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Efficient Enhanced Sleep Awake Scheduling using Fuzzy Logic and Neural Network

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Abstract:** WSN is a distributed network that consists of great amount of sensor nodes and has the capacity of sensing, processing and transmitting the partially processed and required data only. Sensor nodes have a tiny size, low cost but along with it the constraints of sensor node is they have limited memory, power source which is irreplaceable so power conservation should primarily focused by sensor network protocols. Cloud computing is an on interest administration in which shared assets, data, programming and different gadgets are given by the customers prerequisite at explicit time. The proposed model deals with environmental application where detection of forest fire is analyzed by taking parameters such as temperature, humidity, wind speed and time etc. using fuzzy logic. By earlier detection of fire in forest, it helps to prevent huge loss of living organism, infrastructure and property. After detection, the proposed MSA (Modified Sleep Awake) model work is prolonging lifetime of WSN in forest fire application using selective sleep awake approach. Cloud computing exploits the cloud to share and process the sensory data as collected by WSN anytime and anywhere. Sensory data collected from different sensors is decomposed to the base station and is transferred to the cloud gateway, as Cloud provides capacity of storage through which internet users communicate with cloud and access the data from cloud from anywhere at any time. The resource allocation problem is the major problem for a group of cloud user requests. To implement the Efficient Enhanced Sleep Awake Scheduling using Fuzzy logic and Neural Network, MATLAB tool box is used and different parameters are calculated with different input values. The proposed model provides best results when compared to existing work.
***Keywords:** Cloud, FIFO, Internet, WSN, distributed network.*

I. INTRODUCTION

The aim of wireless sensor network comprises reliability, accuracy, easiness of deployment and flexibility. Cloud computing is defined as computing paradigm for hosting and delivering services over the internet. Different academics, firms, IT companies and industry professionals defined cloud computing terms in many different ways. Cloud is large hub where easily virtualized resources (services, application, hardware, and platform) can easily accessible and usable [1-3].

The integration of Wireless Sensor Network (WSN) with Cloud is becoming popular in most of the industry and academics. WSN is bringing attention from past few decades as it used in many geographical area and application. The biggest constraints of WSN are low battery powered and limited processing approaches [4]. WSN is a technology that provides distributed data collection. However, these networks have some limitations. The most important constraint is energy limitations. Although there are many studies in the field of energy efficiency to extend the life of nodes, enough improvement has not been obtained yet. In traditional strategy, the nodes in the cluster sense data and send it to the Cluster Head (CH), if CHs detect redundancy of some data; they remove the duplication and send it to the base station [5]. Existing sleep scheduling algorithms cause an extremely unbalanced energy usage, and due to this, some sensors reduce the overall network's lifetime. The sleep scheduling based on the location of node minimizes the power consumption of WSN [6]. WSN is a distributed network with a large number of distributed, self-directed, low powered, tiny devices called sensor nodes. In many application scenarios, replacement of energy resources might be impossible, and therefore the lifetime of sensor node strongly depends on battery lifetime. To extend the lifetime of wireless sensor network, the design of Energy-Efficient scheduling algorithm is an important factor [7]. Cloud computing (CC) is rising rapidly; an expansive number of clients are pulled in towards cloud administrations for more fulfillments. Distributed computing is most recent developing innovation for expansive scale dispersed processing and parallel registering. Better load adjusting calculation in cloud framework builds the execution and assets use by progressively dispersing work stack among different hubs in the framework [8]. Cloud computing is an interesting era of research, where motivation is to find out the best outcome and productive data security and sharing approach. Load balancing in public impair by way of division of cloud just right geographical position. Load balancing is frequently a strategy of controlling the visitors in a cloud atmosphere [9].

Cloud computing is a computing interpretation which provides convenient way to access resources and in which data can be stored on paid basis. It has become a major component of our life. It provides storage of data at minimal cost.

Resource allocation plays an important role in Cloud Computing, as it optimize the response time on cloud. Cloud Computing become popular as it provide access on paid basics. Thus, assets allocation is necessary. Load Balancing is one of the methods in Cloud Computing which helps in balancing loads as it increase the throughput and minimize the response time [10]. Load balancing has turned out to be significant for productive execution in appropriated conditions. Cloud computing is a developing innovation requesting more administrations and better outcomes.

Cloud computing investigate the challenges in load balancing. Load balancing has been a significant issue for Cloud computing condition. Proficient load balancing plan guarantees productive asset use by giving the assets to cloud on-request of clients' premise. By executing suitable planning criteria, load balancing may organize clients [11]. Both energy-saving and synchronization issues are the paramount concern in wireless sensor networks (WSNs).

Authors proposed a simple and efficient WSN node design based on acoustic positioning applications and present an on-demand sleep/wake scheduling synchronization protocol. Three aspects are already considered in the design: (a) power control; (b) energy efficiency; (c) high synchronization accuracy. The primary goal is to maximize energy saving and to control power supplying according to environments and demands.

Authors established a model of energy consumption and improve it by the ways of power control and on-demand synchronization. The on-demand synchronization protocols are implemented in sensor nodes and evaluated in a test bed. Analysis and simulation were performed that the proposed protocol has significantly reduced the energy consumption [12]. The aid of genetic algorithm and fuzzy theory, present a hybrid job scheduling approach, which consider the load balancing of the system and reduces total execution time and execution cost.

The main goal of the research is to assign the jobs to the resources with considering the VM MIPS and time-span of jobs. The new algorithm assigns the jobs to the resources with considering the job length and resources capacities [13].

II. METHODOLOGY

The proposed model is implemented in the MATLAB. A square region of 100 x 100 m is considered, in which 100 sensors is deployed. After deployment of sensors the region is divided into sub regions. Sub region is selected on the basis of sensing range of the sensor where data of every grouped sensor are almost same. Sensor is sleep and awake on the basis of time using round robin mode.

The time difference is set for sleep and awake of sensors. It is assumed in our simulation that the energy of all sensor nodes is equal and energy of sink node is unlimited.

Cloud computing provides on-demand network access to a shared pool of resources. Cloud computing ensures access to virtualized IT resources that are present at the data center, and are shared by others. The data stored in Cloud are simple to use, and are paid for the usage and can be accessed over the internet.

A. Proposed Modified Sleep Awake (MSA) Algorithm

Input parameters for sleep-awake of sensors for the detection of forest fire are: temperature (Temp), humidity (Hum), wind speed (WS), time (T), output levels - very high (VH), high (H), medium (M), low (L), very low (VL) etc. The steps in proposed algorithms are as follows:

1) *Step 1:* Start
2) *Step 2:* Consider parameters Temperature, Relative Humidity, Wind speed, and Time.
3) *Step 3:* Divide each parameter with three level H (High), M (medium), L (low)
4) *Step 4:* If dataset belongs to level H and M, cloud C sends flag A to base station S, otherwise C sends flag Z to base station S.
5) *Step 5:* Base station S broadcast flags to sensor nodes I. If flag received is A then all sensor nodes will remain awake else all sensor nodes of each sub region will sleep except one in round robin mode.
6) *Step 6:* The process will continue for entire lifetime of WSN

Thus, MSA algorithm define how cloud integrated with base station for performing sleep awake of sensors so that energy consumption will lesser as compared to all time ON sensors.

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III. RESULTS &DISCUSSION

Different problems can be solved using proposed algorithm. The results are discussed as follows:

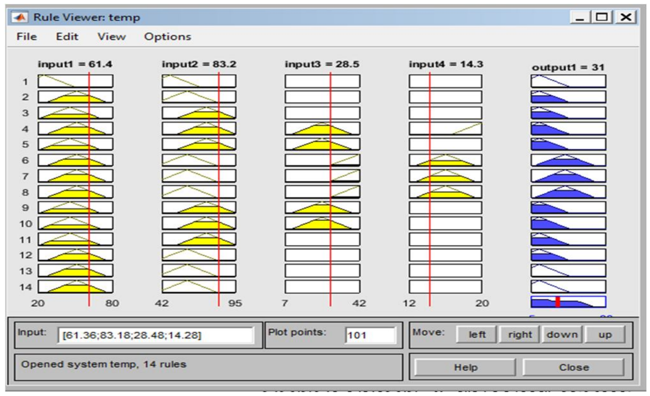

Figure 1: Ruler window for fuzzy

Figure 1 shows a ruler window for fuzzy. In this window, different rules are applied for different parameters like temperature, humidity, wind speed etc. All these are input parameters and output is displayed on basis of these parameters.

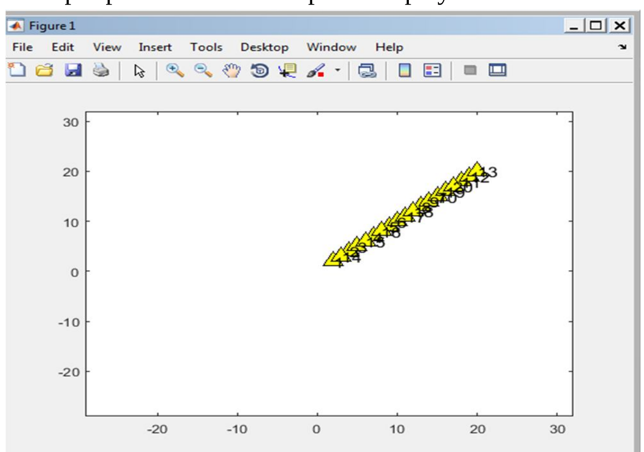

Figure 2: Node formation for cloud

Figure 2 displays the node formation for cloud. In this figure nodes are defined with yellow color and these are overlapped.

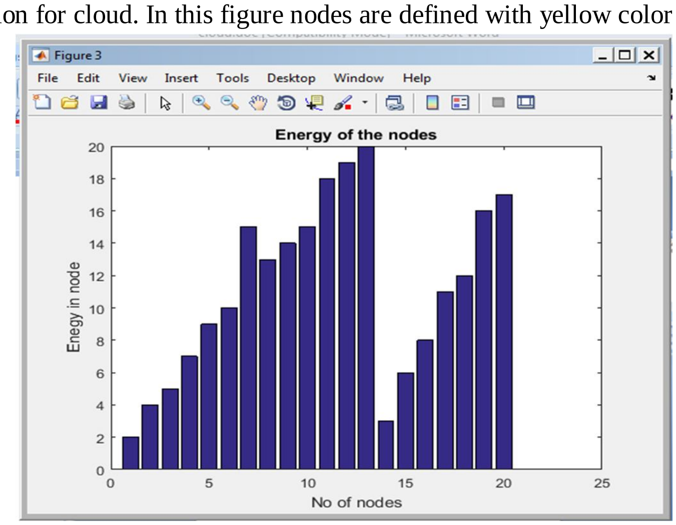

Figure 3: Energy of cloud nodes

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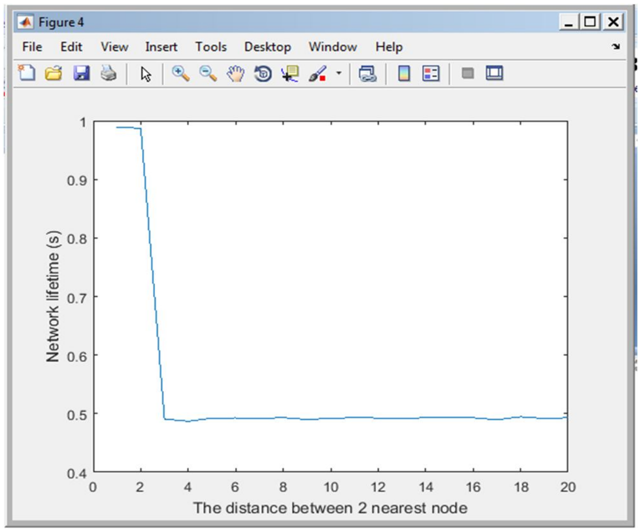

Figure 4: Network life Time of cloud nodes

Figure 3 provides the energy of cloud nodes. In this figure numbers of nodes are represented on x-axis and energy in node is represented on y-axis. Figure 4 displays network life time of cloud nodes along with distance between two nearest nodes. As indicated, firstly network life time is high and then it gets decreased.

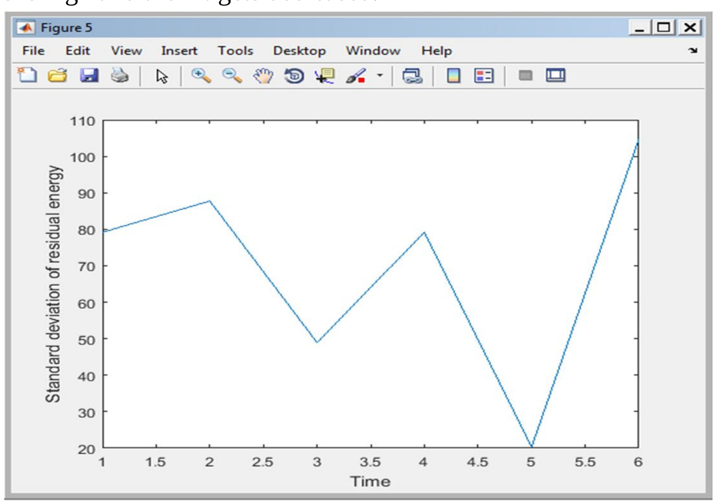

Figure 5: SD of residual energy vs. time

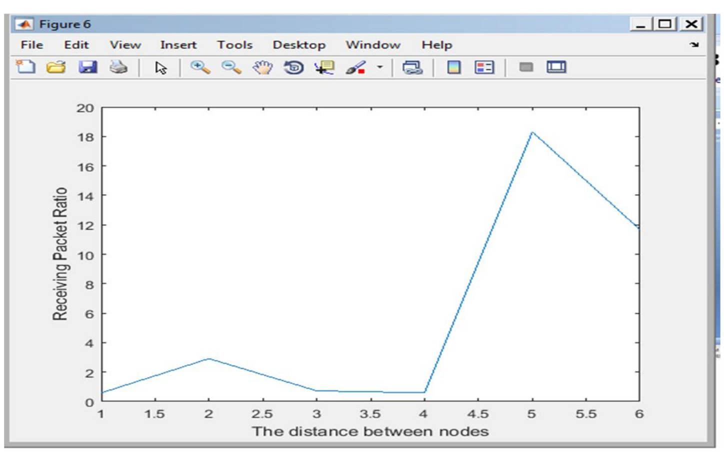

Figure 6: Receiving packet vs. node distance

Figure 5 provides a relationship between the standard deviation of residual energy and time. As indicated, firstly nodes have high energy which then decreased and the increased finally. Figure 6 provides a relationship between receiving packet ratio and node distance. In this figure receiving packet ratio is low and then it is increased and then decreased finally.

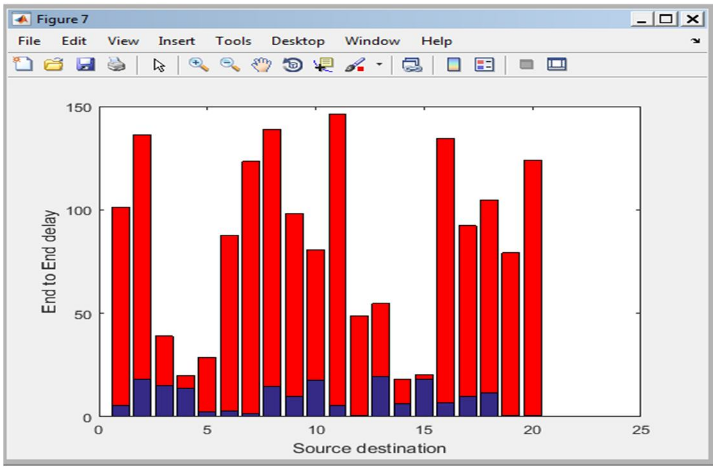

Figure 7: End to end delay vs. source destination

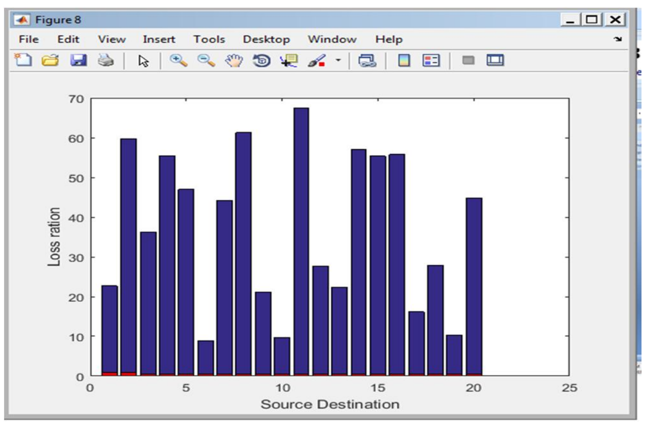

Figure 8: Loss ratio vs. source destination

Figure 7 displays the end to end delay vs. source destination. In this figure red strips indicate the source delays and blue strips indicate the destination delays. Figure 8 displays the loss ratio vs. source destination. Figure 9 displays the throughput vs. source destination. In this figure, blue lines indicate source loss ratio and red lines indicate destination loss ratio.

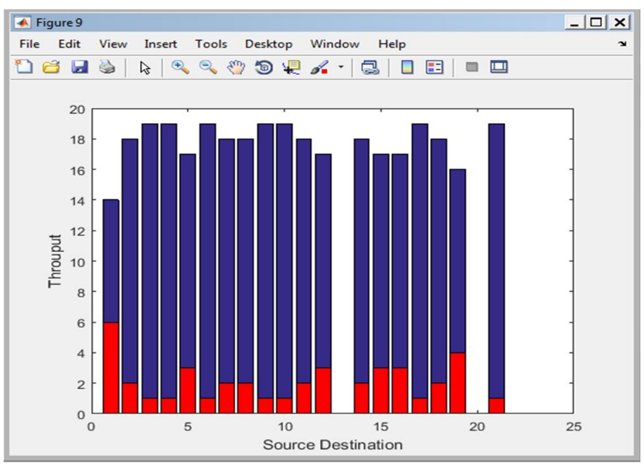

Figure 9: Throughput vs. source destination

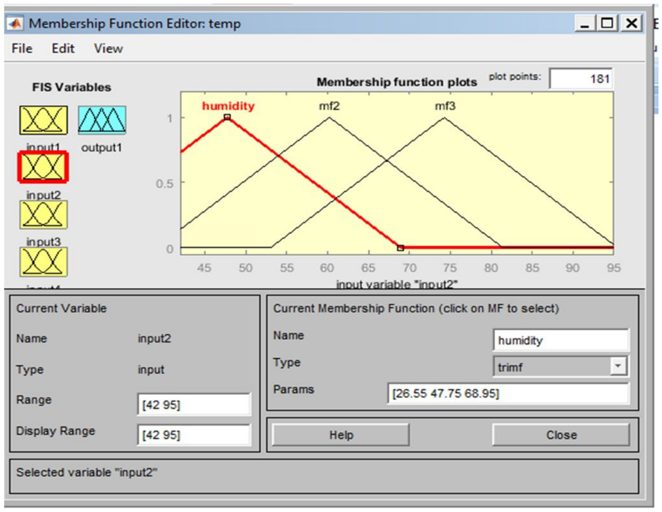

Figure 10: Fuzzy logic window for Humidity

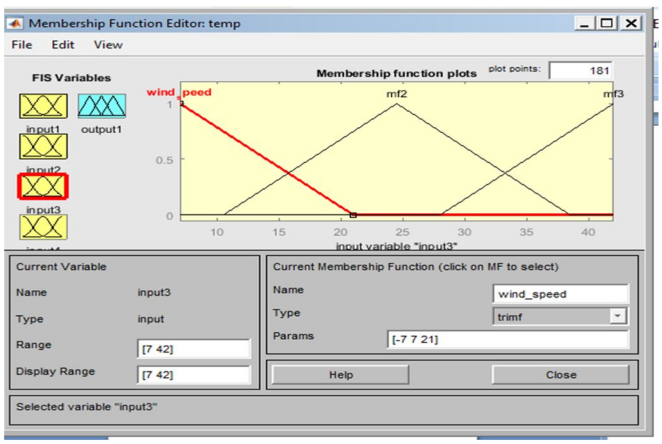

Figure 11: Fuzzy logic window for wind speed

Figure 10 displays a fuzzy logic window for humidity and the figure 11 indicates a fuzzy window for wind speed. Firstly the wind speed is high which then goes low and then it becomes constant.

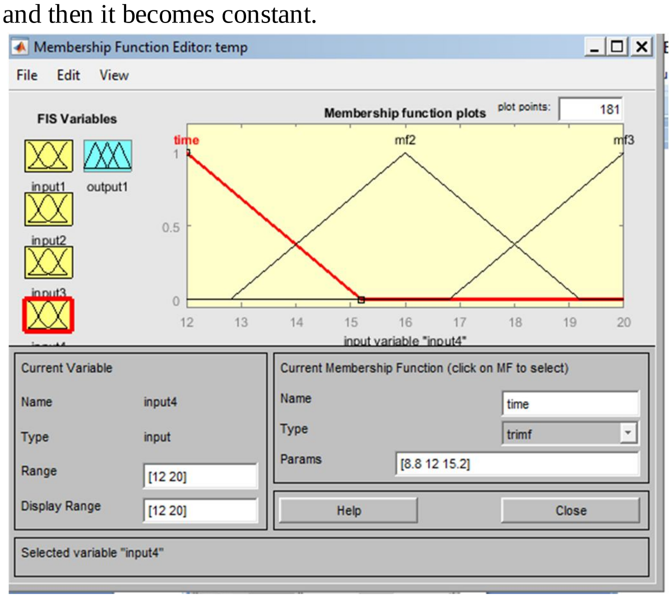

Figure 12: Fuzzy logic window for time

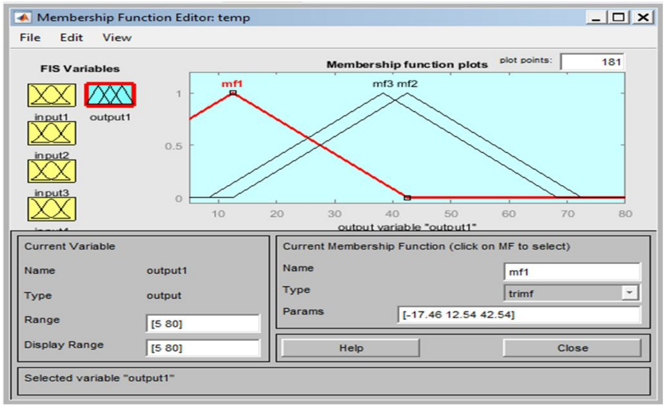

Figure 13: Fuzzy logic window for mf1

The figure 12 indicates the fuzzy window for wind time. First the time is high and then low and then it become constant. Figure 13 displays the fuzzy logic window for membership function.

Table 1: Existing and Proposed Parameter Comparison

Temperature	Humidity	Wind Speed	Time	Existing Output	Proposed Output
20	90	7	18	6.5	8.7
62.2	29.1	7	3.38	82.4	85.6
28.6	90	18.9	8	22.7	26.8
91.6	8.46	12.9	12	85.5	92.6
56.1	42.3	37.1	12.4	60.2	70.5

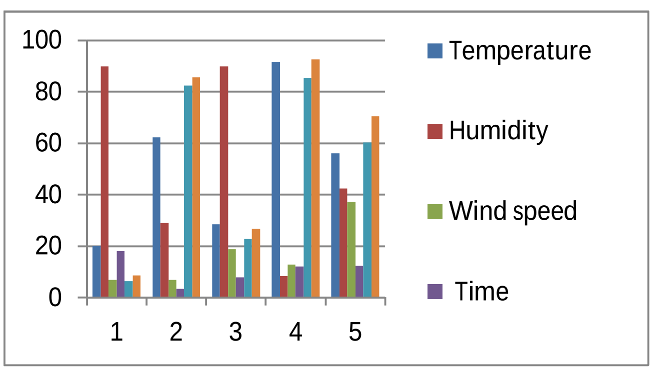

Figure 14: Graphical representation of parameters

Figure 14 specifies the graphical representation of temperature, humidity, wind speed, and time of existing and proposed outputs of different parameters. The values of these parameters are displayed in table 1.

IV. CONCLUSION

The aim of wireless sensor network comprises reliability, accuracy, easiness of deployment and flexibility. Cloud computing is defined as computing paradigm for hosting and delivering services over the internet. Different academics, firms, IT companies and industry professionals defined cloud computing terms in many different ways. Cloud is large hub where easily virtualized resources (services, application, hardware, and platform) can easily accessible and usable. Cloud computing is defined as computing paradigm for hosting and delivering services over the internet. Different academics, firms, IT companies and industry professionals defined cloud computing terms in many different ways.

Cloud is large hub where easily virtualized resources (services, application, hardware, and platform) can easily accessible and usable. Cloud computing help to overcome the limitation of WSN such as limited storage, processing, power life processing. They exploit the cloud to share and process the sensory data as collected by WSN anytime and anywhere. . sensory data collected from different sensors is decomposed to the base station and is transferred to the cloud gateway, as Cloud provides capacity of storage through which internet users communicate with cloud and accessed the data from cloud from anywhere at any time. The resource allocation problem is the major problem for a group of cloud user requests. The scheduling algorithms are termed as NP completeness problems in which FIFO scheduling is used by the master node to distribute resources to the waiting tasks. In this work MATLAB tool box is used and different parameters are calculated with different input values. The proposed result is best as compare to existing work.

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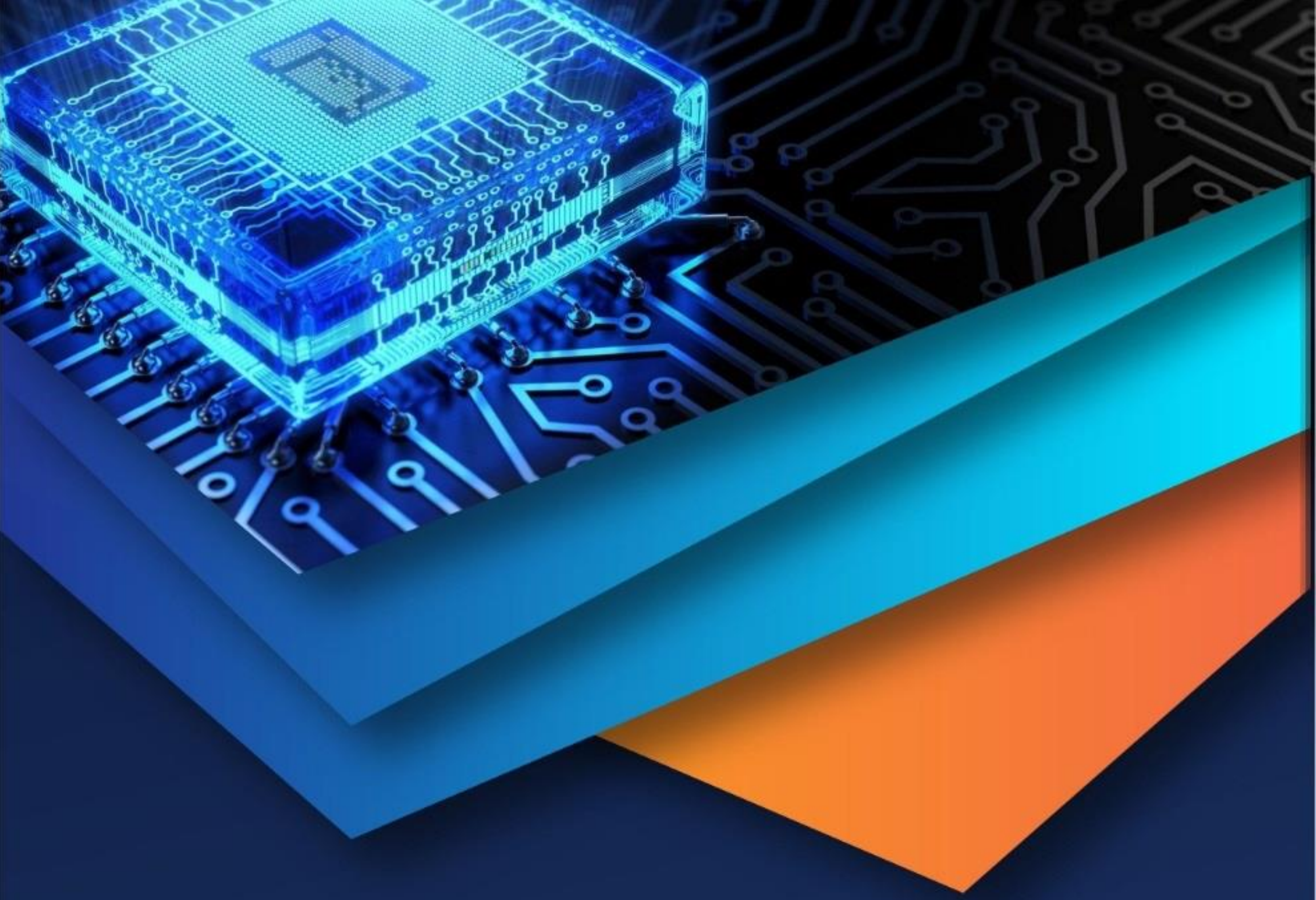

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