

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 paper discusses a novel way to monitor and assess forest area using ubiquitous computing to handle forest fire. Algorithm proposed in this paper 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.

Keywords – UAGNI, Ubiquitous Computing, Security, Wildfire, Intelligent Monitoring, Assessment System

I. 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 end up noticeably covered with dry senescent leaves [5] 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 and botanical riches. The rate of woodland flames [3],[4] is on the expansion and more range is singed every year. This paper discusses UAGNI, an intelligent monitoring [2] and assessment system for forest fire prevention based on ubiquitous computing. Mark Weiser [1] 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 everywhere seamlessly connected to wireless networks to offer computing / communication services to the user. Because of this innovation, we can keep track[6] of everything from remote area utilizing Internet foundation. At the foundation level, UC makes utilization of sensors 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. The rest of the paper is organized as follows. Proposed algorithm and its implementation is clarified in segment II. Exploratory outcomes are introduced in segment III. Closing comments are given in segment IV.

II. PROPOSED ALGORITHM

Proposed method is capable of sensing temperature. Sensors are deployed to form the dynamic clustered head and

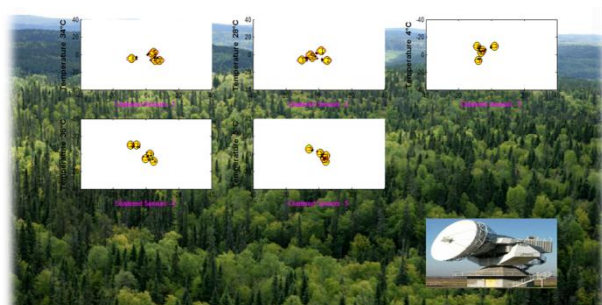
reconfiguration of the network. When the temperature exceeds the threshold temperature, Cluster head transfer signal to base station. These results in reconfiguration during these sensors are moved to new different location. Base station sends signal to nearest fire station. After cooling the region new sensors will be deployed. Hence our proposed method gains intelligent system which works efficiently during bad weather. Malfunctioning of Sensors and damage to the sensors will be prevented.

2.1 Algorithmic Approach for forest attributes and environmental factors

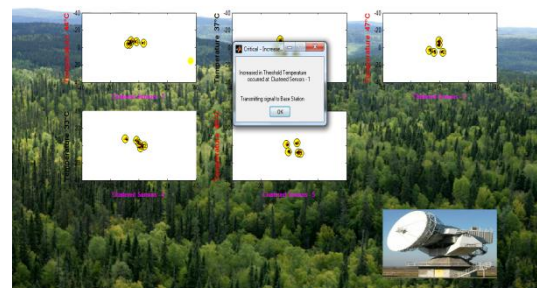
1. Initialize Wireless Nodes in Forest Area (W_i) [$W_i \leq n$] [n : Max. Deployable Nodes]
2. Deploy and Configuration of Sensor Nodes
 - (a) Set $W_{temp} = \text{mintemp}$ [$\text{mintemp} \leq W_{threshold}$]
 - (b) If $W_{temp} \geq W_{threshold}$ go to step 8
 - (c) Else Continue
3. DTWi \rightarrow In [Initialize Data Transfer]
4. Initialize TDglobal [Temperature Detector as Global Object]
5. Set and Report TDglobal = $W_{threshold}$
6. Investigate Current Temperature of Node
 - (a) If ($W_{temp} > TD_{global}$) go to Step 8
 - (b) Else Continue
7. FSA $j = 0$; [Initialize Fire Station Analyzer Object with Zero Records]
8. If ($W_{temp} > TD_{global}$) FSA $_j = \text{FSA}_j + 1$; [Increment FSA for Action]
9. If (Iterations = Required Simulation) then Stop
10. Else Go to Step 1
11. Stop
12. End

2.2 Implementation of Proposed Algorithm

The algorithmic approach and model is implemented on MATLAB 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.



(a)



(b)

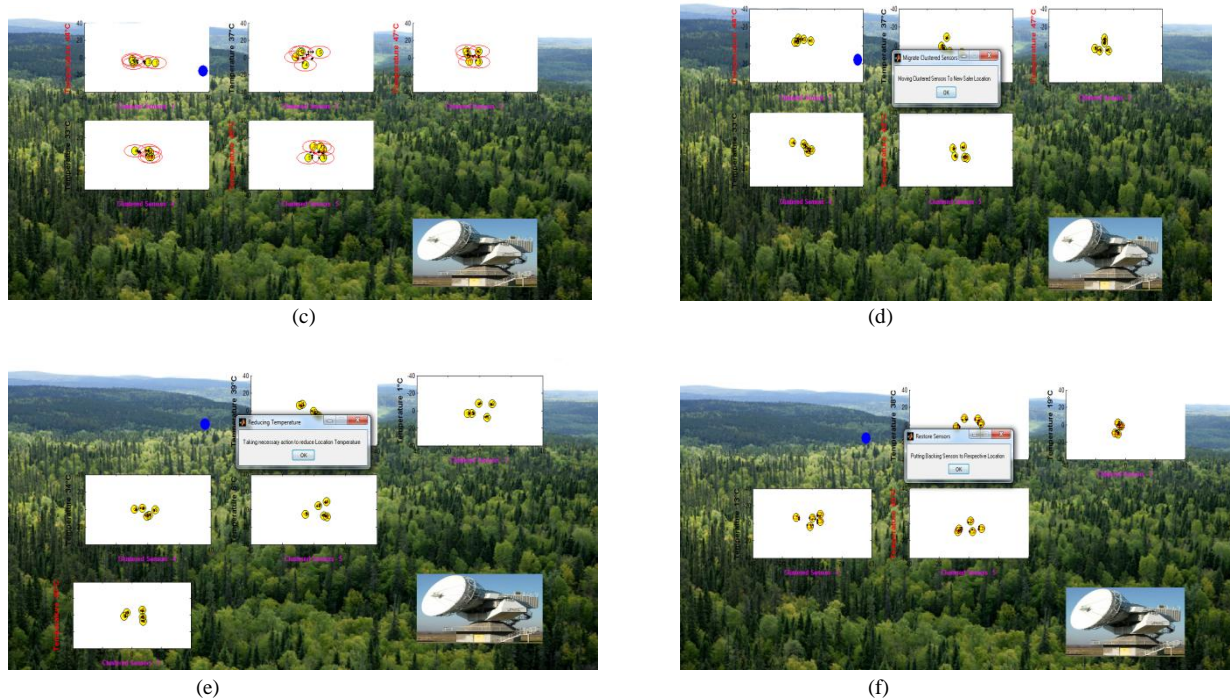


Figure 1. (a) Deploying Sensor Nodes in the Forest Zone (b) Cluster Head 1 sending signal to base station (c) Base station sending signal to the sensor nodes (d) Sensor nodes are moving to safer location (e) Base station is taking necessary action to control fire (f) Sensor nodes reestablishing in previous location

IoT scenario of forest fire for redeployment of sensor nodes is shown in figure 1. 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.

2.3 Flowchart of the Proposed Work

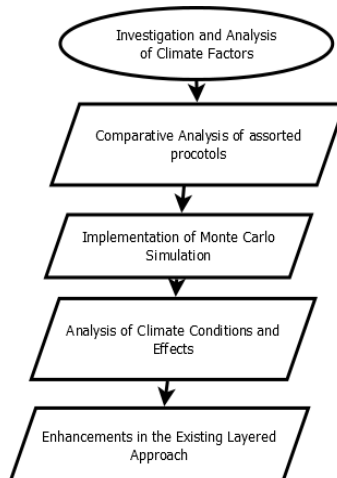


Figure 2. Flowchart of the Proposed Work

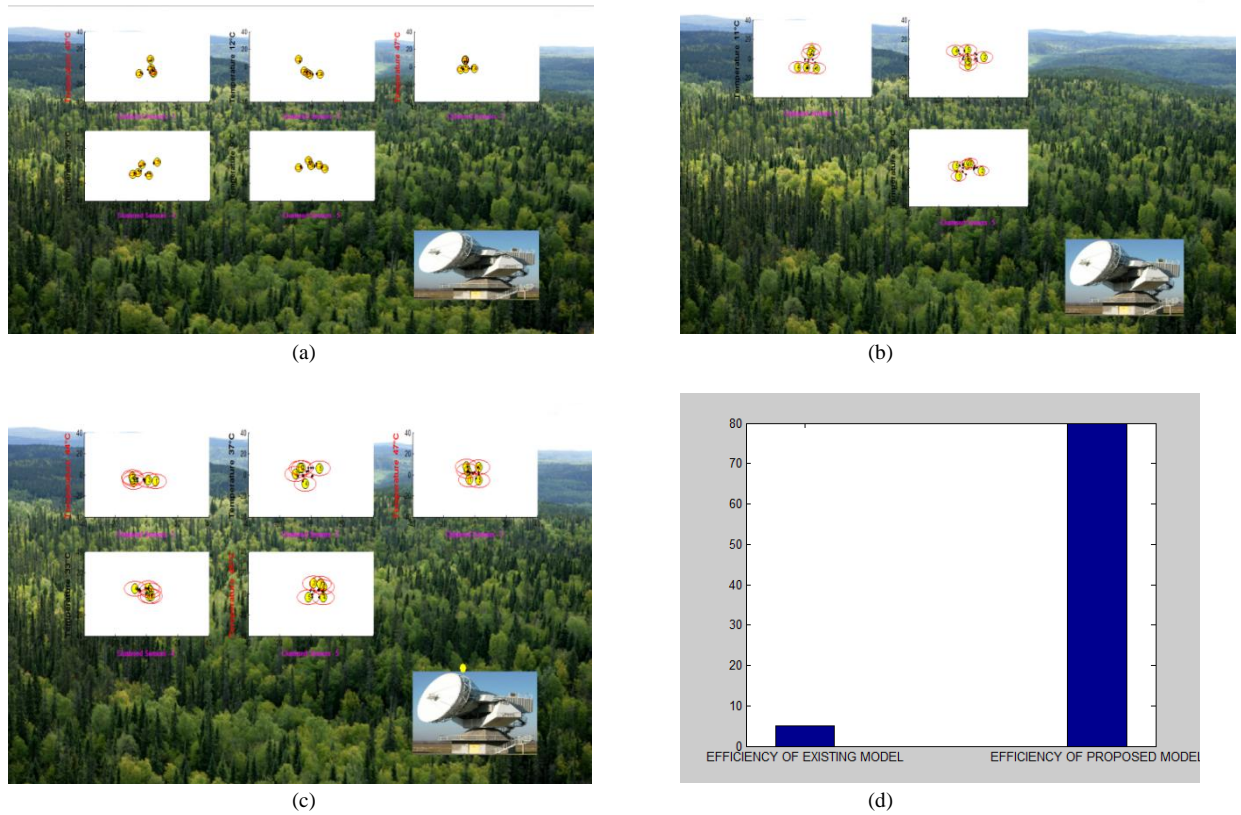
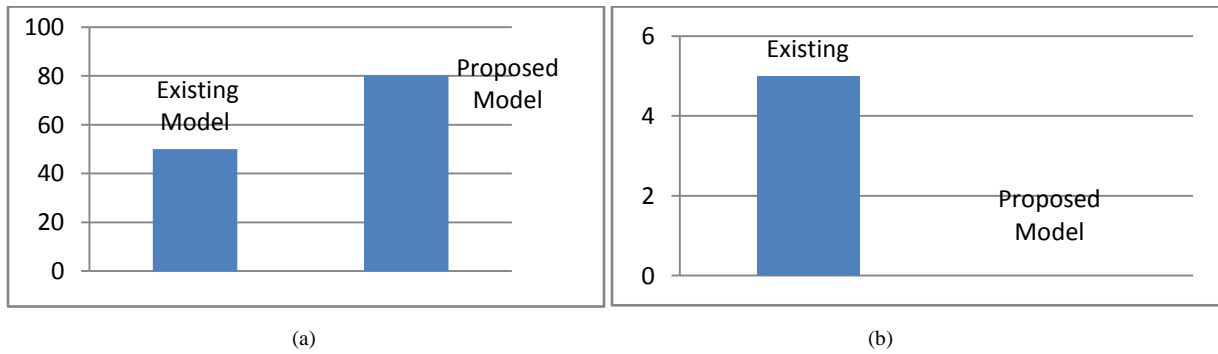


Figure 3. (a) Climate Factors Analysis (b) Temperature Analysis using UC (c) Monte Carlo Simulation of the nodes and signals (d) Efficiency Analysis

Figure 3(a) depicts the initial deployment and activation of the RFID Nodes in the Forest Zone for the monitoring and overall observation of the climate factors. (b) depicts the comparison of the temperature and related parameters which can affect the overall scenario of the network and ubiquitous computing implementation. (c) Represents the integration of monte carlo simulation for the deployment of nodes and transmission of the signals. (d) Depicts the comparison of the classical and proposed approach in terms of the efficiency.

III. RESULTS AND DISCUSSION



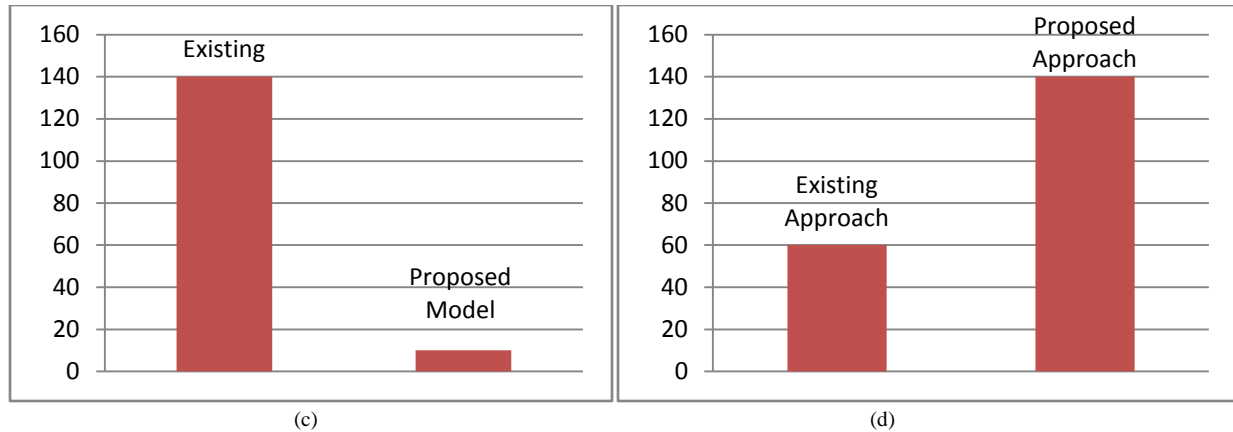


Figure 4. (a) Efficiency comparison (b) Comparison for number of nodes destroyed (c) Comparison in terms of cost (d) Comparison in terms of performance

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 (b), (c) depicts 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 (d) 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.

IV.CONCLUSION

Results prove that our system UAGNI is better in terms of efficiency, performance and cost factor. Our system 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.

REFERENCES

- [1] Weiser, M. "The Computer for the Twenty-First Century". *Scientific American* , 1991, Vol 265, pp 94-104.
- [2] Nitin Jain, S. N. Panda. "Smart Firewall Integrated Intelligent Transportation System for Security in Ubiquitous Computing". *International Journal of Emerging Technology and Advanced Engineering* , 2014, Volume 4 (Issue 1), pp 684-689.
- [3] Collins, Ross D., et al. "Forest fire management to avoid unintended consequences: A case study of Portugal using system dynamics." *Journal of environmental management* 130 (2013): 1-9.
- [4] Flannigan, Mike, et al. "Global wildland fire season severity in the 21st century." *Forest Ecology and Management* 294 (2013): 54-61.
- [5] de Groot, William J., and Michael D. Flannigan. "Climate change and early warning systems for wildland fire." *Reducing Disaster: Early Warning Systems For Climate Change*. Springer Netherlands, 2014. 127-151.
- [6] Demin, Gao, et al. "A forest fire prediction system based on rechargeable wireless sensor networks." *Network Infrastructure and Digital Content (IC-NIDC)*, 2014 4th IEEE International Conference on. IEEE, 2014.