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Cognitive Knowledge of Routing Protocol Configuration in Smart City

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ABSTRACT: Internet of Things (IoT) yields ceaseless opportunities in terms of data sharing and connections. The objective of the work is to create the base for the smart city. A tremendous pressure on aspirations of the smart city is created by both ministry and the private ownership in order to find solutions to the growing problems. The methodology adopted here is to unified standards for routing protocols in the smart city. It is significant to find better routing protocol. By comparing the smart city with Ad Hoc network, strong resemblances in topological distribution and node characteristics can be raised. The outcome of the work is to predict the extension of routing protocol of Wireless Ad-Hoc network in prospective with smart city crisis. In the paper, a broad cognitive knowledge has been taken place for the different routing protocol such as Interior gateway protocols (RIP), Enhanced Interior Gateway Routing Protocol(EIGRP) and Open Shortest Path First (OSPF)., for enhancing smart city.

Keywords: Ad-hoc network; IoT; Routing; Smart city; Wireless Sensor Network; Interior gateway protocols; Enhanced Interior Gateway Routing Protocol; Open Shortest Path First

I. INTRODUCTION

Internet of Things has grown into an emerging advanced automation technology in recent years. The motivation behind IoT is to make an unintelligent environment to intelligent. The smartness in an intelligent environment is the sum of various physical devices such as sensors, actuators and the communicational component which are logically integrated into everyday objects and networked each other to provide interaction between objects. This interaction makes things smart. IoT, plays a considerable aspect in the employment of the smart environment. The smart environment typically encloses smart city, smart home, smart office etc. The smart city presents colossal opportunities for the people to earn economic, social and environmental profits. The goal of the smart city is to increase the usage of public resources, improving the Quality of Service afforded to the citizens, while decreasing the operational cost. Communication, data exchange and inter connectedness are the basis for the smart city. The explosive growth of IoT forges many challenges. New protocols are indirect need to acknowledge these challenges.

RIP, EIGRP and OSPF are the recent trend for acquiring knowledge from 'N' directions to support IoT device communication to the core. Services provided by the smart city range from management to optimization of the public services. It includes parking, transport, surveillance and monitoring air, water, noise, waste and preservation of public constructions like dams, bridges. The organization of this paper is as follows: Section 2 overviews the services provided by the smart city. Section 3presents the gaps in designing the routing algorithm. Section 4 and 5 presents how WSN and Ad-Hoc network protocols can be adapted to the smart city and some protocols have been summarized. In Section 6, future research issues pertaining to routing in the smart city has been enumerated. Finally, section 7 concludes the paper.

II. SERVICES SUPPORTEDBY THE SMART CITY

The various services provided in the smart city are as follows

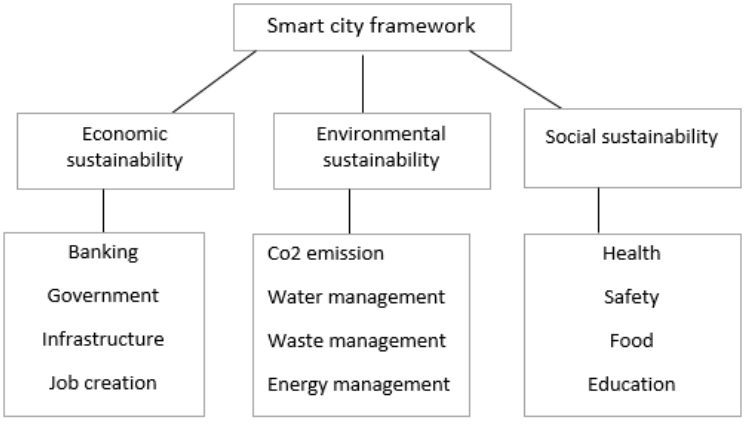

Fig.1. Services contributed by the smart city.

A. Smart Parking
Meanwhile locating parking space at peak hours is tedious. The problem arises due to the growth in the number of vehicles and a limited number of spaces. In MPCR (Multiple Criteria based Parking space Reservation Criteria) was suggested. The motive behind MPCR is to find and reserve parking slot effortlessly by keeping the consumption of time and energy-less. This arrangement is a gain for both landowners and car drivers.

B. City Energy Consumption
There are a lot of benefits in conserving energy. The main benefit is an economical gain. The cost of electricity, fuel and maintenance can be reduced. In the authors had clearly explained an approach to conserve energy in the smart city. Collaborative energy and information transfer has been proposed.

C. Smart Traffic
Traffic management is a keystone in the smart city. The main problem is urban mobility. Traffic management system is connected with GIS empowered digital road map of the city is a basic to stable the traffic. TrafficIntel, Real-Time Traffic Management System is proposed in consisting of real-time traffic monitoring system help drivers to receive data from a network of Tricorder to predict the local traffic.

D. Air Quality Monitoring
Polluting the environment has become a preeminent problem in the smart city. Air quality monitoring is prerequisite to persuade whether the air is likely for breathing or not. In low cost and low powered sensors have been deployed to monitor the air pollutants. In order to educate the citizens, the authors in proposed a framework which bestow supervised machine learning algorithm simplifies in taking an early step towards unpolluted environment.

E. Noise Monitoring
Noise profanation can affect both well-being and attitude of the citizens. Hypertension and insomnia are the consequences of the noise pollution. Low-cost sensor has been improvised in to monitor altitude of the noise and reconciliation is made from the data stored in the cloud.

F. Smart Lightning
Smart lightning concedes favourable energy savings in the smart city meeting the economical solidness. Smart lightning improves the quality of life of the people by providing security to the pedestrians, street drivers. Adaptive lightning dispenses blurred light when movement is not detected and luminous effect on movements. In the author coupled sensors, light source and surveillance camera to adjust the luminous of the light only with a moving person near to the proximity of the source.

G. Smart Waste Management
The major concern in smart city is to reduce the time and energy requirements in waste management. Using IoT prototype and sensors intelligence to waste bins has been afforded in which can read, collect and transmit high volumes of the data over the internet. This data is processed by intelligent algorithms in spatial-temporal context to dynamically manage the waste. The disposable of the wastage is another important problem in the context of the smart city.

H. Structural Health Monitoring Of Buildings
The city is fully crowded with immotile buildings such as roads, bridges, dams. The healthiness of these ancient buildings is crucial. The system perceived in is used at Shreya's fork art museum, India where the data is sent from source to destination through IoT-WSMP (IoT enabled Wireless Sensing and Monitoring Platform).It monitors the climate, moisture and luminous in order to preserve the art in the museum.

III. RESEARCH GAPS

The practical challenges faced while designing routing algorithm in the smart city are listed below. These contradicts can be resolved with the help of the intelligent algorithms.

A. Discrete Topology
IoT has diverse topology connecting heterogeneous devices together. Implementation of composite routing in a varied environment is obscure. The routing algorithm must incorporate both inherent dynamics of network topology and discrepancy of the traffic load.

B. Multitudinal Sources and Destination
Since smart city have multiple sources and destination there is a high probability for packet collision. In cluster based routing, multiple sources create flooding which has to be diminished. The packet collision may eventuate in this scenario.

C. Multi-Objective Routing
The designed methodology must be able to handle multiple objectives effortlessly. The objective can be measured for specific instance or different instances. The most common objective includes minimizing the energy and the cost of routing.

D. Qos Constraints
The QoS requirement for connection is endowed by a set of constraints. It includes jitter, an end to end delay, network throughput, bandwidth, link quality, transmission cost, and packet delivery ratio and energy consumption. The network performance should be improved by enhancing the QoS parameters. In IoT meeting, single QoS requirement is big concern. Likewise, QoC (Quality of Concern) is a big concern. The QoC leans on the quality of the sensor, quality of the context data and the quality of distribution.

E. Secured routing
Since the applications of the smart city are deployed in the open environment, it is subjected to the sensitive attacks. With no loss in the performance of the application, the routing in the IoT must be rendered in an assurance manner. A new solution needs to be discovered to overcome the security risks without sacrificing performance and network bandwidth.

F. Energy Demand
Sensors deployed in the smart city have less power and they are limited to the battery constraints. The intent of energy efficient routing protocol is to boost the network lifetime. Usage of memory can reduce the energy requirements. The memory usage can be reduced in clustering methodology. And also efficient sleep scheduling protocols can be employed to conserve energy.

G. Feasible Deployment

Routing performs a great action in the determination of the network reliability. Almost every routing algorithms are demonstrated by simulations and not implemented in real time. Enforcing it virtually is nearly a great challenge. Possibilities of new challenges can disclose uncertainties and inconsistencies.

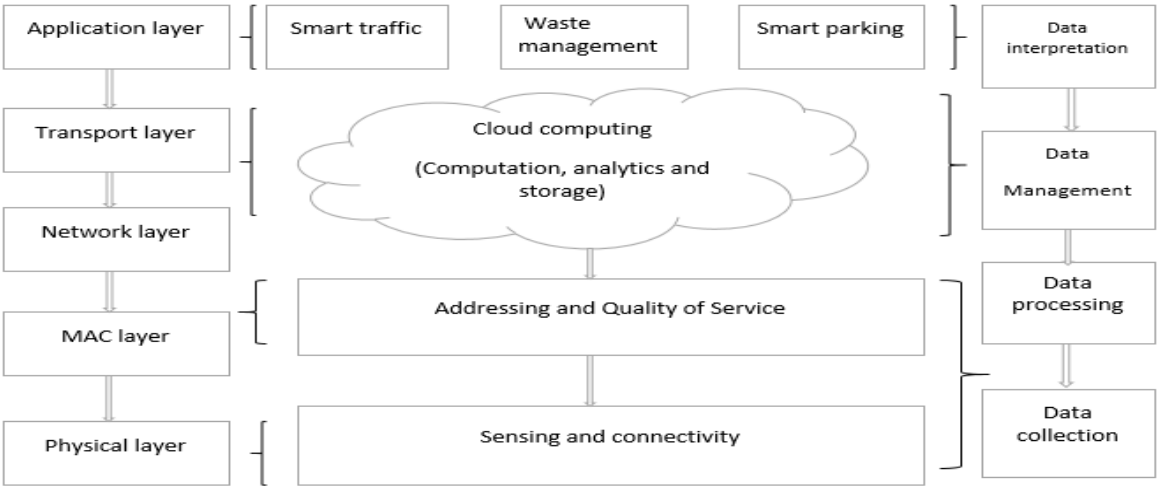

Fig. 2. Data flow framework in a smart city.

H. Resources Deficient

Insufficient resources or insufficient routes to establish communication between nodes is a great risk in routing. The objective is to regulate the number of the resources. Proper scheduling mechanisms have to be followed. Time division based or RR (Round Robin) is used.

I. Storage Inadequacy

Sensors are limited in memory. Routing data have to be stored temporarily in the memory buffer when there is a network traffic. The data must be stored in the compressed form before transmission. Intelligent storage mechanisms are in demand.

J. Optimization Techniques

In order to determine the cost-efficient routes, route optimization techniques have been adopted. Since the data in the smart city is immense there is an expiry time associated with the data

That is data must reach the destination within a certain limit. Either data redundancy elimination or delay minimization can be depleted.

IV. WIRELESS SENSOR NETWORK BASELINE FOR IOT

The sensing part of IoT is WSN. It is one of the four pillars in IoT. WSN contains spatially distributed devices which are connected through a network that monitors and sense the physical environment [1]. They provide a high degree of perception in environmental physical process. The efficient design of Wireless Sensor protocols leads to an elevation in the smart city. To actualize this task efficiently between the sensor nodes, an energy-efficient routing algorithm is vital. The route selection must be such that the lifetime of the network is maximized. The role of routing protocols can be categorized into environmental specific, task-specific and general. Some of the routing issues in WSN are Limited energy capacity: There is a limit in power since sensor nodes are powered by the battery. Energy efficient routing protocol must be designed to enhance the network period.

Sensor locations: Location of sensor nodes impact great on designing routing protocols [2].

Scalability: Routing protocols must be scalable enough to fit large network size. Dynamic environment: Routing in the dynamic network is more challenging due to the rapid changing in routing path. Fault tolerance: Routing protocols must be designed in such a way that it must handle the unexpected failure of nodes. Varied sensing application requirement: Routing protocol must be constructed way such that it supports diverse application guarantee data delivery and accuracy. Routing protocols are classified based on the protocol operations. Based on the functionality they are classified as:

A. Multipath routing

More than one path is constructed between source and destination in order to reduce the load balancing. The supplementary paths provide fault tolerance. Hence, reliability can be realized.

B. Query-Based Routing

In the interest of the request and replies, data transference is carried away. Consequent to the user request the base station broadcast the messages throughout the network. The major challenge in query based is that the sink node receives the same query more than once. Hence it is must to discard the additional ones.

C. Negotiation based routing

The intention of this protocol is to reduce the redundant data by conducting negotiation between the source and destination. Negotiations occur between the sink nodes by sharing of information based on the context and mutually decide the path for transmission.

D. QoS based routing

A path is predetermined and allocated before transmission. The goal of the QoS routing is to provide routing protocols that is proficient in identifying such paths in order to surge the sum of flows. The efficiency of this routing is measured in sense when the traffic is increased.

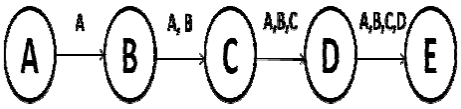

Fig. 3. Route discovery illustration.

E. Routing Protocols In Wsn That Is Related Toiot

The authors in [3] proposed SPR (Survivable Path Routing) which is data-centric gradient based routing technique. The source commences the path establishment by transmitting the interest packets. The packets are flooded throughout the network to find the destination. Flooding is the main problem here. Multiple paths are established at the tail of the path exploration step. It uses [4] route mechanism of SGEAR (Sub-Game Energy Aware Routing).SEGAR is used by the relay nodes for durable routing decisions. SPIN (Sensor Protocol for Information Negotiation) [5] avoids unnecessary communications by performing handshaking with neighbour nodes.

SPIN make decisions from the knowledge of the application along with the resources serviceable to it. Accordingly this helps the sensors to distribute the data speedily. But it is inflexible for potential application changes.

Directed diffusion [6] is data-centric routing technique based on the attribute value pair. Diffusion favours energy savings by preferring aggregable paths empirically. Energy efficient cluster based routing for micro-sensor is proposed in [7].Typical micro-sensor network performs remote monitoring. In LEACH, nodes organise as clusters by electing single node as a cluster pioneer. LEACH is (Low Energy Adaptive Clustering Hierarchy) [8] used for data aggregation in IoT. This allows local processing of the data by reducing the data set. But in LEACH routing overhead is high. The authors in [9] recommended enhanced LEACH and analysed it in the circumstances of end to end lag and routing overhead. Dynamic group management scheme for secure information sensing for IoT is proposed in [10].

Table 1: Comparison of routing protocol.

Routing protocols	Overhead	Power usage	Mobility	QoS	Scalability	Multipath
Spin	low	limited	possible	no	limited	yes
Leach	high	low	fixed	no	good	no
Pages	high	max	BS is Fixed	no	good	no

V. ADHOC WIRELESS NETWORK

Ad Hoc wireless network has a selection of dynamically and arbitrarily distributed mobile nodes which is self-sufficient for rigid framework. Ad hoc nodes must be able to disclose the presence of other devices and able to observe necessary handshaking to grand communication and distribution of information between devices. The devices established in the smart city must be self-adaptive and self-configurable that is devices must adapt themselves to the dynamic changing context of the environment. For example, surveillance camera must be able to change its ambience according to day and night. This is one of the characteristics of Ad-hoc network. Route discovery process in Ad-hoc network is classified into 4 types reactive, proactive, hybrid and hierarchical. The classification is characterized by nodes discovery and renovates routing information. Proactive routing protocols discover and sustain routing tables periodically. Bandwidth consumption increases in respect to the broadcast messages. Extensively known proactive routing protocols include OLSR, WRP and DSDV. Reactive routing protocols look up for nodes only when it is needed.

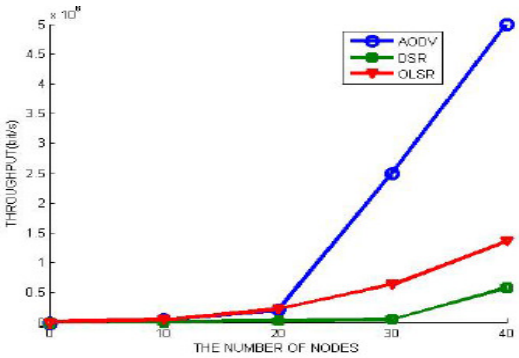

Fig. 4. Throughput with respect to number of nodes.

It resolves bandwidth utilisation and energy efficiency issues but causes delay due to the route discovery process. Well known reactive routing protocol includes AODV, DSR. Hybrid routing protocols jointly provides proactive routing for nearby nodes and reactive routing for far away nodes. CBR is hybrid based routing protocol. The entire network is divided into sub-networks in order to regulate the routing efficiently. CBPR belongs to hierarchical routing [11].

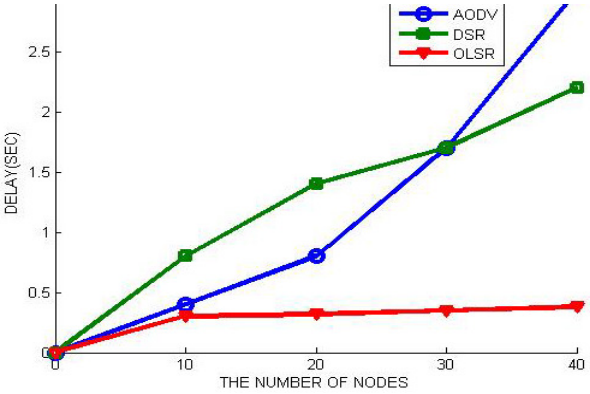

Fig. 5. Delay with respect to number of nodes.

Fig 4 shows the throughput with respect to nodes. The output shows that DSR has the lowest throughput. Fig 5 shows the delay comparison between AODV, DSR and OLSR. Traffic must be regulated in way to maximize the lifetime of the nodes. BMO-based dynamic clustering algorithm is schemed in] manages the data traffic and energy consumption uniformly. This method has profitably reduced condensed residual energy. The altered LEACH in covers smart dynamic CH selection at the end of each round depended on the residual energy and it reinforces a green model for the smart city.

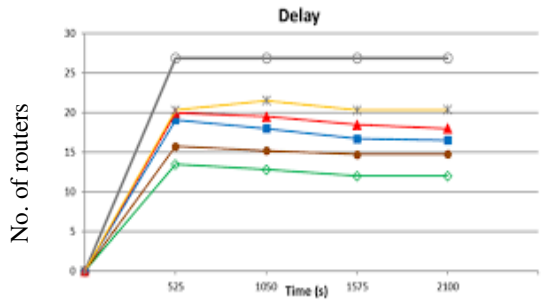

Fig. 6. Routing Interior Protocol.

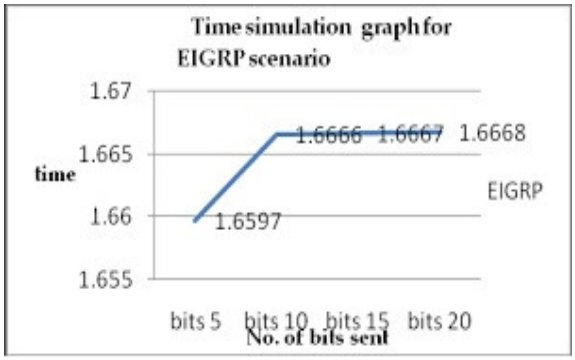

Fig. 7. Enhanced Interior Gateway Routing Protocol.

VI. FUTURE WORK

While urban population grows ,the infrastructure required to support citizens are inefficient. Information and Communication technologies provides a mean to reduce this problem. A most important problem in IoT is data management. The amount of critical and personal data to be handled. The privacy of user data must be ensured. For example, the location of the user must be shared only to the authorized ones and not to everyone. An additional problem is heterogeneity because the platform in IoT has to support various devices, applications and services. In future a common standard has to be proposed that could be adapted to fit different cities of different sizes. Subsequently it is recommended that further research should be undertaken in the succeeding areas like secured routing, energy efficient and multi-target routing is needed.

VII. CONCLUSION

The work is to overseen the various existent protocols of IoT in order to impose an applicable proposition for the smart city. The existing protocols in WSN and Ad-Hoc network is ported to IoT. Ad-Hoc solutions are more robust and viable in supporting the needs of the smart city. More over RIP and EIRGP are also plays a vital role in enhancing routing methodologies using a critical path. A unified, simple and economical avenue to a residue of public servicing, thus discharging potential alliance and proliferating the transparency of the citizens is in demand. These findings are crucial for following the opportunities for future research in the urban communication.

Conflict of interest: No

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