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Internet Traffic Dynamics in Wireless Sensor Networks Based on Energy Efficiency with Routing Protocols

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Abstract: Wireless sensor network (WSN) has emerged as a promising technology for the recent advances in electronics, networking, and information technologies. This dissertation offers multiple methods for modelling various elements of WSN traffic in the area of traffic analysis and modelling for WSNs. This research proposed novel technique in analysing the internet traffic dynamics of WSN by energy efficient and routing of the network. Here the traffic analysis is carried out using dynamic distance vector protocol and the routing is enhanced with energy efficiency using clustering based lightweight spatio energy efficient routing technique. The experimental analysis has been carried out in terms of throughput, traffic analysis, energy efficiency, packet delivery ratio.

Keywords: *Wireless Sensor Network, Internet Traffic Dynamics, Energy Efficient, Routing, Clustering*

1. Introduction

The internet-of-things (IoT) is a new technology that includes internet-connected sensory devices to provide real-time data (remote) collection. A wide range of low power devices with integrated sensing, special purpose computation, and wireless communications capabilities have been created thanks to recent advancements in nanotechnology. WSN is a grouping of numerous tiny devices, each of which has the ability to sense, compute, and communicate. There are numerous possible uses for it, including monitoring the environment and building security. There are two types of sensor node placement in WSN: deterministic and stochastic [1]. A sensor node's size can range from a shoebox to a grain of dust, depending on how it is really implemented. Similar to this, a sensor device's price can range from hundreds of dollars to a few pennies, primarily depending on how complicated embedded sensor is and how much computing power and storage it needs. Contrarily, size and cost restrictions on sensor nodes imposed by the application under consideration have an equivalent impact on resources such as energy, processing power, bandwidth, and storage capacity [2]. Formally stated, a sensor network is made up of a lot of WSN that may communicate with one another. Many different sensors, including pressure, vibration, optical, thermal, acoustic, and others, can be used to simultaneously monitor the environment at various locations. The locally collected data can then be forwarded to a unique sink node for additional processing [3].

The contribution of this research is as follows:

1. To propose novel technique in analysing the internet traffic dynamics of WSN by energy efficient and routing of the network
2. the traffic analysis is carried out using dynamic distance vector protocol and the routing is enhanced with energy efficiency using clustering based lightweight spatio energy efficient routing technique

2. Literature Survey

Recently, the author suggested performing a DPM choice using reinforcement learning ideas [4].The dynamic power allocation was carried out by the authors [5] using reinforcement learning and a fuzzy method; however, limited membership function could prevent optimality in uncertain network settings.The authors attempted to use reinforcement learning techniques in [6], although they mainly concentrated on sleep–awake scheduling as well as path planning.Furthermore, these methods were restricted by a continuous learning environment that was unable to adopt non-linear network circumstances.To accomplish optimal resource use, the authors [7] suggested developing network learning methodologies.The authors [8] stressed the need of maintaining low power consumption under resource-constrained conditions by arranging a sleep-awake condition. In his outstanding work [9] recreated the intricate Internet topology and captured the dynamic evolution of the Local-World.Based on [10], suggested a complicated ad hoc network model with fast expansion in 2007;In order to reduce transmission delay and boost resilience, [11] created a topology control technique that added scale-free features into topology of WSN;In the context of WSN, [12] explored the

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effect of scale-free topologies on Gossiping. This analysis provided an application for security of sensor networks.

3. Proposed Methodology

This section discusses novel technique in analysing the internet traffic dynamics of WSN by energy efficient and routing of the network. Here the traffic analysis is carried out using dynamic distance vector protocol and the routing is enhanced with energy efficiency using clustering based lightweight spatio energy efficient routing technique. the proposed architecture in traffic dynamics of WSN based on routing and energy efficiency is shown in figure-1.

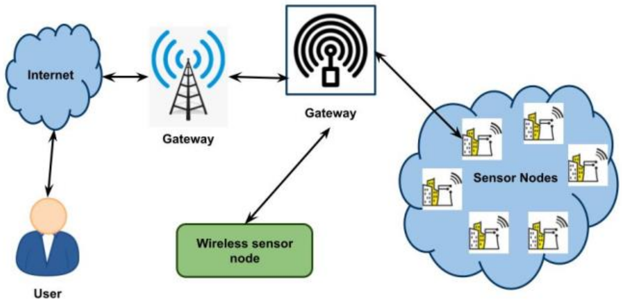

Figure-1 Proposed Architecture in Traffic Dynamics of Wsn Based on Routing and Energy Efficiency

assuming that wireless communication dominates energy dissipation rather than computation. Energy is expressed as for sending and receiving a packet of size s. (1).

$E_{co}(d,s) = \left(E_{TR\_ELE} + E_{AMP} + E_{RE\_ELE}\right) \times s = (E_{TR_{ELE}} + \gamma \times d^{\lambda} + E_{RE\_ELE}) \times S$ (1)

Dynamic distance vector protocol (DDVP):

transmission energy model is also split into two categories: a free space method for short-range communication, and a multi-path fading method for long-range communication.Reception consumption is a representation of the energy used by the reception circuit, whereas transmission consumption is a representation of the energy used by the transmission circuit and amplifier. According to Equation (2), each sensor will use ETx energy to transmit a l-bit data packet over communication distance of d:

$$E_{TX}(l,d) = \begin{cases} l.E_{ELEC} + l.\varepsilon_{fs}d^2 & if\ d < d_0 \\ l.E_{ELEC} + l.\varepsilon_{mp}d^4 & if\ d \geq d_0 \end{cases} \qquad (2)$$

Node v in depth d for node let $H = \{x \mid \text{Depth } (x) = d+1, x \in nbr(v)\}$ a nd $L = \{x \mid \text{Depth } (x) = d-1, x \in nbr(v)\}$. If $\exists h \in H$is selected as next hop node of v, parameter needs to satisfy by eq. (3)

$$\alpha > \frac{1+\frac{c_t}{c_{th}}}{1+\frac{c_t}{c_{th}}+\left(\frac{c_t}{c_{th}}-1\right)Q(v)+\left(Q(l)-\frac{c_t}{c_{th}}Q(h)\right)} \qquad (3)$$

Algorithm of DDVP:

SetLocal Depth() which sets depth of local node

Local energy density=calculate local energy density ()

$\theta_d = \frac{(Local\ depth+I+PDR\ size)}{u_{Msg}}.depth + 1$

Short path

Lin cap = short path (RERR+CLK size)

$\theta_{ed} = u_{Msg}.Energy_{density}/local\_enery_{density}$

Shor path

Cost=distance (neighborID)

$D = U_m/cost$

Lin_cap =BW+CLK size-RERR

Update routing table

If (Local_depth> LD+1) then

setLocal depth (LD+1)

end if

Clustering based lightweight spatio energy efficient routing technique:

The following methods can be used to obtain the power needed to make adaptive transmission by eq. (4):

$$\tau([c,p],\alpha,s,T_h) = \begin{cases} [E_{on} + E_{tx}(c^n,\alpha^n,T_h^n)], & if\ p = ON, s = S_{ON} \\ E_{OFF} & if\ p = OFF, s = S_{OFF} \\ E_{TR} & otherwise \end{cases} \qquad (4)$$

where Etx is the power required for data transmission during time slot n, and EON and EOFF represent the total power spent for ON and OFF state transitions, respectively. ETR is the amount of transmission power used overall during the switching transition by eq. (5).

$$M^P(s) = [m^P(p|p,s)]_{p,p`} \qquad (5)$$

Now, using a C-HMM and transition probability of following equation, the parameters $m^n(\eta), m^{gp}(G_p|\alpha,T_h) and\ \{q^n : n = 0,1,\ldots..\}$ can also be determined using an estimated value of q n + 1 by eq. (6), (7)

$$m^q(q`[q,c,m],\alpha,s,T_h]) = \begin{cases} \sum_{G_p=0}^{o} m^n(q` - [q - G_p]m^{Gp}(G_p|\alpha,T_h)) \\ \quad \sum_{G_p=0}^{o} m^n(\eta), m^{gp}(G_p|\alpha,T_h)) \end{cases} \qquad (6)$$

$$d[q,m],\alpha,s,T_h = \sum_{\eta=0}^{\infty}\sum_{f=0}^{o} m^n(\eta), m^{gp}(G_p|\alpha,T_h)) \times \{q - Gp + nmax([q - Gp) + \eta - Q, 0\} \qquad (7)$$

This results in a similar delay by eq. (8):

$$D_d\bar{D}^{\psi}(y)$$

$\bar{M}^{\psi}(y) = \sum\left[\sum_{n=0}^{\infty}(\rho)^n\tau\left(y^n,\psi(y^n)\right) \mid y^{\circ} = y\right]$, and

$$\tilde{D}^{\varphi}(y) = E\left[\sum_{n=0}^{\infty}(\rho)^n d\left(y^n,\psi(y^n)\right) \mid y^0 = y\right] \qquad (8)$$

Following the goals mentioned in above Eq.9, the mathematical modelling of our suggested strategy

$$\forall R \wedge K \in \text{link } (L) = [1,2,\ldots,n]$$
$$\sum_{k\in K} X_{DP_i(i)} = 1, \quad \forall j \in N, \forall j \in R$$
$$\sum_{k\in K} X_{DP_i(jk)} = 1, \quad \forall i \in N, \forall j \in R$$
$$\sum_{k\in R} X_{DP_i(jk)} = \sum_{j\in R} X_{DP_i(jk)}, \forall i \in N, \forall j \in R \qquad (9)$$
$$\sum_{k\in P} P_k W_{jk} \leq Y, \quad \forall i \in N, \forall j \in R$$
$$\sum_{k\in D} d_k W_{jk} \leq Y, \quad \forall i \in N, \forall j \in R$$
$$MO^1 = OS_i^1 + \lambda \times \left(OS_1^3, \widehat{OS_2^2}, \ldots, OS_4^1, \ldots, OS_k^1\right)$$
$$d_{(F_i,F_j)} = \left\|P_i(F_i) - Pj(F_j)\right\|^2 = \sqrt{\sum_{k=1}^{N_{\dim}}\left(P(F_i)_k - P(F_j)_k\right)^2}$$
$$P(F_i)^{t+1} = P(c)^t + L_a\left(\left(F_j\right)^t - (F_i)^t\right) + S_f(r - 0.5)$$

4. Experimental Analysis

We perform a theoretical analysis, create a MATLAB toolbox for simulation, compare the theoretical analysis and simulation results, and all of this is done to ensure that this model is valid.

Table-1 Comparative analysis between proposed and existing technique

Parameters	DPM	BPM_WSN	ITD_WSN_EE_RP
Throughput	91	93	97
Traffic Analysis	81	83	85
Energy Efficiency	88	91	95
Packet delivery ratio	85	88	92

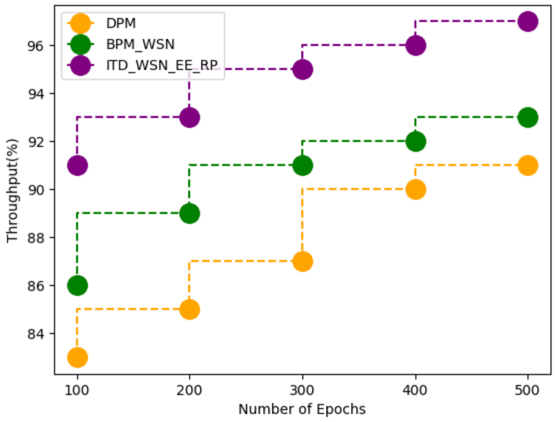

Figure-2 Comparison of Throughput

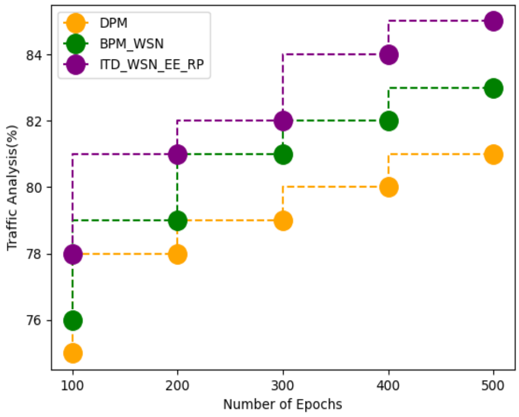

Figure-3 Comparison of Traffic analysis

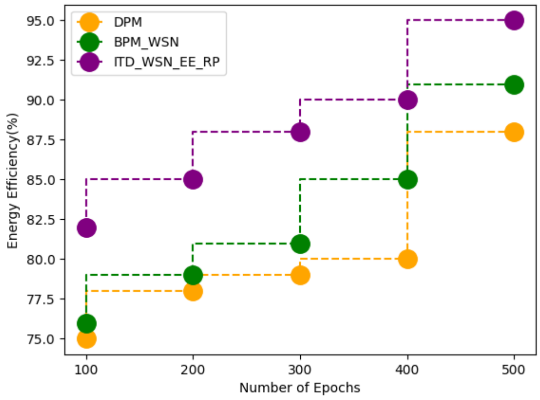

Figure-4 Comparison of energy efficiency

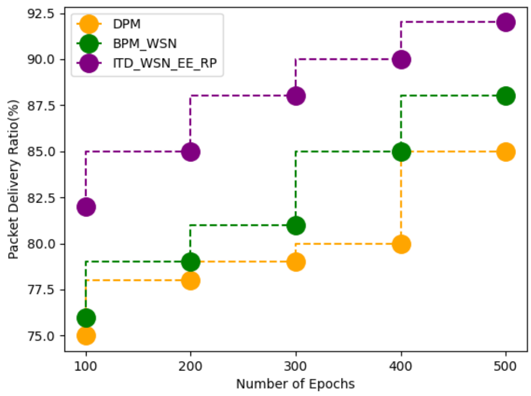

Figure-5 Comparison of PDR

The above table-1 shows comparative analysis between proposed and existing technique based of number of epochs. Here the parameters compared are throughput, traffic analysis, energy efficiency, packet delivery ratio. The existing technique compared are DPM and BPM_WSN with proposed technique.

The above figure 2-5 shows comparison of throughput, traffic analysis, energy efficiency, packet delivery ratio. Here the proposed technique attained throughput of 97%, traffic analysis of 85%, energy efficiency of 95%, packet delivery ratio of 92%, while existing DPM attained throughput of 91%, traffic analysis of 81%, energy efficiency of 88%, packet delivery ratio of 85%; BPM_WSN attained throughput of 93%, traffic analysis of 83%, energy efficiency of 91%, packet delivery ratio of 88%

5. Conclusion

This research proposes novel technique energy efficiency with routing based analysis of internet dynamics in WSN. The routing and energy efficiency based on traffic analysis is carried out using dynamic distance vector protocol and clustering based lightweight spatio energy efficient routing technique. the experimental analysis has been carried out in terms of throughput, traffic analysis, energy efficiency, packet delivery ratio.the multipath fading channel model is used to account for the power loss of multiple path propagation. Reception consumption is a representation of the energy used by the reception circuit, whereas transmission consumption is a representation of the energy used by the transmission circuit and amplifier.the proposed technique attained throughput of 97%, traffic analysis of 85%, energy efficiency of 95%, packet delivery ratio of 92%

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