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Design and Development of a Conduit Wiring Demonstration Board for Teaching and Learning of Electrical Wiring Skills in Technical Colleges.

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Abstract

The project, Design and Construction of a conduit wiring Board for the teaching and learning of Electrical wiring skills was carried out to assist in the teaching and learning of Electrical installation in Technical Colleges. The construction stages of the project include: Preparation of diagrams, laying of conduit pipes, drawing of cables, termination and connection of accessories. The project was tested after construction and it worked as expected. It was recommended that a surface type of the wiring board be constructed also to help students learn understand other types of wiring.

Background of the Project

Electrical wiring is simply a network of wires connecting various accessories for distribution of electrical energy from the source (utility or alternative) to devices that consume the energy such as televisions, refrigerators, lamps etc. (). In domestic installations, electrical wiring consists of two parts- the power circuits and the lighting circuits.

Electrical wiring is the electrical installation of cables and associated devices such as switches, distribution board, power sockets, luminaries, etc. in a building or structure(). Electrical wiring is subject to safety standards for its design and installation, therefore, allowable cable types and sizes are specified according to the circuit operating voltage and electric current capability. Furthermore restrictions are also made on the environmental condition such as ambient temperature range, moisture level, and exposure to sunlight and chemicals.

An electrical wiring board is a platform where all electrical connections obtainable in a building structure are demonstrated on a board.

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The importance of a Wiring Board in an Electrical workshop cannot be over-emphasized. This is so because wiring Board aid teaching and learning of difficult concepts and skills in electrical installation and make the learners more grounded and confident in the world of works. Furthermore, the use of wiring board for teaching and learning electrical installation will help develop the desired skilled human resources which have become the primary asset of many countries all over the world.

Statement of the Problem

It is no news today that the performance of most graduates from Technical and Vocational Education and Training (TVET) programs leaves much to be desired. In the past and most recently employers of labour had rejected graduates from TVET Schools because of lack of performance. Most of the times big organization who can afford it spend huge sum of money retraining them to fit into their establishments. This is against the goal of TVET program which according to UNESCO, is Education and Training that provides knowledge and refined skills for employment. Studies have revealed that the lack of refined skills among graduates of TVET programs is traceable to inadequate facilities available for teaching and learning of appropriate skills in our schools' workshops.

Furthermore, electricity being a vital and necessary part of life has found applications in every facet of human life in the 21st century. Risks associated with working and use of this necessity is unquantifiable. In the past lives and property worth billions of Naira had been lost and are being lost on daily basis due to electrical hazards resulting from poor installation by those who have graduated from schools and are now practicing their professions . There is therefore need to impact adequate skills and competencies on these group of students in order to forestall these ugly scenario. This project when completed and implemented will go a long way in achieving these goals.

Purpose of the Project

The purpose of the project is to design and construct a mobile electrical conduit Wiring/Demonstration board that will aid in the teaching and learning of wiring skills in Technical Colleges.

Significance of the Project

The project will be of immense benefit to the students and Teachers of Technical Colleges in particular and Electrical/Electronic Department of Tertiary institutions in general. The project

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will enhance teaching and learning of difficult concepts in Electrical installation. It will help to inculcate employable skills in the learner.

Components Description

Distribution Board: This is the main electrical line feeds from the power line into the home's circuit breaker panel box. The breaker panel typically is divided into two sections. One section houses the main breaker, which supplies power to the entire home. The other section divides the power between a number of different circuit breakers, each of which is rated at a specific load, such as 15amps , 30amps etc.

Circuit Breaker

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current, typically resulting from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected.

Cables

Electrical wiring used in homes is specified by local and National building codes. There are three different styles of wire being used for installation - Bare wire, insulated solid wire and insulated stranded wire. In the course of this project, the insulated solid wire is used with their different colour codes.

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Red Wires: Red wires are used as live wires, switch legs (like ceiling fan), and are the second hot wire in 240-volt installations. Another useful application is the interconnect wire between two hardwired smoke detectors.

Black Wires (neutral): Black wires are used as the neutral wires. They also feed a switch or outlet and are often used as switch legs.

.**Blue and Yellow Wires:** Blue and yellow wires are also used as live wires in a three-phase connection. Blue and yellow cables were not used in the course of this project as the installation was designed for one-phase installation.

Green Wires: Green wires are used only for grounding. These wires will ground devices and shall be bonded to junction boxes and appliance connections for safety.

Outlets

Electrical outlets, or receptacles, are the means that allow home occupants to tap into homes, electric power for items that do not need constant power, or that might need to be moved, such as lamps, small kitchen appliances, hair dryers and vacuum cleaners. It is also known as sockets.

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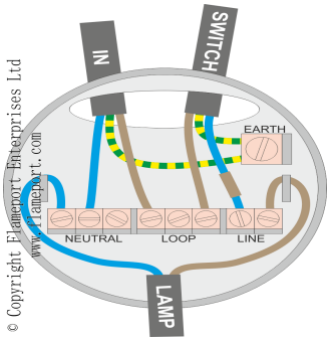
Ceiling rose

A ceiling rose is effectively a junction box for the power fed, switch wire and pendant flex of a ceiling light. The ceiling rose has three sets or two discreet terminals for the current carrying conductors plus an additional terminal for terminating the earthing conductors.



Lamp Holder

It is a device for securing a lamp to its support; specifically, a socket or holder fitted with electric terminals, into which the top of the glass globe of an incandescent lamp is fitted, or from which it hangs.

Switches

A switch is an electrical component that can “make” or “break” an electrical circuit, interrupting the current or diverting it from one conductor to another.

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Cable Selection for the Project

Cables consist of three essential parts namely the conductor, the insulation and the external mechanical protection. There are different types of cable which include the polyvinyl chloride (PVC) cable, multi-core cable and tough rubber sheathed (TRS) cable. The type of cable selected for use in this project is the polyvinyl chloride (PVC) cable. PVC cable is a cable whose insulation is formed from a synthetic resin which softens when heated. PVC cable is selected because PVC has a high tensile strength and the insulation will never be exposed to high temperature.

Project Implementation

Preparation of Diagrams: The Electrical wiring diagram was drawn by reproducing the ground floor plan and showing the lighting fittings, accessories and stationery appliances with familiar graphical symbols.

Preparation of Board: Two wooden boards of 6ft by 6ft were procured for the project, the second one was sliced into two equal halves and one half joined to the first board. This was done so as to have enough space for the main wiring. The stand of the project was constructed with metal rectangular pipes so as to withstand the weight of the board and the wiring done on it.

Preparation of accessories: The electrical wiring diagram was used to prepare the bill of quantity for the project.

Tools for Operation

1) Screw driver
2) Pliers
3) Fish tape
4) Tape measure
5) Voltmeter
6) Hammer:
7) Side cutter
8) Diagonal pliers
9) Wire strippers**:**

Wiring Implementation

The actual wiring on the board was carried out in the following stages:

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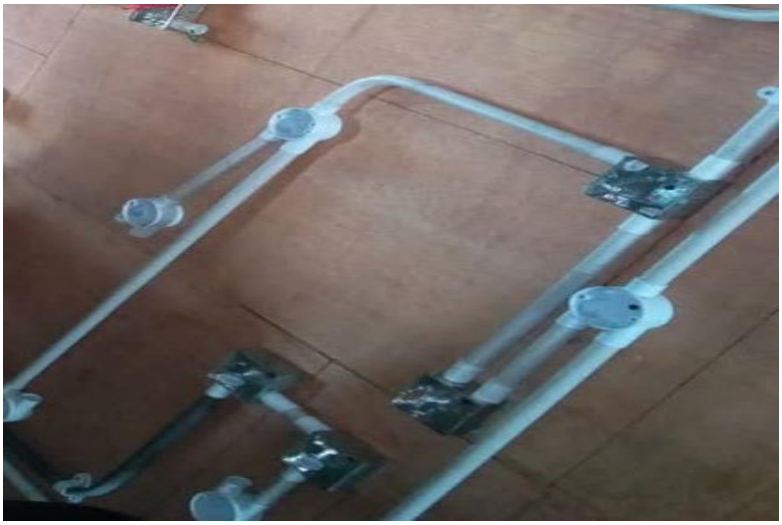
Marking out: The ground floor plan produced was translated into the board by marking out different sections of the building on the board. The actual positions of the fittings were also marked out on the board using the electrical wiring diagram

Piping: The piping was done on the board making provisions for the lighting circuit and power circuit. The shortest way of cable run was used during piping so as to avoid incurring much cost on cables. The conduit pipes were secured onto the board with the use of clips.

Pipe laying



Drawing of cables: Cables were drawn to different parts of the system on the board using fish tape.

Drawing of Cables

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Connection of accessories: Upon completion of drawing of wires, connections to different terminals were effected.

Termination of wires

Precautions Taken

Safety was paramount in the mind of the researcher during the construction of the project. The researcher ensured that the conduit pipes were free of burrs at points of cutting, and the power circuit was separated from the lighting circuit to make tracing easier during maintenance or repair. Also, it was ensured that the cables and materials used conform to BS standard and are of good quality.

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Testing and result

Test	Instrument of Test	Result	Remark
Polarity Test	Screw driver	The neon lamp glowed	Fuses, switches are connected to live conductor
Earthing Test:	Megger-Tester	Reading <5Ω	Earthing good
Ring Circuit Continuity	Ohm-meter	Resistance is ≈ 0Ω	Conductors are of good quality
Insulation Resistance Test	Megger -Tester	Reading on Megger read 1MΩ	Quality of insulating materials is good

Conclusion

The project started with the drawing of the plan and the corresponding electrical wiring diagram followed by the preparation of the wooden board and stand. Thereafter the conduit pipes were laid, the wires drawn accordingly and the final terminations and connections were made. Finally, necessary tests were carried out to ensure that the wiring conforms to standard in terms of safety and performance.

Recommendations

The following recommendations were made:

(1) A wiring project using surface type of wiring should be carried out to expose students to both concealed wiring and surface type wiring

(2) A wiring house should be provided in the Department to make the teaching and learning of wiring skills easier.

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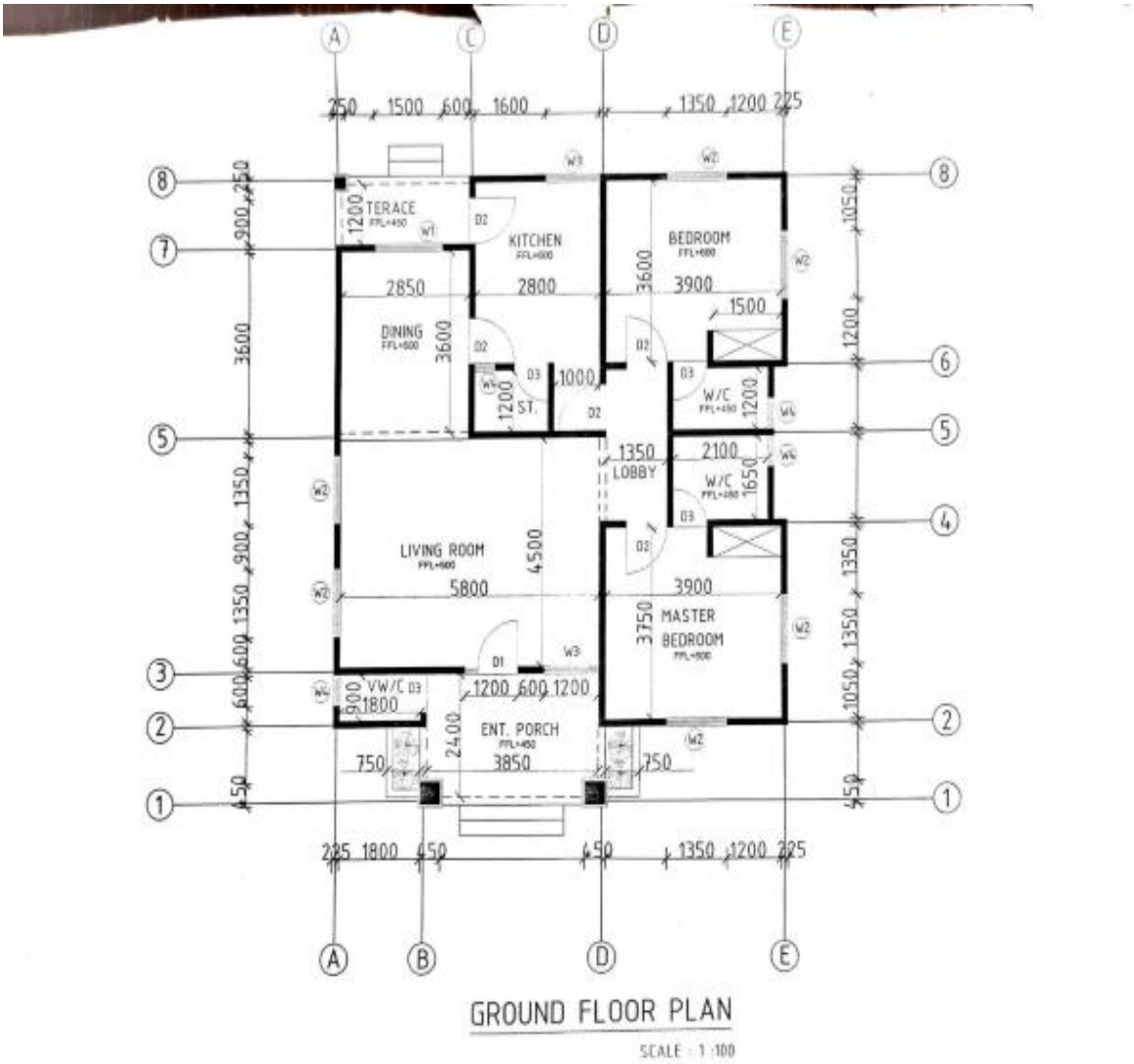
APPENDIX A



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APPENDIX B