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ISCRHF: AN EFFICIENT FRAMEWORK OF IMPLANTABLE SENSOR CLUSTERING FOR REDUCTION OF HEART FAILURE

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ABSTRACT:

Social Sensor Network is defined as the integration of social network (Face book, Twitter, Instagram, etc.) and sensor network which provides several applications for peoples in the world. Social Sensor Network provides various applications, but they cannot provide accurate information for human being. For solving these problems we propose a new framework called ISCRHF, a healthcare application on Social Sensor Network. In this application, we monitor the outpatients who having disease of Heart Failure. This framework collects information by fixing an implantable sensor device (Cardio MEMS HF System) and other body sensor in the patient's body. Then to perform efficient clustering we propose algorithm called Implantable Sensor Clustering. Secure communication is done between intra cluster and inter cluster based on distributed servers which performs effective routing scheme called IZRP_FRR. Our experiments are simulated on omnet++ simulation. Our results should improves the reliability in a network, secure communication, and improved throughput.

Index terms: Social Networks, Sensor Networks, Load balancing, Zone routing protocol, Clustering, ADHF

I. INTRODUCTION:

Social Sensor Networks is a combination of Social Network (Face book, Twitter, MySpace, etc.) and Sensor Network. A number of recent technological advances in hardware and software have enabled the integration of social and sensor network [1]. They work together and provide advance development in different domains like Mobile computing, Data Mining and Signal processing. Information's of those domains are only accessed by mobile phones [2]; Crowd sourcing sensing operation must prove the trust worthy between social community and active patterns. Integration of social sensor networks should reveal impression about positive and negative relationships. Sensor information's are taken in the social network community by using the internet. Smart city applications are the challenging task for the cooperative task of dynamic environment monitoring, timely emergency response and citizen safety guarantee [4]. In Recent technology the Internet of Things (IoT) focuses on the improvement in safety measures and economy.

Different applications shall be progressed effectively with association of social sensor networks. Fig 1 illustrates the integration of social and sensor networks. This application includes sensor's information and people's involvement [3]. In Health awareness, integrating body sensor networks with social network to monitor the patient's health status and provide corresponding solution periodically. Life Style Activity Recognition based application enable sensing smart phones to gather lifestyle of the particular human being. These types of applications are the fashionable in the current generation. Participating sensor is defined as the process of acquiring sensory information from any mobile devices and is stored in any remote area.

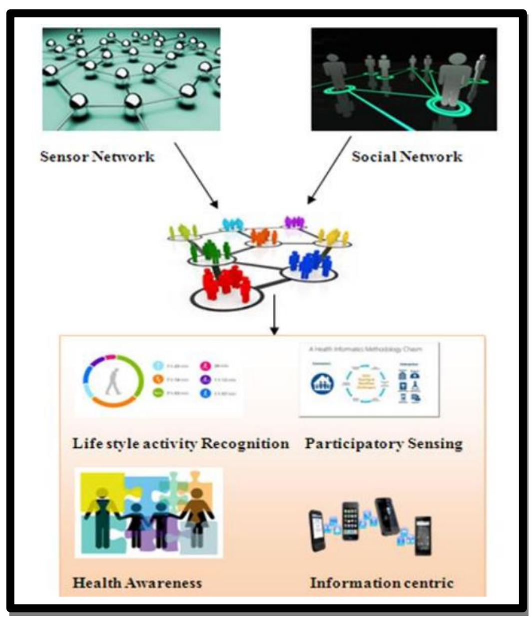

Fig 1: Integration of Social and Sensor Network

These applications applied on non-cooperative game theory and search and retrieval of multimedia documents. This kind of sensing application frequently requires user contributions to take decisions.

Information Centric sensor application should follow onto the dense sensor networks, here combining community structures of sensor data and data recovery algorithms, these applications main goal is to eliminate the sensor maintenance costs [22]. Mobile edge capture and analysis middleware applications are the latest infrastructure for data collection from the mobile devices and provide high level abstraction to express diverse data in social sensing application [23]. Application such as SenseFace was introduced to solve the problem of altering user context from 5G technology of heterogeneous network and covers the community of interest [24]. These applications are used to increase the utilization of the network. In sensor networks malfunction process takes place which takes more time for detection. This causes the degradation of performance of the sensor network. To avoid those performance degradation in several applications of sensor network our framework is to be proposed.

Our Framework reduces the death of human being due to Heart Failure, a disease called *Acute Decompensated Heart Failure (ADHF)*. We use this ISCRHF framework for heart patient monitoring system. Our contribution of the paper consists of:

- Collection of heart patient's data from hospital data server.
- Next, we get symptoms from the implantable sensors and body sensors.
- Based on symptoms we have to make clustering. There are 4 symptoms for the ADHF. They are:
    - High pressure
    - High heart rate
    - Chest pain
    - Higher body weight, whereas the critical stage for the patient, they are immediately admitted to the hospital.

  Clustering process is done by a new Algorithm called Implantable Sensor Clustering.
- Routing mechanism to be done for the packet transmission scheme between the users based on the new scheme named as IZRP_FRR. For balancing the load on servers, the effective Fuzzy with Round Robin algorithm is used on servers.
- Communication (intra cluster and inter cluster) to be done between the patients based on Secure Communication with Dynamic matching scheme. Identity Based Encryption (IBE) is used for the secure key generation process. This process provides the secure communication between two patients who are in same group or in different group.

The remaining of this paper, Section II describes about the literature review of the paper. In Section III we discuss about the Problem definition. In Section IV we discuss about the overview of proposed work and methods and process carried on to the proposed framework of the paper which includes the Process of Sensor, Clustering, Security, and Routing. In Section V Discussion of performance evaluation of our proposed framework and finally in Section VI we conclude the paper.

II. LITERATURE SURVEY:

WBAN is one of the important technologies which are helpful in healthcare applications for examining the patients [5] these sensors does not affects the mobility of the patients. Recent research of WSN is the Structural health monitoring (SHM) [6], Researchers such as Ping Wang, Yan Yan, Gui Yun Tian, Omar Bouzid and Zhiguo Ding proposed the key issues of WSN applied in SHM which includes the integration of different types of sensors with different operational modalities, sampling frequencies, issues of transmission bandwidth. In the recent years smart cities are developing which they mainly focus on the Traffic Management System (TMS) to make more efficient in smart cities [7], here they specify more open challenges and present their vision for the smart cities. Author [8], proposed that wireless technologies are pervasive to support ubiquitous healthcare applications, and they use power control algorithm under a non-cooperative game theory to achieve a network-level objective. In the paper [9], a cluster-based epidemic control scheme is proposed based on smart phone-based body area network and this scheme divides the people to make multiple clusters based on their physical location and social contact information. They developed a computational efficient approach called UGP to enable an effective cluster-based quarantine strategy using graph theory for large scale networks. Author [10], distinguishes the Mobile Social Network (MSN) and conventional social networks. They review the MSN applications and services and provide dominant mobile operating systems. Authors Bo Fu, Yang Xiao, Xiannuan Liang and C. L. Philip Chen [11], they investigate several approaches to realize the architectures and how the bio-inspired communication and networking approaches support the surveillance. Author [12] proposed MobiClique as a way to removing central server to conduct exchanges and it is an opportunistic contact between smart phones to form adhoc communities for social networking and social graph based opportunistic communication. Researchers such as Zhibo Wang, Jilong Liao, Qing Cao, Hairong Qi and Zhi Wang [13] proposed an application named as Friendbook, a novel semantic based friend recommendation system for social networks. This application discovers lifestyles of users from user-centric sensor data, measures the similarity of lifestyles between users and recommends friends to users if their lifestyles have higher similarity. They also use feedback mechanism to further improve the recommendation accuracy. In the paper [14], they presented friend recommendation systems by using complex network theory, cognitive theory and a Pareto-Optimal genetic algorithm for providing quality friend recommendations. This method showed a combined approach has thus far performed purely social and purely network based approaches, but has a drawback of lower performance in social based approaches due to large number of complete data. Researchers such as Surender Reddy Yerva, Jonnahtan Saltarin, Hoyoung Jeung, Karl Aberer [15], presented a travel recommendation system as a practice of the fusion, that offers the information of people's moods regarding the predicted weather on where the people wish to travel. Their system gets various components towards effective large scale social and sensor data fusion. Author [16], presented a survey of the state of the art routing techniques in the Wireless Sensor Networks (WSN). They outlined the design challenges for routing protocols in WSN and presented the survey of different routing techniques, tradeoffs between energy and communication overhead savings. In the paper [17], the Author proposed Modified Zone Routing Protocol which avoids noisy links by choosing the Route Request (RREQ) packets that having highest Signal to Noise Ratio (SNR) that enhances link reliability and system throughput. Researcher Imran Qureshi [18], proposed the various CPU scheduling Algorithm with Different parameters, such as running time, burst time and waiting times, etc. Authors [19], secure Same Symptoms based Handshake scheme, each patient is granted with a pseudo-id and its private keys corresponding to his symptoms. The SSH scheme is based on bilinear pairing for the MHSN. But it has a drawback that the patients who belongs to same group can communicate in SSH scheme. Researchers Giuseppe Ateniese, Marina Blanton, Jonathan Kirsch [20], presents efficient secret handshake schemes with unlinkable, reusable credentials that do not rely on random oracles for their security. They present a secret handshake with dynamic matching and include attributes, allowing the handshake to be based on appropriate matching

III. PROBLEM DEFINITION:

Integration of sensor networks with social networks are called as Social Sensor Networks (SSN) leads to various application that can sense the context of a user in much better ways and thus provides more personalized and detailed solutions. Applications such as healthcare monitoring are deeper integrated into the daily life and context-awareness through social network and sensor network data becomes a key enabler for these emerging services. Most parameters such as Zone Radius (ZR) and Cluster Stability (CFT) are needed to be considered in social sensor networks. Because they are included in different issues like clustering, load balancing and security, that does not provide good results. To solve those problems in SSN, we have created a new framework called ISCRHF which monitor the heart patients who are affected by heart failure disease. In our process, Input values are collected from implantable sensors, heart monitoring sensors and body sensors. From these sensors, we collect symptoms and cluster those peoples according to their symptoms.

IV. PROPOSED FRAMEWORK:

4.1 OVERVIEW:

Overview of our proposed framework only focuses the progresses of Social Sensor Network (SSN). In this framework, we get the health information from the human body by using sensors and associated with social networks for getting services and achieve good results of newly developed social sensor network application. Our new framework ISCRHF is mainly used for monitoring the heart disease patients and prevents patients from heart failure (Acute Decompensated Heart Failure). This monitoring application reduces the count of human's death of human due to heart failure. Our framework includes the concepts such as Clustering, Routing and Load Balancing and security. To perform these operations we develop new algorithms to achieve good results for our proposed work. The overall framework is depicted in Fig 2.

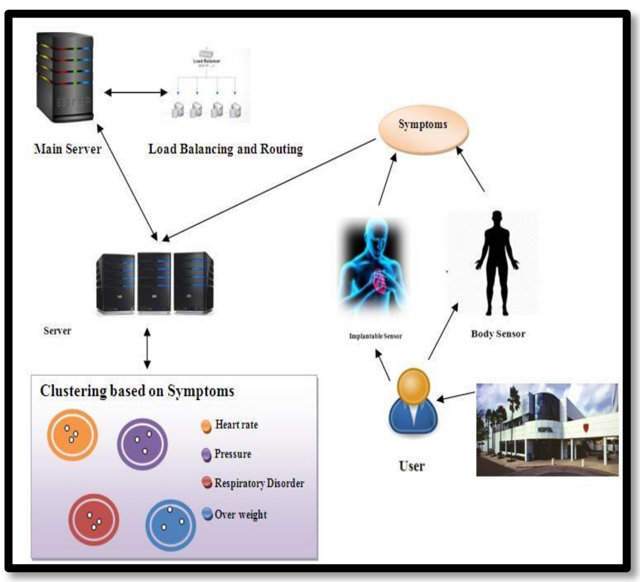

Fig 2: Overall Framework

4.2 PROCESS OF SENSOR:

Sensing process is an initial stage of our process. Heart problems like Chronic Heart Failure Disease affected people have 70% of possibility to cause of critical heart failure i.e. Acute Decompensated Heart Failure (ADHF). The outpatient monitoring process is an old process for early detection and treatment of ADHF. However, there are various questions like which parameters to monitor and what is the specific detection strategies should be used for preventing hospitalization has not been adequately addressed. Many symptoms are there for ADHF disease and the physical examination signs such as pulmonary rales (abnormal ling sounds), peripheral edema (accumulation of fluid causing swelling), and elevated jugular venous pressure (indirectly observed pressure over venous system) reflect increased ventricular filling pressures and vascular congestion. However, these symptoms are poor sensitivity for detecting acute decompensation heart failure in early stage, particularly among patients with chronic Heart Failure syndromes, and also these findings are often relatively the later stages symptoms reflecting substantially elevated ventricular filling pressures. As such, dependence on symptoms and physical examination of the heart failure patient's findings alone has proven ineffective in averting ADHF hospitalizations. Here serial monitoring of body weight has some advantage for the outpatient HF monitoring; HF patients who have increases in body weight can be detectable before ADHF hospitalization. In order to facilitate early detection of ADHF and prevent recurrent hospitalizations, the serial assessment of body weight has been incorporated with other clinical and physiological parameters into multidisciplinary remote patient monitoring programs. For preventing recurrent hospitalization we use Implantable sensor to monitor the peoples (peoples are in mobility). The new Implantable sensor called Cardio MEMS HF System is fixed near the pulmonary artery of the human heart which is used for identifying the pressure in the area of the pulmonary artery that is the first reason for causing the ADHF disease. Also we use heart monitoring sensors such as ECG, EMG and body sensors. Heart patients' information's are collected from all the hospitals in all over the world. Information from every zone, which is forwarded to the main server and it, is maintained in every zone. Every sensor's information is transformed to patients PDA and it is transformed to the zone server. Every sensor collects symptoms that are transformed to the server and we move the process to the next stage of our framework.

4.3 CLUSTERING:

A group of the same or similar elements gathered or occurring closely together. In our framework, clustering is the major part. In our clustering process, the cluster is made up of sensor information i.e. Symptoms. We cluster the patients based on four stages of symptoms.

- Higher Pressure
- Higher Heart Rate
- Respiratory Disorder
- Over Weight

Symptoms are the major symptoms for Heart Failure. Here activities of the heart patients are monitored by the body sensors. The Implantable sensor senses the pressure on the artery valve of the human which checks the pressure in that portion of the heart. They are grouped in a cluster. Then their next stage is heart beat checking, so the patients who have higher heart beat which is checked by ECG sensor are grouped in the second cluster. Next stage of heart failure is respiratory disorder which is checked by EMG sensor, the patients who have respiratory disorder are grouped in third cluster and final stage is over weight of the patients which is critical stage of the disease, so they are immediately admitted to the hospitals. The sensor monitoring information are directly stored on their zone which is forwarded to the server. According to the patients who have heart disease are progressed in the Social Network such as face book, twitter, etc.

Pseudocode : Implantable Sensor Clustering

<u>Inputs:</u> $U_i \rightarrow \{U_1, U_2, U_3 \ldots U_n\}$,
$S_i \rightarrow \{S_1, S_2, S_3, S_4\}$ &
$C_i \rightarrow \{C_1, C_2, C_3, C_4\}$

<u>Initialization:</u>
$U_i = 0$

i) $S_1 \leftarrow U_i$
ii) Set $U_i \rightarrow C_1$
iii) If ($S_2 \leftarrow U_i$)
Set $U_i \rightarrow C_2$
Else if ($S_3 \leftarrow U_i$)
Set $U_i \rightarrow C_3$
Else if ($S_2, S_3, S_4 \leftarrow U_i$)
Set $U_i \rightarrow C_4$
Set AL
End if
End if
End

Fig 3: Implantable Clustering Algorithm

For that issue we have developed a Clustering Algorithm called Implantable Sensor Clustering (ISC) Algorithm. Here Fig 3 represents the pseudo code for the clustering.

The above pseudo code describes the process of clustering in our framework. Here the U_1, U_2, U_3 ... represents the number of users (Heart patients) in the server. And also S_1, S_2, S_3, S_4 represents the symptoms in the disease and finally C_1, C_2, C_3 and C_4 represents the number of clusters in the sensor network. The algorithm starts with initial cluster c_1 because all the users are the heart patients, they have implantable sensor which is placed by the doctors. The patient may suffer any of the other symptoms like higher heart rate, respiratory disorder and Overweight. If the symptoms (all the symptoms) have the higher range than the normal range then they are immediately admitted to the hospitals in order to save the patient's life and the alarm (AL) is setted for the care center and to the hospital. Fig 4 is a diagrammatic representation of cluster formation.

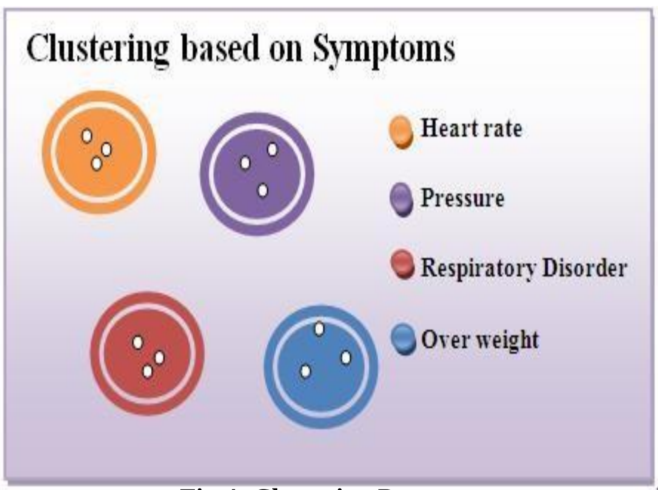

Fig 4: Clustering Process

4.4 ROUTING:

Routing is an important process in the Social Sensor networks for Information transformation between users and servers. Users in the clusters need to communicate with other people in the network through servers. In our paper, we develop a new mechanism called IZRP_FRR. IZRP_FRR scheme should works both for routing and the load balancing technique. The routing table is an important parameter in the routing which has user details such as location, id, neighbor cluster, and neighbor's roles. Path selection process is the next process for the transmission purpose. In our work, we use various servers such as zone servers, Main server which are used for maintenance of the user's information and perform the network access. The zone servers are placed in every location such as country, state, and city. The only one main server is used for the maintaining of the user's information and has the index of all the zone servers. Important parameters we use zone radius and node velocity which are proportional to one another. This process reduces the overhead and end-to-end delay in the process.

Here we use a sequence number for the information transmission for the source to destination. The value of the sequence number is greater than the previous RREQ for the same source destination pair. Seq_No is used to ensure that the same RREQ(S, D) that was previously received at Intermediate node (N_i) will be rejected if received again node N_i the new RREQ(S, D) will be received and processed at Intermediate node (N_i) because the Seq_No is updated.(i.e. incremented by one).

Here we need to use the load balancing algorithm at a timer of the routing because the user gives more requests for the server. The server must handle the entire request so we need to use the load balancing process. We derive a pseudo codes for the Finding Zone Radius in Fig 5, Improved Zone Routing Protocol in Fig 6 and Fuzzy Round Robin in Fig 7.

Pseudo code: Finding Zone Radius

Input: Network topology, Node velocity,

Output: Zonal Radius K for Node N

```
Begin process
 If ((RREQ(S, D)) received at (I ≠ D) && (Seq_No
(RREQ(S, D))) > Prev_Seq_No(S, I, D)) then
     If 0 ≤ V ≤ 5 then set K = 2 hops.
     If 5 < V ≤ 10 then set K = 3 hops.
     If 10 < V ≤ 15 then set K = 4 hops.
     If 15 < V ≤ 20 then set K = 5 hops.
End if
End process
```

Fig 5: Finding Zone Radius

Here S is the source node, D is the Destination node, I the intermediate node, RREQ(S, D) is the Route Request packet node for source and destination pair. Seq_No (RREQ(S, D)) is the sequence number generated by node s for route request packet for destination D. This is the value which one more than the previous route request for the same source destination pair, Prev_Seq_No(S, I, D) is the sequence number of previous RREQ(S, D) received at node I, Zone Radius K and velocity V of a node mps (Meter per second).

The Routing process can be done in the routing manner. The users in the network should pass the request to the zone server Zs. Then the zone server passes the request to the main server Ms. Here the main server analyzes the user's query in the same zone or not. Then the destination zone is analyzed in the routing table by the server. If it is in the same zone, proactive routing will takes place. The proactive routing analyzes the routing table and find the exact location of the destination Ds in the zone server.

Pseudo code: Improved Zone Routing Protocol

Input: RT, $U_i = \{U_1, U_2, U_3 \ldots, U_n\}$, M_s, D_s, U<10

$Z_i = \{Z_1, Z_2, Z_3 \ldots, Z_n\}$

Initialization:

U_i (Req) = 0

1. Send Ui (Req)→Zs
2. Send Zs→Ms
3. If(Ds is present in Z(RT))

   Activate P_{RT}

   Find Ds

   Get Zs←Ms (Rep)

   Get U_i←Zs (Rep)

   Else

   Activate R_{RT}

   Collect next RT

   Find Ds

   Get Zs←Ms (Rep)

   Get U_i←Zs (Rep)

   End if

   End

Fig 6: Improved Zone Routing Protocol

The routing table has the information such as username, zone, and area within the city. And a reply message is send from Ms to Zs and to corresponding user from the Ms. Here the load balancing process takes place for the route identification.

Table 1: Routing Table

Users	Zones
U5	A1[Z1]
U2	A3[Z4]
U9	A1[Z7]
U4	A5[Z6]
U10	A4[Z4]
U7	A9[Z3]

We use Fuzzy Round Robin for the load balancing process in the Ms. From the working of Fuzzy Round Robin load balancing, it could balance all user requests U_i from each and every zone in the world. Here R_q is the ready queue, TQ is the time quantum, B_i is the Burst time of the U_i, R is the remaining time to process the U_i and P is the value for preemption status for the request and it is lesser than $3/8^{th}$ of the time quantum. Here the values of low, middle and high indicates the number of request arrives in the ready queue. If $U_i < 100$ then TQ=10, if $100 <= U_i < 1000$ then TQ= 30 and $U_i > 1000$ then TQ=50.

Initially enter the user request in the ready queue and process the request according the time quantum. If the TQ occurs then the burst time is verified according to the P value. When the condition is true then process the U_i otherwise move to the end of the ready queue and schedule for the other process. After the end of Fuzzy Round Robin the routing mechanism starts again. When the user requested query is not in the particular zone i.e. proactive routing, then Reactive routing takes place to find the Ds by analyzing the routing table in the nearby zones. After finding of the Ds, the Ms pass the reply messages to the Zs and it is followed by Zs to U_i. At the moment of route finding the Fuzzy Round Robin process takes place for the load balancing in an efficient way. Usually hybrid protocols works as both reactive and proactive routing which have the best performance in the routing protocols. People can communicate with each other from different zone or in the same zone that has the same symptoms or in different symptoms. The main reason for choosing the Fuzzy Round Robin scheduling is for reducing the unnecessary overhead and waiting time.

Pseudo code: Fuzzy Round Robin

Inputs: R_Q, U_i →$\{U_1, U_2, U_3 \ldots U_n\}$,
TQ→ {Low (30), High (50), and Middle (30)},
B_i →$\{B_1, B_2, B_3 \ldots B_n\}$, P= 3/8TQ

Output: Scheduled data on the server

1. U_i enters into the R_Q
2. Process U_i
3. If TQ occurs
4. If P <= B_i

   Process U_i

   Else

   Move to end of R_Q

   Schedule other U_i

   End if

   End process

Fig 7: Fuzzy Round Robin

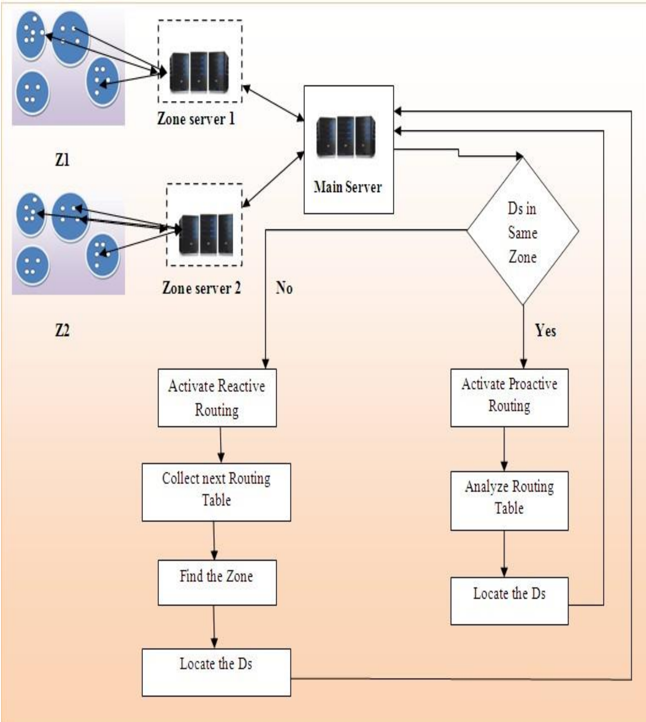

Fig 8: IZRP_FRR

4.5 SECURITY:

An Important issue of Social Networks and Sensor Networks is the security which encompasses the characteristics of authentication, integrity, privacy, nonrepudiation and anti-playback. Here more dependency on the information provided by the networks has been increased, which leads to the more risk of secure transmission of information over the network has been increased. In our proposed process, we provide the secure communication for the user with others users within the same zone or in the different zones by using the Identity Based Encryption with dynamic matching process which is based on the attribute based encryption. Secure key generation process is based on identity based encryption. This dynamic matching process gets the number of groups (Cluster Id) and their user's roles (symptoms of the patient) as input for the secure communication.

Here, the user must specify the cluster and role of the other user that the user wants to communicate. Here in order to find the destination user specified the routing process takes place. In this scheme when a user moves form one group to another group which can be easily changed from the specific patient. According to the proposed process we have four clusters according to the symptoms of the Acute Decompensation Heart Failure (ADHF). Fig 9 describes the process of Secure Communication with Dynamic Matching.

Pseudo code: Secure Communication with Dynamic Matching

<u>Input:</u> RT, $U_i = \{U_1, U_2, U_3 \ldots, U_n\}$, M_s, D_s, $Z_i = \{Z_1, Z_2, Z_3 \ldots, Z_n\}$, $C_i \rightarrow \{C_1, C_2, C_3, C_4\}$

$S_i \rightarrow \{S_1, S_2, S_3, S_4\}$

<u>Initialization:</u>

U_i (Req) = 0

1. Send Ui (Req)$\rightarrow$Zs [Specify the Cluster id & Symptoms]
2. Send Zs$\rightarrow$Ms
3. If(Ds is present in Z(RT))

    Find Ds

    Send response message to U_i

    Get Zs$\leftarrow$Ms (Rep)

    Get $U_i \leftarrow$Zs (Rep)

    Compute K_i

    End if

    End

Fig 9: Secure Communication with Dynamic Matching

<u>K_i Computation process:</u>

1. Ds Encrypt Ui (Req)
2. Generate Ui key
3. Ui Encrypt Ds (Rep)
4. Generate Ds key
5. If (C_{id} && Si matched)

    Start C_i

Secure communication process is explained as follows, when a user (U_i) from any cluster, choose another user (D_s) from any other cluster or in the same cluster by specifying the cluster id and symptoms. Here the routing action takes place for finding another user. After finding destination user (D_s), server sends the request from user to destination user (D_s). And destination user sends the reply to user (U_i). In the reply and request messages which contains encrypted message that is decrypted by their own private key of the users, here they compute the keys which is used for their direct communication. In this computation process the user specified cluster id (C_{id}) and symptoms (S_i) matched, their direct communication process can be successful.

V. PERFORMANCE EVALUATION:

In this section, Cluster stability, Routing Overhead, Delay and Jitter of the existing techniques are compared with our ISCRHF framework. Here the techniques we used are different but the parameters of the proposed system and the existing system are somewhat similar. Here the existing system listed is Distributed Energy Efficient Clustering (DEEC), Zone Based Routing (ZBR) for the routing and the secure handshake mechanism for security. From those results we must compare our proposed framework for provide efficient results. These algorithms are extending for identifying the performance of ISCRHF process in social sensor network. We discuss about the following algorithm:

- **DEEC:** The process of distributed energy efficient clustering selects the cluster head based on energy of the nodes in the cluster and higher residual energy of the sensor node. The stability of a cluster is increased at low death of the sensor nodes and the alive nodes in the cluster.
- **ZRP:** The process of zone based routing protocol uses a proactive routing and reactive routing. Whenever the velocity of a particular node increases it leaves its current zone. This process increases the overhead which relates to the end-to-end delay and jitter.
- **Secure Handshake Mechanism:** The process of secure handshake mechanism allows user to communicate who are in the same group. This allows the people who cannot get additional information apart from the group. They cannot gather the information from other groups.

5.1 SIMULATION RESULTS:

We conduct our experiments on the OMNeT++ simulation framework. This simulation tool should help us to perform proposed ISCRHF framework with new algorithms. OMNeT++ simulation was conducted with some considering parameters which are shown in Table 2.

For conducting our experiments 50 nodes can be used. Each nodes are in mobility in nature and it can be move from random way from (1 to 25) m/s. Simulation should be conducted in the area of 1000 * 1000m. To perform traffic management in social sensor network we have to use Content Bit Rate (CBR) at a time of packet transmission. Usually, transmission range is defined by 200 m. Here traffic source generation upto 512 bytes data packets.

Table 2: Structure of OMNeT++ Simulation

Parameters	Values
Number of nodes	50
Protocol Name	Improved Zone Routing Protocol
Mac type	Mac/802-11
Channel	Wireless Channel
Interface type	Phy/Wireless Phy
Transmission Range	200m
Packet Size	512 byte
Transmission Rate	5 packets/sec
Nodes Speed	25 m/s
Map Size	1000 x 1000 m
Movement Model	Random
Traffic Model	Constant Bit Rate (CBR)

Simulation consists of IEEE 802.11 MAC protocol are uniformly distributed. Nodes presented in our simulation must moves depend upon random waypoint mobility model which can be created and executed by OMNET++ simulation framework. Speed of the mobility nodes are 25 m/s. Actual raw data of each and every nodes was 2Mb/s. Table 2 clearly have the details of parameters involved in this simulation in an appropriate manner.

5.2 PERFORMANCE METRICS:

We consider the following metrics are to be conducted for experiments on OMNeT++ simulation framework between existing and proposed system. Three performance metrics are

- Cluster stability
- Routing Overhead
- End-to-End delay
- Jitter

The above parameters are clearly explained and plotted with its graphical representation in next section.

5.3 COMPARATIVE ANALYSIS:

We conduct the experiments of our proposed system work with existing system algorithms when concentrating variance of each parameter in the performance metrics are as follows. Comparative analysis will be done with the existing algorithms.

Table 3 shows the results in Cluster stability; Table 4 & 5 shows the results in terms of Routing (Jitter and End-to-End delay). The above results consider network size and number of nodes.

Table 3: Performance of Cluster Stability

Algorithms	Cluster Stability
DEEC	0.5%
ISC	0.2%

Table 4: Performance of Routing (Jitter)

Algorithms	Jitter
ZRP	0.9557
IZRP_FRR	0.2147

Table 5: Performance of Routing (End-to-End delay)

Algorithms	End-to-End Delay
ZRP	6.547
IZRP_FRR	0.815

5.3.1 CLUSTER STABILITY:

The cluster stability is defined as the lower number of dead nodes in the cluster which enhances the network lifetime of the process. Fig 10 represents the number of dead nodes per round.

Cluster stability = number of N_{dead} or number of N_{active}

Here

- N_{dead} → denotes the number of dead nodes in the cluster
- N_{active} → denotes the number of active nodes in the cluster

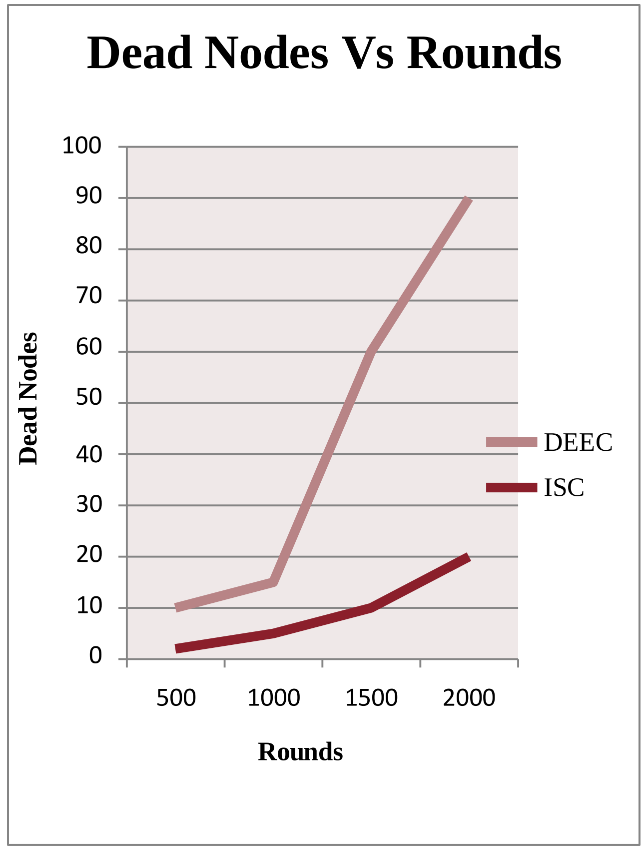

Fig 10: Performance of the Cluster stability based on Dead Nodes

5.3.2 ROUTING OVERHEAD:

The performance of the IZRP_FRR routing results in reduced overhead because it uses the zone radius and node velocity for the routing process. Fig 11 represents the reduced overhead.

5.3.3 END-TO-END DELAY:

End-to-end delay is an important term in routing process that defines the average time taken to a packet for transmission across a network from source to destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted. The End to end delay is calculated by

$$= \sum (\text{arrive time} - \text{send time}) / \sum \text{Number of connections}$$

The Fig 12 shows the end-to-end delay in the proposed process.

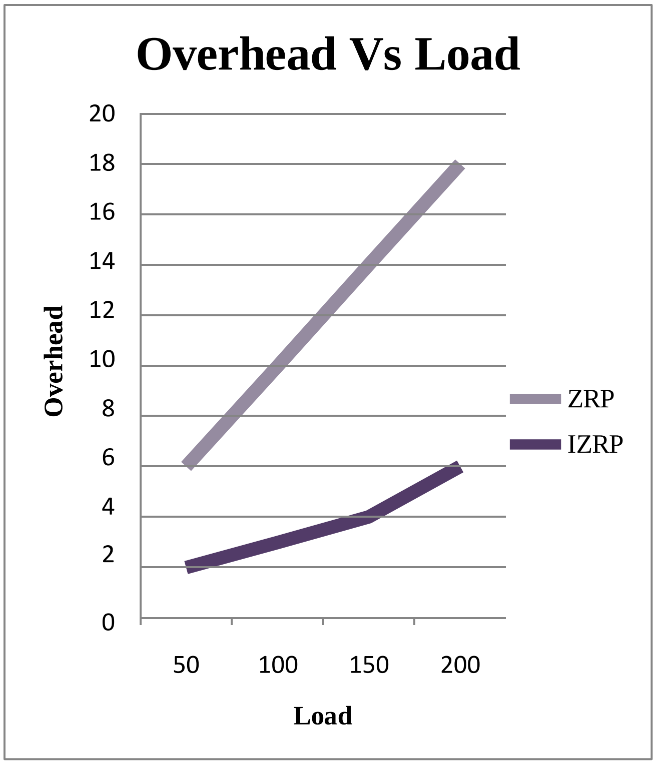

Fig 11: Performance of the Routing overhead

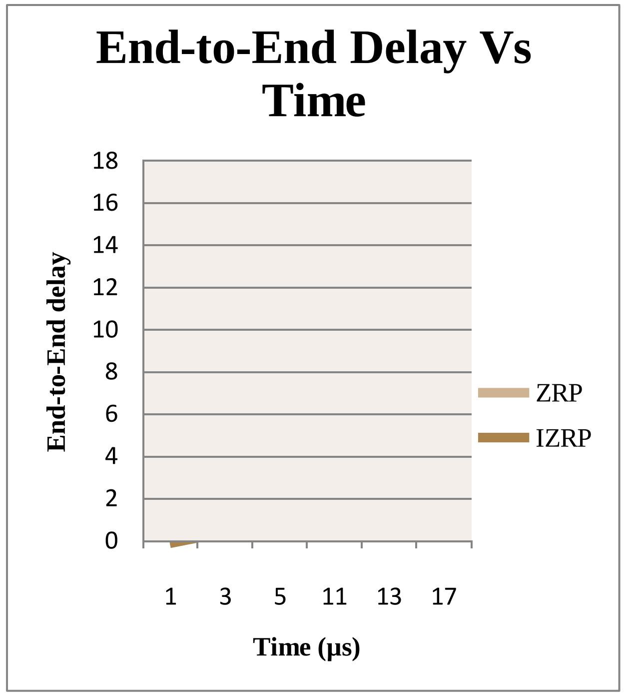

Fig 12: Performance of the End-to-End Delay

5.3.4 JITTER:

This is an important parameter in the wireless sensor network; Jitter is defined as a variation in the delay of received packets. At the sending side, packets are sent in a continuous stream with the packets spaced evenly apart. Due to network congestion, improper queuing, or configuration errors, this steady stream can become lumpy, or the delay between each packet can vary instead of remaining constant. Jitter is sometimes defined as the time difference in packet inter-arrival time to their destination. The Fig 13 shows the Jitter in the proposed process.

$$Jitter = T_{ARR\ (Packet)2} - T_{ARR\ (Packet)1}$$

Where,

- $T_{ARR\ (Packet)2}$ → arrival time of second packet
- $T_{ARR\ (Packet)1}$ → arrival time of first packet

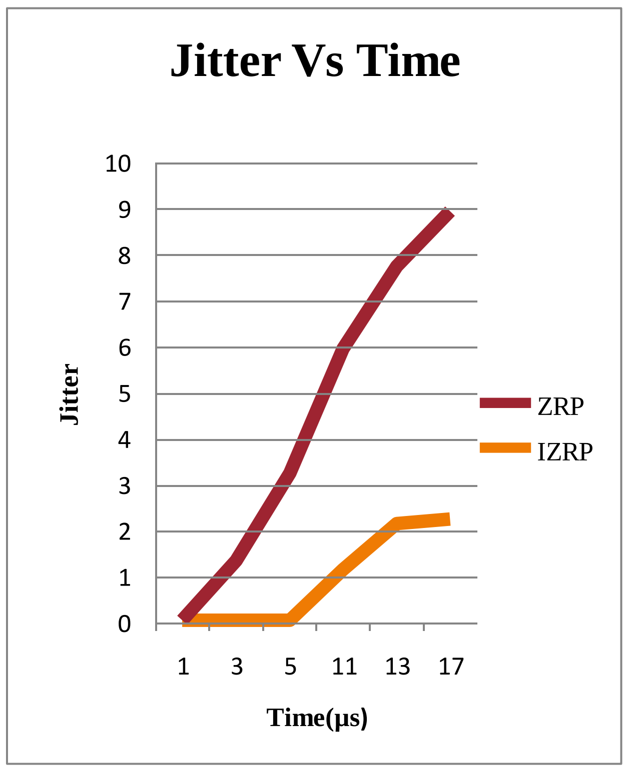

Fig 13: Performance of the Jitter

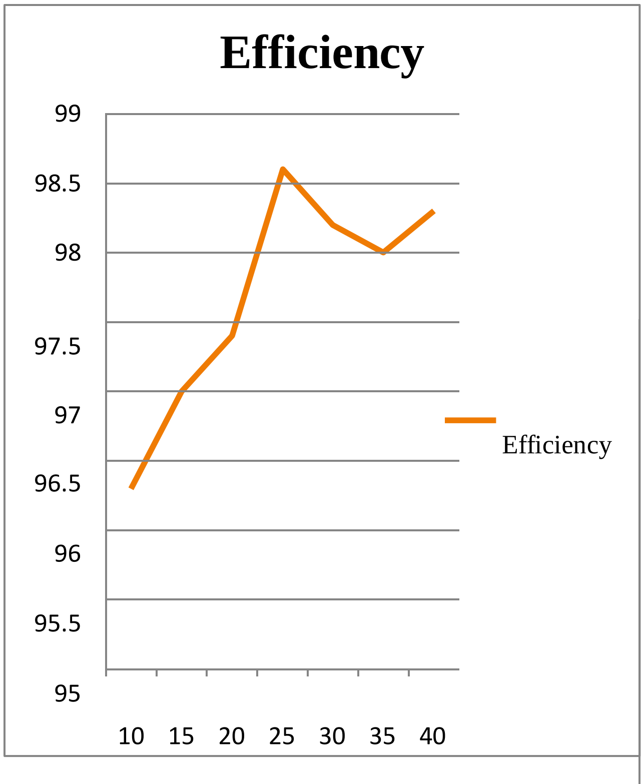

Fig 14: Efficiency of ISCRHF Framework

VI. CONCLUSION:

Our framework named as ISCRHF is the integration of sensor network and social network. Efficiency is the most important factor in the social sensor network because working together process must provide efficient results based on our proposed framework. In this paper, we discussed the various metrics in the previous section. Healthcare monitoring is based on Wireless Body Area Network (WBAN) which is an important factor in the Social Sensor Network. In order to achieve the better results in our proposed framework of ISCRHF performs newly developed clustering method, routing mechanism with Load balancing and also enhances security for the secure communication. In our proposed system we have to find the efficiency of our framework. Comparison of existing with proposed based on the parameters of cluster stability, routing, jitter and end-to- end delay. Those parameters should perform the process of clustering, routing and security. The clusters are formed with the symptoms of the human being for the ADHF disease which are detected by the sensors. After the formation of the clusters, our framework use routing with load balancing mechanism. Finally we provide security to the users for the secure communication with the other people. In order to reduce the death of human due to heart failure disease and to continually monitor the patients in real time, we had created and developed this kind of framework and provide the efficient results. Efficiency of this framework can be evaluated by the overall performance of clustering, routing with load balancing mechanism, End-to-End delay and Jitter. Thus our proposed system achieves effective and efficient works in the social sensor networks.

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