pad), floppy disk drive, hard disk with CPU (central processing unit), CD-ROM drive(compact disk read-only memory), webcam, speaker, scanner, modem(modulation - demodulation device) and printer.
The basic computer normally rest on a table with a chair in front of it. The basic computer is made up to 10+1 device or parts.

On intellectual fun, 10 fingers of the hands and 1 head or chest. What is a minimal computer? A minimal computer is a computer without webcam, scanner and printer.

It has a monitor to display information, keyboard to enter keyed information into memory of a

word processor or text input box, mouse, CPU for information processing and disk or drives for storing or retrieving data. A minimal computer can transmit and receives information or data from a network or Internet. The ability to use a computer just for literature demands a minimal computer. In computing, a user will be termed as a computer literate. A computer worker who does a computer job by using a minimal computer to do that job in invoke in computerization.

A basic introduction to computers involve typing (writing), Calculating (calculator program) and storing (document saving). A minimal computer sometimes are programmed to help in developing study skills and subject knowledge. This is termed computer - assisted learning. A minimal computer has few programs on it and that includes computer games(5), browser (mozilla, Firefox, opera, Microsoft browser), word processor (Microsoft word, open office, notepad), calculator program (scientific / fields numeric), paint tools, video /music player, uncompress format tool, pdf viewer, 3D modelling software (blender/autocad), IDE editor (Netbeans, Eclipse, Jetbrains), Image editor/viewer(Gimp, Adobe Photo shop), clock, weather program, recorder(Microsoft recorder), typing tool (learning), contact, messenger (Gmail, yahoo mail), antivirus (Kapersky, Norton) and more. A total count of programs or software should amount to 33- ((2x15)+(2+1)).

((2x15)+(2+1)) can be read as 15 categories with 2 items each, 2 skill job tools and 1 database software.
Another formulation of software or program on a minimal computer can be 11x3 or (10x1)+23.
11x3 will mean 11 categories of software packages with 3 items each. (10x1)+23 will create a minimal computer with 10 categories of software packages with 1 item each and 23 miscellaneous software of no category.

Software refers to parts of the computer which do not have a material form, such as programs, data, protocols, etc. Software is that part of a computer system that consists of encoded information or computer instructions, in contrast to the physical

hardware from which the system is built. Computer software includes computer programs, libraries and related non-executable data, such as online documentation or digital media. It is often divided into system software and application software Computer hardware and software require each other and neither can be realistically used on its own. When software is stored in hardware that cannot easily be modified, such as with BIOS ROM in an IBM PC compatible computer, it is sometimes called "firmware".

2 Conclusion

In concluding remarks, there is less literature on conception of Computer for specific purposes and the impact of the pc world. Engineering addresses the activities of design is looked at in terms of Computer or electronic machine. This literature is about definitions on computer, electronic machine, computing and engineering.

Further Reading

[Electronic]
[1] Burks, A. R., & Burks, A. W. (1989). The first electronic computer: The Atanasoff story. University of Michigan Press.
[2]Burks, A. W., & Burks, A. R. (1981). First general-purpose electronic computer. IEEE Annals of the History of Computing, 3(04), 310-389.
[3]Burks, A. W., Goldstine, H. H., & Von Neumann, J. (1946). Preliminary discussion of the logical design of an electronic computer instrument.
[4]Prawitz, D., Prawitz, H. K., & Voghera, N. (1960). A mechanical proof procedure and its realization in an electronic computer. Journal of the ACM (JACM), 7(2), 102-128.
[5]Marcus, B. H., Ciccolo, J. T., & Sciamanna, C. N. (2009). Using electronic/computer interventions to promote physical activity. British journal of sports medicine, 43(2), 102-105.
[6]Haddon, L. (1988). The home computer: the making of a consumer electronic. Science as Culture, 1(2), 7-51.
[7]Wynne, C. G. (1959). Lens designing by electronic digital computer: I. Proceedings of the Physical Society (1958-1967), 73(5), 777.
[8]Popper, F., & Hemingway, B. (1993). Art of the electronic age (p. 177). Londres: Thames and Hudson.
[9]Rosen, S. (1969). Electronic computers: A historical survey. ACM Computing Surveys (CSUR), 1(1), 7-36.
[10]McLean, I. S. (1989). Electronic and computer-aided astronomy: from eyes to electronic sensors. The Ellis Horwood Library of Space Science and Space Technology Series in Astronomy.

[Computing]
[11]Ceruzzi, P. E., Paul, E., & Aspray, W. (2003). A history of modern computing. MIT press.
[12]Sztipanovits, J., & Karsai, G. (1997). Model-integrated computing. Computer, 30(4), 110-111.
[13{Cambria, E., & Hussain, A. (2015). Sentic computing. Cognitive Computation, 7(2), 183-185.
[13]Johnson, P. (1996). Mobile computing.
[14]Kennedy, W. J., & Gentle, J. E. (1980). Statistical computing. Routledge.
[15]Picard, R. W. (2000). Affective computing. MIT press.
[16]Papazoglou, M. P., & Georgakopoulos, D. (2003). Introduction: Service-oriented computing. Communications of the ACM, 46(10), 24-28.
[17]Chaturvedi, D. K. (2008). Soft computing. Studies in Computational intelligence, 103.
[18]Dertouzos, M. L. (1999). The future of computing. Scientific American, 281(2), 52-55.
[19]Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., ... & Zaharia, M. (2010). A view of cloud computing. Communications of the ACM, 53(4), 50-58.
[`20]Beale, R., & Jackson, T. (1990). Neural Computing-an introduction. CRC Press.
[21]Denning, P. J., Comer, D. E., Gries, D., Mulder, M. C., Tucker, A., Turner, A. J., & Young, P. R. (1989). Computing as a discipline. Computer, 22(2), 63-70.
[22]Moler, C. B. (2004). Numerical computing with MATLAB. Society for Industrial and Applied Mathematics.
[23]Schmidt, A. (2003). Ubiquitous computing-computing in context (Doctoral dissertation).
[24]Turing, A. M. (2009). Computing machinery and intelligence. In Parsing the turing test (pp. 23-65). Springer, Dordrecht.
[25]Rozenberg, G., Bäck, T., & Kok, J. N. (Eds.). (2012). Handbook of natural computing (pp. 461-477). Springer Berlin Heidelberg.
[26]Păun, G., Rozenberg, G., & Salomaa, A. (1998). DNA computing: new computing paradigms (pp. x+-402). Berlin: Springer.
[27]Almasi, G. S., & Gottlieb, A. (1994). Highly parallel computing. Benjamin-Cummings Publishing Co., Inc..
[28]Steane, A. (1998). Quantum computing. Reports on Progress in Physics, 61(2), 117.
[29]Owens, J. D., Houston, M., Luebke, D., Green, S., Stone, J. E., & Phillips, J. C. (2008). GPU computing. Proceedings of the IEEE, 96(5), 879-899.
[30]Padua, D. (Ed.). (2011). Encyclopedia of parallel computing. Springer Science & Business Media.
[31]Shackelford, R., McGettrick, A., Sloan, R., Topi, H., Davies, G., Kamali, R., ... & Lunt, B. (2006). Computing curricula 2005: The overview report. ACM SIGCSE Bulletin, 38(1), 456-457.
[32]Waldo, J., Wyant, G., Wollrath, A., & Kendall, S. (1996, July). A note on distributed computing. In International Workshop on Mobile Object Systems (pp. 49-64). Springer, Berlin, Heidelberg.
[33]Tucker, A. B. (Ed.). (1991). Computing curricula 1991. Communications of the ACM, 34(6), 68-84.
[34]Fishwick, P. A. (Ed.). (2008). Aesthetic computing. Mit Press.
[35]Eiben, A. E., & Smith, J. E. (2003). Introduction to evolutionary computing (Vol. 53, p. 18). Berlin: springer.
[35]Toffoli, T. (1980, July). Reversible computing. In International colloquium on automata, languages, and programming (pp. 632-644). Springer, Berlin, Heidelberg.
[36]Simonson, M. R., & Thompson, A. (1997). Educational computing foundations. Prentice-Hall (Merrill) Publishing Co.
[37]Satyanarayanan, M. (2001). Pervasive computing: Vision and challenges. IEEE Personal communications, 8(4), 10-17.
[38]Parameswaran, M., & Whinston, A. B. (2007). Social computing: An overview. Communications of the Association for Information Systems, 19(1), 37.
[39]Machado, P., & Cardoso, A. (1998, November). Computing aesthetics. In Brazilian Symposium on Artificial Intelligence (pp. 219-228). Springer, Berlin, Heidelberg.
[Storing]
[40]Deutsch, A., Fernandez, M., & Suciu, D. (1999, June). Storing semistructured data with STORED. In Proceedings of the 1999 ACM SIGMOD international conference on Management of data (pp. 431-442).
[41]Tarjan, R. E., & Yao, A. C. C. (1979). Storing a sparse table. Communications of the ACM, 22(11), 606-611.
[42]Florescu, D., & Kossmann, D. (1999). Storing and querying XML data using an RDMBS. IEEE Data Engineering Bulletin, Special Issue on, 1060(22), 3.

[43]Muhonen, J. T., Dehollain, J. P., Laucht, A., Hudson, F. E., Kalra, R., Sekiguchi, T., ... & Morello, A. (2014). Storing quantum information for 30 seconds in a nanoelectronic device. Nature nanotechnology, 9(12), 986-991.
[44]Venegas-Andraca, S. E., & Bose, S. (2003, August). Storing, processing, and retrieving an image using quantum mechanics. In Quantum Information and Computation (Vol. 5105, pp. 137-147). International Society for Optics and Photonics.
[45]van Heerden, P. J. (1963). A new optical method of storing and retrieving information. Applied Optics, 2(4), 387-392.
[46]Cole, R. (1986). Searching and storing similar lists. Journal of Algorithms, 7(2), 202-220.
[47]Mili, R., Mili, A., & Mittermeir, R. T. (1997). Storing and retrieving software components: A refinement based system. IEEE Transactions on Software Engineering, 23(7), 445-460.
[48]Brakatsoulas, S., Pfoser, D., & Tryfona, N. (2004, July). Modeling, storing and mining moving object databases. In Proceedings. International Database Engineering and Applications Symposium, 2004. IDEAS'04. (pp. 68-77). IEEE.
[49]Amit, D. J., Gutfreund, H., & Sompolinsky, H. (1985). Storing infinite numbers of patterns in a spin-glass model of neural networks. Physical Review Letters, 55(14), 1530.
[50]Reiss, M., & Taylor, J. G. (1991). Storing temporal sequences. Neural networks, 4(6), 773-787.
[51]Córcoles, J. E., & González, P. (2002, November). Analysis of different approaches for storing GML documents. In Proceedings of the 10th ACM international symposium on Advances in geographic information systems (pp. 11-16).
[52]Podjaski, F., & Lotsch, B. V. (2021). Optoelectronics meets optoionics: light storing carbon nitrides and beyond. Advanced Energy Materials, 11(4), 2003049.
[53]Bonstrom, V., Hinze, A., & Schweppe, H. (2003, November). Storing RDF as a graph. In Proceedings of the IEEE/LEOS 3rd International Conference on Numerical Simulation of Semiconductor Optoelectronic Devices (IEEE Cat. No. 03EX726) (pp. 27-36). IEEE.
[54]Bókkon, I., & Salari, V. (2010). Information storing by biomagnetites. Journal of biological physics, 36(1), 109-120.
[Writing]
[55]Yankelovich, N., Meyrowitz, N. K., & Dam, A. V. (1985). Reading and writing the electronic book. IEEE computer, 18(10), 15-30.
[56]Takayoshi, P. (1996). The shape of electronic writing: Evaluating and assessing computer-assisted writing processes and products. Computers and composition, 13(2), 245-257.
[57]Hawisher, G. E., & Moran, C. (1993). Electronic mail and the writing instructor. College English, 55(6), 627-643.
[58]Chon, Y. V. (2009). The electronic dictionary for writing: A solution or a problem?. International Journal of Lexicography, 22(1), 23-54.
[59]Ganiyeva, H. (2020). Enhancing writing through electronic media: Wear the old coat and buy the new book. Архив Научных Публикаций JSPI, 1-4.
[60]Piqué, A., Chrisey, D. B., Auyeung, R. C. Y., Fitz-Gerald, J., Wu, H. D., McGill, R. A., ... & Duignan, M. (1999). A novel laser transfer process for direct writing of electronic and sensor materials. Applied Physics A, 69(1), S279-S284.
[61]Ferris, S. P. (2002). Writing electronically: The effects of computers on traditional writing. Journal of electronic publishing, 8(1).
[62]Jenson, J. D. (2011). Promoting Self-Regulation and Critical Reflection through Writing Students' Use of Electronic Portfolio. International Journal of ePortfolio, 1(1), 49-60.
[63]Bruce, B. C., & Rubin, A. (2013). Electronic quills: A situated evaluation of using computers for writing in classrooms. Routledge.
[64]Gutub, A. A. A., Al-Haidari, F., Al-Kahsah, K. M., & Hamodi, J. (2010). e-Text watermarking: utilizing'Kashida'extensions in Arabic language electronic writing. Journal of Emerging Technologies in Web Intelligence, 2(1), 48-55.
[65]Coogan, D., & Coogan, P. F. (1999). Electronic writing centers: Computing the field of composition. Greenwood Publishing Group.
[66]Inman, J. A., & Sewell, D. (Eds.). (2000). Taking flight with OWLs: Examining electronic writing center work. Routledge.
[67]Jonsson, E. (1998). Electronic discourse: on speech and writing on the Internet.
[68]Han, H., & Lopp, L. (2013). Writing and reading in the electronic health record: an entirely new world. Medical education online, 18(1), 18634.

[69]Ansari, M., & Neupane, D. (2009). Study on determination of errors in prescription writing: A semi-electronic perspective. Kathmandu University Medical Journal, 7(3), 238-241.
[70]Andriessen, J., Erkens, G., Van De Laak, C., Peters, N., & Coirier, P. (2003). Argumentation as negotiation in electronic collaborative writing. In Arguing to learn (pp. 79-115). Springer, Dordrecht.
[71]Tuman, M. C. (1992). Literacy Online: The Promise (and Peril) of Reading and Writing with Computers. University of Pittsburgh Press, 127 North Bellefield Avenue, Pittsburgh, PA 15260.
[72]Bolter, J. D. (2001). Writing space: Computers, hypertext, and the remediation of print. Routledge.
[73]Wittig, R. (1994). Invisible rendezvous: Connection and collaboration in the new landscape of electronic writing. Wesleyan University Press.
[74]Spiliotopoulos, V., & Carey, S. (2005). Investigating the role of identity in writing using electronic bulletin boards. Canadian modern language review, 62(1), 87-109.
[75]Horning, A. (2013). Reading, writing, and digitizing: Understanding literacy in the electronic age. Cambridge Scholars Publishing.
[76]Alsaleem, B. I. A. (2013). The effect of" WhatsApp" electronic dialogue journaling on improving writing vocabulary word choice and voice of EFL undergraduate Saudi students. Arab World English Journal, 4(3), 213-225.
[77]Jiang, P., Ji, Z., Zhang, X., Liu, Z., & Wang, X. (2018). Recent advances in direct ink writing of electronic components and functional devices. Progress in Additive Manufacturing, 3(1-2), 65-86.
[78]Dragoman, M., Flahaut, E., Dragoman, D., Al Ahmad, M., & Plana, R. (2009). Writing simple RF electronic devices on paper with carbon nanotube ink. Nanotechnology, 20(37), 375203.
[78]Zhang, K., Fu, Q., Pan, N., Yu, X., Liu, J., Luo, Y., ... & Hou, J. (2012). Direct writing of electronic devices on graphene oxide by catalytic scanning probe lithography. Nature communications, 3(1), 1-6.
[78]Gabrial, B. (2008). History of writing technologies. Handbook of research on writing: history, society, school, individual, text, 27-40.
[79]Grabill, J. (2005). Electronic writing, research, and teaching. The Clearing House, 78(3), 100.
[80]Bolter, J. D., & Joyce, M. (1987, November). Hypertext and creative writing. In Proceedings of the ACM Conference on Hypertext (pp. 41-50).
[81]Bolter, J. D. (1996). Ekphrasis, virtual reality, and the future of writing. The future of the book, 253-272.
[82]Sullivan, P., & Dautermann, J. (1996). Electronic Literacies in the Workplace: Technologies of Writing. Advances in Computers and Composition Studies Series. National Council of Teachers of English, 1111 W. Kenyon Road, Urbana, IL 61801-1096 (Stock No. 13079-3050: $19.95 members, $26.95 nonmembers)..
[83]Kennedy, X. J., & Gioia, D. (2013). Literature: An introduction to fiction, poetry, drama, and writing. Pearson.
[84]Bonk, C. J., & King, K. S. (2012). Computer conferencing and collaborative writing tools: Starting a dialogue about student dialogue. In Electronic collaborators (pp. 39-60). Routledge.
[Reading]
[85]Hyman, J. A., Moser, M. T., & Segala, L. N. (2014). Electronic reading and digital library technologies: understanding learner expectation and usage intent for mobile learning. Educational Technology Research and Development, 62(1), 35-52.
[86]Anderson-Inman, M. A. H. L. (1999). Supported text in electronic reading environments. Reading & Writing Quarterly, 15(2), 127-168.
[87]Feng, H.L., Roth, D., Fine, H., Prenner, J., Modi, K.K., & Feuer, W. (2017). The Impact of Electronic Reading Devices on Reading Speed and Comfort in Patients with Decreased Vision. Journal of Ophthalmology, 2017.
[88]Attia, M., Khoramnia, R., Auffarth, G., Kirchner, M., & Holzer, M. (2016). Near and intermediate visual and reading performance of patients with a multifocal apodized diffractive intraocular lens using an electronic reading desk. Journal of Cataract and Refractive Surgery, 42, 582–590.
[89]Hyman, J.A., Moser, M., & Segala, L.N. (2014). Electronic reading and digital library technologies: understanding learner expectation and usage intent for mobile learning. Educational Technology Research and Development, 62, 35-52.
[90]アーメド・アリ, & スティーブン・ボーゲル (2012). Electronic reading device and method.
[91]朱光瑞 (2010). Reading prompt method in electronic reading terminal and electronic reading terminal.
[92]Wang, P., Chiu, D.K., Ho, K.K., & Lo, P. (2016). Why read it on your mobile device? Change in reading habit of electronic magazines for university students. The Journal of Academic Librarianship, 42, 664-669.

[Calculating]

[93]Blaha, P., Schwarz, K., Tran, F., Laskowski, R., Madsen, G., & Marks, L. (2020). WIEN2k: An APW+lo program for calculating the properties of solids. The Journal of chemical physics, 152 7, 074101 .
[94]Leng, X., Jin, F., Wei, M., & Ma, Y. (2016). GW method and Bethe–Salpeter equation for calculating electronic excitations. Wiley Interdisciplinary Reviews: Computational Molecular Science, 6.
[95]Wilkes, M., & Renwick, W. (1949). The EDSAC - an Electronic Calculating Machine. Journal of Scientific Instruments, 26, 385-391.
[96]Bennett, J.M., & Kendrew, J. (1952). The computation of Fourier syntheses with a digital electronic calculating machine.
[97]Lebedev, S.A. (1956). The High-Speed Electronic Calculating Machine of the Academy of Sciences of the U.S.S.R. J. ACM, 3, 129-133.
[98]Wilkes, M. (1949). Electronic Calculating-Machine Development in Cambridge. Nature, 164, 557-558.
[99]Hassan, I.U., Ahmad, N., & Zuhaira, B. (2018). Calculating completeness of software project scope definition. Inf. Softw. Technol., 94, 208-233.
[100]Yurchenko, S., Lodi, L., Tennyson, J., & Stolyarov, A. (2016). Duo: A general program for calculating spectra of diatomic molecules. Comput. Phys. Commun., 202, 262-275.