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Smart Sensor Routing Scheme with Failover Management for Smart City Data Propagation

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Abstract: ***This paper presents the concept of personalized routing scheme with failover management in the transmission path of data which is very much required for successful transmission and reception of data traveling on the routes at a faster rate in smart cities. The basic requirement of internet of thing concept is to increase efficiency to design efficient routing algorithm for smart cities. The proposed algorithm reacts in real time to avoid delays and provide alternative routes when necessary. For smart route selection with lesser rate of failure we are using distributed –smart distance based metric calculation process where we can solve the issues of efficient route selection. Adaptive routing algorithm is used to handle key exchange policy during every call.***

Keywords: Internet of things (IoT); Smart city; Adaptive routing; Failover management; Personalized routing

1. Introduction

A smart city is defined as the ability to integrate multiple technological solutions in a secure fashion to manage the city's assets – the city's assets include, but not limited to, local departments information systems, schools, libraries, transportation systems, hospitals, power plants, law enforcement, and other community services. The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs. Business drives technology and large-scale urbanization drives innovation and new technologies. Technology is driving the way city officials interact with the community and the city infrastructure. Through the use of real-time systems and sensors, data are collected from citizens and objects - then processed in real-time. The information and knowledge gathered are keys to tackling inefficiency. Technology can be used as an enabler to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life.[2]

IoT concepts have already been adopted in areas such as energy (e.g., smart lighting, smart grid) and industrial automation. According to a report in eWeek2 about a Cisco conference call with journalists, "as more connections are made, the value to businesses and the global economy will only go up." [4] The eWeek story describes a Cisco vision that goes beyond the IoT to IoE, or the Internet of Everything. This is what Cisco sees as a system of connections that includes not only devices, but also people, data and processes—"…essentially whatever is connected to or crosses over the Internet." Cisco expects the IoE to be worth $14.4 trillion to the global economy by 2020. But, that's another story. Let's get back to the IoT to take a look at how it's being used in smart cities today and explore how it's changing smart cities for the better. IoT in Action in smart cities [2] the IoT plays a significant role in a broad range of city management applications, from managing traffic flow, emergency services, transport schedule updates, etc. [7]

Smart town is that the product of accelerated development of the new generation info technology and knowledge-based economy, supported the network combination of the net, telecommunications network, broadcast network, wireless broadband network and different sensors networks wherever net of Things technology (IoT) as its core. the most options of a wise town embody a high degree of knowledge technology integration and a comprehensive application of knowledge resources. The essential parts of urban development for sensible|a sensible|a wise} town ought to embody smart technology, good trade, good services, good management and good life.

The Internet of Things is concerning putting in sensors (RFID, IR, GPS, optical device scanners, etc.) for everything, and connecting them to the net through specific protocols for info exchange and communications, so as to realize intelligent recognition, location, tracking, observation and management. With the technical support from IoT, good town got to have 3 options of being instrumented, interconnected and intelligent. Solely then a wise town are often shaped by group action of these intelligent options at its advanced stage of IOT development.

The explosive growth of good town and net of Things applications creates several scientific and engineering challenges that decision for ingenious analysis efforts from each world and trade, particularly for the event of economical, scalable, and reliable good town supported IoT. New protocols, architectures, and services ar in dire has to respond for these challenges.

2. Literature Review

De Domenico et. al. [1] has developed the method for personalized routing for multitudes in smart cities. In this paper, the authors have proposed an adaptive routing strategy which accounts for individual constraints to recommend personalized routes and, at the same time, for constraints imposed by the collectivity as a whole. Using big data sets recently released during the Telecom Italia Big Data Challenge, they have shown that our algorithm allows us to reduce the overall traffic in a smart city thanks to synergetic effects, with the participation of individuals in the system, playing a crucial role

Nallur, Vivek et. al. [2] has developed the smart route planning methods using open data and participatory sensing. In this paper, the authors have presented a smart route planning open-source system; SMART-GH utilizes open data and participatory sensing, where citizens actively participate in collecting data about the city in their daily environment, e.g., noise, air pollution, etc. SMART-GH then augments the routing logic with sensor data to answer queries such as return the least noisy route'. SMART-GH enables citizens to make smarter decisions about their daily commute, and subsequently improve their quality of life.

Cardozo, Nicolás et. al. [3] has worked on enabling participatory routing using a smart routing platform. Participatory sensing has been advocated as a decentralized mechanism for getting up-to-date data about a city. However, this leads to data flowing only in one direction, from the citizen to the data collector. They have advocated closing the loop, by creating a platform that aggregates participatory data, visualizes it, and provides utility from the data. They have argued that this will lead to greater participation, as well as greater interest in various aspects of a city that can be collaboratively mapped.

Al-Fuqaha, Ala et. al. [5] has been conducted the survey upon Internet of things, which is focusing upon the technologies, protocols, and applications for IoTs. This paper starts by providing a horizontal overview of the IoT. Then, they have given an overview of some technical details that pertain to the IoT enabling technologies, protocols, and applications. Compared to other survey papers in the field, our objective is to provide a more thorough summary of the most relevant protocols and application issues to enable researchers and application developers to get up to speed quickly on how the different protocols fit together to deliver desired functionalities without having to go through RFCs and the standards specifications. They have also provided an overview of some of the key IoT challenges presented in the recent literature and provide a summary of related research work. Also they have explored the relation between the IoT and other emerging technologies including big data analytics and cloud and fog computing. We also present the need for better horizontal integration among IoT services.

Serrano, Martin et. al. [6] has worked towards defining the stack for service delivery models and interoperability in the Internet of Thing. The authors have discussed the practical case with OpenIoT-VDK. This paper introduces the stack for service delivery models and interoperability in the Internet of Things. The main characteristics and functional layers of the IoT Stack are described. The applicability of the IoT stack is described based on particular use cases and deployed pilots. The validation of the IoT Stack in terms of functionality and adaptation at different IoT particular areas is based on the Virtual Development Kit (VDK) developed and implemented within the framework of the OpenIoT project, OpenIoT project is the awarded Internet of Things open source rookie of the year by BlackDuck Software Co. (www.github.com/OpenIotOrg). The methods and standards that boosted OpenIoT-VDK implementation are described in this paper. An instance of the OpenIoT-VDK process is described as practical use case demonstrating being an IoT platform with autonomic behaviour. OpenIoT-VDK creates IoT instances, analyses the IoT stack dependencies and resolves them following interoperability principles.

Medvedev A. et. al. [4] has worked upon Reporting road problems in smart cities using openIoT framework. The In this paper the authors have discussed the challenges of annotating and retrieving video data streams from vehicle-mounted surveillance cameras. They have also proposed and evaluated the CityWatcher application – an Android application for recording video streams, annotating them with location, timestamp and additional context in order to make them discoverable and available to authorized Internet of Things applications. One of such applications is based on crowdsourced alerts to city authorities about road problems, like potholes, cracks, traffic accidents. These alerts are driver-initiated and are rewarded through an incentive mechanism. OpenIoT platform is used for infrastructure and development support.

Žarko, Ivana Podnar et. al. [7] has worked on the OpenIoT Approach to Sensor Mobility with Quality-Driven Data Acquisition Management. In this paper, the authors have described that the OpenIoT platform offers support for mobile sensors by means of its publish/subscribe middleware solution entitled CloUd-based Publish/Subscribe middleware for the IoT (CUPUS). The CUPUS publish/subscribe component is used to collect data from mobile ICOs in a flexible and energy-efficient manner and to provide preprocessed data into the OpenIoT cloud. Moreover, CUPUS in collaboration with a Quality of Service (QoS) Manager component enables mobility management of ICOs and quality-driven data acquisition from mobile sensors to satisfy the global sensing coverage requirements while taking into account data redundancy and ICO battery lifetime.

3. Findings of Literature Review

In the existing scheme, authors have used distributed-smart distance based metric calculation mechanism to solve the problem of efficient route selection for traffic congestion control in the smart cities also by avoiding the connectivity holes and the dead ends to minimize the data propagation control. The distributed-smart distance based routing mechanism is capable of solving the problem of efficient-route selection up to the level in the nodes connected in tree structure but can’t be considered efficient enough for efficient metric calculation in the distributed environment based smart city scenarios. There is a strong requirement of bypassing the connectivity holes effectively by calculating accurate and balanced paths to minimize the data loss and congestion control. The existing model is based on proactive routing scheme for its resource based scheduling. Tree based mechanism uses multiple path calculation to send the data by route other than direct route with connectivity holes to avoid the data loss. The data is sent through relay nodes among other paths rather than sending it via flawed sink. Tree-based routing in the existing scheme is either not capable of selecting an alternative path on the basis of the energy residual and life estimation. The existing routing mechanism is not an intelligent algorithm and can choose longer path than usual even while using geographical location because it uses route distance based cost/route metric to evaluate the best alternative path. The route cost calculation depends upon the usual routing protocol algorithm. However if the route cost computations process can be made independent of usual routing protocol algorithm on lower layer, it will become more efficient.

4. Proposed Methodology

The existing system will be improved and enhanced for its metric calculation to elect the best route and route for load balancing while sending the data towards the BTS. The BTS will be receiving the data from the cluster heads in the wireless networks. The metric calculation would be improved by combining the values of the next hop trust, overall hop count, dynamic node id and available bandwidth between the source and destination nodes in the smart-city environment. The adaptive load balance balancing based new method will use this new metric route to find the shortest route with balanced, efficient and higher bandwidth based route selection mechanism to make the delivery process faster and to avoid the congestion and data loss. The route cost calculation for load balancing will be based on the individual load on the relay node/s, the alternative routes with the minimum load will be also considered to find the alternative route. Among the shortlisted routes using the load as metric, the route with minimum total route cost will be used to forward the data. The existing algorithm will be compared with our proposed algorithm using end to end delay/latency, packet delivery ratio, network/route load and packet Efficiency of the alternative route. The project will be developed using NS2 simulator. The algorithm to detect the connectivity hole or link failure will be used to update the routing table while the primary route becomes unavailable. We will be using reply back method to detect the link failure, and to execute the backup and load balance route finder event based improved adaptive load balancing rainbow protocol for smart cities.

5. Conclusion

The IoT network is the next generation network of things and is gaining popularity day by day because of its multiple and wide usage. The issue of IoT network route handling is being addressed in the proposed project work. The proposed work in based on the unique combination of mathematical random function to generate the key table. The smart routing table generation and management mechanism used in the proposed work in based on the unpredictable key relationship theory, where the stronghold formula based route relationships will be incorporated to manage the data routing. The proposed work is based on the adaptive smart routing mechanism, which means that every node will be able to handle its key exchange policy with the receiver node during every call setup. In this way, every sender node will be made capable of insuring the integrity of the data propagation in the given IoT network.

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