A Prototype Interactive Result Checker System: A Case Study of Nigeria Polytechnic System

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Abstract: **The main object of information system is to provide information to its users that enable decision making process. The essence of this work is the design of an efficient computerized system that replace the manual result processing, that is prone to a lot of paper works and errors. Background to the information processing was given in the light of courses, credit units, manual processing of result and point grading system as it relates to Polytechnic tertiary institutions in Nigeria. The challenges with the manual result processing were identified, and a prototype software application was developed as insight into how future feature solution will look like. The prototype demo was developed by employing the use of Visual Studio for the front end and MySQL relational database for the backend. The solution serves as data repository that would enable the creation of design for customize solution for respective institution.**

Keywords: **CGPA; GPA; Result; Prototype; Data; Information.**

I.   INTRODUCTION

One of the bane of policy formulation and management of education system in Nigeria is timely and inaccurate data. To obtain accurate data on admission, examination organising bodies; nonteaching; teaching staff and even facilities appears to be a difficult task for the institutions managers. This lack of adequate cognitive development in the areas of data collection; analysis and storage seem to be marred by other socio-politico-economic factors such as fraud; politics of national resource allocation and social apathy; thus; the need to develop an electronic result management system which will serve as an information system. The main object of an information system is to provide information to its users. An information system that evaluates, analyzes, and processes an organization's data to produce meaningful and useful information based on which the management can take right decisions to ensure future growth of the organization [1].

However, [2] hinted that Information System (IS) can be any organized combination of hardware, software, communications networks, data resources, people, policies and procedures that stores, retrieves, transforms and disseminates information in an organization. Hence, an MIS provides information in the form of predefined reports that support the decision-making processes of the managerial users. In an academic community, the automated result is intended to generate reports about students' results to guide the day-to-day decisions of the school management in the maintenance of student status and awarding of diplomas. In this paper a prototype system is proposed that will serve as guide to development of information system. According to [3], Software prototyping is the process of creating an incomplete model of the future full-featured software program, which can be used to let the users have a first idea of the completed program or allow the clients to evaluate the program. This has several advantages such as: the software designer and implementer can obtain feedback from the users early in the project. The client and the contractor can compare if the software made matches the software specification to which the software program is built. It also allows the software engineer some insight into the accuracy of initial project estimate and whether the deadlines and milestones proposed can be successfully met. In this work a prototype system is proposed that will give insight into how the future

system will look like. The paper is aimed at developing an automated prototype system that can save the time involved in result processing, that is, CGPA computation in a Diploma awarding institution. This will permit easy and fast access to student information especially results and student status from a normalized database.

A. BACKGROUND

The grading system used by Nigeria Polytechnics is the Four-Point Grading System, established by the Nigerian Board of Technical Education (NBTE). The grade point system that is used for both the National Diploma programme (ND) and the Higher National Diploma programme (HND) as approved by the National Board for Technical Education (NBTE) is shown in Table 1.

Table 1: The NBTE Four-Point Grading System

Score Range	Letter Grade	Grade Point
75 and above	A	4.00
70 – 74	AB	3.50
65 – 69	B	3.25
60 – 64	BC	3.00
55 – 59	C	2.75
50 – 54	CD	2.50
45 – 49	D	2.25
40 – 44	E	2.00
00 - 39	F	0.00

The courses offered in a diploma programme are allocated a number of credit hours which vary from one course to another, because the courses vary in their needs and scope. Hence some are allocated greater credit hours than others. The measure of performance of a student in any course is given by the grade-points obtained in that course. The grade-points obtained by a student in any course are determined by multiplying the value of the grade (numeric grade) by the credit hours of the course. The total grade-points are obtained by summing up the grade-points of all the courses offered. The Grade-Point Average (GPA) is computed by dividing total grade-points by the sum of credit hours of all the courses offered in that period. Thus

$$GPA = \frac{\text{Total Grade-Points of the courses offered in Semester}}{\text{Summation of the credit hours of the courses in Semester}}$$

The table below (Table 3) illustrates how a student's GPA may be calculated manually. If a student obtains the grades as shown at the end of a semester, the computation of GPA is as shown

How to Calculate Grade Point Average (GPA)

Suppose a student scores in the first semester examination are as shown in Table2:

Table 2: Student Score

COURSE CODE	COURSE TITLE	SCORE
COM 101	Introduction to computing	62
COM 112	Introduction to Digital Electronics	77
COM 113	Introduction to Programming	59
STA 111	Descriptive Statistics	70
STA 112	Elementary Probability	60
MTH 111	Logic & Linear Algebra	67
MTH 112	Function & Geometry	82
MTH 211	Calculus	47
GNS 101	Use of English 1	61
GNS 111	Citizenship Education	58
LIS 001	Use of Library	40
BAM 111	Introduction to Business	50

Table 3: Calculation of GPA

Course Code	Course Title	Score	Letter Grade	Grade Point (G.P)	Credit Unit (C.U)	Value Point (V.P) = G.P x C.U	Grade Point Average (GPA)
COM 101	Introduction to computing	62	BC	3	2	6	GPA TVP/TCU Therefore, GPA = 3.1333
COM 112	Introduction to Digital Electronics	77	A	4	4	16	
COM 113	Introduction to Programming	59	C	2.75	4	11	
STA 111	Descriptive Statistics	70	AB	3.5	3	10.5	
STA 112	Elementary Probability	60	BC	3	3	9	
MTH 111	Logic & Linear Algebra	67	B	3.25	2	6.5	
MTH 112	Function & Geometry	82	A	4	3	12	
MTH 211	Calculus	47	D	2.25	2	4.5	
GNS 101	Use of English 1	61	BC	3	2	6	
GNS 111	Citizenship Education	58	C	2.75	2	5.5	
LIS 001	Use of Library	40	E	2	1	2	
BAM 111	Introduction to Business	50	CD	2.5	2	5	
					Total Cum. Unit (TCU) = 30	Total value point (TVP) = 94	

Total Value-Points (TVP) = 94

Total Cumulative Unit (TCU) = 30

Grade Point Average (GPA) =   94/30   =   3.13

The Total Value-Points (TVP) in any Semester is obtained by dividing the Total cumulative unit. The computation is done for the four semester for award of Diploma, Thus, Cumulative grade point average CGPA for a student is calculated by summation of CTVP of the courses from year one to the last is divided by CTCU for the period, The CGPA is a very important measure, as this is what determines whether a student can move on to the next level or be made to repeat a year or even withdraw totally from the programme. The final CGPA determines the class of diploma awarded to the candidate on eventual completion of the programme. Obviously, for the first year, the CGPA is equal to the GPA. In the award of Diploma, a candidate who satisfies the Academic Board in all prescribed course work, examinations, diploma project and the supervised industrial work experience, and found worthy in learning and in character shall on the recommendation of the Academic Board be awarded a National Diploma or Higher National Diploma certificate in course of study. Such candidates should have completed a minimum of between 90% and 100% of credit units depending on the programme. The following classes of certificates are awarded by the Polytechnic on the basis of the grade obtained by the student is shown in Table 4.

Table 4: Class of Diploma

Class of Diploma	Grade Point Average (GPA)
Distinction	3.50 – 4.00
Upper credit	3.00 – 3.49
Lower credit	2.50 -2.99
Pass	2.00 -2.49
Fail	0.00 – 1.99

However, no certificate is awarded for the grade point average of 0.00 – 1.99. Manually calculating and tracking CGPA for each student is rather laborious, especially with increasing number of students, and is prone to error. With a computer the task becomes much easier, faster, and more accurate.

B. STATEMENT PROBLEM

A number of problems associated with student academic record management include improper course registration, late release of students' results, inaccuracy due to manual and tedious calculation and retrieval difficulties and inefficiency. In most cases the data generated by academic institutions are usually created in non-delineated files for use by different departments/units within the institutions with the same data appearing on several of these files. This means that a simple change of address would have to be processed in two and probably three or four places, depending on the number of other files on which these data appears. The development of database concept is the answer to these problems where the amount of redundant data is reduced and the possibility that data contained on a file might be inaccurate because they were never updated.

The solution, therefore, that arises is to find a method of processing examination results that would be sufficiently be accurate and reasonably timely. The prototype application in this work is intended to bring insight and relieve by providing for timely and accurate processing of students results using the processing power of the computer system.

Of course the objective will be to develop a centralized students' document repository. This paper is focus on creating windows based application, which provided an electronic means of managing student's result in tertiary institutions using Polytechnic as a domain prototype.

Therefore, the significance of this study in essence is to provide a more efficient means of managing activities in tertiary institutions, which include records, and information of staff and students through an electronic medium. The development of the proposed prototype solution has immense benefits to the management of the institutions over the orthodox school management practice.

II. REVIEW OF RELATED LITERATURE

As [4] asserted that data is information, often in the form of facts or figure obtained from experiments and surveys, used as a basis for making calculations or drawing conclusion. However, [5] stated that the terms data, information and knowledge are frequently used for overlapping concepts. Moreover, in capturing data, according to [6], data entry is the act of transcribing some form of information into another medium, usually through input into a computer program. Forms of data that people might transcribe include handwritten documents, information on spreadsheets, sequences of numbers, as well as computer code. In his paper [7] stated that the errors associated with transcribing of data in the existing manual method of processing of students results in most tertiary institutions in Nigeria, make it imperative that computerized approach be used in measuring students' progress. According to him, the manual methods being employed suffer a number of setbacks; they lead to examination results being published late, make the process to be time consuming and prone to error. Sometimes with wrong grades being entered and students' GPAs being wrongly computed. This could lead to wrong conclusions in the awarding of class of diploma.

The solution to the problem, therefore, is to find a method of processing examination results that would be sufficiently accurate and reasonably timely. Although still in [7], result systems can be improved upon by using back-up policies and audit trails. Although his solution was built with java and MySql database, it did not establish any evidence for processing results batched in files to increase data integrity and mitigate fraud. The research could not also address what happens to a student after s/he is on suspension, deferment of studies, medical treatment, supplementary exams or related cases.

As indicated in [8] that publication of students' results in the manual system takes a very long time resulting in the students remaining idle for long. Sometimes the delay in declaration of result causes losses to the students as generally they cannot join further studies. In his contribution, [9] observed that a number of problems associated with student academic record keeping include improper course registration, late release of student results, inaccuracy due to manual and tedious calculation and retrieval difficulties cum inefficiency. According to him, the development of database concept is the answer to these problems, where the amount of redundant data is reduced and the possibility that data contained on a file might be inaccurate because they were never updated. However, [10] proposed a system Academic Records Information System (ARIS) using the incremental software model and prototyping technique. It was also acceptable by their proposal that reporting sheets can only be generated when there are no pending scores for courses registered by students; which implies that the results of all such courses must have been approved by institution authority and uploaded on time.

Some works like that of [11] and that by [12] attempt to address this issue. In his work, the former employs Microsoft Excel spreadsheet program to build an Intelligent Knowledge-Based System (IKBS), making use of various programming facilities provided by that application (Excel). The central issue here is that the programming is hard coded into the cells, and cell referencing is used to monitor and track students' performance (cumulative points, etc.). The system has been reported to be working fine. However, it appears to be rather restrictive, and calls for substantial expertise in programming. In the work by latter, Adobe Dreamweaver, an Integrated Development Environment, is used to create the Graphic User Interface and to write the codes. MYSQL Server, a Relational Database Management System, is used to create the database tables and data. Personal Home Page Pre-Processor (PHP) is used to communicate with and manipulate the database. This application, though tested and found to be working as expected, has however not been put to use widely.

In an attempt to create more awareness in this paper, the prototype concept is employed to give insight in developing robust application. However, the process of prototyping involves the following steps

- *Identify basic requirement*: Determine basic requirements including the input and output information desired, and details such as security can typically be ignored.
- *Develop Initial Prototype*: The initial prototype is developed that includes only user interfaces.
- *Review*: The customers, including end-users, examine the prototype and provide feedback on additions or changes.
- *Review and Enhancing the Prototype:* Using the feedback both the specification and prototype can be improved negotiation about what is within the scope of the contract or product may be necessary if changes are introduced then a repeat of third and fourth steps may be needed.

Software prototyping has many variants, all the methods are in some way based on two major types of prototyping, Throwaway Prototyping and Evolutionary Prototyping.

The Throwaway or sometimes called Rapid Prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the delivered software. After a preliminary requirements gathering is accomplished, a simple working model of the system is constructed to visually show the users what their requirement may look like when they are implemented into a finished system. The most obvious reason for using throwaway prototyping is that it can be done quickly. If the users can get quick feedback on their requirement, they may be able to refine them early in the development of the software. Another, strength of throwaway prototyping is its ability to construct interfaces that the users can test. The user interface is what the user sees as the system, and by seeing it in front of them, it is much easier to grasp how the system will work.

The Evolutionary Prototyping, also known as breadboard prototyping is quite different from throwaway prototyping. The main goal when using evolutionary prototyping is to build a very robust prototype in a structured manner and constantly refine it. The reason for this is that the evolutionary prototype, when build forms the heart of the new system, and the improvements and further requirement will be built.

Evolutionary Prototyping has an advantage over Throwaway prototyping in that they are functional systems. Although they may not have all the features the users have planned, they may be used on an interim basis until the final system is delivered.

III. METHODOLOGY

In adopting the concept of software engineering process of system design we started with interviewing of institutions stakeholders, and compiled our observations into a case study of the state of manual student result preparation and data handling which served as the major issues addressed in the prototype design.

Analysis of the Existing System and its Challenges: The present system carries out most of the students' information processing manually. The system has no central database where the details of all the student in the school are stored and retrieved. The challenges therefore are: Repetition of Work: There is repetition of work in the existing system because the same data is recorded in different branches of the examination. This leads to data duplications, and the institution to purchase papers spends huge amount of money. In existing system, managing of students' record is very tedious. Retrieval of students' records through manual registers, maintaining of records and data reconciliation etc. are very time consuming. Tempering of student Records: In manual school management system, there are chances of tempering with student's records. Sometimes fake results are prepared and there is no online verification of the results. This leads to unfair practices and it mars the credibility of an institution. A number of problems associated with student academic record management include improper subject registration, late release of students' results, inaccuracy due to manual and

tedious calculation and retrieval difficulties/inefficiency. In order to overcome the problems of the existing system, there is need for an automated system using a prototype to give insight for registration and result checking.

Analysis of the Proposed System: The proposed system uses a prototype based method for result computation. The proposed has a central database where all the students and lecturers' details are stored using MySQL. Students and parents can access their students' details from anywhere through the help of internet. The justification for the proposed system is that, of its functionality as it must support the users requirement, it must meet functional requirement within specified time; elimination of duplication error and solve the problem of inaccuracy and data entry error.

IV.   SYSTEM DESIGN

In this prototype design, in the control center the registration process and result checking is limited to one school. The objective of the design is to provide a system that meets the user's requirement, which includes: speed and accuracy, registration process and result checking should be done across the world as long the user is connected to the internet and provision of database system for saving, searching and retrieving student's information.

In the input documents analysis, the output of the proposed system is determined by the input to the system. The proposed system accepts information from the keyboard, scanner, process it and output the report.

A. INPUT/OUTPUT (DATABASE SPECIFICATION)

In this prototype system, MYSQL (Structured Query Language) was the tool used to design the system. This database is limited to those in the administrative section, they are to control the volume of students records that should be stored in the database system. A sample of the input/output design of the database is shown in Table 5, 6, 7 and 8.

B. INPUT DESIGN

The input generally referred to how the system will be able to collect data from its users. The input tables for this system are given below:

Table 5: Admin Login File

Field Name	Data type	Length	Description
User_name	Varchar	(50)	Admin Username
Password	Varchar	(50)	Admin Password

Table 6: Student Registration Account

Field Name	Data type	Length	Description
Id	Int	(50)	Id
User_name	Varchar	(50)	Username
Profile_Picture	Varchar	(50)	Profile Picture
Mobile_number	Varchar	(50)	Phone number
Email	Varchar	(50)	Email
Password	Varchar	(50)	Password

Table 7: Student Registration

	Data Type	Length	Description
User ID	Varchar	10	ID
Password	Integer	10	Pwd
Full name	Char	50	Full name
Phone Number	Integer	11	Phone Number
Email	Char	20	Email
Faculty	Char	35	Faculty
Department	Char	30	Department
Gender	Char	10	Gender
Date of Birth	DOB	20	Date of Birth
Address	Varchar	50	Address
Subject1	Char	10	Course Title
Subject2	Char	10	Course Title
Subject3	Char	10	Course Title
Subject4	Char	10	Course Title

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C. OUTPUT ANALYSIS

The output is how the data that is entered can be displayed back to the user after it has been processed. The Output table for this system is shown in Table 8.

Table 8: The Output System

Field Name	Data type	Length	Description
ID	Int	(11)	Id
Mat_Num	Varchar	(50)	Mat. No
Subject1	Varchar	(50)	Course Title
Subject2	Varchar	(50)	Course Title
Subject3	Varchar	(50)	Course Title
Subject4	Varchar	(50)	Course Title
GP	Varchar	(50)	Course Title
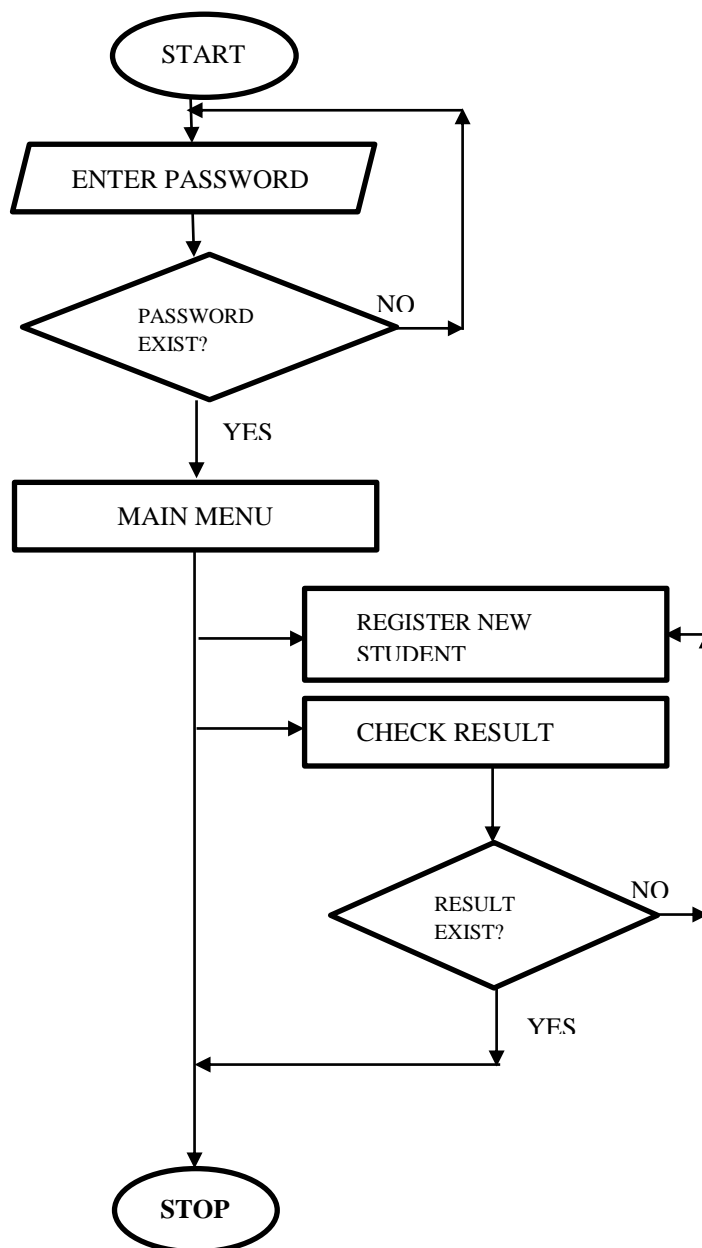
Fig 1: Flowchart Diagram

Fig 2: Interface of System Login

Fig 3: Interface of Registration

Fig 4: A Sample Output

A sample of the program screenshots is displayed here the reason being than it is just a prototype and the evolutionary development is ongoing. However, in the program module specification the system is divided into several parts each performing a task, together achieving the aim of the design.

Main Menu: The main menu consists of login and signing, where the student can register to be able to access the software and students do their registration through this page.

Registration Module: The registration page consists of entry of students' personal data and registration of courses with the course adviser.

Login Module: The course adviser login handles the imputing of students' result, calculation of students' GPA and accessing students result.

Check Admission Module: The check admission module enables the prospective student confirm if they are admitted or not.

Update Students Profile Module: When students register, it is easier to input the result. When results for continuous assessment and examination have been inputted the GPA is generated automatically and saved in the database.

Check Result: This menu displays the result of the prospective student.

The choice of programming language in this sample porotype work is Visual Studio, specifically VB.Net for the frontend and MYSQL for the backend. This language is chosen because of its easy syntax. Flexibility and features for developing windows based applications.

To implement the system, the requirement to aid the efficient and effective utilization and improvement of the prototype designed software is classified into: hardware and software. The hardware requirements are a minimum of 1 gigabyte(gb) RAM memory capacity, 2gb hard disk capacity and 2 gigahertz (ghz) processor system. The software requirements for this system are namely: Microsoft Windows Operating System, Visual Studio and Microsoft SQL Server.

V. CONCLUSION

In this work, the design and implementation of a prototype system was illustrated to reduce the manual processing of result processing using a demo program as a case study. Background to information processing that helps management in decision making was given in the light of courses, credit units, manual processing of result and point grading system as it relates to Polytechnic tertiary institutions in Nigeria. The problem statement was that a number of problems are associated with manual result computation. To overcome this a prototype solution is proposed to give insight to using processing of the computer system. Relevant literatures to this type of system were reviewed and data gathered were analyse and put into a prototype system. The developed application is a demonstration of how the future feature solution should like. Researchers are encouraged to improve on the solution to suite customize institution's needs.

VI. RECOMMENDATION

The background given in this work will serve as data repository to institutions of higher learning. There is need to extend the design by prospective researchers for institutions learning should be encouraging to employ and adopt the technology. There should be a vetting team to ensure that results uploaded were in the recommended format with accurate values, as this will help the administration of institutions to speed decision making.

The mobile result processing system should be developed to enhance flexibility in operation. It is in this light that the future outlook of this work is to make the application more robust, web-enabled, which would greatly enhance its use.

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