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Operationalizing SME Growth: Developing a Low-Cost, Integrated Dashboard System for Real-Time Monitoring and Business Process Optimization

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Abstract - Small and medium enterprises (SMEs) also face major problems in their operation efficiency as vital data is scattered over a number of data applications, some of them chief of functional use, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM). Traditional business intelligence (BI) systems are either prohibitively costly (via a subscription-based feature) or technologically complicated, fostering a reliance on old data, and reducing the ability to efficiently process data and respond sufficiently to data-driven decisions in response to market shifts. In order to enable advanced analytics, this study proposes a combination of dashboard system that can be implemented to optimize business process. The framework is based on a component-based design (CBD) architecture that uses React, Refine, GraphQL and TypeScript, thus facilitates modularity and scalability, which is essential in integrating real-time data to a unified platform using heterogeneous data streams. Through stringent design standards, the platform provides Key Performance Indicators (KPIs) in the form of intuitive visualization, which is low-cognitive load and offers better user experience. The subsequent low-cost solution offers SMEs low-cost, real-time monitoring and proactive response solutions. It guarantees data consistency, cross-functional visibility (key results of successful integration of ERP-CRM) and improves operational efficiency a lot, increases the responsiveness of strategies.

Indexed terms- Agile, Cross-functional visibility, Data consistency, Heterogeneous data streams, Integrated Dashboard System, Modularity, Real-time data integration, Scalability, Unified platform

I. INTRODUCTION

Small and Medium-sized Enterprises (SMEs) are frequently accepted as vital elements of the economic landscape on the planet, contributing to the creation of innovations, employment opportunities, and the economic stability in the region. Although these businesses have important roles to play, they are often faced with serious challenges in their operations which threaten to undermine their competitiveness. Management of fragmented data ecosystem where business intelligence that is essential to any business is widely spread in divergent systems between solitary spreadsheets and accounting application to detached operational instruments is a key challenge. This fragmentation creates data silos, which hinders the timely exchange of the information and decision-makers have to use intuition or historical past reports, instead of the current evidence. This means that most SMEs are forced to be reactive but not proactive in the efforts of adapting to a changing environment in the market especially in terms of sustainability.

Although large businesses manage to work around such complexities with the help of the advanced Business Intelligence (BI) and Enterprise resource planning (ERP) solutions, these are usually prohibitively costly and technically challenging to the resource-limited SME. The high entry barriers posed by the high costs incurred in licensing, infrastructure and the highly professional technical skill needed to sustain the traditional CRM and ERP systems are very hard to overcome. Moreover, with such systems adopted, they are often implemented as isolated systems with databases that are not linked thus resulting in redundancy and inconsistency in fundamental records such as business partners, and service items. The need, hence, is dire to have easily available, inexpensive solutions that will integrate all these different data streams in one, consolidated interface in order to warrant the integrity of the data and continuity of operations.

The paper aims to suggest the creation of a Unified Management Platform (or Integrated Dashboard System) that is bound to fill these gaps in the SME sector. In this regard, this system combines vital management tasks namely Client Relationship Management (CRM) and workflow optimization (Kanban) with real-time analytics to empower the agility of operations. An Integrated dashboard

systems can help with this challenge, using a modern Component-Based Development (CBD) strategy, and exploiting cost-effective technologies, like React, Refine, and GraphQL, and crunching various data streams into real-time visualizations that improve the efficiency and responsiveness of operations and strategies. This system fills the gap of offering a document, technically tough and economical framework of integrating essential SME management roles specifically Customer Relationship Management (CRM) and workflow optimization (Kanban) with real-time analytics. The platform provides a scalable framework that reduces infrastructure overhead. The prototype is expected to democratize access to high-tech business intelligence and provide SMEs with the ability to minimize waste and increase the data-driven decision-making processes without the prohibitive price tag of commercial software.

II. LITERATURE REVIEW

2.1 The Imperative for Unified Data Models in SME Operations

Decision-making depends greatly on detailed and uninterrupted information. Many SMEs are commonly put at a disadvantage by disintegration of data with some of their key information being held in different systems crippling the usefulness of BI tools. The fundamental ERP and CRM functionality are usually done independently, which creates discrete databases, which create irregularities in the data. These inconsistencies need to be addressed by having a common data model to address data integrity, especially for shared data such as business partners, items, and services. ERP (Enterprise Resource Planning) system is normally entrusted with management of important enterprise resources particularly finances and its core operations. The CRM system, on the other hand, aims at regulating the customer interactions, customer satisfaction and customer loyalty. An Integrated Dashboard System with a low cost that will solve these issues will have to integrate different streams of operation data.

2.2 Architectural Paradigms of Integrated CRM and Administration Systems

CRM integration and ERP integration is a long term project that aims to provide a solution to the organizational synergies, which will boost not only the operational efficiency but also the entire customer experience. ERP systems can be considered the backbone of operations and CRM systems the key to customer engagement and retention as well as customized experiences. Nevertheless, these independently developed systems are very hard to integrate. In the system theory, the effective ways of integrating are to establish a holistic business environment in which operational (ERP) and customer-facing (CRM) functions interact and are synchronized. As a part of architecture, the integration module by itself ought to preferably be designed as an independent service that is autonomous in order to be flexible and accommodate various technologies and platforms utilized on the ERP and CRM applications. This strategy is proven by empirical data with statistically significant positive correlation between successful ERP-CRM integration and better results.

2.3 Principles of Effective Dashboard Design for Real-Time Monitoring

In a broader definition, according to Gröger et al. (2013), the dashboard is defined as a panel used to pull together the information displayed across the various visual representations (which could be graphs or maps) that can be integrated with each other with the primary goal of tracking, analysing and enabling any decision making at all levels of hierarchy of the company. In the case of SMEs that need real-time information, dashboard development holds the key to actionable information and decision making. The design philosophy dictates that usefulness must be given more priority than beauty (Tableau, 2017). A proper design reduces cognitive load. The architecture, as far as real-time monitoring is concerned, should allow sustaining the data acquisition, processing, and visualization process.

III. SYSTEM METHODOLOGY AND ARCHITECTURE

A technical architecture must be explicitly provided with a purpose of flexibility, easy maintenance, cost efficiency and scalability of the implementation of a Unified Management Platform in SMEs case. The research focuses on a contemporary modular design of the architecture to build a coherent system that may incorporate the separated data on operations, i.e., on Client Relationship Management (CRM) and workflow optimization, into a real-time analytics framework.

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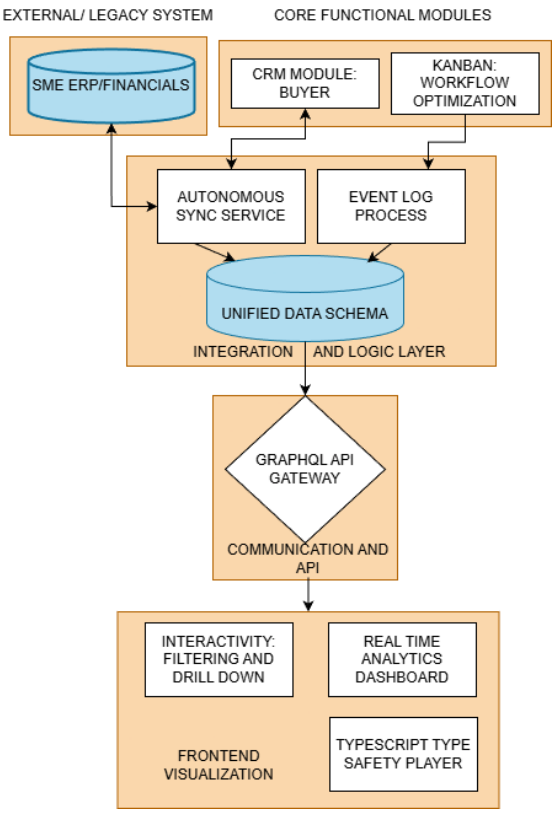

3.1 Component-Based Development (CBD)

It has a Component-Based Development (CBD) approach where the Unified Management Platform is organized as a set of reusable and self-contained components and services. Such an architectural design is strategically important since CBD has a built-in modularity and scalability. With modularity, the system can be designed, deployed, and supported in separate units (components) that SMEs can acquire increments of functionalities of the system, starting with a simple system, and going over time adding components until they reach a larger size. This will enable SMEs to manage their plans according to the budget constraints since they will have an option of implementing the most important functionality. The complexity of integration that is part of the ERP and CRM integration is addressed by the CBD paradigm. CBD focuses business operations into core independent services. This architecture gives the required flexibility to add advanced analytical capabilities in the future, like predictive modelling, without necessarily undertaking a major overhaul of the main system. CBD therefore aids the implementation of an effective cost-saving solution which is not only flexible in its development but also quite effective in terms of adapting to future evolution of the organization.

3.2 Core Technology Stack (React, Refine, GraphQL, Typescript)

The platform proposed is based on a well-chosen core technology stack that has been designed to maximize its performance, development performance as well as user experience with regard to real-time monitoring. The user interface will be developed using the React library, which facilitates the development of dynamic interactive dashboards, which are needed in real-time monitoring. The system capitalizes on Refine, a react-based mechanism that is helpful in the acceleration of the development process to be used in data-intensive applications. Refine has pre-built networking and state hooks to help users build internal tools (admin panels, dashboards) quickly. This option directly responds to the issue of technical expert in the case of SMEs, using a low-code principle to develop facilitated entry to advanced analytics.

In contrast to the conventional REST APIs, GraphQL enables the client to only get the data which is required to minimize network overhead and enhance the performance of real-time visualisation. This feature is essential in SMEs who take data obtained through differing data streams to real-time deep data analytics in order to aid the decision making process. In order to make systems more reliable as well as minimize errors at the runtime stage, the whole codebase all gets typed in TypeScript. Such strict typing does not only enhance the code maintenance's effect but also aids in the detection of the logic errors in the stage of the development, which makes the decision-support system highly reliable for SME's business operations.

3.3 Unified Data and Integration Schema

Fragmentation of data across the isolated system (e.g., different CRM and ERP database) is the major operational failure in the SMEs, which results in duplication of records and inconsistency of the data. The Integrated Dashboard System deploys a Unified Data Schema aimed at being a single source of truth. The system should impose severe synchronization data integrity policies. Global statuses are used to track a Client (partner) entity. A Buyer Candidate is handled under a CRM Suit under pre-sales stage. When the conversion to an affirmed "Buyer" (through a transaction or the creation of a task) is made, the record is harmonised throughout the Workflow module and prevents the duplicate entries as well as keeps the legal and financial information

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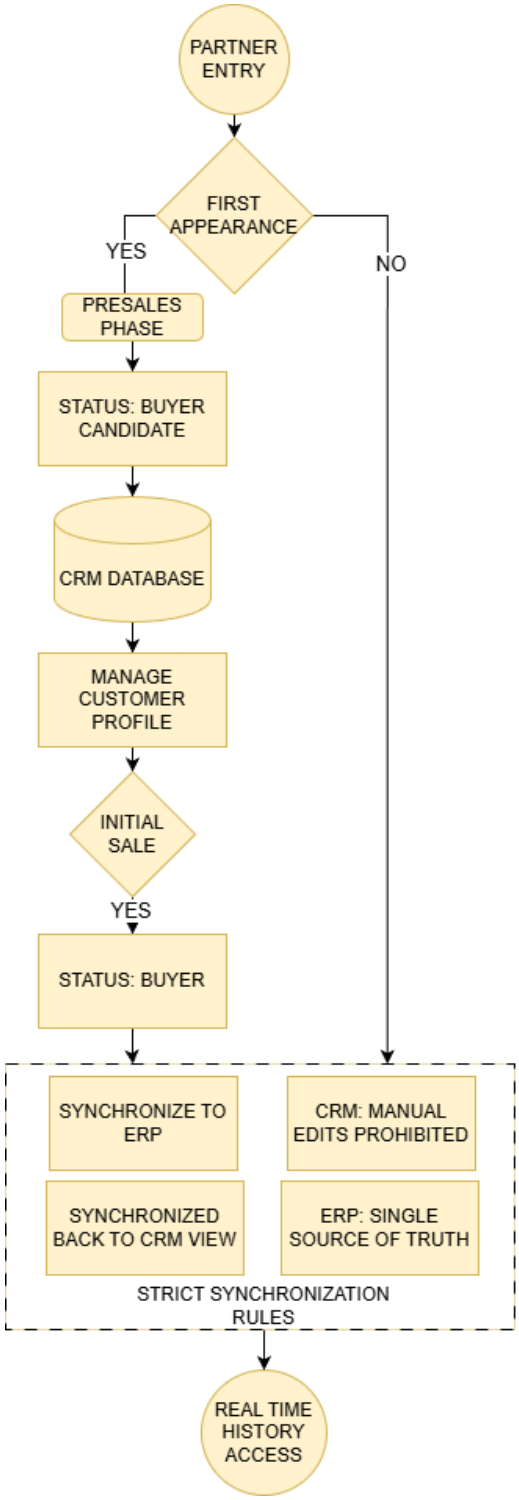
safe. An entity is a Partner (Client) Lifecycle Synchronization, which is managed by means of global statuses. A Buyer candidate will be handled in the CRM module in the pre sales stage. When converted into a confirmed Buyer (through a transaction or task activation) the record is updated throughout the Workflow module thereby avoiding the occurrence of duplicate records and data integrity throughout the whole business process. The backend acts as an independent service that is able to recognize changes in either of the modules and store the information in the local drive to avoid loss in the event of connectivity failure. Proactive decision making requires ensuring real time visibility and therefore in future, the architecture will comprise of a streaming data pipeline that forms a connection between the data ingestion points and the visualization layer. This will make the analytics dashboard capture any operational changes.

IV. SYSTEM IMPLEMENTATION AND FEATURES

The Unified Management Platform is attained by combined application of three basic functional module namely the Client Relationship Module (CRM), the Task and Workflow Optimization Module (Kanban) and the Real-Time Analytics Dashboard. Communication and data flow between these modules is smooth with the component-based architecture which presents a complete and synchronized data environment required to enable the effective SME decision-making. The low-cost stack (React, Refine, GraphQL Ant design) has been utilized by the technical implementation and it covers the concepts of usability and efficiency.

4.1 The Client Relationship Module (CRM)



The CRM is implemented as the key repository of all the business operations, contacts and customer related information to enable SMEs adopt a product oriented thinking to customer oriented thinking. This makes it more profitable as the customers will be maintained and the long term business partner preserved. The system, based on integration paradigms outlined by Tomic and Jovanovic classifies the partners on specific global statuses in

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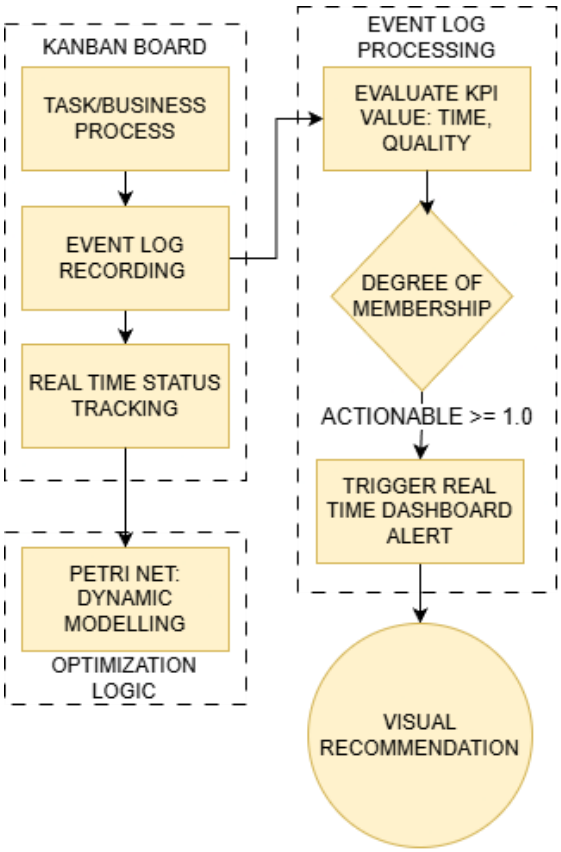
order to ensure data integrity throughout the entire platform. The key aspect of the proposed system in the current paper is the synchronization mechanism between business partners (Clientele), item and services to guarantee consistency and integrity of common records. The system identifies two major global statuses of partners namely the Buyer Candidate (which is played by CRM in presales) and Buyer (which is played by ERP/financial processes after the first sale). In case any partner is initially registered as part of presales operations, they are found in the CRM database first with an indication of Buyer Candidate. After the partnering company becomes a Buyer (say after creating an ERP document, such as an order or an invoice), the CRM cannot access any further changes in data pertaining legal and financial documentation, and the only changes are automated from the ERP base, and the change is reflected back on the CRM. It is narrowed down on the usage of technology to create customer profiles and how their future requirements can be predicted.

4.2 The Task and Workflow Optimization Module (Kanban)

This module gives an opportunity to streamline internal operation workflows, which is the system execution level of tasks and projects since it is aimed at the optimization of business processes. Each important action is documented in the Kanban module as an event in a customizable event log framework. This functionality is essential, since it is the next analytics module that is based on the processing of event logs. This module is explicitly helpful with the visual frameworks applied to the enhancement of the operational activities. Application Visual information (such as icons, graphical annotations or dimensions) is better and more understandable in enhancing process models. Kanban boards visually arrange the tasks and this assists in effective monitoring. Regarding business process related tasks, the system marks key data visually helping users to discover repetitive designs and see where improvements can be made.



Such implementation makes use of colour and text paradigms which are observed to be helpful in offering decision assistance and detailed evaluation of compliance statuses.

4.3 The Real-Time Analytics Dashboard

It is the main visualization layer of the platform that takes in the cohesive data of both the CRM and Kanban modules through the GraphQL API to provide the accessible, real-time information about managerial decision-making. The dashboard uses customized visualization methods that have been known to be effective to the management. Quick comparison of KPIs is done by appropriate visualization tools, including bar charts, line charts, pie charts, and gauges. Indicatively, the system can ensure that intricate data employs a bare minimum of graphical requirements and average colour consumption, since it has not been constrained by the issue of aesthetics in its design. The real-time environment required is supported by the architecture because data acquisition, processing, and data visualization is continuous. The data integrated and processing layer is transformed and cleansed so that the data is correct and timely. This emphasis on the reliability in real-time reduces the chances of the decision-maker relying on any legacy data, resulting

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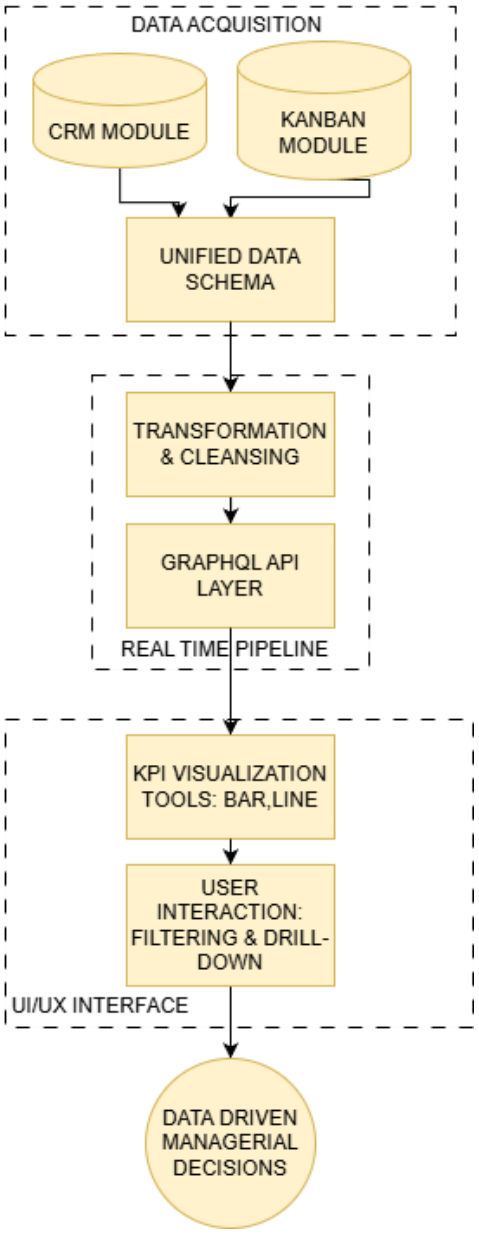
to slow responses. The dashboard embraces the concept of interactivity and offers filtering and drill-down functionality, to give the user (managers and executives) power to experiment with the data at a granular level and test hypotheses. It follows user-centric principles, making the design useful, with minimal cognitive load, and giving individual views depending on the role of the user and his or her decision-support requirements.



IV. CONCLUSION AND FUTURE WORK

Most of the time, the operational viability of Small and Medium-sized Enterprises (SMEs) is undermined by the dependency on disjointed data ecosystems, as well as the excessively high expenses borne by Business Intelligence (BI) tools of enterprise quality. The study has effectively developed and suggested the Unified Management Platform (Integrated Dashboard System), which is a solution designed to fill the gap between the limitations of resources and the need to come up with solutions that are data-driven. This paper shows that complex real-time monitoring can be done without the substantial investment in infrastructure needed by the traditional implementation of enterprise-grade ERP by implementing a low-cost, Component-Based Development (CBD) architecture with React, Refine, and GraphQL. The major value of this work is that it puts together different flows of operations i.e. Client Relationship Management (CRM) and workflow optimization in a single interface based environment. This combination creates a single source of truth that soothes the threats of having redundant and inconsistent data that operatively influences segregated systems. With the facilitation of ease-of-use when accessing real-time analytics, the suggested platform will empower non-technical SME stakeholders with the ability to make the shift towards reactive troubleshooting to proactive strategic planning, which will eventually raise the operational efficiency and responsiveness to market dynamics. The given architectural blueprint is a scaled roadmap, which the SMEs can use to digitize their fundamental processes and have the most important information about the business associates and stock aligned and ready to act.

In an effort to explore the capabilities and confirm the effectiveness of the Integrated Dashboard System more thoroughly, a number of spheres to work on in the future and conduct further research have been revealed. Architectural framework is quite strong, however, in the future research, the use of empirical validation in the range of different SME settings should be the primary focus. System should be tested with real world data to give hopes of the results rather than purely running by assumptions or rationales. The quantitative research is required to comprehend the platforms contribution to such relevant aspects of the organization like finance, customer satisfaction, efficiency of business operations. Making the system more complex and incorporating new machine learning and analytics will be an essential move in the development of this system. This system described operates descriptive analytics, but with the aid of Machine Learning and advanced analytics and proceed to predictive and prescriptive analytics.

Further development of the platform in the future will also need to deal with the challenge of data security in a rigorous fashion as it grows, with more infrastructure and moves to cloud. The studies should be directed towards the application of high-security encryption and data protection privacy methods.

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