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Nigeria in Space and a Satellite Dynamic Server

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ABSTRACT
Choice rather than chance gives direction to development, growth and progress. Nigeria choice to be in space is a welcome development. Communication and Observatory satellites have been successfully launched into space by the most populous nation in Africa. NigComSat-1R, a replacement of NigComSat-1, was put in space in December 2011 to provide wide range of services, not only for Nigerians at affordable prices, but for Africa continent at large. Before the euphoria concomitant with this launching wane, what should be the next line of action for the giant of Africa? When will the next space vehicle build fully by Nigerians, launch right in Nigeria soil, be in space? This paper looks into the efforts so far made and pointed out what next should be done. The physics of space science needs to be further studied, if accurate results in spacecraft launching and positioning are to be procured always. Also, we developed a dynamic class library for thirteen Satellite models using Microsoft Visual Studio, 2010. The robust functionalities of our server were tested and compared with previous works, and found to work to specifications. Developers will find our dynamic server indispensable in swiftly developing accurate satellite applications.

General Terms
Satellites, Server, Nigeria.

Keywords
NigComSat, NigeriaSat, Physics

1. INTRODUCTION
Class library is the imperative developmental foundation for all software applications. It is the platform for functionalities expression. That is within it, you declare and/or instantiate all objects as functions and/or sub-procedures or properties. The scope of what is declared is a function of public or private keyword. If private, the functionalities are inaccessible outside the class, the opposite is true of public. There is no limit as to the number of functionalities you can write. Tasks to perform dictate codes to write, as well as the rule of keep-it-short for ease of maintainability.

A man who buys a car is a buyer, not a manufacturer. The comfort he derives from the use of the car, to a large extent, is dictated by the manufacturer. The neighbours, friends and relatives who come around to sight the car and rejoice with the happy buyer are observers. Similarly, a company or a nation who launches a satellite built by a company is a purchaser, not a manufacturer. The launching of the satellite into orbit, either in the manufacturer's land or the buyer's soil or another place entirely should be a source of joy as it serves its purposes. Those present at the launching in their flowing, smart regalia, besides the builders, are observers.

A satellite in geosynchronous orbit which possesses the same orbital period as the earth's rotation period is geosynchronous satellite. Geostationary satellite, a special case of geosynchronous satellite, has a geostationary orbit–a circular geosynchronous orbit directly above the earth's equator [1]. The altitude at which the satellite orbital period is identical to the earth's rotation once every sidereal day (23hrs 56minutes 4 seconds) is 35,786km (22,236miles).

A geosynchronous satellite appears fixed relative to the earth's surface, but in actual fact it shifts and after each sidereal day must be repositioned using on-board power thrusters [1-4].

Nigeria observatory satellite, NigeriaSat-1 was launched into space on September 27, 2003 for Nigeria to register her footprint in space and to be a satellite data provider [5]. The NigeriaSat-1, the first Nigeria Satellite, is a low earth orbit Micro-satellite for disaster monitoring; it provides high daily temporal resolution images. With it, according to Isoun (2002), Nigeria will be able to have national independence, assessable, inexpensive and flexible dynamic remote sensing capabilities.

The communication satellite NigComSat-1, with expected service life of 15 years, was launched into space May 14, 2007 from the Xichang Satellite Launch Centre (XSLC) in South West China abroad an enhanced Long March 3B (LM-3B/E) launch vehicle; and by July 6, 2007, it was put in orbit at a geosynchronous orbit position of 42.50E [1,6].

In this paper, we discuss the efforts made so far in space science and technology in Nigeria, and also discuss what should be done now that she has registered her footprint in space and demonstrated her full commitments to space science and technology. We develop a dynamic server dvSatCls, using Microsoft Visual Studio 2010 for planet mass, satellite mean orbital radius and period, azimuth and elevation angles, escape velocity and satellite velocity, satellite acceleration and height above the earth. The equations and workings of all the models will be made available dynamically through properties with a view for their use real time for learning and teaching.

2. NIGERIA IN SPACE
Efforts of the Federal Government of Nigeria to be in space should be highly commended. The Government recognized the growing significance of space activities in world affairs and the need to acquire authoritative scientific information to address societal and economic problems of Nigeria [7]. Nigeria has vision to develop and grow, to construct and progress economically, scientifically and technologically; and this was articulated in the nation space policy. The policy emphasized the design, development, construction, operation, and maintenance of space related technologies that Nigeria should find compatible with the development of her economy [7]. The establishment of National Space Research and Development Agency (NASRDA) in 1999 demonstrated the stout commitment of Nigeria to space technology and better Information Communication Technology services with reference to e-learning, e-commerce, e-medicine, among others. The Nigeria National Space Policy was approved in 2001; and by December 15, 2004 Nigeria Communication

Satellite (NigComSat-1) limited signed a contact worth over forty billion Naira for the building of a communication satellite [6]. Within three years the China Great Wall Industry Corporation, the manufacturer of our treasure, came up with a technologically well-decked bride.

NigComSat-1, which has coverage areas over Africa, Middle-East and Europe, carried 40 transponders (28 active, 12 redundant) in four communication satellite frequency bands of C, Ku, Ka and L. Despite its four gateways in Northern Nigeria, South Africa, China and Italy, NigComSat-1 was damaged beyond repairs and could not be recovered for use again barely one and half years after being launched. It is no longer news that NigComSat-1 had a launch mass of 5150kg, and that power failure caused its destruction [1]. What really is new and news is that NigComSat-1 has been replaced with NigComSat-1R, a super-hybrid geostationary satellite optimized to provide diverse services which include internet, data and video services [6]. This replacement satellite has the same features as its predecessor but with modified payload aimed at addressing domestic and international market needs. In addition to hybrid payload, NigComSat-1R has stronger footprints and centre beams over the Africa continent, software re-programmable ability, more powerful strength, increased reliability and high fade margins compensation for attenuation losses due to hydrometeors, and high fault tolerance [6].

It is instructive to note that NigComSat-1R is the 8th satellite built on Dong Fang Hong 4 (DFH-4) satellite bus developed by China Academy of Space Technology (CAST) for in-orbit delivery and the 18th flight LM-3B launch vehicle and the 154th flight in the series of the Long March launchers [6]. Fifty-four years after the first satellite Sputnik-1 was launched into geocentric orbit by the defunct Soviet Union, Nigeria got not only a replacement of her NigComSat-1, but Nigerian-UK trained Engineers designed NigeriaSat-X. Although Sputniks-1 was the first Satellite to be in orbit October 4, 1957, it was not until April 6, 1965 that the first commercial geosynchronous Satellite, EarlyBird, was launched by the International Telecommunication Satellite Organisation (INTELSAT] into space. Sputnik-1 was an experimental Satellite that transmitted telemetry information back to the earth for 7 days [8]. Also, the first artificial communication satellite (SCORE, for Signal Communicating by Orbiting Relay Equipment) was put in space December 18, 1958 by the U.S. Air Force. In July 1962 Telstar J, the first active real time repeater satellite and the first non-governmental space involvement, was launched into space to verify the feasibility of using broadband microwave repeaters for commercial telecommunication applications. Six months after launching Telstar J designed and built by Bell System, Relay I was launched by National Aeronautics and Space Administration (NASA) into space. This RCA built satellite was for experiments with the transmission of voice, video and data [8].

Besides, there are over 300 operational geosynchronous satellites as at today. The first operational geosynchronous satellite, Syncom, invented by Harold Rosen at Hughes Aircraft Company, was launched July 26, 1963 on a Delta rocket B booster from Cape Canaveral. Syncom 2, which was launched a few months later, was used for the first satellite-relayed telephone call between the Prime Minister of Nigeria, Sir Abubakar Tafawa Balewa and the President of United States of America, John F. Kennedy. By August 19, 1964 Syncom 3 was put in geostationary orbit with a Delta D launch vehicle from Cape Canaveral to telecast the 1964 summer Olympic in Tokyo to the United States of America [1].

The Nigeria made spacecraft, NigeriaSat-X launched alongside NigeriaSat-2 by a Dnepr Launch Vehicle from Yaseny, Russia is a source of celebration because it was designed by Nigerians, though in a foreign land and under alien instructors. The NigeriaSat-2 with expected life span of seven years, built by Surrey Satellite Technology Limited (SSTL) was, according to the manufacturer, the most advanced small satellite ever to be launched to define new standards in Earth observation and Avionics [9]. This replacement of NigeriaSat-1 is expected to provide high resolution maps of Nigeria every four months and high quality geospatial data. With 2.5 meters GSD in the panchromatic channel, NigeriaSat-2 is truly a high resolution satellite, sure remarkable improvement over NigeriaSat-1 [6].

Although geostationary satellites cause propagation delay, and require more power and significant transmitter and maintenance cost in space, they are far better than terrestrial microwave communications and low-orbit satellites [1-2, 4]. For one, the satellite footprint permits simultaneous transmission to several locations. Also, minus certain weather conditions and solar disturbances which impair transmission, propagation path to and from the satellite is frequently available; thus, constant data, video, and services are made available most times. Also, geostationary satellites have the merit of remaining permanently in the same area, consequently the ground-based antennas do not need to track them but remain fixed in one direction [1, 4].

Again, we have every cause to celebrate, the colossal amount spent notwithstanding. At least a journey of a thousand years, the Chinese proverb says, begins with a step. More so, the Yoruba adage says no one stands afar off to know the sweetness of a stew. By buying a satellite with a 15-year operational support service and a comprehensive training program [6], we are moving close to space technology. However, in order to draw closer there are certain things that should be done. Satellite technology, without atom of doubt, is a veritable tool for strategic planning, youth empowerment, military surveillance, apart from its impacts in all facets of human endeavours such as health, education, agriculture, and disaster management and information communication. Satellite, according to Tesi (2002), has significantly improved the reliability and accuracy of aviation and maritime communications, removing these functions from the high frequency (HF) portion of the electromagnetic Spectrum. Consequent upon advances in Satellite technology cost of required terrestrial equipment has dropped. Besides, satellite provides the cheapest way of transmitting information over a long distance.

The satellite technology, however, has not been fully grasped in most developing nations; consequently, the need to rely on the developed nations for building satellites and launching them into orbit in foreign land. NigComSat limited, a company charged with the responsibility of providing internet infrastructure, voice over internet protocol, satellite and wireless communications, turns six in April 4, 2012. She is committed to providing quality and reliable services, which without argument, could only be achieved promptly and accurately with the provision of electronic equipment driven by accurate software packages.

3. DYNAMIC SERVER

In this section, we develop a robust class library, dvSatCls using Microsoft Visual Studio 2010. A software package without dynamic class library is like a woman who gives birth without pregnancy. Class library is the fuel that powers all software applications, small and big, simple and complex. Kepler laws are very significant in the study of satellites; for instance, satellites obey the third law of Kepler which says that the square of the orbital period of planets are directly proportional to the cube of the semi-major axis of the orbits [10]. Mathematically put, we have, $T^2 \alpha R^3$

From this law, we know that as the mean orbital radius (R) increases, the orbital period (T) on a circular orbit increases. The satellite period and mean orbital radius is related to planet mass, M as seen in Table 1 S/n 1. The planet mass varies from one planet to another. For instance, the earth mass is about 80 times that of the moon [11]. Satellites with different masses moving in the same orbit possess identical acceleration which has the tendency to move towards the centre of the orbit. Also, the mean orbital radius is the same for all the satellites in the same orbit. Consequently, the speed of all the satellites (Vs) in the same orbit, as well as the period (T), is the same. We should not forget that without a centrifugal force, the centre-seeking satellites will collapse inside the orbit. The gravitational force acting on the satellite and the centripetal force must balance each other for the orbiting satellite to stay in orbit. By equating the two forces, we obtain the velocity of the satellite (see Table 1, S/n 6). For fuller explanations and detailed derivation of the equations in Table 1, see [3, 12-20]. Also, G is not acceleration due to gravity (g in m/s2), which on earth is about 9.8m/s2; and on the moon, it is one-sixth that on the earth (gm = g/6). However, G is a universal constant written in capital letter G, while acceleration due to gravity is always in lower cap (g), and the units are not the same (see Table 1, S/n 1). The data inputs' order in a DataGridView (DGV) control argument for all the methods is crucial to obtaining correct result(s); thus it should be followed without alteration.

Table 1 shows the satellite equations treated, nine serial numbers, but thirteen models. It is healthy for future maintenance and ease of call to modularize the models. The methods in our class library (dvSatCls) are in Table 2, the last column gives the task(s) of the methods. All the methods are polymorphized, and a reference DGV control holds the inputs and returns the result(s) in it.

4. WHAT NEXT?

Those who choose to grow and be ahead of others embrace software packages in doing their daily chores, business activities and in conducting quality researches. Well-designed, well-conducted, much-relied-upon experiments often employ the use of computer loaded with good software applications. Without software packages, there won't be what is today known as computer. All computers are driven by software packages.

Nigeria has done it again as she further registered her footprint in orbit to further provide satellite data for socio-economic, techno-scientific development. Nigeria is in space, but she is not truly in space. He who has the pipe, the proverb says, dictates the tone. We bought what we were told was faithfully packaged; but the

Table 1: Some Satellite Models

S/n	Item	Equation
1	Planet Mass, M	$M = \frac{4\pi^2 R^3}{GT^2}$ Where R = Satellite mean orbital radius. T= Satellite period G = universal gravitational constant with numeric value of $6.6726 \times 10^{-11}\ Nm^2kg^{-2}$; M = planet mass. Data inputs' order: R, T
2	Satellite orbit period, T	$T = \sqrt{\frac{4\Pi^2 R^3}{GM}}$ Also, T is obtained from (1). Terms as in (1) above. Data inputs' order: R, M
3	Elevation angle of Antenna, E	$E = \tan^{-1} (x/y)$ Where $x = Cos(G).Cos(L) - 0.1512$ $y = \sqrt{[1 - Cos^2(G).Cos^2(L)]}$ $G = S - N$ $S = Satellite\ Longitude$ $N = Site\ Longitude$ $L = Site\ Latitude$ Data inputs' order: S, N, L
4	Azimuth angle of antenna, A	$A = 180^0 + tan^{-1}(k)$ Where $k = \frac{\tan(G)}{Sin(L)}$ Terms as in (2) above. Data inputs' order: S, N, L

5	Escape Velocity, V_e	$Ve = \sqrt{\frac{2GM}{R}}$ Terms as in (2) above. Data inputs' order: R, T
6	Satellite Velocity, Vs	$Vs = \sqrt{\frac{GM}{R}}$ or $V_s = \frac{2\lambda R}{T}$ Terms as in (1 and 2) above. (a) Data inputs' order: M, R (b) Data inputs' order: R, T
7	Satellite mean orbital radius, R	$R = R_e + h$ $R = \frac{V_s^2}{a}$ $R = \sqrt{\frac{GM}{a}}$ a = Satellite acceleration h = height of satellite above the earth R_e= earth radius with numeric constant of 6.37 x 10^6m Others terms as previously defined. (a) Data inputs' order: R_e, h (b) Data inputs' order: V, a (c) Data inputs' order: M, a
8	Satellite acceleration, a	$a = \frac{GM}{R^2}$ or $a = \frac{V_s^2}{R}$ Terms as defined above. (a) Data inputs' order: M, R (b) Data inputs' order: V, R
9	Satellite height above the earth, h	$h = R - R_e$ Terms as defined above. Data inputs' order: R, R_e

Table 2. dvSatCls class library Methods

S/n	Methods	Task(s)
1	dvCalAzimuthAng	It evaluates azimuth angle.
2	dvCalElevnAngAnt	It computes elevation angle.
3	dvCalEscapeVelocity	It calculates escape velocity.
4	dvCalPlanetMass	It computes planet mass.
5	dvCalSatAccn	It calculates satellite acceleration.
6	dvCalSatHeight	It evaluates satellite height above the earth.
7	dvCalSatPeriod	It estimates satellite period.
8	dvCalSatOrbitalR	It estimates satellite mean orbital radius.
9	dvCalSatVelocity	It evaluates satellite velocity.

reality is that profit rather than national development is the driving force behind any company goal. The manufacturers of our satellites dictated what we got, including faulty battery. If half of what was utilized to buy a satellite was pumped into research in Nigeria Universities and research institutions towards building a true virile satellite technology, Nigeria by now will be on the true path to satellite technology. To be a builder, rather than a buyer and a consumer, is the best for the growth of the nation; and it will tremendously challenge Nigeria Scientists, Engineers and Technologists; and true national goals and development will further be carefully defined and scrupulously pursued.

The ingenuity of Nigerian-UK trained Engineers should be commended for producing NigeriaSat-X in UK under UK Engineers using UK facilities. Enough has been spent buying satellites, Nigeria Government should pump money into tertiary institutions and research institutes in Nigeria to commence true space technology as young Nigerians are trained in Nigeria. State-of-the-art facilities will be in the nation not only to build satellite but to launch same. This will provide more jobs for Nigerians, apart from developing the nation and conserving our foreign reserves. Let's start from somewhere as those UK-trained Nigerian Engineers are imported back to Nigeria to train Nigerians in our citadel of learning. A satellite built in UK by UK-trained Nigerians under UK experts is not truly a Nigeria satellite. A day is coming, very near too, if research is brought and established in our institutions, when true Nigeria satellite will be built and launched on Nigeria soil.

Physics is all about facts and figures; its application is to produce precise results for human benefits regardless of nation or color. If satellites in orbit are misbehaving

the physics of spacecraft should further be looked into by the manufacturer, especially the indigenous Scientists, Technologists and Engineers. A problem once identified should not be denied, but isolated for analysis, and immediate possible solution should be proffered to nib the problem in the bud. Further study of the problem(s) will expose its cause, nature and magnitude with a view to preventing future occurrence.

Sound growth is very far from any nation who fails to embrace physics, the king of all subjects. In virtually every aspects of life, physics is used to do one thing or the other. Without physics, there won't be computer and myriad electronics gadgets that bring speed and comfort. Upon the principles of physics securely rests space science and meaningful technological growth which every nation should pursue with her vigour this 21st century. It is therefore imperative that every nation willing to develop, yes remove *under* from underdeveloped, to embrace Physics, the chief of all courses.

To achieve our noble national goals for space and technological advancement more Physicists should be employed to teach various aspects of physics in our elementary and tertiary institutions all over Nigeria. Space Science should be introduced in the curriculum as from primary school to secondary school. Thus, the current curriculum needs to be reviewed to accommodate all necessary and desire changes in-depth which modern trend of things impacts on education. We should stop deceiving ourselves like the mother of twins who, when asked about the second child who at birth had been committed to mother earth, will always say he is at a distance location. Nigeria has not manufactured aircrafts but bought aircrafts.

5. RESULTS AND DISCUSSION

Methods in Table 2 generate the results in Tables 3-11. By keeping the number of results shown low, we are able to display as much results. However, one hundred thousand inputs could be accepted and processed for multiple results. Results could be shown in various formats set by user via dvFMT property. Each of the models in Table 1 has a property to display their equation, which we expect is to be called separate from the workings. Note that S/ns 5 and 9 have two properties each, while S/n 8 has three. We separated them for ease of call. The workings are generated for each of the models with a view to providing dynamic workings which could be employed real-time for teaching and learning, and return it through dvGetResult property. At each stage of operation dvInfo property will provide rich information on the server status. That software saves time and gives high degree of accuracy is evidence in dvSatCls capacity to accept and process a hundred thousand data which no super-human could evaluate in less than ten minutes in various desired formats. The variables used in Tables 3-11 are identical to that already defined in Table 1.

Table 3: Azimuth Angle

S	N	L	G	Tan(G)	Sin(L)	k=tanG/SinL	y=ArcTan(k)	A
30	40	12.0	-10	-0.17633	0.207912	-0.848085935	-0.703381801	139.70
60	79	10.0	-19	-0.34433	0.173648	-1.982903696	-1.103705927	116.76
10	89	5.0	-79	-5.14455	0.087156	-59.02713756	-1.553856587	90.97
12	39	15.0	-27	-0.50953	0.258819	-1.968655163	-1.100800238	116.93
40	21	1.5	19	0.344328	0.026177	13.153848540	1.4949189030	265.65
83	90	35.0	-7	-0.12278	0.573576	-0.214068349	-0.210885502	167.92

Table 4: Elevation Angle

S	N	L	G	x	y	x/y	tan^(-1)(x/y)
30	40	12.0	-10	0.812087	0.268473	3.024843	71.7063397
60	79	10.0	-19	0.779954	0.364626	2.139052	64.9440570
10	89	5.0	-79	0.038883	0.981768	0.039605	2.26801321
12	39	15.0	-27	0.709446	0.509203	1.393247	54.3311922
40	21	1.5	19	0.793995	0.326508	2.431780	67.6464827
83	90	35.0	-7	0.661846	0.582199	1.136804	48.6632266

Table 5: Satellite height, h

R	T	M
30	15	7.10E+13
60	25	2.05E+14
10	8	9.25E+12
12	9	1.26E+13
40	10	3.79E+14

Table 6: Satellite Period, T

M	R	Velocity
30	40	1.00E-05
60	79	1.01E-05
10	89	3.87E-06
12	39	6.41E-06
40	100	7.31E-06

Table 7: Satellite Acceleration, a

Given M and R			*Given V and R*		
M	**R**	**a**	**V**	**R**	**a**
30	40	1.25E-12	10	40.0	2.50
60	79	6.41E-13	20	79.0	5.06
10	89	8.42E-14	30	89.0	10.11
12	39	5.26E-13	40	39.0	41.03
40	100	2.67E-13	50	100.0	25.00
20	1.6	5.21E-10	60	1.6	2250.00

Table 8: Satellite height, h

R	Re	h = R - Re
30	40.0	-10.0
60	79.0	-19.0
10	6370000.0	-6369990.0
12	39.0	-27.0
40	100.0	-60.0
20	1.6	18.4

Table 9: Satellite Period, T

R	M	T
30	40.0	19984082.0
60	79.0	40220332.0
10	89.0	2578323.0
12	39.0	5120022.7
40	100.0	19459080.0
20	1.6	54389783.0

Table 10: Satellite radius

Given Re and h			*Given V and a*			*Given M and a*		
Re	**h**	**R = Re + h**	**V**	**a**	**R**	**M**	**a**	**R**
30	458	488	30	800	1.125	542	800	6.72E-06
60	79	139	60	79	45.56962025	300	79	1.59E-05
6370000	790	6370790	265	6400	10.97265625	265	6400	1.66E-06
12	213	225	12	39	3.692307692	12	39	4.53E-06
40	100	140	400	100	1600	400	100	1.63E-05
4600	1.6	4601.6	20	1.6	250	20	1.6	2.89E-05
6370000	7000	6377000	17890	3000	106684.0333	0.2378	3000	7.27E-08

Table 11: Satellite Velocity (Vs)

Given R and T			*Given M and R*		
R	**T**	**Vs**	**M**	**R**	**Vs**
30	2	9.7081296	30	40.0	7.07E-06
60	7	7.3386562	60	79.0	7.12E-06
10	8	2.8024956	10	89.0	2.74E-06
12	9	2.8944050	12	39.0	4.53E-06
40	10	5.0132566	40	100.0	5.17E-06
20	15	2.8944050	20	1.6	2.89E-05

In testing our class library, we used different Re (see Tables 8 and 10), but we should realize that the correct value is 6.37 x 10^6 m. Also, in Tables 3-11 the arbitrary values are deliberately not given in ascending order to ensure that the class is working independent of the order of the inputs. However, the inputs order in a DGV control is very important; else wrong result(s) will be obtained. The order has been given in the last column of Table 1.

In evaluating Azimuth angle (the horizontal pointing angle of the earth station antenna), G and L should be converted to radians; so also x/y value in column 7 of Table 4 before its arc tan is obtained. The elevation angle is the looking angle to the satellite. The NigComSat-1R has a better looking angles and shorter latency for intra Africa communication traffic [6]. The satellite acceleration and velocity could be evaluated given two different inputs as seen in Tables 7 and 11 respectively. The satellite mean orbital radius could be estimated in three ways (see Table 1, S/N 7) depending on what are given as inputs. Table 10 gives the entire results for the three different inputs. The equations are given separately, calling one of the thirteen properties. It could be displayed with and apart from the workings. In each case the equations are supplied, values substituted in them dynamically before obtaining the results. The workings could be utilized real-time for teaching and learning. The accurate dvSatCls class library provides comprehensive functionalities for computing all the models treated. All the results are compared with previous works [3, 10, 12-13, 17-18, 21-23], and found to be accurate.

6. CONCLUSION

Nigeria has not truly built a satellite, but bought and launched observatory and communication satellites into space. Concerted efforts should be made to redefine our school curricula to meet current global innovative, creative and competitive challenges of the 21st century. Younger ones should be encouraged to appreciate science, especially physics, the father of all subjects, and to seek knowledge and skill for personal use and national development.

A flexible and accurate powerful dynamic server for thirteen satellite models was developed. More satellite models should be included in dvSatCls class library, besides developing satellite client application for use at all levels of our educational systems. Our burning expectation is that we look forward to seeing the first satellite build by Nigerians under Nigerian instructors in Nigeria, and launch into space by industrious Nigerian Scientists, Engineers and Technologists in Nigeria. It is a possible task!

REFERENCES

[1] wikipedia :www.en.wikipedia.org

[2] S.Jeffrey Beasley and T. Joseph Page II. Computing Azimuth and Elevation Angles With Javascript. www.et.nmsu.edu (Year Not Given).

[3] nasa: www.grc.nasa.gov/centers/glenn/home/index.html

[4] infoplease :www.infoplease.com

[5] R.A. Boroffice, The Nigeria Space Program:An Update. Africa Skies. 2(2008) 40-45.

[6] nigcomsat :www.nigcomsat.net

[7] T.T. Isoun, Speech of the Honourable Minster of Science and Technology at theFirst Regional Workshop on Satellite Communications, at OAU, Ile-Ife. Nigeria.Pp. 1-10, 16-20 Sep. 2002.

[8] I. Tesi Raji, Signal Processing in Satellite communications. First Regional WorkshopOn Satellite Communications, at OAU,Ile-Ife. Nigeria. Pp. 1-10, 16-20. Sep. 2002.

[9] www.sstl.co.uk

[10] www.easycalculations.com

[11] M. Nelkon, Principles of Physics. CSS Bookshops and Hart-Davis Educational, 1978.

[12] www.ajdesigner.com/phygravity/keplers-law-equation-period.php

[13] aticourses :http://www.aticourses.com/

[14] braeunig www.braeunig.us/space/index.htm

[15] csgnetwork :www.csgnetwork.com

[16] daviddarling:www.daviddarling.info

[17] www.eculator.com/formula

[18] www.ga.gov.au

[19] www.philiplaven.com

[20] www.reflib.wikispaces.com

[21] www.satcom.co.uk

[22] www.satellite-calculation.com

[23] www.usno.navy.mil