

Study on Theoretical Aspects of Enhanced Intelligent Coaching Agent in Employee Performance Appraisal in Tertiary Institutions in Nigeria

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Abstract- The intelligent coaching agent for enhancing employee performance appraisal was designed to appraise the employee performance and illustrated how intelligent coaching agent – supervised learning can be used as a support tool for the assessment of employee task performance. We have shown how it provides weight score for each task and later used for the evaluation of the team performance in terms of job executed as against the expected performance. We have also indicated how it gives manager the ability to incorporate accuracy levels for the staff performance appraisal. The new system allows employee, team managers and general manager to access their performance records from any point of internet access point. The system has facilities: staff registration module, setting up of task and assigning weight scores to the task, assigning task to individuals in the team, monitoring the execution of those task, comparative analysis of the performance using supervised learning to determine the level of performance based on the assigned task against the task executed by the team. The result obtained from the testing of the new system shows a high level of accuracy in determining the team performance and rates it in percentage.

Keywords- Supervised Learning, Employee Appraisal and Team Managers.

I. INTRODUCTION

All over the world, employee capacity and performance is key to organizational growth. For organization to achieve its target objectives, proper management of the human resource, enhancing teamwork and staff performance appraisal is very crucial. Human resource management (HRM) is the policies and practices involved in carrying out the human resource aspects of a management position including human resource planning, recruitment, selection, orientation, job analysis, compensation, performance appraisal, training and development, and labor relations [1]. The practices of HRM defined as organizational activities directed at managing the pool of human resources and ensuring that the resources employed towards the fulfillment of organizational goals [2]. Employee performance appraisal is one of the critical components of HRM system and as such, it is a key determinant of the progress of the organization. Therefore, the field of performance measurement has been the focus of much attention by academics and practitioners, in both public and private sector organizations as a way to manage and control organizations. For public sectors, the measurement of performance is now an increasingly important part of the management of public services and intrinsic to performance management approaches. At the heart of the performance, management framework is the role of employee performance in achieving organizational goals. Individual employee performance is a core concept

within work and organizational psychology and researchers have made progress in clarifying and extending the performance concept [3]. Employee performance appraisal is the equivalent of a report card on an employee, how their managers assess their performance over a period. Performance appraisal processes are not same as it varies across organizations. Unfortunately, some designed to fail, but also to create a negative experience for both the manager as well as the employee. Performance appraisal has also been looked at as the method by which the performance and productivity of each worker is measured in order to determine the worker's contribution to the effort of the organization towards the achievement of the set goals and objectives. The method used in the measurement and evaluation of a worker's performance differ from one organization to another. However, the ultimate purpose is to estimate the job performance of each employee towards the achievement of organizational objectives. Performance appraisal is also carried out for the purpose of promotion and transfer to new job tasks and positions within an organization [4]. Performance appraisal serves as a tool for enhancing productivity in modern organizations. Through the process of performance appraisal, the productivity of organizational members is measured. It is one of the most delicate issues in human resources management because an employee's overall success in an organization depends largely on the outcome of performance appraisal.

Performance appraisals are an annual process where an employee's performance and productivity evaluated against a predetermined set of objectives. Performance management is super important, not only because it is the determining factor in an employee's wage rise and promotion but also because it can evaluate an employee's skills, strengths, and shortcomings accurately. Therefore, the focus of this thesis is to develop an intelligent coaching agent system for enhancing employee performance appraisal. A platform for assessing employee performance based on assigned jobs in the organization developed. One of the cardinal functions of the proposed system is to monitor employee performance over a period using supervised learning. It will integrate the feedback knowledge in the system for improved organization performance.

The Intelligent coaching Performance evaluation model for managing staff-work information and auto-Scoring based on organization's predefined uniform company-wide appraisal score-weights, create a prototype of the proposed model, and evaluate the prototype. An extensive literature review provided the basis for developing an appreciation of the relevant issues in the study. The knowledge gained from the literature survey used to construct a theoretical background of the research. The organization's predefined uniform company-wide appraisal score-weights served as the basis for proposing the model of the coaching agent-based performance evaluation system used in managing staff-work information and auto-Scoring

II. REVIEW OF RELATED WORKS

[5] Conducted research on the Impact of Human Resource Management Practices on Employees Performance to explore the contribution of Human Resource Management (HRM) practices including selection, training, career planning, compensation, performance appraisal, and job description and employee participation on perceived employee performance. They found that HR Practices are having positive correlation with employee performance. [1] Proposed performance appraisal that has the means to evaluate an employee's current and past performance relative to the employee's performance standards. It is a process which involves creating work standards; evaluate employee's actual performance relative to those work standards; and giving feedback to employee so as to motivate him or her to improve the job performance or to eliminate performance deficiency. [6] Stated that, some potential aims of performance appraisal might include identifying particular behavior or job. Human resource management experts to evaluate the performance of an employee have used various techniques or methods. [7] Outlined some of the appraisal methods include ranking; trait scales; critical incident; narrative, and criteria-based. [6] Mentioned few other methods including management-by-objectives (MBO), work planning and review, 360° appraisal and peer review. With all the available techniques, it is essential to understand that different organization might use different technique in assessing staff performance. Since all the techniques mentioned

above has their own advantages and disadvantages, most organizations might mix and match different techniques for their own performance appraisal system that can fulfill their organizational needs. Performance appraisal system has become one of the most valuable management tool in which organization members use to achieve collective goals. In order to ensure that the results of the performance appraisals are useful and reasonable to the superior when evaluating their subordinates, it is important for the performance appraisal system consistently produce reliable and valid results for the management of an organization. Fuzzy based method applied into several performances appraisal systems. [8] Proposed a methodology utilizing fuzzy set theory and electronic nominal group technology for multi-criteria assessment in the group decision-making of promotion screening. The study suggested that the methodology is a good method for a transparent and fair multi-criteria performance evaluation in military organizations. Researchers have demonstrated that fuzzy set theory successfully used to solve multiple criteria problems [8]. This is because, in many circumstances, appraiser tends to use vaguely defined qualitative criteria in evaluating the performance of their subordinates. Based on the findings of their work, the application of fuzzy set theory in fuzzy group decision support system (FGDSS) able to assist decision maker to make better decisions under different circumstances and alternatives a good example of the application of the fuzzy-set theory to decision-making process is multi-factorial evaluation model. [9] Presented a multi-agent approach to the problem of recommending training courses to engineering professionals. The recommendation system built as a proof of concept and limited to the electrical and mechanical engineering disciplines. Through user modeling and data collection from a survey, collaborative filtering recommendation implemented using intelligent agents. The agents work together in recommending meaningful training courses and updating the course information. The system uses a user's profile and keywords from courses to rank courses. A ranking accuracy for courses of 90% is achieved while flexibility is achieved using an agent that retrieves information autonomously using data mining techniques from websites. This manner of recommendation is scalable and adaptable. Further improvements made using clustering and recording user feedback. [10] Presents an approach to using intelligent agent architecture for a training system based on multiple models. In the architecture, the domain model contains all the domain knowledge of the target application; the user model contains all users' profiles. A methodology for organizing the knowledge available presented, along with an approach to explanations, which they believe are central to good training systems. The design of an intelligent agent based system for communicating this knowledge to various users in a relevant and context specific way described. The domain model and the user model have proved quite functional and helpful enabling the intelligent interface agent to give assistance to trainees. The methods presented in the paper produce good results according to their experiments.

Table1: Summary of the various performance appraisal techniques

Technique	Key Idea	Advantages	Disadvantages
Graphic Rating Scales	A scale that lists a number of traits and a range of performance for each, the employee rated by identifying the score that best describes his or her performance for each trait.	<ol style="list-style-type: none"> 1. Simple. 2. Easily constructed. 3. Ease of use. 4. Results are standardized what allows comparison to be made between employees. 5. Reduce the personal bias. 	<ol style="list-style-type: none"> 1. Rating may be subjective. 2. Each characteristic is equally important in evaluation of the employee's performance.
Ranking Method	Ranking employees from best to worst on a particular trait, choosing highest, then lowest, until all ranked.	<ol style="list-style-type: none"> 1. Fastest 2. Transparent 3. Cost Effective 4. Simple and easy to use 	<ol style="list-style-type: none"> 1. Less objective 2. Morale problems not rated at or near the top of the list. 3. Suitable for small workforce. 4. Workers strengths and weakness cannot be easily determined.
Critical Incident	Keeping a record of uncommonly good or undesirable examples of an employee's work related behavior and reviewing it with the employee at predetermined times	<ol style="list-style-type: none"> 1. Easy and economical to develop and administer. 2. Based on direct observations. 3. It is time tested and provides more face time. 	<ol style="list-style-type: none"> 1. Time consuming and laborious to summarize and analyze the data. 2. Difficult to convince people to share their critical incidents through a survey. 3. Provides a personal perspective of organizational issues.
Management by Objective	Employees evaluated how well they accomplished a specific set of objectives that have been determined to critical in the successful completion of the job.	<ol style="list-style-type: none"> 1. Easy to implement and measure. 2. Employee motivated, as he is aware of expected roles and accountability. 3. Performance oriented diagnostic system 4. Facilitates employee counseling and guidance. 	<ol style="list-style-type: none"> 1. Difficult to employees agree on goals. 2. Misses intangibles like honesty, integrity, quality, etc. 3. Interpretation of goals may vary from manager to manager, and employee to employee. 4. Time consuming, complicated, lengthy and expensive
Narrative Essays	Evaluator writes an explanation about employee's strength and weakness points, previous performance, positional and suggestion for his (her) improvement at the end of evaluation time.	<ol style="list-style-type: none"> 1. Report actually shows employee's performance. 2. Can Cover all factors. 3. Examples are given. 4. Provides feedback. 	<ol style="list-style-type: none"> 1. Time consuming. 2. Supervisor may write a biased essay 3. Effective writers are very difficult to find
Behaviorally Anchored Rating Scale	BARS combines elements from critical incident and graphic rating scale approaches. The supervisor rates employees' according to items on a numerical scale.	<ol style="list-style-type: none"> 1. Job behaviors describe employee performance in a better way. 2. More objective 3. More acceptances due to participation of managers and employees. 	<ol style="list-style-type: none"> 1. Scale independence may not be valid/reliable. 2. Behaviors are activity oriented rather than result oriented 3. Very time consuming for generating BARS. 4. Each job will require creating separate BARS scale.
360 Degree	It relies on the input of an employee's superior, colleagues, subordinates, sometimes customers, suppliers and/or spouses.	<ol style="list-style-type: none"> 1. Excellent employee development tool. 2. Accurate, reliable and credible system 3. Legally more defensible 4. More objective being multi-rate system. 	<ol style="list-style-type: none"> 1. Time consuming and very costly. 2. Sensitive to organization and national culture. 3. May damage self-esteem of employees if the feedback is brutal. 4. Prone to political and social games played by people. 5. Difficult to implement in cross functional teams. 6. Maintaining confidentiality may pose challenge in small organizations.

III. ANALYSIS OF THE PROPOSED SYSTEM

The proposed intelligent coaching agent for enhancing employee performance appraisal will enable an auto-determinant appraisal scores for every staff in an organization. A manager or project team head can provide weight values to agreed appraisal metrics. Management can detect staff's attitude to work automatically through intelligent approaches such as Staff-Computer Inactivity Time, Staff-Email response time. An appraisal administrator can view non-editable appraisal scores at will and it allows management provides informed judgments and decisions based on the appraisal outputs. The model consists of three tiers, namely the Staff Client Agent or Staff-Agent tier, the Data Interpreter Server tier, and the Score tier as shown in figure 1. The Staff Client Agent or Staff-Agent tier is the major component where data about staff and the context or computing environment of staff, otherwise called staff service-delivery environment, provided to the data interpreter middleware. The followings are the sub components of the Staff Client Agent: Profile Manager, Project Manager, Attendance Manager, Communication Manager, and Leave Manager. The Profile Manager is a reader component, for retrieving useful staff information needed for the appraisal computation. The Project Manager Component, which focuses on the tasks and projects delivered by a staff, is an important component of the staff-agent. The project manager has three major functions, namely Project Weighted Score Computation, Project Throughput Scoring Manager, and Project Duration Store.

In a service-delivery environment, the role of the Project Manager (PM) component is to extract project title and its weighted score value. The PM component achieves this through direct request from line-manager or a project-scoring document. Project Throughput Scoring function carried out after a successful project sign-off. This function computes the rate at which project delivered efficiently Project Duration function gives the period of a project. Managers must estimate the calendar time required for executing a project successfully. The Attendance Manager Component is a primary component for retrieving punctuality information of each staff. This component informs the appraisal system of the attendance rate of every staff. The Communication Manager Component retrieves useful information about the staff-response rate per email. This component interacts with the mailing system and retrieves useful mail information. The communication manager component helps to determine staff effectiveness, collaborations and contributions in organizational tasks, projects and duties. The Leave Manager Component captures Leave information per staff, Leave Frequency, and Current staff pending projects on the Leave Handover document. The Data Interpreter Server is the middle tier component. This component interprets information retrieved from the first Tier of the architecture. The second Tier manages all information

received from the components of the 1st-Tier. Other roles played by these components include representation of information in format acceptable by the third tier. The information bus stores all information about staff, project, communications and attendance per time. In the third Tier: The Score Tier, a staff-friendly metrics were selected and infused flexibly by allowing organization appraisal human resource manager input weight worth/value per metric. Staff weighted means computations managed by the Score-Manager component. The second tier provides the weighted values per metrics. These weighted values of the metrics retrieved by the various component of the first Tier. In the application developed, the system makes provision for the employee work details to capture. The system captures some details about the work schedule of an employee as well as the supervisor for that project. The application also makes provision where new employees added. This section allows new project to be included stating explicitly, the duration of the project, the project description, name of the project and who will be the supervisor of the project. As many projects as desired can be added in this section. This platform used to enter new employee's details i.e. new employee registration. This section allows employee to add to the system. It accepts valid information about the employee such as the name, contact details, date of birth, residential address, emergency contact details, and so on. As many employee as desired can be added to the system via this platform. The application also has a platform where projects are rated. This page allows supervisor check the status of projects if it completed or not. It also provided relevant information as regards a project.

IV. ALGORITHM

Algorithm for Supervised Learning Task

1. procedure supervised learning task
2. Input: Teamwork Database
3. Output: Performance Report
4. if (user authentication=true) then
5. showtaskreport()
6. select team
7. show the task executed
8. use supervised learning to determine the percentage performance
9. end procedure

Algorithm for Performance Task

1. procedure performance task
2. Input: Teamwork Database
3. Output: Performance Report
4. if (user authentication=true) then
5. showtaskreport()
6. select team
7. show the expected task executed, executed no of times and score
8. compute the performance percentage performance
9. end procedure

Data Flow Diagram of the Proposed System

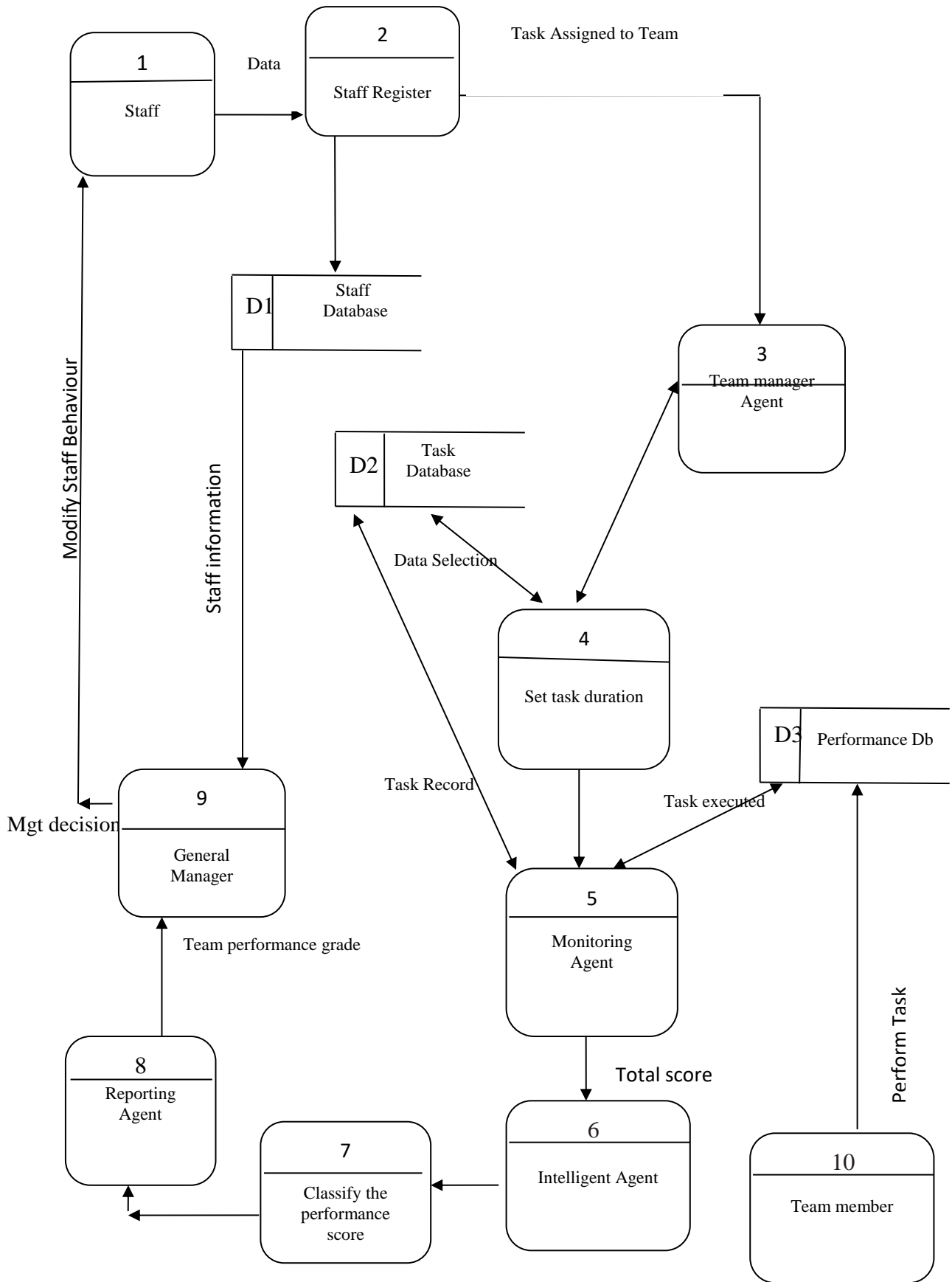


Figure 1: Analysis of the proposed System

Experimental Output Developed

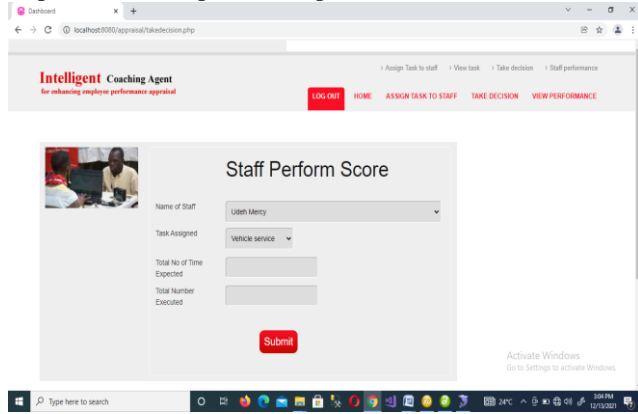


Figure 2: Take Decision on Team weight score Form

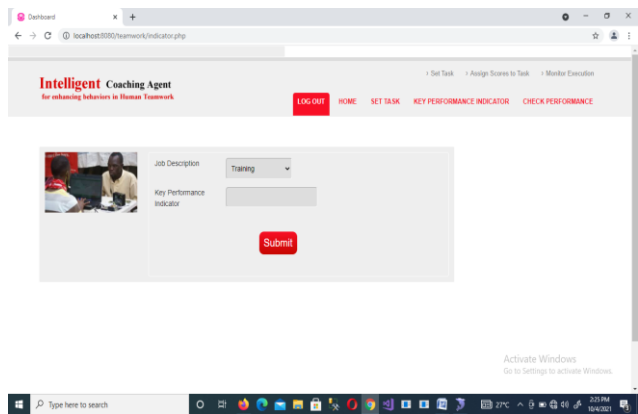


Figure 3: Setup Task Form

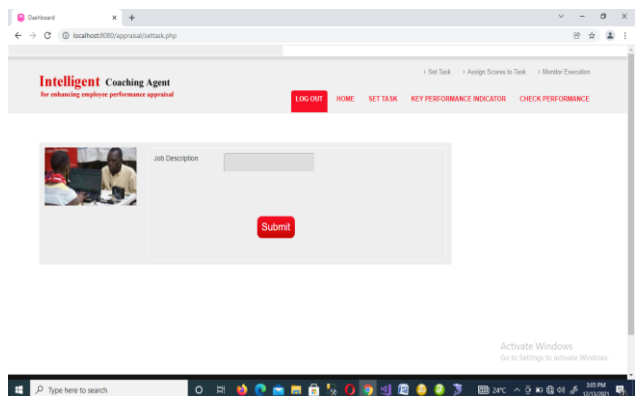


Figure 4: Assign weight score to task Form

V. PERFORMANCE EVALUATION

The software performance was tested using accuracy of task performance weight scoring and security of the data protection. Table 2 and Figure 5 show the performance grading of the proposed system.

Table 2: Performance Results Obtained

Technique Applied	Accuracy in classifying the task performance score	Security of the database
Intelligent coaching agent	97%	85%

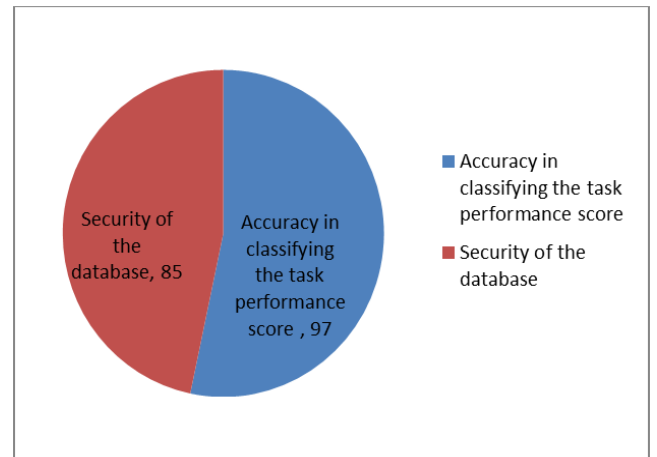


Figure 5: Performance grading of the proposed system

VI. CONCLUSION

This paper has thrown more light on employee performance enhancement more especially in a teamwork scenario. Performance evaluation is a systematic and continuous process that helps establishments assesses its staff to give appropriate appraisal to the individual and teamwork performance. There is need for proper evaluation of performance for employees because it will help determine the productivity of every employee in the organization. Also for the teamwork performance, proper evaluation needed for avoidance of biasness to get the adequate productivity level of the team in the organization. This thesis has developed a system that will remove biasness in performance evaluation for the employees of the company because some previous performance appraisal models allow/give room to biasness, which has made productive employees in a firm to laid, off due to favoritism towards some other employees. In this case, the performance appraisal is automatic; each task assigned a weighted score, so as soon as an employee performs the task the system automatically scores him/her. Hence, it is easy to track individual performance as well as team performance. The system developed utilizes supervised learning to monitor the task executions and determine the weight score for the task before scoring the team. This system will help those that are worthy of keeping their jobs keep it and help improve employees that need to work on some specific areas to develop themselves as plainly revealed. While the system appraises the teamwork performance, the output will help the general manager to know when to promote a staff or reward the team based on their performance.

REFERENCES

[1] Dessler, G. (2013). Human Resource Management. New Jersey, USA: Pearson Education, 2013.
 [2] AlShaikhly, N.A. (2017). The Impact of Human Resource Management Practices on Employees' Satisfaction: A Field Study in the Jordanian Telecommunication Companies. Middle East University, 2017.
 [3] Koopmans, L., Bernaards, C. M., Hildebrandt, V. H., and Beek, A. J. (2013). measuring individual work performance:

- Identifying and selecting indicators. *Work. A Journal of Prevention, Assessment and Rehabilitation*, **2013**.
- [4] Eldman, D. C. A. and Hugh J. (2019). *Managing Individual and Group Behavior in organism*. McGraw Hill Book Company, Japan, 392, **2019**.
- [5] Shaukat, H. M.N. (2015). Impact of Human Resource Management Practices on Employees Performance. *Middle-East Journal of Scientific Research* **23 (2), 329- 338, 2015**.
- [6] Terrence, H. M. and Joyce, M. (2014). *Performance Appraisals*, ABA Labor and Employment Law Section, Equal Employment Opportunity Committee, **2014**.
- [7] Vicky, G. (2019). *Performance Appraisals*, Loss Control Services, Texas Association of Counties, **2019**.
- [8] Jing, R.C, Cheng, C. H. and Chen, L. S. (2017). A Fuzzy-Based Military Officer Performance Appraisal System. *Applied Soft Computing*, **7(3), 936-945, 2017**.
- [9] Vukosi, N. M., George, S., and Tshilidzi, M. (2020). An Intelligent Multi-Agent Recommender System for Human Capacity Building. *Proceedings of the 5th International symposium on Spatial Data Quality*, June **2020**.
- [10] Keith, B., Nick, T., Yanguo, J. and Tariq, K. (2017). *Intelligent Agents an Approach to Supporting Multiple Model Based Training Systems*. Intelligent Systems Lab Department of Computing & Electrical Engineering Heriot-Watt University, Edinburgh, UK, **2017**.