

## Examining the Integration of a GPS-based Staff Performance Monitoring and Assessment System within Academic Settings

Mary Nkechinyere Nwakamma <sup>1,\*</sup>, Michael Chukwudi Ndinechi <sup>2</sup>, Cosmas Kemdirim Agubor <sup>2</sup>, Longinus. S. Ezema <sup>2</sup>, Gerald Iheachoro Nwakamma <sup>3</sup> and Reginald Uche Ossai <sup>1</sup>

<sup>1</sup> Department of Electrical/Electronics, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria.

<sup>2</sup> Department of Electrical/Electronics, Federal University of Technology, Owerri, Imo State, Nigeria.

<sup>3</sup> Department of Optometry, Federal University of Technology, Owerri, Imo State, Nigeria.

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### Abstract

Research evidence of manipulations of appraisal systems of various institutions in Nigeria abound, and little is known about the application of a Geographical positioning system (GPS) enabled system in this context. To cover this gap, this study investigates the integration of a real-time staff performance monitoring and assessment system with GPS technology, within academic settings. With the increasing emphasis on quality education and efficient resource utilization, academic institutions are exploring innovative approaches to monitor staff performance and student outcomes. The integration of real-time performance systems offers a promising avenue to achieve these goals by providing timely feedback, fostering accountability, and facilitating data-driven decision-making processes. This study outlines the key components of such a system, including its technological infrastructure, data collection methods, and performance evaluation metrics. Additionally, it explores the potential benefits and challenges associated with its adoption, considering factors such as staff engagement, privacy concerns, and institutional culture. Through a comprehensive examination of existing literature and case studies, this research aims to provide valuable insights and recommendations for academic institutions seeking to leverage real-time staff performance monitoring for institutional enhancement and educational excellence. While this study highlights the significance of stakeholder collaboration and continuous improvement mechanisms in ensuring the successful integration and sustained effectiveness of the monitoring system, it introduces a nuanced novel GPS technology and highlights some design implications which will guide future human-computer interaction researchers.

**Keywords:** Staff performance; GPS; Assessment; System; Technology

### 1. Introduction

Performance appraisal and/or evaluation is a systematic process through which employees are given feedback on their performance and further reward and promotion. Criteria for evaluating academic staff of universities and colleges can be categorized into three groups: teaching, research and service; teaching being the primary assignment of the academic.

Accurate assessment of staff activities in tertiary institutions is very pertinent to achieving academic and non-academic excellence. The manual approach poses a lot of issues such as human errors, mismanagement of vital documents, negligence of duty, sense services, prone to data disorganization, delays in profile updates, prejudiced decisions, delays in delivery of services, result submission, absenteeism from lectures and other impending issues that hinder the excellence of tertiary institutions. Most importantly, promotion, salary increment, staff conversion (from non-academic

\* Corresponding author: Mary Nkechinyere Nwakamma

to academic or vice versa), regularization, confirmation, disciplinary activities and other staff matters are really the hard nut to crack and therefore, the need for an automated annual performance, real-time monitoring, evaluation and promotion sustainability system for tertiary institutions. In response to these challenges, the convergence of cutting-edge technology, particularly Global Positioning System (GPS) technology, with performance management has given rise to a transformative solution: the Real-Time Staff Performance Monitoring and Evaluation System (RT-SPMES).

The advantages of engaging a real-time staff performance monitoring and evaluation system (RT-SPMES), as regards data management in tertiary institutions range from faster information procedure, and greater accuracy in information management schemes to enhanced inter-staff communications. RT-SPMES will serve as a powerful tool in prompting staff into anticipated actions in their areas of jurisdiction and thereby improve productivity in the quest for academic excellence. As a monitoring arrangement, it will help the school management to harness staff

Competencies and hence develop staff proficiencies rather than just promotion and remuneration drives.

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## 2. Review of previous literature

There is a paucity of studies that investigated staff performance systems, however, few good ones exist. For example, [1] used a rapid application development model to implement a database system for the evaluation of staff performance. Their findings led to the recommendation of their system for organization managers. While this study applied some advanced software design technicalities, it lacked research rigour. Our study applies a unique GPS technology to staff monitoring, and this makes it stand out. For organizational success to be fully achieved, Human Resources managers must be able to carry out effective employee performance management [2]. Performance appraisal is a core component of performance management in many organizations. [3] Defined performance management as a systematic process of improving an organization's performance, by enhancing individuals' and teams' performances within an agreed framework of planned goals, standards and competency requirements. Past literature suggests that performance appraisal systems should use key performance indicators and standards specific to a particular role/position in the organization. According to [4], the essence of evaluating employees' performance in any tertiary institution is to realize the goals of the institution by measuring the contribution of each employee.

Organizations are migrating their employee performance appraisal systems from the traditional format to web-technology-based formats to increase the accuracy, reliability and objectivity of appraisal criteria [5]. This web-based system allows, system users, to access it and monitor it whenever it is needed avoiding the problems caused by geographical distance. [6] Also corroborated the postulation by a study, that electronic employee performance monitoring has a positive impact on employee achievement. Organizations can more accurately capture employee performance with the use of electronic-performance management systems and can also use e-performance management systems to evaluate employee performance [7]. This ensures that employees with more competencies will be rewarded more and because of that employees will be encouraged to improve their performance to get more rewards [7].

According to [8], Geo-Information System (GIS) is a computer-based system that captures, stores, manipulates, analyzes, and visualizes spatially referenced data. [9] Outlined the effectiveness of GPS technology in tracking the real-time location of students to determine their safety and quality of life. For instance, if a student goes missing from an educational institution for any reason, a simple electronic message will be sent to the parents. Through this means, the regularity and punctuality of students to class can be accurately tracked. The research also finds GPS integration in the education system very vital in aiding students with disabilities to compete and fair favourably with other students.

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## 3. Key performance indicators of a real-time staff performance monitoring and evaluation system within academic institutions

In the context of appraisal of teaching staff, the following key performance indicators have been identified as critical: Attendance and punctuality to lecture sessions, Regularity to school, Timeliness of result submission, seminars and projects, and Publications in Journals, conferences papers and attendance to workshops and membership to professional bodies and industry certifications.

### 3.1. Attendance and Punctuality to Lecture Sessions

One of the key job responsibilities of an academic staff is to carry out lecture sessions for the students. It has been observed that some lecturers approach this strategic responsibility with shared negligence, leaving the students at the mercy of some unqualified proxy instructors, and tutorial classes and sometimes totally abandoned. This exposes the

students to victimization and intimidation by the lecturers and fellow students who in their desperation to scale through academic hurdles will be forced to succumb to unwanted pressure. It also increases the rate of exam malpractice among the students and significantly obstructs high academic performance. Due to these concerns, the institution ends up producing “half-baked” students who cannot be able to defend their certificates.

GPS (Geo Positioning System) based staff monitoring and evaluation systems can be deployed to monitor the activities of the lecturers for instance how often they attend lecture sessions, how early they arrive at the lecture venue and how long those lecture sessions last. The system should analyze the Attendance data gathered to determine the following:

- Punctuality of the lecturer to the class.
- Duration of the lecture session.
- A suitable punctuality to class rating is presented in Table 1 below.

**Table 1** Punctuality to class rating

Punctuality	Points
0 – 15 minutes into the scheduled time	50 (100%)
16 – 30 minutes into the scheduled time	37.5 (75%)
31 – 60 minutes into the scheduled time	25 (50%)
61 – 90 minutes into the scheduled time	12.5 (25%)
91 – 120 minutes into the scheduled time	2.5 (5%)

The score of a lecturer for the duration of a lecture session is calculated based on how long the lecture lasted as follows:

$$\text{Duration of class} = \text{Lecture end time} - \text{Lecture start time}$$

**Table 2** Duration of lecture rating

Lecture duration		Points
91 – 120 minutes	(1hr 46 mins – 2hrs)	50 (100%)
61 – 90 minutes	(1hr 1min – 1hr 45 mins)	35 (70%)
31 – 60 minutes	(31 mins – 1hr)	17.5 (35)
1 – 30 minutes		5 (10%)

### 3.2. Regularity to School

The core duties of an academic staff go beyond just conducting lecture sessions. Among other responsibilities, they participate in training opportunities and initiatives at the Institution and provide support, guidance and counselling to students. They are also expected to set, invigilate and grade assignments, tests, and exams, conduct research, and write, proposals, journal articles, and books as well as attend departmental and school board meetings, etc. Hence, they need to be in school on all working days, not just only when they have lectures to attend. This justifies evaluating their regularity to school. This will significantly impact on their productivity outside academic tasks positively.

GPS-based appraisal systems can be designed to capture these appraisal criteria. Each academic staff will be required to log into his dashboard upon arrival to school on every working day. The system will automatically read the GPS data of the device with which they logged in and compares it with the Geo Information System map of the Institution stored in the cloud. If the device's GPS coordinates correspond with any location within the institution's map, attendance is automatically recorded for the staff for the day.

### 3.3. Timeliness of Result Submission, Seminars and Project Scores:

Grading of quizzes, practical works, exams, seminars and projects, compilation of the scores and subsequent submission to the relevant department is paramount. This is to be accorded high priority as the negligence by a single lecturer is enough to mar the calculation and publishing of results especially for final year students going for Youth Service. The

proposed system will appraise the timeliness of such critical tasks by the academic staff. The system will incorporate a result submission portal that will be accessible directly from the lecturers' dashboard. Examination timelines will be provided at the beginning of each session during the publication of the Academic Calendar, for the system to use in monitoring the submission process.

The suitable evaluation scale for the proposed system is shown in Table 3.

**Table 3** Timeliness of result submission rating

Time Frame	Score
< 3 weeks after exams	100%
4 – 5 weeks after exams	70%
6 – 7 weeks after exams	50%
8 – 10 weeks after exams	20%
Exceeding deadline	0%

### 3.4. Publications in Journals, Conference Papers, Attendance to Workshops, Membership to Professional Bodies and Industry Certifications

Most Tertiary Institutions have existing appraisal policies with regard to the KPI. The proposed system will enable the lecturer to upload all evidence of publications done within the appraisal year and workshops attended within the same time referenced. The appraisee will also be able to upload all evidence of membership to professional bodies and industry certifications such as Nigeria Society of Engineers (NSE) and Council for Regulation of Engineers (COREN) certification for engineers, ICAN and Certified Chartered Accountants, for Accountants and Managers, etc. The policy will be digitized and the score obtained will be used for appraisal. This means that the proposed system will allocate scores automatically to the appraisee upon validation of the documents he/she has uploaded by the Head of Department.

**Table 4** Employee appraisal/promotion framework of Federal Polytechnic Nekede

S/N	CADRE	CONPCASS	Requirement
1	ASSISTANT LECTURER		No Requirement
2	LECTURER III	3	By promotion of a suitable Assistant Lecturer after a minimum of 3 of satisfactory service.
3	LECTURER II	5	Presentation of two seminar/conference papers OR one journal article accepted for publication.
4	LECTURER I	6	Presentation of at least two seminar/conference papers since the last promotion AND at least one additional journal article accepted for publication.
5	SENIOR LECTURER	7	Presentation of two journal papers since the last promotion plus two seminar/conference papers Or two meaningful chapter contributions in a standard textbook and two seminar/conference papers
6	PRINCIPAL LECTURER	8	Presentation of three journal papers since the last promotion plus three seminar/conference papers OR Three chapters contributions in a standard textbook and three seminar/conference papers OR One standard textbook plus three seminar/conference papers Registration with professional bodies Favorable report from external assessors

7	CHIEF LECTURER	9 – 15	Publication of four journal papers, Three seminar/conference papers, and Four chapters contribution in a standard textbook or two standard textbooks.
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### 3.5. Final Aggregation of Appraisal Score

Considering the role and importance of each of the criteria discussed, each variable has been allocated a percentage of the overall evaluation score. Presented below is the distribution of the appraisal score among the aforementioned variables.

- Attendance to class = 25%
- Regularity to school = 20%
- Result Submission timeline = 25%
- Paper publications and membership to professional bodies = 30%

Appraisal Score = Attendance to class score (Sa) + Regularity to school core (Sr) + Result Submission score (Ss) + Paper publication score (Sp).

## 4. Key components in the real-time staff performance monitoring and evaluation system

### 4.1. The Staff Dashboard

The starting point of a real-time staff performance monitoring and evaluation system is the staff dashboard. It is the landing page for regular staff after successful authentication. Login into this dashboard automatically clocks in the staff for daily attendance. It is on this dashboard that the staff is expected to supply his/her biodata indicating class attendance, upload conference papers, industry certifications, journal papers etc, and accept or reject appraisals, among other things.

### 4.2. HOD's Dashboard

The HOD should have the privilege of viewing the details of each staff's appraisal form. This is to enable him to make an objective assessment of the data provided by the staff, particularly the validation of the documents and results uploaded by the staff. It should also grant the HOD the privilege of viewing the appraisal score generated for the staff by the automated evaluation system. A link should be provided on the HOD's dashboard, which would forward the appraisal form to the Dean upon clicking, to review and make remarks also, in accordance with the appraisal policy. The Dean is saddled with the responsibility of forwarding the appraisal information of all the staff in his faculty to the School Appraisal Board for final review which consequently rewards or penalizes the staff based on his appraisal score.

The system continually aggregates and cumulates the staff's appraisal score and stores it in the database. Each time a staff uploads a new document, a notification is sent to the HOD. When the HOD validates the document, the staff's score is updated with the accrued score which is based on the policy discussed in chapter three. Similarly, the score for attendance to classes accumulates each time the staff indicates his presence in scheduled lecture sessions and the same is affirmed by the required number of students as specified in the appraisal policy.

## 5. Staff performance appraisal framework

Every staff is expected to log into their dashboard upon arrival at the institution. The system then automatically documents the GPS location and time of time of arrival of such staff. It is noteworthy to state that only authentication from within the institution's geo-fence is regarded as valid. Upon successful authentication, the system compares the staff's Geo-location with the coordinates of the institution and if valid, the score is updated in the database. More so, the staff is notified via a pop-up if authentication happens outside the perimeter of the institution. Since Results are submitted directly to the ERP portal of the institution, this real-time staff performance monitoring and evaluation system was designed to retrieve the result submission data from the institution's ERP portal through an exposed API.

The HODs and the Deans have the privilege of viewing, commenting on and validating the data from the Staff's dashboard. While the HOD's privilege is restricted to the staff in his department, the Dean can view the data of all staff within his/her faculty. However, both the HOD and Dean do not possess any power to modify the score awarded to a staff. The HOD's validation of uploaded documents is to verify the authenticity of such documents. Having reading access to the staff data also provides him with real-time information on each staff's performance, for feedback and guidance.

## 6. Conclusion

A holistic appraisal policy was presented in the paper, ensuring that all critical key performance indicators were considered in the evaluation of staff, for accurate appraisal. Attendance, delivery of expected academic functions which involves handling lecture sessions and marking students' tests, exams, and projects as well as publication of journal papers were all factored into the appraisal policy. A novel integration of GPS technology for real-time staff performance tracking into the appraisal of the systems was suggested. This leverages the reliability of the inbuilt sensors in smartphones and notebook PCs to assess various aspects of academic staff performance, including teaching effectiveness, attendance tracking, administrative duties, and student interactions.

The introduction of real-time monitoring and feedback mechanisms represents a significant advancement in the field of academic staff evaluation. This contribution addresses the need for timely insights and actionable data, facilitating continuous improvement among educators. By providing a framework for improved performance monitoring and evaluation, this work aims to elevate teaching and learning experiences, benefiting both academic staff and students.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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### Author's short biography



An accomplished scholar with an M.Eng. in Electrical Electronic Engineering from a top-tier Institution – Federal University of Technology Owerri (FUTO) Imo State Nigeria, specialized in Telecommunications, AI, and Computer Applications. Published articles in renowned journals with expertise in computational modelling. Recognized for exceptional teaching skills and awarded for contributions to student mentorship. Active participant in interdisciplinary research collaborations.