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UAGNI an Intelligent Wildfire Monitoring and Assessment System

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Abstract: The most widely recognized risk in woodlands is woodlands fire. They represent a danger to the forest riches as well as to the whole administration to fauna and vegetation truly irritating the bio-differing qualities and the nature and condition of a region. Customary strategies for fire prevention action are not demonstrating powerful and it is presently basic to move towards new techniques that utilization current innovations to forestall out of control fire. The real reason for this disappointment is the piecemeal way to deal with the issue. Both the national concentration and the specialized assets required for supporting a methodical forest fire management program are deficient. Mulling over the genuine way of the issue, it is important to make some significant upgrades in the forest fire management technique. This study discusses a novel way to monitor and assess forest area using ubiquitous computing to handle forest fire. Algorithm proposed in this study for the deployment and activation of the sensor nodes in the forest area is novel in terms of higher security as well as integrity and redeployment in the forest area.

Key words: UAGNI, ubiquitous computing, security, wildfire, intelligent monitoring, assessment system

INTRODUCTION

Jungle flames are as old as the woodlands themselves. Amid summer when there is no rain for a considerable length of time, the forests (Gomes, 2006) end up noticeably covered with dry senescent leaves (Groot and Flannigan, 2014) and twinges which could blast into blazes lighted by the smallest start. Timberland fire causes uneven characters in nature and imperils biodiversity by lessening faunal (Goldammer *et al*., 2009) and botanical riches (Flannigan *et al*., 2009). The rate of woodland flames (Collins *et al*., 2013; Flannigan *et al*., 2013) is on the expansion and more range (Bond *et al*., 2005) is singed every year. This study discusses UAGNI, an intelligent monitoring (Jain and Panda, 2014) and assessment system for forest fire prevention (Groot *et al*., 2006) based on ubiquitous computing. Weiser (1991) is frequently eluded as the father of ubiquitous computing. The vision of ubiquitous computing focuses on seamless interaction between system entities and the smart environment filled with autonomous computing systems. Devices in all forms, sensors every where seamlessly connected to wireless networks to offer computing communication services to the user. Because of this innovation, we can keep track (Demin *et al*., 2014) of everything from remote area utilizing Internet foundation. At the foundation level, UC makes utilization of sensors (Ramachandran *et al*., 2008; Hefeeda and Bagheri, 2007) and installed chips which are embedded in the framework that we require to screen and tag on. RFID (Radio Frequency Identification) based gadgets are traditionally utilized in UC usage.

MATERIALS AND METHODS

Proposed algorithm: Proposed method is capable of sensing temperature. Sensors are deployed to form the dynamic clustered head and reconfiguration of the network. When the temperature exceeds the threshold temperature, cluster head transfer signal to base station. These results in reconfiguration during these sensors are moved to new different location. Base station sends signal to nearest fire station. After cooling the region new sensors will be deployed. Hence, our proposed method gains intelligent system which

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works efficiently during bad weather. Malfunctioning of sensors and damage to the sensors will be prevented.

Algorithmic approach for forest attributes and environmental factor:

- Initialize Wireless Nodes in Forest Area (Wi) [Wi<= n] [n: Max. Deployable Nodes]
- Deploy and configuration of sensor nodes
  - Set Wtemp = mintemp [mintemp <= Wthreshold]
  - If Wtemp >= Wthreshold] go to step 8
  - Else Continue
- DTWi -> In [Initialize Data Transfer]
- Initialize TDglobal [Temperature Detector as Global Object]
- Set and Report TDglobal = Wthreshold
- Investigate Current Temperature of Node
  - If (Wtemp > TDglobal] go to Step 8
  - Else Continue
- FSA j = 0; [Initialize Fire Station Analyzer Object with Zero Records]
- If (Witemp > TDglobal) FSAj = FSAj+1; [Increment FSA for Action]
- If (Iterations = Required Simulation) then Stop
- Else Go to Step 1
- Stop
- End

Implementation of proposed algorithm: The algorithmic approach and model is implemented on MATLAB using Monte Carlo simulation and the following results are fetched on multiple scenarios. The key points and assorted parameters taken and implemented for the analysis of environmental scenario in ubiquitous computing are efficiency, performance, reconfiguration of the network and cost factor.

IoT scenario of forest fire for redeployment of sensor nodes is shown in Fig. a-g. Here, the destroyed nodes are under observation and in redeployment model. The cluster head send the signal to base station if any diversion of temperature exists in the network infrastructure. The environmental factors are measured at regular intervals. The entire scenario is being monitored by the base station and the threshold values are measured at every moment for taking the appropriate action. After receiving the signals from base station, sensor nodes are moving to the safer locations as the temperature has increased to threshold limit. Base station transmits signal to the satellite and helicopters for the actions. Reconfiguration and deployment of the network in IoT scenario for effective communication and performance takes place.

Flowchart of the proposed work: Figure 2 depicts the initial deployment and activation of the RFID Nodes in the Forest Zone for the monitoring and overall observation of the climate factors. Figure 3 depicts the comparison of the temperature and related parameters which can affect the overall scenario of the network and ubiquitous computing implementation. Figure 4 represents the integration of

(a)

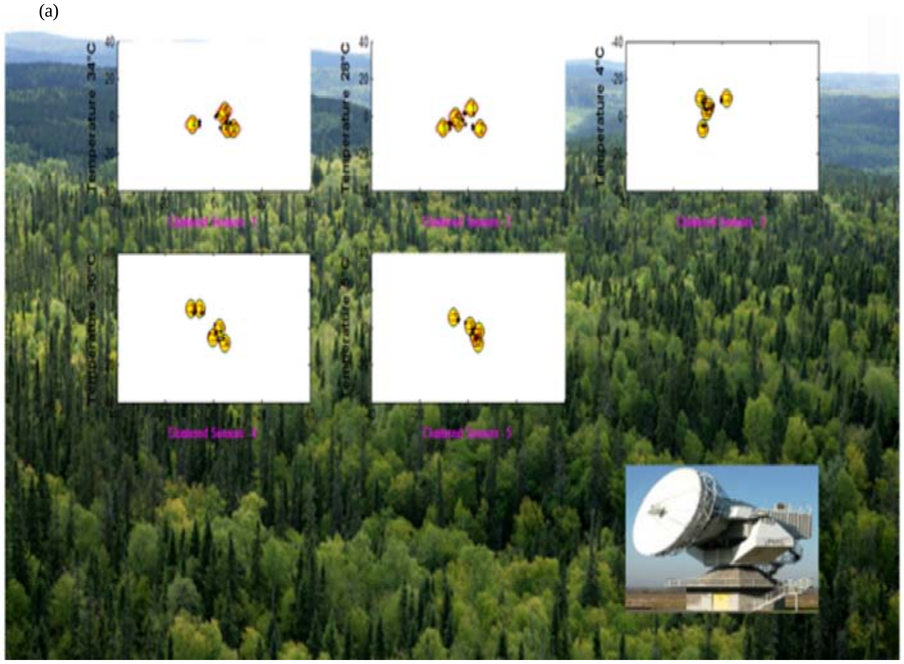
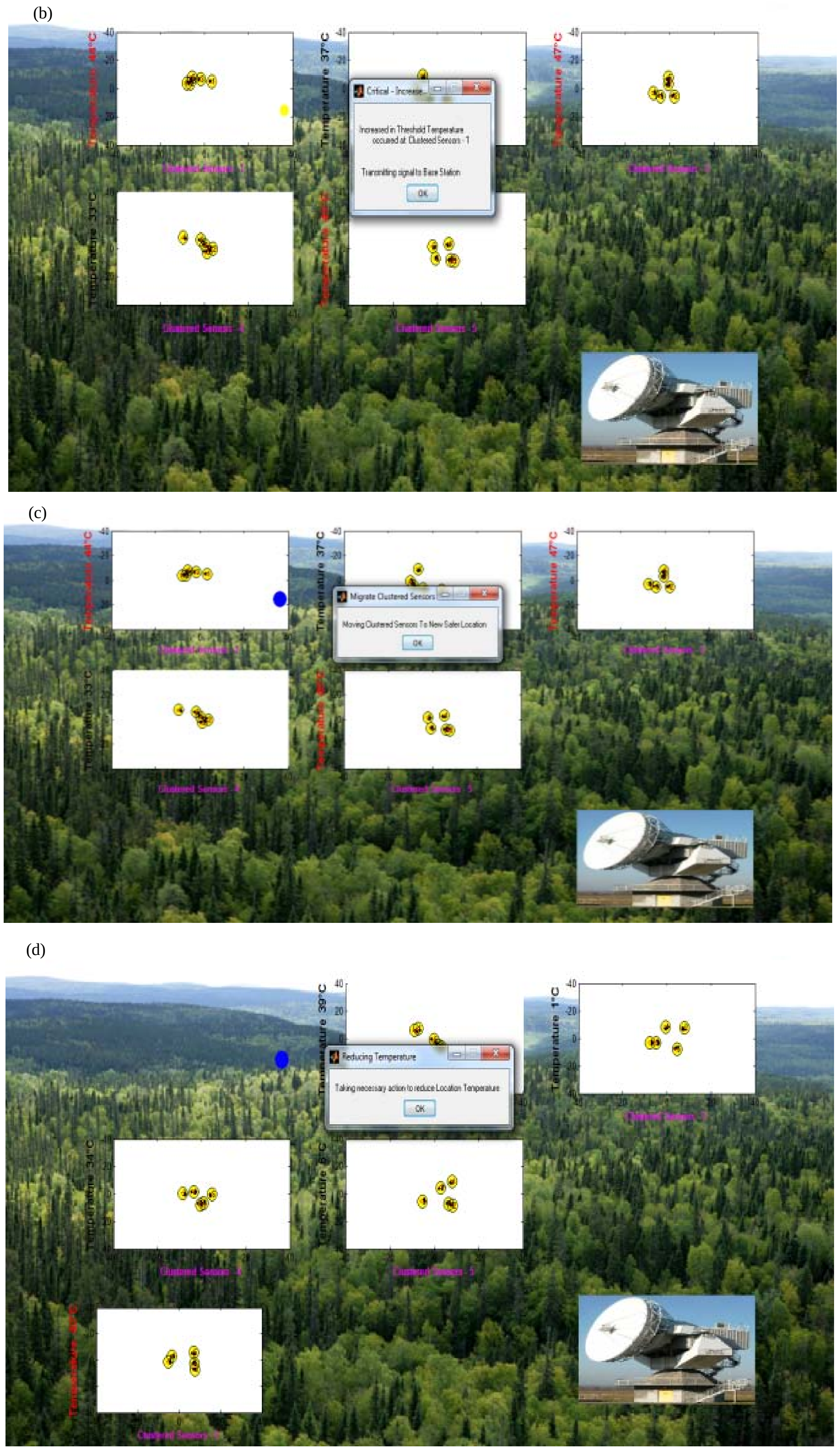


Fig. 1: Continue



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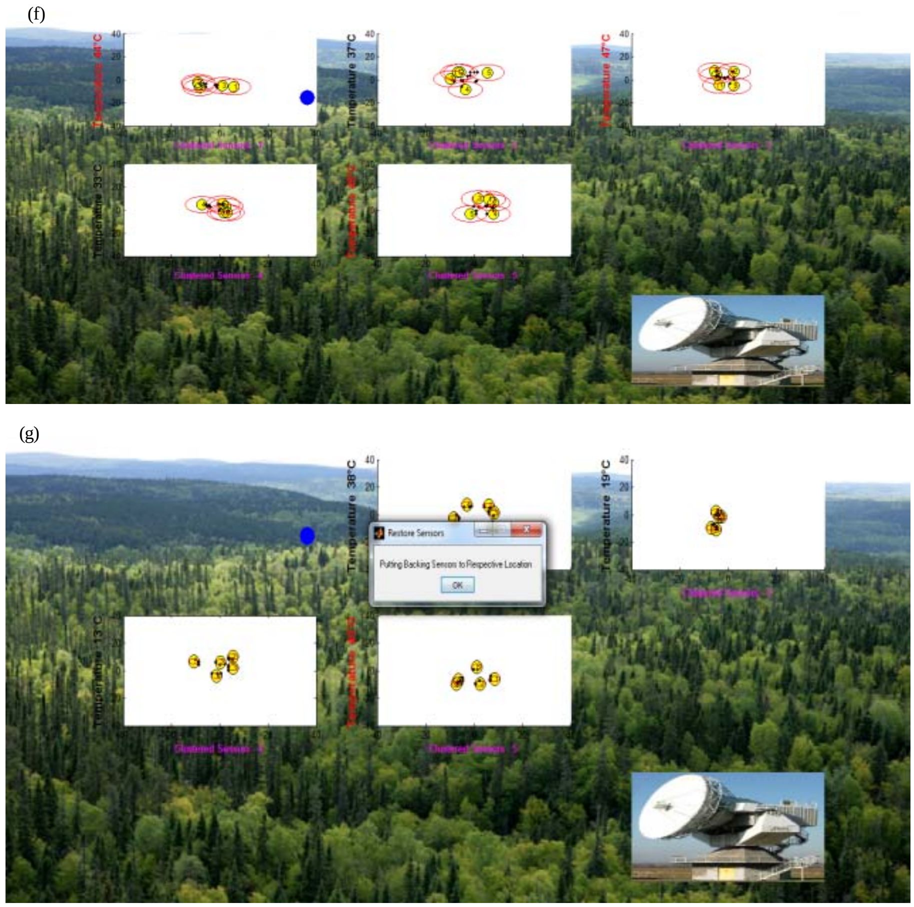


Fig. 1: a) Deploying sensor nodes in the forest zone; b) Cluster Head 1 sending signal to base station; c) Base station sending signal to the sensor nodes; d) Sensor nodes are moving to safer location; e) Base station is taking necessary action to control fire; f) Sensor nodes reestablishing in previous location

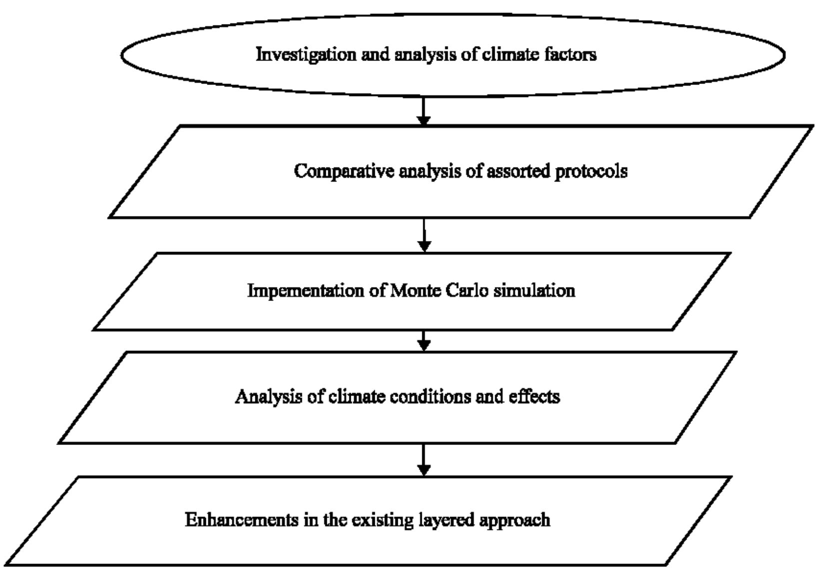
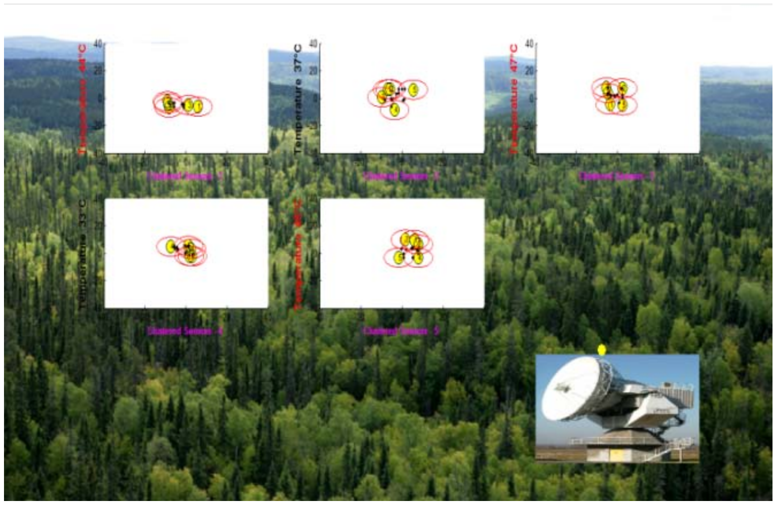
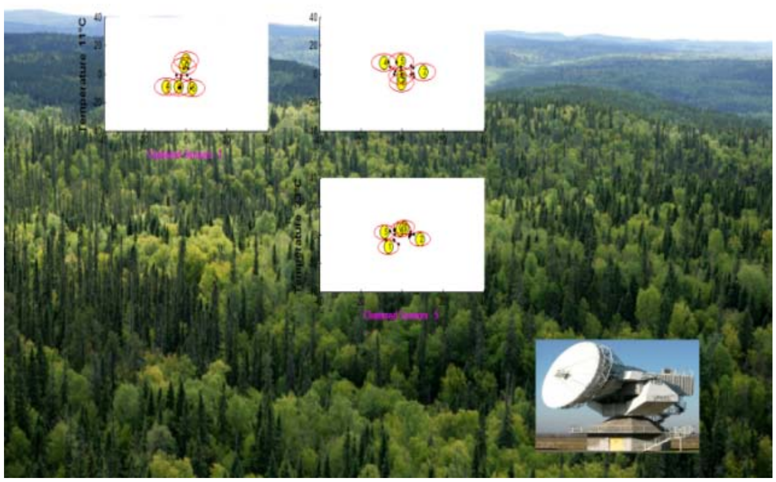


Fig. 2: Flow chart of the proposed work

(a)



(b)



(c)

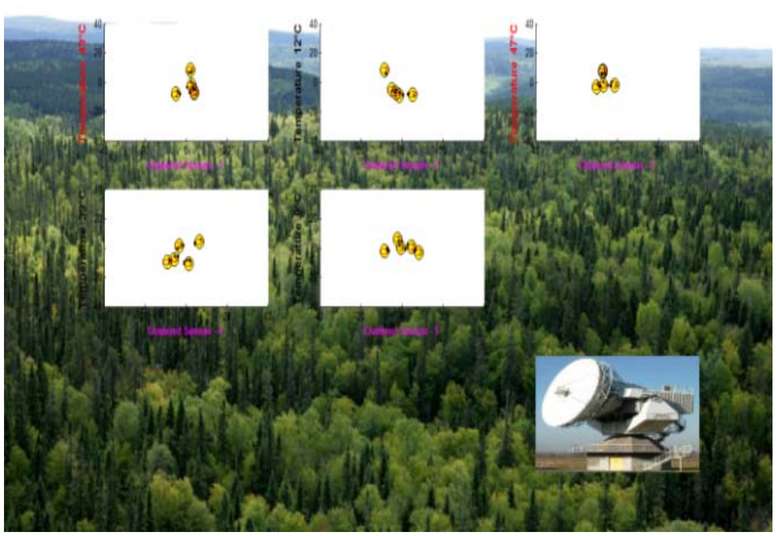


Fig. 3: Continue

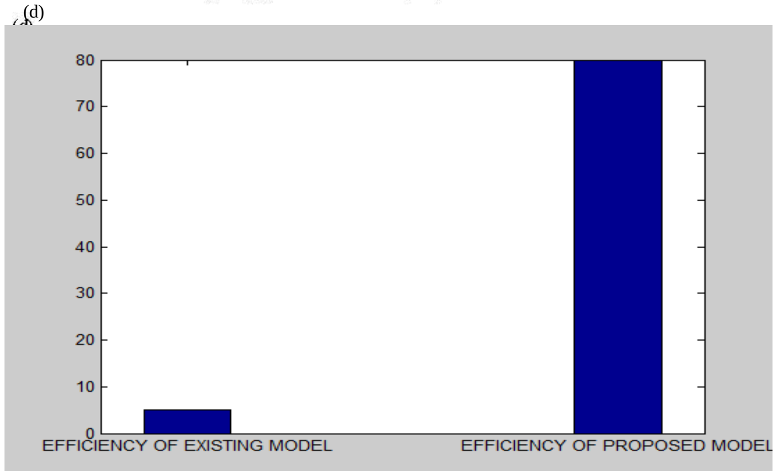


Fig. 3: a) Climate factors analysis; b) Temperature analysis using UC; c) Monte carlo simulation of the nodes and signals; d) Efficiency analysis

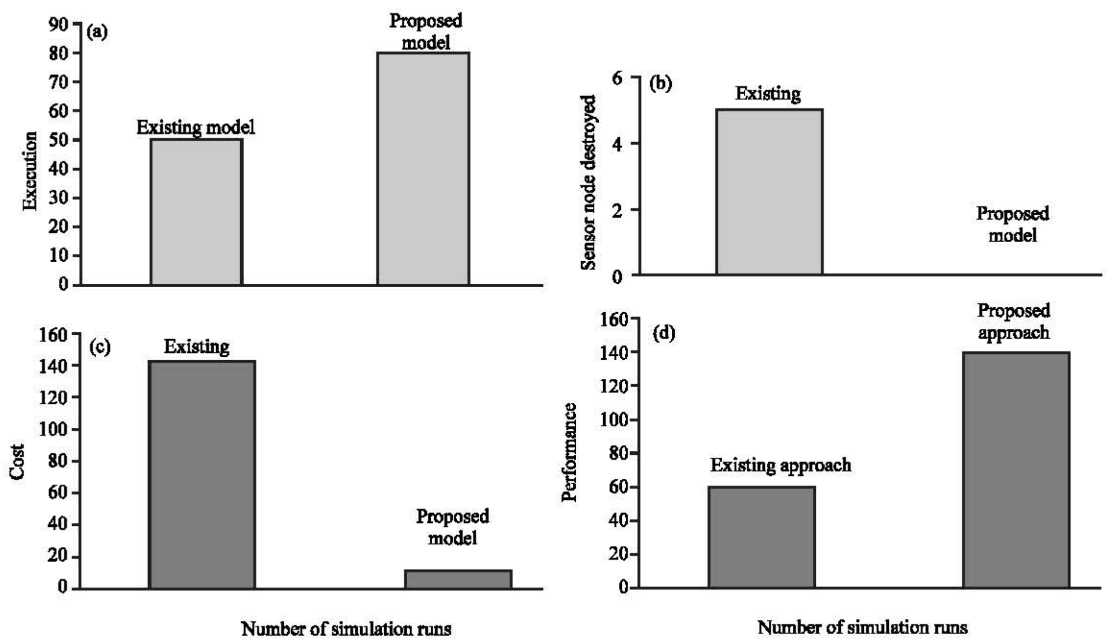


Fig. 4: a): Efficiency comparison; b) Comparison for number of nodes destroyed; c) Comparison in terms of cost; d) Comparison in terms of performance

monte carlo simulation or the deployment of nodes and transmission of the signals. Figure 3 depicts the comparison of the classical and proposed approach in terms of the efficiency.

RESULTS AND DISCUSSION

Figure 4 a depicts that proposed approach is efficient and better than the classical approach. The comparison is done based on the cumulative parameter of the efficiency. Figure 4b and c depict that the number of nodes destroyed and cost parameter of proposed approach is lesser than the classical approach. The comparison is done based on the cumulative parameter of the sensor nodes or RFID destroyed and cost factor. Figure 4d represents that the performance of proposed approach is better than the classical approach. The comparison is done based on the cumulative parameter of the performance.

CONCLUSION

Results prove that our system UAGNI is better in terms of efficiency, performance and cost factor. Our sys tem effectively monitors the results related to the environmental parameters. This ultimately results in preventing the sensors to inactive state. Sensors are not destroyed and huge loss of infrastructure with network damage would be avoided. Proposed model can be enhanced by incorporating alternative soft computing approaches for modeling systems to accomplish better outcomes regarding scalability, efficiency, precision and performance.

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