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GM-SPIN(Genetic Based Modifly Sensor Protocol For Information via Negotiation) In Wireless Sensor Network.

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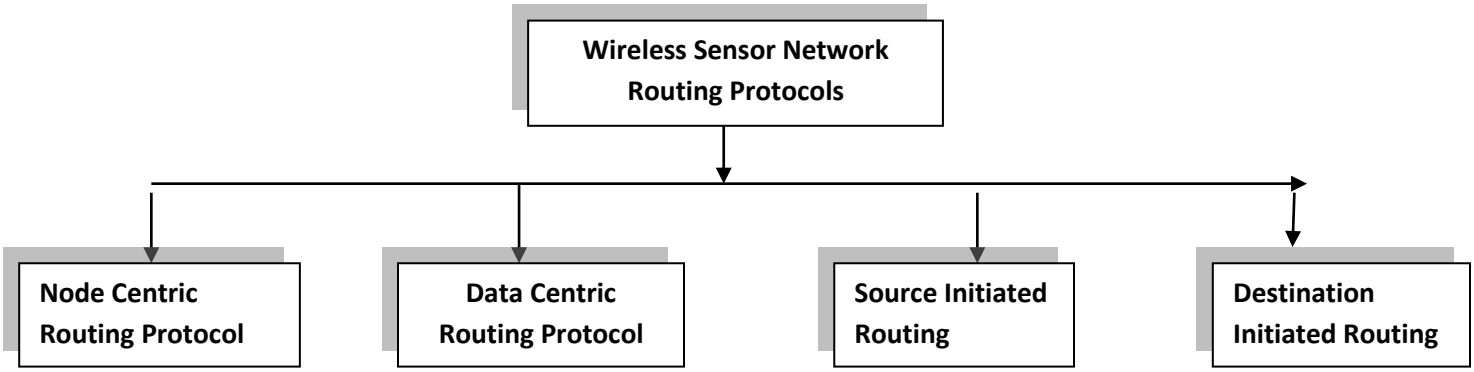
Abstract: Wireless sensor network has a number of autonomous nodes and important task of WSN, collect data from an node and send to the base station .Node in a WSN are power constrained due to limited battery power. Energy Consumption is one of the main issue in WSN. to increase the network life time and reduced battery consumption various routing protocol are used. LEACH, DEEC, DDEEC, EDEEC and SPIN are the routing protocol for Wireless sensor network. The limitations of traditions protocols has been removed by M-spin. M-spin helps to increase the network life time of the nodes. However there are some limitations of M-spin protocol. Drawback of M-spin protocol can be overcome by applying Genetic Algorithm on M-spin protocol. In this paper, we present the comparative review of M-spin protocol with Genetic Algorithm.

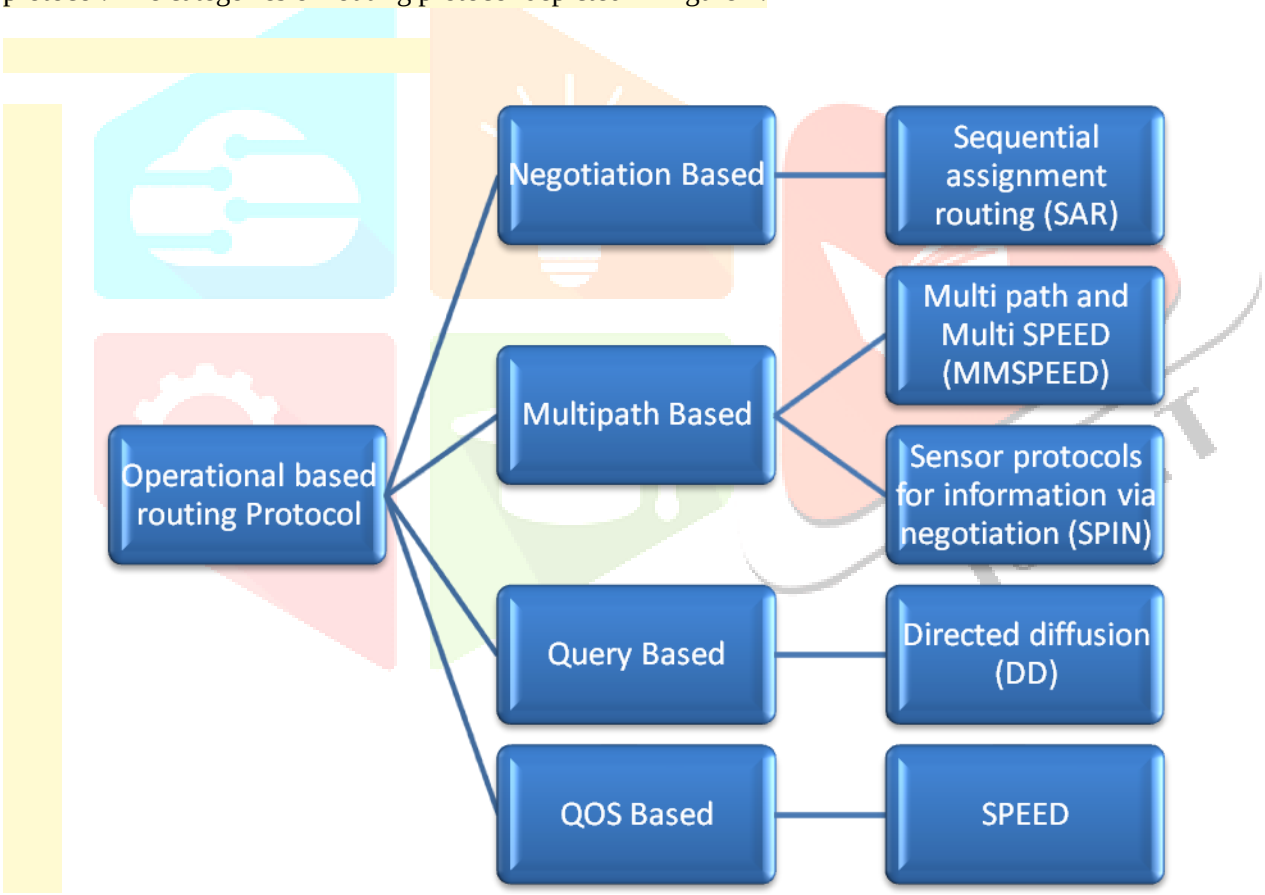
Keywords: Modified Spin protocol, Wireless sensor network, Genetic Algorithm.

Introduction: Wireless sensor network has a number of autonomous nodes and important task of Wireless sensor network, collect data from a node and send to the base station. Wireless sensor network used to monitors different parameter such as temperature, humidity, weather station , noise ,free parking slot, by which we can allows to minimizes the money and time as well as maximize the results.[9] The key challenge in WSN is increase the network life time and improve the battery consumption. For increase the network life time in WSN, from last few year variety of changes and different routing protocol have been made. The routing protocol is a process to select suitable path for sending data form sender to receiver. While selecting the route several difficulties occur, which depends upon type of network, channel characteristics and the performance metrics[3].

Energy Efficiency, Complexity, scalability, delay, Robustness these are some design challenges in Wireless sensor networks. In routing techniques, for established the communication sending the data between sensor nodes and base station.[10] Routing protocol decreased the network lifetime and increase energy consumption . for increase the network lifetime many routing protocol have been developed .The basic classification of routing protocols is shown in fig 1.



The routing protocols can be categories on the basis of their network organization, process they used to discover the routes and according to the operational basis. [1] But in this paper we will emphasis on the operational basis routing protocol. The categories of routing protocol depicted in Figure 2.



Operational Based routing protocol can be divided in to negotiation based, Multipath based, Query Based, QOS Based. Multi-path routing protocols provide multiple paths for data to reach the destination , also provide alternate path in case of failure of any path. Multipath routing protocols are:

- Multi path and Multi SPEED (MMSPEED)
- Sensor protocols for information via negotiation (SPIN)

Related Work: SPIN (Sensor protocol for information via Negotiation) is a Data centric , Multipath routing protocol. In data centric protocols, when the sender node send their data to the sink, other neighbor nodes can performs aggregation on original data from other neighbor nodes and send that aggregate data towards the sink. In this process less transmission required to send the data so result it can save energy.[3]. And Multipath routing protocol provide multiple paths for data to reach the destination providing load balancing, also provide alternate path in case of failure of any path.

In SPIN (Sensor Protocols for Information via Negotiation) the nodes sense data throughout the network by means of negotiation. SPIN nodes use three types of messages for communication:

ADV-When a node has new data and want to share; it can advertise this data using ADV message.

REQ-When Nodes need to receive actual data they sends an REQ message to sender node.

DATA-When sender receive REQ message from nodes. Then its send DATA message to particular node by which its get REQ message and DATA message contains actual data [2].

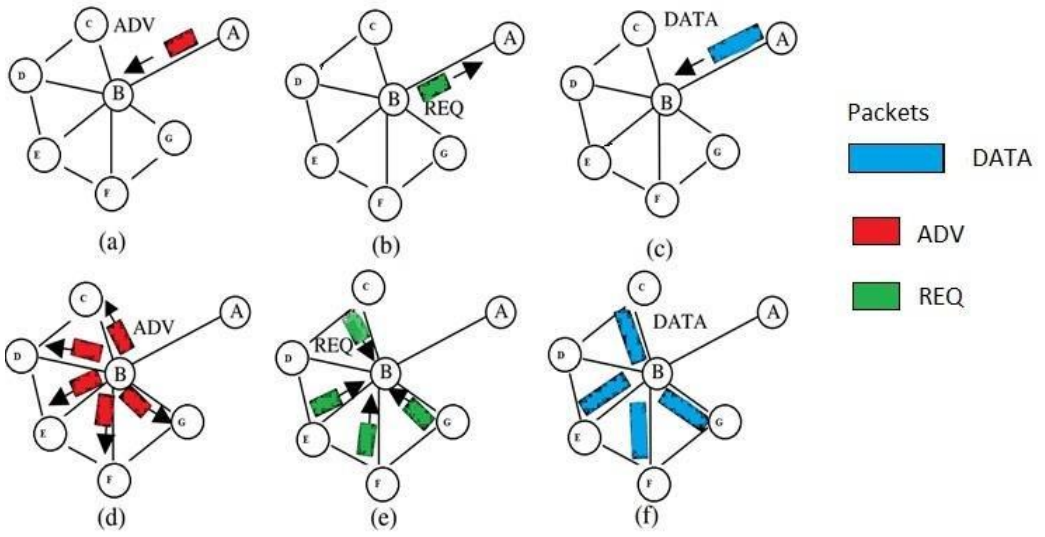


Fig. 3 The SPIN Protocol. Node A starts send ADV message advertising its data to node B (a). Node B responds by sending a request to node A (b). After receiving the requested data (c), node B then sends out advertisements to its neighbors (d), who in turn send requests back to B (e,f).

Data Centric Protocol has 3 drawbacks : a) Implosion, b) Overlap , c) Resource blindness. SPIN Protocol overcome the all the drawback of data centric protocol[6].

Modified SPIN Protocol(M-SPIN) : In SPIN Protocol when we send or transmit the data from one node to other node and when node received the data in both the condition energy consumption is more occur because consumption of energy does not only depends upon sensing data but also in transmitting or receiving the data to or from the neighbor nodes.[2] So we can save a significant amount of energy if we can control the number of transmit and receipt of the data messages. . Fig. 4 shows an example of a WSN. And having M-spin Routing techniques.

A WSN Example. WSN Contain number of sensor nodes. WSN divides the networks in two region when an event occurs. Region A contain the sensor nodes , region B contains the sensors nodes and sink node and event node lies between the region A and region B. If event node want to send data to sink node through region A nodes. sensor nodes of region A upon receiving the data from event node, and transmitting that data then region A nodes unnecessarily waste their energy. The data will also have to travel more hops in order to reach the sink.

And when event nodes send data to sink through region B nodes, its save energy because data travel less hops in order to reach the sink. Modified SPIN (M-Spin) Protocol Support this types of selective transmission.

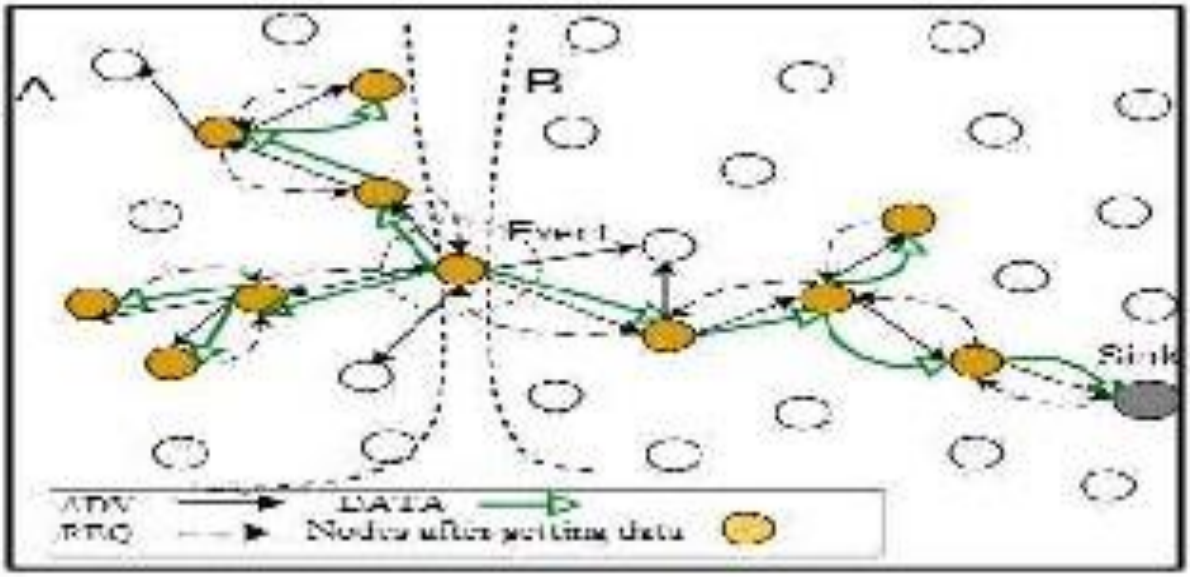


Fig 5. Data Transmission in WSN

M-SPIN has 3 phases:

1) Distance discovery.
2) Negotiation.
3) Data transmission.

Distance Discovery: In Distance discovery phase of M-SPIN. In network when sink node want to send data Initially its broadcasts Startup packet in the network . and startup packet contain type, node id and hop. Here

Type = types of messages.

Node id = sending node id

hope = hop distance from the sink node.

In Network Sensor node received the data in the form of startup packet and startup packet has 3 forms type, node id, hop. So Sensor node in network after receiving the data store types of message, sender node id and hop value in memory. After storing the value, the sensor node rebroadcast the start up packet to its neighbors and increase the value of hop by 1. Sometime sensor node received multiple startup packets from different nodes.the This process is continued until all nodes in the network get the Startup packets at least once within the Distance discovery phase.[4].

Negotiation: In negotiation , sender nide sends the ADV message to all neighbor node. After receiving ADV message ,each neighbor node verifies the advertised data is already received or requested or not. And comparison the distance of node with sink node in term of ADV message and verifies whether it is nearer to sink node or not.If hop distance of the receiving node (own_hop) is less than the hop distance received by it as part of the ADV message (rcev_hop), i.e. *own_hop* < *rcev_hop*, then the receiving nodes send REQ message to the sending node for current data. The sending node then sends the actual data to the requesting node using DATA message. [7].Using the function *storepkt node stores the data in its memory and node*

get data from sensor node. To specify which data is presently residing in its memory they uses *setCurrent* function. When ADV message is received, then Using the function *chkHistory* each receiving node first checks its record to ascertain whether it already has seen that data. and want to find which data packet is waiting for, call setDesired function[7].The source nodes which receive the REQ use the function *getCurrent[3]*.

Data Transmission: After completion of data discovery and negotiation, next phase is data transmission. When source node received the request, data immediately sent to the requesting node. If requesting nodes are sink node then immediately sent to the requesting node. If requesting nodes are sink node then negotiation phase will stop. Otherwise negotiation phase will reperat. During negotiation phase intermediate sensor nodes broadcast ADV message for data and modified hop distance value. The sending nodes add the packet format of ADV message with modify value of hop distance field with its own hop distance value. The process continues till data reaches the sink node.

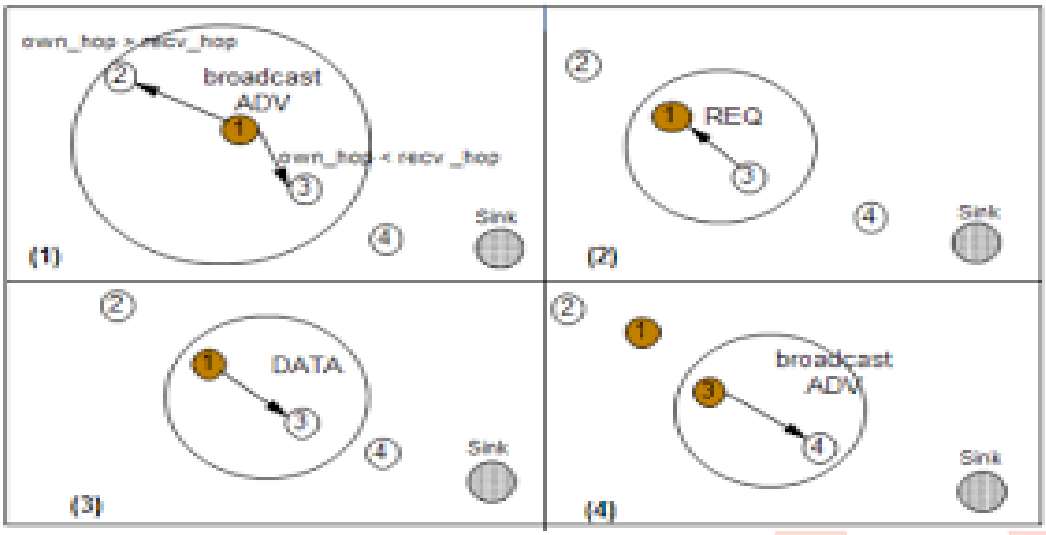


Fig 6 M-SPIN Protocol In Step(1) Node Broadcast ADV message to all its neighbor.Step(2) Node 3 sending a request to node 1.Step(3) Node 1 send the data to node 3 after receiving request.Step(4) Node 3 broadcast ADV message to its neighbor node for the data that it receiving from Node 1.

So above study show that the M-spin protocol performs better as compare to other networks protocol.

Proposed work: Number of schemes were to make the communication more energy efficient like SEP, SPIN,SPIN-PP, SPIN EC.[6]. But these protocols are not considers as realistic approaches due to their limited level of heterogeneity .Our proposed scenarios are based on M-SPIN. To increase the stability time and for efficient energy utilization .We propose Genetic based M-SPIN routing protocol schemes.

Formula for average energy of rth round:

$$E(r) = \frac{1E_{total}(1-\frac{r}{R})}{N}$$

$$R = \frac{E_{total}}{E_{round}}$$

$$E_{total} = NE_0(1 + m(a + bm_0))$$

$$E_{round} = (2NE_{elect})$$

Here,

E(r) = Average energy of rth round.

R = Total round.

r = number of round

K = No. of cluster.

Probability too become head for current round of nodes given as:

$$P_i = \frac{P_{opt} E_i(r)}{\left(1 + m(a + m_0 b)\right)} E(r)$$

At starting of each round, node decides whether to become CH or not all depend on threshold values[5][8]:

T(Si) = Pi/1-Pi(rmod 1/pi)

In above the equation Popt is equal to reference value for average probability pi.. In our proposed protocol values of Popt is calculate using genetic algorithm[3][9].

1 Find the initial population of individuals.population It is a subset of all the possible (encoded) solutions to the given problem.

2.Evaluate the fitness value of each individual in that population. A fitness function simply defined is a function which takes the solution as input and produces the suitability of the solution as the output. In some cases, the fitness function and the objective function may be the same, while in others it might be different based on the problem.

3 If fitness value of population is gives better value than initial population then terminate the algorithm. Else perform genetic operators(Mutation and crossover).

4.Generate new individuals through crossover and mutation operations to give birth to offspring. 5.Evaluate the individual fitness of new individuals.

7.Replace least-fit population with new individuals.

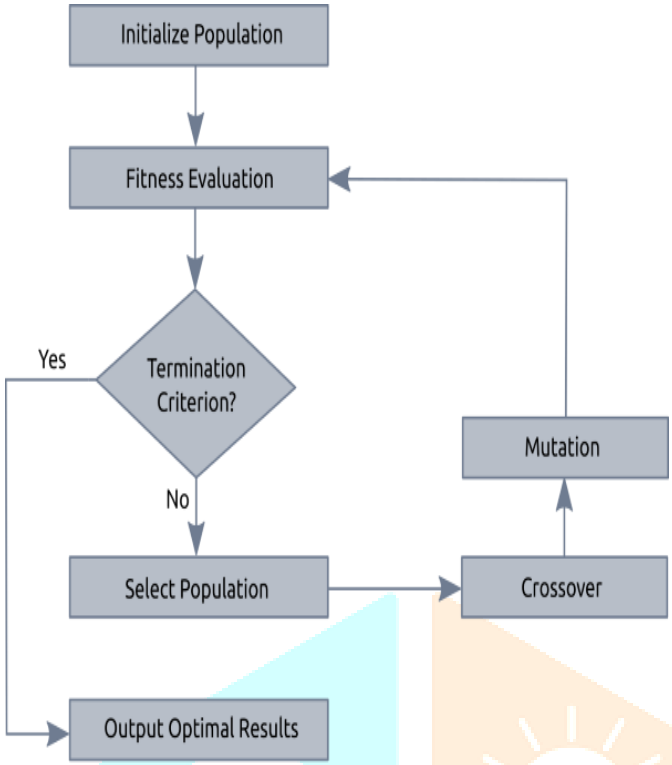


Figure 2: Basic structure of Genetic Algorithm

Conclusion:

In this paper we have studied SPIN and M-SPIN data centric protocols used in Wireless Sensor Networks. SPIN is an energy efficient protocol for WSN. M-SPIN protocol also belong to family of SPIN.M-SPIN is modified version of the traditional SPIN protocol. M-SPIN helps to increase the network life time of nodes and Decreased the battery consumption the of the nodes. However M-spin protocol have some limitations. It has complex computation because to calculate energy level at each node everytime makes the computation complex. So in proposed work we apply the genetic algorithm in M-SPIN Protocol. Genetic algorithm is used to determine the optimal probability for head formation in WSN. Genetic based M-SPIN perform better as compare to other protocols like SPIN,SPIN-PP and M-SPIN . It has best performance in terms of stability period and network life time.

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