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Fabrication of an X-Ray Viewing Box using an Alternative Power Supply

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Abstract:- The conventional radiographic viewing boxes in hospitals and diagnostic centers has a common disadvantage in which they are mostly used with electric power supply and in the event of power failure it becomes impossible to use which is a big cause for concern. This study is aimed therefore at seeking to address this disadvantage by improving on the design of a radiographic viewing box with an alternative source of power. A metallic sheet casing and a perplex screen were used. The device was able to be powered solely with a rechargeable battery. The result obtained from the testing operation of the locally fabricated illuminator viewing box indicates that the X-ray film viewing box was able to be powered using a 3.7V battery. In conclusion, this illuminator box is a technological improvement on the conventional X-ray viewing box and will greatly assist in eliminating the challenge of power failure especially in rural areas where hospitals do not have regular power supply.

***Keywords**:- Fabrication, X-ray Viewing Box, Alternative.*

I. INTRODUCTION

X-ray viewing box is a device that is made of lights placed behind a translucent screen and used to provide backlighting for radiographic image. It helps clinicians see the brightness, contrast, and details of an image. It is also known as an illuminator. Radiographic films remain the norm in developing countries and interpreting them is easier and more reliable using a view box than holding it up to light (Kenneth, 2011). Accurate diagnosis from radiographs depends upon optimal viewing conditions. A magnifier-viewer and adequate light are of utmost importance (Brynolf, 1971). Sensitivity and specificity has been shown to be reduced with inappropriate illumination (Patel *et al.*, 2000). In diagnostic radiology, viewing boxes with low brightness will reduce the light reaching the eye, limiting visual acuity, and thus reducing the ability to carry out adequate assessment of radiographs. A good viewing box should also demonstrate consistent spatial illumination; otherwise, areas of the image will transmit less light than adjacent areas even when optical densities in the two areas are the same. Also, ambient lighting should be minimized (Abildgaard and Notthellen, 1992). It should not escape one's mind that digital imaging systems also have their relevant quality control requirements needed for optimal viewing of images (Nyathi, 2008). The conventional radiographic view boxes in hospitals and diagnostic centers has a common disadvantage in which the viewing boxes are mostly used with electric power supply and in the event of power failure it becomes impossible to use the viewing box which is a big cause for concern especially in a country like Nigeria where constant power supply is quite a huge problem and this can lead to complications in patients in cases of emergency where the use of a radiographic viewing box is required. There is therefore the need to redesign a radiographic viewing box which can be powered with an alternative source such as a rechargeable battery power supply (DC power). This study is aimed at fabricating a radiographic viewing box with an alternative power supply using locally available materials. Meanwhile, to fabricate a radiographic viewing box that is durable, easy to carry around and rechargeable are some of the specific objectives for this study.

II. MATERIALS AND METHOD

This design and construction work is to show how to locally fabricate an X-ray viewing box with battery as an alternative power supply. To conveniently use the commonly available X-ray films for demonstration, a 58 x 48 x 8 cm in size battery powered illuminator box was designed.

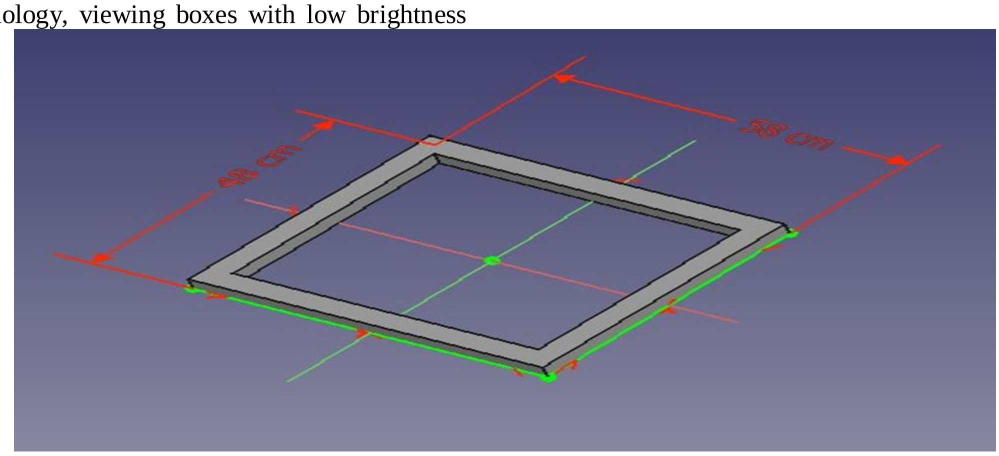

Fig. 1: Showing the dimensions of the X-Ray box

A. Fabrication of the Illuminator Housing

This is a four-sided metallic framework with a handle for convenient carriage. The dimension is 58 x 48 x 8cm with a Perspex screen surface. It is constructed mainly of metals and a plastic Perspex screen. This was strongly made to ensure the desired stability and durability of the structure. Four pair of plastic clips was attached between the Perspex screen and metal frame casing. The top part of the box where the Perspex glass is attached is made to be able to open and close to allow for access to the inside of the box with two inches holding it firm. Also a metallic handle is attached to use for this purpose. The components that were employed for the fabrication of this x-ray had these specifications.

- Six Super bright Direct Current (DC) light emitting diode (LED) for providing the illumination.
- Nine metallic core from transformer coil arranged in pairs of three to serve as a platform to hold the LEDs and also serve as a conductor where the LEDs are soldered to in parallel. These LEDs have positives and negative terminals. On each pair of the three wires, two LEDs are soldered in parallel and then connected together in series.
- Copper wires are used to connect both the positive and the negative terminals of these LEDs to the main switch.
- A 5V DC fan that serves as a ventilator or for evacuation of heat to the exterior.
- Copper wires are used running from one end to the main switch.
- A 3.3-37V Buck converter (an electronic device that can step down voltage from a higher value to a lower value) was used to determine the intensity of illumination as it varied by turning it clockwise or anticlockwise.
- 13 amps 3-pin attached to the main cable head and used for plugging into the wall socket.
- Two switches, one for main power into the illuminator (i.e. ON/OFF) control and one for switching ON/OFF the power bank module when the batteries is low and needs charging or switching off the batteries when full.
- Ten 3.7V li–ion rechargeable battery connected in series were used to power the LEDs
- A 5V Power Bank module with Liquid Crystal Display (LCD) screen was used to recharge the battery
- A 5V AC-DC adaptor with type B USB pin was used to recharge the battery through the power bank module.
- A heat shrink tube of 5mm was used to insulate and cover the wires for neatness and proper insulations. The fabrication process of the illumination box includes plate marking and cutting, folding, welding, drilling, Filling and finally painting. After painting the electrical connection was now done within the illuminator box and then tested for lighting. A Perspex screen was placed at the top of the lid cover of the illuminator housing which helps in the diffusion of light from the LEDs tubes. A voltage regulator Circuit which will provide AC and DC voltage was used. The main voltage which is AC is converted to 5V DC with the help of an adapter circuit. This DC is supplied to the power bank module which is connected to the 3.7V li-ion battery. The output of the power bank is connected to the LEDs through the potentiometer to vary the voltage. In addition to the components earlier mention, some other off-board components such as indicators pilot lamps, transformer, main and toggle switch, 4 rechargeable batteries (6V.5ah), main wire, extensor fan, display screen, voltage meter tube starter and knob were also used in this fabrication.

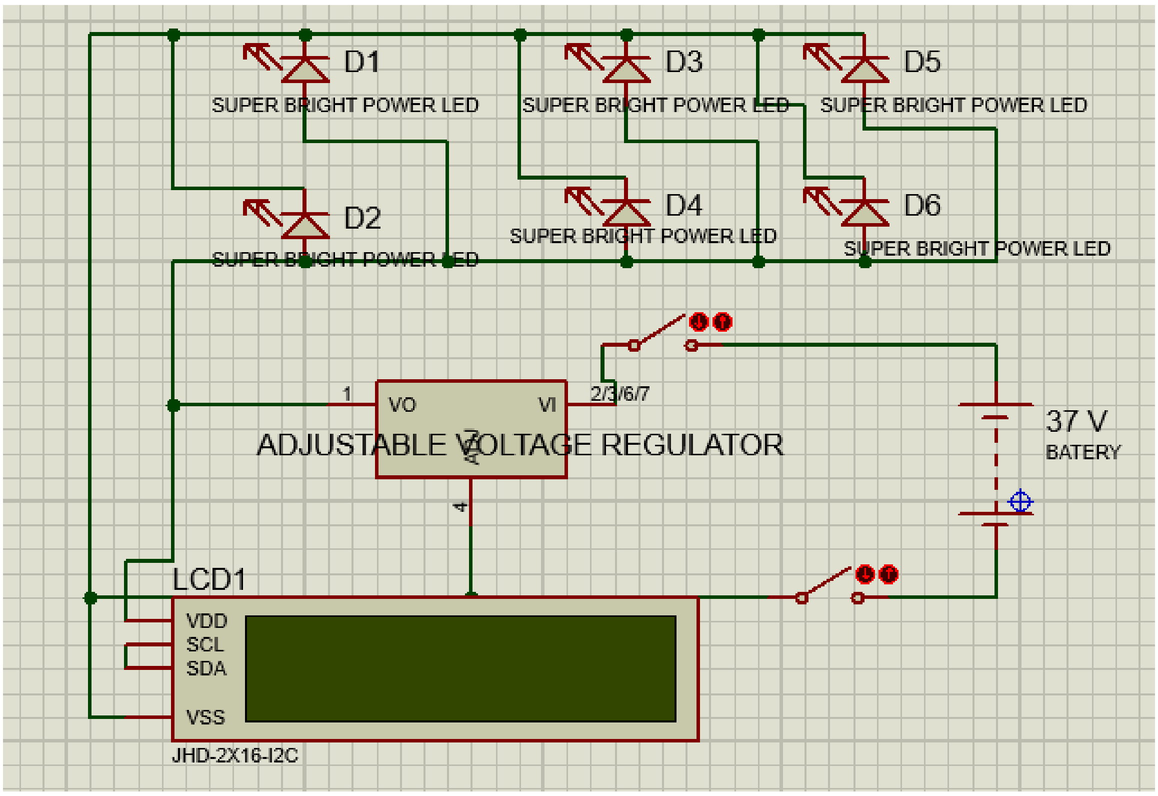

Fig. 2: X-ray box Electronic Circuit Diagram

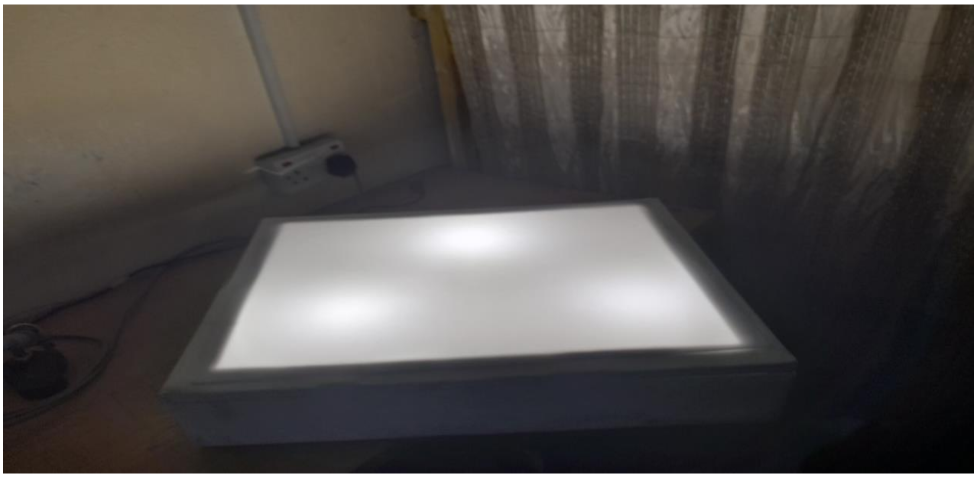

Fig. 3: Fully Powered X-ray viewing box with an alternative power source

III. RESULT

A. Machine Testing and Performance

After fabrication, the X-ray viewing box or illuminator box was charged with a very good power supply. To charge the unit, plug a 5 V adapter (AC to DC) to the AC mains or source, connect a USB to this adapter and plug the type B part of the USB cable to the charging port of the bulk converter. Once this is done, the LCD screen on the bulk converter will come on with a blue light indicating that the battery is charging with an “IN”. Also, the percentage of the battery level is indicated on the screen. When fully charged, the battery can last for up to 6 hours. In situation where the light quality is poor, it is recommended that the unit is shut down during the charging period. The inclusion of a fan in the box assists in reducing overheating.

IV. DISCUSSION

From this study, the testing operation of the locally fabricated illuminator viewing box showed that the x-ray film viewing box could be powered by using a 3.7V battery. The ability of the locally fabricated x-ray viewing box to produce power conforms to the findings of Diartama *et al.* (2017) who designed a radiology viewing box using charger system (battery) and potentiometer in which the viewing tool box made can adjust the intensity of the light produced. It uses battery as a charger system, so that the viewing box can be used anywhere, especially in areas that have not been reached by electricity. The fabricated x-ray view box has a potentiometer that enable a user to increase or decrease the light intensity produce. Also, this fabricated x-ray viewing box has a moderate weight, cost effective, movable and easy to operate. It requires constant proper care and maintenance to keep the device in a good working condition. It can be used in both urban and rural areas where electricity has been a challenge especially in health centers.

V. CONCLUSION

This illuminator box is a technological improvement on the conventional X-ray viewing box and has successfully achieved the objective of eliminating the challenge of power failure. It is durable and has controlled light intensity and can be used for teaching, research and in hospitals.

VI. RECOMMENDATION

It is recommended that the use of locally made technology should be encouraged and funding made available for mass production of this product. Funding have been a greater challenge and limitation to this study.

PUBLICATION OF THIS ARTICLE

Authors wish to state that this article have not been published or submitted for publication in any journal or elsewhere.

REFERENCES

[1.] Kenneth, V. I & Jeremiah, M. T (2011). X-ray view box: on-site manufacture. Tropical Doctor, 41(3): 144-145.

[2.] Brynolf, I (1971). Improved viewing facilities for better roentgendiagnosis. Oral Surgical, Oral Medical, Oral Pathology; 32(5): 808-811.

[3.] Patel, N, Rushton, V.E, Macfarlane, T.V, Horner K (2000). The influence of viewing conditions on radiological diagnosis of periapical inflammation. British Dental Journal, 189(1): 40-2.

[4.] Abildgaard, A, Notthellen, J.A. (1992). Increased contrast when viewing Radiographic Images. Radiology; 185: 475-8.

[5.] Nyathi, T., Mwale, AN, Segone, P. Mhlanga, SH, (2008). Radiographic viewing conditions at Johannesburg Hospital. Biomedical Imaging and Intervention Journal, 4(2):17

[6.] Diartama, A.A.A, Suswaty, S., Priantoro, W., Sugiyanto, Sudiyono, Anwar, M.C, Latifah, L., Santjaka, A., Amri, F., Mulyantoro, D.K. (2017). The design of Radiology viewing box using charger system and potentiometer. Investigative Radiology, 17(4): 402-406.