ABSTRACT

Operational systems are detailed, application specific and limited reporting capabilities which are known as called online transaction processing (OLTP) systems. The use of business intelligence (BI) has been increasing day by day in all most all business organizations irrespective of size and complexity of the business. BI systems consist of historical data that uses online analytical processing (OLAP) which are known as traditional BI or analytical systems. Mostly, traditional BI systems are historic, static, non-process oriented, longer action time, limited user access and decision making information is not up-to-date. Business in 21st century demands right decision making tools in current time. These tools are obtained by integrating operational and analytical systems and extending analytics to operational level. On the other hand, the gap between operational and analytical systems reduces because of wide development of technology and tools which leads to an evaluation of next generation BI which is known as operational business intelligence (Operational BI).

Such evolved Operational BI systems are current, dynamic, process driven, even based, reduced action time, accessible to large number of user, and provides decision making information for operational, tactical and strategic levels. Early attempts of building Operational BI systems are merely replicated operational data, without any integration between operational and analytical systems, confined to limited user access, does not provide measurement of business, operational, and process performance, and limited decision making information to the users. Thus, there is a great need to develop a business information system that provides decision making information in current time which is the main focus of this research study.

The thesis is entitled as “A Novel System for Operational Business Intelligence” that extends BI functionality into operational level decision making in current time. In this thesis, definitions, scope and functionality of the proposed system are presented. The key features of Operational BI system are summarised. The functional architecture of the proposed system is presented from the identified key features of the system. A methodology for developing requirements for Operational BI is presented which is based on business context and key feature of the system.

The major components of the proposed system are identified from their functional architecture that are namely business performance management, event notification and monitoring, operational analytics, operational reporting and portal.
The functionality of Check algorithm is presented and explained the generation of real time alerts and monitoring of configurable parameters. The conceptual architecture is presented from the identified major components. Architectural design of the system is presented which is based on business functionality and principles of enterprise architectural framework that uses Model View Controller Model 2 architecture of J2EE. Moreover, the generic objects, sequence and deployment diagrams of the proposed system are presented. The proposed architectural framework provides reuse of the functionality, improves performance, scalability and maintainability of the system.

An algorithm for Association Mining \( K^{th} \) frequent Itemset, in short AMKIS, is designed and implemented. The AMKIS algorithm generates \( K^{th} \) frequent itemset directly without generating previous itemsets that uses binary principles and lookup table. The AMKIS algorithm always outperforms Apriori for 2-itemset to 5-itemset. The AMKIS algorithm has the several advantages namely one time scanning of database, no massive candidate generation, extracts the missing knowledge lost during the pruning process of support count thresholds and uses simple data structure different from Apriori and FP growth.

In addition, two incremental association mining algorithms are designed and implemented. The former algorithm is Incremental mining for \( K^{th} \) frequent itemset for update database, in short INK, and the later algorithm is Incremental Frequent Itemset Mining, in short INFRIM. The INK algorithm generates directly \( K^{th} \) frequent itemsets from transactional database without generating lower frequent itemsets. The performance of INK algorithm is compared with Apriori and found the speedup ratio ranges between 2.35 and 11.07 for 2 and 5-itemsets respectively. The INFRIM algorithm generates the required frequent itemsets by recursive call of \( K^{th} \) frequent itemset which uses a simple check of 1-itemset count. The speedup ratio of INFRIM ranges between 1.2 and 3.1 for 2-itemset to 5-itemset as compared with Apriori algorithm.

Finally, this is to conclude from the above architectural framework and implemented– AMIKS, INK and INFRIM association mining algorithms that the proposed Operational BI system provides decision making information to the users in current time.