



Construction and Installation of a Modern Display System Using Dot Matrix

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ABSTRACT

The LED dot matrix display is a display system which is used in information dissemination to larger number of audience within the location which it is situated. It has three sections; power, control and display. This which could be grouped into two main part; the hardware and software. The display system physically conveys set of programmed data on the controller card, the hardware part comprises of numbers of LED module, power supply module, controller card and the casing. The software part is the part on the controller card that stores the received programmed data. It uses a volatile memory which allows reprogramming and memory formatting for maximum of 1000times. The casing of the display system comprises of rectangular screwed and riveted aluminium rod, ACO Board and transparent plastic which covers it both in the front and back. The system switches on automatically whenever it is plugged to the AC Supply and it has a minimum efficient life span of 50,000hours and a maximum viewing angle and distance of 140degrees and 25metres.

Keywords: *Display, Dot Matrix, Interface, Light Emitting Diode, Module.*

1. INTRODUCTION

Visual impact is the most effective mode of influencing human's minds main aim of communication. A display device serves this purpose. A display device is a device for presentation of information for visual reception, acquired, stored, or transmitted in various form. The display device is use to display the information on machines, clock, railway departure indicator and many other devices require a simple display of limited resolution. (Mazidi 2012). The display consist of a matrix of lights or mechanical indicator arranged in rectangular configuration (other shapes are also possible) such that by switching on or off the text or graphics can be displayed.

Our initial goal was to create a display that would be useful and interactive in order to attract attention. In the development of our main goal, the modular LED array, we found that we would be dealing with three major components,

- i. Integrated circuits consisting of microcontroller, resistor array, and LED driver.
- ii. Printed circuit board technologies, as well as software involved in their design.
- iii. Programming in assembly language to drive the microcontroller and scan through individual row of LED's with the data needed to produce a message.

For moving a message on display we design a dot-matrix display which contains 16x32 dots (LED's), the LED's are connected like a matrix with 16 rows of 32 LED's per each row and a matrix is designed on a board to display characters. LED dot matrix are very popular means of displaying information as it allows both static and animated text and images. Perhaps, you have encountered them at gas stations displaying the gas prices, or in the public places and alongside highways, displaying advertisements on large dot matrix panels. (Roman 2002).

A dot matrix display is an array of light emitting diodes (LEDs) arranged in a 8x8 matrix that is used to display a programmed data/information. (Zhou et al 2013). An information

display is a way of providing information and/or is used as an object for promotion. It can be seen in a form of cardboard or tarpaulin at stores/shops, streamers and electronic display devices. But the advent of new technologies made the information in the form of an electronic display in the world of advertisements and promotions. The ability to display a short message can be useful application to be available for any business. A LED display board is perfect for this application. It can be used for both indoor and outdoor which makes it universal fit for any business or event. The LED display board is very efficient and cost effective way to spread messages to thousands of people, without any personal contact or door-to-door sales. LED is a solid state light source with several attractive properties for display application. It is chosen as the main component for displaying messages because, today LED is the most energy efficiency example as compared to incandescent light bulb. (Roland 2002). A LED light emit very little heat and saves a lot of energy, as 98 percent of the energy used by a traditional incandescent light can be lost as heat energy instead of light energy. (. Sheng-Fu 2005).

2.0 CONSTRUCTION

The project comprised of 24 LED dot matrix modules which gives a dimension of (2.1 × 6.3ft), connected together with many data cable and connectors and it is powered by three 200W, 5V SMPS module which supplies power to each of the module through power cables and connectors connected in parallel.

For the successful completion of the project, the following materials were used,

- ❖ 24 (16 x 32) LED module
- ❖ 3 (200W) SMPS module
- ❖ 1 TF-A6UW controller card
- ❖ An Aluminium Frame works
- ❖ 24 Hub 12 Data cable
- ❖ 25 power distribution cable
- ❖ ACO board
- ❖ Screws

- ❖ Power plugs
- ❖ PowerLED software.
- ❖ **2.1 PROGRAMMING**

The PowerLED software is a program designed by the TF-A6UW controller card manufacturer to program the controller card. This eliminates the need for manual programming with an Integrated Development Software (IDE). The program is designed with the PowerLED software and written on the controller card.

The process involved in programming the controller card through the PowerLED software is listed below.

2.1.1 Installation Procedure:

- ❖ Download the PowerLED software on your PC.
- ❖ Click on “powerled.exe” to setup the application.
- ❖ Choose installation language, click “English”.
- ❖ Allow installer to copy files and click finish.

2.1.2 Software Interface:

Double click on the PowerLED shortcut usually on the desktop to open the PowerLED window.

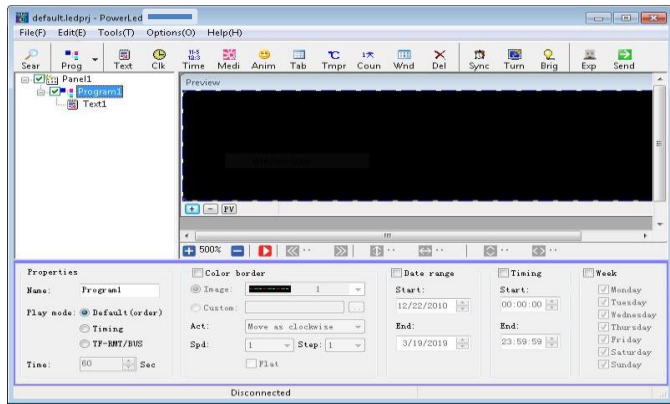


Fig 1: PowerLed software interface

2.1.3 Interfacing the PowerLED Software:

After opening the software, create a new file by clicking on the “File” Tab and select a new file. Click on the “Tools(t)” tab and then “Panel Setup”. Enter the password for the software and the panel setup window pops up.

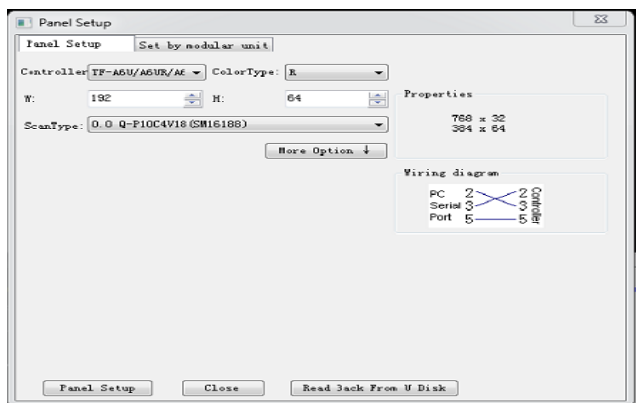


Fig 2 : Panel setup window

The following can be done on the panel setup.

- ❖ Select the controller card: It shows a dropdown menu several of controller cards from which the one to be used is then selected.
- ❖ Select the colour type: It shows the red, green, blue and the RGB, from which the colour of the display to be used could then, be selected.

- ❖ The width: This total number of LEDs in a row.
- ❖ The height: This is the total number of LED on a column
- ❖ The scan mode: This is the type of scan mode to be used in the design ranging from 1/2, 1/4, 1/8 etc.

The panel setup allows setup for unit or Modular. Clicking on the modular unit, allows for setting the panel in modules. The type of modules used is selected from the three options P10, F3 and F5. After the panel setup the text, image, animations etc., can then be edited.

2.30 SOFTWARE OVERVIEW:

- ❖ **SEARCH:** This tab search for the nearby controller card if the Wi-Fi of the system has been turned on or the controller card has been connected through the USB to the computer, it helps to detect the controller card and get it ready for recipient of programmed data.
- ❖ **PROGRAM:** This tab helps to select as much program as possible and each program can contain variety of parameters such as text, time, date etc.
- ❖ **TEXT:** This tab enables to type a desired text. Font type, font size, animations, color etc. can also be added the text.
- ❖ **CLK:** This selects clock to be on a program, showing the pointer to indicate time.
- ❖ **TIME:** This also selects clock to be on a program, this which is displayed digitally i.e. indicating the time in digits.
- ❖ **IMAGE:** This option helps to select images to be in a program
- ❖ **VIDEO:** This helps to upload a video into a program, but it is inactive because of the type of controller card and display being used.
- ❖ **ANIMATION:** This enables animation of a text.
- ❖ **TEMPERATURE:** This enables display of temperature. This depends on whether the controller card has a temperature sensor on it.
- ❖ **COUNTER:** This enable display of a counter whenever needed.
- ❖ **WIND:** This indicates windows, enabling to open different windows in a program
- ❖ **DEL:** This enables deletion of programs
- ❖ **SYNC:** This enable setting of synchronizing time.
- ❖ **TURN:** This enables adjusting the timing, either manual or analog and setting its time
- ❖ **BRIGHTNESS:** This enables adjusting of the brightness.
- ❖ **EXPORT:** This enables exporting to disk of the written program.
- ❖ **SEND:** This enables sending of the whole written program to the already detected controller.

The above instructions were strictly followed and the written program took one minute and twenty-six seconds to complete its whole program display and it is run continuously with a maximum of five seconds for display of each set of text. The design has in it nine programs:

Program 1: To display the logo of the Federal Polytechnic Ado-Ekiti, and the text “WELCOME TO”.

Program 2: To display the text “THE FEDERAL POLYTECHNIC, ADO-EKITI PMB5351, EKITI STATE”

Program 3: To display the text “TRAINING FOR SKILL AND EXPERTISE”

Program 4: To display “SCHOOL OF BUSINESS STUDIES” and the seven departments i.e. “ACCOUNTANCY, BANKING AND FINANCE, BUSINESS ADMINISTRATION AND MANAGEMENT, MARKETING, OFFICE TECHNOLOGY & MANAGEMENT, PURCHASING AND SUPPLY, GENERAL STUDIES”.

Program 5: To display “SCHOOL OF ENGINEERING” and the seven departments i.e. “AGRIC AND BIO - ENVIRONMENTAL ENGINEERING, AGRICULTURAL TECHNOLOGY, CIVIL ENGINEERING ELECTRICAL/ELECTRONIC ENGINEERING, FISHERY TECHNOLOGY, MECHANICAL ENGINEERING, MINERAL AND PETROLEUM RESOURCES ENGINEERING”.

Program 6: To display “SCHOOL OF ENVIRONMENTAL STUDIES” and the six departments i.e. “ARCHITECTURAL TECHNOLOGY, BUILDING TECHNOLOGY, ESTATE MANAGEMENT. QUANTITY SURVEYING, SURVEYING AND GEO-INFORMATIC, URBAN®IONAL PLANNING”.

Program 7: To display “SCHOOL OF SCIENCE AND COMPUTER STUDIES” and the six departments i.e. “COMPUTER SCIENCE, FOODTECHNOLOGY, GLASS AND CERAMIC TECHNOLOGY, MATHEMATICS AND STATISTICS, SCIENCE TECHNOLOGY”.

Program 8: To display “date, weekday and time”.

Program 9: To display “COURTESY: DEPARTMENT OF ELECTRICAL/ ELECTRONIC ENGINEERING”.

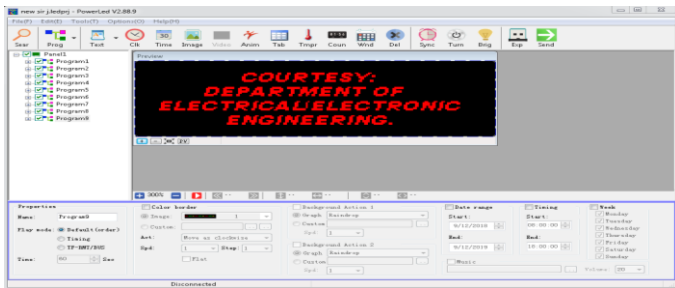


Fig 3: Software interface showing the list of programs

3.0 WIRING

This involves connections of all the LEDs together for synchronizing their actions, the connections include the data and power.

Data connection: Data is being transmitted and circulated to the arranged module by linking all the LED module together with a data connection cable i.e. the HUB 12 cable, this connects the whole module together by a side by side method of connecting and it also connects the controller card to the module to enable sending of the data to be displayed all which is done parallel and in a form which data flows from left to right.

Power connection: The module is being powered by the SMPS and the power is uniformly supplied to the circuit by a parallel connection using the power cable and the power cable also connects the module to the SMPS, the electric current flows from left to right.



Fig 4: Wiring diagram (data and power)

4.0 DATA COMMUNICATION

After the successfully written program the next step is to send the program to the controller card, the controller card being used as a

USB port which it could accept signals or data through. The controller card also has an antenna from which could receive data from transmitter (computer using hotspot).

After the program has been written and an antenna has successfully been installed on the controller card, then the Wi-Fi of the computer is turned on and the hotspot with the SSID (TF-WIFI_8B6D75) is detected and connected to, then the program will be launched and the panel will be searched and detected and using the SEARCH tab the program could then be sent to it. When any program is sent to the controller card, it automatically clears off the program which is previously on it.

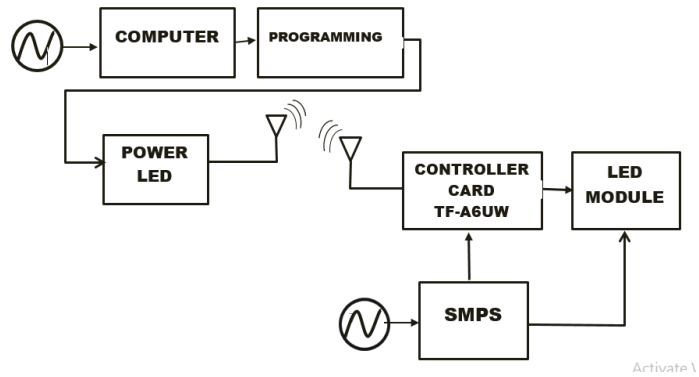


Fig 4: Block diagram of signal transmission and reception

5.0 CASING
The casing includes the combination of the framework which is composed of aluminium sheets screwed and riveted together, a plain plastic material used for the front display front protection and beautification and also a length of ACO Board which is used to cover the back. All these parts (Aluminium Framework, Plain Plastic, ACO Board, and Sealant) were fastened by tight screws which makes a firm and tight contact with each other.

6.0 TESTING
Three tests were carried out at the completion of the project; These are the electrical and mechanical test and Physical Test.

Electrical test: Two types of electrical test were carried out, the insulation test and continuity test

Mechanical test: This to involve mechanical inspection. This was carried out to ensure firmness and stability of the whole frame or casement, it involve using a plum to test if it is not resting towards a particular side, the test indicate balance and a builder square was used to test the firmness of the centres. The whole casement was slightly shaken to test it strength towards vibration and it.

Physical Test
This comprises of two tests; the Day time test and the Night time test, both involves inspection as regard the performance during the day and night, using a measuring tape and protractor.

7.0 PERFORMANCE ANALYSIS
At the completion of the project the combination of the display modules and other circuitry which is now a display system was connected to the surge protector and then to the mains and it automatically turns on and start to display the programmed parameters. The whole of the programs were displayed there are nine sets of programs displayed and each of this programs includes two sub programs either a text or image and all this has an HOLD time of 4seconds and has an uploading speed of 5 (according to the standard of the software it is approximately 4seconds). The whole display of the program data took one minute and twenty-six seconds (86 seconds). This process of displaying continues starting and ending as long as the display system is turned on and

terminates when there is power outage. The text could be programmed and reprogrammed. The controller card allows formatting and uploading for approximately one thousand times during its life span.

8.0 CONCLUSION

The project is the design and construction of an LED DOT MATRIX DISPLAY dimensioned (6.3x 2.1 feet) is a gradual process which includes the construction of a frame capable of housing 24 LED modules and the use of a power supply module capable of supplying the LEDs and other circuits involve, the use of a controller card capable of storing and conveying information required to be display and coverings such as the transparent plastic and ACO board which gives physical protection from environmental hazards.

This project has enabled student to put into practice theoretical classroom room-based knowledge in the production of tangible electronic device, thereby bridging the gap between the classroom theory and their practical application.

The execution of the project has broadened student knowledge on the practical application of the following; wireless communication, principle of operation and a common connection and control of the light emitting diode, applications of some computer program and their interaction to the environment, the use of different integrated circuit (ICs).

The project will also contribute to technological growth in the aspect of information dissemination involving display boards and add to the beauty of the environment. It will increase the percentage of people getting an information due to its attractive, viewing angle and viewing distance.

It is us believe that a highly improved version of this project can be achieved by adding special features to the already produced ones.

9.0 RECOMMENDATION

Since the project is limited to the construction of a display system to display text only, it is recommended that in such project to be done by student, they should design the project to display different colours and produce an audio output and such it will be capable of displaying pictures with their full colour and also videos, this feature will attract more audience.

The major challenge of this project is finance, as this limits the size of this project, as such it is recommended that if such expensive project is given to student, the department or the school should encourage student by financing part of the projects to encourage execution of standardize project. The school should also try giving out project topics from the first year of study to give enough time for research, design and construction and encourage student to avoid procrastination so has to hasten the project implementation.

REFERENCES

1. Ameriqbal Qureshi (2014), Let make LED matrix displays, microtronics, Pakistan, (pp192-194).
2. Augarter, Stan, (2009), the most widely used computer on a chip, a photographic history of integrated circuit, Ticknor & fields, New York, (pp 1-2).
3. Bellu, Rene (2006). Automobile. Toutes les voitures francaises, history & collections Nr 78s.
4. Brandon Rubadou, Stephen Hansen, (2012), colour dot matrix proof of concept, Worcester, (pp1-4).
5. Disha Kapoor, Rohit Pandey, Rishav Vaid, m.v Patil, (2016), electronic dice using dot matrix display, Thomson Reuters, India (pp 1-2).
6. Dogam Ibrahim, and Louis (2006),30 projects using pic basic and pic basic pro, mpg books ltd, Great Britain (pp 1-3).
7. Dot matrix(printers&display). [www.wikiwand.com /en/ Dot_Matrix](http://www.wikiwand.com/en/Dot_Matrix).
8. F.h Fahmy, s.m Sadek, n.m Ahmed, m.b. Zahran, Manton and Abdel-shafy a. Nafeh, (2010), microcontroller based moving message display powered by photovoltaic energy, re & pad, Egypt, international conference on renewable energies and power quality research journal, vol.1, no.8, (pp 1566-1571).
9. Gowrishankar Kasilingam, Mritha Ramaligam and Chandra Sekar, (2014), a survey of light emitting diode (LED) display board, India journal of science and technology, Indian journal of science and technology, vol 7(2), issn (print): 0974-6846, Malaysia (pp 188-185).
10. Grantham pang, Chi-ho Chan and Thomas Kwan, (2004), tricolour light emitting diode dot matrix display system with audio output, university of Hong Kong annual journal (2004), (pp1-10).
11. Health Steve(2003), Embedded systems design,Newness,India, (pp 11-12).
12. History of display technology, last edited(may,2018),from [www.en.m. Wikipedia.org/wiki/history-of_display_technology](http://www.en.m.wikipedia.org/wiki/history-of_display_technology).
13. Htet Thit san, Chaw Wyatt Nwe and Hla Myo Tun, (2014), implementation of pic based LED display, international journal of electronics and computer science engineering, volume3, no3, India (pp 191-198).
14. LED life expectancy(2018),[www.philips.com/main/support/support/faqs /life-and-used-output/](http://www.philips.com/main/support/support/faqs/life-and-used-output/)
15. Lemley Linda and Chris (2012), discovering computers, university of Florida archived, chapter6, (pp 30-35).
16. Louis d. Silverstein, (2006), hybrid spatial temporal colour synthesis and its applications, journal of society for display volume 14, no1, (pp.3-13),
17. Matick r, link d.t, Gupta s and dill f, (2006), all point addressable raster display memory, journal of research and development, volume 28 no 4, (pp 325).
18. Microcontroller-A Beginners guide(2014)from www.newhiehac.com/mcu_restandcircuit.aspx
19. Microchip technology Inc. (2008), SMPS AC/DC Reference design user guide, DS70320B-(PP 1-10).
20. Muhammad Ali Mazidi, Janice G. Mazidi, D. Mckinlay, (2007), the microcontroller and embedded systems using assembly and c,2nd edition, India (pp 2-3).
21. M.Firox Perez, Abdul al Mortuza, Hassan and Ma Sayid Haque, (2016), novel scanning technique for LED dot matrix display to reduce flicker issn- 2277-1956, institute of electronics, atomic energy research journal Bangladesh (pp 19-24).
22. N. Jagahanmohan Reddy and G. Venkareshunarlu, (2013), dot matrix displays, international journal of electrical/electronic and data, issn: 2320-2084 volume-1, issue-10, India (pp 50-54).
23. Obiechiene f. Okechukwu, David t. And don Okpala v. Uche, (2013), design and construction of a moving text display digital board, Pelegia research library issn: 0976-8610, Nigeria, (pp 512-525).

24. Rachna Devi, BhawnaSaini, Shilipi Dhankar Mohammad Ziaul-Haque (2014), smart LED display boards, international research publication house, international journal of electronic and electrical engineering. Issn 0974-2174 volume 7, no 10 India, (pp 1057-1067).
25. Simpson, A (1978), testing methods and reliability electronics, English edn. The encyclopaedia Americana, international, Macmillan press ltd., London, vol. 26, (pp 755-56).
26. TF-Wi-Fi control cards (TF A6UW) Data sheet (pp 1-6) www.ilker.com.tr
27. TC5020(S&CIC0996) data sheet, www.superchip.cn
28. VK Mehta and Rohit Mehta, (2008), principle of electronics, s. Chand & company, new Delhi (pp 125-132).
29. Sheng-Fu Su, The Design and Implementation of the ZigBee Protocol Driver in Linux, White Paper dated 26 July 2005.
30. J. Ronald, (Monroe community college) and neals, S. (purdue University). Digital systems, principle and applications (8th edition). Retrieved on August 9, 2011, from http://en.wikipedia.org/wiki/Seven-segment_display 1998.
31. Swiatkowski, M.; Wozniak, K.; Olczyk, L., "Student Notice Board Based on LED Matrix System Controlled over TCP/IP Protocol," *Photonics and Microsystems, 2006 International Students and Young Scientists Workshop*, vol., no., pp.59,60, June 30 2006-July 2 2006.
32. William L.F, *An Introduction to Modern Electronics*, John Wiley and Sons Inc. **1991**, pp. 42-45.
33. Zhang X Song Y, Feng Y, Ma J., Design of LED display control system based on AT89C52 single chip micro-computer. China, *Journal of Computers*. 2011; 6(4):718–24.

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