International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

Enhancement in Cognitive Radio Network Relay Based Selection Path Using Fuzzy Logic

M.Tech. Scholar Akhilesh Kumar Prof. Tejraj
Dept. of Electronics & Communication Engineering,
Dev Bhoomi Institute of Technology
Dehradun, Uttarakhand, India

Abstract- **Cognitive Radio has been invented to provide wireless communications with efficient radio spectrum utilization. The secondary users (SUs) can therefore, access opportunistically licensed band by sensing spectrum holes without interfering with primary users (PU) or keeping the interference, if it happens below a tolerable threshold. Main functions of cognitive radio are: Spectrum sensing, spectrum management, spectrum mobility and spectrum sharing. This research focuses on sensing and spectrum access optimization in cooperative multi-hop cognitive radio networks. In a cooperative spectrum sensing, nodes located in their vicinities can experience spatially correlated fading and it leads to a degraded detection performance. In the research proposes a novel scheme for cooperative spectrum sensing on distributed cognitive radio networks. A fuzzy logic rule - based inference system is proposed to estimate the presence possibility of the licensed user's signal based on the observed energy at each cognitive radio terminal. The estimated results are aggregated to make the final sensing decision at the fusion center. Simulation results show that significant improvement of the spectrum sensing accuracy is achieved by our schemes.**

Keywords- **Fuzzy Logic, Cognitive Radio, Wireless network**

I. INTRODUCTION

In the field of wireless communication frequency spectrum is as expensive as gold. Wireless Service providers must pay a huge amount of money to purchase the right to use the frequency spectrum for communication. With the advancement of wireless communication system in this decade, the new wireless communication system has frequently been used in the same area. Here every user in the system has a requirement of high data rate because of certain kinds of quality services, so demand for high bandwidth is the compulsory requirement. The number of subscribers also increases that result saturation of frequency domain drastically.

During the last few decades, we have witnessed a very high increase of wireless devices simultaneously with spectrum greedy multimedia applications. Though, most of the spectrum bands have been allocated to licensed users, it has been noticed by regulatory structures that they were not efficient used while radio spectrum was already a limited resource. Based on measurements of the Federal Communications Commission (FCC) done in New York State, temporal and geographical variations in the utilization of the allotted spectrum range from 15% to 85%[1].

While certain frequency bands like military and paging frequencies are under- utilized, cellular networks are encumbered in most parts of the world. To deal with this in efficient radio spectrum utilization, Cognitive Radio Network (CRN) has arisen. Cognitive radio is based on the well-known "Software-Defined Radio" but improves it by bringing some intelligence in detection of spectrum holes in the licensed users' radio band using spectrum sensing Figure 1.

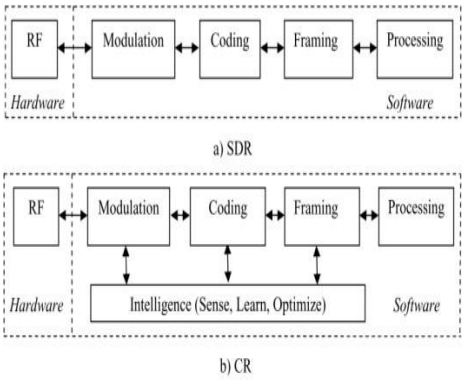

Figure 1 Contrasting (a) SDR and (b) Cognitive Radio.

II. PROPOSED METHODOLOGY

In proposed methodology we implement Fuzzy logic interface are described here. The proposed method provides better selection of secondary users and also it reduces the total error ratio about missing alarm and false detecting alarm message in the cognitive radio network having n number of CRs. This helps us to overcome

problem of congestion which comes across because of the hidden terminal with cooperative sensing technique In our work we use a cognitive radio network is which uses cooperative spectrum sensing which checks for the existing of the primary users in cognitive radio networks and the secondary users communicate the data and perform the communication and communicates with unused spectrum during the absence of the primary user.

Cooperative spectrum sensing is a technique in which all the cognitive users made their independent decisions and then send it to a common receiver. These can be achieved by employing with the using the optimization spectrum sensing techniques which can be detect about the primary user. The main goal of Opportunistic spectrum usage approaches which and checks for the unused spectrum and characteristics of the spectrum sensing technique in the real-time environment.

But this can cause spectrum inefficient utilization and interface to the adjacent secondary users so has to overcome we implement and approach using Fuzzy Interface System (FIS) to control the spectrum access. To make sure to calculate the available spectrum and efficient spectrum sensing technique using fuzzy logic.

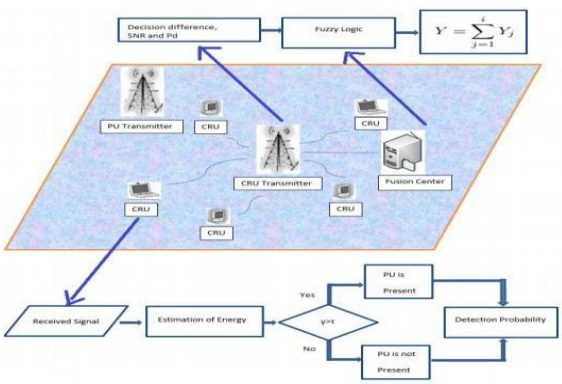

Figure 2 Proposed FL-CSS Scheme for Spectrum Sensing.

A Cluster based cooperative sensing is proposed as a bandwidth and energy efficient scheme. The number of channels to the fusion center for reporting is reduced in it which results in less usage of radio spectrum. Thus it reduces the capacity as well as improves the detection performance. The proposed radio fuzzy logic scheme in this research gives much better results than cluster based sensing too, which have been shown by simulations.

III. PROPOSED COOPERATIVE SPECTRUM SENSING SCHEME

For LU's signal detection, we consider a cooperative spectrum sensing scheme like Fig. 3. Each CU conducts its local estimation of LU signal presence possibility based on its observed energy, and then transmits its estimation result to the fusion center (FC) where the final decision is made.

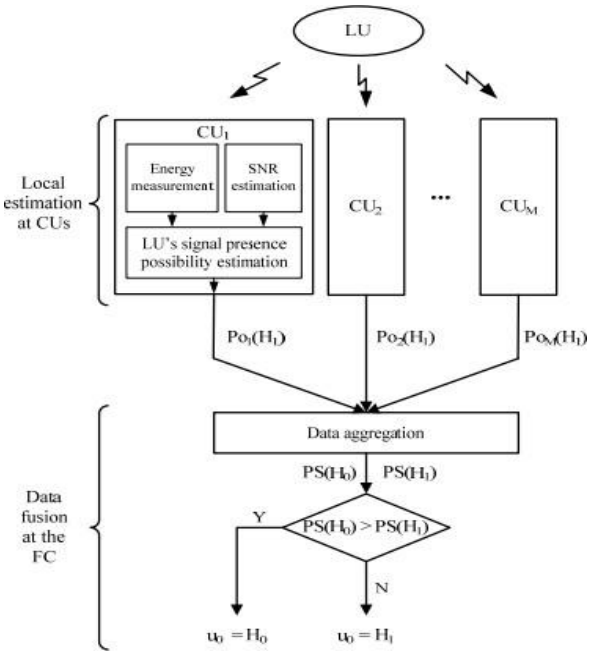

Figure 3 The fuzzy logic-based cooperative spectrum sensing scheme.

IV. SIMULATION RESULTS

In the simulations of the proposed FL-CSS scheme will be shown. The performance analysis of Spectrum Sensing Techniques is based on signal to noise ration and bit error rate.

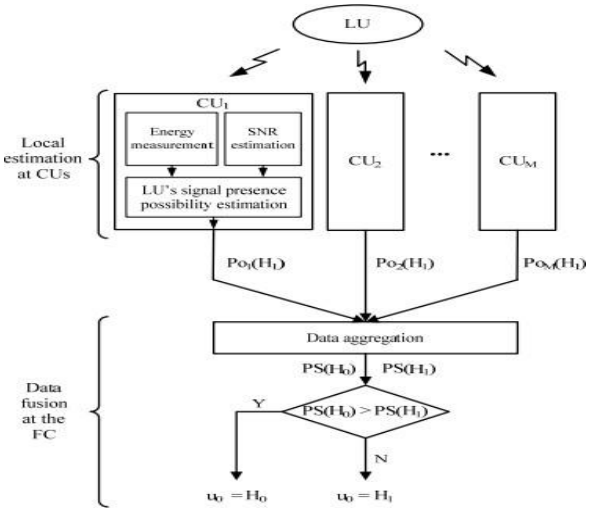

Figure 3 The fuzzy logic-based cooperative spectrum sensing scheme

International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

V. SIMULATION RESULTS

In the simulations of the proposed FL-CSS scheme will be shown. The performance analysis of Spectrum Sensing Techniques is based on signal to noise ration and bit error rate.

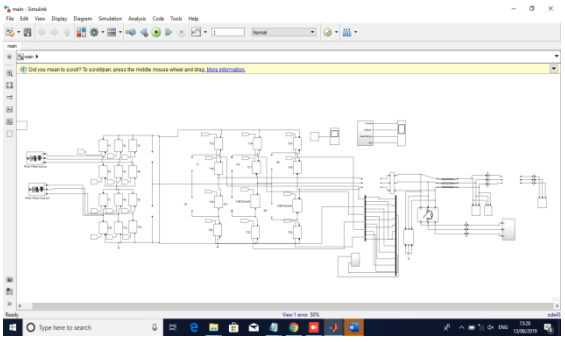

Fig.4 Proposed model.

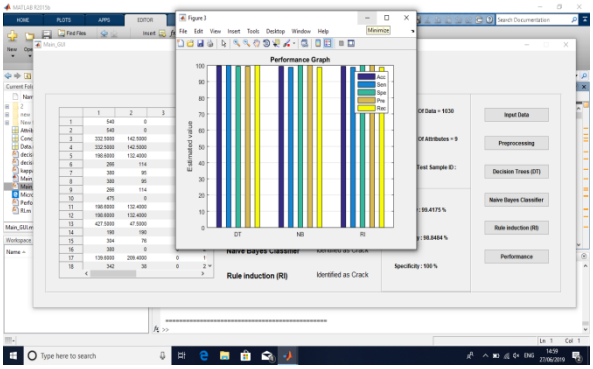

Fig.5 Performance Graph

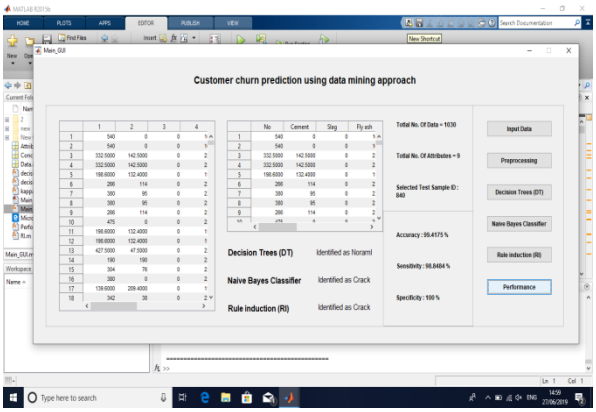

Fig.6 Customer churn prediction using data mining approach.

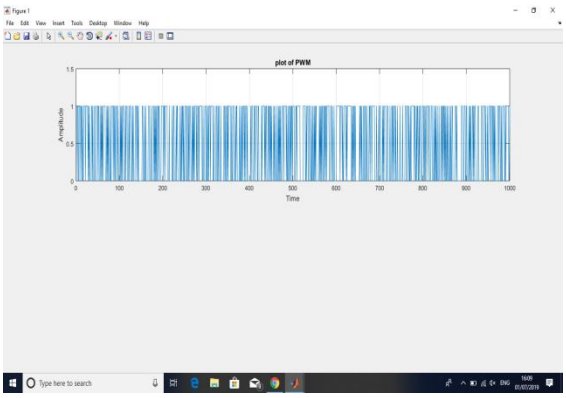

Fig.7 Plot of PWM.

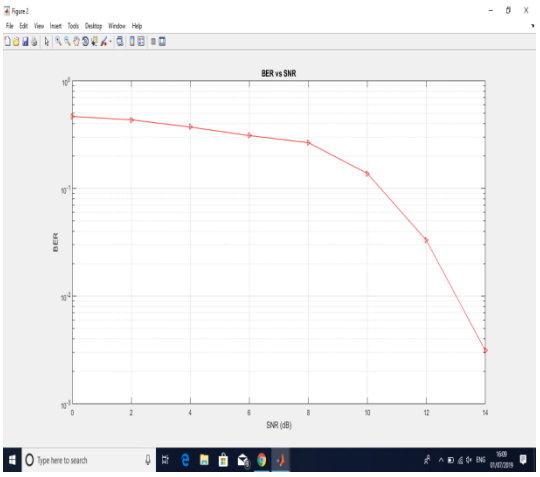

Fig.8 BER vs SNR

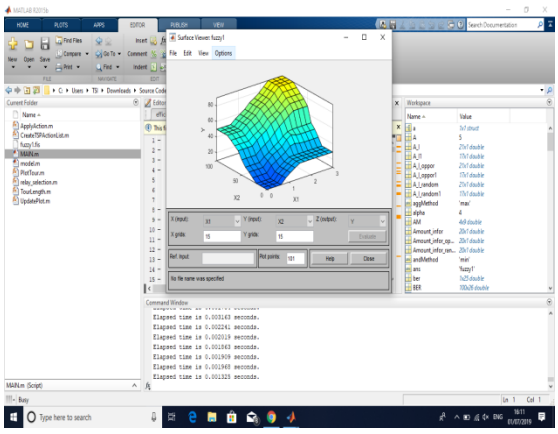

Fig.9 Surface view of fuzzy

International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

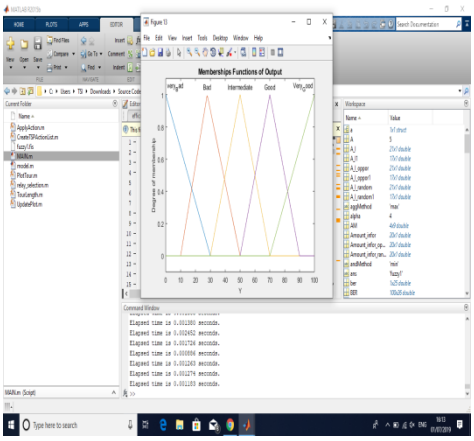

Fig.10 Membership function of output

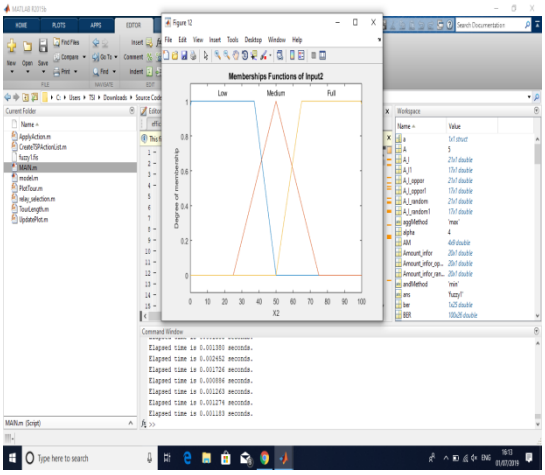

Fig.11 Membership function of input 2

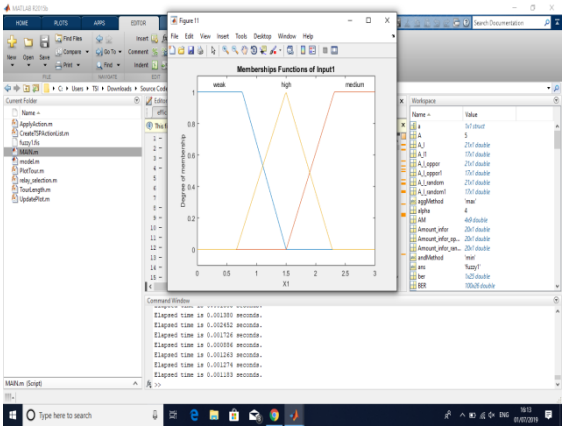

Fig.12 Membership function of input 1

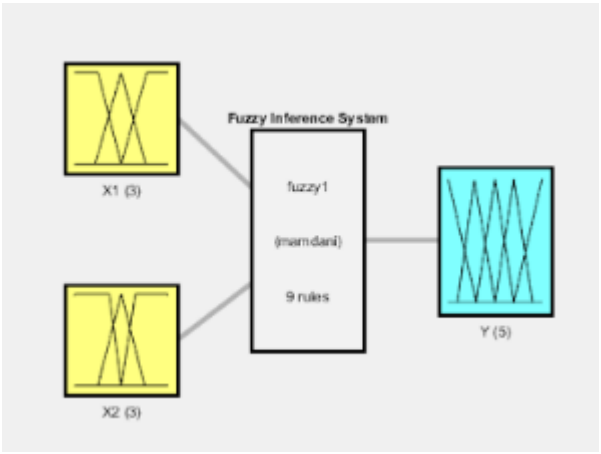

Fig.13 fuzzy interference system show input and output.

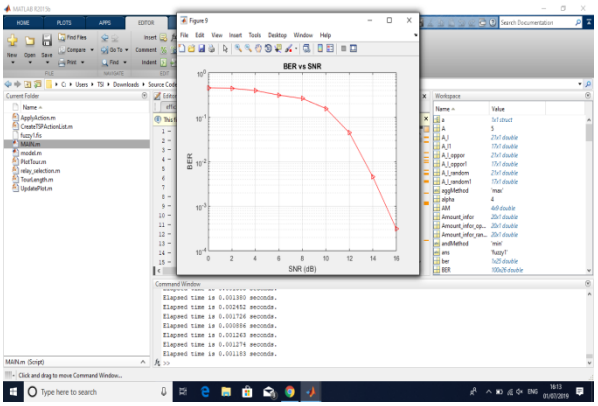

Fig.14 BER vs SNR

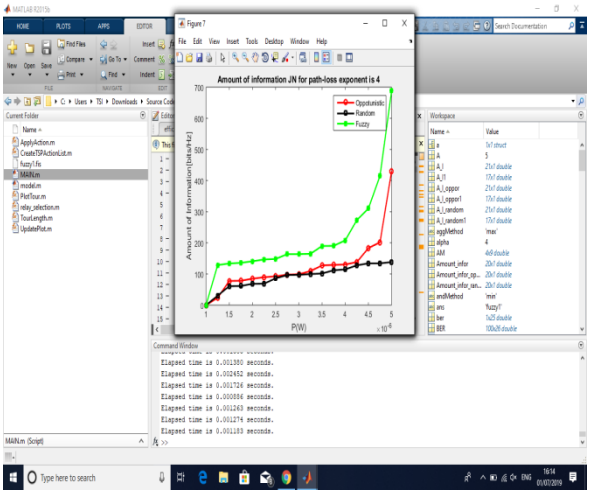

Fig.15 Amount of information JN for path-loss exponent is 4

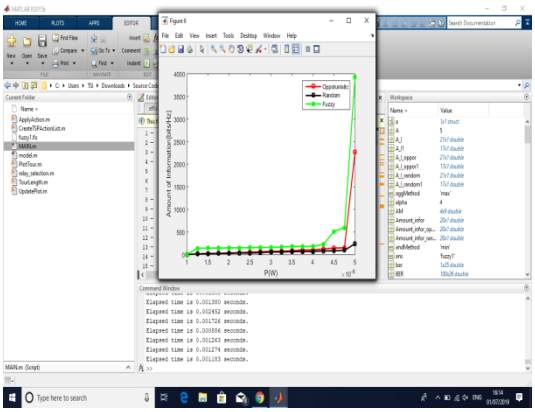

Fig.16 Amount of information vs P(W).

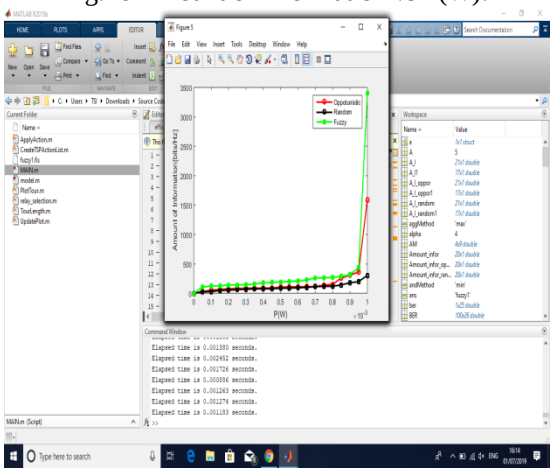

Fig.17 Amount of information vs P(W) at different value of P(W).

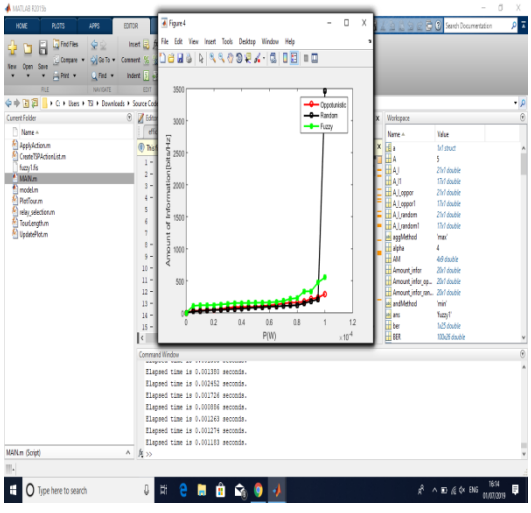

Fig.18 Amount of information vs P(W) at different value of P(W).

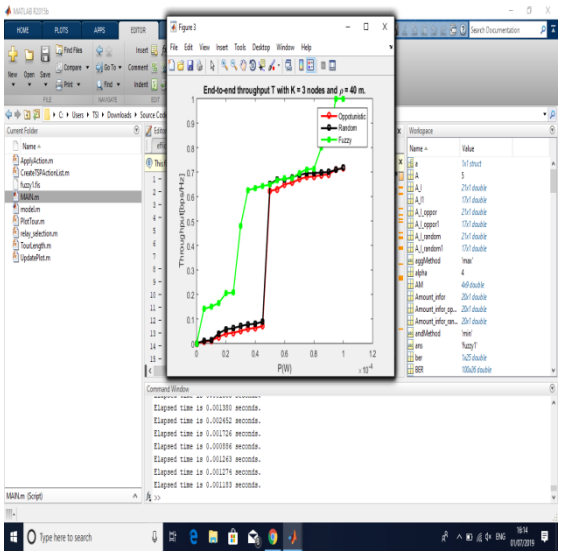

Fig.19 End to end throughput T with k=3 nodes and ρ=40m.

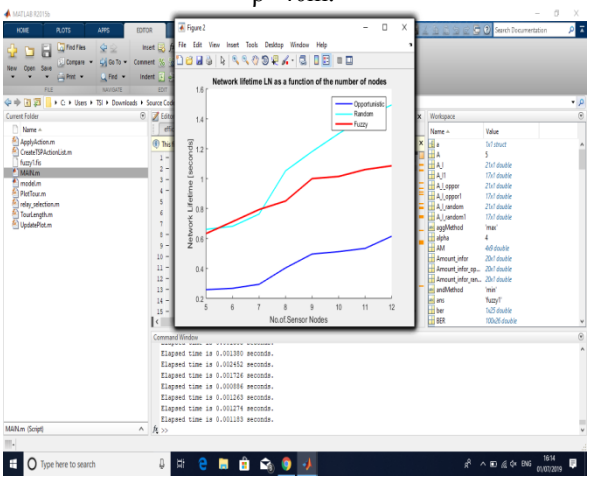

Fig.20 Network lifetime LN as a function of the number of nodes.

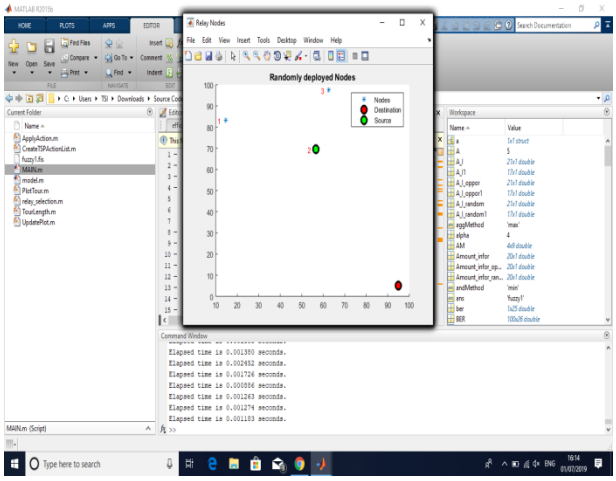

Fig.21 randomly deployed nodes

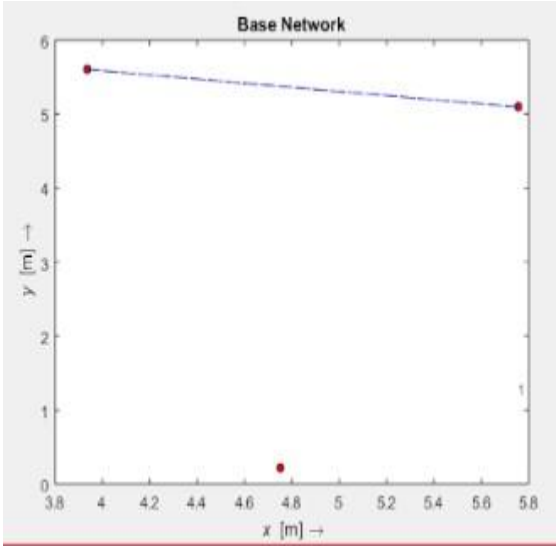

Figure 22 base network.

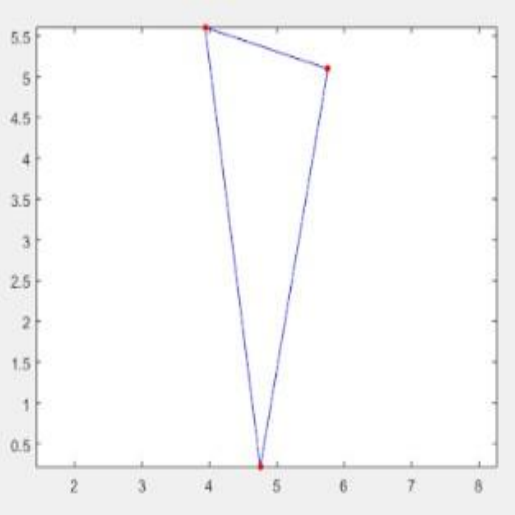

Figure 23 Nodes in network

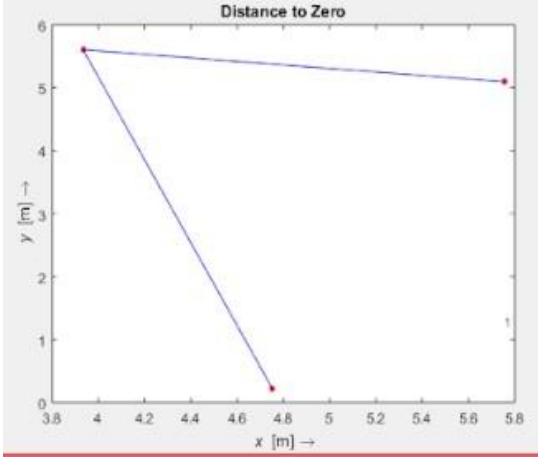

Figure 24 distance to zero.

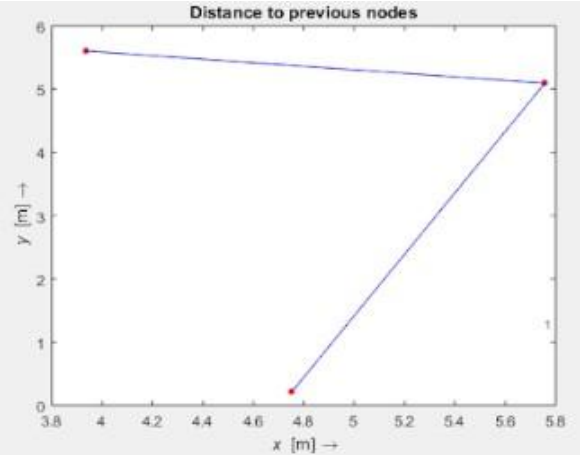

Figure 25 distance to previous node.

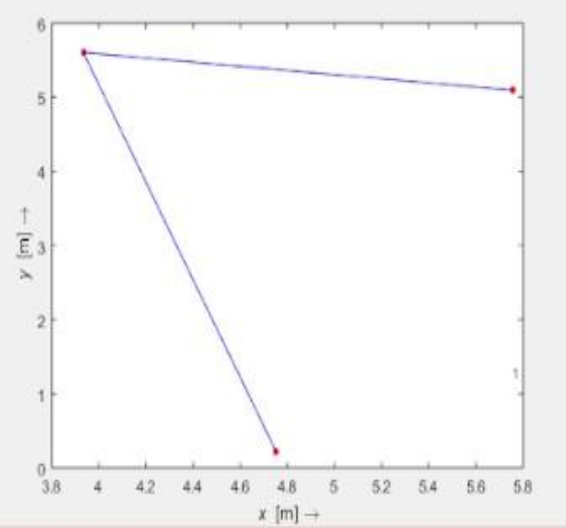

Figure 26 Nodes in fuzzy system

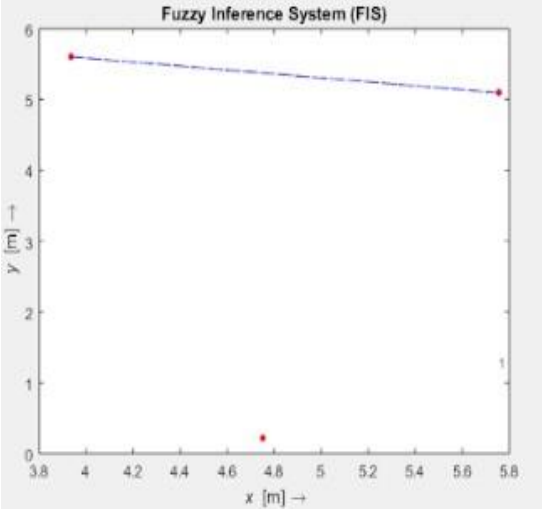

Figure 27 fuzzy interference systems

VI. CONCLUSION

We propose an efficient and effective sensing algorithm which is based on transmission decision at one time slot for one Cognitive radio and also guarantees a target error bound by taking few Cognitive radios form the network in spectrum sensing with energy detection in cognitive radio networks. It has been made a practical implementation minimize the total error probability with the ban half-voting rule. Optimal detection threshold has been presented. Efficient spectrum sensing algorithm has been proposed while satisfying a given error bound. Spectrum sensing is a fundamental problem in CR networks. In this paper, we have proposed a cooperative spectrum sensing scheme using fuzzy logic to estimate the presence possibility of the LU's signal at CUs. At the fusion center, the final sensing decision is made based on local estimated results of the CUs. The detection probabilities over fading channels may also be improved by Cooperation among CRUs but it causes an additional overhead. So to provide better cooperation with lower overhead, the need to improve the local sensing has emerged. Thus FL-CSS scheme is proposed.

REFERENCE

[1] Rasheed, T., Rashdi, A., & Akhtar, A. N. (2018, February). Cooperative spectrum1 sensing using fuzzy logic for cognitive radio network. In 2018 Advances in Science and Engineering Technology International Conferences (ASET) (pp. 1-6). IEEE.

[2] Zhang, G., Ding, R., & Huang, L. (2011). Using trust to establish cooperative spectrum sensing framework. Procedia Engineering, 15, 1361-1365.

[3] Alhammadi, A., Roslee, M., & Alias, M. Y. (2016, November). Fuzzy logic based negotiation approach for spectrum handoff in cognitive radio network. In 2016 IEEE 3rd International Symposium1 on1 Telecommunication Technologies (ISTT) (pp. 120-124). IEEE.

[4] Wang, Y., Li, Y., Yuan, F., & Yang, J. (2013). A cooperative spectrum sensing scheme based on trust and fuzzy logic for cognitive radio sensor networks. International Journal of Computer Science Issues (IJCSI), 10(1), 275.

[5] Matinmikko, M., Rauma, T., Mustonen, M., Harjula, I., Sarvanko, H., & Mammela, A. (2009). Application of fuzzy logic to cognitive radio systems. IEICE transactions on communications, 92(12), 3572-3580.

[6] Khan, R. T., Islam, M. I., Zaman, S., & Amin, M. R. (2016). Optimum Access Analysis of Collaborative Spectrum Sensing in Cognitive Radio Network using MRC. IJACSA) International Journal of Advanced Computer Science and Applications, 7(7).

[7] Ejaz, W., ul Hasan, N., Aslam, S., & Kim, H. S. (2011, September). Fuzzy logic based spectrum sensing for cognitive radio networks. In 2011 Fifth International Conference on Next Generation Mobile Applications, Services and Technologies (pp. 185-189). IEEE.

[8] Giweli, N., Shahrestani, S., & Cheung, H. (2015, December). Selecting the sensing method in cognitive radio and future networks: A QoS-aware fuzzy scheme. In 2015 IEEE International Conference on Data Science and Data Intensive Systems (pp. 497-504). IEEE.

[9] Kaniezhil, R., & Chandrasekhar, C. (2012, December). An efficient spectrum utilization via cognitive radio using fuzzy logic system for heterogeneous wireless networks. In 2012 International Conference on Emerging Trends in Science, Engineering and Technology (INCOSET) (pp. 300-307). IEEE.

[10] Nabil, M., & ElNainay, M. (2016, June). Fuzzy-based assignment algorithm for channel sensing task in cognitive radio networks. In 2016 IEEE Symposium on Computers and Communication (ISCC) (pp. 843-848). IEEE.