

COMPSYS 704: Individual Research Project Proposal

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Introduction:

With the upward trend in the Internet of Things (IoT), many consumer products, vehicles, industrial and utility components, sensors and other everyday objects are equipped with the internet connection capability. Because of this, the development of Smart Homes and Smart Cities becomes a desirable application scenario and an attractive future to work forward to. A market research company, MarketsandMarkets, analyzed that the global IoT in smart cities market size is expected to grow from 113.1 billion USD in 2020 to 260.0 billion USD by 2025 [1]. This projection is made from the rising demand for connected devices for real-time insights in business processes across key applications, such as smart utilities, and smart buildings. However, the current cloud computing service architecture is limited in efficiency and latency, thus not ideal for the wider range of application.

In order to solve this challenge, intelligent edge emerges as an attractive alternative as it provides an intermediate medium for end devices and the cloud. The inclusion of edge computing in cloud computing introduces many benefits and better capabilities in terms of latency, privacy, scalability, reliability, diversity and cost [2]. Distributed edge computing can handle a large number of computation tasks without accessing data from the cloud, alleviate the network from high load traffic which also reduces delay, while the cloud can serve as a powerful backup storage for the system. However, the use of Intelligent Edge for a wider range application scenario such as in Smart Cities has not been explored in detailed. For example, the introduction of IoT technology has allowed smart grid to achieve ubiquitous monitoring and reliable communication for energy management. A long-term energy efficient energy management system can be made using edge computing infrastructure combined with deep reinforcement learning to analyze large data [3]. The objective of this research project is to explore the service provision of edge computing and how it can leverage the efficiency of smart cities.

Project Plan:

With the objective in mind, the first step is to research for existing smart city infrastructures, find where they are lacking and opportunities for edge computing to be implemented. Also, existing solutions that incorporate the use of intelligent edge will be identify and studied to obtain a deeper insight regarding the benefits and/or limitations. The knowledge gained would then be used to help formulate a recommendation on how Intelligent Edge can be used to improve an existing system inside the smart city infrastructure.

References:

- [1]: IoT in Smart Cities Market by Solution (Remote Monitoring, Network Management, Reporting, and Analytics), Service, Application (Smart Transportation, Smart Building, Smart Utilities, and Smart Citizen Services), and Region - Global Forecast to 2025. <https://www.marketsandmarkets.com/Market-Reports/iot-smart-cities-market-215714954.html>
- [2]: X. Wang, Y. Han, V. C. M. Leung, D. Niyato, X. Yan and X. Chen, "Convergence of Edge Computing and Deep Learning: A Comprehensive Survey," in *IEEE Communications Surveys & Tutorials*, vol. 22, no. 2, pp. 869-904, Secondquarter 2020, doi: 10.1109/COMST.2020.2970550.
- [3]: Y. Liu, C. Yang, L. Jiang, S. Xie and Y. Zhang, "Intelligent Edge Computing for IoT-Based Energy Management in Smart Cities," in *IEEE Network*, vol. 33, no. 2, pp. 111-117, March/April 2019, doi: 10.1109/MNET.2019.1800254.