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Probabilistic Approach of Improved Binary PSO Algorithm Using Mobile Sink Nodes

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ABSTRACT: *In Wireless Sensor Network (WSN) applications for efficient data accumulation, the use of mobile sinks plays a very important part. In sensor networks that make use of existing key pre distribution schemes of pairwise key establishment and authentication between sensor nodes and mobile sink, the use of mobile sinks of data collection elevates a new security challenge. Improved Binary Particle Swarm Optimization algorithm (IBPSO) has been used to find the exact location of a three-way process such as sink, distribution of frequency, and localization. The Orthogonal Frequency Division Multiple Access (OFDMA) technique is used to identify the frequency in the communication channel for finding the exact frequency. The existing multiple access techniques have not been used to combine the three-way process such as sink the node, frequency, and positions for utilizing the efficiency of energy in the particular positions to transfer a packet. The proposed research is used to implement the IBPSO algorithm with OFDMA techniques for utilizing exact bandwidth to perform the energy level at the scheduled time. The experimental results have been implemented in the mathematical approach of Polynomial pool based scheme for finding the regions. In this region, the normal distribution procedure has measured optimally to produce the Quality of Service (QoS) for accessing the better outcome of bandwidth and it provides an easy way to access mechanism with higher energy efficiency.*

KEYWORDS: *Mobile Sink, Improved Binary Particle Swarm Optimization, OFDMA, Wireless Sensor Network, Quality of Service*

1. Introduction

The Mobile Sink is used in many applications for producing accurate and timely phenomena detection is required. OFDMA based MAC protocol for underwater acoustic Wireless Sensor Networks described that is configurable to suit the operating requirements of the underwater sensor network. The protocol has three modes of operation, namely random, equal opportunity and energy-conscious modes of operation. The MAC design approach exploits the multi-path characteristics of a fading acoustic channel to convert it into parallel independent acoustic sub-channels that undergo flat fading (Khalil et al., 2012). Delay tolerant data gathering in energy harvesting sensor networks with a Mobile Sink has specified that the energy conversion efficiently investigated. The impact of different parameters on the performance this is the first kind of work of data collection for energy harvesting sensor networks with mobile sinks (Ren & Liang, 2012). Particle swarm optimization for time difference-of-arrival based localization shown the PSO approach provided accurate source location estimation for both known and unknown propagation speed, and also gives an efficient speed estimate in the latter case (Lui et al., 2007). Reliable and load balanced multi-path routing for multiple sinks in wireless sensor networks specified that an efficient load balanced multipath routing for multiple sinks is obtained and the fault detection and recovery can be made effectively (Mahadevaswamy & Shanmukhaswamya, 2012). Architecture of wireless sensor networks with mobile sinks exploited the tradeoff between the successful information retrieval probability and the nodes energy consumption, a number of multiple node transmission scheduling algorithms are proposed (Song & Hatzinakos, 2007).

Energy-aware data aggregation for grid based Wireless Sensor Networks with a Mobile Sink proposed that each sensor node with location information and limited energy is considered. This approach utilized the location information and selects a special gateway in each area of a grid responsible for forwarding messages (Wang et al., 2007). Band based go casting for mobile sink groups in the wireless sensor Networks delivery-guaranteed and effective data dissemination for mobile sink groups in wireless sensor networks. A mobile sink group denotes a set of tightly coupled mobile sinks for team collaborations such as a team of firefighters and a group of soldiers (Park et al., 2013). Energy balanced routing algorithm based on Mobile Sink for Wireless Sensor Networks. The algorithm defined the transmitting coordinate (TC) of by mobile sink and the sensor nodes, which TC is the same formed a chain cluster using a greedy approach. It also defined collecting row (CR) and paralleling column (PC), and each PC transmits information to CR synchronously. Finally, information is transmitted to mobile sink by LEADER node which residual energy is the most (Guan et al., 2012). SRP-MS: a new routing protocol for delay tolerant wireless sensor network lifetime maximization of delay tolerant wireless sensor networks (WSNs) through the manipulation of Mobile Sink (MS) on different trajectories (Javaid et al., 2013; Paulus et al., 2012). Reducing delay data dissemination using mobile sink in Wireless Sensor Networks for reducing drastically for data packet collection from the networks and save energy consumption, congestion and average end to end delay problem for the collection of data packets in the network (Waghole & Deshpande, 2013). Zhao et al. (2014) described the positioning accuracy, they put forward an improved weighted centroid algorithm, then self-corrected. The distributed multi-cell beamforming algorithm converges to an NE point in just a few iterations with low information exchange overhead. Moreover, it provides significant performance gains, especially under the strong interference scenario, in comparison with several existing multi-cell interference mitigation schemes, such as the distributed interference alignment method (Xu & Wang, 2012). The information related to the residual battery energy of sensor nodes to adaptively adjust the transmission range of sensor nodes and the relocating scheme for the sink (Wang et al., 2013). The key concept in virtual backbone scheduling is to minimize the energy consumption and more throughputs concentrated by Umesh et al. (2013). Huang et al. (2014) presented optimization of routing protocol in wireless sensor networks based on improved ant colony and particle swarm algorithm. The shown the results verify the effectiveness of the improved algorithm, and improve the search for optimal routing.

The objective of our research work is to find the appropriate position using IBPSO algorithm in all locations to acquire accurate bandwidth which minimizing the error through mobile sink. In order to communicate in scheduled time, the exact bandwidth can be used by OFDMA technique.

2. Architectural models

Figure 1 shows the architectural model of Mobile sink with IBPSO for finding the appropriate position in WSN. It shows the how sensor networks are distributed the data to various networks. The mobile sink has used to sink all the sensor nodes. Each sensor is used to find the exact position to transmit the data with IBPSO. The swarming of all the sensors has been assigning the data in the particular location. The IBPSO algorithm is used with time scheduled for distributing with higher bandwidth with respect to OFDMA/TDMA for defining the appropriate periods.

3. Mobile sink with IBPSO

A mobile sink sends data request message to sensor nodes via a stationary access node. These mobile sink request messages will initiate the stationary access node to trigger sensor nodes for transmitting their data to the requested mobile sink. The main advantage of mobile sink is used to secure way of communication has to be established in the sensor networks. It is enabled to collect all information from a remote machine and the information has been timely improved with energy. The sink nodes find their geographic locations by the configuration of localization techniques. The OFDMA techniques also implemented in mobile sink for controlling the information without having any error. In WSN, the acknowledgement cannot be predicted to all transmissions. So, OFDMA

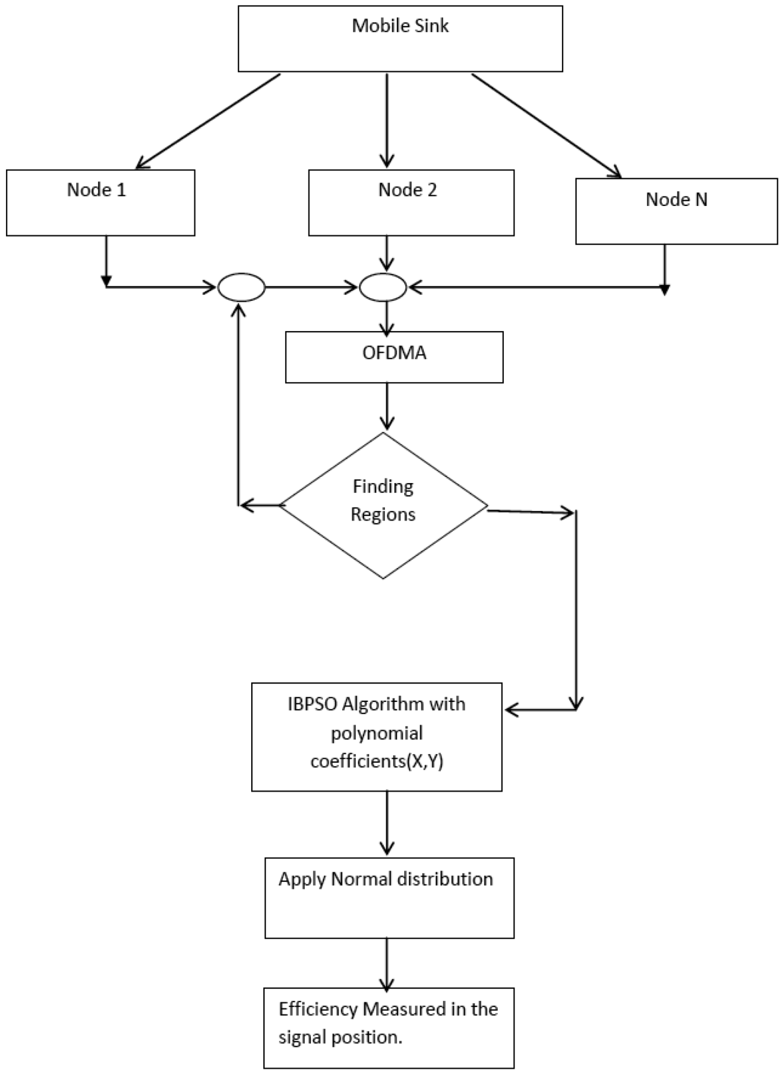

Figure 1 Interconnection of Mobile Sink with IBPSO for Finding the Position

is scheduled the time for every transmission in mobile sink and finding the appropriate position through IBPSO.

Figure 2 depicts the mobile sinks which identifies all the sink nodes and neglect the unauthorized nodes. Then the data has been transferred to the particular location using an IBPSO algorithm for finding the exact location and also improving the performance.

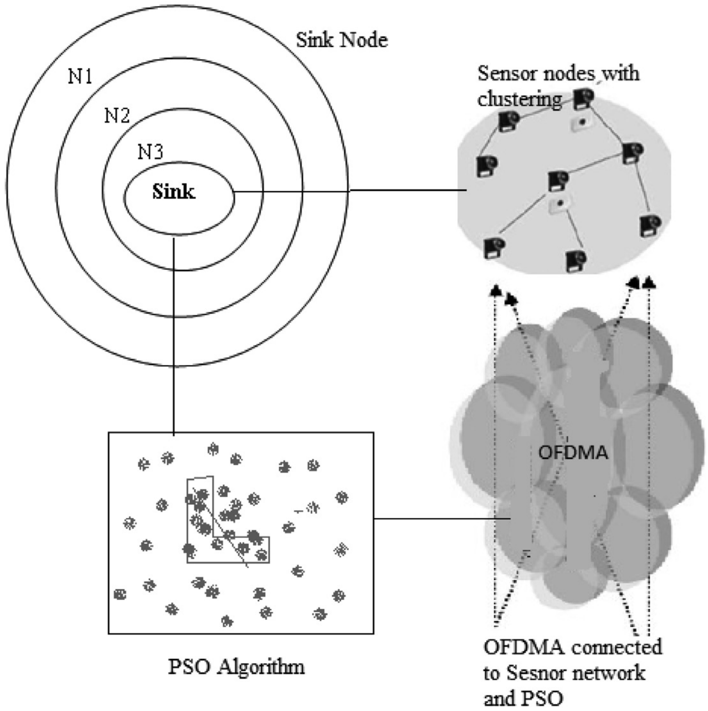

Figure 2 Clustering of Sensor Node Sink with Position of Binary PSO in OFDMA

4. Improved Binary PSO algorithm

IPSO is a heuristic global optimization procedure, which is based on swarm Intelligence. IPSO is an algorithm for optimizing a non-linear and multidimensional problem which usually reaches good solutions efficiently, while requiring minimal parameterization. The overall function of this problem is optimized and also it finds the exact solution for an appropriate location. The function can be defined as $f(x_i)$ and the nodes are $f(x_{i,0})$, ..., $f(x_{i,d})$ and also it represents how the particle's position in the multidimensional space is relative to the desired goal. With this problem, the IPSO algorithm shows that how the frequencies are calculated at the rate of weights and also binds the "d" dimensions to be optimized for given a problem modeled as an optimization one of dimensions d. So, it has positioned as x_i $(x_1, x_2, ..., x_n)$ and velocity v_i $(v_1, v_2, ..., v_n)$.

The Improved Binary PSO (IBPSO) algorithm is called by IPSO, the particle position is not a real value, but either the binary 0 or 1. So that velocity $v_{i,d}$ mapped into interval [0,1]. In this case velocity has been updated in Equation (1) and positions have been updated in Equation (3). In this algorithm, swarm means all the particles share information and it says that best position in every visited and also by any particle in the swarm.Each particle has a position can be defined in the Equations (1) and (2).

$$x_{i,d}(it + 1) = x_{i,d}(it) + v_{i,d}(it + 1) \tag{1}$$

and

$$v_{i,d}(it + 1) = v_{i,d}(it)$$

$$+C_1 * Rnd(0,1) * \left[p^{b_{i,d}}(it) - x_{i,d}(it) \right]$$

$$+C_2 * Rnd(0,1) * \left[g^{b_d}(it) - x_{i,d}(it) \right] \tag{2}$$

$$x_{i,d}(it+1) = \begin{cases} 1 & if\, \sigma < \frac{1}{1+e^{-v_{i,d}}} \\ 0 & otherwise \end{cases} \tag{3}$$

where

i, particle's index, used as a particle identifier

d dimension being considered, each particle has a position and a velocity for each dimension

it iteration number, the algorithm is iterative

$x_{i,d}$ position of particle i in dimension d

$v_{i,d}$ velocity of particle i in dimension d

C_1 acceleration constant for the cognitive component;

Rnd stochastic component of the algorithm, a random value between 0 and 1

$P^{b}_{i,d}$ the location in dimension d with the best fitness of all the visited locations in that dimension of particle i and gb is the global position

C_2 acceleration constant for the social component

σ Random factor in the [0,1] interval

5. Integrated polynomial pool based scheme

This scheme is used to define the combination of polynomial pool based scheme as well as the three tier security scheme. This scheme is defined position in the particular regions using IBPSO. Based on the region the packets are maintained efficiently with a short spot of time. The sink node is used to identify the unintended nodes, which are sent from the source place and also protect the unauthorized data along with two keys named as Sending key (S) and Receiving key (R). Consider the four regions in the particular positions. The regions are located in the position with small particle $R_1 = (-4, 0)$, $R_2 = (-1, 0)$, $R_3 = (1, 0)$ and $R_4 = (3, 0)$. Among the four regions, the exact location can be identified by the following procedure and the polynomials of coordinating points are described in Figure 3 with sine wave.

$$P(x) > 0 \text{ for } x \in (-\infty, -4) \cup (3, \infty) \tag{4}$$

$$P(x) < 0 \text{ for } x \in (-4, -1) \cup (1, 3) \tag{5}$$

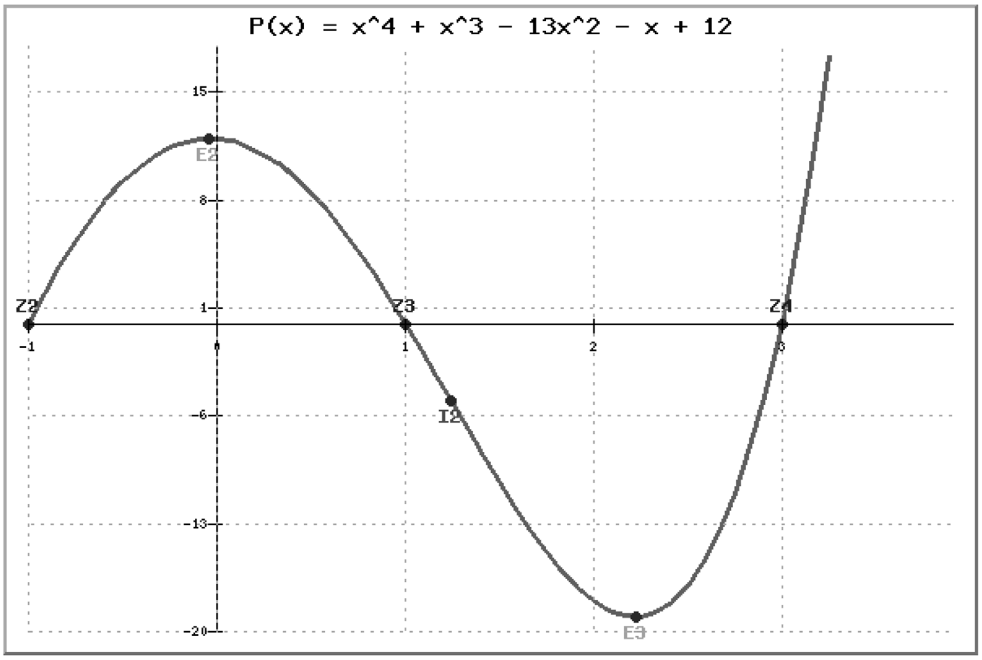

Figure 3 Polynomial of Coordinating Points in the Particular Regions

IBPSO algorithm:

Step 1: Searching the nodes $N_1, N_2, ..., N_i$ for sending the data.

Step 2: Checking by mobile sink nodes, whether $N_1, N_2, ..., N_i$ are malicious or original data.

Step 3: Generating the keys $S_1, S_2, ..., S_i$ for the given data and encrypting the keys along with the data.

Step 4: For each particle i in s do

Step 5: For each dimension d in D d
$x_{i,d} = Rnd(x_{\min}, x_{\max})$

$u_{i,d} = Rnd(-v_{max}/3, v_{max}/3)$
End

Step 6: Evaluate the polynomial for the particular particle using the Equations (4) and (5). For each region in Swarm
(i) if (the position value of $X_i > P_i$) then $P_i = X_i$
(ii) if (the position value of $X_i > P_g$) then $P_g = X_i$
for each dimension of particle
(i) Update each dimension velocity using the Equation (2)
(ii) Update velocity if ($V_{id}(t + 1) > V_{max}$) then $V_{id}(t + 1) = V_{max}$
(iii) From Equation (3) $S = \frac{1}{1+e^{-v_{i,d}}} + 1$
(iv) S > rand(0,1) then Xid(t + 1) = 1
else $X_{id}(t + 1) = 0$

Step 7: Find the frequency with each dimension of the following
Frequency = $\frac{v_{i,d}}{S}$ and global position = Frequency

Step 8: T_i(Time) = global position + (Hours * 60) + Minutes
if(T_i == maxHours),
Message "Error: Request time is more"
Else Print the total time with frequency

Step 9: Print the position with appropriate frequency level.

Step 10: return T_{i_Time}

6. Simulation

Figure 4 shows the parameter position finding without -1 value in the localization. In the particular location, nodes are having the appropriate position to find the signal strength. If the values are -1, returns the negative position and also not finding the localization.

Figure 5 shows how localization can be found in every location. When the position is identified, every node has connected to its neighboring node. The graph shows the square mark in every link to find its positions. The data are traversed through this node and finally reach to its destination. The efficiency of the sensor nodes are defined with normal distribution for providing the optimal solution in the particular location.

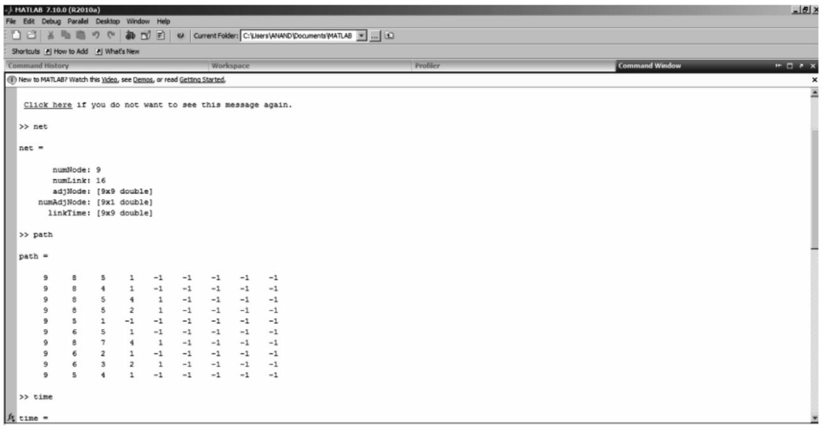

Figure 4 Implementation of Node Position Finding in the Localization in Matlab

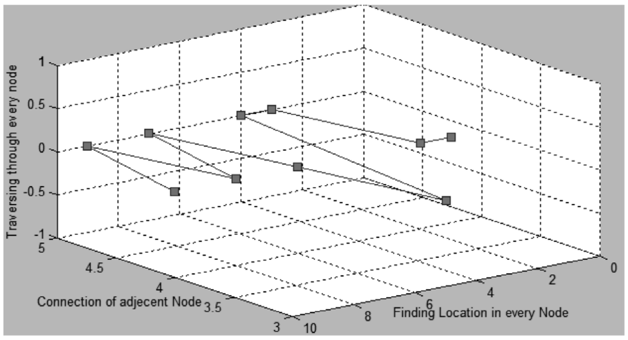

Figure 5 Traversing through Every Node for Finding in the Localization

The solution has been optimally selected in the upper area of the normal curve with intersect point. Consider the 25 nodes have been participated in sending the data through the signal position of the 4 regions. In such a case all the nodes are intersected with the optimal solution with the efficiency of the time 0.5 seconds in the normal curve. The following steps are taken into the consideration with respect to finding optimal solutions.

Step 1: Since $\mu = 25$ and $\sigma = 4$ we have:

$$P\,(0 < X < 25) = P\,(0 - 25 < X - \mu < 25 - 25) = P\,(\frac{0-25}{4} < X - \mu\sigma < \frac{25-25}{4})$$

Since $Z = \dfrac{x - \mu}{\sigma}$, $\dfrac{0-25}{4} = -6.25$ and $\dfrac{25-25}{4} = 0$ we have:

$$P\,(0 < X < 25) = P\,(-6.25 < Z < 0)$$

Step 2: Use the standard normal table to conclude that:

$$P\,(-6.25 < Z < 0) = 0.5$$

Such that $P\,(0 < X < 25) = 0.5$

Figure 6 shows the appropriate position finding with the various coordination. The graph shown the various coordination for finding the position and the average delay times are calculated in every position. This is normally represented for data distribution in the particular location, for how much of time can be utilized for transmitting data in the particular location. Figure 7 shows that the reliability of IBPSO algorithm. The reliability has measured in percentages and the IPSO algorithm has found the position with same reliability measurement. In this scenario, the time has been measured for finding the position which is incorporated in the particular regions.

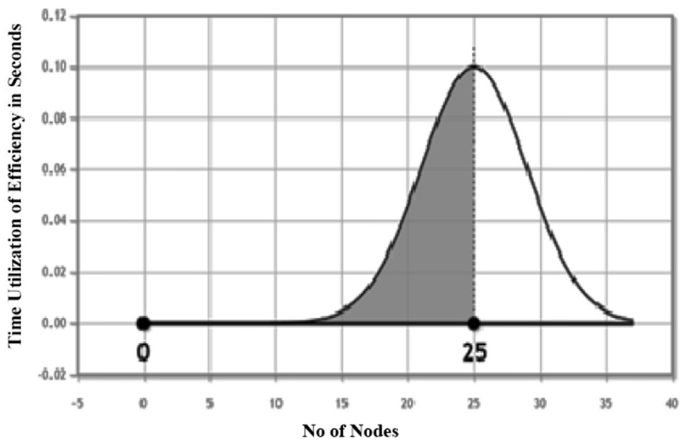

Figure 6 The Node Position Finding in the Localization

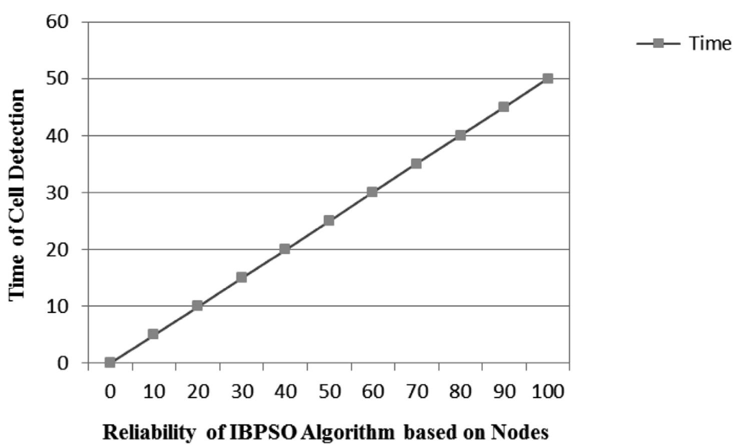

Figure 7 imes for Reliability of IBPSO in Cell Detection

In every shot of signals, the average value has been calculated based on the number of nodes. If 100 nodes are transmitting the data, the overall reliability of data transfer in time is 0.5 seconds with percentage.

7. Conclusions

The main proposed system of the study described that three way distribution processes of improved particle swarm optimization frequencies for mobile sink in localization of wireless sensor network. In this study the IBPSO algorithm used for finding the location and to identify the localized environment. The mobile sink has been allocated the sink node for distribution of the data between one sink nodes to another sink node. During the distribution the OFDMA used to define the frequency with constant level. In the frequency channel all the data have distributed securely with the polynomial pool based method applied for protecting from unauthorized data. Finally, all the techniques are accumulated together in a channel without having any errors and also the efficiency have been utilized in the particular location to send the packets.

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