

Firefly Optimization in IOT Applications for Wireless Mesh Networks

Dr.Shaji. K. A. Theodore M. Samira^a, and Dr. G. Revathy^b

^a Faculty of IT - Networking, Dept of IT, University of Technology and Applied Sciences, Al-MUSANNA, Sultanate of Oman.

^b Assistant Professor, Department of CSE, Erode Sengunthar Engineering College, Perundurai, Erode, Tamilnadu, India

Article History: Received: 11 January 2021; Accepted: 27 February 2021; Published online: 5 April 2021

Abstract: Internet of Things is an budding focus of technical, social, and economical importance. At the same time, Internet of Things hoist momentous challenges that may perhaps plunk in the way of apprehend its prospective reimbursement. The 'thing' in IoT may perhaps be a person with a heart monitor or an automobile in the midst of built-in-sensors, i.e. objects that have subside dole out an IP address and encompass the capability to accumulate and convey data over a network without manual assistance or intervention. The business processes hosted on the wide-spread geographical distribution of sensors should retort to dissimilar sensing events congregate in the dynamic IoT environment as swift as they could. So to Produce better IoT applications, process optimization is indispensable in the IoT environment. For example, data analytics in energy embarrassed IoT Networks uses Optimization Framework to recuperate the network implementation delay and accuracy. Here we imply firefly Optimization Algorithm Framework, wherever the nodes make a decision where their data analytic tasks will be executed, in order to jointly optimize their average execution delay and accuracy, while respecting power consumption constraints compared to previous other techniques. Our new fire fly optimization techniques shows 81% better results compared to previous techniques such as Genetic and ant colony etc...

Keywords: Internet of Things, Wireless mesh networks, Firefly Optimization

1. Introduction

WMN are optimistic inclination in panorama of wireless networks. The crucial assistance of WMN slouch in its native gaffe restraint alongside network failures, unfussiness to milieu affirmative a network and a broadband competence. WMN rigging elevated mobility appraise to erstwhile wireless networks since WMN has superior energy storage and power storage. The features of WMN are self configuring and self healing technique all the way in the course of which the node malfunction or path malfunction is slickly enhanced since in WMN a node can be full of zip as client as well as a server depending on the request.[1][2][4][5].

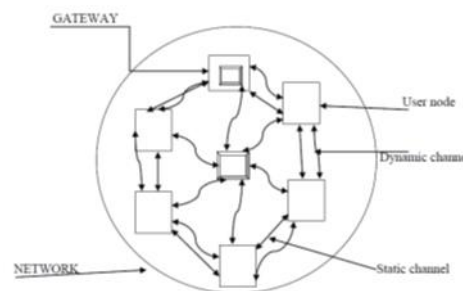


Fig 1 describes a typical WMN architecture. There are 2 dissimilar clusters surround mesh nodes. Figures 1 depict simple figure mesh networking. When we go for sophisticated there are manifold nodes in each cluster and hence when we want to convey data from initial place towards target we have near recognize shortest path for broadcast. In this concurrence we have realize a new technique of setting IoT sensor to each nodes and make the navigate fast using Jaya Optimization.

IOT

IoT sermon provides basic and advanced concepts of IoT. Our Internet of Things tutorial is intended for beginners and professionals. IoT stands for Internet of Things, which resources admittance and conniving daily functional equipments and devices using Internet. Our IoT tutorial includes all topics of IoT such as prologue, features, advantage and disadvantage, ecosystem, resolution framework, architecture and domains, biometric, security camera and door unlock system, devices, etc.

What is an Internet of Things (IoT)

The mechanism have their own individual features, but what regarding if these all communicate with each other to provide a better environment? For example, the phone brightness is accustomed based on my GPS location or my direction. Connecting everyday things embedded with electronics, software, and sensors to internet enabling to collect and exchange data without human interaction called as the Internet of Things (IoT). The term "Things" in the Internet of Things refers to anything and everything in day to day life which is accessed or connected through the internet.

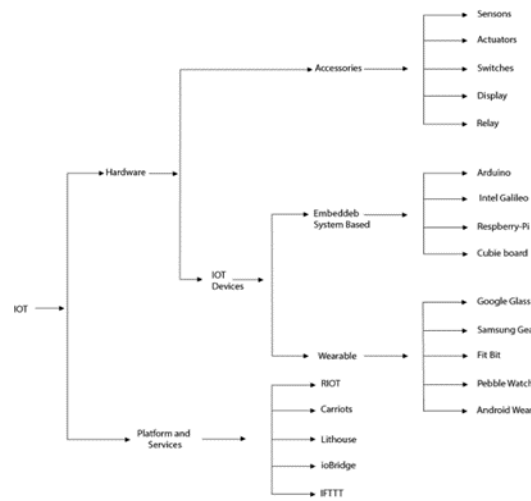


IoT Architecture

There is not such a unique or standard consensus on the Internet of Things (IoT) architecture which is universally defined. The IoT architecture differs from their functional area and their solutions. However, the IoT architecture technology mainly consists of four major components:

Components of IoT Architecture

- o Sensors/Devices
- o Gateways and Networks
- o Cloud/Management Service Layer
- o Application Layer



IoT Devices and Technologies

IoT Data Link Communication Protocol

The IoT Data Link communication protocol provides service to the Network Layer. There are various protocols and standard technologies specified by the different organization for data link protocols.

Bluetooth

Bluetooth is a short-range wireless communication network over a radio frequency. Bluetooth is mostly integrated into smartphones and mobile devices. The Bluetooth communication network works within 2.4 ISM band frequencies with data rate up to 3Mbps.

2. Firefly Optimization

Idealize some of the flashing characteristics of fireflies so as to develop firefly-inspired algorithms. For simplicity in describing our new Firefly Algorithm (FA), we now use the following three idealized rules: 1) all fireflies are unisex so that one firefly will be attracted to other fireflies regardless of their sex; 2) Attractiveness is proportional to their brightness, thus for any two flashing fireflies, the less brighter one will move towards the brighter one. The attractiveness is proportional to the brightness and they both decrease as their distance increases. If there is no brighter one than a particular firefly, it will move randomly; 3) The brightness of a firefly is affected or determined by the landscape of the objective function. For a maximization problem, the brightness can simply be proportional to the value of the objective function. Other forms of brightness can be defined in a similar way to the fitness function in genetic algorithms.

Firefly Algorithm

Objective function $f(x)$, $x = (x_1, \dots, x_d)^T$

Generate initial population of fireflies x_i ($i = 1, 2, \dots, n$)

Light intensity I_i at x_i is determined by $f(x_i)$

```

Define light absorption coefficient
while (t < MaxGeneration)
  for i = 1 : n all n fireflies
    for j = 1 : i all n fireflies
      if ( $I_j > I_i$ ), Move firefly i towards j in d-dimension; end if
      Attractiveness varies with distance r via  $\exp[-r]$ 
      Evaluate new solutions and update light intensity
    end for j
  end for i
  Rank the fireflies and find the current best
end while
Postprocess results and visualization
Proposed algorithm
The steps of the proposed algorithm is

```

Input:

1. Sample data X_i from data streaming without label or target (unsupervised learning).
2. Use Firefly algorithm to obtain the optimal D_{thr} value. Output: Shortest path results in C.
- Step 1: Apply Fire fly algorithm to select the best D_{thr} value of ECM according to the input data.
- Step 2: Apply firefly algorithm on the shortest path parameters.

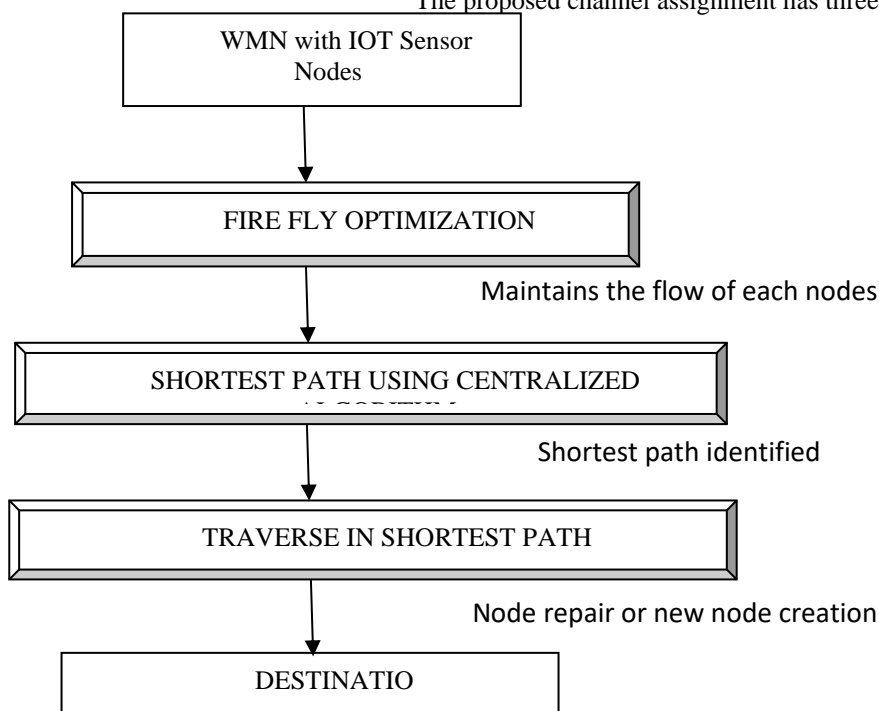
Step 3: Establish the first cluster C_1 by taking the first entered data point X_1 as the first cluster center (C_{c1}) with an initial cluster radius (R_{u1}) value of 0.

Step 4: If all the sample data in the data streaming have been disposed, then, the method is terminated, otherwise, proceed to calculate the distance between current entered data x_i and all the existing cluster centers C_{cj} using the formula $D_{ij} = \|x_i - C_{cj}\|$, $j = 1, 2, \dots, k$; where k stands for the number of existing clusters. $\square x_i \square$

Step 5: If $D_{ij} \leq R_{uj}$, $j = 1, 2, \dots, k$; this indicates that the current input Dim C_{cj} data x_i belongs to an existing cluster C_m , $\square, k(x_i \square \min 1, 2, \square j \square C_{cm}$ and, in this case, $x_i \in C_m$. if no new cluster is created and no existing cluster center or radius is updated, go back to step 2, otherwise, proceed to the next step Step 6: Determine the sum of D_{ij} of the current input data x_i and all existing cluster centers C_{cj} and the corresponding cluster radius R_{uj} , that is, $S_{ij} = D_{ij} + R_{uj}$, $j = 1, 2, \dots, k$. Select a cluster center C_a (the corresponding cluster center is C_{ca} and the radius is R_{ua}) and make it meet $S_{ia} = D_{ia} + R_{ua} = \min(S_{ij})$, $j = 1, 2, \dots, k$. Step7: If $S_{ia} > 2 \times D_{thr}$, then, x_i does not belong to any existing cluster. Employ the method in Step 1 to create a new cluster, then, go back to Step 2. Step8: If $S_{ia} \leq 2 \times D_{thr}$, then $x_i \in C_a$ and C_a is updated by removing its C_{ca} and adding its R_{ua} . The new cluster radius $R_{unewa} = S_{ia}/2$; remove the new cluster center C_{cnewa} to the ligature of x_i and C_{ca} and make it satisfy the condition $\|C_{cnewa} - x_i\| = R_{unewa}$; then, revert to Step 2.

3. Proposed Model Diagram

The proposed channel assignment has three 3 process.



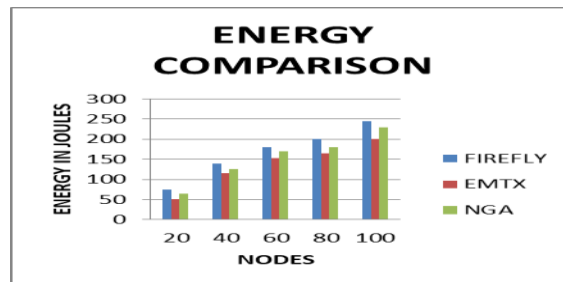
4. Result analysis

The WMN supports large number of nodes but for the implementation of testing we compare 20,40,60, 80 and 100 nodes at different times at the area of 2500m * 2500m We decided to perform the simulation in Ns-2 ver. 2.31. Although Network Simulator 2 (NS2) has been the dominant network simulation tool, it does not provide native support for multi-channel simulation. Modifications are carried out both on TCL and on C++ codes. In TCL level ns-mobile node.tcl and ns-lib.tcl are modified to assemble the multi-channel components and to make TCL scripts to support multi-channel configuration. In C++ level MAC and Physical layer related files are modified to add the cross-layer based channel selection algorithm and to manage the multi-channel node lists.

Parameter	Value
Simulation Time	200
No. of Nodes	Varied Between 20 to 100
Traffic Type	Constant Bit Rate
Pause Time	10 Sec
Topology Area	2500 X 2500
Packet Size	512 bytes
MAC Protocol	IEEE 802.11
Mobility Model	Random Way Point
Wireless Channel	Physical Wireless
Antenna Type	Omni Directional
Queue Type	Drop Tail

Table 3.1 Simulation parameters

Energy level determines the lifetime of a node in the network. The JAYA when compared with EMTX and NGA shows 85 % increase with EMTX and 77% increase with NGA.



5. Conclusion

The proposed technique shows higher stability of energy comparison when compared with previous techniques. The Jaya optimization algorithm can be slightly modified and updated for QOS parameters such as throughput, error rate, jitter, scalability etc..

References

1. Dr G.Revathy, Ms Anju, Parimalam and Imaya Kanishka, "Diabetic Detection Using Irish", International Journal of Scientific Research in Engineering and Management (IJSREM), Volume: 04 Issue: 03 | Mar -2020 ISSN: 2582-3930
2. Dr.G.Revathy, N.S.Kavitha, K.Senthivadivu. D.Sathya and P.Logeshwari, " Girl Child Safety using IoT Sensors and Tabu Search Optimization" International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 volume 8, January 2020.
3. Dr.G.Revathy, Dr.G.Saravanan, Dr.R.Madonna Arieth and Mr.M.Vengateshwaran, "
4. Magnify Qos with Tabu & Link Scheduling In Wmn", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8, Issue-4, November 2019
5. Mrs G.Revathy, "Mounting Eminence of services in wireless mesh networks", International journal of Research and Analytical reviews, sep 2018(ISSN 2349 5138)
6. Mrs.G.Revathy and Dr.K.Selvakumar, " Sustain route by tabu and amplified qos by distributed scheduling in wmn", International Journal of Recent trends in Engineering and research (ISSN: 0973-7391).

7. Mrs.G.Revathy and Dr.K.Selvakumar, “Channel assignment using tabu search in wireless mesh networks”,Wireless personal communication ISSN NO 09296212.
8. Mrs.G.Revathy and Dr.K.Selvakumar,”Increasing quality of services in wireless mesh networks”, International journal of advanced research in computer engineering and technology, vol 7, issue 3, march 2018. ISSN 22781323
9. Mrs.G.Revathy and Dr.K.Selvakumar, “Escalating quality of services with channel assignment and traffic scheduling in wireless mesh networks”, Cluster computing, Jan 2018. ISSN no 13867857.
10. Mrs G.Revathy and Dr.K.Selvakumar, “Route maintenance using tabu search and priority scheduling in wireless mesh networks”, Journal of advanced research in dynamical and control systems, vol 9,sp-6, 2017. ISSN 1943023X