

Elevating Enterprise Resource Planning For Emerging Enterprises

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Abstract— *Managing core business functions like human resources, customer relationships, supply chain, and finance often poses significant challenges for budding startups. These businesses frequently lack cost-effective, scalable solutions to streamline operations, resulting in inefficiencies and hindered growth. To address these issues, a tailored Enterprise Resource Planning (ERP) system has been developed specifically for early-stage startups. This system integrates key modules, including Human Resource Management System (HRMS), Customer Relationship Management (CRM), Supply Chain Management (SCM), and Finance, to optimize critical processes effectively.*

The ERP system comprises two applications: a web-based interface for desktop users, designed for simplicity and usability, and a mobile application enabling customers to access rate sheets, distribution centers, invoices, and NFC-based payment capabilities. Advanced technologies, such as Artificial Intelligence (AI), further enhance functionality. AI-driven predictive models facilitate decision-making for purchase orders, contracts, and general ledger management, while sentiment analysis interprets customer feedback. Additionally, Optical Character Recognition (OCR) automates data entry, reducing manual workload. Built on a modern technology stack, the system utilizes Angular for the web frontend, Flutter for the mobile application, Java Spring Boot with microservices for the backend, PostgreSQL for database management, and Docker for containerization, ensuring portability and scalability. This innovative ERP solution offers startups an affordable and efficient platform to streamline operations, improve productivity, and drive business growth in competitive markets.

Keywords— *ERP, startups, Artificial Intelligence, OCR, microservices, scalability*

I. INTRODUCTION

In today's fast-paced and competitive business environment, startups face unique challenges in managing core business operations such as Human Resource Management (HRM), Customer Relationship Management (CRM), Supply Chain

Management (SCM), and Finance. These operations, which are critical to the success and growth of any business, often become overwhelming for small businesses due to a lack of affordable and scalable solutions. Traditional Enterprise Resource Planning (ERP) systems like NetSuite, Microsoft Dynamics 365, SAP S/4HANA, and others, while powerful, are designed primarily for large enterprises and specific industries. These systems often present high costs, complex implementations, and rigid architectures, making them unsuitable for startups with limited resources and dynamic requirements.

The need for a streamlined, flexible, and cost-effective ERP solution for startups is evident. Existing systems fail to address the specific needs of early-stage businesses, resulting in inefficiencies, poor decision-making, and an inability to scale effectively. Startups require a tailored solution that simplifies operations, integrates modern technologies, and fosters growth while being easy to adopt and maintain.

To address this gap, we propose a custom-built ERP system designed specifically for startups. This system integrates core business functions into a unified platform, including HRMS, CRM, SCM, and Finance, to optimize operations and improve efficiency. The system is further enhanced with cutting-edge technologies such as Artificial Intelligence (AI) for predictive modeling, Optical Character Recognition (OCR) for automated data entry, and NFC-based payment gateways for seamless mobile transactions. By leveraging these technologies, the proposed ERP system offers startups the tools needed to streamline operations, enhance decision-making, and adapt to a rapidly changing market.

The proposed ERP solution consists of two primary components: a web-based application designed for

desktop users with an intuitive and user-friendly interface, and a mobile application that empowers customers to engage in key activities such as purchasing items, accessing distribution centers, and generating invoices through an NFC-enabled payment gateway. These features not only improve operational efficiency but also provide an enhanced user experience for end-users and customers alike.

The system's architecture is built using a modern technology stack to ensure scalability, reliability, and performance. The web frontend is developed using Angular, while the mobile application leverages Flutter for cross-platform compatibility. The backend is powered by Java Spring Boot with microservices architecture, providing modularity and ease of integration. PostgreSQL is employed as the database for efficient data management, and Docker is utilized for containerization to ensure portability and scalability.

This project aims to empower startups by delivering an ERP solution that is both affordable and scalable, tailored to their unique needs. By integrating advanced technologies and simplifying business processes, the system enables startups to overcome operational challenges, improve productivity, and achieve sustainable growth in competitive markets. The proposed solution addresses the existing gap in the ERP landscape and positions startups for long-term success.

II. LITERATURE SURVEY

Böhme et al. [1] critically examined the limitations of traditional Enterprise Resource Planning (ERP) systems, focusing on their rigidity and the high entry barriers they present for startups and rapidly growing small to medium-sized enterprises (SMEs). Through 15 exploratory interviews with industry experts, the study identified several key challenges, including the inflexibility of existing ERP solutions, the high costs associated with implementing implicit processes, and the lack of interoperability with existing organizational tools. To address these issues, the authors proposed a shift towards process-centric business process platforms, emphasizing three primary enablers. First, treating business processes as first-class entities allows for greater flexibility and customization, enabling organizations to efficiently adapt workflows to meet evolving business needs. Second, the use of semantic technologies facilitates better data integration and understanding across

various systems, thereby enhancing interoperability and reducing data management complexity. Lastly, leveraging cloud-native architectures ensures that these platforms can scale seamlessly and maintain high availability, effectively meeting the dynamic demands of modern enterprises. This approach underscores the importance of adaptability and scalability in addressing the limitations of traditional ERP systems.

Basu, Dutta, and Jha [2] examined the adoption of cloud-based Enterprise Resource Planning (ERP) systems among Small and Medium-sized Enterprises (SMEs) using an extended Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model. Their study identified key factors influencing adoption, including performance expectancy (perceived job performance enhancement), effort expectancy (ease of use), social influence (peer perception), facilitating conditions (supportive infrastructure), hedonic motivation (enjoyment), price value (cost-benefit trade-off), and habit (automatic behavior from learning). Through exploratory research and a quantitative survey, the findings highlighted these determinants as critical to SMEs' behavioral intentions and actual use of cloud ERP. This study offers valuable insights into facilitating successful adoption and implementation of cloud ERP solutions for SMEs.

Khaing and Htike [4] explored the integration of Artificial Intelligence (AI) into Enterprise Resource Planning (ERP) systems to enhance workflow automation. They focused on employing Artificial Neural Networks (ANNs) to improve predictive accuracy and operational efficiency within ERP frameworks. Through a detailed case study involving a retail company, the researchers demonstrated that AI-enhanced workflows significantly reduced process cycle times, decreased error rates, and optimized resource utilization. The study also addressed challenges associated with AI integration, such as data quality issues, system complexity, and user acceptance, providing recommendations for successful implementation. This research underscores the transformative potential of AI in automating ERP workflows, leading to more efficient and responsive business operations.

Babkin and Burkaltseva [5] explored the potential of integrating AI methods into ERP systems to optimize various business processes. Their study identified key areas where AI can enhance ERP functionalities,

including customer relationship management, supply chain management, production, and product lifecycle management. By implementing AI algorithms, organizations can achieve improved decision-making, increased efficiency, and enhanced adaptability to market changes. The authors emphasized the importance of developing ICT solutions that

incorporate AI to maintain a competitive edge in the evolving business landscape.

Below is a table that describes the factors for which the papers were referred that helped us to formulate the problem statement.

TABEL-1 FACTORS FOR PROBLEM STATEMENT

Rank	Factors	Definition	Source
1	Security of the systems	Refers to the assurance that the cloud-based ERP system provides a secure line of defence for the organisation against fraud and misuse, providing an unassailable network to workers anywhere, regardless of their location.	[14, 24, 25, 26]
2	Senior management support	Refers to the role of the senior management in an organisation when adopting cloud-based ERP in determining the resource allocation required and approving the project before execution.	[14, 18, 27, 28]
3	Add-ons and customisation	Refers to suppliers who provide integration with third-party add-ons or the opportunity to integrate particular modules for additional functionality in a cloud ERP system. A program's customisation or setup is not inexpensive.	[1, 19, 25]
4	Ease of integration	Refers to a cloud ERP service provider's ability to seamlessly connect with other cloud-based ERP services based on the demands of the firms.	[1, 24, 30]
5	User education and training	Refers to the level at which a company trains its staff before the implementation stage, in order to keep pace with changes and to improve or at least maintain the experience and capabilities of employees who use CERP systems.	[15, 16]
6	Effectiveness of employees' ICT skills	Refers to the essential ICT skills that the employees should possess, especially cloud computing skills.	[16, 17]
7	Service providers' dependability	Relates to the vendor's reliability with regard to cloud-based ERP software applications.	[19]
8	Data backup and recovery	Relates to the extent to which a cloud ERP service can swiftly return to operating in a safe manner following an unforeseen disruption.	[20]
9	Retention of data	Determines if cloud ERP systems can preserve data when customers or cloud service providers alter or remove data. There might still be data left behind, potentially disclosing sensitive information to unauthorised parties.	[19]
10	Cost of software maintenance and upgrades	Refers to the vendor's costs for, and frequency of, upgrades and whether the charges for these changes are included in the original cost of the cloud ERP system.	[18]
11	Maintainability	Refers to the capacity of cloud ERP service providers to make changes without interfering with the service or having a negative impact on the system.	[23]
12	Usability as perceived	Refers to the degree to which consumers believe cloud ERP is simple to access, learn, and use.	[28]
13	Effectiveness of inventory and inventory carrying cost	Refers to the delivering of one-time asset reduction (cost of the material stored), but also continuing reductions in inventory carrying costs, storage, handling, obsolescence, insurance, taxes, damage, and shrinkage.	[24]

14	Reliability of the Internet	Relates to the dependability of an Internet connection and infrastructure, which encompasses connection to the Internet and access as well as Internet speed.	[26]
15	Government regulations and policies	Refers to whether the government has a distinct policy on technological advances, in which case firms are more inclined to adopt them.	[27]
16	Use of latest IT technology	ERP suppliers utilise the most recent advances in information technology. As a result, they quickly modify their systems to make use of cutting-edge technologies such as open-source software, client-server technologies, and e-commerce.	[29]

III. PROPOSED SYSTEM ARCHITECTURE

Figure 3.1 outlines two ERP workflows: order placement and module-based operations. The first involves finding an item, placing an order, making payment, confirming the purchase, and accessing the invoice. The second covers accessing a module, using its services, modifying data, and reviewing it. Together, these processes highlight streamlined ERP functionalities for transactions and data management.

The system architecture represents a microservices-based ERP system, designed to integrate core business functions and modern technologies. It connects various components such as IoT peripherals, ERP web applications, and customer mobile apps via an API gateway and Eureka Server for service discovery and load balancing. The system's modular approach ensures that each service (e.g., CRM, HRMS, SCM, Financial) operates independently while sharing data across dedicated databases for efficient and scalable management. Advanced features like contract auditing, general ledger analysis, and sentiment analysis are powered by Flask endpoints, enabling enhanced decision-making and customer feedback analysis.

The system architecture boasts several key features designed to enhance functionality, scalability, and user experience. At its core, the microservices-based design ensures modularity and flexibility, enabling independent services for CRM, HRMS, SCM, and Finance to operate seamlessly. The API Gateway acts

as a central entry point, managing communication between the web and mobile applications and backend services, while the Eureka Server ensures dynamic service discovery and fault tolerance, minimizing downtime. IoT integration, supported by peripherals like the ESP-32 CAM, extends the system's capabilities for automation and monitoring. Advanced features such as contract auditing, general ledger analysis, and sentiment analysis, powered by Flask endpoints, provide real-time insights and predictive analytics, supporting informed decision-making. Furthermore, the architecture employs dedicated databases for each module, ensuring data integrity and optimized performance.

This system offers significant benefits to users, particularly startups and growing enterprises. Its modular microservices design ensures scalability, allowing businesses to adapt the system to their evolving needs. The flexibility of independent services reduces maintenance overhead and simplifies updates or enhancements. AI-powered analytics deliver actionable insights, enabling improved decision-making in financial management, customer sentiment evaluation, and operational planning. The integration of IoT and mobile platforms enhances accessibility and streamlines workflows, while the use of a load-balanced architecture ensures high performance and quick response times. Overall, the system provides a cost-effective, user-friendly, and scalable solution tailored to modern business demands.

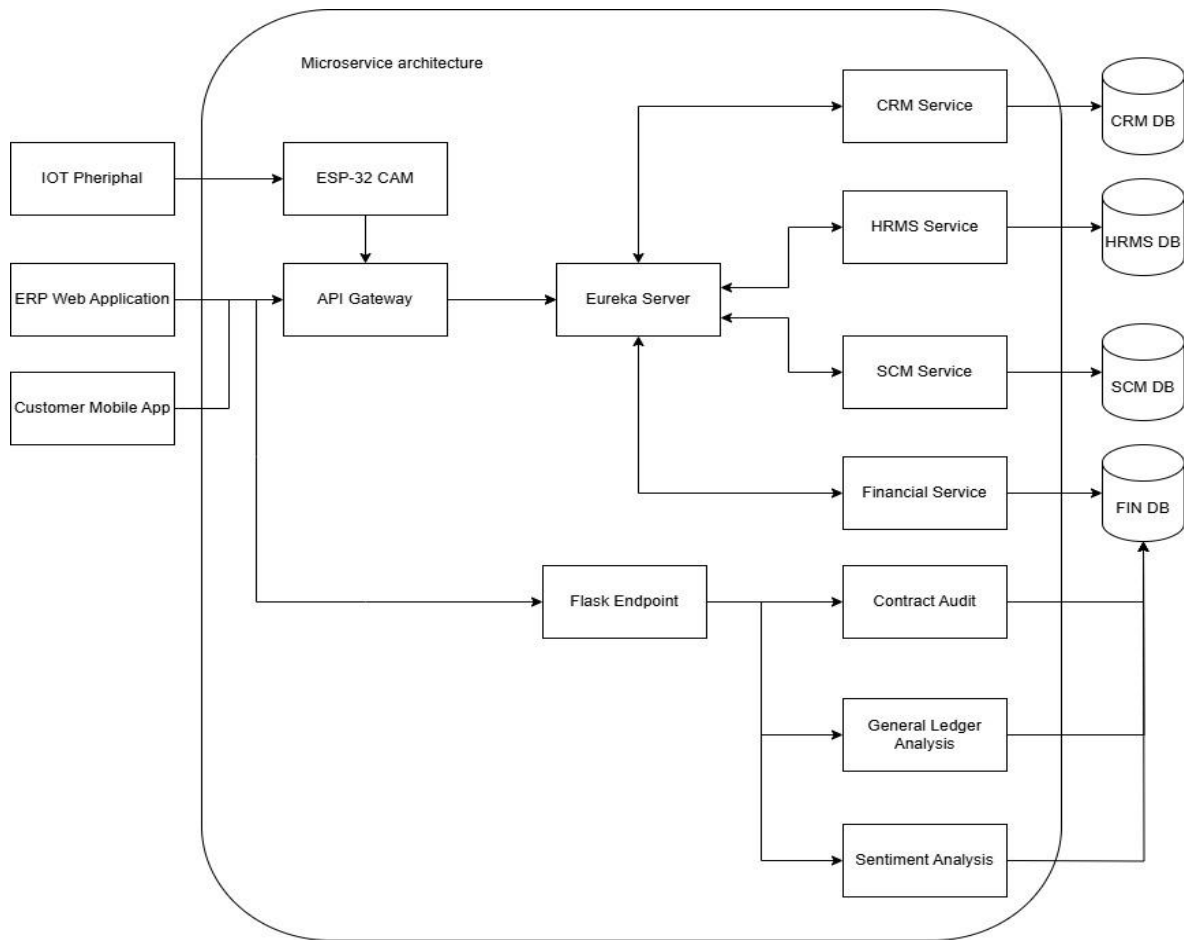


Fig. 3.1 System Architecture

The Human Resource Management System (HRMS) module is designed to streamline employee management by efficiently handling employee records, departmental structures, and documentation. The module encompasses several key functionalities. The Employee Management feature maintains detailed employee profiles, including personal information, job roles, and salary details, ensuring a centralized repository for all employee-related data. The Department Management functionality organizes employees into departments, enabling structured management and simplified reporting. Document Management provides secure storage and handling of employee-related documents, such as contracts and performance reviews, ensuring data integrity and accessibility. The Leave Management system automates the process of leave requests, approvals, and balance tracking, ensuring smooth and efficient HR operations. The Payroll Management feature calculates employee salaries, deductions, and

bonuses, while also generating payslips, simplifying the payroll process. Additionally, the Attendance Management system monitors employee attendance, working hours, and absenteeism, ensuring accuracy in payroll calculations and performance evaluation. The Figure 3.2 illustrates the interaction flow within the HRMS module. The process begins with the frontend initiating a service subscription via the gateway. The gateway then routes the request to the Eureka server for service discovery, where the HRMS service is registered. The HRMS service processes the request by interacting with the database to retrieve or update data, such as employee information or attendance records. The retrieved data is sent back through the service layers, ensuring a structured response to the frontend, complete with the necessary data, status, and body. This flow demonstrates the seamless integration and efficient functioning of the HRMS module, enabling smooth HR operations and robust system performance.

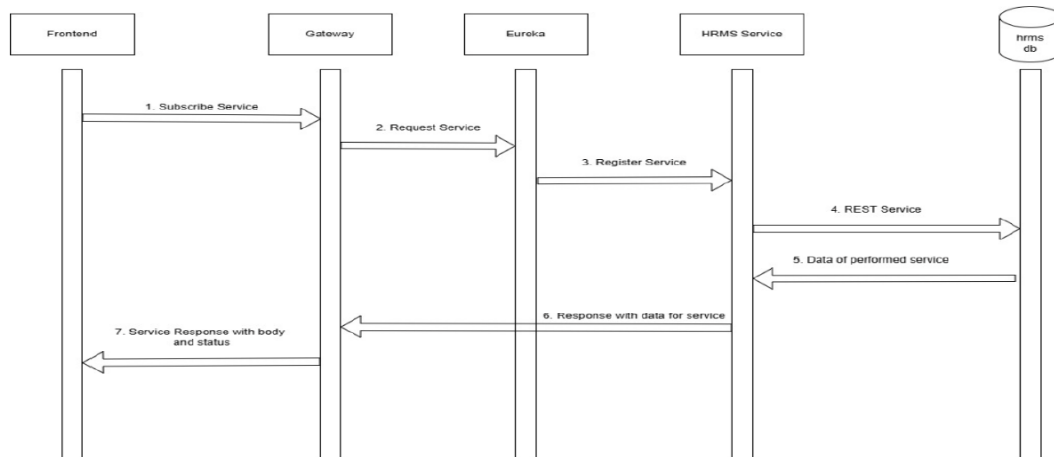


Fig. 3.2 Data Flow Diagram for Human Resource Management System Module

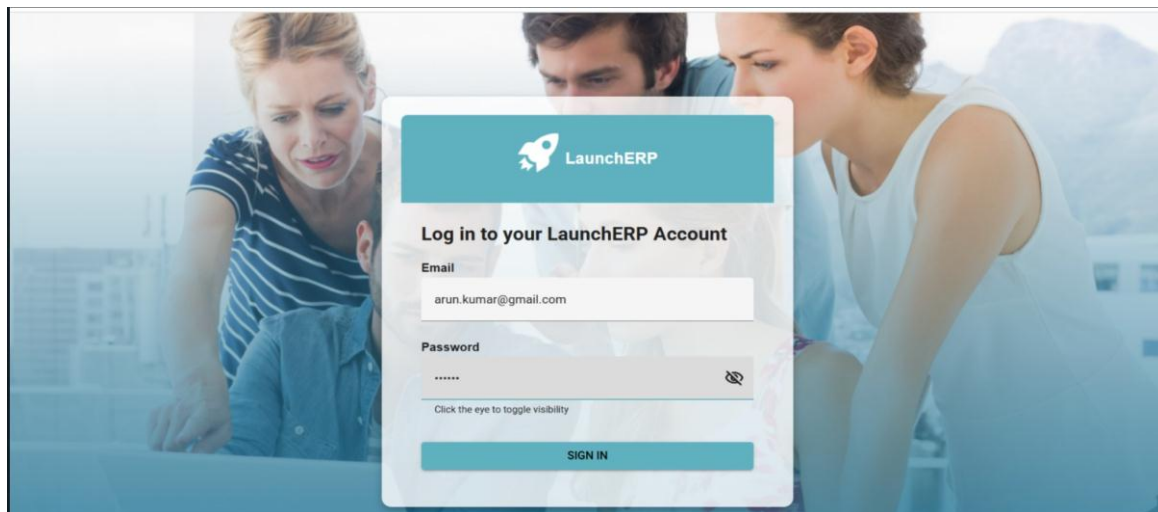


Figure 3.3 Website Login UI

The visual elements of the system showcase its user-friendly interface and seamless functionality across platforms. The Login Screen provides a secure and intuitive entry point for users, ensuring a smooth authentication process. The SCM Dashboard offers a comprehensive overview of supply chain operations, featuring key metrics, order statuses, and inventory updates, enabling efficient decision-making and streamlined workflows. On the mobile platform, the Customer Mobile App Login Screen delivers a clean and accessible interface for customers to log in effortlessly.

Additionally, the New Orders Screen on the mobile app simplifies the order placement process, allowing customers to browse products, select items, and make payments seamlessly. These interfaces highlight the system's commitment to usability, accessibility, and

operational efficiency across desktop and mobile environments.

IV. CONCLUSION

The Enterprise Resource Planning (ERP) system for emerging startups integrates essential modules such as Human Resource Management, Customer Relationship Management, Supply Chain Management, and Finance into a streamlined, user-friendly platform. Accessible via both web and mobile applications, the system ensures seamless functionality across devices. Leveraging advanced technologies like predictive models for purchase orders, sentiment analysis for customer feedback, and optical character recognition, it enhances decision-making, automates data entry, and improves overall efficiency. Built on a microservices architecture with Docker for containerization and PostgreSQL for

robust database management, the system delivers scalability and reliability. Comprehensive testing has validated its core functionalities, ensuring a reliable and efficient solution. This ERP system simplifies business processes, supports startups in optimizing their operations, and lays a strong foundation for scalability to meet evolving business demands.

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