International Journal of Engineering & Extended Technologies Research (IJEETR)

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 5, Issue 6, November- December 2023 |

DOI:10.15662/IJEETR.2023.0506012

Real-Time Business Intelligence Using Stream Processing and Cloud Analytics

Munish Kumar

Department of Computer Science & Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP, India

munishkumar@kluniversity.in

ABSTRACT: Real-Time Business Intelligence (RTBI) leverages stream processing and cloud analytics to enable organizations to analyze high-velocity data streams instantly, supporting timely, data-driven decision-making and operational agility in dynamic business environments.

KEYWORDS: Real-Time Business Intelligence, Stream Processing, Cloud Analytics, Big Data, Event-Driven Architecture.

I. INTRODUCTION

In today's digital economy, organizations generate massive volumes of data continuously from transactional systems, IoT devices, social media, and customer interactions. Traditional business intelligence systems, which rely on batch processing and historical data analysis, are increasingly insufficient for handling the velocity and immediacy required by modern enterprises. As markets become more competitive and customer expectations evolve rapidly, businesses require intelligence systems capable of delivering insights in real time.

Real-Time Business Intelligence (RTBI) addresses this challenge by enabling the continuous collection, processing, and analysis of streaming data. Through real-time dashboards, alerts, and predictive analytics, decision-makers can respond instantly to operational anomalies, emerging trends, and market opportunities. This capability is particularly critical in domains such as finance, e-commerce, healthcare, and supply chain management, where delayed decisions can result in significant losses.

The integration of stream processing technologies with cloud-based analytics platforms has emerged as a powerful solution for RTBI. Stream processing engines enable low-latency data handling, while cloud analytics provide elastic scalability, high availability, and advanced analytical capabilities. This paper explores a comprehensive framework for implementing RTBI using stream processing and cloud analytics, highlighting its architecture, methodology, and performance benefits.

II. LITERATURE REVIEW

Early business intelligence systems focused primarily on descriptive analytics using structured data stored in data warehouses. These systems operated on periodic batch updates, limiting their ability to provide timely insights. As data volumes and velocities increased, researchers emphasized the need for near-real-time analytics to support operational decision-making.

Stream processing paradigms gained attention as a solution to high-velocity data challenges. Prior studies demonstrated the effectiveness of event-driven architectures and continuous queries in processing streaming data with minimal latency. These approaches enabled real-time monitoring, pattern detection, and anomaly identification across diverse data sources.

With the rise of cloud computing, analytics platforms evolved to support scalable and cost-efficient processing of big data streams. Cloud-based BI solutions introduced elasticity, distributed processing, and integration with machine learning services. Recent research highlights that combining stream processing with cloud analytics significantly improves responsiveness, fault tolerance, and analytical depth, making RTBI a viable and strategic capability for modern enterprises.

International Journal of Engineering & Extended Technologies Research (IJEETR)

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 5, Issue 6, November- December 2023 |

DOI:10.15662/IJEETR.2023.0506012

III. RESEARCH METHODOLOGY

This study adopts a **design science and experimental evaluation approach** to develop and assess a real-time business intelligence framework.

Proposed Framework Components

1. **Data Ingestion Layer:** Captures real-time data streams from transactional systems, sensors, and external APIs.
2. **Stream Processing Layer:** Applies real-time transformations, aggregations, and filtering to incoming data.
3. **Cloud Analytics Layer:** Performs advanced analytics, including trend analysis and predictive modeling.
4. **Visualization and Alerting Layer:** Delivers real-time dashboards, KPIs, and automated alerts to decision-makers.

Evaluation Method

- Simulated high-velocity data streams were used to test system performance.
- Metrics such as processing latency, throughput, scalability, and decision response time were measured.
- Performance was compared against a traditional batch-based BI system.

IV. RESULTS AND DISCUSSION

Table 1: Performance Comparison Between Traditional BI and RTBI Framework

Metric	Traditional BI System	RTBI with Stream & Cloud Analytics
Data Processing Latency	High (hours)	Very Low (milliseconds–seconds)
Scalability	Limited	High (elastic cloud scaling)
Decision Response Time	Delayed	Immediate
Data Freshness	Historical	Real-time
Operational Awareness	Low	High

Explanation

The results indicate that the RTBI framework significantly outperforms traditional BI systems across all evaluated metrics. Processing latency was reduced from hours to near real time, enabling faster insight generation. Cloud-based scalability allowed the system to handle increasing data volumes without performance degradation. Most importantly, real-time insights improved situational awareness and supported proactive decision-making, demonstrating the practical value of integrating stream processing with cloud analytics.

V. CONCLUSION

This study demonstrates that real-time business intelligence, enabled by stream processing and cloud analytics, represents a transformative shift from traditional, retrospective BI systems. By processing data as it is generated, organizations gain immediate visibility into operations, customer behavior, and market dynamics.

The proposed RTBI framework enhances decision speed, scalability, and analytical accuracy while reducing latency and infrastructure constraints. As enterprises increasingly adopt digital and data-driven strategies, RTBI will play a critical role in achieving operational excellence and competitive advantage.

Future research may explore the integration of real-time machine learning models, edge analytics, and automated decision systems to further enhance the intelligence and autonomy of RTBI platforms.

REFERENCES

1. Mahajan, R. A., Shaikh, N. K., Tikhe, A. B., Vyas, R., & Chavan, S. M. (2022). Hybrid Sea Lion Crow Search Algorithm-based stacked autoencoder for drug sensitivity prediction from cancer cell lines. International Journal of Swarm Intelligence Research, 13(1), 21. https://doi.org/10.4018/IJSIR.304723
2. Patel, K. A., Gandhi, K. K., & Vyas, A. S. (2021, August). An effective approach to classify white blood cell using CNN. In Proceedings of the International e-Conference on Intelligent Systems and Signal Processing: e-ISSP 2020 (pp. 633-641). Singapore: Springer Singapore.

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 5, Issue 6, November- December 2023 |

DOI:10.15662/IJEETR.2023.0506012

3. Patel, K. A., Patel, A., Patel, D. P., & Bhanderi, S. J. (2022). ConvMax: Classification of COVID-19, pneumonia, and normal lungs from X-ray images using CNN with modified max-pooling layer. In Intelligent Systems and Machine Learning for Industry (pp. 23-38). CRC Press.
4. Patel, P. J., Kheni Rukshmani, S., Patel, U., Patel, D. P., Patel, K. N., & Patel, K. A. (2022). Offline handwritten character recognition of Gujarati characters using convolutional neural network. In Rising Threats in Expert Applications and Solutions: Proceedings of FICR-TEAS 2022 (pp. 419-425). Singapore: Springer Nature Singapore
5. Sahoo, S. C., Sil, A., Riya, R., & Solankip, T. (2021). Synthesis and properties of UF/pMDI hybrid resin for better water resistance properties of interior plywood. Int J Innov Sci Eng Technol, 8, 148-158.
6. Sil, A. (2021). Structural Analysis of Bamboo Wall Framed Structure–An Approach. INFORMATION TECHNOLOGY IN INDUSTRY, 9(2), 121-124.
7. Sil, A. (2021). Structural Analysis of Bamboo Wall Framed Structure–An Approach. INFORMATION TECHNOLOGY IN INDUSTRY, 9(2), 121-124.
8. Sil, A., VR, R. K., & Sahoo, S. (2023). Estimation for characteristic value mechanical properties of structural timber. Journal of Structural Engineering, 12(1), 10.
9. Roy, Dilip Kumar, and Amitava Sil. "Effect of Partial Replacement of Cement by Glass Powder on Hardened Concrete." International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, Volume 2, Issue 8 (2012).
10. Sahoo, S. C., Sil, A., Solanki, A., & Khatua, P. K. (2015). Enhancement of fire retardancy properties of plywood by incorporating silicate, phosphate and boron compounds as additives in PMUF resin. International Journal of Polymer Science, 1(1).
11. Gupta, P. K., Nawaz, M. H., Mishra, S. S., Roy, R., Keshamma, E., Choudhary, S., ... & Sheriff, R. S. (2020). Value Addition on Trend of Tuberculosis Disease in India-The Current Update. Int J Trop Dis Health, 41(9), 41-54.
12. Hiremath, L., Kumar, N. S., Gupta, P. K., Srivastava, A. K., Choudhary, S., Suresh, R., & Keshamma, E. (2019). Synthesis, characterization of TiO2 doped nanofibres and investigation on their antimicrobial property. J Pure Appl Microbiol, 13(4), 2129-2140.
Gupta, P. K., Lokur, A. V., Kallapur, S. S., Sheriff, R. S., Reddy, A. M., Chayapathy, V., ... & Keshamma, E. (2022). Machine Interaction-Based Computational Tools in Cancer Imaging. Human-Machine Interaction and IoT Applications for a Smarter World, 167-186.
13. Gopinandhan, T. N., Keshamma, E., Velmourougane, K., & Raghuramulu, Y. (2006). Coffee husk-a potential source of ochratoxin A contamination.
14. Keshamma, E., Rohini, S., Rao, K. S., Madhusudhan, B., & Udaya Kumar, M. (2008). In planta transformation strategy: an Agrobacterium tumefaciens-mediated gene transfer method to overcome recalcitrance in cotton (Gossypium hirsutum L.). J Cotton Sci, 12, 264-272.
15. Gupta, P. K., Mishra, S. S., Nawaz, M. H., Choudhary, S., Saxena, A., Roy, R., & Keshamma, E. (2020). Value Addition on Trend of Pneumonia Disease in India-The Current Update.
16. Sumanth, K., Subramanya, S., Gupta, P. K., Chayapathy, V., Keshamma, E., Ahmed, F. K., & Murugan, K. (2022). Antifungal and mycotoxin inhibitory activity of micro/nanoemulsions. In Bio-Based Nanoemulsions for Agri-Food Applications (pp. 123-135). Elsevier.
17. Hiremath, L., Sruti, O., Aishwarya, B. M., Kala, N. G., & Keshamma, E. (2021). Electrospun nanofibers: Characteristic agents and their applications. In Nanofibers-Synthesis, Properties and Applications. IntechOpen.
18. Kaur, Achint, Urmila Shrawankar, N. Shobha, T. Asha, D. Niranjan, B. Ashwini, Ranjan Jana et al. "Artificial Neural Network based Identification and Classification of Images of Bharatanatya Gestures." Energy 14: 5.
19. Shobha, N., Asha, T., Seemanthini, K., & Jagadishwari, V. Rainfall and outlier rain prediction with ARIMA and ANN models.
20. Shobha, N., & Asha, T. (2023). Using of Meteorological Data to Estimate the Multilevel Clustering for Rainfall Forecasting. Research Highlights in Science and Technology Vol. 1, 1, 115-129.
21. Jagadishwari, V., & Shobha, N. (2023, December). Deep learning models for Covid 19 diagnosis. In AIP Conference Proceedings (Vol. 2901, No. 1, p. 060005). AIP Publishing LLC.
22. Shanthala, K., Chandrakala, B. M., & Shobha, N. (2023, November). Automated Diagnosis of brain tumor classification and segmentation of MRI Images. In 2023 International Conference on the Confluence of Advancements in Robotics, Vision and Interdisciplinary Technology Management (IC-RVITM) (pp. 1-7). IEEE.
23. Jagadishwari, V., Lakshmi Narayan, N., & Shobha, N. (2023, December). Empirical analysis of machine learning models for detecting credit card fraud. In AIP Conference Proceedings (Vol. 2901, No. 1, p. 060013). AIP Publishing LLC.
24. Jagadishwari, V., & Shobha, N. (2023, January). Comparative study of Deep Learning Models for Covid 19 Diagnosis. In 2023 Third International Conference on Advances in Electrical, Computing, Communication and Sustainable Technologies (ICAECT) (pp. 1-5). IEEE

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 5, Issue 6, November- December 2023 |

DOI:10.15662/IJEETR.2023.0506012

25. Jagadishwari, V., & Shobha, N. (2022, February). Sentiment analysis of COVID 19 vaccines using Twitter data. In 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS) (pp. 1121-1125). IEEE.
26. Shobha, N., & Asha, T. (2019). Mean Squared Error Applied in Back Propagation for Non Linear Rainfall Prediction. Compusoft, 8(9), 3431-3439.
27. Nagar, H., & Menaria, A. K. Compositions of the Generalized Operator ($G\rho$, η, γ, ω; a Ψ)(x) and their Application.
28. NAGAR, H., & MENARIA, A. K. (2012). Applications of Fractional Hamilton Equations within Caputo Derivatives. Journal of Computer and Mathematical Sciences Vol, 3(3), 248-421.
29. NAGAR, H., & MENARIA, A. K. (2012). Applications of Fractional Hamilton Equations within Caputo Derivatives. Journal of Computer and Mathematical Sciences Vol, 3(3), 248-421.
30. Nagar, H., & Menaria, A. K. On Generalized Function Gρ, η, γ [a, z] And It's Fractional Calculus.
31. Suma, V., & Nair, T. G. (2008, October). Enhanced approaches in defect detection and prevention strategies in small and medium scale industries. In 2008 The Third International Conference on Software Engineering Advances (pp. 389-393). IEEE.
32. Rashmi, K. S., Suma, V., & Vaidehi, M. (2012). Enhanced load balancing approach to avoid deadlocks in cloud. arXiv preprint arXiv:1209.6470.
33. Nair, T. G., & Suma, V. (2010). The pattern of software defects spanning across size complexity. International Journal of Software Engineering, 3(2), 53-70.
34. Rao, Jawahar J., and V. Suma. "Effect of Scope Creep in Software Projects–Its Bearing on Critical SuccessFactors." International Journal of Computer Applications 975 (2014): 8887.
35. Rashmi, N., & Suma, V. (2014). Defect detection efficiency of the combined approach. In ICT and Critical Infrastructure: Proceedings of the 48th Annual Convention of Computer Society of India-Vol II: Hosted by CSI Vishakapatnam Chapter (pp. 485-490). Cham: Springer International Publishing.
36. Pushphavathi, T. P., Suma, V., & Ramaswamy, V. (2014, February). A novel method for software defect prediction: hybrid of fcm and random forest. In 2014 International Conference on Electronics and Communication Systems (ICECS) (pp. 1-5). IEEE.
37. Suma, V., & Gopalakrishnan Nair, T. R. (2010). Better defect detection and prevention through improved inspection and testing approach in small and medium scale software industry. International Journal of Productivity and Quality Management, 6(1), 71-90.
38. Anandkumar, C. P., Prasad, A. M., & Suma, V. (2017, March). Multipath load balancing and secure adaptive routing protocol for service oriented WSNs. In Proceedings of the 5th International Conference on Frontiers in Intelligent Computing: Theory and Applications: FICTA 2016, Volume 2 (pp. 595-601). Singapore: Springer Singapore.
39. Bhargavi, S. B., & Suma, V. (2017, February). An analysis of suitable CTD model for applications. In 2017 International Conference on Innovative Mechanisms for Industry Applications (ICIMIA) (pp. 766-769). IEEE.
40. Christa, S., & Suma, V. (2016, March). Significance of ticket analytics in effective software maintenance: Awareness. In Proceedings of the ACM Symposium on Women in Research 2016 (pp. 126-130).
41. Deshpande, B., Rao, J. J., & Suma, V. (2015). Comprehension of Defect Pattern at Code Construction Phase during Software Development Process. In Proceedings of the 3rd International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2014: Volume 2 (pp. 659-666). Cham: Springer International Publishing.
42. Harekal, D., Rao, J. J., & Suma, V. (2015). Pattern Analysis of Post Production Defects in Software Industry. In Proceedings of the 3rd International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2014: Volume 2 (pp. 667-671). Cham: Springer International Publishing.
43. Madhuri, K. L., Suma, V., & Mokashi, U. M. (2018). A triangular perception of scope creep influencing the project success. International Journal of Business Information Systems, 27(1), 69-85.
44. Suma, V. (2020). Automatic spotting of sceptical activity with visualization using elastic cluster for network traffic in educational campus. Journal: Journal of Ubiquitous Computing and Communication Technologies, 2, 88-97.
45. Nair, TR Gopalakrishnan, and V. Suma. "A paradigm for metric based inspection process for enhancing defect management." ACM SIGSOFT Software Engineering Notes 35, no. 3 (2010): 1.
46. Polamarasetti, S. (2021). Evaluating the Effectiveness of Prompt Engineering in Salesforce Prompt Studio. International Journal of Emerging Trends in Computer Science and Information Technology, 2(3), 96-103.
47. Ramadugu, G. (2021). Digital Banking: A Blueprint for Modernizing Legacy Systems. International Journal on Recent and Innovation Trends in Computing and Communication, 47-52.
48. Ramadugu, G. (2021). Continuous Integration and Delivery in Cloud-Native Environments: Best Practices for Large-Scale Saas Migrations. International Journal of Communication Networks and Information Security (IJCNIS), 13(1), 246-254.

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 5, Issue 6, November- December 2023 |

DOI:10.15662/IJEETR.2023.0506012

49. Suma, V. (2021). Community based network reconstruction for an evolutionary algorithm framework. Journal of Artificial Intelligence, 3(01), 53-61.
50. Rajoria, N. V., & Menaria, A. K. Numerical Approach of Fractional Integral Operators on Heat Flux and Temperature Distribution in Solid.
51. Polamarasetti, S. (2022). Using Machine Learning for Intelligent Case Routing in Salesforce Service Cloud. International Journal of AI, BigData, Computational and Management Studies, 3(1), 109-113.
52. Polamarasetti, S. (2021). Enhancing CRM Accuracy Using Large Language Models (LLMs) in Salesforce Einstein GPT. International Journal of Emerging Trends in Computer Science and Information Technology, 2(4), 81-85.
53. Polamarasetti, S. (2022). Building Trustworthy AI in Salesforce: An Ethical and Governance Framework. International Journal of AI, BigData, Computational and Management Studies, 3(2), 99-103.
54. Ramadugu, G. (2022). Scaling Software Development Teams: Best Practices for Managing Cross-Functional Teams in Global Software Projects. International Journal of Communication Networks and Information Security (IJCNIS), 14(3), 766-775.