Enhancement to Operational Efficiency in Smart City using Big Data Analytics(OE4SC)

Smart Education Context

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Abstract

The rapid global adoption of Smart City concepts has led to a significant increase in the development of Smart Education initiatives. However, despite the existence of well-established accreditation standards like the ISO 9000 series, IEEE, IET, BSI, ANSI, and others, there remains a gap in the global recognition and standardization of Smart Education within the context of Smart Cities. This doctoral research addresses this gap by proposing a unified method and framework to evaluate and enhance the operational efficiency of Smart Education in Smart Cities through Big Data Analytics. Initially, the study examines the current state of Smart Education within Smart Cities and identifies challenges related to global qualification and recognition. It highlights the absence of Open Data-based evaluations for operational efficiency and threshold criteria. Drawing upon the ISO/IEC Joint Technical Committee frameworks for Smart Cities and the International Communication Technology Framework, this research develops a Smart Education framework and method, complete with an analytic visualization dashboard. This dashboard serves as a reference tool for developers, allowing them to establish an efficiency baseline standard and anticipate outcomes for future Smart Education or Smart Infrastructure initiatives. Leveraging Big Data Analytics, the proposed solution aims to enhance productivity, operational efficiency, and reduce operational costs, aligning with Open Data and transparency goals. The research contributes to the field by establishing a globally recognized metric and threshold for Smart Education within Smart Cities, thereby paving the way for a more standardized approach to developing and evaluating such initiatives.

Methods: Utilizing industry standards makes replication easier, beginning with **Data Acquisition, Analysis, Curating, Storage, and Data Usage**. Extensive literature indicates that metric data already exist in silos across various organizations, such as UNESCO, World Bank, Open Data, IMF, ISO, and UK Data Science. These data are fed into Big Data frameworks like Apache Hadoop and its ecosystem, which includes Apache PIG, Apache HBase, Apache Hive, Apache Sqoop, Apache Flume, and Apache Zookeeper. The research employs a Map-Reduce algorithm to **classify data** pre- and post-analysis, **discover** data outliers, **visualize** patterns, and **provide** adequate recommendations. These steps generate insights and quantitative metrics for establishing a model baseline.

Results: The evaluation relies on available data or recommendations to inform developers' expectations regarding smart buildings in the context of Smart Education or Smart Infrastructure. The model is expected to become a central reference tool for formulating a collective efficiency baseline standard. We hypothesize that the model will improve reliability and accuracy, reduce time-to-production, and mitigate failures, thereby enhancing productivity and operational efficiency while reducing operational costs.

Conclusions: This innovative framework and dashboard can guide policymakers, educators, and developers in their pursuit of enhanced educational experiences and infrastructure within smart urban environments. Cities aiming to develop smart and sustainable urban areas can use this model as a one-stop benchmark for operational efficiency. The model aims to validate developments based on industry standards, providing a baseline in the form of an analytic visualization dashboard. This will enable developers in developing countries to access data without incurring travel expenses, thereby reducing their carbon footprint. The frequency of available fresh data is subject to external factors, as Open Data still lacks global transparency.

Keywords: Smart City, Smart Education, Big Data Analytics, Efficiency, Standardization, ISO/IEC, Visualization Dashboard, Thresholds, Infrastructure, Performance.