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ACCEPTED MANUSCRIPT

Mobile Couriers' Selection for the Smart-grid in Smart-cities' Pervasive Sensing

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***Abstract*–** The explosion of wireless devices has given rise to numerous data-sharing applications in smart-cities' Pervasive Sensing (PS) paradigms. This vision has been further expanded in the Internet of Things (IoT) era to embrace multipurpose resources within a smart city setup such as public sensors on roads/vehicles, cameras, RFID tags, and readers. The realization of such a prophecy is significantly challenged in terms of connectivity disruption, resource management, and data gathering under mobile conditions. In this paper, we present a hybrid pervasive sensing framework for data gathering in IoT-enabled smart-cities' paradigm. This framework satisfies service-oriented applications in smart cities where data is provided via data access points (APs) of various resources. Moreover, public vehicles are used in this work as Data Couriers (DCs) that read these APs data packets and relay it back to a base-station in the city. Accordingly, we propose a hybrid fitness function for a genetic-based DCs selection approach. Our function considers resource limitations in terms of count, storage capacity and energy consumption as well as the targeted application characteristics. Extensive simulations are performed and the effectiveness of the proposed approach has been confirmed against other heuristic approaches with respect to total travelled distances and overall data-delivery cost.

Keywords- *Data Collectors, Sensor Networks, Internet of Things, Fitness functions, Smart Cities, Genetic Algorithms.*

I. INTRODUCTION

Wireless Sensor Network (WSN) has come a long way, from their support in area specific deployments such as irrigation systems, health care, and supply chains, to supporting multiuser systems that enable simultaneous access of application that operate in large scale Internet of Things (IoT) paradigm [1][2]. Smart cities are examples of such applications that support multiuser access on a multi-application platform. These users may want to access information such as the availability of parking space in the city, electric grid information from the smart meters around the city such as electricity consumption levels, peak hours, etc., and/or major road accidents and any other reported emergencies. Smart cities are expected to have a grid of wireless sensor networks to provide access to large-scale information [4]. In smart cities different challenges related to type/nature of surrounding buildings and obstacles' need to be taken into account. In this study, cities with high rise buildings are assumed, which can severely attenuate the signal strength/quality and accordingly users may experience poor service. In addition, varying distances between the base station and users due to mobility is assumed. This can also be a key challenge in the assumed smart city setup where fixed transmission range from the base station can lead to significant waste in energy in case it is set to the maximum unnecessary coverage distance. Additionally, in dense deployment of wireless user equipment, interference may happen and degrades quality of service (QoS) and bandwidth utilization in homogenous networks functioning over unique frequencies.

Pervasive sensing (PS) is one great example that uses low cost sensory devices in mobile devices to create a large-scale network for transferring data among users for the greater good of the public in smart cities [2][3]. The proliferation of wireless sensors has given rise to Pervasive Sensing (PS) as a vibrant data sharing model. This vision can be extended under the umbrella of the Internet of Things (IoT) to include versatile data sources within smart cities such as cell phones, radio frequency identification tags and sensors on roads, beaches and living spaces. The facilitation of such a vision faces many challenges under the outdoor harsh operational conditions in terms of inter-operability, resource management, and pricing. With PS incorporated into IoT, it will be able to extend to data generating/sharing systems including Wireless Networks (WNs), IoT operating systems, database centers, personal and environmental monitoring devices deployed both in cities and urban regions. Smart city projects in the urban regions introduce innovation in the provision of infrastructure services making applications accessible directly and in large-scale. Smart grids initiatives for utilities represent part of this big scenario of smart cities. The innovation of the smart grid can affect almost all services necessary for the economic development and the well-fare state of human beings in smart cities. Smart-grid has been evolved recently in managing our vast electricity demands in a sustainable, smart and economic manner, while utilizing already existing Heterogeneous Networks' (HetNets) infrastructures. The Smart-grid is simply an energy network that can automatically monitor the flow of electricity in a city and adjust to changes in users' demands accordingly. It comes with smart meters which are connected to the Internet to provide consumers/suppliers with smart-decisions on their on-going energy usage/production. For example, a number of smart home appliances viz., dishwashers, washing machines, and air conditioners can communicate with the grid using these smart meters and automatically manage their electricity usage to avoid peak times and make more profit. Moreover, these smart

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