[Fadiram, 3(7): July 2016]
DOI-10.5281/zenodo.59142

ISSN 2348 – 8034
Impact Factor- 4.022

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

COMPUTATION OF ELECTRICAL LOAD OF A HOUSING ESTATE USING VISUAL BASIC LANGUAGE

Fadiran, G. O.[*1], Ashim, M. O.[2], Akindele, O. A.[2] & Olasoji, O. S.[3]

[*1]Department of Computer Engineering, The Polytechnic, Ibadan
[2]Department of Electrical Engineering, The Polytechnic, Ibadan
[3]Department of Architecture, The Polytechnic, Ibadan

ABSTRACT

Overloading of electrical system is one of the factors that affect the satisfactory operation of electricity supply of a housing estate. Overloading is a fundamental error at design stage of electricity supply which can be averted if a right approach is used to estimate the electrical needs prior to the specification and installation of electrical equipment.. In this paper, the electrical requirement of a housing estate is calculated, then the relevant regulations of Institute of electrical and electronics engineers (IEEE) for safety and economic reasons are applied and the sizes of electrical equipments are specified. The main objective is to prepare a computer program in object oriented programming language to be able to estimate the electrical load for any housing estate with a click of few buttons on computer interface. The developed program was tested with the data of Palmarium Estate at Karudu Commercial Layout Amac, Abuja. Also, it can be easily modified to accommodate changes if the need arises.

Keywords: *Electrical Equipment, Housing Estate, Overloading, Visual Basic.*

I. INTRODUCTION

The determination of electric load of electrical designs is one of the critical tasks to be performed by the design engineer as the capacity of the load determines the specification of major equipment and components in the design. This task is usually executed by applying the theoretical formulae and insert figures of the sum of the individual load allowed for in the design using an electronic calculator. Deitel, H. M, (2005) defined a computer as a device capable of performing computations and making logical decisions at speeds millions (even billions) of times faster than human beings can. A person operating a calculator could spend an entire lifetime performing calculations and still not complete as many calculations as a powerful personal computer can perform in one second! (Points to ponder: How would you know whether the person added the numbers correctly). Computers process data under the control of sets of instructions called computer programs. Programming is the craft of transforming requirements into something that a computer can execute. Problem solving on computer is a task of expressing the solution to the problem in terms of simple concepts, operations and computer code (program) to obtain the results. In this paper, the processes and steps involved in determining the electrical loads of housing estate is transformed into computer programs using Visual Basic programming language.

II. LITERATURE REVIEW

Housing Estates

Housing estates are the usual form of residential design used in new towns. in Wikipedia.org/wiki/private_housing_estate , housing estate is defined as a group of homes and other buildings built together as a single development and produced by either local corporations or by private developers. Accordingly, a housing estate is usually built by a single contractor, with only a few styles of house or building design, so they tend to be uniform in appearance. The electrical load of an estate consists mainly of lighting and power loads. The uniformity of the majority of the buildings eases the design of electrical services and thus the determination of load current.

Electrical Circuits of Building

Sccaddan B (2000) enumerated the procedure of design of electrical systems of building as follows :

i. Assessment of general characteristics
ii. Determination of design current
iii. Selection of protective device having nominal rating

[Fadiram, 3(7): July 2016] ISSN 2348 – 8034
DOI-10.5281/zenodo.59142 Impact Factor- 4.022

iv. Selection of appropriate correction factors
v. Calculation of conductor current
vi. Selection of suitable conductor size
vii. Calculation of voltage drop
viii. Evaluation of shock risk
ix. Evaluation of thermal risks to conductor

It is required of the design electrical engineer to have executed the assessment of general characteristics of the housing estate the outcome of which results in the determination of the design current which is the ultimate goal of this research. The final outlets of electrical system in a building are lighting points, socket outlets and fixed equipments. The wiring to each of these comes from a fuse in a distribution board, but one fuse can serve several outlets. The wiring from one fuse to all the outlets fed from the same sub-circuit is known as the final sub-circuit. The fuse must be large enough to carry the largest current ever taken at any one instant by the whole of the equipment on that sub-circuit. Since the fuse protects the cables, no cable forming part of the circuit may have the current carrying capacity less than that of the fuse Porges F. (1975). The size of both the fuse and cable is therefore governed by the number and type of outlets on the circuit. The IEEE regulations give guidance on the number of outlets that may be connected to one final sub circuit .

Diversity Factor

Porges F. (1975 published that the fuse must be rated for the largest current taken at any one instant by all equipment on the circuit. This is not necessarily the sum of the maximum currents taken by all the equipment on the circuit, since it may not happen that all the equipment is on at the same time. The design engineer can apply a diversity factor to the total installed load to arrive at the maximum simultaneous load . To do this, the engineer needs an accurate knowledge of how the premises are going to be used which he can get by combination of factual knowledge and intuition. The 16th edition of IEEE regulations tabulates diversity in form of percentage of full loads for various circuits in a range of installations. However, it is for the design enginerr to make a careful judgment as to the exact level of diversity to be applied.

Visual Basic Programming Language

Visual Basic (VB) programming language falls into the category of the fourth generation of programming language evolved from the earlier DOS version called BASIC (Beginners All-purpose Symbolic Instruction Code) Fadiran, G. O. (2005). McBride P.K (2000) published 'Programming in Visual Basic' in which he explained that Microsoft's Visual Basic language, introduced in the early 1990s simplifies the development of Microsoft Windows applications and has become one of the most popular programming languages in the world. The designer uses readymade objects such as forms, labels, CommandButtons and TextBoxes, to build user interfaces that make up the application. This approach to programming drastically reduces the amount of code required to develop a Windows application. It is non procedural because it allows programmers to specify what the computer is supposed to do without specifying how it is to be done. Thus, they need much fewer programming statements to achieve the same result as procedural languages. Visual Basic falls into a category of programming referred to as event driven programming. Event driven programs respond to events from the computer, such as the mouse button pressing, menu selection, mouse click … etc. An event processor governs VB. Nothing happens until an event is detected. Once an event is detected, the code corresponding to that event, the event procedure is executed. Program control is then returned to the event procedure. This process continues until the program ends.

III. METHODOLOGY

Figure 1 depicted the form showing a frame which contains the different types of building that can be in an estate. i.e. two-storey building, 3-storey building, duplexes, etc. For each type of building there are labels for every part of the building i,e the sitting room , the bed room. Kitchen, store, toilets (editable to accommodate more parts) and corresponding text boxes inside which the designer specifies the number of lighting and the load for each point The total lighting is thus computed for each building with the knowledge of the numbers of each building the total lighting load is computed. At the power section. There are label controls for general purpose socket outlets, cooker control unit and air conditioners. The electrical load for each power load is posted on the text corresponding text boxes with the numbers in the design. The total load for power circuit is computed . At the diversity factor, a factor

ISSN 2348 – 8034
Impact Factor- 4.022

of 90% is allowed for the calculated lighting loads and a a factor of 60 % for the power load while a factor of of 70% is allowed for the total load an d the KVA load is calculated .

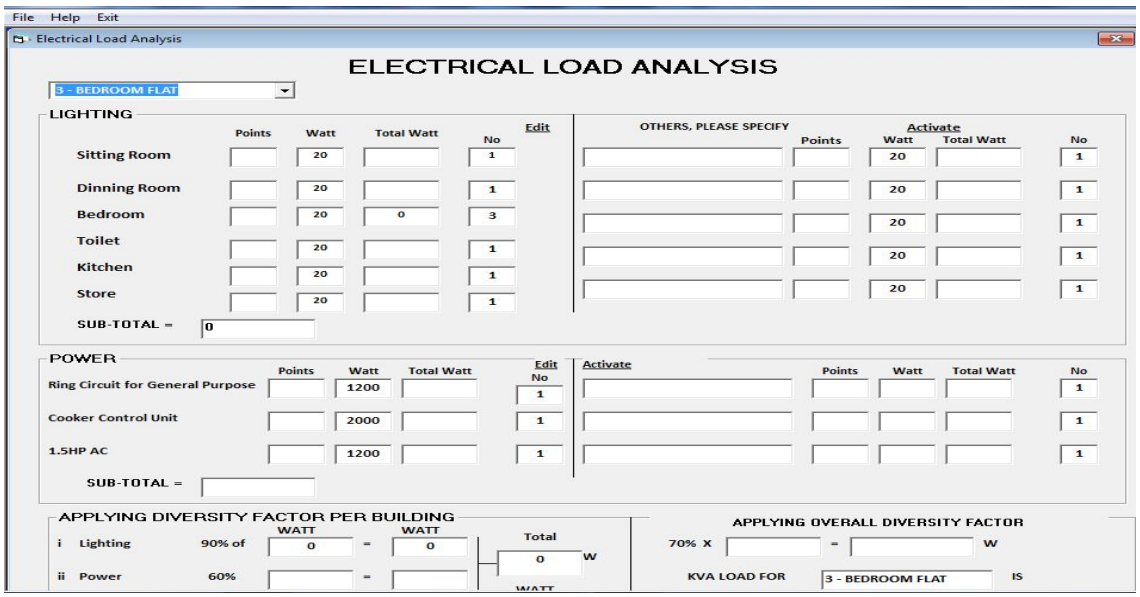

Figure 1: Electrical Load Analysis

Figure 2 is the summary form. inside the frame are calculated load for each residential building and the allowances for the other loads inside the estate i.e the street lighting loads . the schools, the worship centers, the event centre and any others that might be included in the estates the over all load is the computed and the electrical systems like the transformer can then be specified using the IEEE regulation of 60% usage all other electrical systems are then follow suit.

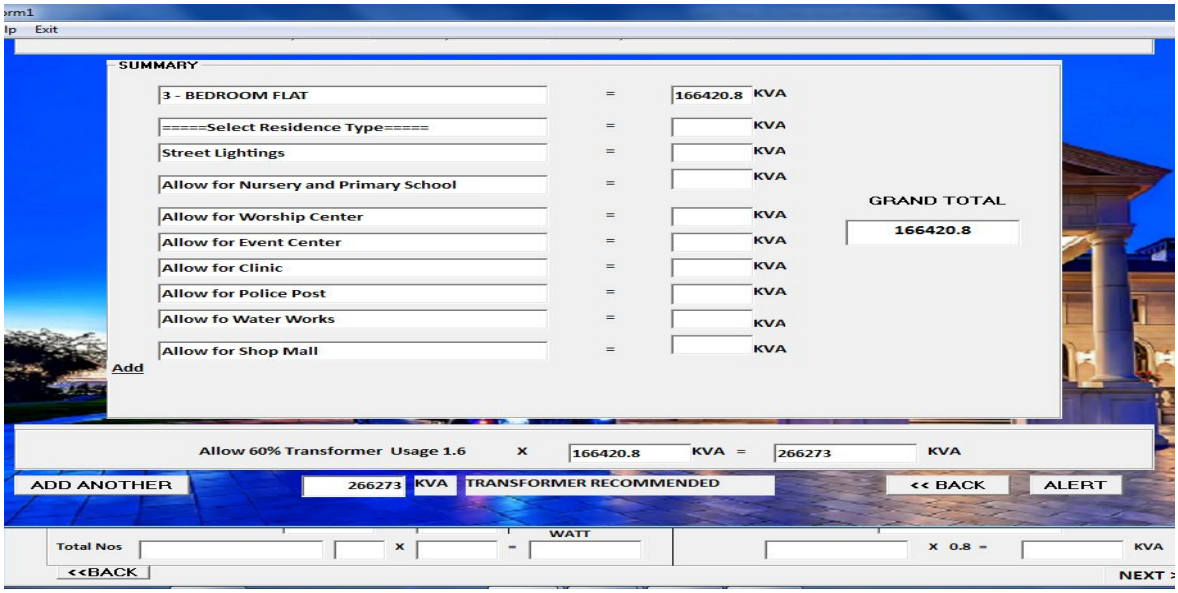

Figure 2: Summary of Electrical Loads

[Fadiram, 3(7): July 2016] ISSN 2348 – 8034
DOI-10.5281/zenodo.59142 Impact Factor- 4.022

IV. RESULT AND ANALYSIS

At Palmarium Estate at Karudu Commercial Layout Amac, Abuja. There are 35 nos 3-bedroom units, 64 nos of 2-bed room units, 4 lock-up shops and a recreation center. The computed electrical loads are as follows:

1. 3-Bedroom Unit

a) Lighting (60W Per Point)

S/N	Description	No of Points	Total (W)
i.	Sitting room	4	240
ii.	Dining room	2	120
iii.	Bedroom	6	360
iv.	Toilet	3	180
v.	Kitchen	2	120
vi.	Store, lobby, others	4	240
	SUBTOTAL		**1260**

a) Power

S/N	Description	No Of Circuits	Allowable Wattage	Total Watts
i.	Rings circuit for General purpose	2	1200	2400
ii.	Cooker control unit	1	2000	2000
iii.	1. 5HP AC	5	1200	6000
	SUBTOTAL			**10400**

Applying Diversity Factor per building

i. Lighting 90% of 1260W = 1134W
ii. Power 60 % of 10400W = 6288W
Total = 7422 W

There are 35 Nos 3-Bedroom units 35 X 7422W = 259770W
Applying overall Diversity factor 70% X 259770W = 181839W
Applying 0.8 power factor
Total load for 3 Bedroom units is 181839 X 0.8 = 145KVA

1. 2-Bedroom Units

a) Lighting (60W Per Point)

S/N	Description	No of Points	Total (W)
i.	Sitting room	4	240
ii.	Dining room	2	120
iii.	Bedroom	4	240
iv.	Toilet	3	180
v.	Kitchen	2	120
vi.	Store, lobby, others	4	240
	SUBTOTAL		**1140**

b) Power

S/N	Description	No of Circuits	Allowable Wattage	Total Watts
i.	Rings circuit for General purpose	2	1200	2400
ii.	Cooker control	1	2000	2000

ISSN 2348 – 8034
Impact Factor- 4.022

	unit			
iii.	1. 5HP AC	4	1200	4800
	SUBTOTAL			9200

Applying Diversity Factor per building
i. Lighting 90% of 1140W = 1026W
ii. Power 60 % of 9200W = 5520W
TOTAL = **6546 W**

There are 64 Nos 2-Bedroom units 64 X 6546W = 418944W
Applying overall Diversity factor 70% X 418944W = 293260W
Total load for 2-Bedrroom units is 293260 X 0.8 = 235KVA

2. ***Street lightings*** There 80 nos of 250W MBF lamps
Total street light loads 80 X 250W = 20000W 20 KVA

3. Allow 5KVA per Lock up shops
Total load for 4 nos lock up shops is 5 X 4 = 20KVA

4. Allow for Recreation Center = 40KVA

Summary

S/N	Description	**Total load (KVA)**
1.	3-Bedroom Units	145
2.	2-Bedroom Units	235
3.	Street lightings	20
4.	Allow 5KVA per Lock up shops 5 X 4	20
5.	Allow for Recreation center	40
	GRANDTOTAL	**460**
	Allow 60% Transformer usage 1.6 X 460KVA	**736**

Having obtained 736 KVA as the total load for the estate, the next available rating of electrical equipment is 750 KVA. Thus the 750KVA is the nominal rating for the estate. It is the value that form the basis for the main equipment i,e 750 KVA Transformer and all other electrical distribution and protective equipment follow suit.

V. CONCLUSION

This paper presents determination of electrical load of a housing estate. A computer program in object oriented language is prepared which determines the electrical load for housing estate. The application of readymade object such as forms, frames, labels, command buttons and text boxes was used to build the user interfaces. The program designed has advantages over the conventional methods for its high precision and accuracy.

REFERENCES

1. *Deitel, H. M, (2005). "C++ How to Program", Fifth Edition, Prentice Hall, ISBN-13 978-0-13-185757-5 pp 3*
2. *Fadiran G. O. (2005). "Computer systems and Programming", Triumph Concepts And Printing Consultants, 20 Oyo Road Mokola Ibadan. Pp 52-54.*
3. *McBride P.K (2000). "Programming in Visual Basic", The Guernsey Press Company Ltd Braye Road Vale. Pp 8-15*
4. *Porges F. (1975). "The Design of Electrical Services for Buildings", John Wiley And Sons, Inc New York. Pp 63-65.*

ISSN 2348 – 8034
Impact Factor- 4.022

5. *Scaddan B. (2000). "Design And Verification of Electrical Installations", Butterworth-Heinemann Linacre House, Jordan hill, oxford OX2 8DP. Pp 55-57.*
6. *Wikipedia.org/wiki/private_housing_estate.*