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HR SALARY INTELLIGENCE AND WORKFORCE ANALYTICS

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ABSTRACT

Human Resource departments manage large amounts of employee information related to salary, experience, designation, department, performance, education, and other workforce characteristics. Analyzing this information can help organizations understand salary structures, workforce distribution, compensation patterns, and employee-related trends. Data-driven HR analytics can support better workforce planning and compensation analysis.

The **HR Salary Intelligence and Workforce Analytics** system is designed to analyze employee salary and workforce data and generate meaningful insights. The system processes attributes such as employee ID, department, job role, experience, education, salary, performance rating, employment type, location, and joining year. Data preprocessing techniques are applied to handle missing values, duplicate records, inconsistent formats, and invalid entries.

The system performs salary and workforce analysis using statistical and visualization techniques. Important indicators such as average salary, median salary, salary range, employee count, department-wise salary, experience-wise salary, and role-wise compensation are calculated. Interactive dashboards can present these metrics through KPI cards, charts, graphs, tables, and filters.

The prediction component can use Machine Learning techniques to estimate salary ranges or analyze salary-related patterns based on historical employee information. Factors such as experience, job role, education, department, location, and performance can be used as predictive features. The system can also support workforce segmentation based on experience, salary levels, and organizational roles.

Overall, the proposed system combines salary analytics, workforce analysis, visualization, and predictive modeling into a centralized platform. It can help HR teams understand compensation patterns and workforce characteristics using available historical data. Future enhancements can include salary benchmarking, attrition prediction, skill-gap analysis, workforce forecasting, and automated HR reporting.

I. INTRODUCTION

Human Resource Management plays an important role in managing employees and maintaining an organization's workforce. Employee salary is one of the major components of workforce management and can vary according to experience, job role, department, education, location, performance, and other organizational factors. Analyzing these factors can provide useful insights into compensation patterns.

Organizations generate large amounts of workforce data through employee management systems, payroll systems, performance management platforms, and recruitment processes. When this data is analyzed systematically, HR teams can identify salary distributions, workforce composition, department-level differences, and changes in compensation over time.

Traditional HR systems mainly focus on storing employee records, processing payroll, maintaining attendance, and managing employee information. Although these systems

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are important for administrative activities, they may provide limited analytical capabilities. HR professionals may therefore depend on spreadsheets or separate reporting tools to perform detailed salary and workforce analysis.

Data visualization can simplify the interpretation of large employee datasets. Dashboards can display employee counts, average salary, salary distributions, experience patterns, department-wise compensation, and job-role comparisons. Interactive filters can allow HR users to examine specific departments, locations, roles, experience levels, or salary ranges.

Machine Learning can further enhance HR salary analytics by identifying relationships between employee characteristics and compensation. Predictive models can estimate salary ranges or classify employees into salary categories when appropriate historical data is available. The proposed system combines workforce analytics, salary intelligence, visualization, and predictive techniques to provide a comprehensive HR analytics platform.

II. LITERATURE SURVEY

HR analytics has become an important area of organizational data analysis because companies generate significant amounts of employee-related information. Workforce datasets may include employee demographics, department, job role, experience, education, salary, performance, location, and employment history. These attributes can be analyzed to understand workforce characteristics and compensation patterns.

Salary analysis is commonly used to examine differences in compensation across job roles, departments, experience levels, and geographical locations. Statistical measures such as mean, median, minimum, maximum, and salary range can be used to summarize compensation information. Such analysis can help identify general salary patterns within a dataset.

Experience and job role are important factors frequently considered in compensation analysis. Employees with different levels of experience and responsibilities may have different salary distributions. Comparing salary against experience and job roles can provide insights into compensation structures and career progression patterns.

Workforce analytics also examines the distribution of employees across departments, roles, locations, employment types, and experience groups. Visualization techniques such as bar charts, histograms, box plots, and heatmaps can make these patterns easier to understand. Interactive dashboards can allow HR users to explore workforce data from different perspectives.

Machine Learning techniques can be applied to salary prediction and workforce analysis. Regression models can estimate numerical salary values, while classification models can categorize employees into predefined salary groups. The accuracy of such models depends on the quality and relevance of the historical employee data and selected features.

Modern HR analytics systems combine descriptive analytics, visualization, predictive modeling, and reporting. Such systems can support workforce planning, compensation analysis, employee segmentation, and organizational decision-making. The proposed system follows this approach by integrating salary intelligence and workforce analytics into a unified platform.

III. SYSTEM ANALYSIS

The HR Salary Intelligence and Workforce Analytics system is designed to analyze employee salary and workforce information. The system accepts data such as employee ID, department, job role, experience, education, salary, performance rating,

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location, employment type, and joining year. The input data is validated to ensure that required fields and supported formats are available. A preprocessing module handles missing values, duplicate records, invalid entries, and inconsistent formats. Numerical attributes such as salary and experience are standardized when required for analysis. Categorical attributes such as department, job role, education, and employment type are converted into suitable analytical formats. Feature engineering creates useful attributes such as experience groups, salary categories, and joining-year groups. The analytics engine calculates employee count, average salary, median salary, salary range, and department-wise compensation. Role-wise and experience-wise salary analysis identifies compensation patterns across different employee groups. Workforce analysis examines employee distribution across departments, roles, locations, and employment types. A Machine Learning module can be trained using historical employee information to predict selected salary-related outcomes. The prediction module can estimate salary ranges or classify employees into predefined salary categories. Visualization components present results through charts, graphs, tables, and KPI cards. The final dashboard provides an integrated view of salary intelligence and workforce analytics.

Existing System

Existing HR systems are primarily designed for maintaining employee records, payroll processing, attendance management, recruitment, and performance tracking. These systems store important employee information such as salary, department, job role, experience, and employment details. However, basic HR systems may provide limited advanced salary intelligence and workforce analytics. HR professionals may need spreadsheets or separate Business Intelligence tools to perform detailed salary comparisons. Identifying salary relationships with experience, role, department, education, and location can require manual analysis. Historical salary trends may not always be available through interactive dashboards. Workforce distribution across different organizational categories may also require separate reports. Predictive salary analysis is generally limited in traditional employee management systems. Data from different HR modules may also require additional processing before analysis. Manual reporting can consume time and may increase the possibility of calculation errors. These limitations create a need for a centralized system that combines salary analysis, workforce analytics, visualization, and predictive capabilities.

Disadvantages of Existing System

- Limited advanced salary analytics.
- Manual salary comparison across departments and roles.
- Limited workforce trend analysis.
- Difficult to analyze large employee datasets manually.
- Limited experience-wise salary analysis.
- Limited location-wise compensation analysis.
- Salary prediction may not be available.
- Limited interactive dashboards.
- Manual preparation of HR reports.
- Difficult to identify workforce distribution patterns.
- Separate tools may be required for advanced analytics.
- Limited integration of predictive insights.

Proposed System

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The proposed HR Salary Intelligence and Workforce Analytics system provides a centralized platform for analyzing employee compensation and workforce information. Users can upload historical employee datasets or connect the system to an authorized HR data source. The validation module checks required fields, data types, formats, and basic data quality. The preprocessing module removes duplicate records and handles missing, invalid, and inconsistent information. Salary and experience values are standardized to support accurate analysis and comparison. Feature engineering creates attributes such as experience groups, salary categories, department groups, and joining-year categories. The analytics module calculates employee count, average salary, median salary, minimum salary, maximum salary, and salary ranges. Department-wise analysis compares employee distribution and salary patterns across organizational units. Job-role analysis identifies differences in compensation across different positions. Experience-wise analysis examines salary progression across employee experience groups. Location and education analysis can be used to identify additional workforce and compensation patterns. A Machine Learning module can analyze historical employee features and predict suitable salary-related outcomes. The prediction module can estimate salary ranges or classify employees into salary categories where appropriate. Interactive dashboards display KPIs, salary distributions, workforce trends, comparisons, and prediction results. The proposed system therefore provides a unified platform for HR salary intelligence and workforce analytics.

Advantages of Proposed System

- Provides centralized HR salary analytics.
- Automates salary-related calculations.
- Provides average and median salary analysis.
- Supports department-wise salary comparison.
- Supports job-role-wise compensation analysis.
- Provides experience-wise salary analysis.
- Supports location-wise workforce analysis.
- Provides workforce distribution insights.
- Supports salary prediction using Machine Learning.
- Provides interactive dashboards.
- Reduces manual HR reporting effort.
- Makes complex workforce data easier to understand.

IV. METHODOLOGY

The methodology begins with collecting historical employee salary and workforce data from authorized HR datasets or organizational sources. The collected data is validated to check its structure, required attributes, data types, and completeness. Data preprocessing is performed to remove duplicate records and handle missing, invalid, and inconsistent values. Numerical attributes such as salary, experience, and performance scores are converted into suitable numerical formats. Categorical attributes such as department, job role, education, employment type, and location are transformed into appropriate analytical representations. Feature engineering creates useful attributes such as experience groups, salary categories, joining-year groups, and performance categories. Exploratory Data Analysis is performed to understand salary distributions and workforce characteristics. Statistical analysis is used to calculate average salary, median salary, salary range, employee count, and other workforce indicators. Department-wise, role-wise, experience-wise, and location-wise analyses are performed to identify compensation patterns. Machine Learning models

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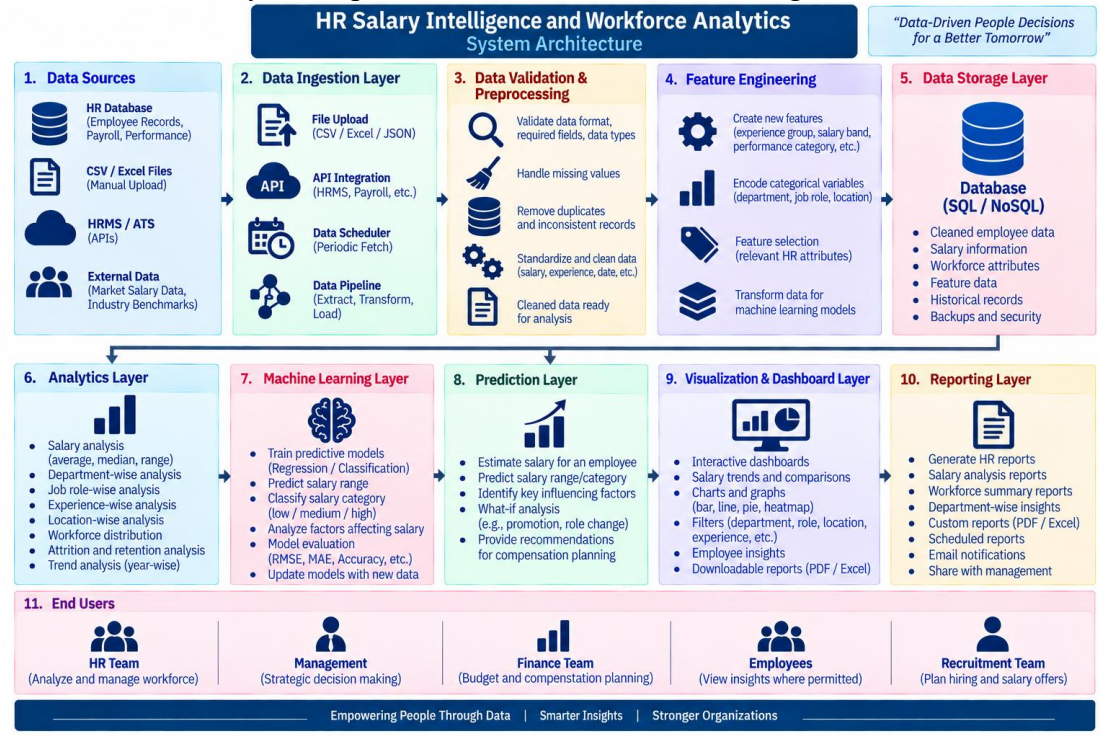
can be trained using suitable employee features to predict salary ranges or salary categories. Appropriate evaluation metrics are used to assess the predictive model performance. Finally, the analytical and predictive results are presented through an interactive HR analytics dashboard.

SYSTEM ARCHITECTURE

The system architecture consists of several interconnected layers that process employee salary and workforce data and generate analytical and predictive insights. The Data Source Layer provides employee, salary, department, job-role, experience, education, performance, and location information from authorized HR sources. The Data Input Layer accepts information through CSV files, Excel files, databases, or APIs. The Data Validation Layer checks file formats, required fields, data types, and basic data quality. The Data Preprocessing Layer handles missing values, duplicate records, invalid entries, and inconsistent formats. The Feature Engineering Layer creates attributes such as experience groups, salary categories, performance groups, and joining-year categories. The Data Storage Layer securely stores cleaned employee and salary records. The Salary Analytics Layer calculates average salary, median salary, salary range, and salary distribution. The Workforce Analytics Layer analyzes employee counts and distributions across departments, job roles, locations, education levels, and experience groups. The Comparative Analysis Layer compares compensation patterns between different employee categories. The Machine Learning Layer trains and evaluates models for selected salary-related prediction tasks. The Prediction Layer generates estimated salary ranges or salary categories for suitable input data. The Visualization Layer presents results through interactive dashboards, KPI cards, charts, graphs, tables, and filters. The Reporting Layer generates salary and workforce analytical reports for authorized HR and management users.



V. RESULT AND OUTPUT

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VI. CONCLUSION

The HR Salary Intelligence and Workforce Analytics system provides a data-driven platform for analyzing employee compensation and workforce information. The system transforms raw HR data into meaningful insights through data preprocessing, statistical analysis, visualization, and Machine Learning techniques.

The system analyzes important factors such as employee salary, experience, department, job role, education, performance, employment type, and location. This helps identify salary patterns, workforce distribution, compensation differences, and trends across different employee categories.

The interactive dashboard presents information through KPI cards, department-wise salary charts, job-role analysis, salary trends, experience-wise salary distribution, location-wise comparisons, and workforce summaries. These visualizations make large employee datasets easier to understand and support efficient HR analysis.

The prediction module can estimate an appropriate salary range based on selected employee characteristics such as job role, experience, education, and location. This provides analytical insights that can support workforce planning and compensation analysis when sufficient historical data is available.

In the future, the system can be enhanced with salary benchmarking, employee attrition prediction, skill-gap analysis, workforce demand forecasting, automated HR reports, compensation anomaly detection, and real-time HR system integration. These enhancements can make the platform more comprehensive and useful for data-driven workforce management.

REFERENCES

[1] Kumar, R. D., Prudhviraj, G., Vijay, K., Kumar, P. S., & Plugmann, P. (2024). Exploring COVID-19 through intensive investigation with supervised machine learning algorithm. In Handbook of Artificial Intelligence and Wearables (pp. 145-158). CRC Press.

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DATA SCIENCE AND IOT MANAGEMENT SYSTEM
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[2] Swathi, B., Vijay, K., Sushanth Babu, M., & Dinesh Kumar, R. (2024, November). Machine Learning Techniques in Cloud Based Intrusion Detection. In The International Conference on Artificial Intelligence and Smart Environment (pp. 557-564). Cham: Springer Nature Switzerland.

[3] Sv satyakrishna, shirisha rangu ,bhargavi nalacheruve.(2024) Prospective investigation on colorectal cancer with SMOTE on machine learning Algorithm

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[5] V. N. S. Manaswini, K. K, C. Nigam, S. S. Ali, R. Niranjana, and Suman, "Real-Time Object Detection in Drone Surveillance Using YOLOv5," in Proc. 2025 3rd Int. Conf. IoT, Communication and Automation Technology (ICICAT), Gorakhpur, India, 2025, pp. 1–6, doi: 10.1109/ICICAT68430.2025.11414670.

[6] B. Soundarya, V. N. S. Manaswini, M. Ayyakrishnan, R. D. Kumar, "Contextual Analysis of Big Data Analytics in Intelligent Transportation Frameworks," in Intersection of Artificial Intelligence, Data Science, and Cutting-Edge Technologies: From Concepts to Applications in Smart Environment, Lecture Notes in Networks and Systems, vol. 1353, Cham: Springer, 2025, doi: 10.1007/978-3-031-88304-0_79.

[7] R. D. Kumar, V. N. S.Manaswini, "Applications of blockchain in smart cities: detecting fake documents from land records using blockchain technology," in Blockchain for Smart Cities, Elsevier, 2021, pp. 105–117, doi: 10.1016/B978-0-12-824446-3.00017-X.

[8] Tejavath Veeramma, Badarla Anil, Guguloth Ravinder, "An advanced movie recommender using collaborative filtering and sentiment analysis," International Research Journal of Modernization in Engineering Technology and Science, vol. 7, no. 7, July 2025, doi: 10.56726/IRJMETS81618.

[9] Ravi Kumar Banoth, Ramana Murthy B V, "Automatic crop recommendation system using LightGBM and decision tree machine learning models," Journal of Machine and Computing, vol. 5, no. 1, pp. 343, Jan. 2025, doi: 10.53759/7669/jmc202505026.

[10] Ravi Kumar Banoth, Dr. B.V. Ramana Murthy, "Smart agriculture through IoT and machine learning for analyzing carbon footprints," in Proc. Int. Conf. Computer Science and Communication Engineering (ICCSCE), Apr. 2025.

[11] Ravi Kumar Banoth, B. V. Ramana Murthy, "Soil image classification using transfer learning approach: MobileNetV2 with CNN," SN Computer Science, vol. 5, art. no. 199, 2024, doi: 10.1007/s42979-023-02500-x.