An Optimize Energy Efficient Approach to Analyze the Performance of MAC Layer Protocol for IEEE 802.11 Standards

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Abstract – *I*n this paper studies that the performance based on a duty cycled pooling access approach that activities the transmission opportunity power mode described in the IEEE standards like IEEE 802.11 ac to enhance the quality of the energy efficiency of WLANs depends on the IEEE standards. Evaluation of the performance based on duty cycle polling based admittance procedure that deals with the Transmission Opportunity energy save mode which is well defined in IEEE 802.11ac standard to increase the efficiency in terms of energy in Local Area Networks which is totally rely on the IEEE 802.11. The evaluation of the network in terms of the performance by considering significant parameters such as load of the traffic, data rate, and numerous stations in the network and their energy consumption is one of the main problems in the wireless networks. The normal knowledge behind the research approach, named MAC Layer Protocol with PSO optimization and Green Poll, is configure free sessions, based-on polling with stations, during which wireless beacons could save the energy by turning off their radio transceivers after modifying data with the access point. The green polling method is defined that to update the status in each iterations. The wireless networks which must be optimize to have low network load and high packet deliveries with increase of the number of stations. If the load increases then we will perform the optimization procedure using swarm optimization and evaluate the performance in terms of saturation energies to check the robustness of the system in terms of the energy efficiency.

Keywords – Wireless Networks, MAC layer Protocol, PSO (Particle Swarm Optimization) and Green Poling method.

I. INTRODUCTION

In few years, the smart grid had gained worldwide attention for its potential to address the challenges in the new power-grid, i.e., maximum load requirements, speedily components, failure occur and renew energy sources. Information and communication technologies play critical roles in the smart system. WC (Wireless Communications) gives various unique characteristics to utilities. In illustrations, wireless sensor networks could accommodate situation considering applications due to their capacity of work in extended environment situations. It could be world-wide application to the smart grid adding power-delivery, generation and utilization etc. In the wireless network support flexible addition and device was deleted and optimized the installation costs [1].

In some years, main research work related to the MAC and Physical Layer of IEEE 802.11 ac standards for WLANs were concerned on enhancing accuracy (Throughput), end to end delay, attaining some QoS in an otherwise best effort technology. Although, the currently energy-efficiency in Wireless Local Area Networks had developed a main design aim , being recently a research area, due to the world wide spread of device requirement with wireless local area network designs like smartphones[2].

IEEE 802.11 ac standard defines those two modes in power management for objection devices that operate in wireless local area network. It referred to stations in the standards [3].

(i) Active Mode defines that the stations retain their wireless transceivers always active mode, being ready to either transmit data and energy consuming important amounts of efficient energy.
(ii) Power saver mode, the stations enter a sleep mode, wherein their wireless transceivers are switched off. [4]

Therefore, minimizing the energy consumption of a WLAN interface is an important design issue for mobile devices. The energy consumption (in Joules) of a WLAN interface is determined by the power (in Watts) consumed by a WLAN interface in the transmitting, receiving, or doze states, and how long (in hours) the WLAN interface operates in these states. Solutions either reduce the power consumption of a WLAN interface or minimize the time that the WLAN interface operates in power consuming states such as receiving and transmitting. Previous studies propose hardware approaches to reduce the power consumption of a WLAN interface, such as separating the voltage and clock domains of a WLAN system-on-chip (SoC) for better power management, using low-power baseband algorithms, and using low-power circuits. A major cause of energy consumption in an infrastructure WLAN is the Access Point (AP) coordinating an access to the shared channel between mobile stations located in the coverage area [5,6].

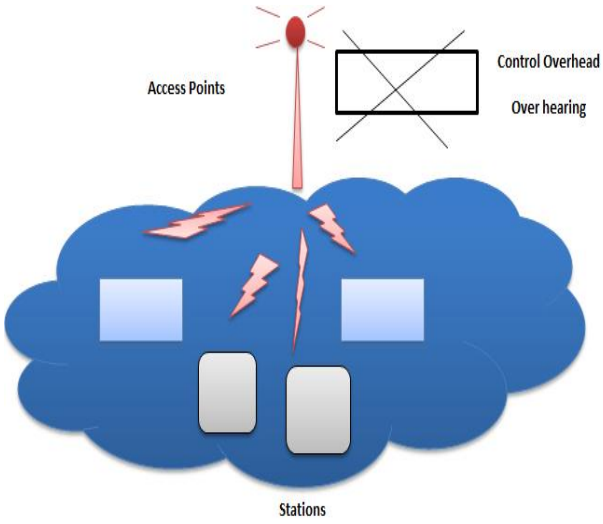

Fig 1. WLAN structure

II. RELATED WORK

Tsao & Huang et al., 2011 [7] provides a survey and an experimental study of the energy consumption issues and energy-efficient technologies of the MAC protocol in IEEE 802.11a WLAN. In recent years, IEEE 802.11a wireless local area networks (WLANs) have been widely deployed, and more and more mobile devices have built-in WLAN interfaces Be that as it may, WLAN utilizes the transporter sense different access with crash evasion (CSMA/CA) medium get to control (MAC) convention, which expends a critical segment of the vitality assets of a cell phone. Hence, minimizing the energy consumption of the WLAN interface in mobile devices has recently attracted considerable interest in both academia and industry. **Palacios et al., 2012 [8]** introduces an improved MAC protocol for infrastructure WLAN, incorporating a novel approach of bidirectional transmissions in the point (PCF) and distributed (DCF) coordination functions of the WLAN MAC standard aiming to increase energy efficiency. Based on this new concept, an access point and a station might exploit each successful established connection to convey bidirectional data. The enhanced MAC solutions are then evaluated through extensive simulations. The results of this work prove the feasibility of the MAC improvements to increase the energy efficiency in terms of Joule per bit, as well as throughput and bandwidth utilization, when compared with the legacy scheme. **Hsieh et al., 2009 [9]** proposed an energy-efficient multi-polling mechanism which combines power management strategy with a low overhead Medium Access Control (MAC) protocol. The main idea is to put STAs into the Doze state and determine a suitable wake-up time schedule to statistically achieve desirable guarantee of bandwidth utilization. From both analysis and simulation results, they found that, compared with the original ordered-contention multi-polling scheme, their proposal mechanism saves up to 80% of energy for a network consisting of 20 polled STAs with 5% loss of system bandwidth utilization as tradeoff. The significant saving of energy is a consequence of alleviating the overhearing problem with well scheduled wake-up times for STAs. **Palacios et al., 2015 [10]** proposed an approach, named Green Poll, is to enable contention free periods, based on polling with beacons, during which wireless stations can save energy by turning off their radio transceivers after exchanging data with the access point. The closed expression of energy efficiency of Green Poll is formulated in their work and is used to evaluate the performance of Green Poll considering important parameters like the traffic load, packet length, data rate, and number of stations in the network.

III. MAC PROTOCOL

In this MAC protocol (Medium Access Control) play important role in message end to end delay and communication energy efficiency features. Although, a high efficient energy normally consequences in a delay message. Medium Access Control protocols for low rate and minimum distance requirements could be kinds into contention based, scheduling based and crossbreeds methods[11].

(i) In contention based MAC protocols, sensors contend to obtain station for arbitrary access, which might consequence in un-predictable interval times arising from collisions.
(ii) The max MAC protocol utilizes included alive case to attain a minimum delay and maximum throughput according to the sensing packets.[12]
(iii) The QoS MAC protocol is implemented for smart grid division monitoring.

MAC protocol, performance responding to the time applications of the smart grid application and the network situation. However, various protocols based on contention could mitigate delays, it remains problem to eliminate the effect produced by collisions.

IV. METHODOLOGY IN PROPOSED WORK

In this section, we explained the proposed work in optimize the energy efficient approach to analyse the performance of MAC protocol for IEEE 802.11 standards. To study the IEEE 802.11e based standard protocols and their evaluation in terms of energy efficiency. To implement the polling based energy efficient MAC layer protocol for performance evaluation. To implement the optimize approach to reduce the packet loads, increase data rates and high packet deliveries. Compare the proposed performance approach with the base paper approach to check the robustness of the system.

Steps defined:

Step I. Firstly we will initialize the specifications like number of stations, generation of data frame and execution times.

Step II. Then we will perform deployment of nodes, access points, quality stations for the transmission of packets.
Step III. Then we will perform the clear to send signals transmission between the number of stations and access points. We will obtain the active stations and perform the transmission of packets through active stations. Then we will evaluate the total transmission times in both directions (bi-directions).
Step IV. Then we will evaluate the energies like transmission energies, receiving energies, idle energies.
Step V. If the load increases then we will perform the optimization procedure using swarm optimization and evaluate the performance in terms of saturation energies to check the robustness of the system in terms of the energy efficiency.

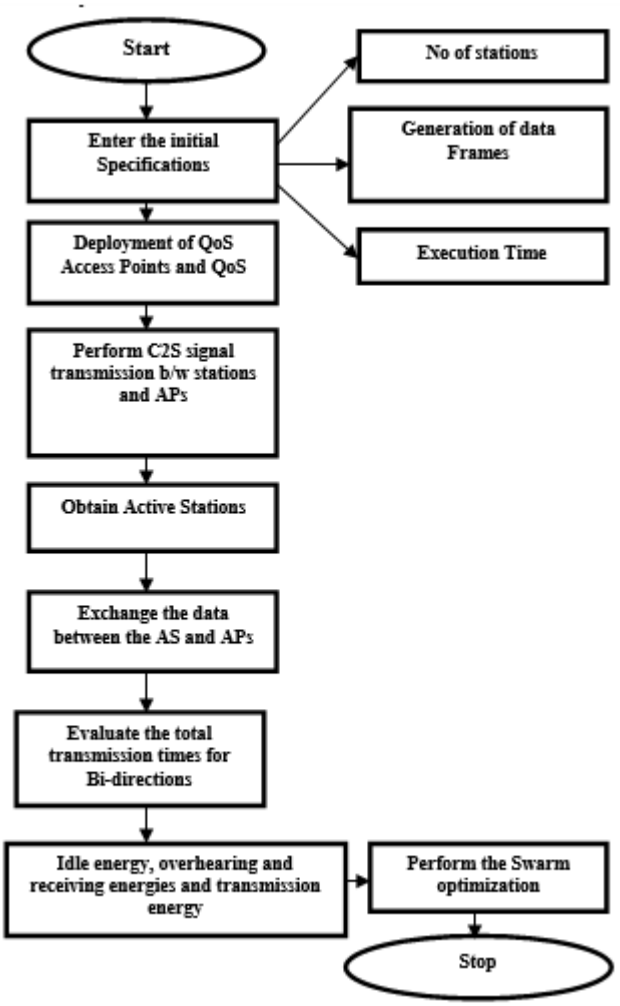

Fig 2. Proposed Flow chart

V. RESULT DISCUSSION

In this section, we explained the result identifies based on particle swarm optimization approach. We work on the simulation tool used in MATLAB 2016a. The deployment of the quality stations and access points which are deployed in the network area of 1000m in length and 1000m in width. The active stations an id which is given in the message box and through which the communication will take place with the access points.

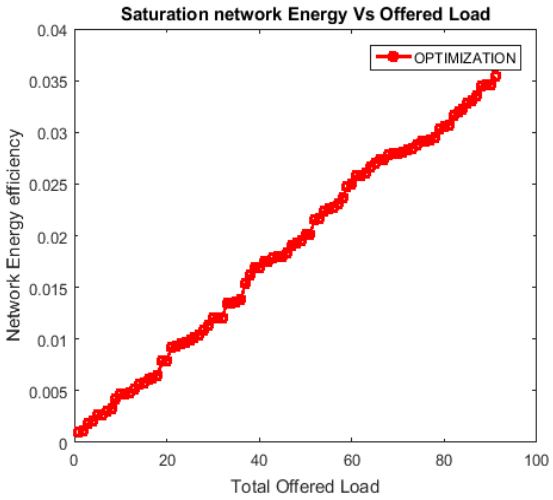

Fig 3. Saturation Energy Efficiency vs offered Load

The above figure shows the Network energy efficiency with respect to the Network load using swarm optimization. It is noticed that the energy is consuming less as the Network load increases than the base approach.

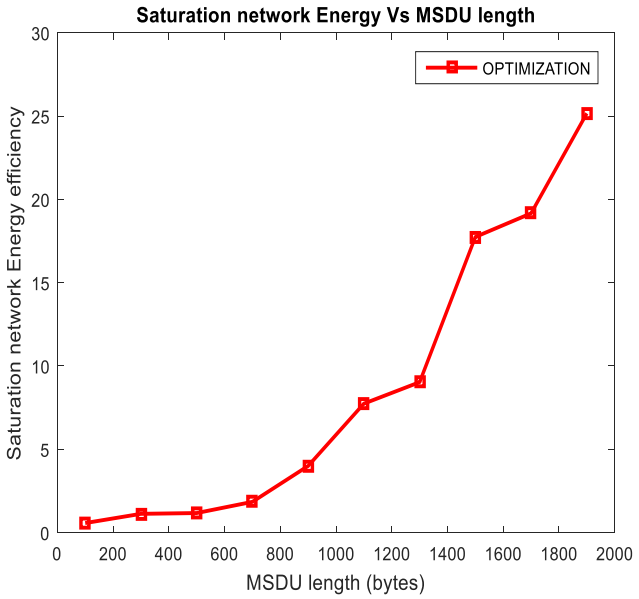

Fig 4. Saturation Energy Efficiency vs MSDU length (optimization)

The above figure shows the Network energy efficiency with respect to the MSDU (Mac Service data unit) length using swarm optimization. It is noticed that the energy is consuming less as the MSDU length increases than the base approach.

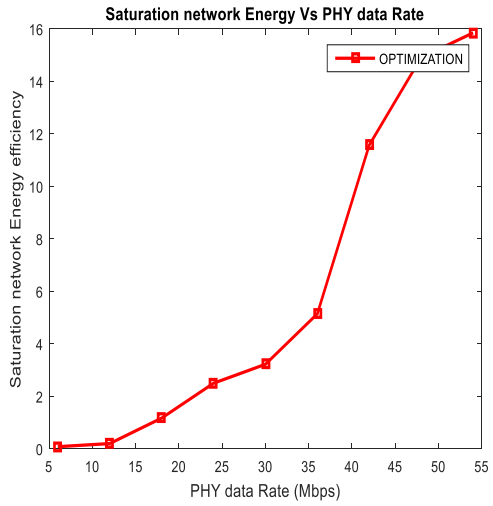

Fig 5. Saturation energy efficiency vs PHY data rate (optimization)

The above figure shows the Network energy efficiency with respect to the PHY layer and shows that it is consuming 16 (Mb/J). A PHY layer helps to connect a link layer method with the physical medium like an optical fiber and shows that the proposed approach is able to achieve less energy consumption than the base approach which is green poll process.

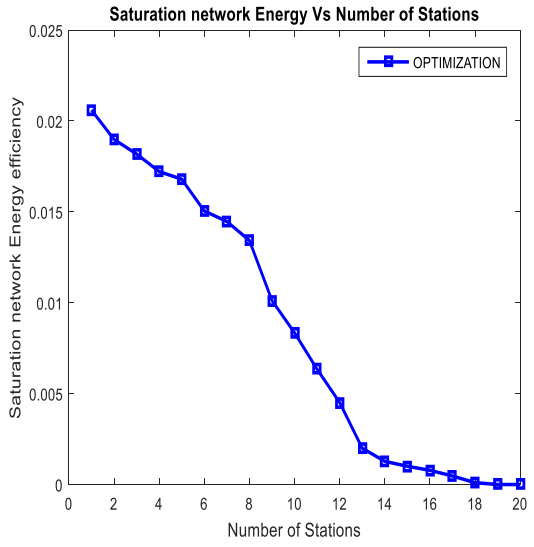

Fig 6. Saturation network energy vs No. of stations (Optimization)

The above figure shows the proposed energy efficiency with respect to the number of stations in which the energy consumption is decreasing as the number of stations increases.

Table 1. Comparison between proposed (PSO) and existing work (Green Poll)

Parameters	**Base** (Mb/J)	**Proposed** (Mb/J)
Saturation Energy wrt Network load	37	26
Saturation Energy wrt MSDU length	6.5	0.040
Saturation Energy wrt PHY layer	24	16
Saturation Energy wrt number of stations	0.007	0.002

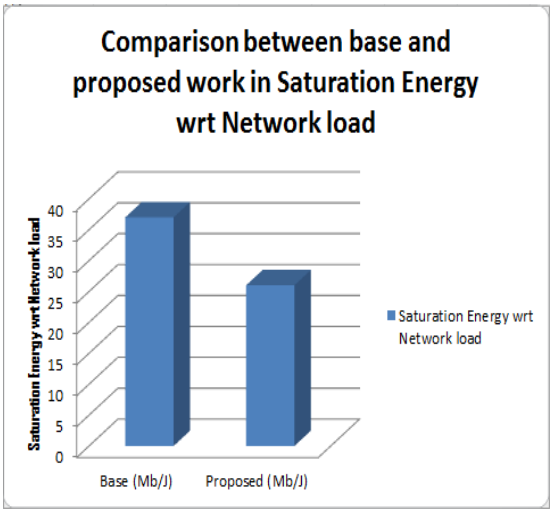

Fig 7. Comparison between existing and proposed work in Saturation Energy W.r.t Network Loads

The above figure shows the comparison between the saturation network energy with respect to the MSDU length and shows that the proposed approach is more energy efficient than the base approach.

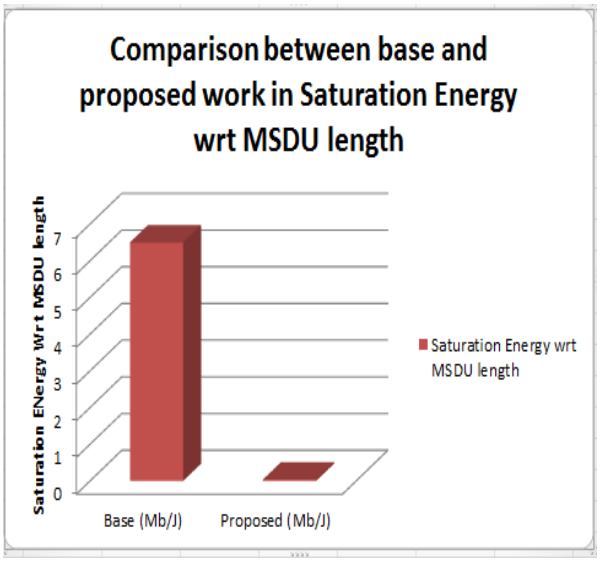

Fig 8. Comparison between Proposed and existing work in Saturation energy w.r.t MSDU length

The above figure shows the comparison between the saturation network energy with respect to the load and shows that the proposed approach is more energy efficient than the base approach. The load must be balanced for high packet deliveries and less error probabilities.

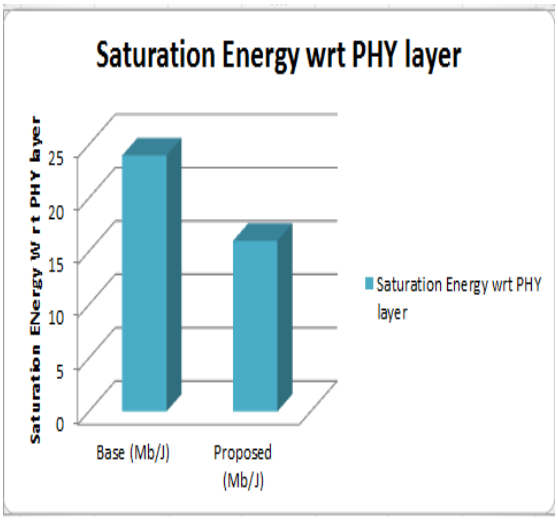

Fig 9. Comparison between base and proposed work in saturation Energy w.r.t PHY layer

The above figure shows the comparison between the saturation network energy with respect to the PHY data rate and shows that the proposed approach is more energy efficient than the base approach in link failures and dropping packet probabilities.

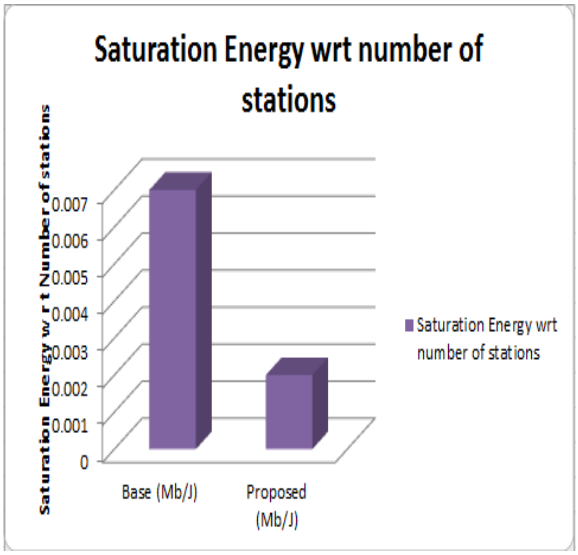

Fig 10. Comparison between Base and Proposed In saturation Energy w.r.t No. of stations

The above figure shows the comparison between the saturation network energy with respect to the number of stations and shows that the proposed approach is more energy efficient than the base approach in terms of increasing number of stations. As the station increases the network will become more dense and interference increases.

VI. CONCLUSION AND FUTURE SCOPE

In this research work concluded to reduce the energy efficiency with swarm optimization approach. In existing work used in Green polling methods status update the every iteration. The normal knowledge behind the research approach, named MAC Layer Protocol with PSO optimization and Green Poll, is configure free sessions, based-on polling with stations, during which wireless beacons could save the energy by turning off their radio transceivers after modifying data with the access point. The modifications done by can help improve the energy efficiency of the 802.11a MAC Layer protocol, with minimum impact on channel utilization and packet transmission delays. Be that as it may, the execution of the proposed swarm algorithm with MAC Layer protocol convention ought to be deliberately broke down within the sight of channel mistakes, and give the required changes. We work on swarm optimization with MAC layer protocol the multi-rate capability of the stations which can increase the throughput gain and energy saving per bit. In order to validate the high energy efficiency of MAC LAYER protocol with SWARM methods in a more realistic environment, on-going work is aimed at implementing swarm (PSO) algorithm in programmable wireless platforms.

In Future work, it will implement the Hybrid Approach to reduce the overhead in saturation environment in the Wireless Local area Networks. It will be trying to explore the most efficient techniques to resolve the recharging problem of WSN so as to increase the network efficiency.

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Neha Sharma , student of M.tech (CSE) in Department of Computer Science,Punjabi University Patiala carrying out her research work under the guidance of the Dr. Maninder Singh. Her main research interest is to optimize the energy efficiency approach so that performance of the mac layer can be analyse.

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