CHAPTER 1

INTRODUCTION

The era of Wireless communications leads to the convergence of all media and data services which emerges with wide acceptance. Among the new technology the health care sector is growing effectively to admin the healthcare sector. Particularly wireless vital signs monitoring is emerging as that latest and the modern health care system which grows very rapidly.

Wearable Human Body Monitoring system which is now treated as Wearable health monitoring systems are the basic elements of an emerging class of sensor network. Such sensor networks are recently called Wireless Body Area Networks (WBANs). These sensors include many functions such as health crisis support, diet monitoring, and detection of activity and so on. Based on the interest of many researchers, system designers and application developers depend on the body sensor networks architecture. This work made many advances on ultra-low-power and light weight, small-size and smart monitoring wearable sensors.

WBAN is a set of miniaturized, low-power, invasive or non-invasive lightweight wireless sensor nodes that observe the functions of the body parts of human with its associates to the surrounding environment. Each sensor in WBANs continuously supervises physiological activities and physical actions of the human periodically.
The physiological activities and physical actions are based on the health condition and movement pattern (Chen et al., 2011; Lamprinos I.E et al., 2005).

More over the wireless senor networks support many applications for its innovation under military applications, ubiquitous health-care, interactive gaming and entertainment. At present, only a single application can be done with current WBANs and also the computational capability and storage capacity are limited. This also includes no mobility support. This brings clumsy and impractical for processing complex sensor data. Hence, on openly speaking theoretically, always the difficult WBAN application to find a place in dealing out the complex sensor information. This situation makes a need of WBAN platforms to provide easy and simple environment for handling computationally complex tasks. On handling the complex tasks, WBAN uses minimum power in order to extend network uptime.

Under this research study, three frame works are proposed. As a first work, an energy efficient MAC Protocol specifically for human health monitor is designed based on the Wireless Human Area Networks. Then the second work, an efficient routing algorithm under private cloud for WHAN was proposed. To provide the secure authentication HAN enabled Cloud services using NYMI was proposed. Finally Adaptable Energy Efficient MAC (AEE MAC) for Health Care Analysis as an application is proposed. All these frame works are planned and implemented with adequate computational and compact software solutions with memory resources utilized to achieve high performance and feasibility.
1.1 OVERVIEW OF THE RESEARCH

A WBAN may be an assortment of multiple functionality, miniaturized and economical consuming wireless sensor nodes that watches functions of body in association with its environment. WBAN used several wireless sensor nodes for observance completely different parameters associated with body and reports the standing of every detector to a central node that is known as sink node or coordinator node. This node itself is a sensor node which may act as master node. Generally it may be used as a relaying and aggregating device. Coordinator node successively sends ascertained knowledge for any process to act as a backbone network through wireless Access Purpose (AP) (Akyildiz et al., 2002).

Our analysis identifies three frameworks focused at wireless Human sensor networks centered on pervasive care applications. This model exploits the attributes of network to style a really little power overwhelming design that remains able of quick response to any irregular events.

As an initial frame work, we present physiological condition for MAC Protocol which is particularly designed for Wireless Human Area Networks. WHANs carries with HAN protocol formed with a receiver and transceiver and also connected to the human body to watch important observations of the body like body temperature, body movements, heart pulse rate and so on.
Under a second framework, for WHAN underneath private cloud a well-organized routing rule is projected. Most often mbps may be transmitted by the body at fraction of your time. Thus this provides the necessity of the environment for planning the packets at a high transmission rate with maintain a lot of integrity, dependableness and secure packet delivery. Thus this tends to project a brand new algorithm known as near field coupling algorithm for planning of packet, delivery and routing inside the Wireless Human Area Network. This projected algorithm decrease the consumption of energy, provides efficient routing of packet with effective planning schedule that uses WHAN as basic skeleton for sending with an optimized line underneath the cloud environment. For secure authentication, WHAN enabled Cloud services using NYMI is additionally increased. A distinct authentic answer to the HAN enabled handheld pervasive devices is provided as a basic objective of this work. As we all know HAN could be a wide used advance communication protocol for observant intra human postures. This protocol exists with an efficient stacking the states that represent the communication rules. A number of the relevant applications of HAN enabled handheld devices are PDA, mobile smart phones, tablet and so on.

Finally, because the third frame works an Adaptable Energy Efficient MAC (AEE MAC) for Health Care Analysis is projected. This adaptable Energy Efficient MAC Protocol is enforced for the preservation a energy. This provides a isolated mechanism to monitor and gather health record knowledge of a patient’s using wearable sensor. This approach provides the high security level and privacy for the
care professionals and additionally plays an important in storing and guaranteeing the patient’s records.

1.2 GENESIS OF THE THESIS

There are some pertinent questions that prompted the research.

a. How can a standardized communication protocol be optimized for efficiency and scalability of huge networks?

b. Is it possible to develop secure communication protocols for handling real time scenarios like health care monitoring through Wireless Sensor Networks?

c. Is there any possibility of secure interoperability between WSNs and other networks in order to resolve the resource constraints in sensors?

This research has specified a path to achieve a solution to these questions providing openness towards establishing security with WHAN with MAC protocol, an efficient Field Coupling routing algorithm for WHAN in private cloud and HAN enabled Cloud services for secure authentication using NYMI were proposed. The integration of WSN with Cloud Computing (sharing Resourceful environment) for secure data storage is attempted. The performance of secure communications has been exploited using simulation software and initiated using real time experimental setup.
1.3 BASIC CONCEPTS OF RESEARCH

Many industrial and consumer applications (Akyildiz et al., 2002; Akyildiz et al., 2006; Hande Alemdar and Cem Ersoy 2010) depends on well-established technology named Wireless Sensor Networks (WSNs) for management and observation functions. Some of the acquainted applications are

i. Automatic Meter Reading (AMR): It reads the gas meters or electricity with in the residential areas (Maróti et al., 2004; Wang et al., 2008).

ii. Environmental Monitoring: It monitors and reports the environmental conditions at sensors' locations and stores the main points of the farms and therefore the forests in the connected base stations (De Stefani et al., 2010; Perkins and Bhagwat 1994; Amaro et al., 2011).

iii. Inventory Management: In huge industries the main points of things are kept within the warehouses sensor nodes that is hooked up to items or shelves. These sensors report concerning any shortage of explicit things and also used to determine the positions of things at any time. Additionally to the sensors the Radio-Frequency Identification (RFID) systems are unremarkably used (Mrinmoy Barua et al., 2011).
iv. Surveillance and Tracking: In security systems (Otto et al., 2006; Li H et al., 2009), sensors are getting used for investigating moving objects.

v. Industrial Automation and Control: To observe mechanical faults in risky environments or due to harsh, the WSNs plays an important role to manage and monitor industrial processes (Mrinmoy Barua et al., 2011).

Multi-hop network is made by the WSNs that consists of nodes that are interconnected to each other. Based on the sort of node, its applications, its practicality, its protocols used, a single node is ready to attach with different one or several nodes. Every WSN node consists of microcontroller, power supply, optical sensors, actuator, digital electronic equipment and wireless transceiver. The dimensions of WSNs varies from simply few to hundreds or thousands of nodes. Based on the application and therefore the protocols used, WSNs will form a straightforward single hop star topology or a lot of advanced multi-hop mesh topologies. Here the challenges that are required to be thought of comes whereas coming up with and developing a WSN with analysis on the factors like scalable, robustness, fault tolerance, and quality, network lifespan and energy consumption.

1.3.1 Wireless Body space Network

In several applications primarily in health care applications radio-frequency-based wireless networking instrumentality is employed for communication with nano technology sensor nodes fixed within the
human body. This same procedure is carried within the wireless human area network. The seek of WBANs is to form all the straightforward nodes to urge improved speed, accuracy, and reliableness throughout communication with sensors that is placed around the human body. Continuously WBAN affords persistent networking applications varying from health care to uniformed personnel protection. This challenge brings several openings for several. This WBAN analysis comes and its improvement in many technologies. It explores at many parts like application framework, radio systems, device devices and association of WBANs to bring the view purpose on energy or power consumption, network coverage and trade-offs between rate. Such open problems and challenges at intervals every wireless network based area brings several supply of inspiration towards additional enhancements and developments in WBANs.

1.3.2 Cloud Computing

Cloud computing that may be a example that facilitates the numerous virtual applications network services from the suppliers and server storage has become the backbone of the many companies (Liting Cao et al., 2008). Nowadays, several corporations act as service suppliers that pose multiple cloud services to their workers and totally different companies who act as services customers. To boot, cloud services suppliers supply the services at high level for anytime access, notably from the commodity cloud suppliers (Henry et al., 2009). In the earlier stage, the personal cloud does not have enough knowledge on its architectural deployments, impact and research, its performance and therefore so on (Daryl et al., 2012). Except this nature who
hypothecate a thriving preparation of the personal cloud will necessitate the accomplishment of cloud services brokerage.

Recently due to modification of new consumer attitude in device possession and services utilization prospect there is a quick swing in tutorial and industrial analysis to a lower place the pervasive cloud computing (PCC) (Lester et al., 2005; Vainio 2000). This becomes as associate common incidence among today's customers who have multiple transferable devices like smart phones, tablets and so on. This brings synchronization of services among all the devices. The deployment of such cloud-centric applications paradigm brings utilization of 'n' kind of devices as Ubiquitous Cloud Computing (UCC) by one consumer.

Among the various definitions of the cloud the known and accepted definition provided by the National Institute of Standards and Technology (NIST) (Buettner et al., 2006) states that 'Cloud computing could also be a model for convenient with uniform sharing of configurable computing resources like servers, networks, storage, services and applications which will be rapidly rises and discharged with lowest service provider interaction' (Minsu Park et al., 2013). Cloud Computing could also be a term to elucidate every proposal along with the infrastructure and a form of applications. Under the platform of Cloud Computing, for gathering and managing knowledge from different applications rather than having many local servers it is suggested to have virtual or physical machines which are designed dynamically in accordance with the actual requirements. For instance during a solar or wind station, the data collected by the
WSN concerning the weather are processed on in conjunction with data obtained by the smart inverters i.e. grid-related knowledge to boost plant efficiency and to fulfill the energy demand. Such applications is remotely accessed by cloud computing through the net. Also, such cloud-based applications produce use of huge datacenters and powerful servers nearly like web-based services and net-based applications.

1.3.2.1 Cloud computing choices

The most important cloud computing choices are

i. Service on demand: Requests of the purchasers are fulfilled automatically whereas not the involvement of associate human operator.

ii. Elasticity of demand: Purchasers utilize the given resources for a flexible quantity of some time in line with their own wishes.

iii. Abstraction: The hardware or software system package resources are hidden to purchasers. The purchasers use resources provided by the provider rather than knowing the availability location of the information arrival.

iv. Service measurement: The service provider uses the standard tools for measurement of the usage of actual data of the services used.

v. Resource pooling: Dynamically in line with clients’ requests, the pool of the services are assigned.
1.3.2.2 Cloud Computing Services

Based on the implementation of Cloud computing Services, the various service provided are organized as follows:

**IaaS (Infrastructure as a Service):** The essential storage and therefore the computing setting are provided by this model over the network. Therefore the client doesn't have to be compelled to get its hardware resources like servers, storage systems, networking devices, etc.

**PaaS (Platform as a Service):** This model provides the software package and its development setting as a service as services offered by Google’s App Engine or Windows Azure.

**SaaS (Software as a Service):** Based on the client’s request the services are provided by this model. The service’s one occasion is executed on the cloud and might be utilized by many users.

1.3.2.3 Cloud Computing Models

Based on operation of cloud infrastructure completely various models of cloud computing will be outlined. Well known cloud computing models are as follows:

**Private Cloud**

The cloud infrastructure is managed by the organization. The organization that has its final goal to maximise the potential of resource utilization. The strength of this model is accumulated security and low price in information transformation.
Public Cloud

This normal Cloud Computing model makes resources like applications, storage etc out there to the final public over the web. This model exists as ‘way on usage’ or ‘free of usage’ model. Since the resources like software, hardware and bandwidth costs are supervised by the supplier results in low price in setting the system. The improved quantifiability and potential are obtained by this method.

Hybrid Cloud

Hybrid cloud utilizes the services provided by each private and public cloud so as to carry out different functions at intervals an equivalent organization. However the different degrees of services are obtained by public cloud services are probably more price and ascendible than the private clouds.

Community Cloud

Multi-tenant infrastructure is provided by this community cloud. This is shared by several organizations with common computing problems. The community members usually share same privacy, security and performance and compliance needs.

1.3.2.4 Major Characteristic of Cloud

The major characteristics of cloud are as follows:
Elasticity: Elasticity is considered as main characteristics of cloud
system that confines the potential of the infrastructure’s alteration and challenges.

Reliability: No loss of knowledge and no resetting of code throughout execution is achieved to make sure continuous operation of the system while not interruption. Through the whole resource utilization the reliableness is achieved.

Quality of service: It supports significant ability in providing highest quality of services.

Agility and adaptability: This feature completely has faith in the elastic skills. It adaptation to the changes within the environmental circumstances and includes in response of time to the real modifications within the quantity of requirements.

Availability: It denotes the provision of services and information to the cloud systems and its cloud environment.

Such applications of ad hoc network place forth a challenge of coming up with one protocol to control expeditiously across network configurations and between its operational conditions. Two ad-hoc routing methodology like Reactive routing and Pro-active methodology plays a distinguished role. The restrictions of each methodology evolve with a particular restricted region.

Usually, reactive protocols are applied for the networks wherever the quality quantitative relation is comparatively terribly low is maintained. On the opposite hand the Proactive routing protocols are
most suitable option for networks wherever quality quantitative relation is comparatively high is maintained. The performance these protocols gets degraded between the two extremes of ad hoc network area since these protocol regions does not set for rest body communication.

Wireless Human Network protocol chains for repose and intra body communication (Shah et al., 2008). In private cloud, the data will be routed to nearest save purpose either by suggests that of close node or close poll. With high quality quantitative relation, each node carry on trailing for nearest node and establishes the session results. On the other side with low quality quantitative relation, each closest node is permitted to perform routing through back tracking. Local routing purpose in private cloud will not permitted to offer a group of increased services because of high quality local route data. Local field data, broadcast and its property details are known by its overlapping and through the broadcast messages. These varieties of services will be applied in global route discovery, name-address translation, path focuses and so on.

1.3.3 Pervasive Cloud

In the field of computing, cloud computing is a new paradigm which is found by the big shift from grid computing distributed computing, parallel computing, autonomic computing and utility computing. Recently the cloud computing gets its prominent migration towards utilizing the computing services as an on-demand utility. Both the small enterprise and large organization gets easy access of IT resources and data storage on demand. In addition, this environment
promises its users computing services as on-demand utility with increased scalability, reliable location independence, high availability, broad network access, good sustainability and reduced financial burden on administration and maintenance. In spite of the potential benefits, the cloud computing model has a lot of wonderful challenges to the future community.

1.3.3.1 Research Issues on Pervasive Cloud

Cloud computing offers software, working platform and infrastructure over internet and fulfills growing demand for storage and data processes needs of WSN applications. In order to make the efforts of researchers true and enhance the confidence level of the beneficiaries, the following threats in cloud computing have to be addressed Cloud Security and privacy, Data lock-in, Multi-tenancy, Data management, Service portability, SLA management and Performance prediction. From the survey conducted by the IDC enterprise panel, it is clear that the significant barrier to cloud environment can be overcome only when the information security and privacy issues are addressed though the solution to other stake issues listed above come into existence. An attempt is made to provide unique security solution which addresses not only the fundamental requirements of confidentiality, Integrity and availability of the outsourced data but also to provide the best access control policy to the data characteristics. This research work has the privacy and security issues are investigated and a specific scalable secure solution that can be adopted for the data security requirements of the consumers is presented.
1.3.3.2 WSNs and Cloud Computing

WSNs and cloud computing are the two paradigms mixed together easily by analyzing and sharing real-time sensor data (Sensium T.M. 2008). The highlights and the advantages of the two paradigm permits the sensor to provide its service over the internet. Due to this nature the sensor could both easily be analyzed locally and globally. As the result the two terms are framed in terms of ‘Sensor Event as a Service’ and ‘Sensing as a service’. Sensor Event as a Service refers to the events of interests provided by the cloud infrastructure.

Integration of these two technologies brings its usefulness for a large number of different applications. Some of the applications are

a) Transport Monitoring

In Transport Monitoring, the sensors are gathered by the cloud platform permits to design as worldwide traffic system which could be dynamically updated by the user themselves. The same data collected by the sensor are used for several applications like automatic toll gates, collision avoidance systems, vehicle classification and so on. Some more utility systems (Jimenez et al., 2012) are system handling for emergency vehicle notification, traffic control, toll way management, automatic recognition of plates, dynamic traffic light management and so on.

b) Military Use

Top level security could be provided by the Private Cloud computing (Durisic et al., 2012). Based on smart dust concept the
military applications are designed with Wireless sensor networks (Sanjit Kumar Dash et al., 2010).

c) **Weather Forecasting**

   Environmental sensors (Kwak et al., 2012) collect the data based on the environmental features like temperature and all the factors are solved by the large computational cloud in a minimum cost.

d) **Health Care**

   Nowadays in health care applications the sensor networks are widely used in many hospitals and health care centres. The health care sensors are used for the continuous monitoring of health and improving the quality of life. Some of the instances are constantly and remotely monitoring the discharge patients from the hospitals, getting real-time warnings for the heart attack persons and so on.

1.4 **WIRELESS BODY AREA NETWORK SENSORS**

   WIRELESS BODY AREA NETWORK is a low power invasive and less weight wireless sensor nodes that monitor the functions of the human body and the surroundings. Also it supports the number of other widely used applications like military, entertainment, ubiquitous health-care, interactive gaming and so on. Sensor data processing on a conventional personal computer becomes confusion due to its complex data. In order to compute the complex data with enough memory computation speed could be achieved by the WBAN .With more advances and low power nano wireless technology WBAN brings more
applications of wireless networks. A wireless body area network (WBAN) is a Radio Frequency (RF)-based wireless networking technology that communicates with small sensor node placed in or around a human body. Each sensor is placed about 2m. Another network named wireless personal area networks (WPANs) is designed and its transmission range is about 10m. General specifications of WBAN is tabulated below in Table 1.1.

**Table 1.1 Specifications of WBAN**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>Normal- 2 mts, Special case- 5 mts</td>
</tr>
<tr>
<td>Start up time</td>
<td>Less than 100 ns</td>
</tr>
<tr>
<td>Network Setup time</td>
<td>Less than 1 second per device</td>
</tr>
<tr>
<td>Power consumption</td>
<td>appr.1mW/Mbps</td>
</tr>
<tr>
<td>Network density</td>
<td>2-4 Nets / m²</td>
</tr>
<tr>
<td>Latency</td>
<td>10 milliseconds</td>
</tr>
<tr>
<td>Network size</td>
<td>Max 100 devices per Network</td>
</tr>
</tbody>
</table>

WBANs in a variety of medical applications includes monitoring Cardiovascular Disease (CVD), Paraplegic, Cancer, Broken teeth & building crowns and bridges, Alzheimer, depression, Hypertension and so on. Other applications are lifestyle and sports, Military Applications and Social Networking, Music for Headsets and Forgotten Things Monitor. The applications are tabulated in Table 1.2.
<table>
<thead>
<tr>
<th>WBAN Applications</th>
<th>Medical</th>
<th>Non-Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wearable WBAN</td>
<td>Assessing Soldier Fatigue and Battle Readiness</td>
<td>Real Time Streaming</td>
</tr>
<tr>
<td></td>
<td>Aiding Professional and Amateur Sport Training</td>
<td>Entertainment Applications</td>
</tr>
<tr>
<td></td>
<td>Sleep Staging</td>
<td>Emergency (non-medical)</td>
</tr>
<tr>
<td></td>
<td>Asthma</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wearable Health Monitoring</td>
<td></td>
</tr>
<tr>
<td>Implant WBAN</td>
<td>Cardiovascular Diseases</td>
<td></td>
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<tr>
<td></td>
<td>Cancer Detection</td>
<td></td>
</tr>
<tr>
<td>Remote Control of Medical Devices</td>
<td>Ambient Assisted Living (AAL)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient Monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tele-medicine Systems</td>
<td></td>
</tr>
</tbody>
</table>

The ultimate goal of the WBAN applications is to improve the humans life quality (Kaghyan & Sarukhanyan 2013). Technical parameter of WBANs are dependent on application. They are in-body and on-body applications. WBAN can also be connected in both local area network and wide area network with the wired and wireless communication technologies as shown in Figure 1.1.
**Figure 1.1 WBANs vs. Other Wireless Technologies**

There are various advantages introduced by using wireless BANs which include: –

- **Flexibility**

  Sensors which are non-invasive observe the physiological readings automatically and can be forwarded to nearby devices (a laptop, cell phone, a laptop, a wrist watch and so on) based on the application needs.

- **Effectiveness and efficiency**

  Reliable and accurate physiological estimations could be obtained effectively through the signals provided by the body sensors and also the ultra power consumption makes the batteries life long-lasting.
• **Cost-effective**

In the case of medical and gaming environments due to the big demand of sensors, bulk sensors in mass are produced at a relatively low cost.

### 1.4.1 WBAN perspective

The lot of issues makes Bluetooth insufficient from WBAN perspective (Sisinni et al., 2014). Some of them are listed below.

1. **Power consumption**: Bluetooth consumes more time and power because of procedures of lengthy Frequency Hopping (FH) synchronization.

2. **Failure of Automatic network formation**: The entire network collapses when the master of an established network moves away and brings divergence with the dynamically changing networks requirements.

3. **Limitation of network nodes**: Scatter net is defined but rarely used in practice. With the Bluetooth PAN profile, only single piconets are supported. Additionally, it supports only up to 8 piconet. ZigBee supports up to 65536 nodes in a network (Bestoon 2009).

4. **Slow connection**: Only the connection is set for 5 seconds. On-going communications and data transfers are interrupted by Lengthy inquiry procedures. Additionally, it leads to failure of Bluetooth Inquiry.
5. Restriction of resources: Excess memory, Excess overheads and resource processing are required for the implementation of blue tooth. For the resource-restricted sensor devices, Bluetooth stack may not be available for the usage in WBAN applications.

6. Security Issues: Link level security is defined by the Blue tooth which results in disasters if the extreme care are not taken by application developers since the link layer level details are send to application developer (Vellingiri et al., 2013).

1.4.2 WBAN Sensor Devices

The sensors are of two categories: wearable and implanted. The wearable sensors are (1) Pulse oxy-meter (2) Electrocardiography (3) Blood pressure sensor (4) Electromyography (EMG) (5) Accelerometer and Gyroscope and (6) Electroencephalography (EEG). The implantable sensors are (1) Glucose Monitoring (2) Implantable Neural Stimulators and (3) Endoscope capsule (gastrointestinal).

1.5 STORE AND FORWARD PROTOCOL MECHANISM

Store and Forward mechanism is used for the reliable packet delivery. Initially based on request all the nodes are sent and all its information is effectively shared with each and every node by making the use of the node parameter ‘nodeid’. When data transmission is performed, then particular data is stored in each node and data starts
transmitting from the source to destination. This procedure is repeated until final is obtained.

Let \( n \) = nodes count in the system

\( P_n \) = Probability of ‘n’ system nodes

\( C \) = count of services

\( \mu \) = ‘L & S rate’ (Load & store rate)

\( \lambda \) = Forward rate

\( \mu_n = n\mu \) \( 1 < n < C = C \mu, \) \( n > C \)

\( \lambda_n = \lambda, \) For all \( n > 0, \mu_n = \begin{bmatrix} n\mu \\ C\mu \end{bmatrix} \) where \( 1 < n < C \)

As the requirement of static model, the following calculations are consired.

\[
P_n = \frac{\lambda_n}{(n\mu)(n-\mu)((n-\mu)\mu)((n-\mu)(\mu-\mu)...(1\mu))} P_0 \quad \text{for} \quad 1 < n < C \quad (1.1)
\]

\[
P_n = \frac{\lambda_n}{[(C\mu)(C\mu)...(C\mu)](C\mu)[(C-1)(\mu)][(C-2)(\mu)...(1\mu)]} \quad (1.2)
\]

Applying the \( P_n \) with the function \( \sum_{n=1}^{\infty} P_n = 1 \) for all valid nodes \( n \)

\[
P_n = \frac{1}{\sum_{n=1}^{\infty} \frac{1}{n!}(\lambda) + \frac{\lambda}{C(\mu)} \left( \frac{\mu C}{\mu C - \lambda} \right)} \quad (1.3)
\]

This above obtained result is valid if \( (\mu C)^{-1} < 1 \).
1.6 ADAPTIVE POINT (AP) FRAMEWORK

By using this Adaptive point, it is treated as Semi cloud in which mobile node’s information is protected locally. It is designed to direct the movement of nodes. In general, the packets are generated in the range of 20-500.

1.6.1 D2RCR Algorithm

In the Field of cloud computing as a key service platform in reliable packet delivery which delivers resource sharing in the form of scalable build blocks, application environment, value added business deals in cloud and middleware in client end. Cloud computing is a new model of distributed client server environment. The data base under the cloud environment requires effectively routing protocol. The service provider interaction is established with the computing resources for the effective utilization of the communication channel. In wireless network the collection of nodes are utilized for the communication through the wireless links. In some application, the infra structured networks are often not possible. This reveals the fact the wireless communication is completely meant for sharing of information.

The following Figure 1.2 provides the details of the D2RCR Algorithm.
1. At initial stage
   \[ W_0(L, r) = \frac{V_r}{n}; \quad U_0(L, r) = 1; \quad H_0(r) = 0; \]

2. In Route level
   \[ U_0(L, r) \leftarrow L; \]

3. For each \( L = 1-n \)
   If \( (U_{l=2}(L, r) \leq M_{j=2}(L, r)) \)
   Request Forwarded
   Else
   \( P = (\text{load} (U_{l=2}(L, r) \leq) \&\& \text{store}(M_{j=2}(L, r))) \)

4. If (\( A_{\text{dapt}} < p \))
   Request Dropped
   Else
   Request forwarded

5. Distribute the route information \( U_0 \& U_0(L, r) \) locally;

6. Donate the traffic information globally;

**Figure 1.2 D2RCR Algorithm**

### 1.7 INTENTION OF THE RESEARCH

The intention of the current analysis work area unit is as follows:

- To realize the role of key management methods in establishing security and overcoming threats in WSN.
- To implement a standardized Secure Routing Protocol (MAC).
• To depict a cloud central vision in proposing a security framework for the idea of a net of things, thereby integration WSN and Cloud computing.

• To build a model to perform well with regard to procedure time and dependableness within the context of security.

1.8 SCOPE OF THE ANALYSIS

This work was driven by the necessity for correct performance analysis of communication and localization in Wireless Human space Networks. Understanding however the body space channel propagates is extremely vital and difficult. As we know, the IEEE 802.15.6 (MAC Protocol) is specializing in wireless body area networks (WBANs). However, to today, there's no wide accepted model for wireless propagation in body space network. Numerous studies are created upon this drawback, however in body activity and experiment area unit very troublesome.

Implementation of high level of security is very important for any sort of network. Because the second frame work, WHAN enabled Cloud services for secure authentication using NYMI is projected.

As a third framework the implementation of a brand new Adaptable Energy Efficient MAC (AEE MAC) Protocol targeted the utility of the wireless Human space sensing element networks significantly targeted on applications of pervasive health care.

Their affiance is evaluated in terms of correct transmission, memory management and power consumption. In several systems
numerous routing parameters like throughput, convergence time and delay area unit compared to indicate its efficaciousness. For such environments packet delivery is created with high transmission rate, correct planning of packets, integrity and security.

Therefore to perform the packet planning, a new algorithm named close to field coupling algorithm is additionally increased to support the AEE MAC transmission. Supported the scheduled packets the routing and delivery of packet at intervals the Wireless Human space Network is performed. An efficient packet routing and planning time with energy consumption is maintained with WHAN framework for effective transmission. To strengthen the communication, the cloud surrounding is optimized efficiently.

1.9 ORGANIZATION OF THE THESIS

This doctoral thesis is structured as follows. Chapter 1 is the Introduction of the dissertation. Chapter 2 gives a literature study on WBANs components and wireless sensor network. In Chapter 3, an Energy Efficient Routing Using Near Field Coupling is discussed. Chapter 4 discusses in detail about an Adaptive Energy Efficient Mac for Wireless. Chapter 5 discusses in detail an On-Body Routing based on Dynamic Distributed Route Level Content. Chapter 6 discusses in detail about an adaptive energy efficient MAC for health care analysis. Chapter 7 sheds light on the conclusion and discussion on future enhancement.