

EFFICIENT ENERGY HARVESTING APPROACH FOR WSN BASED IoT APPLICATIONS

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Abstract: - Internet-in-Things (IoT) is embedded with hardware and as well as the software. The day to day physical objects are connected with one another and the sensors are used to receiving the information from objects and all these structure form a network and it communicate with each other without any human interaction. This IoT network is depends on the wireless sensors and the massive amount of data is collected by the sensors and communicates these data to specified locations of the network. The lifetime of the network and communication process is purely based on the energy sources of the objects and applications. Energy consumption is one of the major issue in WSN based IoT applications.

The researchers and developers are always taken this issue as a challenge for WSN based IoT environment. The IoT sensors are main resource is battery power and it always receiving the information and communicating the information to remote location of the IoT network using this energy only. So the energy harvesting is the only solution to retain the lifetime of the sensors and the network. In this paper, the new energy harvesting

technique is introduced to increase the availability of the sensors and retain the lifetime of the network.

Keywords: - Energy, Objects, Harvesting, IoT, Sensors, Wireless, Network.

1. WSN and IoT

Internet of Things (IoT) is an intellectual of the unique detective devices that are capable of communicating wirelessly with others, services, and the large number of people on the Internet. IoT, internet is nowhere and widespread, and has the ability to affect many aspects of users' quality. WSN is typically used to monitor environmental or geographical location for some specific purpose. WSN consists of sensor nodes that have the capability of self-configuration and its deployment in target area is so easy. WSNs have some limitations in terms of battery power, data rates, memory, and processing. A WSN is generally described as a single network, which controls the unity and the environment, helping to communicate between persons or computers and surrounding situations [2]. Currently WSNs usually include sensor nodes, actuator edges, gates, and clients.

A large number of sensor nodes were placed inside Creation of networks through the Sensor Field or Self-Setting System. The sensor tracks the data stored by the consoles by transferring the data between the other sensor terminals. During the transfer process, when the multihop routing is over, the data tracked by the system may be monitored several times and can finally go to the management point of the Internet or satellite. Networking devices connected to IoT architecture are generally sensors, controller processors, wireless transceivers and an energy source (Eg, a battery) to monitor their environment and receive / receive data. One of the major technical challenges is the low power consumption of equipment [9] and mechanisms for obtaining electricity or harvest power from various sources, as well as saving harvest energy. In recent developments in wireless sensor networks, one of the most widely known popular research topics in literature is the energy harvest. To deal with the energy base problem in WSN, energy harvesting technology should be used to harvest energy from the network environment using protocol and algorithm [8] to ensure continuous operation of the WSN based IoT applications.

Energy Harvest-based WSNs can be used by the power of many forces, such as solar power, wind, engine vibrations, temperature variations, and magnetic fields.

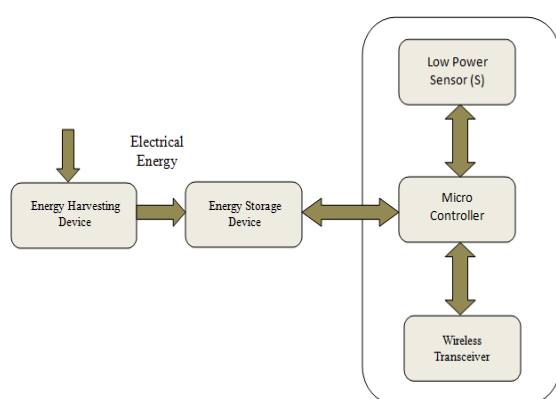


Figure 1: - Architecture of EHWSN

The above architecture illustrates the block diagram of an Energy Harvesting Wireless Sensor Network. Energy Harvest and Energy Storage

Devices generate energy harvesting power management systems that allow WSN terminals to be permanently or extended to the lifespan of the terminal network, for energy and / or future use.

2. WHY ENERGY HARVESTING?

In recent few years, 'Internet of Things' (IoT) has become a dictatorship. IoT is a Information and Communication Technology, the Technology Revolution (ICT) extends to "anytime" and "any place" already "anything". Based on various technical analysts and communications companies, this technology now moves quickly from the rise of media. In fact, the IoT is already based on anything. Between 2008 and 2009, the number of devices connected to the Internet is above the world population, which can be used as a symbol of IoT's revelation. In the year 2020, it is estimated that 26 to 50 billion items will be linked to IoT, which is larger than all current Internet programs, which are connected to smart phones. As already calculated, currently 200 people per person can be linked to IoT, which will lead to hundreds of billions of communications devices.

Internet of Things (IoT), or devices connected to the Internet, third, and large bandwidth are rapidly developing in cyberspace. In 2020, IoT 2820 billion Internet connections are expected to connect in 2020, with more than a billion users accessing the net by accessing personal computers or two billion users on phones and tablets. Internet offer opportunities, but risks can occur. Not yet IoT's neglected feature is a potential increase in power consumption. IoT devices are generally expected to be accessed through other devices at all times.

It is the device itself, or at least its contact volume, the primary function of power consumption even when the device is not in its use. While not in use, most devices enter a wait state, which uses considerably less energy. Even billions of such devices have raised concerns over excessive wait power consumption, even if they have moderate power requirements.

2.1. IoT implementation status in India

In October, India creates its first IoT framework. By 2020 it will reach the new era of \$ 20 billion that means, affecting the current 200 million-to-2.7 billion devices in 2020, which is mostly associated with private companies. The government would like to put 21 million dollars in 21 years to 50 percent of the required investment for at least five projects in the smart cities, water, environment, health, waste management, agriculture, security and supply chain. The task of providing infrastructure in the country and the wireless connection is not easy. But on the bright side, now there are more than two million mobile app developers in India, which is expected to rise to three million by 2019.

S.No	Application Area	Application
1.	Smart Home	Smart Lighting, Home Automation, Smart Applications.
2.	Smart Health	Sleep Monitoring, Fall Detection
3.	Smart Retail	Smart Vending Machine
4.	Smart Mobility	Smart Road, Smart Street Lighting
5.	Smart Office	Office Automation, Access Control, Intrusion Detection.
6.	Smart Factory	Machine Wear Monitoring, Machine Diagnostics, Machine Remote Control.

Table 1: - IoT Applications and scope of the Research

We estimate that the use of green applications will be higher in relation to additional Standard PC energy consumption, as the future count of the devices is expected to be higher. Yellow applications were considered less relevant: Based on the standpoint of Table 1, many IoT edge devices are operated by the battery. While these devices are not in the scope of this project, some early estimates of global battery consumption and associated productivity have been made. An estimate of the proliferation of the associated edge devices was first established to evaluate the impact of IOT applications prior to global energy consumption. Although many IOT market forecasts are, only a few and scattered databases provide unit calculations with a frequency of the work.

Energy harvesting networks will change the way designed and reviewed. Electricity non-power-driven IoT is controlled by the capacity of their

batteries, following the power saving approach and intended to improve communication and network movement. In this work, our primary focus is on WSN based IOT applications to study energy harvesting performance.

3. EXISTING APPROACHES

Energy harvesting is one of the hot issues of IoT. Various energy harvesting algorithms exist to reduce the energy consumption of the IoT based network. Those existing approaches are listed below.

Distributed Energy Harvesting Aware Routing (DEHAR) Algorithm

It is the Communication and Distribution Rounding of EHWSNs, which calculates the availability of narrow paths and capacities on the hop number. In order to add awareness to the power harvest for the algorithm, a local chain is assigned to each point. This fine, dynamically updated, is the opposite of the separation of energy available to the node. When the node power buffer is fully charged, this fine must be zero, while the node should be endless when it reduces its energy. When a tip is caused by a change in local sentences, it promotes its immediate neighbors. At each end, the local penalty is attached to the distance from the sink, which is to define the node's energy distance, which is used when the possibility of relay selection by other terminals. If a node changes the neighbor's penalty due to variations in the availability of its energy, the power of a terminal becomes a local minimum. To solve this problem, distributed penalties are introduced.

Duty cycle-based Adaptive toPOLogical KR aLgOrithm (D-APOLLO)

This is a harvest-geographical routing protocol. Their approach can increase the use of harvested energy, changing dynamic cycle and the knowledge limit (KL) of each term may be delayed and interrupted. Knowledge with each term is a wide range of information it collects. The KL dimension is the trade between the validity of the path prepared by the routing algorithm and the

ability to collect and maintain a large number of information about the neighbor's.

This previous work, design energy-harvesting-aware routing protocols for heterogeneous WSN-based IoT applications in the presence of ambient energy sources. We propose a new routing algorithm EHARA, which is further enhanced by integrating a new parameter called 'extra backoff'. The algorithm improves the lifetime of sensor nodes as well as the quality-of-service (QoS) under variable traffic load and energy availability conditions.

Different from the existing routing protocols, this paper develops an effective energy-harvesting-aware routing algorithm referred to as EHARA. The algorithm addresses the issues of EE, quality-of-service (QoS) and network lifetime extension in the presence of the EH techniques. In particular, the EHARA selects the best routes using a cost metric that is based on a combination of the consumed energy, the harvested energy and the residual energy at nodes

2.1. Difficulties in Existing Approach

The global information is unable to adapt to variations in sensor nodes' energy levels.

Here do not consider the actual amount of harvested energy accumulated during the harvesting period. Use constant rates of replenishment for all sensor nodes in the network. Thus, they cannot deal with the stochastic characteristics of the ambient energy sources.

3. PROPOSED APPROACH

In this proposed work, a novel framework named MDDA-EHWSN as Malleable Directing Scheme with Data Aspect in Energy Harvesting Wireless Sensor Networks. We present a new adaptive routing algorithm for finding energy optimized routes in a wireless sensor network with energy harvesting. And to continuously adapt the energy requirements of sensor nodes based on availability of renewable energy sources, network routing needs and application quality constraints addressing these trade-offs is our

distinctive contribution in this paper. And present a novel algorithm to find the optimal uniform data quality for approximated data collection in a multihop energy-harvesting wireless sensor network.

In results the algorithm is shown to be able to adapt to changes in harvested and stored energy. Simulations results show the proposed routing protocol has advantages over competing routing protocols in terms of energy efficiency, Data quality and energy cost for data packet delivery.

We present an adaptive routing algorithm which is able to find and maintain energy optimized routes from any source node to a base station (called the sink or destination node in the following). By energy optimized routes we mean routes that avoid nodes with too little energy, effectively allowing these nodes to regain their energy level through energy harvesting.

The proposed algorithm is adaptable and distributed, i.e., each node runs autonomously, taking routing decisions based solely on available energy on its neighbouring nodes. As each node makes local routing decisions, a route may change while the data is being routed. To assure a net energy gain, it is important to also account for the energy used by the routing algorithm itself.

In our setup we simulate the uncertainties of energy harvesting through global parameters, such as time of day, and local parameters, such as amount of shadow for a given node position. This emulation of the environment is observed by the proposed routing algorithm and used to direct network traffic such that nodes in areas with lower energy are kept alive.

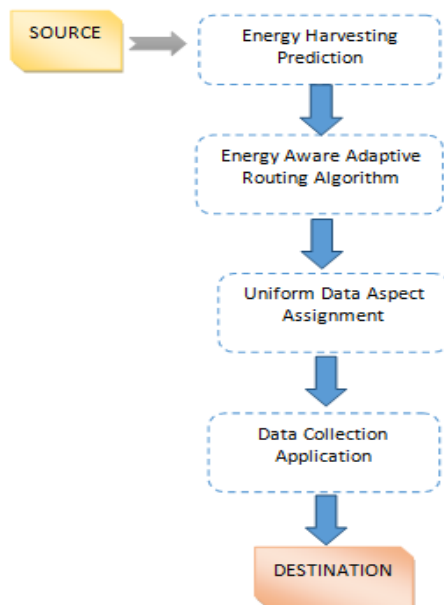


Figure 2: - Proposed System Structure

Our algorithm is shown to be able to adapt to changes in harvested and stored energy. The proposed routing protocol has advantages over competing routing protocols in terms of energy cost for data packet delivery.

4. RESULTS AND DISCUSSIONS

In this paper, we included an MDDA-EHWSN routing algorithm proposed and implemented algorithm in NS-2.34 simulator. The implemented MDDA_EHWSN routing algorithm can be evaluated by standard measurements such as packet delivery rate, overhead, delay, throughput and energy.

Performance Measurements: The MDDA-EHWSN routing algorithm must address performance measurements such as increasing the packet delivery rate and decrease efficiency, decrease delay, and power consumption of the wireless sensor network.

1. Throughput:

This is the rate of data packets successfully provided for seconds in the network between targets.

2. End to end delay:

This is the time taken by data packets for transmission between targets across the wireless sensor network. This interval is caused by a delay in transmission, suspension, and transfer in MAC.

3. Packet delivery ratio:

This is the ratio between packets generated between packets received.

4. Overhead:

This is calculated by the ratio of the total number of control packs sent by the sources to the number of data packets successfully distributed.

5. Energy:

This is [the ultimate energy = start-up energy-consumed energy].

We have done our research analysis in wireless sensor networks by using NS2. Comparative analysis done between proposed system and existing system. Now two matrices are evolved and remaining parameters would be found in the future.

Delay

The delay comparison figure 3 shown. Reduced delay in comparison with the existing system. The system in the first 20s is better than the proposed system. If the simulation time increases, the proposed system is better than the existing system.

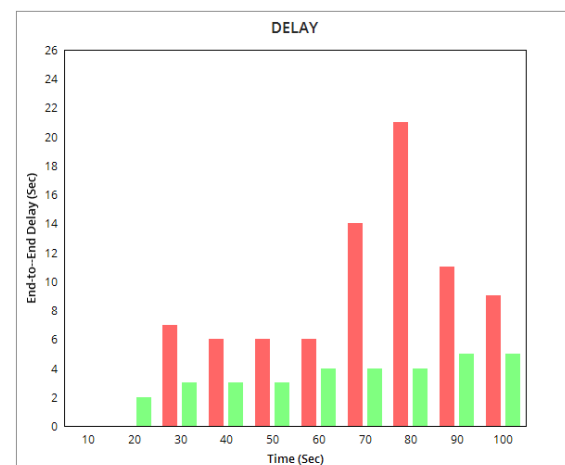


Figure 3: - Delay

In the above figure 3, the green bars represent the proposed system result and red bars

represent the existing system functionality in the parameter of delay.

Packet Delivery Ratio (PDR)

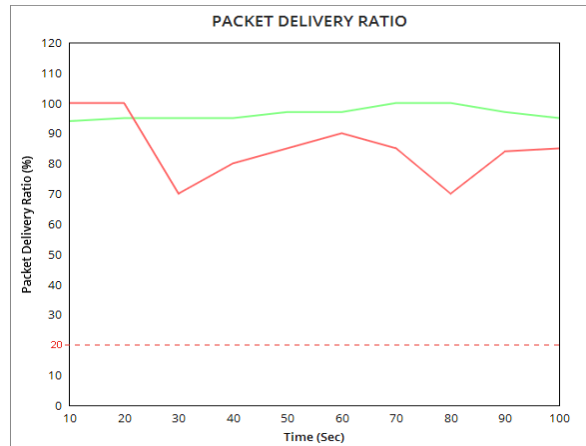


Figure 4: - Packet Delivery Ratio

PDR comparison shown in Figure 4. The system in the first 20s is better than the proposed system. If the simulation time increases, the proposed system is better than the existing system. In the above figure 4, the green bars represent the proposed system result and red bars represent the existing system functionality in the parameter of packet delivery ratio.

Throughput

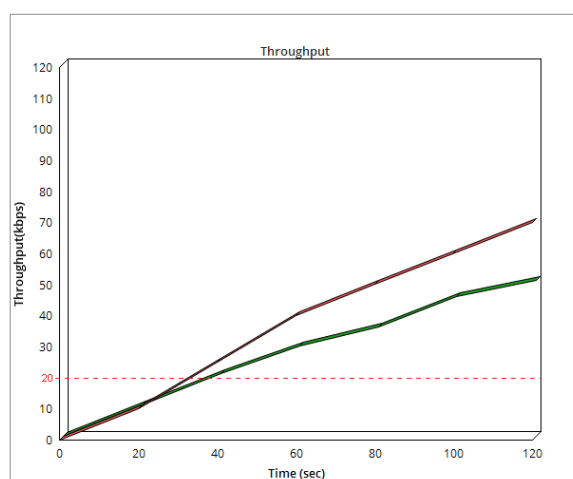


Figure 5: - Throughput

Throughput comparison is shown in Figure 5. Throughput is increase when compared to the existing system. In first 20 s the existing system is better than the proposed system. If the simulation time is increase the proposed system is better than the existing system.

5. CONCLUSION

In this paper, a new energy harvesting protocol is proposed for WSN-based IOT applications. The current energy harvesting techniques can not conform to the variations in the energy levels at the global information sensor nodes. There is no actual level of harvest harvested during the harvest season. Use filler rates for all sensor terminals in the network.

Thus, they cannot handle the unique properties of environmental energy sources. The approach to our new approach is to overcome difficulties and our algorithm is shown to be able to adapt to changes in harvest and stored energy. The proposed router protocol provides benefits for energy packages for data packet delivery on competing roaming algorithms. When compared to the existing system the Packet Delivery Ratio is around 13% increase, Delay is around 40% decrease, the network life time of wireless sensor network is increases based up on Quality of Service parameters.

In this paper, there are two parameters are evolved with existing approach. In future, Energy Efficiency, Data transmission cost, Data quality, and Network Life time parameters are evolved and analyzed with existing approach.

In our future work, the detailed study of this MDDA-EHWSN is to be carried out. In future, it can be partitioned into three modules like initialization, Adaptive routing scheme and Uniform data quality assessment is analyzed.

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