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RESEARCH ARTICLE

COMPREHENSIVE FRAMEWORK FOR EMPLOYABILITY FORECASTING IN HIGHER EDUCATION: AN ARIMA-BASED PREDICTIVE MODEL USING ALUMNI TRACER DATA AT PAMANTASAN NG LUNGSOD NG PASIG

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ABSTRACT

Higher education institutions continuously seek innovative approaches to track and assess alumni employability to improve academic programs and career support services. This study explores the use of predictive analytics in higher education, specifically employing the Autoregressive Integrated Moving Average (ARIMA) model to forecast alumni employability trends at Pamantasan ng Lungsod ng Pasig (PLP). This research aims to enhance the alumni tracking by integrating predictive analytics into an online-based Alumni Tracking System, which streamlines data collection and provides valuable insights into employment trends. The proposed system is a web-based portal designed to optimize the tracking of college graduates of Pamantasan ng Lungsod ng Pasig that improve data management, and strengthen the connection between the institution and the alumni. Through this platform, the alumni can able to update their employment status, participate in institutional activities, and communicate with the university. Additionally, faculty and administrators can efficiently monitor alumni progress, analyze patter of the employment and can utilize data-driven decision-making enhancing curriculum development and support career programs. This study provides a data-driven approach to predict trends of employment, enabling the institution to anticipate industry demands and refine educational strategies accordingly by integrating ARIMA-based forecasting within the system. The automated feature of the system minimizes the burden on alumni while ensuring real-time, accurate data collection. The study's findings highlight the potential of predictive analytics in alumni tracking, demonstrating how data-driven insights can contribute to institutional growth and graduate success.

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INTRODUCTION

Education is more than just essential, it is a transformative tool that enhances the life on an individual which greatly influences overall well-being by expanding knowledge, refining skills, shaping personality, and fostering a positive attitude. Most importantly, education is a vital factor in career development, as those with a solid educational foundation are more likely to attain meaningful and rewarding employment [7]. Gaining insight into alumni employability is very crucial for higher education institutions like Pamantasan ng Lungsod ng Pasig (PLP). Which requires predicting employability trends and job opportunities using trained data models. By doing so, PLP can tailor its academic programs to meet industry demands, equipping graduates with the necessary skills for the workforce. Therefore, staying informed about market shifts and future trends is vital for PLP to refine its academic offerings effectively. Various statistical tools are available for analyzing employability, with ARIMA (Autoregressive Integrated Moving Average) being one such model that utilizes time series data to generate forecasts and extract meaningful insights [18], [19].

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Employability refers to the ability of higher education graduates to effectively perform in professional roles requiring a university degree. It includesthe capacity to secure and retain employmentfocusing ontheir qualifications and their workforce readiness. Graduate employability serves as a key performance indicator to any higher education institutions, reflecting their efficiency in preparing students for the job market [19]. This study aims to predict the employability rate of alumni from Pamantasan ng Lungsod ng Pasig (PLP) using the ARIMA model. Additionally, it seeks to develop an Alumni Tracer Website for PLP, enabling the forecasting of job opportunities based on user-provided data and study instruments.

Statement of the Problem: This research will assess the effectiveness of ARIMA-based modeling in providing insights for academic institutions, policymakers, and students to improve career readiness. Here are eight detailed statements of the problem that provide a structured way to address various aspects of employability forecasting using ARIMA-based predictive modeling.

1. How do demographic factors, such as age at graduation, gender, and residential location, influence the employability outcomes of alumni?

2. What is the impact of academic factors, including degree program, CGPA or academic performance, and year of graduation, on alumni employability?
3. How do employment and industry factors, such as current employment status, industry sector, job position, salary level, and job tenure, affect career stability and professional growth?
4. To what extent do institutional support and alumni engagement contribute to employability outcomes?
5. How do economic conditions and labor market demand impact alumni employability?
6. What role do technological factors, particularly engagement with the tracer website and historical employment data, play in improving employability forecasting?
7. How do technical and soft skills contribute to alumni employability and career success?
8. What is the accuracy, reliability, and practical utility of predictive analytics tools in forecasting alumni employability?

Objectives of the Study: This study primarily aims to develop a predictive model utilizing the ARIMA (AutoRegressive Integrated Moving Average) methodology, integrated with an Alumni Tracer Website, to forecast employability trends among graduates of Pamantasan ng Lungsod ng Pasig (PLP). Specifically, it seeks to predict the employability rate of PLP graduates by analyzing historical alumni data and identifying potential job opportunities aligned with their qualifications.

Significance of the Study: This study has significant implications for various stakeholders within the university. Utilizing an ARIMA-based predictive model, it aims to enhance institutional strategies, improve curriculum development, and support data-driven decision-making processes related to graduate employability. The alumni of Pamantasan ng Lungsod ng Pasig are the core beneficiaries of the system, using the alumni tracer tool to monitor employment trends, assess career opportunities, and receive job market forecasts that strengthened alumni networks foster collaboration between graduates and students, enhancing mentorship and career success. Business employers benefit from insights into employability trends, improving hiring strategies, and workforce planning. Career services and guidance counselors can offer informed career advice and develop targeted training programs based on real-time employment trends. For current students and upcoming graduates, the system helps them align their studies with industry demands, ensuring better job market preparation. Educational institutions can update curricula based on job market needs, equipping graduates with relevant skills. External stakeholders, including employers and partner institutions, indirectly benefit from improved educational standards and stronger industry partnerships. Future researchers can use the study as a foundation for further investigations into employability forecasting and education outcomes. The IT department gains experience in managing predictive analytics technologies, ensuring system efficiency and advancement. Policymakers and accreditation bodies can use the findings to assess academic program relevance and improve curriculum standards. University administrators and planners can leverage predictive analytics for faculty development, alumni engagement, and resource optimization, enhancing the institution's reputation. Accreditation bodies benefit from real-time employability reports, supporting the university's accreditation efforts and workforce alignment.

Scope and Delimitation: This study focuses on the employability of graduates from Pamantasan ng Lungsod ng Pasig (PLP). The key variables considered include the graduate's name, gender, age, contact information, degree earned, year of graduation, cumulative grade point average (GPA), grades in major subjects, extracurricular involvement, and soft skills development during college. The data collected is based on responses from alumni who completed the online survey questionnaire within the designated data-gathering period. This study specifically aims to track the employability and job retention of PLP graduates, providing insights into their career progression and alignment with their academic background.

REVIEW OF RELATED LITERATURE

As the demand for graduates with a strong combination of academic knowledge and practical skills continues to grow, many institutions are turning to predictive models—such as the Auto-Regressive Integrated Moving Average (ARIMA) model—to analyze and forecast employability trends. This review aims to emphasize the importance of these forecasting methods in optimizing educational planning and enhancing graduate success in an ever-evolving job market. Hoque and Islam (2021) demonstrate that big data analysis using the ARIMA model can predict in-demand job skills, helping to address skill mismatches and employment gaps. This approach is expected to reduce Bangladesh's graduate unemployment rate by aligning education with labor market needs. The ARIMA model is widely used in time series forecasting due to its effectiveness in modeling linear trends within large datasets. Katoch et al. (2021) highlight its application in India's COVID-19 response, where ARIMA's predictions helped improve planning and decision-making to mitigate the epidemic's spread. The study provided realistic forecasts of confirmed COVID-19 cases, aiding region-specific interventions. The ARIMA model is a widely used time series forecasting technique due to its ability to effectively model linear trends in large datasets. Katoch et al. (2021) demonstrate its application in India's COVID-19 response, where ARIMA-based forecasts supported strategic planning and decision-making to control the epidemic. The model provided realistic predictions of confirmed cases, helping authorities implement timely, region-specific interventions. Predictive modelling is a vital for strategic planning in education, helping forecast enrolment and employability trends. Calvo et al. (2020) used data mining and ARIMA to estimate higher education enrolment, aligning graduate output with market demands. However, Kontopoulou et al. (2023) note ARIMA's limitations in handling non-linear trends, such as economic fluctuations. They recommend hybrid models with machine learning to enhance forecasting accuracy, emphasizing the need for adaptive, data-driven approaches in higher education.

Khan (2021) analyzed the impact of graduate unemployment on Saudi Arabia's economic development using the ARIMA (p, d, q) model. Forecasting unemployment trends from 1996 to 2025, the study found that female graduates consistently outnumber males, yet their unemployment rate remains significantly higher. Predictions indicate that female unemployment will rise from 22.5% to 23.7% by 2019, while male unemployment is expected to drop to nearly 1%. The study emphasizes the need for targeted policies to improve female employment rates, supporting Saudi Arabia's transition to a tech-driven economy. Bektemyssova et al. (2022) used ARIMA and the Augmented Dickey-Fuller Test in MATLAB to forecast network traffic, finding that data transformation was necessary for accuracy and confirming model reliability with a 95% confidence interval. Najamuddin and Fatima (2022) compared ARIMA, BRNN, and hybrid models for exchange rate forecasting, showing higher accuracy for developed countries and providing insights for financial decision-makers. Mapuwei et al. (2022) used ARIMA to forecast Zimbabwe's tobacco yield, predicting a decline due to inefficient farming practices and recommending machine learning for better accuracy. Kontopoulou et al. (2023) reviewed ARIMA, Machine Learning, and Deep Learning in time series forecasting, concluding that ML models offer better accuracy but require more computational resources, while ARIMA remains useful for specific cases. Xu (2024) used ARIMA to predict student employment trends over five years, demonstrating its accuracy in forecasting employment rates. The study emphasized ARIMA's value in helping universities improve alumni outcomes through better planning and program adjustments, supporting its use in forecasting alumni employability at Pamantasan ng Lungsod ng Pasig. Bharatpur (2022) reviewed time series forecasting methods, including ARIMA, highlighting their concepts, applications, advantages, and limitations. This review provides a foundation for

understanding ARIMA's role in forecasting employment trends. The adaptability of ARIMA has been demonstrated across various fields. Konarasinghe (2020) used ARIMA to predict employment trends in Sri Lanka's tourism industry, while Tolesh and Biloshchytska (2024) applied ARIMA and Brown models to forecast international migration in Kazakhstan until 2060. These studies illustrate ARIMA's effectiveness in analyzing complex data patterns, reinforcing its relevance in forecasting alumni employability at Pamantasan ng Lungsod ng Pasig.

Conceptual Framework: A conceptual framework serves as a structured blueprint that outlines the key variables, relationships, and theoretical foundations of a study. It provides clarity on how different components of the research interact and guides the investigation toward achieving its objectives.

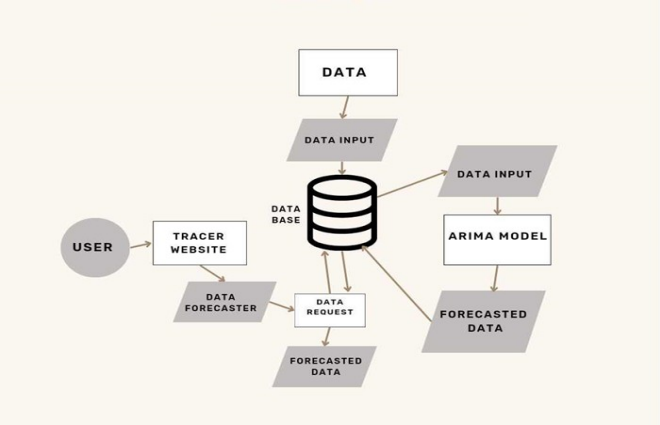

Fig. 1. Conceptual Framework

This conceptual model illustrates an ARIMA-Based Employability Forecasting System, outlining the flow of data from collection to predictive insights. Alumni employment data is gathered via a Tracer Website and stored in a Database, which acts as a central repository. The ARIMA Model processes historical employment trends, generating Forecasted Data on job demand, skills relevance, and workforce alignment. The Data Forecaster retrieves necessary inputs for analysis, while stakeholders such as university administrators and policymakers use these insights for decision-making and academic program improvements. This system ensures a data-driven approach to enhancing graduate employability.

METHODOLOGY

The methodology involves collecting alumni tracer data on employment trends, preprocessing it through data cleaning and transformation, and developing an ARIMA model by identifying optimal parameters. The model is trained and validated using historical data to forecast employability trends. The results provide insights into job demand and industry alignment, enabling universities to refine academic programs and career services for better workforce preparedness.

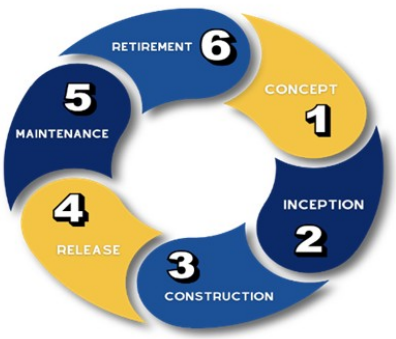

Fig. 1.2. Agile Methodology

This methodology comprises six stages: Each stage is essential in the software development lifecycle, providing a systematic and efficient approach from the initial idea to its eventual discontinuation.

A. Concept, where the software idea is identified and assessed for achievability;
B. Inception, which incorporate planning, requirement gathering, and defining the project scope;
C. Construction, where the progress of coding, and system design take place;
D. Release, which incorporate testing, finalization, and deployment to users;
E. Maintenance, where updates, bug fixes, and improvements are made based on user feedback; and
F. Retirement is when the software is phased out or replaced when it becomes obsolete.

Research Design: This study employs a quantitative research design incorporating descriptive analysis, predictive analytics, and system development to construct an ARIMA-based employability forecasting model integrated with an Alumni Tracer Website. The primary objective is to predict the employability rate of Pamantasan ng Lungsod ng Pasig (PLP) graduates, identify key influencing factors, and enhance job matching through a user-friendly digital platform. The research approach consists of three main components. First, descriptive research is utilized to evaluate alumni employability trends based on historical data from the PLP Alumni Tracer Website and to identify critical factors such as academic background, skills, industry trends, and demographic characteristics. Second, predictive analytics is applied using the AutoRegressive Integrated Moving Average (ARIMA) model to forecast employability rates. This model's accuracy is compared against other forecasting techniques, such as Exponential Smoothing, Multiple Regression, and Machine Learning models like Random Forest and Neural Networks. To ensure reliability, the study employs validation metrics such as Mean Absolute Percentage Error (MAPE), Root Mean Squared Error (RMSE), and Akaike Information Criterion (AIC). Third, the study focuses on system development and implementation, integrating the ARIMA model into the PLP Alumni Tracer Website and developing a job-matching platform. This platform will allow students to create profiles and receive personalized job recommendations based on their academic performance, skills, and career preferences, while also ensuring real-time data processing for enhanced employability insights.

The study uses multiple data collection methods. Primary data sources include information from the PLP Alumni Tracer Website that provides details on employment status, job relevance, salary trends, and industry classification. Additionally, alumni surveys will be conducted to gather insights on job-seeking experiences, while employer feedback surveys will assess labor market expectations and skill gaps among graduates. Secondary data sources include university records, such as academic performance, course history, and graduation rates, as well as labor market reports from agencies like the Department of Labor and Employment (DOLE) and the Philippine Statistics Authority (PSA). The collected data will be analyzed using various data analysis techniques. Descriptive statistics will be applied to examine employment rates, job alignment, and the sectoral distribution of alumni. Predictive modeling will involve training and validating the ARIMA model using historical employability data while comparing it to alternative forecasting techniques to determine the most accurate approach. Additionally, feature analysis will be conducted to identify key predictors of employability, such as GPA, internship experience, and industry demand. The effectiveness of the job-matching platform will also be assessed through system usability testing using feedback from students and employers. This research complies with the ethical considerations, ensuring that permission to use theirdata is acquired from the alumni and the employers before starting collecting of data. It will also comply with RA 10173 (Data Privacy Act of the Philippines) by anonymizing alumni records to safeguard personal information and ensuring that all data is handled confidentially.

The expected outcomes of this study include the development of a validated ARIMA-based model for forecasting alumni employability in higher education, a comparative analysis of forecasting techniques to determine the most effective method, and the enhancement of the Alumni Tracer Website through predictive analytics integration. Moreover, the job-matching platform is expected to facilitate a seamless transition from education to employment, providing students with data-driven career directives and lastly, this research aims to come up withthe institutional recommendations to improve employability approaches and strengthen alumni commitment at the Pamantasan ng Lungsod ng Pasig. This tracer study utilized a descriptive research design to systematically analyze and interpret data on the employability of graduates from various academic programs at Pamantasan ng Lungsod ng Pasig (PLP). The study focused on alumni from the following degree programsBS in Accountancy, BS in Business Administration Major in Marketing Management, BS in Computer Science, BS in Information Technology, BS in Entrepreneurship, BS in Nursing, Bachelor of Secondary Education Major in English, BS in Electronics Engineering*and*Bachelor of Elementary Education, BS in Hospitality Management.

The research covered graduates from the academic years 2014 to 2021, ensuring a diverse dataset that reflects various employment trends across different fields. By employing a descriptive approach, the study aimed to identify patterns, relationships, and influencing factors affecting alumni employability. Data collection involved structured survey assessment, distributed to alumni through an electronic Alumni Tracer System, as well as institutional records obtained from the Alumni Office and the Office of the Registrar of the Pamantasan ng Lungsod ng Pasig. The collected data was scrutinized to assess employment rates, job alignment with academic background, career progression, and factors influencing alumni success in the workforce. Furthermore, the study incorporated predictive analytics using the ARIMA model to forecast employability trends, enabling PLP to align its curriculum with industry demands and enhance career development initiatives for future graduates.

Instrument and Data Gathering: The primary instrument used in this study is the Alumni Tracer Study Questionnaire, which is designed for each academic program. It includes sections on student demographics, educational background, academic performance, extracurricular activities, and soft skills development. The questionnaire was converted into a Google Form and distributed via email to graduates from 2013 to 2024. Graduate records used in the study were obtained from the Alumni Office and the Office of the Registrar at Pamantasan ng Lungsod ng Pasig.

Software Design: The alumni tracer website will be split into three layers. Front-End, Back-End, and the Tracer-Website. The development of the Alumni Tracer Website and employability forecasting system will focus on creating a user-friendly and visually appealing interface while integrating predictive analytics using ARIMA. The backend will be powered by Laravel, a PHP framework that effectively handles authentication, database interactions, and API integrations. Python will be utilize to administer ARIMA for predicting the model for the effectiveness of data processing capabilities. The system will be designed to facilitate seamless communication between Laravel and Python through a Flask or FastAPI-based REST API, enabling real-time employability predictions. The front end will utilize HTML, CSS, JavaScript, Tailwind CSS, and Bootstrap to ensure a responsive and aesthetically pleasing user experience. Tailwind's utility-first approach combined with Bootstrap's pre-built components will streamline development and improve design consistency. jQuery will be employed for dynamic UI interactions and AJAX-based functionalities, though integrating Vue.js could enhance scalability and maintainability. For data storage, MySQL or MariaDB will be used, with MariaDB offering potential performance advantages for handling large datasets. The system will be optimized with proper indexing and query optimization to support real-time data processing. Additionally, Redis caching may be implemented to store frequently accessed predictions and job recommendations, reducing API latency. To enhance the system performance, ARIMA model will be consistently retrained with enhance alumni data, ensuring forecasting accuracy over time. Laravel will be considered for asynchronous processing, preventing delays in user interactions and security will be a priority with built-in authentication, CSRF protection, and encrypted data storage safeguarding sensitive alumni records. Overall, the development will integrated with advanced web technologies and predictive analytics to give an interactive, data-driven platform that enhances alumni engagement and facilitates better job matching. With a well-structured backend, a dynamic frontend, and a robust forecasting model, the system aims to bridge the gap between education and employment, helping students transition seamlessly into the workforce.

RESULTS

Demographic factors greatly influence the employability result of alumni by shaping job opportunities, career development and overall employment trends. Understanding these demographic elements helps educational institutions and policymakers develop optimize plan and strategies to improve alumni employability and promote equal opportunities in the job market.

- ***Age (Graduation):*** Young professional and newly graduate may have a competitive in securing entry-level positions due to their adaptability and longer career path, older graduates may face challenges in the job market but could leverage prior experience to transition into roles align with their skills.
- ***Gender:*** Direction of employment frequently show gender-based challenges, where male and female graduates may experience diverse career advancement opportunities, industry preferences, and salary differences. Community-based, employer biases, and industry demands can contribute to these differences.
- ***Residential Location:*** Residing in urban areas typically have better access to various job opportunities, networking events, and professional growth in contrast in rural or less developed regions may encounter limited employment possibilities necessitating relocation or remote work opportunities.

Academic componentsnotably contribute to alumni employability.

- Degree programs aligned with industry requirement like STEM and business fields that offer higher job opportunities.
- GPA and academic performance improve employability, as strong academic records signal discipline and expertise to employers.
- Year of graduation impacts job prospects due to evolving economic and industry conditions, with recent graduates often benefiting from current trends, while older cohorts may need to upskill.

Job market and industry trends heavily affect career stability and professional growth, current employment status identify financial stability and career development opportunities, with employed alumni gaining relevant experience, while underemployment or unemployment may hinder growth. The Field of industry plays a role in job security, as high-demand industries (e.g., IT, finance, and healthcare) provide more stable and profitable career paths. Job position/role affects career trajectory, with entry-level roles serving as a foundation for skill development, while mid-management and executive roles indicate upward mobility. Remuneration plays vital role in job satisfaction and workforce stability with competitive compensation motivating employees to stay and grow within the organization, professional tenure embodies stability and expertise, as longer appointments lead to career development, leadership capabilities, and increased professional integrity. Academic Institutional involvement and alumni relations significantly enhance employability results. Utilizing career services support graduates with

job posting assistance, creation of a good resume, and interview preparation, enhancing their chances in securing employment. Involvement in alumni frameworks fosters professional engagement, coaching opportunities and industry endorsements, increase access to job openings and career advancement. Professional experience programaided with training opportunities equip students with real-world experience and industry-specific skills, making them more competitive in the job market. These factors collectively bridge the gap between education and employment, ensuring graduates are well-prepared for workforce demands. Economic provisions and labour market requirement play a crucial role in alumni career prospects like in Pamantasan ng Lungsod ng Pasig. Economic provisions, like recessions directly influence job availability, compensation rates, and hiring trends. Amid financial crises, employment opportunities may be limited while economic expansion often drives higher employment and career growth. Labour market demand defines the relevance of alumni skills in different industries.

Growing sectors like technology and healthcare, allocatehigher employment opportunities whereas industries with low demand may face job deficiency. Understanding these factors aid institutions like Pamantasan ng Lungsod ng Pasig align academic programs with workforce needs, ensuring graduates are better prepared for evolving job markets. Technological variables in engaging with the tracer website and historical employment datais very essentialto improve forecasting employability. The tracer website interaction allows alumni to update their employment status, skills, and job-seeking activities, giving real-time insights into workforce trends. Regular engagement ensures that institutions have up-to-date data for analysis. Utilization of data in ARIMA modellingprovides historical employment records to identify patterns and predict future employability trends by integrating these technological tools, universities can enhance the accuracy of their forecasts, refine academic programs, and provide better career guidance to students and alumni.

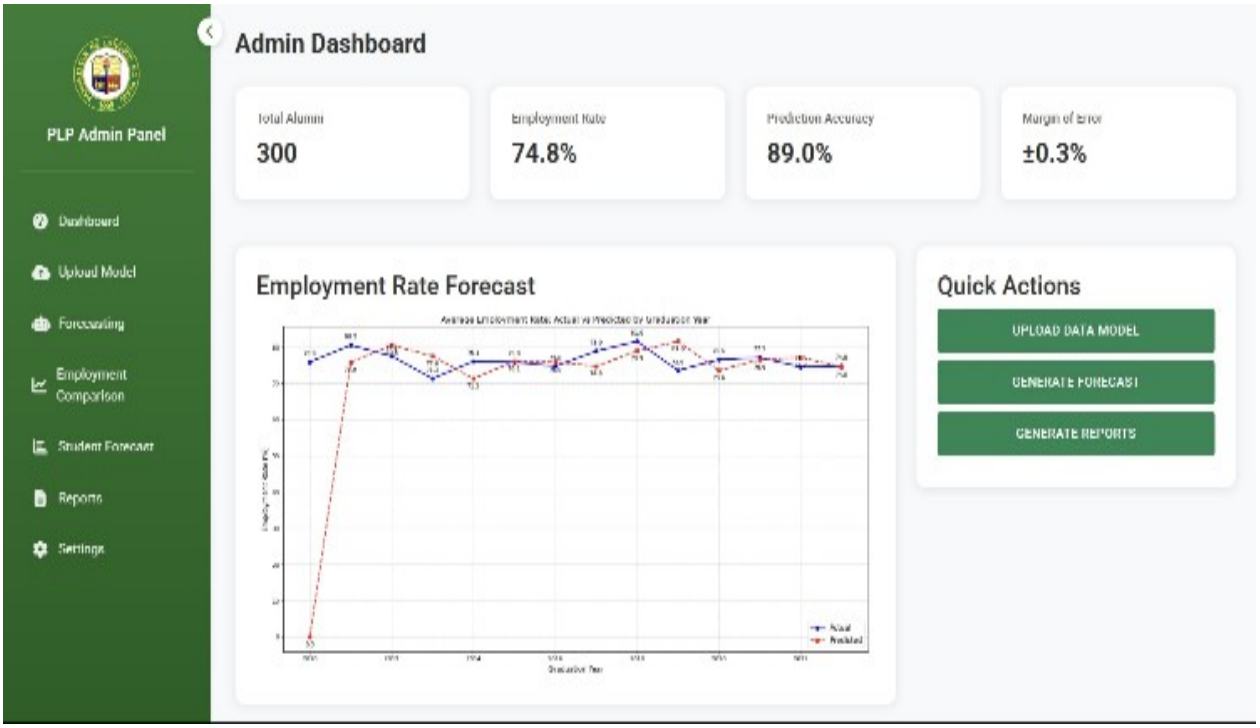

Fig. 1.3. Admin Dashboard

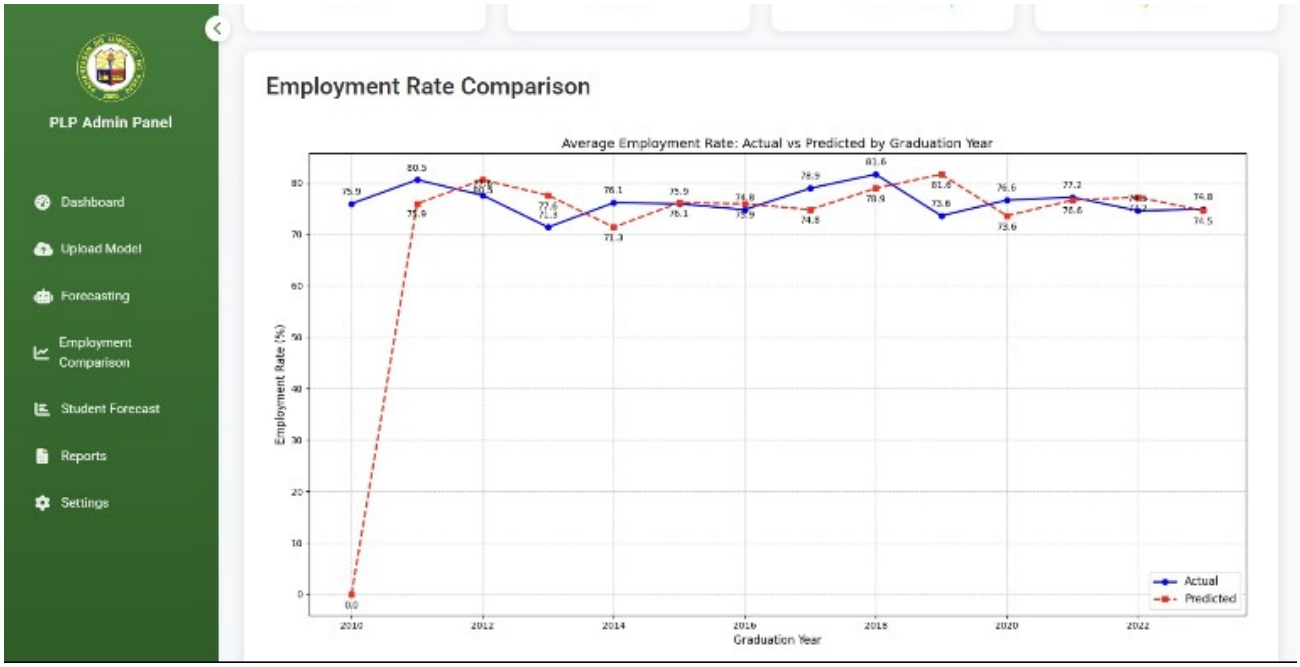

Fig. 1.4. Employment rate Comparison

Both technical and soft skills play a crucial role in alumni employability and career growth. Technical skills provide graduates with specialized expertise required for specific job roles making them competitive candidates in their respective industries, employers often seek professionals with strong technical foundations relevant to their field. Alternatively, soft skills like as leadership, communication, teamwork, and critical thinkingenhance workplace adaptability and career development, these competencies help alumni excel in collaborative environments, solve complex problems, and take on leadership roles.

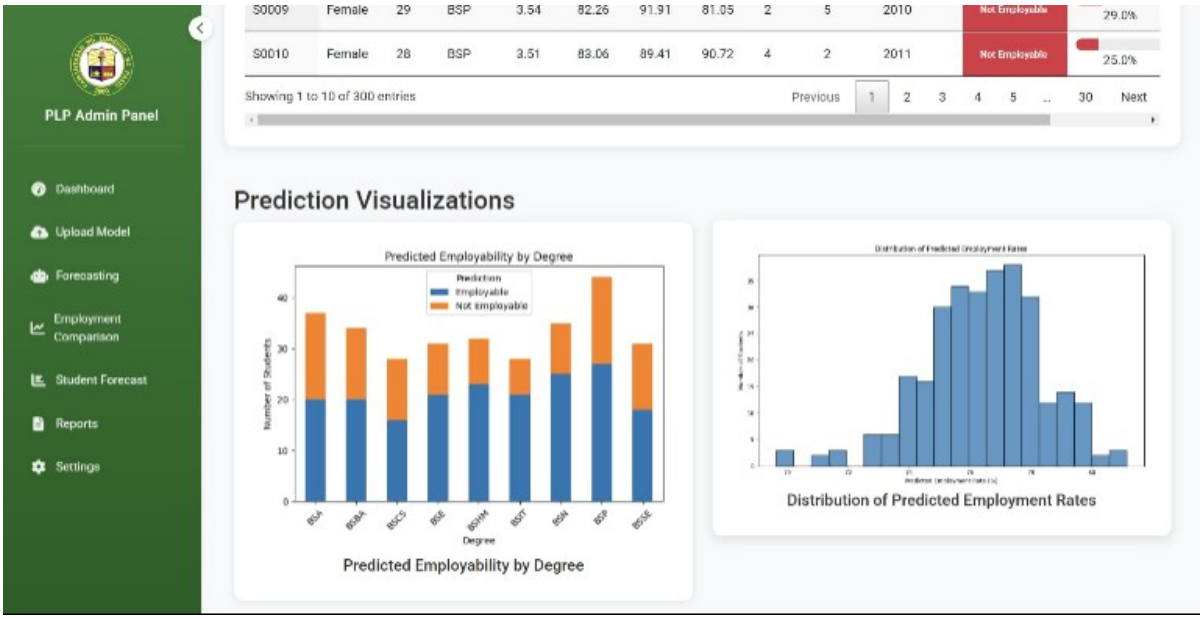

Fig. 1.5. Prediction Visualization

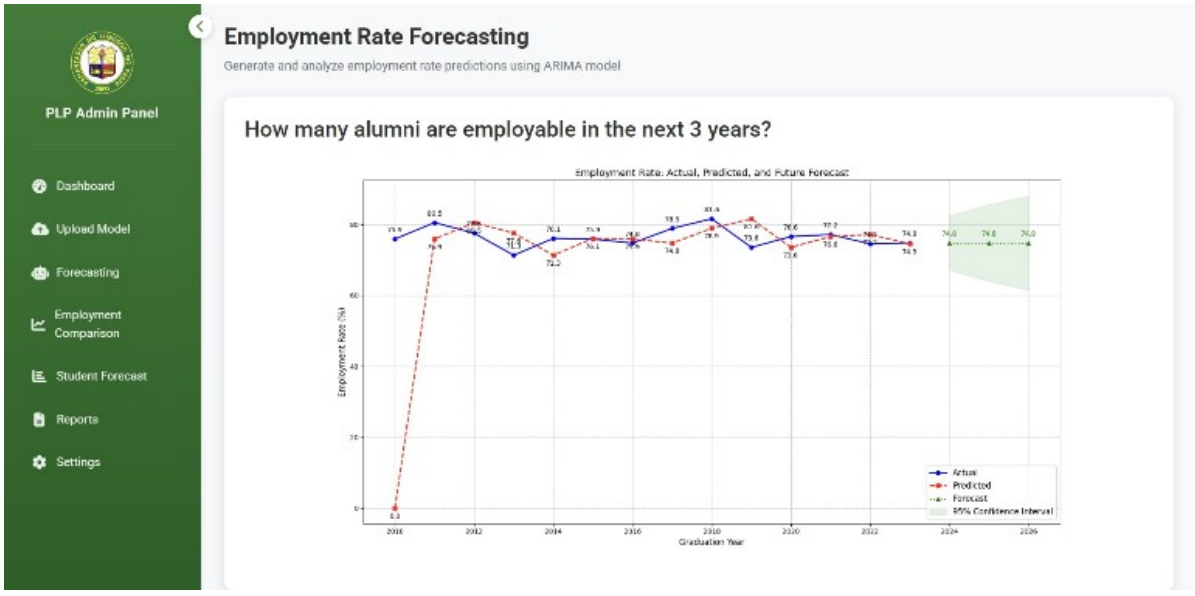

Fig. 1.7 Reports Generation

A balance of both skill sets increases job opportunities and long-term career growth. The accuracy, reliability, and practical utility of predictive analytics tools in forecasting alumni employability depend on the effectiveness of the model and the quality of the data used. Accuracy is determined by how well the model, such as ARIMA, can predict employment trends based on historical data. A well-calibrated model minimizes errors and improves forecasting precision. Reliability refers to the model's consistency in generating dependable predictions across different datasets and time periods. Practical utility highlights the model's real-world applications, such as helping universities refine academic programs, guiding career services, and assisting policymakers in workforce planning. When properly implemented, predictive analytics tools enhance decision-making and improve employability outcomes. This section presents the data collected by the researcher to showcase how the system addresses the statement of the problem. Incorporate with screenshots of the developed system to illustrate its interface design, functionality, and overall user experience. Additionally, it presents the results of the system evaluation, which is based on questionnaires assessing key attributes such as functionality, performance, reliability, security, and usability.

Figure 1.3 displays the Admin Dashboard of the PLP Admin Panel, designed for employment rate forecasting of alumni. At the top, four key statistics are presented: Total Alumni (300), Employment Rate (74.8%), Prediction Accuracy (89.0%), and Margin of Error (±0.3%), providing a quick overview of alumni employment trends. Employment Rate Forecast graph visualizes actual versus predicted employment rates over different graduation years, helping to analyse employment trends and the accuracy of the predictive model. The left-side navigation menu contains sections such as Dashboard, Upload Model, Forecasting, Employment Comparison, Student Forecast, Reports, and Settings, allowing administrators to manage

and analyse alumni employability data effectively. On the right is the Quick Actions panel offers buttons for uploading data models, generating forecasts, and producing reports, ensuring efficient system operation, the dashboard is structured for data-driven decision-making, aiding stakeholders in assessing alumni employment outcomes and refining academic programs accordingly.

Figure 1.4 Employment Rate Comparison section of the PLP Admin Panel, showing a line graph that compares actual employment rates (blue solid line) with predicted employment rates (red dashed line) across different graduation years. The x-axis represents graduation years, while the y-axis indicates employment rate percentages. The graph highlights differences between actual and predicted employment rates over time, with some fluctuations where predictions slightly deviate from actual values. In earlier years, there was a significant discrepancy, especially around 2010, when the predicted rate started from 0% before rapidly aligning with actual values, in more recent years, the predictions closely follow actual employment trends indicating improved forecasting accuracy. The left-side contains sections such as Dashboard, Upload Model, Forecasting, Employment Comparison, Student Forecast, Reports, and Settings, suggesting a comprehensive system for analysing and managing alumni employment data, this aspect allows administrators to assess the accuracy of the predictive model and improve employment forecasting techniques. Figure 1.5 presents a Prediction Visualizations section from the PLP Admin Panel, displaying two key graphical representations of employability predictions. The left graph, titled "Predicted Employability by Degree," is a grouped bar chart that illustrates the number of students predicted to be Employable (blue) and Not Employable (orange) across different degree programs. The distribution varies, showing that some degree programs have a higher proportion of employable graduates, while others have a significant number of students predicted to be not employable. The right graph "Distribution of Predicted Employment Rates," is a histogram that visualizes the frequency of predicted employment rates across different students. The histogram follows a somewhat normal distribution, with most predicted employment rates clustering between 74% and 78%, suggesting that the majority of students have a moderate likelihood of being employed. These visualizations gives analytical perspective how the different academic programs impact employability and the overall distribution of predicted employment success, helping administrators and educators make data-driven decisions to enhance student career readiness.

Figure 1.6 displays the Employment Rate Forecasting section of the PLP Admin Panel, which uses the ARIMA model to predict employment trends. The primary focus is on estimating alumni employability over the next three years. The line graph presented in the image visualizes actual, predicted, and future employment rates from 2010 to 2026. The blue solid line represents actual employment rates, while the red dashed line shows predicted values based on historical data. The green dotted line projects future employment rates for the next three years (2024–2026), with a shaded green region indicating the 95% confidence interval, suggesting a range of possible variations in the forecast. From the graph, employment rates have fluctuated over the years but generally stayed within the 71%–81% range. The forecasted employment rate for 2024–2026 remains stable at approximately 74.8%, indicating minimal expected changes in alumni employability within this period. This visualization helps administrators and policymakers in identifying employment trends, allowing them to refine academic and career support strategies to improve graduate outcomes. Figure 1.7 displays the Reports Generation section of the PLP Admin Panel, which allows users to filter and export employment prediction reports. The table titled Latest Prediction Results presents employability predictions for students based on various academic and skill-related factors. The table contains multiple columns, including Student Number, Gender, Age, Degree, CGPA, Average Professor Grade, Average Elective Grade, OJT (On-the-Job Training) Grade, Soft Skills Average, Hard Skills Average, Year Graduated, Predicted Employability, and Employability Probability. Each row represents an individual student with their respective attributes and employment probability. The Predicted Employability column categorizes students as either "Employable" (marked in green) or "Not Employable" (marked in red). The Employability Probability column provides a percentage score indicating the likelihood of employment. For example, a female BSN graduate from 2013 (Student S0001) has a 97.0% employability probability, while a male BSCS graduate from 2023 (Student S0002) has a lower probability of 45.0% and is classified as "Not Employable." This interface helps administrators and decision-makers analyze trends in student employability based on academic performance, practical training, and skill levels. The ability to filter by year graduated and degree allows for a more focused analysis of specific student groups, the Print Report button on the top-right corner suggests that users can generate and export reports for further review and documentation.

CONCLUSION AND RECOMMENDATION

The study presents the capability of the ARIMA-based predictive model in forecasting employability trends using alumni tracer data in assessing the historical employment patterns, the model provides valuable insights into job demand, industry alignment, and workforce proficiency.

Recommendation

Graduating students must receive sufficient training and experience to adapt to the evolving industry landscape, particularly with the increasing reliance on technology and remote work setups. Seminars and workshops play a crucial role in providing students with both theoretical knowledge and hands-on practice. To further enhance employability, the school should allocate in hiring additional competent professors, especially for specialized subjects, while also upskilling current faculty members to ensure they can effectively teach students how to navigate industry changes. Additionally, seeking participationto any alumni who have established careers in their respective fields to serve as resource speakers for pre-employment seminars that can provide valuable insights and inspiration to those seeking employment whether they are unemployed, underemployed, or recent graduates. The curriculum must crucial toaddress critical thinking, problem-solving, and decision-making skills with other essential competencies to strengthen students' employability, additionally, extending seminars, workshops, and training opportunities to unemployed alumni can help improve their career prospects. Finally, the school should strengthen and expand collaboration partnership with local and international industries to ensure better on-the-job training opportunities and facilitate job placements for both graduating students and alumni.

CONCLUSION

The research has proven to be an essential tool for tracking graduates' employment status and gathering insights into their career progression. Seamless deployment highlights the relevance of data-driven decision-making in higher education institutions by efficiently collecting tracer data, universities can assess the effectiveness of their academic programs and make informed improvements to enhance graduate employability. One of the advantages of this system is the ability to bridge the gap between academia and industry. Schools can use the collected data to identify employment trends, industry demands, and skill gaps, enabling them to tailor their curriculum and training programs accordingly. Furthermore, the researchoffers a direct channel for alumni engagement, permitting graduates to stay connected with their alma mater, participate in connecting opportunities and obtain access to job postings relevant to their field of specialization. Additionally, the job search functionality embedded in the system benefits both graduates and employers, alumni graduates can explore career opportunities efficiently, while companies can recruit skilled professionals who have received education and training from the institution. This fosters a sustainable ecosystem where universities, alumni, and industries collaborate to

enhance workforce readiness and ensure that graduates meet labour market expectations.

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