**PERFORMANCE EVALUATION OF DECISION TREE AND SUPPORT VECTOR MACHINES ON STAFF APPRAISAL**

**RESEARCH PROJECT**

**BY**

**EKWERE, MFONOBONG FELIX**

***AK16/NAS/CSC/DE/015***

**SUBMITTED TO**

**THE DEPARTMENT OF COMPUTER SCIENCE**

**FACULTY OF NATURAL AND APPLIED SCIENCE**

**AKWA IBOM STATE UNIVERSITY,**

**IKOT AKPADEN, MKPAT ENIN L.G.A**

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**In partial fulfillment for the Requirement of the Award of Bachelor of Science (B.Sc) in Computer Science**

**December, 2019**

**CERTIFICATION**

This is to certify that this Research work was exclusively and fully carried out by me. This work has not been presented elsewhere by anyone or any researcher for the award of a degree, except as reference.

**Ekwere, Mfonobong Felix ……………………… (Student) Signature/Date**

**APPROVAL PAGE**

This Research work titled **“PERFORMANCE EVALUATION OF DECISION TREE AND SUPPORT VECTOR MACHINES ON STAFF APPRAISAL”** has been approved by the Department of Computer Science, Faculty of Physical Sciences, Akwa Ibom State University as a document of the department by:

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(Head of Department) Signature/Date

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(External Examiner) Signature/Date

**DEDICATION**

This research work is dedicated to the almighty God for granting me the Grace and Favour to complete this project successfully, and Strength throughout the period of study in the University.

**ACKNOWLEDGEMENT**

I am dearly obliged to my supervisor, Mrs Idara I. Jamesfor giving me an opportunity to do this project Successfully. she provided valuable information helpful comments, Corrections, discussion, and support to making this work a success. I also appreciate the contributions of the project Coordinators; Mr. Otuekong Ekong and Mr. Idorenyin A. Amaunam, and my Head of Department, Dr. Godwin O. Ansa, other Lecturers too numerous to mention and staff of the Department of Computer Science for their useful assistance throughout my stay in the department.

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May the almighty God Bless and reward them bountifully.

**Ekwere, Mfonobong Felix.**

**ABSTRACT**

In organisations, one of the critical issues faced in giving staff recommendation is inability to evaluate staff performance. This is due to some factors like staff knowledge of Job tittle, volume of work, the use of modern equipment etc. To curb these challenges a support Vector Machine Model is proposed. A quantitative approach of questionnaire which was designed to gather data from previous staff evaluation was adopted. The data was further subjected through analysis using excel application so as to remove unwanted information. The results of the analysis are served as input to the SVM(SMO) and C4.5(J4.8) models. The model was evaluated with WEKA data mining tool kit to generate rule set which was used on the performance evaluation system. The performance evaluation System was design using Unified modelling language with specific interest on use case diagram and activity diagram. The result of analysis showed that SVM(SMO) model had a better accuracy rate of 93.67% against 92.33% of C4.5(J4.8) counterpart. The performance evaluation System using SVM(SMO) also predicted accurate recommendation for staff. It could be concluded that SVM(SMO) model could be adopted for use during staff recommendation processes in organisations.

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# **CHAPTER ONE**

# **INTRODUCTION**

**1.0 Background of Study**

With the unpredictable business environment and intense business competition, companies are required to reach certain standards by improving their performance to align with great demands; otherwise, a lot of problems will surface, including running the risk to close down the business. This performance relates to the firm or individual level which sees the human resource becoming the most determining factor to achieve the organizations’ objectives. In fact, an abundance of resources such as infrastructures or physical facilities are made meaningless without the support of qualified human resources that directly disrupt the continuity of the business operations. Within the framework of the professionals, good Staff performance mirrors the ability to contribute through their works leading to the behavioural achievement that is in accordance with the goals of the company. Meanwhile, the level of the enterprises’ success depends on the performance of the human resource management (Muda *et al.*, 2014).

Evaluations provide input into important decisions such as promotions, transfers, and terminations. Evaluations identify training and development needs. It pinpoint Staff skills and competencies that are currently inadequate but for which programs can be developed to remedy. Evaluations also fulfill the purpose of providing feedback to Staff on how the organization views their performance. As stipulated by Gendiga and Duntsch (2014), evaluation has to do with the general endeavor that can be characterized by the following features:

* Evaluation is a task, which results in one or more reported outcomes.
* Evaluation is an aid for planning, and therefore the outcome is an evaluation of different possible actions.
* Evaluation is goal oriented. The primary goal is to check results of actions or interventions, in order to improve the quality of the actions or to choose the best action alternative.

Based on the aforementioned, organizations use evaluation to check the outcome of actions, interventions or performances so as to improve upon it or opt in for best alternative action.

Performance is understood as achievement of the organization in relation with its set goals. It includes outcomes achieved, or accomplished through contribution of individuals or teams to the organization strategic goals. The term performance encompasses economic as well as behavioral outcomes.

Performance evaluation of Staff serves a number of purposes in organizations; it can be used as a criterion against which selection and development programs are validated. Newly hired Staff who perform poorly can be identified through performance evaluation and training effectiveness can be measured. Furthermore, performance evaluations are used as the basis for reward allocations.

These days, a machine learning technique has given a great deal of concern and attention in information industry because of its ability to produce intelligent decision that implements Knowledge Discovery in Database (KDD) approach. This is due to the wide accessibility of enormous amount of data and the important need to turning such data into useful information as intelligent knowledge (Han and Kamber, 2006). A very promising tool to attain valuable information about staffs’ work performance in an organization is the use of data mining. Data mining techniques are used to discover hidden information, patterns and relationships of large amount of data, which is very much helpful in decision making. Data mining techniques are useful for data analysis and predictions (Pandey and Sharma, 2013). In data mining, tasks such as classification, clustering and association are used to discover implicit knowledge from huge amount of data. Classification technique is a supervised learning technique in machine learning, which the class level or the target is already known (Jantan *et al.*, 2010).

Due to advancement in technology, there are many supervised machine learning classifications that can be used for classification such as Decision Tree, Artificial Neural Network (ANN), Random Forest, Naïve Bayesian, RBF Network, Artificial Immune System (AIS), Support Vector Machine (SVM) and etc. SVM is considered as a powerful technique in classification and leads to increase the performance in pattern recognition, regression, estimation and etc. (Yasodha and Prakash, 2012). In addition, SVM is known as the most robust and accurate method among the well-known algorithms such as back-propagation neural network (BPN), k-means and C4.5 algorithms (Wu *et al.,* 2008). SVM can be used for classification with optimization ability for complex non-linear decision boundaries.

In this research work, Support Vector Machine (SVM) algorithm is adopted as an efficient analytical tool for classifying and predicting staff performance in organizations. This help the human resource managers to evaluate staff performance to know where recommendation of staff is necessary.

# **1.1 Statement of Problem**

Evaluation of staff for accurate recommendations for promotion in organizations has caused several challenges, both to the managers who give recommendations and to staff who are due for recommendation.

Nevertheless, studies have revealed that evaluation of staff based on existing approach such as C4.5 (J4.8) is challenging, which is attributed to considering giving recommendations based on human experience, knowledge of the job title, preferences, volume and proximity of potential customer to works, the use of modern equipment in some organizations which enhances higher volume of productivity, amount of energy exerted, Naira volume of sales, profitability and amount of product produce, the number and type of meaningful metrics being collected in different organizations, etc.

This challenge at times hinders human resource managers from carrying out adequate appraisal of staff who are due to be recommended for promotion.

In view of the aforementioned challenge, it is imperative to adopt a Classification Technique such as Support Vector Machine (SVM) model to evaluate the staff performance to know whether the staff gets recommendation for promotion or not. Results of the evaluation will be further used in developing a Performance Evaluation System for staff future recommendations.

1.2 **Aim and Objectives of Study**

This study aims at performing evaluation of SVM and Decision tree on Staff appraisal using the rule set of the data mining classification technique to evaluate the Staff performance in order to discover whether the Staff is due to be recommended for promotion or not.

In order to realize the aforementioned aim, the objectives are formulated as follows:

# to analyse the existing system for fast and accurate prediction of Staff’ performance.

# to design a system that will evaluate and predict Staff’ performance.

# to evaluate the system in order to determine its efficiency.

# to implement a system that will assist Human Resource Managers in evaluating and predicting staff Performance.

# 1.3 **Significance of the Study**

They enormous significance of this study is:

1. This study will aid in analyzing and evaluating staff performance.
2. This study will assist Human Resource managers in making appropriate decisions for staff recommendations.
3. The study will help organizations to improve their evaluation results thus boosting their productivity.
4. Accurate Recommendations can improve organization sustainability by delivering better environment and economic outcomes

# 1.4 **Scope of Study**

This research work covers the use of Machine learning Model in analyzing and evaluating staffs’ performance.

Data for this study was collated from three organizations, Villa Marina Hotels Eket, Champion Breweries Limited Uyo and Department of Petroleum Resources Eket.

**1.5 Limitation of the Study**

Several limitations were faced in the course of carrying out this study, these include:

1. **Response time:** The researcher was faced with the problem of getting responses of questionnaire from the Organizations on time.
2. **Financial stress:** The researcher was challenged with limited funds to acquire, e-books on the Internet, and to pay for browsing time in order to gather information.

## **1.6 Definition of Terms**

**Data mining:** Data mining is the process of discovering interesting knowledge, such as associations, patterns, changes significant structures and anomalies, from large amount of data stored in databases or data warehouses or other repositories**.**

**Evaluation**: This refers to a judgment or calculation of the quality, importance, amount or value of something.

**Classification Technique:** A classification model tries to draw some conclusion from input values given for training. It will predict the class labels/categories for the new data

**Support Vector Machines:** SVM is a hyperplane that separates a set of positive examples from a set of negative examples with maximum margin.

**Sequential Minimal Optimization:** The Sequential Minimal Optimization (SMO) algorithm is derived by taking the idea of the decomposition method to its extreme and optimizing a minimal subset of just two points at iterations.

**C4.5 (J4.8**): is used in Data mining as a decision tree classifier which can be employed to generate a decision, based on certain data sample.

**WEKA:** This is a JAVA based customization tool, which is free to use. It includes visualization and predictive analysis and modelling techniques, clustering, association, regression and classification. It is a collection of Machine Learning Algorithms for Data Mining tasks.

**Machine learning:** Is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed**.**

CHAPTER TWO

# LITERATURE REVIEW

## **2.0 Introduction**

With the rise in business competition and unpredictable /changeable business environment, many businesses seem to attain standards by improving their staff’s performance so as to overcome some problems. However, Human resource is the back bone of any organization. The most valuable asset of any organization is human resource. Human resources (HR) manager is not only to write policy and procedures and to hire people (the administrative role) but also to use strategic plans to ensure the right people are hired and trained for the right job at the right time. Various managements use evaluation as a tool for human resource decisions. Evaluations offer feedback into essential decisions, which include promotions, transfers and terminations. With evaluations, management can identify training and development needs. Organizations use evaluation to check the outcome of actions, interventions or performances so as to improve upon it or opt in for best alternative action.

A good staff performance shows the ability of the staff to contribute through his/her works leading to the behavioral achievement that is in agreement with the goals of the organization. Furthermore, the level of the organization’s success depends on the performance of the human resource management. Thus, the need for human resource management to carry out routine evaluation of Staff performance in order to ascertain that their performances are in agreement with the goals of the organization.

This chapter has emphases on literature review. It looks into the contributions from several authors on this research subject matter, which are made based on the following sub-headings:

## **2.1 Business Organization and Management**

Business is any activity showing that a man is busy. It refers to the production or purchase of goods while bearing in mind to sell them for profit or rendering services on payment to other people. It may also be defined as a human activity directed towards producing or acquiring wealth through buying and selling of goods and services (Garg, 2009). A business is an organization, which make use of economic resources or inputs to deliver goods or services to customers in exchange for money or other goods and services (Staff, 2016).

Organization has a lot of definitions based on the subjects. But according to Hancy cited in (Garg, 2009), organization is defined as a *“harmonious adjustment of specialized parts for the accomplishment of some common purpose”.* However, an organization takes care of putting together of men, material and machines to accomplish the defined goals. With organization, there is interrelation, which results in efficient functioning of an enterprise and resulting into profits to the enterprise, more wages to its employees and lower cost of goods to the consumer. The importance of organizations is that they enable people to share skills and knowledge, specialize and pool resources. This results in synergy is where organizations can achieve more than individuals on their own.

Business organization has to do with a group of people having a set of goals and objectives to be achieved. Thus, a business organization is structured in the most effective and efficient way to fully utilize its resources such as capital, human, knowledge in products and services, and both external and internal information in order to accomplish its strategic goals.

Business organizations come in different types. There are 4 Types of business, which include:

1. **Service Business:** A service type of business provides intangible products (products with no physical form). Service type firms offer professional skills, expertise, advice, and other similar products. Examples of service businesses are: schools, repair shops, hair salons, banks, accounting firms, and law firms (Garg, 2009)
2. **Merchandising Business:** This type of business buys products at wholesale price and sells the same at retail price. They are known as "buy and sell" businesses. They make profit by selling the products at prices higher than their purchase costs. A merchandising business sells a product without changing its form. Examples are: grocery stores, convenience stores, distributors, and other resellers. (Garg, 2009)
3. **Manufacturing Business:** Unlike a merchandising business, a manufacturing business buys product with the intention of using them as materials in making a new product. Thus, there is a transformation of the products purchased. A manufacturing business combines raw materials, labor, and factory overhead in its production process. The manufactured goods will then be sold to customers. (Garg, 2009)
4. **Hybrid Business:** Hybrid businesses are companies that may be classified in more than one type of business. A restaurant, for example, combines ingredients in making a fine meal (manufacturing), sells a cold bottle of wine (merchandising), and fills customer orders (service). Nonetheless, these companies may be classified according to their major business interest. In that case, restaurants are more of the service type – they provide dining services. (Garg, 2009) According to Koi-Akrofi (2018) explains that management has to do with understanding the word manage, which is “to take charge or care of” or “to be in charge (of); administer”. Going by Harold Koontz definition of management, cited in Koi-Akrofi (2018), Management refers to an art of getting things done through and with people in formally organized groups.

It is an art of creating an environment in which people can perform and individuals can co-operate towards attainment of group goals. In management, who and what to manage are:

1. Human Resources: This refers to the people.
2. Inanimate Resources: This refers to the processes, finances, systems, assets, etc.,

The essence of management is to meet set goals. This cuts across; being it personal or an organization.

## **2.2 Human Resource Management**

Human resource management (HRM) arose as a concept in the 1980s and as a result, rebranding personnel management quickly became popular, but many organizations had little awareness of the theory behind the concept. Human Resource Management, sometimes abbreviated as HRM, or HR, is focused on all aspects of how people are employed and managed in organizations (O’Riordan, 2017). There are various definitions of human resource management, which vary based on degrees of complexity. As defined by (Armstrong, 2016), Human resource management is a strategic, integrated and coherent approach to the employment, development and well-being of the people working in organizations. While Boxall and Purcell, (2016) defined that Human resource management is the process through which management builds the workforce and tries to create the human performances that the organization needs.

More so, the goals of Human Resource Management as explained by Armstrong and Taylor (2015) are:

1. HRM supports the organization in achieving its objectives by developing and implementing HR strategies that are integrated with business strategy
2. HRM contributes to the development of a high-performance culture
3. HRM ensures that the organization has the talented, skilled and engaged people it needs
4. HRM creates a positive employment relationship between management and employees and a climate of mutual trust
5. HRM encourages the application of an ethical approach to people management.

In an organization, HRM has duties or practices carried out to ensure that organization’s performance is impacted positively. As explained by O’Riordan, (2017), these are six key work practices performed by HRM:

1. **Career development and opportunities for advancement:** Career progression and development are essential motivation and retention tools. However, career progression does not have to include promotion. Employees value greater autonomy, varied work, and opportunities to acquire new skills. Two considerations for organizations are the importance of development opportunities for all staff, even those that remain at the same level and the need to develop an appropriate and honest message in respect of development opportunities.
2. **Training opportunities:** Training is the use of systematic and planned instruction and development activities to promote learning. Training opportunities enhance staff commitment and, if based on an objective assessment of need, result in a more efficient and effective organisation. ‘On the job’ coaching or ‘stretch’ assignments are frequently more useful to staff compared to formal training.
3. **Job influence and challenge:** Job design is an area that deeply influences people’s experience of work. Where people have some influence over how they do their job, and where they find their job demanding and challenging, they are much more likely to have job satisfaction. Techniques that support good job design include, job rotation, job enlargement, job enrichment and self-managed teams.
4. **Involvement and communication:** The opportunity to contribute to decisions and have a sense of involvement is valued by most employees. Much of the knowledge required by organizations to be more productive is in employees’ heads, so accessing it makes good business sense. Where managers encourage involvement, it is associated with higher levels of satisfaction with management in organizations. Effective communication is a further vital part of the process. The good intentions of leaders can be ruined and mutual trust damaged by managers who do not pass on messages, who distort the message they are entrusted with, or who do not feed-back what they have been told by staff. A range of mechanisms are used by organizations to promote involvement and participation by staff, for example employee opinion surveys, suggestions schemes, town hall meetings, partnership committees and works councils.
5. **Performance management and appraisal processes:** In employee opinion surveys, tolerance for under performance frequently emerges as a major source of dissatisfaction among employees. However, in order to be able to identify under-performance, organizations need to clarify for both managers and staff what constitutes an acceptable level of performance. In addition, performance reviews or evaluation focuses far more on performance planning and improvement than on retrospective appraisal.
6. **Work-life balance:** Work-life balance emerges as an important area influencing employee attitudes towards their employer. It is important to consider work-life balance for all employees not just those with young children and the type of flexibility that people want. It is often not so much reduced hours that employees indicate they would benefit from but the possibility of varying hours at short notice to deal with whatever pressures they have outside of work.

## **2.3 Staff Performance Evaluation**

Performance management (PM)is a goal-oriented process directed toward ensuring that organizational processes are in place to maximize the productivity of employees, teams, and ultimately, the organization. It is a major player in accomplishing organizational strategy in that it involves measuring and improving the value of the workforce. PM includes incentive goals and the corresponding incentive values so that the relationship can be clearly understood and communicated. There is a close relationship between incentives and performance (Giannetto, 2009).

Performance management systems are one of the major focuses in business today. Although every Human Resource function contributes to performance management, training and performance appraisal play a more significant role. Whereas performance appraisal occurs at a specific time, performance management is a dynamic, ongoing, continuous process. Every person in the organization is a part of the Performance management system. Each part of the system, such as training, appraisal, and rewards, is integrated and linked for the purpose of continuous organizational effectiveness. With PM, the effort of each and every worker should be directed toward achieving strategic goals. If a worker’s skills need to be improved, training is needed. With PM systems, training has a direct tie-in to achieving organizational effectiveness. In addition, pay and performance are directly related to achieving organizational goals (Robert, 2011).

According to Robert, (2011). “Performance management is the single largest contributor to organizational effectiveness. If you ignore performance management, you fail.” Organizations must take a more strategic approach to performance appraisal. Organizations need to integrate the company’s mission, vision, and values into their performance management systems.

Many studies use the terms “performance evaluation” and “performance appraisal” interchangeably, stating performance appraisals are a systematic way of evaluating the standard of a worker’s performance. Performance appraisal (PA) is a formal system of review and evaluation of individual or team task performance. It is especially critical to the success of performance management. Although performance appraisal is but one component of performance management, it is vital, in that it directly reflects the organization’s strategic plan. Although evaluation of team performance is critical when teams exist in an organization, the focus of PA in most firms remains on the individual employee. Regardless of the emphasis, an effective appraisal system evaluates accomplishments and initiates plans for development, goals, and objectives (Robert, 2011).

According to Spence and Wood, (2007), highlighted that performance appraisal has occupied the attention of researchers in human resource management, organizational behavior, and industrial/organizational psychology for many years. Performance appraisal is the process of obtaining, analyzing and recording information about the relative worth of an employee. The focus of the performance appraisal is measuring and improving the actual performance of the employee and also the future potential of the employee. Performance appraisal and evaluation is identified as the identification, Measurement and management of human performance in organizations and provides individuals with useful feedback and coaches them to higher levels of Performance (Gomez-Mejia *et al.*, 2007).

Performance appraisal has different objectives for management and for the employees. Employees are interested in having an assessment of their work from the viewpoint of personal development, work satisfaction and involvement in the organization. Management assesses the performance of employees to maintain organizational control and disburse rewards and punishments to further organizational goals.

Performance appraisal serves many purposes, and improved results and efficiency are increasingly critical in today’s globally competitive marketplace. Therefore, abandoning the only program with *performance* in its name and *employees* as its focus would seem to be an ill-advised overreaction.

Developing an effective performance appraisal system has been and will continue to be a high priority for management.

The service quality or overall performance of the organization depends on the performance of the employees as the employees play a crucial role in delivering quality products and service to the consumers according to their needs and preferences (Zhan, 2016). Performance Evaluation is a constructive process to acknowledge the performance of a non-probationary career employee. The essence of employees’ evaluation in an organization is that they are evaluated based on their performance in order to represent their talent ability. Performance evaluation is a necessary and beneficial process, which provides annual feedback to staff members about job effectiveness and career guidance. Appraisal is an important instrument in the manpower management.

### **2.3.1 Performance Appraisal Methods**

Human Research Managers may choose from among a number of appraisal methods. The type of performance appraisal system used depends on its purpose. If the major emphasis is on selecting people for promotion, training, and merit pay increases, a traditional method, such as rating scales, may be appropriate. Collaborative methods, including input from the employees themselves, may prove to be more suitable for developing employees (Robert, 2011).

The following are various performance appraisal methods:

1. **360-Degree Feedback Evaluation Method:** This is a popular performance appraisal method that involves evaluation input from multiple levels within the firm as well as external sources. In this method, people all around the rated employee may provide ratings, including senior managers, the employee himself or herself, supervisors, subordinates, peers, team members, and internal or external customers (Drakes, 2008).
2. **Rating Scales Method:** The rating scales methodis a performance appraisal method that rates employees according to defined factors. Using this approach, evaluators record their judgments about performance on a scale. The scale includes several categories, normally 5–7 in number, defined by adjectives such as *outstanding, meets expectations,* or *needs improvement.* Although systems often provide an overall rating, the method generally allows for the use of more than one performance criterion. One reason for the popularity of the rating scales method is its simplicity, which permits quick evaluations of many employees. (Robert, 2011)
3. **Critical Incident Method:** The critical incident methodis a performance appraisal method that requires keeping written records of highly favorable and unfavorable employee work actions. When such an action, a “critical incident,” affects the department’s effectiveness significantly, either positively or negatively, the manager writes it down. At the end of the appraisal period, the rater uses these records along with other data to evaluate employee performance. With this method, the appraisal is more likely to cover the entire evaluation period and not focus on the past few weeks or months.
4. **Essay Method:** The essay method is a performance appraisal method in which the rater writes a brief narrative describing the employee’s performance. This method tends to focus on extreme behavior in the employee’s work rather than on routine day-to-day performance. Ratings of this type depend heavily on the evaluator’s writing ability. Supervisors with excellent writing skills, if so inclined, can make a marginal worker sound like a top performer. Comparing essay evaluations might be difficult because no common criteria exist. However, some managers believe that the essay method is not only the most simple but also an acceptable approach to employee evaluation.
5. **Work Standards Method:** The work standards methodis a performance appraisal method that compares each employee’s performance to a predetermined standard or expected level of output. Standards reflect the normal output of an average worker operating at a normal pace. Firms may apply work standards to virtually all types of jobs, but production jobs generally receive the most attention. An obvious advantage of using standards as appraisal criteria is objectivity.
   1. However, in order for employees to perceive that the standards are objective, they should understand clearly how the standards were set. Management must also explain the rationale for any changes to the standards.
6. **Ranking Method:** The ranking methodis a performance appraisal method in which the rater ranks all employees from a group in order of overall performance. For example, the best employee in the group is ranked highest, and the poorest is ranked lowest. This procedure is followed until all employees are ranked. A difficulty occurs when all individuals have performed at comparable levels (as perceived by the evaluator).
7. **Forced Distribution Method:** The forced distribution methodof performance appraisal requires the rater to assign individuals in a work group to a limited number of categories, similar to a normal frequency distribution. The purpose of forced distribution is to keep managers from being excessively lenient and having a disproportionate number of employees in the “superior” category.
8. **Behaviorally Anchored Rating Scale Method:** The behaviorally anchored rating scale (BARS) methodis a performance appraisal method that combines elements of the traditional rating scales and critical incident methods; various performance levels are shown along a scale with each described in terms of an employee’s specific job behavior.
9. **Results-Based System:** The manager and subordinate jointly agree on objectives for the next appraisal period in a results-based system, in the past a form of *management by objectives.* In such a system, one objective might be, for example, to cut waste by 10 percent. At the end of the appraisal period, an evaluation focuses on how well the employee achieved this objective.

### **2.3.2 Performance Appraisal Criteria /Factors**

According to (Tervahartiala, 2013), there are various evaluation criteria or factors such as;

1. **Performance Factors**
   1. ***Knowledge, Skills and Abilities:*** Employee's work product demonstrates an application of the technical knowledge and various skills needed i.e. managing computer-based records, familiarity with UPD policies, laws and regulations. Employee keeps abreast of developments and trends in law enforcement.
   2. ***Quality of Work:*** Produces accurate, neat work product. Performs work thoroughly, expresses self well in verbally and in writing.
   3. ***Quantity of Work (Productivity):*** completes work assigned, and on time, and manages a variety of tasks and projects.
   4. ***Work Habits/ Time Management:*** Employee develops comprehensive, realistic plans and organizes work assignments to ensure timely completion of quality work products. Manages time well and effectively handles multiple demands and competing priorities. Take initiative in assuming more complex assignments and developmental activities. Attends work regularly, and observes work hours.
   5. ***Communication:*** Interacts professionally and courteously with supervisors, coworkers, citizens and others; readily shares information and provides assistance; verbally communicates information in an understandable manner; written communications are consistently clear and accurate; demonstrates understanding of instructions; demonstrates tolerance in working with coworkers, others and with changes in job conditions; demonstrates tolerance of differing behaviors, customs and communication styles; understands and works toward group goals and objectives; encourages and is receptive to new ideas and procedures. (Tervahartiala, 2013)
2. **Behavioral Traits Factors**
   1. ***Dependability:*** Performs duties willingly. Personal problems do not affect work performance. Accepts suggestions and follows directions. Considers constructive criticism and makes necessary changes in performance. Follows directions of supervisor.
   2. ***Interpersonal Relationships:*** Employee gets along with others and establishes effective relationships to accomplish work products or service. Demonstrates respect for others, including the community and peers. Demonstrates courtesy and tact when dealing with people. Fully participates as a team member in the accomplishment of the work product (Tervahartiala, 2013).
   3. ***Initiative/Creative***: Understands and accepts new situations, performs well with minimal instructions. Makes sounds decisions in absence of detailed instructions or direct supervision. Keeps supervisor informed on status of assigned work.
   4. ***Adaptability***: Demonstrates good judgment, makes reasonable decisions, Practices self-control—thinks before acting. Employee Analyzes situations accurately and adapts well to change. Performs well in new situations, adjusts to new scheduling and/or changes in schedules, and demonstrates willingness to learn new tasks and procedures. Demonstrates willingness to incorporate new ideas or methods.
   5. ***Judgement***: Uses good judgment and a common-sense approach to situations, particularly during stressful situations; requires minimal supervision; determines appropriate course of action and takes same; does not allow situations to further deteriorate; recognizes when to ask for assistance; anticipates situations and prepares for them; is capable of changing way of thinking and performing in conjunction with the needs of the organization.
   6. ***Punctual***: Gets to work on daily basis and on time.

**C Supervisory Factors**

* 1. ***Leadership***: Demonstrates the ability to get other people to work together effectively; is able to see the "big picture" and articulate how the pieces fit together; takes ownership for own activities; recognizes and appreciates individual differences; interacts with others objectively; is able to draw upon his/her own resources in Assessing situations and taking or recommending appropriate action for resolution (Tervahartiala, 2013).
  2. ***Delegation***: Assigns responsibility to an employee to complete a task, grants the employee sufficient authority to gain the resources to do the task and allows the employee decide how that task will be carried out. Shares accountability with the employee for ensuring the task is completed.
  3. ***Planning & Organizing:*** Defines expectations and tasks clearly. Plans and organizes work, coordinates with others, establishes appropriate priorities. Allows sufficient time for completion of assignments. Delegate authority when appropriate. Determines appropriate action and follows through in a timely and decisive manner. Is well organized and uses time productively. Ensures that work products and services consistently meet needs of customers.
  4. ***Developing others***: Effectively and timely evaluates subordinates; encourages and initiates regular discussion of performance; fosters the learning and development of others through coaching, managing performance, and mentoring.
  5. ***Personnel management:*** Brings about an enthusiastic and optimistic attitude in the unit, Rewards and recognizes individual and team successes. Provides timely information on performance and frequent feedback. Resolves differences and seeks win/win outcomes. Acts forthrightly in response to unacceptable behavior or performance and focuses on the situation, issue or behavior rather than on the person. Promotes employee safety and wellness. Maintains appropriate confidentiality
  6. ***Overall Performance:*** To arrive at an overall evaluation of the employee’s performance, supervisors consider the relative importance of each work goal and competency with its relative weight. Moreover, supervisors should consider performance and accomplishment that furthered the goals/objectives of the organization, contributions above and beyond completion of basic work assignments and completion of or contribution to special projects.

# **2.3.3 Performance Appraisal Rating Scale**

There are many performance evaluation scales in used today. Some ranges from: Unsatisfactory – 1, Improvement Needed – 2, Satisfactory – 3, Superior – 4 and Exceptional – 5. According to **(**Tervahartiala, 2013), performance evaluation scale can rate from level 1 through level 9. Table 2.1, below explains the scale.

***Table 2.1. Performance evaluation scale***

|  |  |
| --- | --- |
| **Scale** | **Interpretation** |
| Level 9 | The employee’s performance is excellent and clearly exceeds all job requirements and the quantitative and qualitative objectives assigned to the employee. |
| Level 8  Level 7 | The employee’s performance satisfies all job requirements very well. The performance exceeds the quantitative and qualitative objectives assigned to the employee in many respects. |
| Level 6  Level 5 | The employee’s performance satisfies the job requirements and the objectives assigned to the employee well. Performance attains a high quality standard in key fields of duty. |
| Level 4  Level 3 | The employee’s performance satisfies the basic job requirements and the principal objectives assigned to the employee. Some aspects of performance are nevertheless in need of improvement. |
| Level 2  Level 1 | There is a substantial need for improvement in the employee’s performance |

## **2.4 The Overview of Data Mining**

Data Mining is the process of analyzing data from different perspectives and summarizing it into useful information - that can be used to increase revenue, cut costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases. Data Mining, also popularly known as Knowledge Discovery in Databases (KDD), refers to the nontrivial extraction of implicit, previously unknown and potentially useful information from data in databases. While data mining and knowledge discovery in databases (or KDD) are frequently treated as synonyms, data mining is actually part of the knowledge discovery process. (Shruthi and Chaitra,2016).

Anuradha and Velmurugan (2015), states that Data mining is the process of discovering meaningful patterns in large quantities of data. Data mining is emerg­ing as promising frameworks which provide wide variety of techniques, methods and tools to enable provide for thorough analysis of available data in various fields. In educa­tional domain, data mining techniques are very useful for enhancing the current educational standards and man­agements. These techniques provide a route to a multiple level of ranking, a finding which gives a new perception of how people can become proficient in these educational sectors (Anuradha and Velmurugan, 2015).

The main functions of data mining are to apply various methods and algorithms in order to discover and extract hidden patterns of stored data (Abdulsalam *et al.*,2014). Data mining (DM) tools predict patterns, future trends and behaviors, allowing businesses to effect proactive, knowledge-driven decisions.

### **2.4.1 Steps Involved in Data mining**

The Knowledge Discovery in Databases process comprises of a few steps leading from raw data collections to some form of new knowledge. The iterative process consists of the following steps (Shruthi and Chaitra,2016):



***Figure 2.1. Data Mining Process (Shruthi and Chaitra,2016)***

1. **Data cleaning**: Also known as data cleansing, it is a phase in which noise data and irrelevant data are removed from the collection.
2. **Data integration**: At this stage, multiple data sources, often heterogeneous, may be combined in a common source.
3. **Data selection**: At this step, the data relevant to the analysis is decided on and retrieved from the data collection.
4. **Data transformation**: Also known as data consolidation, it is a phase in which the selected data is transformed into forms appropriate for the mining procedure.
5. **Data mining**: It is the crucial step in which clever techniques are applied to extract patterns potentially useful.
6. **Pattern evaluation**: In this step, strictly interesting patterns representing knowledge are identified based on given measures.
7. **Knowledge representation**: Is the final phase in which the discovered knowledge is visually represented to the user. This essential step uses visualization techniques to help users understand and interpret the data mining results.

### **2.4.2 Techniques of Data Mining**

According to Shruthi and Chaitra, (2016), there are various data mining techniques, these include:

1. Association rule
2. Classification rule
3. Clustering techniques
4. Sequential and Pattern prediction
5. ***Association rule:*** Association rule is also called as pattern discovery. The pattern is discovered based on the relationship between particular items with other item in the same transaction. This association rule involves a single attribute or predicate that repeats. Association rules that contain a single predicate are referred to as single-dimensional association rules. Association rule involving more than one attribute or predicate is called a multi-dimensional association rule.
6. ***Classification Rule*** Classification is a process of finding a model (or function) that describes and distinguishes data classes or concepts. The model is derived based on the analysis of a set of training data (i.e., data objects for which the class labels are known). The model is used to predict the class label of objects for which the class label is unknown.
7. ***Clustering Techniques:*** The objects are clustered or grouped on the principle of maximizing the intra-class similarity and minimizing the interclass similarity. That is, clusters of objects are formed so that objects within a cluster have high similarity in comparison to one another, but are rather dissimilar to objects in other clusters. Cluster analysis can be performed on customer data to identify homogeneous subpopulations of customers. These clusters may represent individual target groups for marketing.
8. ***Sequential and Pattern Prediction:*** Frequent patters, as the name suggest, are patters that occur frequently in data. There are many kinds of frequent patters, including frequent item sets, frequent subsequences (also known as sequential patterns), and frequent substructures. A frequent item set typically refers to a set of items that often appear together in a transactional data set.

## **2.5 Classification Techniques**

According to Longbing, (2009), the classification is a data mining technique which includes systematic approach to building the classification models from an input dataset. Some of the popular classifiers used to solve a classification problem are decision tree classifiers, rule-based classifiers, neural networks, support vector machines, and naive Bayes classifiers. The classification techniques use learning algorithm to identify a model that best fits the relationship between the attribute set and class label of the input data.

Furthermore, classification is a simple process of discovering a proto­type (or function) that recognize the salient features of data classes or concepts, for the purpose of being able to use the model to predict the class of objects whose class label is unknown. It forecast distinct and unordered labels in huge datasets. As with classification, the test set is used to build a predictor but an independent test set should be used to assess its accuracy. The data classification pro­cess involves learning and classification. In learning the training data are analyzed by classification algorithm. In classification test data are used to estimate the accuracy of the classification rules. The classifier training algorithm uses these pre-classified examples to determine the set of parameters required for proper discrimination (Baradway and Pal, 2017).

Some of the classification algorithms are discussed below:

### **2.5.1 Rule-based Classification Algorithm**

Rule based classification algorithm also known as separate-and-conquer method is an iterative process consisting in first generating a rule that covers a subset of the training examples and then removing all examples covered by the rule from the training set. This process is repeated iteratively until there are no examples left to cover (Phyu, 2009). The following are the rule-based algorithms:

**i) OneR** or “One Rule” is a simple algorithm proposed by Holt. The OneR builds one rule for each attribute in the training data and then selects the rule with the smallest error rate as its one rule. The algorithm is based on ranking all the attributes based on the error rate (Tayel*et al.*, 2013).

**ii) PART** is a separate-and-conquer rule learner. The algorithm producing sets of rules called decision lists which are ordered set of rules. A new data is compared to each rule in the list in turn, and the item is assigned the category of the first matching rule (a default is applied if no rule successfully matches).

**iii) Decision Table** algorithm builds and using a simple decision table majority classifier. It summarizes the dataset with a decision table which contains the same number of attributes as the original dataset. Then, a new data item is assigned a category by finding the line in the decision table that matches the non-class values of the data item. Decision Table employs the wrapper method to find a good subset of attributes for inclusion in the table. By eliminating attributes that contribute little or nothing to a model of the dataset, the algorithm reduces the likelihood of over-fitting and creates a smaller and condensed decision table.

**iv) DTNB** this is for building and using a decision table/naive bayes hybrid classifier. At each point in the search, the algorithm evaluates the merit of dividing the attributes into two disjoint subsets: one for the decision table, the other for naive Bayes. A forward selection search is used, where at each step, selected attributes are modeled by naive Bayes and the remainder by the decision table and all attributes are modeled by the decision table initially. At each step, the algorithm also considers dropping an attribute entirely from the model.

**v) Ridor** algorithm generates a default rule first and then the exceptions for the default rule with the least (weighted) error rate. Then it generates the “best” exceptions for each exception and iterates until pure. Thus, it performs a tree-like expansion of exceptions. The exceptions are a set of rules that predict classes other than the default.

**2.5.1.1 Advantages of Rule-Based Classifiers**

1. As highly expressive as decision trees
2. Easy to interpret
3. Easy to generate
4. Can classify new instances rapidly
5. Performance comparable to decision trees

**2.5.2 Neural Networks Classification Algorithm**

There are two main types of neural network models: supervised neural networks such as the multi-layer perception or radial basis functions, and unsupervised neural networks such as Kohonen feature maps. A supervised neural network uses training and testing data to build a model. The data involves historical data sets containing input variables, or data fields, which correspond to an output. The training data is what the neural network uses to “learn” how to predict the known output, and the testing data is used for validation. The aim for the neural networks to predict the output for any record gives the input variables only.

**The Advantages of Neural Networks classifiers**

1. High Accuracy: Neural networks are able to approximate complex non-linear mappings.
2. Noise Tolerance: Neural networks are very flexible with respect to incomplete, missing and noisy data.
3. Independence from prior assumptions: Neural networks do not make a priori assumptions about the distribution of the data, or the form of interactions between factors.
4. Ease of maintenance: Neural networks can be updated with fresh data, making them useful for dynamic environments.

**The Disadvantages of Neural Networks classifier**

1. Poor Transparency: Neural networks operate as “black boxes”.
2. Trial-and-error design: The selection of the hidden nodes and training parameters is heuristic.
3. Data hungry: Estimating the network weights requires large amounts of data, and this can be very computer intensive.
4. Over-fitting: If too many weights are used without regularization, Neural Network becomes useless in terms of generalization to new data.

### **2.5.3 Naive Bayes Classification Algorithm**

A Naïve Bayes classifier is a simple probabilistic classifier based on applying Bayes theorem (from Bayesian statistics) with strong (naive) independence assumptions. A more descriptive term for the underlying probability model would be "independent feature model". In simple terms, a Naïve Bayes classifier assumes that the presence (or absence) of a particular feature of a class is unrelated to the presence (or absence) of any other feature. For example, a fruit may be considered to be an apple if it is red, round, and about 4" in diameter. Even if these features depend on each other or upon the existence of the other features, a Naïve Bayes classifier considers all of these properties to independently contribute to the probability that this fruit is an apple (Shruthi and Chaitra,2016).

Depending on the precise nature of the probability model, Naïve Bayes classifiers can be trained very efficiently in a supervised learning setting. In many practical applications, parameter estimation for Naïve Bayes models uses the method of maximum likelihood; in other words, one can work with the Naïve Bayes model without believing in Bayesian probability or using any Bayesian methods. In spite of their Naïve design and apparently over-simplified assumptions, Naïve Bayes classifiers have worked quite well in many complex real-world situations (Shruthi and Chaitra, 2016).

**Advantages of Naïve Bayes Algorithm**

1. Naïve Bayes classifier requires a small amount of training data to estimate the parameters (means and variances of the variables) necessary for classification.
2. Because independent variables are assumed, only the variances of the variables for each class need to be determined and not the entire covariance matrix.
3. It improves the classification performance by removing the irrelevant features.
4. High Performance, but with short computational time

**Challenges of Naïve Bayes Algorithm**

1. Incomplete training data
2. Continuous variables
3. Attribute independence
4. It works well with a small dataset.

**Steps of Naïve Bayes Algorithm**

**Step 1:** Scan the dataset (storage servers)

**Step 2:** Calculate the probability of each attribute value. [n, n\_c, m, p]

**Step 3:** Apply the formulae P(attribute value(ai) /subject value vj)=(nc + mp)/(n+m)

*Where:*

n = the number of training examples for which v = vj

n\_c = number of examples for which v = vj and a = ai

p = 1/number of subject values

m = the equivalent sample size [number of attributes]

**Step 4:** Multiply the probabilities by p

**Step 5:** Compare the values and classify the attribute values to one of the predefined sets of class.

### **2.5.4 Decision Tree Classification Algorithm**

A decision tree is a flow-chart tree structure, where each internal node is denoted by rectangles, and leaf nodes are denoted by ovals. All internal nodes have two or more children node and the internal nodes contain splits, which test the value of an expression of the attributes (Olaniyi, *et al.*, 2017).

According to Anuradha and Velmurugan, (2015), Decision tree classifiers are one of the popular and powerful tools for classification. Generally, decision tree classifiers have a tree-like structure which starts from root attributes, and ends with leaf nodes. It also has several branches consisting of different attributes, the leaf node on each branch representing a class or a kind of class distribution. Decision tree algorithms describe the relationship among attributes, and the relative importance of attributes.

**The Advantages of decision trees are that:**

1. They represent rules which could easily be understood and interpreted by users,
2. Do not require complex data preparation, and
3. Perform well for numerical and categorical variables.

**The Disadvantages of decision trees are that:**

1. Decision tree engine requires more coding i.e. Each tree is “unique” sequence of tests, so little common structure
2. Need as many examples as possible
3. Higher CPU cost - but not much higher
4. Learned decision trees may contain errors

The algorithm, summarized as follows.

**Step 1:** create a node N;

**Step 2:** if samples are all of the same class, C then

**Step 3:** return N as a leaf node labeled with the class C;

**Step 4:** if attribute-list is empty then

**Step 5:** return N as a leaf node labeled with the most common class in samples;

**Step 6:** select test-attribute, the attribute among attri­bute-list with the highest information gain;

**Step 7:** label node N with test-attribute;

**Step 8:** for each known value of test-attribute

**Step 9:** grow a branch from node N for the condition test-attribute= a*i*;

**Step 10:** let s*i* be the set of samples for which test-attri­bute= a*i*;

**Step 11:** if s*i* is empty then

**Step 12:** attach a leaf labeled with the most common class in samples;

**Step 13:** else attach the node returned by generate deci­sion tree (s*i*, attribute-list, and test-attribute)

### **2.5.5 Bayesian Network Classification Algorithm**

Bayesian classifiers are statistical classifiers that predict class membership by probabilities, such as the probability that a given sample belongs to a particular class. Bayesian networks and Naive Bayes are the two popular Bayesian classifiers which are more commonly used in real-world applications (Kabakchieva, 2013).

**Advantages of Bayesian Network (Kabakchieva, 2013):**

1. Simply to apply
2. It has computational efficiency and
3. It has a very good performance.

**Challenges of Bayesian Network**

A Bayesian classifier is based on the idea that the role of a (natural) class is to predict the values of features for members of that class. Bayesian classifiers are based on Bayes theorem, which says:

P(*cj*|*d*) = *p*(d|cj)*p*(*cj*)*p*(*d*)

*P* (c*j*| d) = probability of instance d being in class c*j*,

*p* (d | c*j*) = probability of generating instance d given class c*j*,

*P* (c*j*) = probability of occurrence of class c*j*,

*p* (d) = probability of instance d occurring

### **2.5.6 K-means Clustering Classification algorithm**

K-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

**The Advantages of K-Means classifier:**

1. If variables are huge, then K-Means most of the times computationally faster than hierarchical clustering, if k is kept small.
2. K-Means produce tighter clusters than hierarchical clustering, especially if the clusters are globular.

**The disadvantages of K-Means classifier:**

1. Difficult to predict K-Value.
2. It cannot work well with global cluster.
3. Different initial partitions can result in different final clusters.
4. It does not work well with clusters (in the original data) of different size and Different density.
   * 1. **Genetic Classification Algorithm**

Genetic algorithms are a class of algorithms designed to explore a large search space and find optimal solutions by mimicking evolution and natural selection. Potential solutions are randomly found, evaluated, and bred with one another in hopes of producing better solutions.

The process of using genetic algorithms is as follows:

1. Determine the problem and goal
2. Break down the solution to bite-sized properties (genomes)
3. Build a population by randomizing said properties
4. Evaluate each unit in the population
5. Selectively breed (pick genomes from each parent)
6. Rinse and repeat

**Advantages of Genetic Algorithm**

1. It helps in getting algorithm within tolerances fairly quickly

**Disadvantages of Genetic Algorithm**

1. It does not fit perfectly for a lot of problems.

### **2.5.8 K-Nearest Neighbour Classification Algorithm**

The K-Nearest Neighbor Algorithm (K-NN) classify objects based on the closest training examples in the fea­ture space. K-NN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The major drawback of K-NN algorithm is that its accu­racy can be severely degraded by the presence of noisy or irrelevant features. Similarly, its accuracy becomes poor if the feature scales are not consistent with their impor­tance (Kabakchieva, 2013). In K-Nearest Neighbor algorithms, number of training instances is described by n attributes. Each instance is representation of a point in n-dimensional space forming pattern space of training tuples. When unknown instance comes, a K-Nearest Neighbours algorithm looks the pattern space of the k training tuples that are closest to new instance (Kulkarni and Ade, 2014).

In k-Nearest Neighbours classification, each of the characteristics in the training set is considered as a dif­ferent dimension in some space, and take the value an observation has for this characteristic to be its coordinate in that dimension, so getting a set of points in space. The similarity of two points is considered to be the distance between them in this space under some appropriate met­ric. The way in which the algorithm decides which of the points from the training set are similar enough to be considered when choosing the class to predict for a new observation is to pick the k closest data points to the new observation, and to take the most common class among these. This is why it is called the k Nearest Neighbours algorithm.

**Advantages of K-NN algorithm**

* 1. Simple to implement
  2. Flexible to feature/ distance choices
  3. Naturally handles multi-class cases
  4. Can do well in practice with enough representative data

**Disadvantage of K-NN algorithm**

1. Its accu­racy can be severely degraded by the presence of noisy or irrelevant features
2. Its accuracy becomes poor if the feature scales are not consistent with their impor­tance.
3. Large search problem to find nearest neighbours
4. Storage of data
5. Must know there is a meaningful distance function

The k-Nearest Neighbours classification can be sum­marized as:

**Step 1:** A positive integer k is specified, along with a new sample.

**Step 2:** The k entries in the dataset are selected in the databases which are closest to the new sample.

**Step 3:** The most common classification of these entries is identified.

**Step 4:** This is the classification of the new sample.

### **2.5.9 Support Vector Machines Classification Algorithm**

SVM (Support Vector Machines) have become an increasingly popular tool for machine learning tasks involving classification, regression or novelty detection. In particular, they exhibit good generalization performance on many real issues and the approach is properly motivated theoretically. There are relatively a few free parameters to adjust and the architecture of the learning machine does not need to be found by experimentation.

SVM technique was introduced by Cortes and Vapnik in 1995 with many advantages such as it can perform well for data sets that have many attributes resolving the small sample, non-linear and high dimensional pattern recognition (Hu *et al.*, 2009). Moreover, SVM has no upper limit on the number of attributes and uses kernel trick which the model can be built within expert knowledge on the problem by adjusting the kernel. Besides that, SVM is the most competent methods for training which can produces high accuracy of model. In two-class learning, the aim is to find the most suitable classification function in differentiating between the members of two categories in a training dataset. Therefore, in a linearly separable dataset, a linear classification function will correspond to the separating hyperplane that passes through the middle of the two categories by separating it into two different categories. Once this function is identified, new data can be classified by simple testing task in assigning the data to the categories that they belong to (Zhang, *et al.*, 2010). SVM implements the idea that vector is nonlinearly mapped to a very high dimension future space. In this feature space, a linear separation surface is created to separate the training data by minimizing the margin between the vectors of the two classes (Magnin *et al.*, 2009).

Due to many such linear hyperplanes, SVM technique has found the most suitable function by maximizing the margin among the two categories. Intuitively, the margin shows the amount of space, or separation among the two categories as defined by the hyperplane. The margin corresponds to the minimal distance between the closest data points to a point on the hyperplane. SVM insists to identify the maximum margin hyperplane because it offers the best generalization ability. This will indicate not only the best classification performance or correctness on the training data, but also much room for the correct classification of the future data (Wu, et al., 2008). SVM algorithm for training used kernel parameter to separate data between the hyperplane which is the input data and are called input space and the output data in hyperplane are called feature space. There are four types of kernel in SVM: linear kernel function; polynomial kernel function; Gaussian (RBF) and S-type (sigmoid kernel function). After data separating process is done, the minimal margin between vector and hyperplane is calculated.

**Advantages of Support Vector Machines Classifiers**

1. High dimensional input space
2. Sparse document vectors
3. Regularization parameter.

**Disadvantages of Support Vector Machines Classifiers**

1. SVM has unbalanced data challenges i.e. some classes have few data, while some a lot.
2. It has structural data sets issues i.e. an instance may not be a vector
3. It has multi-label classification issues i.e. an instance associated with greater than or equal to 2 labels.
4. It also has large-scale Data challenges i.e. SVM cannot handle large sets if using kernels.

## **2.6 Data Mining in Human Resource Management**

In this day and age, the K-Era, knowledge is a valuable asset and among the crucial issues to address. Knowledge can be discovered through many approaches and one of them is by using data mining technique. In data mining, tasks such as classification, clustering and association are used to discover implicit knowledge from huge amount of data (Jantan *et al*., 2010). There are many fields adapted this approach as their problem solver method, such as finance, medical, marketing, stock market, telecommunication, manufacturing, health care, customer relationship, education and some others. Nevertheless, the application of data mining has not attracted much attention in Human Resource Management (HRM) field (Chien & Chen, 2008; Ranjan, 2008).

The vast amount of data in Human Resource Management can provide a rich resource for knowledge discovery and for decision support system development. Besides that, the valuable knowledge discovered from data mining process should be considered as part of knowledge management issues. In any organization, they have to struggle effectively in term of cost, quality, service or innovation. The success of these tasks depends on having enough right people with the right skills, employed in the appropriate locations at appropriate point of time. This is categorized as part of the talent management task in HRM (Cubbingham, 2007).

Data mining technique has been applied in many fields, but its application in Human Resource Management (HRM) is very rare (Chien & Chen, 2008). Recently, there are some researches that show interest in solving HRM problems using Data mining approach (Jantan, *et al.*, 2009; Ranjan, 2008). Table 2.2 lists some of the applications in HR that use data mining tasks, and it shows that there are few researches on that. Moreover, data mining technique is usually used in personnel selection, in order to choose the right candidates for a job. The use of data mining techniques in HRM are infrequent and there are some examples such as to predict the length of service, sales premium, persistence indices of insurance agents and to analyze miss-operation behaviors of operators (Chien & Chen, 2008).

***Table 2.2. Data mining task in Human Research Application***

|  |  |
| --- | --- |
| **Data mining task** | **Activity in HRM** |
| ***Classification*** | Personnel selection (Chien & Chen,  2008),  Job attitudes ( Huang, 2006)  Personnel Selection – Recruit and  Retain Talents (Chien & Chen,  2007) |
| ***Association*** | Training (Chen, *et al.,* 2007) |
| ***Classification***  ***and***  ***Prediction*** | Project Assignment (Huang, 2006) |
| ***Classification***  ***and***  ***Association*** | Personnel Selection (Tai & Hsu,  2005) |

Besides that, there are very few researches on the uses of data mining in talent management such as for talent forecasting, project assignment and, staff performance evaluation, talent recruitment. Due to these reasons, this study attempts to use classification techniques in data mining to determine the employee’s performance by predicting their performance based on the past experience knowledge from employee databases.

## **2.7 Classification Software Tools**

There are many ready-made tools available for data mining today. Some of these have common functionalities packaged within, with provisions to add-on functionality by supporting building of business-specific analysis and intelligence.

Listed below are some of the popular multi-purpose data mining tools that are leading the trends (Invensis, 2017):

1. ***Rapid Miner (erstwhile YALE):***This is very popular since it is a ready-made, open source, no-coding required software, which gives advanced analytics. Written in Java, it incorporates multifaceted data mining functions such as data pre-processing, visualization, predictive analysis, and can be easily integrated with WEKA and R-tool to directly give models from scripts written in the former two.
2. **WEKA**: This is a JAVA based customization tool, which is free to use. It includes visualization and predictive analysis and modelling techniques, clustering, association, regression and classification. It is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from a Java code. It is also well-suited for developing new machine learning schemes (Shah, 2017).
3. ***R-Programming Tool:***This is written in C and FORTRAN, and allows the data miners to write scripts just like a programming language/platform. Hence, it is used to make statistical and analytical software for data mining. It supports graphical analysis, both linear and nonlinear modelling, classification, clustering and time-based data analysis.
4. ***Python based Orange and NTLK:***Python is very popular due to ease of use and its powerful features. Orange is an open source tool that is written in Python with useful data analytics, text analysis, and machine-learning features embedded in a visual programming interface. NTLK, also composed in Python, is a powerful language processing data mining tool, which consists of data mining, machine learning, and data scraping features that can easily be built up  for customized needs.
5. ***Knime***: Primarily used for data pre-processing – i.e. data extraction, transformation and loading, Knime is a powerful tool with GUI that shows the network of data nodes. Popular amongst financial data analysts, it has modular data pipe lining, leveraging machine learning, and data mining concepts liberally for building business intelligence reports.

**2.8 Related Literature**

There are several studies, which have used Data Mining for extracting rules and predicting certain behaviors in many fields. The abundance of data has attracted Data Mining research towards the domain of Human Resource Management. However, this approach dose not really attract researchers in HR and HR decision support application that use this approach is also quite rare.

Lamarca and Ambat, (2018), proposed a framework for development of a performance appraisal System, which used Decision Tree (J48 algorithm) and Fuzzy Logic. This study presents the development of performance appraisal system which aims at studying the HR specific to the educational environment and brings out the role of data mining in achieving quality enhanced development in its faculty.

The result of the study was on utilizing J48-generated IF-THEN rules in conjunction with FLC to predict individual or institutional faculty performance.

**Limitation:** The evaluation process was time consuming because of the need to explain the concept behind the prototype and the respondent observed that the computation of the performance appraisal was a little bit slow.

Tupe and Uplenchwar (2017), developed an Employee Performance Evaluation System Using ID3 Algorithm. In this system all the task was performed by the admin. Task means adding training data set which is required for calculating an entropy and information gain. Once these two modules are calculated the decision tree is created by using an ID3 algorithm. After this employee data is added to the database by considering the attributes like quality, behaviour, skills, projects etc. Here number 1 to 10 was being assigned to each attribute of an employee for calculating a performance of an employee using a decision tree, considering the information provided by admin the probability of an employee performance is generated. The result of the study by using this system showed a significant improvement on the performance and quality of a management system.

**Limitation:** This study was to find the data which will give more information on predicting the performance, but was not able to give recommendation where necessary.

Kirimi and Moturi (2016), applied Data Mining Classification in Employee Performance Prediction to build a model for predicting employee performance from previous appraisal records that is parallel to the criteria used for performance evaluation. Decision tree was the main Data Mining tool used and the results showed that employee performance was highly affected by experience, age, academic qualification, professional drill, gender, marital status and previous performance appraisal scores.

**Limitation:** The prediction of the employee was being down according to category of the employee, it was being recommended to predict the performance of the employee as a continuous value to make it more robust.

Jantan, Yusoff, and Noh. (2014), proposed an SVM classification model using SMO algorithm for academic performance achievement via several experiments on selected datasets. The result was on the accuracy of the proposed model, which was considered acceptable and needs further enhancement.

**Limitation:** In this study, there were some probable reasons regarding the accuracy of the model produced by SMO algorithm. The selection of attributes could be considered as one of the reasons that affecting the accuracy of the model. It was recommended that the accuracy of the classification model can be enhanced by a comparative study conducted using other SVM algorithms.

Sarda, *et al.,* (2014) built models that used classification algorithm like decision trees and Naïve Bayes to rank the applicants for a job profile based on their resume and social media presence. Theirs is a match making system where the companies will be given a list of ranked candidates using information retrieval technique like two-way relevance ranking.

**Limitation:** It was to rank the applicants for a job profile based on their resume and social media presence, the performance of the staff was not being evaluated and there were no recommendations either.

## 

## **2.8.1 Summary of Related Literature**

In this research work, various views and reports from authors centered on the subject matter have been reviewed. Business organization and management, human resource management, staff performance evaluation have been discussed. The importance of performance management and performance appraisal have also been emphasized. Data mining and its step, the classification techniques, and the data mining in human resource management were all considered. A lot of studies have looked into the applications of Data Mining in the Human Resource Management domain, none has applied Data Mining to evaluate and predict the employee’s performance based on their inherent characteristics, which could be initially mined from previous Staff appraisal records. Instead, predictions of performance and talents have been stressed out.

This research work strives to evaluate the performance of Staff from previous appraisal records. The system gets the dataset of previous records of staff performance evaluation gathered as its input and use Support Vector Machine classifier to classify the data into related groups, the classified result is used to generate a rule set which was further used to test the accuracy of the predictors of the performance evaluation system for each staff.

**CHAPTER THREE**

**SYSTEM ANALYSIS AND METHODOLOGY**

## **3.0 Introduction**

Systems analysis is the process of observing systems for troubleshooting or development purposes. System analysis is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components. It is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem-solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose. Analysis specifies what the system should do. This chapter takes an overview on the system analysis and various research methodologies and the entire research work.

## **3.1 Analysis of the Existing System**

An organization is saddled with the responsibility of coordinating people and their actions so as to obtain set goals. Huan resource being the back bone of any organization takes care of staff recruitment, training, development and welfare. The service quality or overall performance of the organization depends on the performance of the employees as the employee plays a crucial role in delivering quality products and service to the consumers according to their needs and preferences. Performance Evaluation is conducted annually by human resource department. The essence of employees’ evaluation in an organization is to represent their talent ability. Staff are evaluated through some methods, which are, rating scales, critical incident, essay, work standards, ranking, forced distribution, etc., using some performance factors such as knowledge, skill and abilities, quality of work, quantity of work, work, habits/time management, communication, dependability, interpersonal relationship, initiative/creative, adaptability, leadership, etc. The performance rating scales ranging from 1-5 or 1-9 are used in grading the performance factors of a staff. With these, staff performance can be evaluated and remarks given on whether the staff is to be promoted or need improvement in form of training.

The limitation of the existing system is that some human resource managers spend a lot of time and money in evaluating their employee’s performance during promotion.

In the existing system, Decision tree was the main Data Mining tool used to build the classification model, where several classification rules were generated. To validate the developed model, a prototype was constructed and the data collected from the institute’s Human Resource Department was used. Results showed that employee performance was highly affected by experience, age, academic qualification, professional training, gender, marital status and previous performance appraisal scores.

|  |  |  |
| --- | --- | --- |
| Number | Technique | Classification accuracy |
| 1 | ID3 | 64.52% |
| 2 | Naïve Bayes | 80.33% |
| 3 | C4.5 (J4.8) | 92.60 |

The comparison of accuracy rate obtained for the various classification techniques is given in table above and Decision Tree C4.5 algorithm had the highest accuracy of 92.69% and was therefore best suited for the training and development of the classification model. The classifier model generated after the classification process was evaluated using cross fold validation and full training evaluation techniques. A 10 - fold cross validation with 70% hold out was performed on the J48 algorithm. The percentage accuracy was 70.83%.

In view of that, it is imperative to use classification techniques such as Support Vector Machines (SMO) to classify the employee’s performance to know whether the employee gets recommendation for promotion or not. The result of classification produces the rule set, which is used in generating predicting model for employees’ future performance evaluation.

### **3.1.1 Architecture of Existing System**



***Figure 3.1: Architecture of existing System (Kirimi and Moturi, 2016).***

1. **Define performance indictors:** This stage entails the definition of performance predictors or variables. It has details of important attributes extracted from the databases, which will be used to create the dataset.
2. **Training set:** This has to do with the extraction of instances based on the needed attributes, which will be used for data analysis.
3. **Testing set**: This has to do with the extraction of instances based on the needed attributes, which will be used for testing the trained data (Prediction model).
4. **Prediction model:** Prediction model is developed after an acceptable accuracy rate of correctly classified instances have been achieved. The model is generated though decision tree – C4.5 algorithm.

Unknown data

Define Performance predictors

Training set

Testing set

Prediction Model (SVM-SMO)

Prediction

Model Prediction

Promotion and Reward

Improvement

Recommendation

1. **Unknown Data:** This is the unknown data extracted from the databased, which is used for prediction of the performance of staff through prediction model generated.
2. **Prediction:** This is the outcome of the result obtained through the use of prediction model on unknown data.
3. **Model performance**: This entails the process of analyzing the prediction model to further increase its accuracy.
4. **Reward:** This process entails various incentives given to the employees that have high performance.
5. **Improvement:** This process entails various training and development given to the employees that have poor performance.

### **3.1.2 Advantages of Existing System**

The advantages of the existing system are as follows:

1. The existing system assists in identifying some areas where a staff needs training, development or advice.
2. The existing systems help to track employees’ performance records
3. The existing system aids the human resource managers to make decisions on the duties and responsibilities given to the right personnel at the right time.

### **3.1.3 Disadvantages of the Existing System**

After investigating the existing system and the following drawbacks were identified:

1. It is time consuming and delaying when it gets to the period of evaluating staffs’ performance.
2. It is difficult to acquire a complete assessment of staff performance in order to discover their abilities, strength and weakness.
3. The result or outcome of the performance evaluation can be tempered with due to involvement of humans in the rating of staff.

## **3.2 Analysis of the Proposed System**

The proposed system in Figure 3.2 is an application of Data Mining model in evaluating staff performance in order to predict the employees’ performance based on their inherent characteristics through previous appraisal records. The system gets the dataset of previous records of staff performance evaluation gathered as its input and use Support Vector Machine classifier to classify the data into related groups and performance prediction model is generated through rule set as well as giving recommendations where necessary.

Unknown data

Define Performance predictors

Training set

Testing set

Prediction Model (SVM-SMO)

Prediction

Model Prediction

Promotion and Reward

Improvement

Recommendation

***Figure 3.2: Proposed Performance Evaluation Model***

### **The Advantages of the Proposed System**

The advantages of the proposed system are:

1. The system evaluates and predicts staff performance in little or no time.
2. The system keeps track of all the previous result of performance evaluation.
3. The system helps the human resource manager in carrying out staff performance evaluation without any favor or influence when rating performance.
4. The system will assist organizations in making decision regarding assignment of the right personnel to the right job at the right time.

### **3.2.2 Justification of the Proposed System**

The justification for the staff performance evaluation system includes:

1. It will help in evaluating and predicting staff performance without time consumption.
2. It will help keep a comprehensive report of the previous result of performance evaluation.
3. It will enable the human resource manager in carrying out staff performance evaluation without any favor or influence during performance rating.
4. It will help human resource management in an organization to plan decisively on the staff to assign to the right job at the right time.

## **3.3 Research Methodology**

The term research methodology is usually considered to include research design, data gathering and data analysis, the research methodology used helps to ensure that a thorough study of the present system is effectively carried out, thus helping the project research team to completely understand the operation of the existing system so as to know how the new system should be structured and the functionalities needed in it to address the seemingly existing problems discovered.

In this work, data from previous staff performance evaluation result is being collected from three organizations and is analyzed using Excel Application so as to remove impurities. The model is formulated based on Support Vector Machine (SMO) algorithm and rule set generated from the classification. The weights of the decision will be determined based on Support Vector Machine (SMO) algorithm using WEKA Data Mining toolkit. The model is being implemented on a Desktop based application.

**3.3.1 Types of Research Methodology**

There are many different methodologies used in various types of research in gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques will be used in this work and they are:

1. Qualitative method: This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview, survey, questionnaire as presented in appendix A etc.
2. Quantitative method: This refers to the sources where data were obtained by the researcher from Journal, Library source and Internet materials and electronic books. The data collected from this means have been covered in literature review in the chapter two of the project.

### **3.3.2 Justification of Research Methodology**

This research work adopts the quantitative approach because it’s based on variables measured with numbers and analyzed with statistical procedures and also qualitative Method. In this work, data from previous staff performance evaluation result is being collected from organizations.

The system development methodology also adopted is Rational Unified Process (RUP). Rational Unified Process is adopted because:

1. It leads to higher efficiency due to testing at each phase
2. Changes in the project are easy to make.
3. It is used for desktop-based application development

**3.3.2.1 Rational Unified Process**

The Rational Unified Process is not a concrete development model, but rather is intended to be adaptive and tailored to the specific needs of the project, team, or organization. This Process is based on a few fundamental ideas, such as the phases of development and the building blocks, which define who, what, when, and how development will take place. It is a general process model and was designed for object-oriented development using the Unified Modeling Language (UML).

It is an object oriented and each succession involves planning evaluation, requirement, analysis and design, implementation and testing.

This model was created by the Rational Software Company. It has the under listed characteristics:

* Incremental and iterative approach where large projects are divided into smaller projects.
* It adopts architecture-centric, where architecture is a function of user needs. The Rational Unified Process is presented in Figure 3.3.

**Analysis and Design**

**Requirement**

**Implementation**

**Planning and Evaluation**

**Testing**

**Initial Planning Stage**

**Deployment Stage**

**Management**

**Environment**

**Configuration**

**Management**

***Figure 3.3 Rational Unified Process flow diagram***

**3.3.2.2 Application Area of Rational Unified Process**

1. It can be used in the development of all kinds of software
2. It can be used mostly in developing larger software project
3. It is also used in developing non software project.

**3.3.2.2 Justification of Rational unified Process Method**

1. Changes in the project is easy
2. It leads to higher efficiency
3. Used for software and non-software project respectively.

## **3.4 Proposed System Architecture**

The proposed system in Figure 3.4 comprises a 3-tier architectural design that consists of the Graphic User Interface (GUI), Data and Analytical Processing Logic and the Database Management System



***Figure 3.4. System Architecture for Staff Performance Evaluation Model***

### **3.4.1 Description of Key Components**

i) **Interface Tier (GUI):** The User interface presented in the conceptual architecture of the proposed system is used to capture input of staff evaluation details and give an output of prediction to the user of the system. The interface is developed using HTML, CSS, PHP technologies and MySQL as database.

ii) **DBMS**: It maintains the storage of previous prediction result, in case of future reference. The database management System accepts requests for data from an application program through user interface. The equerries and responses are submitted and received according to the format that conforms to one or more application protocols.

iii) **Performance** **Prediction Model:** It is a computer processing that enables users to easily and selectively extract and view data from different points of view. DAPL tier performs the classification and prediction thereby giving out the result of staff performance evaluation.

## **3.5 Data Collection and Preparation**

This research used data from previous staff performance evaluation result, which was collected from organizations and was cleansed through the use of Excel Application. The prediction model was formulated based on SVM-SMO classification and rule set generated from the classification. The weights of the decision were determined based on SVM-SMO algorithm using WEKA Data Mining toolkit. The model was implemented on a Desktop-based application.

## **3.5.1 Data Classification**

Classification is the most commonly applied data mining technique, which employs a set of pre-classified examples to develop a model that can classify the population of records at large. The approach used in this study is Support Vector Machine classification algorithms. Data classification is the process of organizing data into categories for its most effective and efficient use. The data classification process involves learning and classification. In Learning the training data are analyzed by classification algorithm. In classification test data are used to estimate the accuracy of the classification rules. If the accuracy is acceptable the rules can be applied to the new data tuples. The classifier-training algorithm uses these pre-classified examples to determine the set of parameters required for proper discrimination. The algorithm then encodes these parameters into a model called a classifier.

**3.6 Support Vector Machine**

Support Vector Machine is used for Linear and Non-Linear classification. It is a powerful; state-of-the-art algorithm with strong theoretical foundations based on the Vapnik-Chervonenkis theory. SVM has strong regularization properties. Regularization refers to the generalization of the model to new data. Support vector machines in particular were designed as a tool to solve supervised learning classification problems. Supervised learning is an area of machine learning in which some “training set" of data are given for which now a priori the appropriate classifications.

The geometrical interpretation of support vector classification (SVC) is that the algorithm searches for the optimal separating surface, i.e. the hyperplane that is, in a sense, equidistant from the two classes. SVC is outlined first for the linearly separable case. Kernel functions are then introduced in order to construct non-linear decision surfaces. However, for noisy data, when complete separation of the two classes may not be desirable, slack variables are introduced to allow for training errors.

**3.6.1 Sequential Minimal Optimization of SVM**

In its simplest, linear form, a SVM is a hyperplane that separates a set of positive examples from a set of negative examples with maximum margin. This study adopts Sequential Minimal Optimization (SMO) of SVM because its algorithm is conceptually simple, easy to implement, often faster and has better scaling properties than a standard algorithm of Support Vector Machine that uses project conjugate gradient (PCG). The standard algorithm of SVM is slow, especially for large problems. The standard SVM training algorithms are complex, subtle and sometimes difficult to implement. The SMO algorithm was proposed by John C. Platt in 1998 and became the fastest quadratic programming optimization algorithm, especially for linear SVM and sparse data performance.

The Sequential Minimal Optimization (SMO) algorithm is derived by taking the idea of the decomposition method to its extreme and optimizing a minimal subset of just two points at each iteration. The power of this technique resides in the fact that the optimization problem for two data points admits an analytical solution, eliminating the need to use an iterative quadratic programming optimizer as part of the algorithm. The requirement that the condition is enforced throughout the iterations implies that the smallest number of multipliers that can be optimized at each step is 2: whenever one multiplier is updated, at least one other multiplier needs to be adjusted in order to keep the condition true. At each step SMO chooses two elements and to jointly optimize, find the optimal values for those two parameters given that all the others are fixed, and updates the α vector accordingly.

The choice of the two points is determined by a heuristic, while the optimization of the two multipliers is performed analytically. Despite needing more iterations to converge, each iteration uses so few operations that the algorithm exhibits an overall speed-up of some orders of magnitude. Besides convergence time, other important features of the algorithm are that it does not to store the kernel matrix in memory, since no matrix operations are involved, that it does not use other packages, and that it is fairly easy to implement.

**3.6.2 The Mathematical concept of Support Vector Machine and SMO**

In the linear case, the margin is defined by the distance of the hyperplane to the nearest of the positive and negative examples. The formula for the output of a linear SVM is: where *w* is the normal vector to the hyperplane and *x* is the input vector. The separating hyperplane is the plane *u=*0. The nearest points lie on the planes *u* =1. The margin *m* is thus:

Maximizing margin can be expressed via the following optimization problem:

Where ***xi***is the ***i*th** training example, and ***yi*,** is the correct output of the SVM for the ***i*th** training example. The value ***yi*** is **+1** for the positive examples in a class and **-1** for the negative examples.

Using a Lagrangian, this optimization problem can be converted into a dual form which is a Quadrative problem (QP) where the objective function Ψ is solely dependent on a set of Lagrange multipliers **αi,**

(where *N* is the number of training examples), subject to the inequality constraints**,**

And one linear equality constraint **.**

There is a one-to-one relationship between each Lagrange multiplier and each training example. Once the Lagrange multipliers are determined, the normal

vector and the threshold *b* can be derived from the Lagrange multiplier:

Because can be computed via equation above from the training data before use, the amount of computation required to evaluate a linear SVM is constant in the number of non-zero support vectors.

There are datasets that are not linearly separable. Thus, there may be no hyperplane that splits the positive examples from the negative examples. Based on the above formulation, the non-separable case would correspond to an infinite solution.

The medication to the original optimization allows, but penalizes, the failure of an example to reach the correct margin. The modification is:

Where **ξ*i*** are slack variables that permit margin failure and ***C*** is a parameter which trades off wide margin with a small number of margin failures. When the new optimization problem is transformed into the dual form, it simply changes the constraint: into a box constraint: The variable **ξ*i***do not appear in the dual formulation at all.

SVMs can be even further generalized to non-linear classifiers. The output of a non-linear SVM is explicitly computed from the Lagrange multipliers:

Where *K* is a kernel function that measures the similarity or distance between the input vector and the stored training vector . Examples of *K* include Gaussians, polynomials, and neural network non-linearities. If *K* is linear, then the equation for the linear SVM is recovered.

The Lagrange multipliers α*i* are still computed via a quadratic program. The non-linearities alter the quadratic form, but the dual objective function Ψ is still quadratic in α:

The quadratic programming (QP) problem in equation above, is the QP problem that the SMO algorithm will solve. In order to make the QP problem above be positive definite, the kernel function *K* must obey Mercer’s conditions.

The Karush-Kuhn-Tucker (KKT) conditions are necessary and sufficient conditions for an optimal point of a positive definite QP problem. The KKT conditions for the QP problem above are particularly simple. The QP problem is solved when, for all *i*:

Where ***ui*** is the output of the SVM for the ***i*th** training example. It is important to note that the KKT conditions can be evaluated on one example at a time, which will be useful in the construction of the SMO algorithm.

**3.6.3 The Algorithm for Support Vector Machine SMO**

The steps for using Support Vector Machine Sequential Minimal Optimization (SMO) to classify and predict data are as follows:

Step 1: Input: *C*, kernel, kernel parameters, epsilon

Step 2: Initialize *b* and all α’s to 0

Step 3: Repeat until KKT satisfied (to within epsilon):

Step 3.1: Find an example *e1* that violates KKT (prefer unbound examples here, choose randomly among those)

Step 3.2 Choose a second example *e2*. Prefer one to maximize step size (in practice, faster to just maximize |E1-E2|). If that fails to result in change, randomly choose unbound example. If that fails, randomly choose example. If that fails, re-choose *e1*.

Step 3.3 Update α1 and α2 in one step

Step 3.4 Compute new threshold *b*

Step 4: Compute *b1* and *b2* as follows:

*b*1 = *E*1 + *y*1 (

*b*2 = *E*2 + *y*1 (

Step 5: Choose *b* = (*b*1 + *b*2) / 2

Step 6: As a shortcut, if and were not clipped, it is in fact guaranteed that *b* = *b*1 = *b*2 so one of them can just be computed.

# **CHAPTER FOUR**

# **SYSTEM DESIGN AND IMPLEMENTATION**

# **4.0 Introduction**

This chapter focuses on system design, design architecture, system requirement, justification of programming languages, system implementation, system testing, method of system conversion, evaluation of results and discussion of results.

# **4.1 System Design**

This is the process of defining the element of a system architecture, interfaces, module and data, to satisfy specific requirements. It could also be seen as the application of system theory to product development and the system configuration that meets an identified or required set of requirements.

# **4.1.1 Input Design**

It is necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. In order to develop user-friendly interface; as well as process for getting quality data into the information system in a truly accurate format, a secured input data entry form needs to be designed. The interface that provides a template for the capture of essential data is the input form. This links data entry to the database for storage. The new system is composed of some input forms, which are Staff Access form, registration form, performance evaluation form, and input layout form. These forms are represented in Figure 4.1 to 4.3 respectively.

**Access form**

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

(a) Primary Source

This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview and questionnaires.

(b) Secondary Source

The secondary data were obtained by the researcher from magazines, Journal, Newspapers, Library source and Internet downloads. The data collected from this means have been covered in literature review in the chapter two of the project.

3.1.1 Oral Interview

This was done between the researcher and the management staff of Heritage Polytechnic. Also various departmental heads were interviewed. Reliable facts were got based on the questions posed to the staff by the researcher.

3.1.2 Study of Manuals

Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

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• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

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Kin Text 30

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Entry Mode Text 20

Sponsor Text 50

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Type Text 20

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Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

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Duration Integer 2

Activities Text 50

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Exams and Records Single 4

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Date Date\time 8

Receipt Text 20

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Fig. 3.4.1 Use case diagram for android based clearance system

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Enter Username:

**Staff Access Form**

**Login**

Enter Password:

**Exit**

**Figure 4.1 Input Layout (Access form)**

**Registration form**

**Registration Form**

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There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

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The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

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Other Names Text 50

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Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

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Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

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Fig. 3.4.1 Use case diagram for android based clearance system

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Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

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The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

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Department :

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The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

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3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

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Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

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Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

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Fig. 3.4.1 Use case diagram for android based clearance system

Register

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When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

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• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

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The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

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Fig. 3.4.1 Use case diagram for android based clearance system

**Figure 4.2 Input Layout (Registration Form)**

**Performance Evaluation Form**

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Fig. 3.4.1 Use case diagram for android based clearance system

Staff No.:

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The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

Department:

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

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Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

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3.3 ANALYSIS OF THE PROPOSED SYSTEM

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3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

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a) Student Register

b) Clearance Form

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The report generated by the system includes:

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• Student clearance certificate

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Award Text 50

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Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

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FIELD NAME DATA TYPE FIELD SIZE

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Reg No Text 30

Finance Single 4

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Fig. 3.4.1 Use case diagram for android based clearance system

Job Description Pre-knowledge (JD)?:

Back

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Select rating value

Predict

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Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

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3.1.1 Oral Interview

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Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

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3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

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a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

Algorithms are the set of well-defined instruction in sequence to solve a program. An algorithm should always have a clear stopping point.

The following are the algorithm of the proposed system:

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Step four: If Admin logs in successfully THEN carry out clearance ELSE GOTO step one.

3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

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Fig. 3.4.1 Use case diagram for android based clearance system

Attended Training since Date of Appointment (AT)?:

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Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

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3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

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This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

The new system is composed mainly of two forms of input form, they are:-

a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

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The following are the algorithm of the proposed system:

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3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

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Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

Previous Good Performance (PGP)?:

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

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3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

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3.3 ANALYSIS OF THE PROPOSED SYSTEM

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Dept Text 50

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Address Text 50

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Job Ability (JA):

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Fig. 3.4.1 Use case diagram for android based clearance system

Communication Ability (CA):

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3.1 RESEARCH METHODOLY

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This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview and questionnaires.

(b) Secondary Source

The secondary data were obtained by the researcher from magazines, Journal, Newspapers, Library source and Internet downloads. The data collected from this means have been covered in literature review in the chapter two of the project.

3.1.1 Oral Interview

This was done between the researcher and the management staff of Heritage Polytechnic. Also various departmental heads were interviewed. Reliable facts were got based on the questions posed to the staff by the researcher.

3.1.2 Study of Manuals

Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

The new system is composed mainly of two forms of input form, they are:-

a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

Algorithms are the set of well-defined instruction in sequence to solve a program. An algorithm should always have a clear stopping point.

The following are the algorithm of the proposed system:

Step one: IF user’s choice is student login THEN GOTO step two (a) ELSE GOTO step four.

Step Two (a): IF user’s choice is Login THEN GOTO step three ELSE GOTO step two(b).

Step two (b): IF user’s choice is cancel THEN GOTO step one ELSE GOTO step two(a).

Step three: IF user’s choice is Registration THEN allow student to complete their clearance registration ELSEIF user’s choice is Clearance request THEN allows students to apply for clearance from various departments ELSEIF user’s choice is Logout THEN GOTO step two(a) ELSE GOTO step three.

Step four: If Admin logs in successfully THEN carry out clearance ELSE GOTO step one.

3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

Human Relations (HR):

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

(a) Primary Source

This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview and questionnaires.

(b) Secondary Source

The secondary data were obtained by the researcher from magazines, Journal, Newspapers, Library source and Internet downloads. The data collected from this means have been covered in literature review in the chapter two of the project.

3.1.1 Oral Interview

This was done between the researcher and the management staff of Heritage Polytechnic. Also various departmental heads were interviewed. Reliable facts were got based on the questions posed to the staff by the researcher.

3.1.2 Study of Manuals

Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

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This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

The new system is composed mainly of two forms of input form, they are:-

a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

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Step four: If Admin logs in successfully THEN carry out clearance ELSE GOTO step one.

3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

Loyalty and Honesty (LH):

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

(a) Primary Source

This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview and questionnaires.

(b) Secondary Source

The secondary data were obtained by the researcher from magazines, Journal, Newspapers, Library source and Internet downloads. The data collected from this means have been covered in literature review in the chapter two of the project.

3.1.1 Oral Interview

This was done between the researcher and the management staff of Heritage Polytechnic. Also various departmental heads were interviewed. Reliable facts were got based on the questions posed to the staff by the researcher.

3.1.2 Study of Manuals

Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

The new system is composed mainly of two forms of input form, they are:-

a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

Algorithms are the set of well-defined instruction in sequence to solve a program. An algorithm should always have a clear stopping point.

The following are the algorithm of the proposed system:

Step one: IF user’s choice is student login THEN GOTO step two (a) ELSE GOTO step four.

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Step two (b): IF user’s choice is cancel THEN GOTO step one ELSE GOTO step two(a).

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Step four: If Admin logs in successfully THEN carry out clearance ELSE GOTO step one.

3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

Punctuality and Attendance (PA):

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

(a) Primary Source

This refers to the sources of collecting original data in which the researcher made use of empirical approach such as personal interview and questionnaires.

(b) Secondary Source

The secondary data were obtained by the researcher from magazines, Journal, Newspapers, Library source and Internet downloads. The data collected from this means have been covered in literature review in the chapter two of the project.

3.1.1 Oral Interview

This was done between the researcher and the management staff of Heritage Polytechnic. Also various departmental heads were interviewed. Reliable facts were got based on the questions posed to the staff by the researcher.

3.1.2 Study of Manuals

Manuals and report based on clearance were studied and a lot of information concerning the system in question was obtained. The clearance forms were gathered and information relating to clearance fee and other requirements were also obtained.

3.1.3 Evaluation of Forms

Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

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3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

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a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

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The report generated by the system includes:

• Student Clearance Status

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3.4.3 ALGORITHM

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Kin Text 30

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FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

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Student Affairs Single 4

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Remark Text 30

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Fig. 3.4.1 Use case diagram for android based clearance system

Quality and Productivity (QP):

Prediction outcome:

Recommendation:

Total Score:

Save

This chapter takes an overviews on the system design and the entire research work, it is important to note that a poorly designed system will equally produce an incorrect output as such this chapter presents a skeletal approach to the design of the entire system.

3.1 RESEARCH METHODOLY

During the research work, data needed for the project was gathered from various sources. In gathering and collecting necessary data and information needed for system analysis, two major fact-finding techniques were used in this work and they are:

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Some forms that are necessary and available were assed. These include clearance form, fee receipts, etc. These forms help in the design of the new system.

3.2 GENERAL ANALYSIS OF THE EXISTING SYSTEM

When a student is about to graduate, he/she will take his/her degree exam after which he obtains a clearance letter from various departments and unions. The Registrar's Office carefully reviews each degree candidate's academic record and certifies to the faculty that the candidate has completed requirements for the degree. Also the bursary has to certify that the student has completed all payments.

3.2.1 ADVANTAGES OF THE EXISTING SYSTEM

The major advantage of the current system is that it presents students with physical receipt that can be documented for future references.

3.2.2 DISADVANTAGES OF THE EXISTING SYSTEM

The current clearance system of the polytechnic is a manual one. This makes the system so tedious and time consuming. Here, students have to visit all the clearance offices with a form for them to sign. Once these forms are signed, it proves that the student has been cleared. This process takes some months to be completed and possess a lot of stress to both staff and students involved.

In the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student’s clearance form.

3.3 ANALYSIS OF THE PROPOSED SYSTEM

The objective of the existing system is to enable student pay all their fees before leaving the school. Some levies are charged for processing student’s files and others for departmental dues or otherwise. The clearance system is designed to help students pay all the dues and obtain a clearance certificate without actually visiting each office.

3.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

The new system is designed to solve problems affecting the manual system in use. It is designed to be used online through an android phone thereby relieving both the students and staffs from much stress as experienced in the manual system.

This system will do the analysing and storing of information either automatically or interactively. It will make use of online access to Internet.

The proposed system will also have some other advantages like:

• Accuracy in the handling of data.

• Fast rate of operation and excellent responses time

• Flexibility (i.e.) it can be accessed at any time.

• Easy way of data backup in case of data loss.

• Better storage and faster retrieval system.

• Accessibility from any part of the world

3.3.2 DISADVANTAGES OF THE PROPOSED SYSTEM

The major disadvantage of the proposed system is if it is successfully hacked, information may be altered. With this students who have not completed their payment may still be cleared by various departments.

3.4 SYSTEM DESIGN

In order to achieve effective online clearance system, Structured System Analysis and Design Methodology (SSADM) were used. This is because; SSADM is an internationally accepted software engineering model mainly used in most result oriented analysis and design.

3.4.1INPUT LAYOUT

It is also necessary to denote that data inputted in the computer for processing determines what the output will be. Screen designs are generally or basically made for data entry or capture. Since data are captured from a hardcopy form, the sequence of data capture should be identical to the hardcopy form made for data collection.

The new system is composed mainly of two forms of input form, they are:-

a) Student Register

b) Clearance Form

3.4.2 OUTPUT LAYOUT

The sequence of the report is one of the important features that should be concluded. This is emphasized because it forms the basis of the school management decision. It aims at providing the management with adequate, effective, well documented up-to- date and formatted output to help as a tool in planning and decision making / based on the student clearance form.

There are methods of generating reports in the new package.

Hardcopy – This is a process of printing from the printer to paper, and

Softcopy – It is the process of displaying an output on the computer screen.

The report generated by the system includes:

• Student Clearance Status

• Student clearance certificate

3.4.3 ALGORITHM

Algorithms are the set of well-defined instruction in sequence to solve a program. An algorithm should always have a clear stopping point.

The following are the algorithm of the proposed system:

Step one: IF user’s choice is student login THEN GOTO step two (a) ELSE GOTO step four.

Step Two (a): IF user’s choice is Login THEN GOTO step three ELSE GOTO step two(b).

Step two (b): IF user’s choice is cancel THEN GOTO step one ELSE GOTO step two(a).

Step three: IF user’s choice is Registration THEN allow student to complete their clearance registration ELSEIF user’s choice is Clearance request THEN allows students to apply for clearance from various departments ELSEIF user’s choice is Logout THEN GOTO step two(a) ELSE GOTO step three.

Step four: If Admin logs in successfully THEN carry out clearance ELSE GOTO step one.

3.4.4 FLOWCHART

3.4.5 DATABASE LAYOUT

The file used in the design is stored in a database file. The database is created using Microsoft Access database. The database Structure is as follows:

Student Register Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

State of origin Text 20

Home Town Text 20

Marital Status Text 15

Nationality Text 30

Gender Text 10

Session Text 20

Level Text 20

Birth Date\time 8

Dept Text 50

Religion Text 30

Address Text 50

Kin Text 30

Kin Address Text 50

Entry Mode Text 20

Sponsor Text 50

Sponsor Address Text 50

Type Text 20

Qualification Text 50

Institution Text 50

Subject Text 50

Award Text 50

School Text 50

Study Text 30

Year Text 10

Duration Integer 2

Activities Text 50

Table 4.1 Students Register Database Structure

Student Clearance Database Structure

FIELD NAME DATA TYPE FIELD SIZE

Surname Text 20

First Name Text 20

Other Names Text 50

Reg No Text 30

Finance Single 4

Library Single 4

Student Affairs Single 4

Security Single 4

Department Single 4

Exams and Records Single 4

Clearance Single 4

Date Date\time 8

Receipt Text 20

Remark Text 30

Table 4.2 Students Clearance Database Structure

3.4.6 SYSTEM ARCHITECTURE

3.4.7 USE CASE DIAGRAM

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

Fig. 3.4.1 Use case diagram for android based clearance system

**Figure 4.3 Input Layout (Performance evaluation Form)**

**4.1.2 Database Design**

The database management used in this research work is SQLite relational database. The required entity (table) of the database is structured as follows in Table 4.1, 4.2, 4.3 respectively.

***Table 4.1 Access Table***

|  |  |  |
| --- | --- | --- |
| Field | Data type | Field size |
| **Id** | Auto Inc (PK) | 10 |
| **Username** | Text | 15 |
| **Password** | Text | 10 |

***Table 4.2 Staff Table***

|  |  |  |
| --- | --- | --- |
| Field | Data type | Field size |
| **Id** | Auto Inc. | 10 |
| **Staff\_No** | Text | 10 |
| **Name** | Text | 30 |
| **Phone** | Text | 11 |
| **Position** | Text | 16 |
| **Department** | Text | 20 |
| **Salary** | Double | 15 |
| **Date** | Date |  |

***Table 4.3 EvaluationTable***

|  |  |  |
| --- | --- | --- |
| Field | Data type | Field size |
| **Id** | Auto Inc. | 10 |
| **Staff\_No** | Text | 10 |
| **Staff\_Name** | Text | 30 |
| **Department** | Text | 20 |
| **Date** | Date |  |
| **JD** | Text | 1 |
| **AT** | Text | 1 |
| **PDP** | Text | 1 |
| **JA** | Number | 3 |
| **CA** | Number | 3 |
| **HR** | Number | 3 |
| **LH** | Number | 3 |
| **PA** | Number | 3 |
| **QP** | Number | 3 |
| **Score** | Number | 3 |
| **Prediction** | Text | 10 |
| **Recommendation** | Text | 20 |

**4.1.3 Output Design**

The output design helps deliver meaningful timely and purposeful information in a specified format to the preferred destination. This system is designed to speed up the processing and accessing of information in various formats. It is displayed on screen as softcopy and through a printer in a hardcopy for a purposeful and result oriented format. Information stored in the database can be access and presented as output on request by the user. The output design is shown below in Table 4.4:

***Table 4.4 Output Design (Registered staff Report)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Staff no** | **Name** | **Phone** | **Position** | **Department** | **Salary** | **Date** |
| **S-0100** | Emmanuel John | 0802343824 | Worker | Laundry | 25000 | 22/09/2019 |
| **S-0101** | Mfon Akpan | 0909234823 | Recieptionist | Recieption | 20000 | 23/09/2019 |

**4.2 Design Architecture**

This describes the various software components and their interfaces to establish the framework for the development of a whole system. It will entail system block diagram, Activity diagram, Sequence diagram and Use case diagram.

**4.2.1 System Block Diagram**

Different modules of the staff performance evaluation system is presented in Figure 4.4

**Staff Performance Evaluation System**

Registration

Login

Quit

Performance Evaluation

Evaluation Report

Registered Staff

***Figure 4.4: System Block Diagram***

**4.2.2 Unified Modelling Language**

The model was designed with Universal Modelling Language (UML). UML’s representation supersedes the flowchart because it makes provision for many different viewpoints on a system. Three UML type diagrams that were used are: the Use Case and activity and diagrams.

**4.2.2.1 Use Case Diagram**

The use case diagram in Figure 4.2 is the description of the system’s behaviour from a user’s viewpoint. This diagram is a valuable aid during the analysis as developing use cases helps to understand requirements. The different Use Cases of the Use Case diagram is as described;

**Staff login:** In this case, the human resource (HR) Manager or authorized staff has to enter valid login credentials in order to have access to the application.

**Register staff:** In this case, the HR Manager gets staff details, register the staff details and save the details into the database.

**Evaluate performance:** In this case, HR Manager gets employee’s performance details, preform performance prediction and save the result into the database.

**View/print registered staff:** In this case, list of all the registered staff in the organization is viewed or printed.

**View/print evaluation performance:** In this case, the result of staff performances in the organization is viewed or printed. HR Manager gets the performance result known to the staff.

However, the Use Case Diagram of staff performance evaluation system is represented in Figure 4.5.

**4.4.2.2 Activity Diagram**

The activity diagram shown in Figure 4.6 depicts the sequential flow of activities of the use case; it was used to model actions that will be performed when an operation is being executed as well as the results of those actions.

**4.3 System Requirements**

This system requirements specification is a document use to describe the feature and behavior of a system. It is estranged into hardware requirements and software requirements.



***Fig. 4.5. Use Case Diagram of Staff Performance Evaluation***

****

***Fig. 4.6: Activity Diagram of Staff Performance Evaluation***

**4.3.1 Hardware Requirements**

For the effective operation of the newly designed system, the following minimum hardware specifications are recommended:

1. A computer system with 32/64-bit Operating System and processor speed of 1.8GHz.
2. The Random-access memory (RAM) should be at least 128KB.
3. The system should have a hard disk of at least 20GB.
4. The system should be equipped with an E.G.A/V.G.A, monitor.
5. An uninterruptible power supply (UPS) units

These listed configurations are the minimum requirements, but if the configurations are higher the reports derived will definitely be better and the program will run much faster.

**4.3.2 Software Requirements**

The software specifications required on the computer system are:-

1. Visual Studio 15
2. SQLite database
3. DotNet Framework 4 or higher

**4.4 Justification of the Programming Language**

The programming language chosen for the development of the system is Visual basic.net (*pronounced as visual basic dot net*) for desktop-based application. Visual basic.net is object-oriented programming languages used for the development of desktop-based software applications.

**4.5 Models Performance Evaluation**

The performance evaluation of the models was achieved using WEKA tool kit.

**4.5.1 Overview of *Waikato Environment for Knowledge Analysis* (WEKA) Toolkit**

***Weka*** is data mining software that uses a collection of machine learning algorithms, which can be applied to a data set directly, or called from Java application. It contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It also has some application interfaces such as Weka GUI Chooser screen, Weka application interface, Explorer, etc.

More so, WEKA supports data formats such as the Attribute Relation File Format (ARFF) for data analysis, by default. Some data can be imported with these formats: CSV and Database using ODBC. It also supports the following data types for attributes: Numeric, <nominal-specification>, String, date, @data – Defined in the Data section followed by the list of all data segments.

**4.5.2 Steps for performing Analysis and Prediction in WEKA application**

Step 1. Prepare dataset

Step 2. Save it as CSV format

Step 3. Launch WEKA toolkit

Step 4. Click on Explorer button, under WEKA GUI application chooser menu

Step 5. Under Preprocess tab, click on Open file button, select the file in CSV format and open it.

Step 6. Click on Classify tab, under click on Choose button, under the list of functions, select SMO algorithm.

Step 7. Under test options, select Cross-validation fold and the figure e.g. 10

Step 8. Click on Start button to classify the instances.

Step 9. On the Result list, the model of the trained data is created.

Step 10. On the classifier output, the result of the trained data model is displayed.

**4.5.3 Analysis of the dataset**

The dataset of 300 instances used in this study was obtained from three (3) establishments such as Champion Breweries, Villa Marina Hotel and Department of Petroleum Resources, on sampling method of previous records of staff performance evaluation from the year 2017 and 2018. A few derived attributes or predictors were selected and some of the information for the variables or predictors were extracted from the databases. The dataset was preprocessed with Excel application so as to remove impurities. In Weka toolkit, the excel file with the dataset of 300 instances, 10 attributes which were divided into 219 instances representing “Good” (staff promoted) and 81 instances representing “Poor”, (staff not promoted) was uploaded and SVM Classifier (SMO function) algorithm with Test mode of 10-fold cross-validation was applied to obtain the model. The time taken to build the model was 0.9 seconds.

**Table 4.5 Staff performance evaluation related variables.**

|  |  |  |
| --- | --- | --- |
| **Predictor** | **Description** | **Possible values** |
| JD | Job Description Pre-Knowledge? | {Y,N} |
| AT | Attended Training Since Date Of Appointment? | {Y,N} |
| PGP | Previous Good Performance? | {Y,N} |
| JA | Job Ability | {4,3,2,1,0.5} |
| CA | Communication Ability | {4,3,2,1,0.5} |
| HR | Human Relations | {4,3,2,1,0.5} |
| LH | Loyalty and Honesty | {4,3,2,1,0.5} |
| PA | Punctuality and Attendance | {4,3,2,1,0.5} |
| QP | Quality and Productivity | {4,3,2,1,0.5} |
| CLASS | Class label | {Good for Promoted, Poor for Not Promoted} |

**4.5.4 Model Analysis Summary**

Model Analysis Summary shows the machine linear showing the attributes weight (Table 4.6), confusion matrix (Table 4.9), performance measures (Table 4.7) and accuracy (Table 4.8) of the results. The Confusion Matrix shows the performance value of correctly classified samples and the result is presented in Table 4.7. Consequently, the model performance summary with C4.5 (J4.8) algorithm is equally presented on Table 9, 10 and 11 respectively.

**Table 4.6 Machine Linear: Showing Attributes Weights**

|  |  |  |
| --- | --- | --- |
| **S/N** | **Attribute (Normalized)** | **Weights** |
| 1. | JD with label ‘N’ | -0.0723 |
| 2. | AT with label ‘N’ | 0.7835 |
| 3. | PDP with label ‘Y’ | -0.3921 |
| 4. | JA | -1.2777 |
| 5. | CA | -0.4571 |
| 6. | HR | -1.3715 |
| 7. | LH | -1.6288 |
| 8. | PA | -0.4309 |
| 9. | QP | -1.4491 |

**Table 4.7 Model Analysis summary with SVM(SMO) algorithm**

|  |  |
| --- | --- |
| Performance Measures | SVM - SMO |
| Correctly classified (281) | 93.67 % |
| Incorrectly classified (19) | 6.33 % |
| Relative Absolute Error | 16.034 % |
| Root Relative Squared Error | 56.68 % |
| Total number of Instances | 300 |

**Table 4.8 Detailed accuracy by SVM(SMO) algorithm class**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TP Rate | FP Rate | Precision | Recall | F-Measure | Mcc | Roc Area | PRC Area | Class |
| 0.959 | 0.123 | 0.955 | 0.959 | 0.957 | 0.837 | 0.918 | 0.945 | Good |
| 0.877 | 0.041 | 0.888 | 0.877 | 0.882 | 0.837 | 0.918 | 0.811 | Poor |
| 0.937 | 0.101 | 0.936 | 0.937 | 0.937 | 0.837 | 0.918 | 0.909 | Weighted Avg |

**Table 4.9 Model performance summary with C4.5 (J4.8) algorithm**

|  |  |  |
| --- | --- | --- |
| **Performance Measures** |  | **C4.5(J4.8)** |
| Correctly classified (277) |  | 92.33% |
| Incorrectly classified (23) |  | 7.67% |
| Relative Absolute Error |  | 27.4966% |
| Root Relative Squared Error |  | 58.7542 % |
| Total number of Instances |  | 300 |

**Table 4.10 Detailed accuracy by Class of C4.5 (J48)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TP Rate | FP Rate | Precision | Recall | F-Measure | MCC | ROC | PRC | CLASS |
| 0.959 | 0.123 | 0.955 | 0.959 | 0.957 | 0.837 | 0.918 | 0.945 | GOOD |
| 0.877 | 0.041 | 0.888 | 0.877 | 0.882 | 0.837 | 0.918 | 0.811 | POOR |
| 0.937 | 0.101 | 0.936 | 0.937 | 0.937 | 0.837 | 0.918 | 0.909 | Weighted Avg. |

**Table 4.11 Confusion Matrix**

|  |  |  |
| --- | --- | --- |
| **Confusion Matrix** | | |
| A | B |  Classified as |
| 210 | 9 | a = Good |
| 10 | 71 | b = Poor |

**4.6 Generated IF-THEN Rules**

The knowledge represented by generated model based on the weight of the predictors in Figure 4.6 is further represented as an form of IF-THEN rules. The IF-THEN rules will be used for a rating the predictors for each staff in the performance evaluation system.

**Table 4.12 IF-THEN Rules**

|  |  |
| --- | --- |
| **S/N** | **Rules** |
| 1 | IF (JA > 2 AND QP > 1) THEN CLASS = GOOD |
| 2 | IF (HR <= 3 AND AT = N) THEN CLASS = POOR |
| 3 | IF (LH > 2 AND PGP = Y) THEN CLASS = GOOD |
| 4 | IF (QP <= 1 AND CA <= 2) THEN CLASS = POOR |
| 5 | IF (PGP = N) CLASS = POOR |

**4.7 Evaluation of Results**

A full training data set of 300 staff was used for the evaluation. The percentage accuracy for the J48 (C4.5) algorithm was 92.33%. A detailed accuracy by class, and the cross-validation performance measures summary from both techniques is shown in the Table 4.11

Figure 4.7 illustrates the Relative Square error of both C4.5(J48) and SVM(SMO), which shows that SVM had a minimum Relative square error than C4.5 and it’s also shows the Correctly classified percentage accuracy of both C4.5(J4.8) and SVM(SMO) which shows that Support vector machines (SMO) algorithm had a maximum percentage accuracy than C4.5(J48).

Accuracy =

The Accuracy is determined as the ratio of instances correctly classified during testing to the total of instances tested. With reference to Table 4.8 and Table 4.10, the accuracy of the classified was evaluated through precision, recall ROC Receiver operating characteristics) analysis.

Where precision =

No. of true positives correctly labelled as belonging to the class.

Recall =

Total No of true positive divided by the total number of elements that actually belong to the positive class, Recall also refers to the true positive value.

**Table 4.13:** Correctly classified percentage accuracy of both C4.5 (J48)

and SVM(SMO) and Relative Error of both C4.5(J48) and SVM(SMO)

|  |  |  |
| --- | --- | --- |
| **Performance Accuracy** | **SVM(SMO) model** | **C4.5 (J4.8) model** |
| Correctly classified | 93.67% | 92.33% |
| Root relative error | 0.56 | 0.59 |

**Figure 4.7***: Correctly classified percentage accuracy of both C4.5 (J48) and SVM(SMO) and Relative Error of both C4.5(J48) and SVM(SMO)*

**4.8 Discussion of Result**

The results of the analysis show the Support Vector Machine using SMO algorithm Model had an accuracy rate of 93.67%. This suggests that the model generated has an acceptable prediction accuracy. Based on the generated rule set, it revealed that staff that were rated 2 or more in Job Ability and 1 or more in Quality and Productivity had a good performance. It further revealed that staff that were rated 3 or less in Human Relations and did not Attend Training since date of Appointment had a poor performance. More so, it was also revealed that staff that were rated 2 or more in Loyalty and Honesty and had previous good Performance also had a good performance. Staff that were rated 1 or less in Quality and Productivity and 2 or less in Communication Ability also had a poor performance. At last, the staff that did not have previous good performance had a poor performance.

The application developed captures staff details, predicts staff performance based on the If-Then rules generated from the SVM-SMO model and enabled the report of the registered staff and past predictions of staff performances to be viewed and printed.

**4.9** **System Implementation**

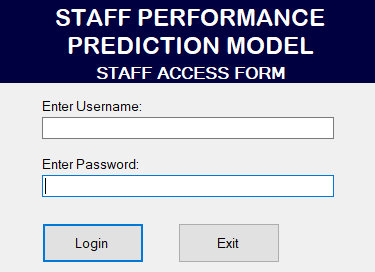
This section describes an overview of the project implementation. It broadens the scope by presenting the input and output snapshots of the proposed system. System implementation details the changes of the system from user requirement into an achievable product; it describes the various functionalities step by step under each module with their outputs.

**4.9.1 Deployment**

The generated model was implemented in a stand-alone Desktop application. The essence of the desktop application was to implement the results achieved after producing the predictive modeling in code. By using class methods in VB.net programming language, this was achieved. The result of the SVM-SMO algorithm were then placed into VB.net class method that accepted some predictors such as Job Ability, Quality and Productivity, Human Relations, Attended Training since date of Appointment, Loyalty and Honesty, Previous Good Performance, and Communication Ability. The class method then returned the final result of that particular evaluation, indicating the performance category of an employee.

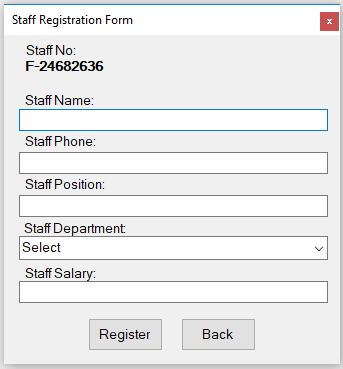
**4.9.2 System Implementation Input Snapshot**

1. **Staff Access form:** This module allows users to gain access to the application by supplying correct login details.



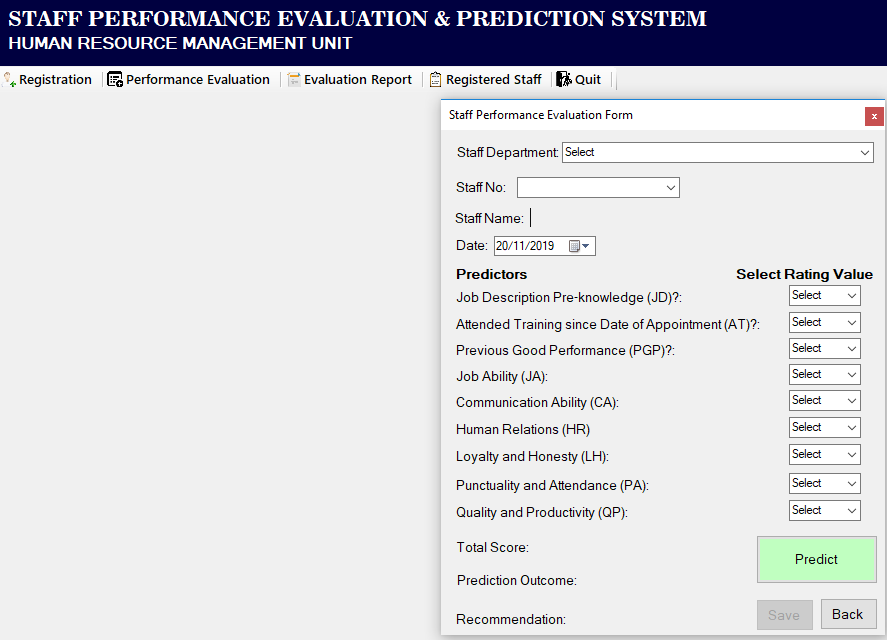
**Figure. 4.8: Staff Access screen**

1. **Staff Registration Screen:** This module allows staff details to be registered and saved for future performance evaluation.



**Figure. 4.9: Staff Registration screen**

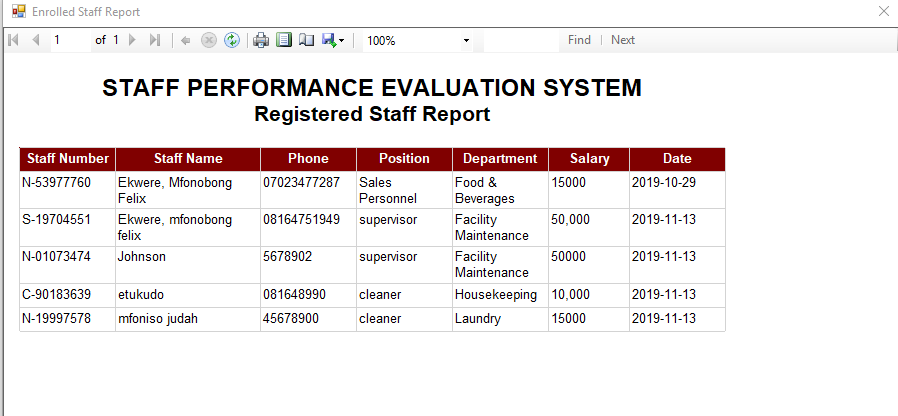
1. **Staff Performance Evaluation:** The module on Figure 4.10 allows the staff performance to be predicted and recommendations proffered based on the staff’s performance evaluation outcome. This is achieved through classification ruleset from SVM- SMO model. While the result is saved into the database.



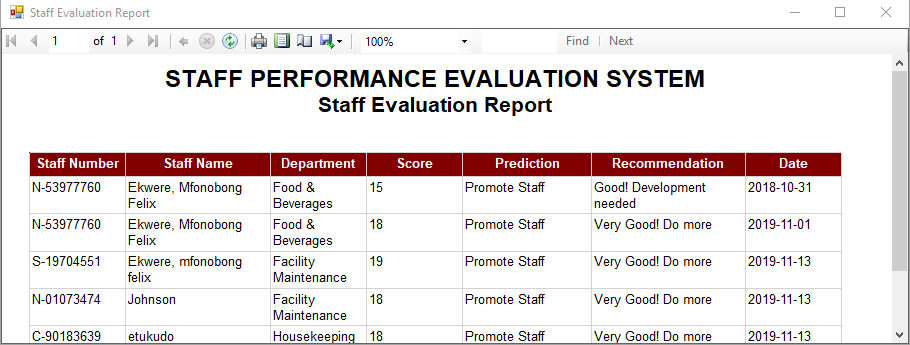
**Figure. 4.10: Staff Performance evaluation screen**

**4.9.3 System Implementation Output Snapshot**

1. **Registered Staff Report?** This module allows the list of all the registered staff to be viewed and printed. This is shown in Figure 4.10
2. **Performance Evaluation Report:** The module on Figure 4.11 allows the past records of performance evaluation of staff to be displayed and printed**.**



**Figure: 4.10: Registered Staff Report screen**



**Figure: 4.11: Performance Evaluation Report screen**

**4.9.4 System Testing**

System testing can be stated as the process of validating and verifying that a software program or application or product, meets the business and technical requirements that guided its design and development. The system has been tested and the technical requirements have been met.

**4.9.5 Method of System Integration**

System integration is the process of replacing the old system with the new

system. There are four different ways of replacing the old system with the new system. The reason for choosing one implementation type over another depends upon some variables. They, amongst others include; how swiftly the change-over should happen? How important is it to prevent data loss? What will the cost of the changeover be?

1. **Direct changeover:** In this system the old system is no longer available and everything must run on the new system. Problems with the new system can cause major problems for the business, only suitable for non-critical systems.
2. **Phased implementation:** Takes longer to complete the implementation but the risks to the business are less than for direct changeover. The new system can be split into separate working parts e.g. sales, marketing, payroll etc. part of the old system is replaced with the new one until the replaced part is working properly. Continue the process until the entire old system has been replaced by the new system.
3. **Parallel Running:** Highly fault tolerant, new system and the old system are used with extra staffs recruited to run the new system but it is very expensive. Both systems continue to run until the new system is working properly then the old one is discarded.
4. **Pilot Running:** If the business has many different offices or sites then this is an option. One single site is chosen and the old system is replaced with the new system in the same way as direct changeover but only on one site, the rest of the business continue to use the old system. Once the new system is shown to work well in that one ‘pilot’ site then the new system can replace the old one in the rest of the company. The system integration method recommended and chosen by the system developer is the parallel running so as to prevent data loss.

**4.10 Merits of the Developed System**

1. The proposed system will be used in evaluating and predicting future staff performance.
2. The proposed system will aid in storage and quick retrieval of all the previous result of performance evaluation.
3. It will serve as a decision support system to the human resource manager in performing staff performance evaluation.
4. It will assist management assigning the right personnel to the right job at the right time.

**CHAPTER FIVE**

**SUMMARY, CONCLUSION AND RECOMMENDATION**

**5.0 Introduction**

This chapter focuses on a brief summary of the entire research work. It examines the problems encountered during the design and implementation of the system. It evaluates the system performance recorded by the project based on the set aim and objectives presented. Summary, review of achievement, conclusion, contribution/areas of application of the work, recommendations and suggestions for future research are made based on performance and capability.

**5.1 Summary**

This study attempted to develop a predicting model using the ruleset of data mining classification technique (Support Vector Machine algorithm) to evaluate and classify the employee’s performance in order to discover whether the employee performance gets recommendation for promotion or not. The application assisted Human Resource managers in knowing whether appropriate recommendations for their staff where necessary.

The dataset of 300 instances used in this study was obtained from three (3) establishments, on sampling method of previous records of staff performance evaluation from the year 2017 and 2018. An Excel application and Weka toolkit, were used to prepare the dataset and analysis of the data through SVM Classifier (SMO function) algorithm with Test mode of 10-fold cross-validation was applied to obtain the predictive model respectively.

The results of the analysis showed the Support Vector Machine using SMO algorithm Model had an accuracy rate of 93.67%. This suggests that the model generated has an acceptable prediction accuracy than the existing System.

**5.2 Review of Achievement**

This research work has achieved its set goals and objectives giving that the application developed captured staff details, predict staff performance based on the If-Then rules generated from the SVM-SMO model and enabled the report of the registered staff and past predictions of staff performances to be viewed and printed.

**5.3 Conclusion**

An organization has to do with the coordination of people and their actions so as to obtain something desired or valued. Management work is to get people together to accomplish desired goals as well as objectives using resources that are available efficiently and effectively. Human resource is the back bone of any organization. Employees in an organization are evaluated based on their performance in order to represent their talent ability and ensuring that the right personnel gets the right job at the right time so as to improve the overall productivity of the business. In this research work, SVM-SMO classification algorithm was adopted as an efficient analytical tool for classifying and predicting staff’ work performance in an organization in order to help the human resource managers evaluate staff performance to know whether they are recommended for promotion or not.

**5.4 Contribution/Areas of Application of the Study**

The work contributed to knowledge in the sense that the proposed classification Technique was able to give a high system accuracy and efficiency thus helping the Human Resources in adequate evaluation of staff for Recommendation and promotions.

**5.5 Recommendations**

# Due to the outcome of the analysis and developed application, it is recommended that

# The new system for staff performance prediction should be employed by some organizations in Akwa Ibom State to assist in predicting the staff’s performance in order to discover whether the employee’s performance gets recommendation for promotion or not.

# Both hardware and software specifications must be followed so as to enhance smooth running of the application.

# The application should be used for adequate and reliable documentation of previous staff performance evaluation records to aid referrals when need arises.

**5.6 Suggestions for Future Research**

The future work for this research work should be channelled to the improvement of the strength of predictive model by increasing the number of instances in dataset to 600 and above level and employing another data mining classification model.

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**APPENDICES A – Sample of Questionnaire.**

**VILLA MARINA HOTEL – EKET**

ANNUAL PERFORMANCE EVALUATION REPORT

(Year of Assessment…………….)

CONFIDENTIAL

PART 1 - (PERSONAL RECORDS OF STAFF)

1. Full Name of Staff (Block letters) – surname First: …………………………………………………………………………………………………………………………….

2. Department: ………………………………………………………………………………………………………………………………..

**3. (A). personal particulars Section/Unit**

|  |
| --- |
| (a) Date of Birth: dd/mm/yy: |
| (b) Date of First Appointment in Service |
| (c) Post to which First Appointed |
| (d) Date of confirmation |
| (e) Present Substantive Post |

|  |
| --- |
| (f) Date appointed to Substantive Post |
| (g) Grade Level |
| (h) salary per Annum |
| (i)Date of Actiing Appointment During the period covered by the report |

|  |  |  |
| --- | --- | --- |
| S/N | Qualifications held(academic, professional or Technical) | Year Obtained |
| (i)  (ii)  (iii)  (iv) | …………………………………………………………………………………………………………  ……………………………………………………………………………………………………………  ……………………………………………………………………………………………………………  …………………………………………………………………………………………………………… | …………………………………  …………………………………  …………………………………  ………………………………… |

4**. Leave Records:**

(A) Total number of days absent on sick leave during the period covered by the Report:

|  |  |  |
| --- | --- | --- |
| From | To | No. of Days |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. Hospitalization
2. Treatment Received abroad

(where applicable)

1. Sick leave

|  |  |  |
| --- | --- | --- |
|  |  |  |

(B) **Maternity Leave**

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

(C) (i) Annual leave

(ii) Casual/compassionate Leave

1. Study Leave

**PART 11**

5. **Job Description:**

a) State below in order of importance the main duties performed in relation to your job schedule

During the period of report:

……………………………………………………………………………

(b) was there any joint discussion between you and your supervisor on how to accomplish the targets set?

……………………………………………………………………………

(C) Were you properly equipped professionally/technically/Administratively to perform the jobs allotted to you? Yes/No if not, what were your Difficulties or Constraints? .....................................................................................

…………………………………………………………………………….

(d) in the light of (C) above state the efforts you and your supervisor put in to rectify the difficulties.

…………………………………………………………………………………………………………………………………………………………

(e) After the review did your performance measure up to the prescribe standards set at the beginning of the year? ………………………………………………………………………………………………………………………………………………

(f) If the answer to (e) above is No, State what Solution or admonition given for the short Comings:

…………………………………………………………………………………………………………………………………………………………

(g) I have served for / over 6 months under:

(i)…………………………………………………………………………………………………... the supervisor

From: ………………………………………. To:……………………….

(ii)…………………………………………………………………………………………………….. the supervisor.

From: ………………………………………. To:…………………….

6**. Training courses/seminars Attended since Appointment:**

|  |  |  |  |
| --- | --- | --- | --- |
| Type of training/Seminar | Where the Training was  Held | Period of | Training |
|  |  | From | To |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

7. **Has he past Training received enhanced your performance and productivity**? ……………………………

8. **Job performance:**

a) Looking back on the past year, which task(s) assigned to you, do you think you have undertaken satisfactorily, in relation to the main duties performed during the period of the report?

…………………………………………………………………………………………………………………………………………………………

b) What were the causes, personal or otherwise, to which you ascribe your success or failure?

…………………………………………………………………………………………………………………………………………………………

c) Do you think that you need more training or experiences to enable you do your job better? If so, of what kind? …………………………………………………………………………………………………………………………………………………………

d) Is the most effective use being made of your capabilities in your present job? ……………………………

e) Do you think that your abilities could be better used in your present job or in another kind of job?

…………………………………………………………………………………………………………………………………………………………

f) During the period of this report, did you have job satisfaction, if not, what were the causes?

…………………………………………………………………………………………………………………………………………………………

g) Any other comments on issues not mentioned above? …………………………………………………………………………………………………………………………………………………………

h) Date report was submitted to the Supervisor/Head of Department: ……………………………………………………………………..

PART 111

(To be completed by the Reporting officer under whom the staff has been serving during the year)

9. **Assessment of performance**:

(a) Did you and the person reported upon agree on the Targets set **YES/NO**

(b) Did you and the person reported upon agree on the main duties performed and the order of importance under the target set? **YES/NO**

(if not, please discuss the changes with him/her and record any unresolved difference here)

…………………………………………………………………………………………………………………………………………………………

10**. Aspects of performance**

In assessing performance, you are to consider some or all of the following aspects and comment on as well as assess them separately. Each aspect is described in terms of “Outstanding (a) – poor (e)”.

Rating ‘A’ or ‘E’ should be given if you believe it is generally true statement. Either of the two rating however, must be supported in paragraph 14 and General Remarks.

The following Values are attached to the grading:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4  A | 3  B | 2  C | 1  D | 0.5  E |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. A - 4 outstanding
2. B - 3 very Good
3. C - 2 Satisfactory
4. D - 1 Fair
5. E - 0.5 poor

11. **Assessment of Actual performance Standards/general Ability**

Job Assessment/General Ability

(Assess Objectivity how the staff has performed his/her set tasks.)

These may include:

1. How well he/she understands, organizes and does his/her job.
2. How well he/ she applied his/her professional / technical/

administrative or any other acquired knowledge.

1. How much he/she was able to accomplish

within a set time frame.

1. Judgement (quality of his/her decisions and contributions where relevant.
2. Work – speed and accuracy

**Communications Effectiveness**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **A** | **C** | **D** | **E** |  |
|  |  |  |  |  |
|  |  |  |  |  |

f) Expression on Paper

g) Oral Expression

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D | E |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Human Relations**

h) Relations with staff

i) Relations with public

j) Management Staff

please justify the grading ………………………………………………….

……………………………………………………………………………..

**Character Traits**

In assessing character Traits, consideration should be given to:

1. Dependability (whether he/she is able to work consistently without close inspection, supervision, or compulsion)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D | E |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. Loyalty to the Organisation
2. Honesty
3. Reliability under pressure
4. Sense of responsibility
5. Appearance

Please, justify the grading ………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

III **Work Habits**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D | E |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
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|  |  |  |  |  |
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|  |  |  |  |  |

1. I. punctuality to work

ii. Attendance at work

iii. Drive and Determination

iv. Resource Utilization

v. Reliability

vi Quality of work

vii Productivit

Vii Effective Use Of Figures/Other Data

ix Initiative

Please, justify the grading ………………………………………………………………………………………………………………………………………………

1. Sanctions:

Has any disciplinary action been taken against the staff during the period covered by this report? **YES/NO** IF ‘YES’ give details ………………………………………………………………………………………………………………………………………………………..

1. Reward:

Has the staff received any special commendation (written) during the year for Outstanding performance YES/NO if ‘YES’ give details ……………………………………………………………………….

……………………………………………………………………………………………………………………………………..

12. **overall Assessment:**

From the above assessment, indicate the overall performance of his/her duties by ticking the appropriate box below:

|  |  |  |
| --- | --- | --- |
| A | Outstanding |  |
| B | Very Good |  |
| C | Satisfactory |  |
| D | Fair |  |
| E | Poor |  |

Average Score of Performance

100 – 81 A

80 – 61 B

60 – 45 C

44 – 21 D

20 – 01 E

Factors Performance Rating

An exceptional Valuable member of Staff, performance is well above the required Standard for the job.

Displays good all – round level of effectiveness; performance meets requirements in all important tasks.

A competent of the staff, generally achieves the standards required.

Inconsistent, only meeting minimum requirements

Performance does not meet the required standard.

**13. Training Needs**

Indicate training needs necessary to improve the performance or potential of the staff,

………………………………………………………………………………………………………………………………………………

14. **General Remarks**

Please provide any additional relevant information here drawing attention to any particular strength or weakness and indicate special aptitudes (if any) demonstrated by the staff ………………………………………………………………………………………………………………………………………………

15. **Do you suggest the staff for:**

(a) A different job in the same grade? **YES/NO**

(b) Transfer to a job at similar level in another occupational group or cadre? **YES/NO**

If you have answered YES to either questions say which kind of job and give reasons below:

………………………………………………………………………………………………………………………………………………

16. **promotability:**

(a) Exceptionally well qualified, the staff already seems likely to fit in the next higher post

(b) Has promotion potentials

(c) No evidence of promotion potential at present.

(d) Unlikely to qualify as he/ she seems to have reached the limit of his/her capacity

**SUMMARY**

**EMPLOYEE’S COMMENTS REGARDING THIS EVALUATION:**

I certify that I have seen the comments of this Report and that the supervisor/HOD has discussed them with me.

I have the following comments to make (if no comment, indicate here under):

………………………………………………………………………………………………………………………………………………

Date of Review: ……………………………………………………………………………

**Signature (employee):………………………**

**Signature(supervisor/HoD):** ……………………..

**Signature (personal manager);** ……………………

**Signature (GenManager**): ………………………………

**APPENDICES B**

**VISUAL BASIC. NET SOURCE CODES**

Option Explicit On

Imports System.Text

Imports System

Imports System.Windows.Forms

Imports System.Diagnostics

Imports System.Data

Imports System.Data.SQLite

Imports System.Drawing

Imports System.IO

Imports System.ComponentModel

Public Class frmAccess

Dim DbMainPath As String = Application.StartupPath & "\dbPerformance.db"

Public Sub RetAccess()

Dim bs As BindingSource = New BindingSource

Dim con As SQLiteConnection = New SQLiteConnection() : Dim cmd As New SQLiteCommand()

Dim dataAdapter As SQLiteDataAdapter = New SQLiteDataAdapter : Dim TSTable As DataTable = New DataTable()

Dim ds As DataSet = New DataSet : Dim TotalRows As Integer = 0 : con.ConnectionString = "Provider=Microsoft.Jet.Sqlite.4.0;Data Source='" & DbMainPath & "'"

Try

con.Open() : cmd.CommandText = "SELECT \* FROM tblAccess WHERE [username]='" & txtUser.Text & "' and [password]='" & txtPass.Text & "'"

cmd.Connection = con : dataAdapter.SelectCommand = cmd

dataAdapter.Fill(TSTable) : bs.DataSource = TSTable

If TSTable.Rows.Count <> 0 Then : TotalRows = TSTable.Rows.Count : End If

Dim n As Integer = 0

If TotalRows > 0 Then

MessageBox.Show("Access Granted")

Dim f As New frmHome

f.Visible = True

Else

MessageBox.Show("Access Denied")

txtUser.Focus()

con.Close()

Exit Sub

End If

con.Close()

Catch ex As SQLiteException

MessageBox.Show(ex.ToString, "ConnectionError or RunNonQuery", MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

End Sub

Private Sub btnLogin\_Click(sender As Object, e As EventArgs) Handles btnLogin.Click

RetAccess()

End Sub

Private Sub btnExit\_Click(sender As Object, e As EventArgs) Handles btnExit.Click

Application.Exit()

End Sub

End Class

Option Explicit On

Imports System.Text

Imports System

Imports System.Windows.Forms

Imports System.Diagnostics

Imports System.Data

Imports System.Data.SQLite

Imports System.Drawing

Imports System.IO

Imports System.ComponentModel

Public Class frmEnroll

Dim DbMainPath As String = Application.StartupPath & "\dbPerformance.db"

Public Sub StaffNO()

Dim XNoArray() As Char = "0123456789".ToCharArray

Dim xCharArray() As Char = "ABCDEFGHIJKLMNOPQRSTUVWXYZ".ToCharArray

Dim xGen As System.Random = New System.Random

Dim xStr2 As String = String.Empty

Dim xStr1 As String = String.Empty

While xStr2.Length < 8

If xGen.Next(0, 2) = 0 Then

xStr2 &= XNoArray(xGen.Next(0, XNoArray.Length))

End If

End While

While xStr1.Length < 1

If xGen.Next(0, 2) = 0 Then

xStr1 &= xCharArray(xGen.Next(0, xCharArray.Length))

End If

End While

lblId.Text = xStr1 & "-" & xStr2

End Sub

Public Sub SaveToDB()

Dim con As SQLiteConnection = New SQLiteConnection() : Dim cmd As New SQLiteCommand

Try

con.ConnectionString = "Provider=Microsoft.Jet.Sqlite.4.0;Data Source='" & DbMainPath & "'"

cmd.CommandType = CommandType.Text

cmd.CommandText = "INSERT INTO tblStaff([staff\_no],[name],[phone],[position],[department],[salary],[dates]) VALUES(@1,@2,@3,@4,@5,@6,@7)"

cmd.Parameters.AddWithValue("@1", lblId.Text)

cmd.Parameters.AddWithValue("@2", txtName.Text)

cmd.Parameters.AddWithValue("@3", txtPhone.Text)

cmd.Parameters.AddWithValue("@4", txtPosition.Text)

cmd.Parameters.AddWithValue("@5", cboDepartment.Text)

cmd.Parameters.AddWithValue("@6", txtSalary.Text)

cmd.Parameters.AddWithValue("@7", Format(Now(), "yyyy-MM-dd"))

cmd.Connection = con : con.Open()

cmd.ExecuteNonQuery()

MessageBox.Show("Registration was successful!")

con.Close()

clsClear()

Catch ex As SQLiteException

MessageBox.Show(ex.ToString, "ConnectionError or RunNonQuery", MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

End Sub

Public Sub clsclear()

StaffNO()

txtName.Clear()

txtPhone.Clear()

txtPosition.Clear()

txtSalary.Clear()

cboDepartment.Text = Nothing

End Sub

Private Sub btnBack\_Click(sender As Object, e As EventArgs) Handles btnBack.Click

Me.Visible = False

End Sub

Private Sub btnRegister\_Click(sender As Object, e As EventArgs) Handles btnRegister.Click

If IsNumeric(txtName.Text) = True Or txtName.Text = Nothing Then

MessageBox.Show("Enter Staff Name")

Exit Sub

End If

If IsNumeric(txtPhone.Text) = False Or txtPhone.Text < 11 Then

MessageBox.Show("Invalid Phone Number")

Exit Sub

End If

If txtPosition.Text = Nothing Then

MessageBox.Show("Enter Staff Position")

Exit Sub

End If

If cboDepartment.Text = "Select" Then

MessageBox.Show("Select Staff Departmemt ")

Exit Sub

End If

If IsNumeric(txtSalary.Text) = False Then

MessageBox.Show("Enter Staff Salary")

Exit Sub

End If

SaveToDB()

End Sub

Private Sub frmEnroll\_Load(sender As Object, e As EventArgs) Handles MyBase.Load

StaffNO()

End Sub

End Class

Option Explicit On

Imports System.Text

Imports System

Imports System.Windows.Forms

Imports System.Diagnostics

Imports System.Data

Imports System.Data.SQLite

Imports System.Drawing

Imports System.IO

Imports System.ComponentModel

Imports Microsoft.Reporting.WinForms

Public Class frmEvaluationRep

Public Sub clsRetrieve()

Dim DbMainPath As String = Application.StartupPath & "\dbPerformance.db"

Dim strcn As String = "Data Source='" & DbMainPath & "'"

Dim cn = New SQLiteConnection(strcn) : Dim cmd As SQLiteCommand = New SQLiteCommand

Dim da As SQLiteDataAdapter = New SQLiteDataAdapter : Dim dt As System.Data.DataTable = New System.Data.DataTable

Dim ds As DataSet = New DataSet : Dim bs As BindingSource = New BindingSource

'binding data to datagridview

Dim rds As ReportDataSource = Nothing

Try

cn.Open() : cmd.CommandText = "SELECT [staff\_No],[Staff\_Name],[Department],[Score],[Prediction],[Recommendation],[Dates] from tblEvaluation"

cmd.Connection = cn : da.SelectCommand = cmd

With Me.ReportViewer1.LocalReport

.ReportEmbeddedResource = "Staff\_Performance\_Appraisal\_System.RepEvaluate.rdlc"

.DataSources.Clear()

End With

da.Fill(dt) : bs.DataSource = dt

rds = New ReportDataSource("dsEvaluation", bs)

Me.ReportViewer1.LocalReport.DataSources.Add(rds)

Me.ReportViewer1.RefreshReport()

'Me.ReportViewer1.SetDisplayMode(Microsoft.Reporting.WinForms.DisplayMode.PrintLayout)

cn.Close()

Catch ex As Exception

MessageBox.Show(ex.Message, My.Application.Info.Title, MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

'Me.tblStaffTableAdapter.Fill(Me.dsReport.tblStaff)

'Me.ReportViewer1.RefreshReport()

End Sub

Private Sub frmEvaluationRep\_Load(sender As Object, e As EventArgs) Handles MyBase.Load

clsRetrieve()

End Sub

End Class

Option Explicit On

Imports System.Text

Imports System

Imports System.Windows.Forms

Imports System.Diagnostics

Imports System.Data

Imports System.Data.SQLite

Imports System.Drawing

Imports System.IO

Imports System.ComponentModel

Public Class frmPerformance

Dim DbMainPath As String = Application.StartupPath & "\dbPerformance.db"

Private Sub btnBack\_Click(sender As Object, e As EventArgs) Handles btnBack.Click

Me.Visible = False

End Sub

Protected Sub listOfStaffNO()

Dim strcn As String = "Provider=Microsoft.Jet.Sqlite.4.0;Data Source='" & DbMainPath & "'"

Dim cn = New SQLiteConnection(strcn) : Dim cmd As SQLiteCommand = New SQLiteCommand

Dim da As SQLiteDataAdapter = New SQLiteDataAdapter : Dim dt As DataTable = New DataTable

Dim ds As DataSet = New DataSet : Dim bs As BindingSource = New BindingSource

Try

cn.Open() : cmd.CommandText = "SELECT \* FROM tblStaff"

cmd.Connection = cn : da.SelectCommand = cmd

da.Fill(dt) : bs.DataSource = dt

If dt.Rows.Count > 0 Then

cboStaffNo.DataSource = dt

cboStaffNo.DisplayMember = "Staff\_No"

Else

cboStaffNo.DataSource = Nothing

cboStaffNo.DisplayMember = ""

End If

cn.Close()

Catch ex As SQLiteException

MessageBox.Show(ex.ToString, "ConnectionError or RunNonQuery", MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

End Sub

Public Sub SelectedStaff()

Dim bs As BindingSource = New BindingSource

Dim con As SQLiteConnection = New SQLiteConnection() : Dim cmd As New SQLiteCommand()

Dim dataAdapter As SQLiteDataAdapter = New SQLiteDataAdapter : Dim TSTable As DataTable = New DataTable()

Dim ds As DataSet = New DataSet : Dim TotalRows As Integer = 0 : con.ConnectionString = "Provider=Microsoft.Jet.Sqlite.4.0;Data Source='" & DbMainPath & "'"

Try

con.Open() : cmd.CommandText = "SELECT \* FROM tblStaff WHERE [Staff\_No]='" & cboStaffNo.Text & "'"

cmd.Connection = con : dataAdapter.SelectCommand = cmd

dataAdapter.Fill(TSTable) : bs.DataSource = TSTable

If TSTable.Rows.Count <> 0 Then : TotalRows = TSTable.Rows.Count : End If

Dim n As Integer = 0

If TotalRows > 0 Then

For n = 0 To (TotalRows - 1)

txtName.Text = TSTable.Rows(n)("Name")

txtDepartment.Text = TSTable.Rows(n)("Department")

Next n

Else

con.Close()

Exit Sub

End If

con.Close()

Catch ex As SQLiteException

MessageBox.Show(ex.ToString, "ConnectionError or RunNonQuery", MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

End Sub

Private Sub cboStaffNo\_SelectedIndexChanged(sender As Object, e As EventArgs) Handles cboStaffNo.SelectedIndexChanged

SelectedStaff()

End Sub

Private Sub btnPredict\_Click(sender As Object, e As EventArgs) Handles btnPredict.Click

If cboTW.Text = "0" Then

MessageBox.Show("Select Team Work Value")

Exit Sub

End If

If cboPS.Text = "0" Then

MessageBox.Show("Select Problem Solving Value")

Exit Sub

End If

If cboPO.Text = "0" Then

MessageBox.Show("Select Planning & Organization Ability")

Exit Sub

End If

If cboTJ.Text = "0" Then

MessageBox.Show("Select Technical Knowledge of Job Value")

Exit Sub

End If

If cboCS.Text = "0" Then

MessageBox.Show("Select Customer Service Skill Value")

Exit Sub

End If

If cboRO.Text = "0" Then

MessageBox.Show("Select Result Orientation Value")

Exit Sub

End If

If cboAP.Text = "0" Then

MessageBox.Show("Select Attendance & Punctuality Value")

Exit Sub

End If

If cboDW.Text = "0" Then

MessageBox.Show("Select Dedication to Work Value")

Exit Sub

End If

If cboGE.Text = "0" Then

MessageBox.Show("Select Going Extra Mile Value")

Exit Sub

End If

If cboCO.Text = "0" Then

MessageBox.Show("Select Communication Skills Value")

Exit Sub

End If

clsSumScore()

clsPredict()

clsRecommendation()

If MessageBox.Show("Do you want Save?", "Confirm", MessageBoxButtons.YesNo, MessageBoxIcon.Warning) = DialogResult.No Then

Exit Sub

End If

btnSave.Enabled = True

btnPredict.Enabled = False

End Sub

Public Sub clsSumScore()

lblScore.Text = (CInt(cboTW.Text) + CInt(cboPS.Text) + CInt(cboPO.Text) + CInt(cboTJ.Text) + CInt(cboCS.Text) + CInt(cboRO.Text) + CInt(cboAP.Text) + CInt(cboDW.Text) + CInt(cboGE.Text) + CInt(cboCO.Text)).ToString

End Sub

Public Sub clsPredict()

If CInt(cboPO.Text) <= 6 Then

lblPredict.Text = "Don't Promote Staff"

ElseIf CInt(cboPO.Text) = 7 And CInt(cboTW.Text) <= 5 Then

lblPredict.Text = "Don't Promote Staff"

ElseIf CInt(cboPO.Text) = 7 And CInt(cboTW.Text) >= 6 Then

lblPredict.Text = "Promote Staff"

ElseIf CInt(cboPO.Text) >= 8 Then

lblPredict.Text = "Promote Staff"

Else

lblPredict.Text = "Oops! No Prediction"

End If

End Sub

Public Sub clsRecommendation()

Dim Score As Integer = CInt(lblScore.Text)

If Score >= 0 And Score <= 39 Then

lblRecommendation.Text = "Poor! Serious improvement needed"

ElseIf Score >= 40 And Score <= 59 Then

lblRecommendation.Text = "Fair! Improvement needed"

ElseIf Score >= 60 And Score <= 74 Then

lblRecommendation.Text = "Good! Development needed"

ElseIf Score >= 75 And Score <= 89 Then

lblRecommendation.Text = "Very Good! Do more"

ElseIf Score >= 90 And Score <= 100 Then

lblRecommendation.Text = "Outstanding! Keep it up"

Else

lblRecommendation.Text = "Err! invalid score"

End If

End Sub

Public Sub SaveToDB()

Dim con As SQLiteConnection = New SQLiteConnection() : Dim cmd As New SQLiteCommand

Try

con.ConnectionString = "Provider=Microsoft.Jet.Sqlite.4.0;Data Source='" & DbMainPath & "'"

cmd.CommandType = CommandType.Text

cmd.CommandText = "INSERT INTO tblEvaluation([staff\_No],[staff\_Name],[Department],[Dates],[tw],[ps],[po],[jt],[cs],[ro],[ap],[dw],[ge],[co],[score],[prediction],[recommendation]) VALUES(@1,@2,@3,@4,@5,@6,@7,@8,@9,@10,@11,@12,@13,@14,@15,@16,@17)"

cmd.Parameters.AddWithValue("@1", cboStaffNo.Text)

cmd.Parameters.AddWithValue("@2", txtName.Text)

cmd.Parameters.AddWithValue("@3", txtDepartment.Text)

Dim [Edate] As String = Format(dtpDate.Value.Date, "yyyy-MM-dd")

cmd.Parameters.AddWithValue("@4", [Edate])

cmd.Parameters.AddWithValue("@5", cboTW.Text)

cmd.Parameters.AddWithValue("@6", cboPS.Text)

cmd.Parameters.AddWithValue("@7", cboPO.Text)

cmd.Parameters.AddWithValue("@8", cboTJ.Text)

cmd.Parameters.AddWithValue("@9", cboCS.Text)

cmd.Parameters.AddWithValue("@10", cboRO.Text)

cmd.Parameters.AddWithValue("@11", cboAP.Text)

cmd.Parameters.AddWithValue("@12", cboDW.Text)

cmd.Parameters.AddWithValue("@13", cboGE.Text)

cmd.Parameters.AddWithValue("@14", cboCO.Text)

cmd.Parameters.AddWithValue("@15", lblScore.Text)

cmd.Parameters.AddWithValue("@16", lblPredict.Text)

cmd.Parameters.AddWithValue("@17", lblRecommendation.Text)

cmd.Connection = con : con.Open()

cmd.ExecuteNonQuery()

MessageBox.Show("Performance recorded successfully!")

con.Close()

clsClear()

Catch ex As SQLiteException

MessageBox.Show(ex.ToString, "ConnectionError or RunNonQuery", MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

End Sub

Public Sub clsclear()

txtName.Clear()

txtDepartment.Text = Nothing

cboTW .Text = "0"

cboPS .Text = "0"

cboPO .Text = "0"

cboTJ.Text = "0"

cboCS.Text = "0"

cboRO.Text = "0"

cboAP.Text = "0"

cboDW.Text = "0"

cboGE.Text = "0"

cboCO.Text = "0"

lblPredict.Text = Nothing

lblRecommendation.Text = Nothing

lblScore.Text = Nothing

End Sub

Private Sub btnSave\_Click(sender As Object, e As EventArgs) Handles btnSave.Click

If CInt(lblScore.Text) >= 0 AndAlso CInt(lblScore.Text) <= 100 Then

SaveToDB()

btnSave.Enabled = False

btnPredict.Enabled = True

Else

MessageBox.Show("Sorry! Score is <0 or >100")

End If

End Sub

Private Sub frmPerformance\_Load(sender As Object, e As EventArgs) Handles MyBase.Load

listOfStaffNO()

cboStaffNo.Focus()

End Sub

End Class

Option Explicit On

Imports System.Text

Imports System

Imports System.Windows.Forms

Imports System.Diagnostics

Imports System.Data

Imports System.Data.SQLite

Imports System.Drawing

Imports System.IO

Imports System.ComponentModel

Imports Microsoft.Reporting.WinForms

Public Class frmStaffRep

Public Sub clsRetrieve()

Dim DbMainPath As String = Application.StartupPath & "\dbPerformance.db"

Dim strcn As String = "Data Source='" & DbMainPath & "'"

Dim cn = New SQLiteConnection(strcn) : Dim cmd As SQLiteCommand = New SQLiteCommand

Dim da As SQLiteDataAdapter = New SQLiteDataAdapter : Dim dt As System.Data.DataTable = New System.Data.DataTable

Dim ds As DataSet = New DataSet : Dim bs As BindingSource = New BindingSource

'binding data to datagridview

Dim rds As ReportDataSource = Nothing

Try

cn.Open() : cmd.CommandText = "SELECT [staff\_no],[name],[phone],[position],[department],[salary],[salary],[dates] from tblStaff"

cmd.Connection = cn : da.SelectCommand = cmd

With Me.ReportViewer1.LocalReport

.ReportEmbeddedResource = "Staff\_Performance\_Appraisal\_System.Report1.rdlc"

.DataSources.Clear()

End With

Dim CaseDB As String = "Staff"

Select Case CaseDB

Case "Staff"

da.Fill(dt) : bs.DataSource = dt

rds = New ReportDataSource("dsStaff", bs)

End Select

Me.ReportViewer1.LocalReport.DataSources.Add(rds)

Me.ReportViewer1.RefreshReport()

'Me.ReportViewer1.SetDisplayMode(Microsoft.Reporting.WinForms.DisplayMode.PrintLayout)

cn.Close()

Catch ex As Exception

MessageBox.Show(ex.Message, My.Application.Info.Title, MessageBoxButtons.OK, MessageBoxIcon.Error)

End Try

'Me.tblStaffTableAdapter.Fill(Me.dsReport.tblStaff)

'Me.ReportViewer1.RefreshReport()

End Sub

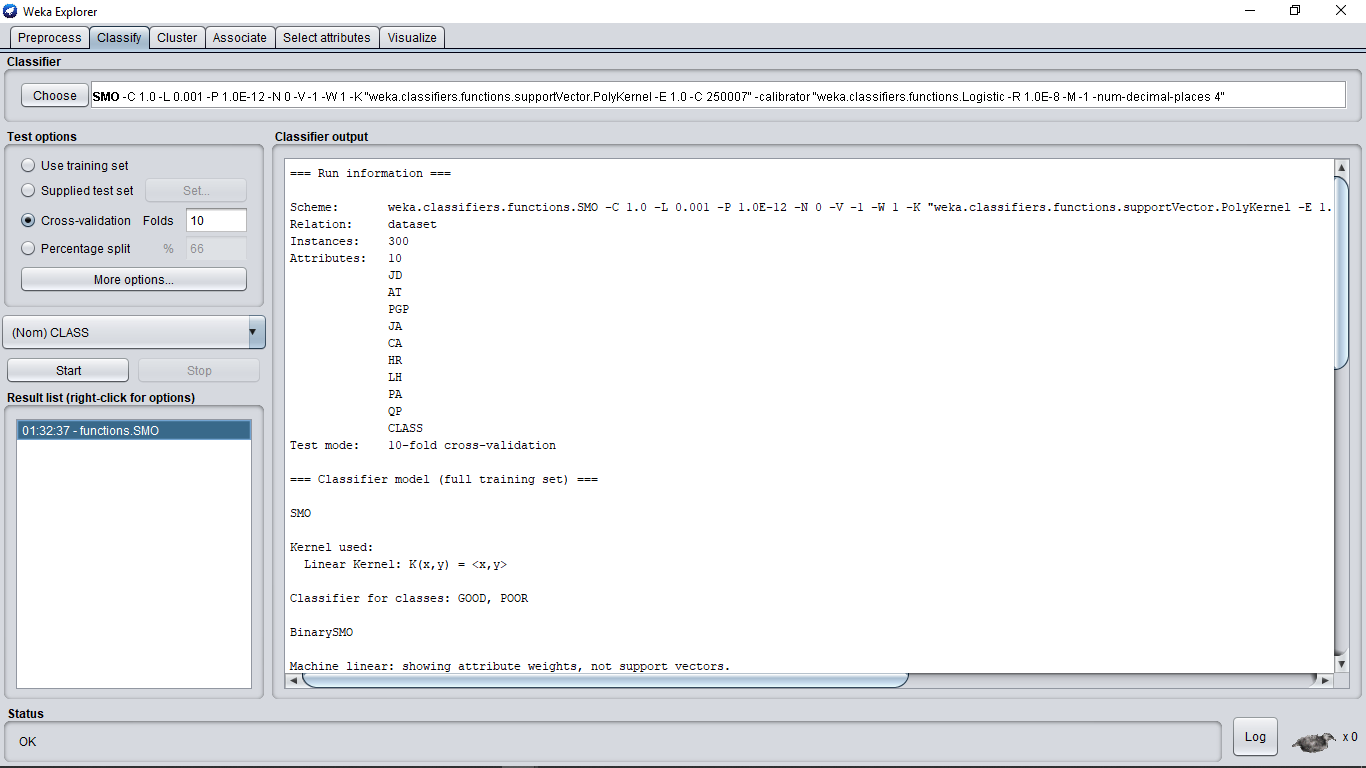
Private Sub frmStaffRep\_Load(sender As Object, e As EventArgs) Handles MyBase.Load

clsRetrieve()

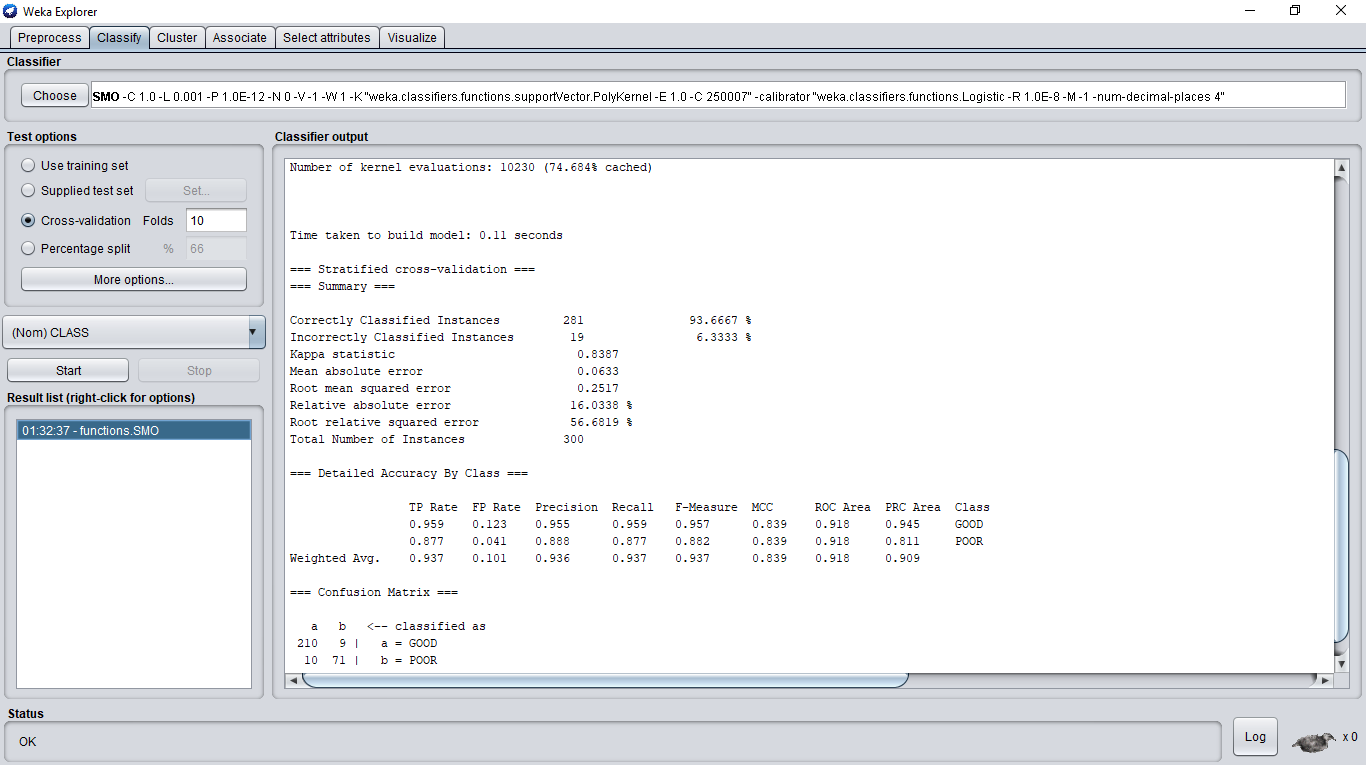
End Sub

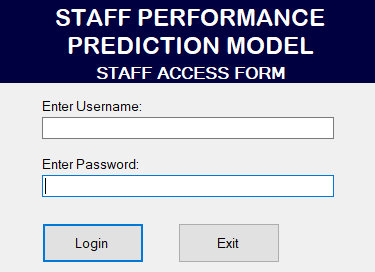
End Class

**APPENDICES C**

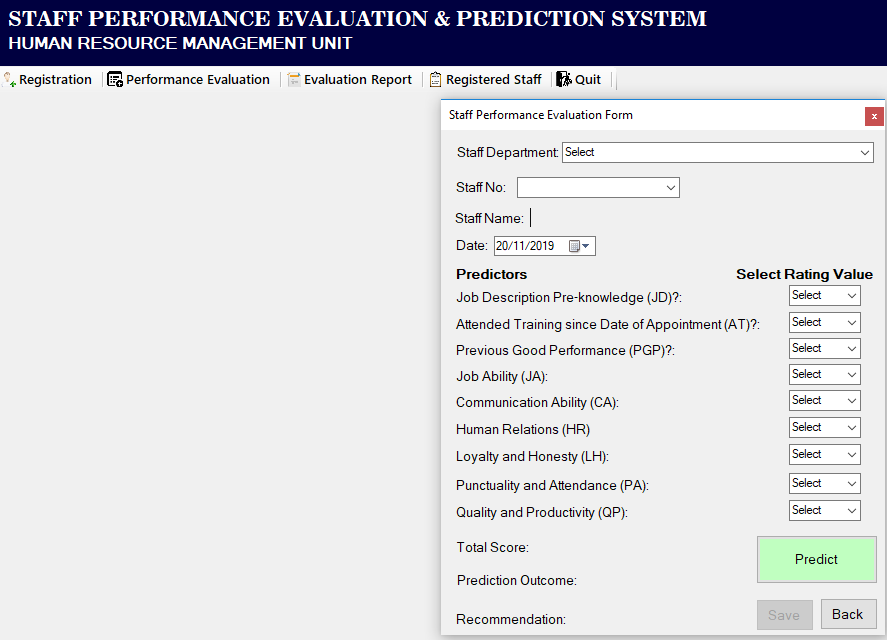


The Snapshort of the Weka Analysis Tool Environment





The Snapshot of the Staff Performance Evaluation System Login Screen



The Snapshot of the Staff Performance

Evaluation Form