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A Novel Approach to Reduce Handoff failure probability in Next Generation Wireless Networks (NGWS)

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Abstract: ***In this paper we contribute a technique minimizing handoff failure probability using offered technology, while not compromising bandwidth efficiency significantly, by altering and streamlining the practicality and task division of the modern handoff technique. this may end in fewer call failures and in congestion-free networks.Here we have a tendency to apply another base station to the common overlapping area of old base station (OBS) and new base station (NBS). during this intermediate base station(IBS) we conjointly install a checker machine that checks whether or not the signal of a cell is being immediately initiating handoff,or it need to wait within the intermediate base station. Although, the IBS is not terribly high battery-powered,but it has the identical capability to occupy same number of channels as the OBS and NBS. So,there are the number of available free channels are raised .The simulation depicts that our evaluated proposal will solve the matter of call drop and helps to decreasing handoff failure chance.***

Keywords: Next Generation Wireless Communication, Handoff, handoff failure probability,channel distribution, Pre-active scanning scheme, Selective Channel Scan technique.

I. INTRODUCTION

Now a days, in mobile communication technology Handoff has an important particular. It is become much more famous for especially urban areas due to the restricted covered area of Access Points (AP)[1]. When a Mobile Station move from its recent AP to another AP due to the change of its location, handoff process immediately take place .

1.1 Channel distribution

The 2.4 GHz ISM band operates with IEEE 802.11b and IEEE802.11 g and uses 11 of a maximum of 14 channels, accessible through the same frequency channels and consequently compliant. The channels which are numbered as from ch1 to ch13 respectively. Each of the channel has the frequency of 5MHz with the bandwidth of 22MHz. There is also a 1MHz guard band [3]. The overall concept is depicted in Fig. 1:

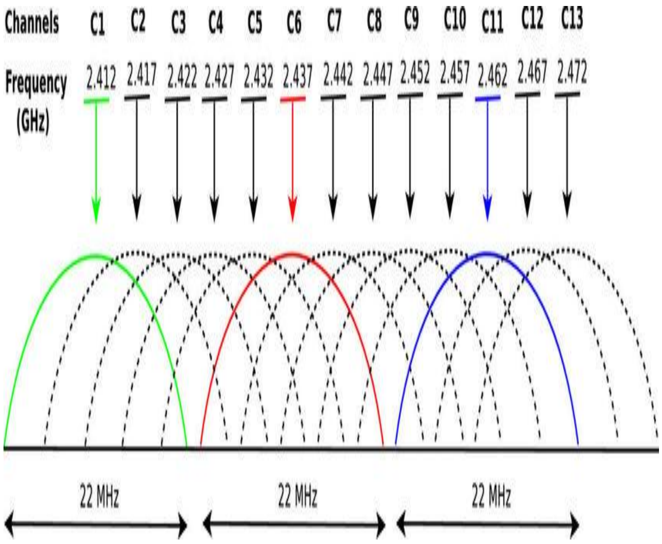

Fig. 1: Channel Distribution

It should be noted that in channel distribution there may be a chance to interference between close proximity APs[5] due to overlapping frequencies. So most APs can handle those channels which are not overlapped to each other[5], it is like channel number 1st, 6th and 11th are an extremely well organized network.

1.2. Types of handoff

Handoff may be of various types:

Hard handoff: Jointly referred to by the connection ***"break before make"***. Initially this type of handoff is used wherever a MS would derail connection to the recent AP before attached with the new one[1][2].

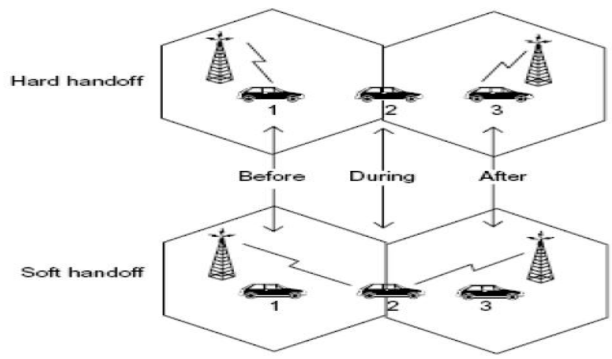

Fig 2: Hard Handoff vs. Soft handoff

Soft handoff: a connection also referred to as

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"make-before-break". The past connection is maintained in soft handoff until a brand new one is established. So, as a result it decrease the probability of packet loss .

handoff also classified as the following two types: H***orizontal handoff and Vertical handoff***[1][2].

Horizontal Handoff: In this technique handoff take place between two base station of an unique system [1][2]. Figure 3 shows horizontal handoff between base station BS10 and BS11. It also be further classified into two types:

Link layer Handoff: Link layer handoff take place between two base station, which are belongs to the same Foreign Agent[FA][1][2]. In system B, base station named BS20 BS21 engaged in link layer handoff, which are belongs to the same Foreign Agent(FA) named FA20, shown in Fig. 3.

Intra-system Handoff: In this technique, handoff take place between two base station. These two base stations are belong to two different foreign agents(FA) but from the same Gateway Foreign Agent (GFA) as well as the same system. Here in figure 3, BS10 and BS12 are involves in intra-system handoff, which are belongs to two different Foreign Agent named FA10 and FA11. But these foreign agents are belongs under the same Gateway Foreign Agent named as GFA1 as well same system named System A, which is shown in Fig. 3.

Vertical handoff: When handoff occurs between two base stations which are from two completely different Gateway Foreign Agents (GFAs) as well as from two different systems. This process is called verticle handoff. Here in Fig. 3 shows, base station BS11 and BS21 are from different GFAs as well as from different systems named System A and System B.

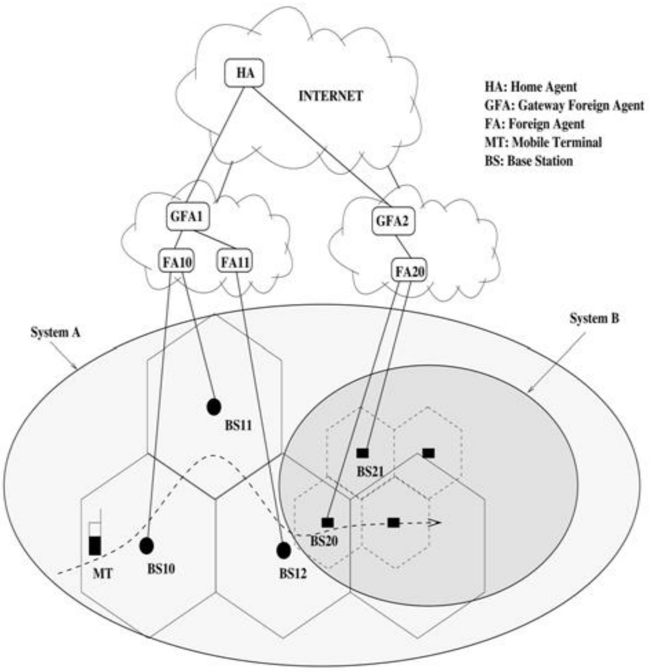

Fig. 3: handoff scenario of modern Mobile Networks

Handoff technique operates in the following three phases [see Fig. 4].

- **Scanning**: When a mobile station move away from its recent Access Point (AP), handoff initiation immediately take place, due to the reduction of Received Signal Strength and signal-to-noise ratio (SNR)[10].

- **Authentication**: The Authentication provides a link between the new APs[10], which is very important. Authentication should either be immediately linked or follow a channel scanning immediately. In pre-authentication systems, the Mobile Station authenticates the new AP immediately upon completion of the scan cycle[10]. Authentication process has two types:

  ✧ ***'Open system' authentication, which*** is a an algorithm of null valued.

  ✧ ***'Shared Key'*** authentication may be a mechanism of four-way authentication. Only null authentication frames must be changed within a re-authentication phase if the **Inter Access Point Protocol (IAPP)** is used. It takes 1-2 ms to exchange a null authentication frame.

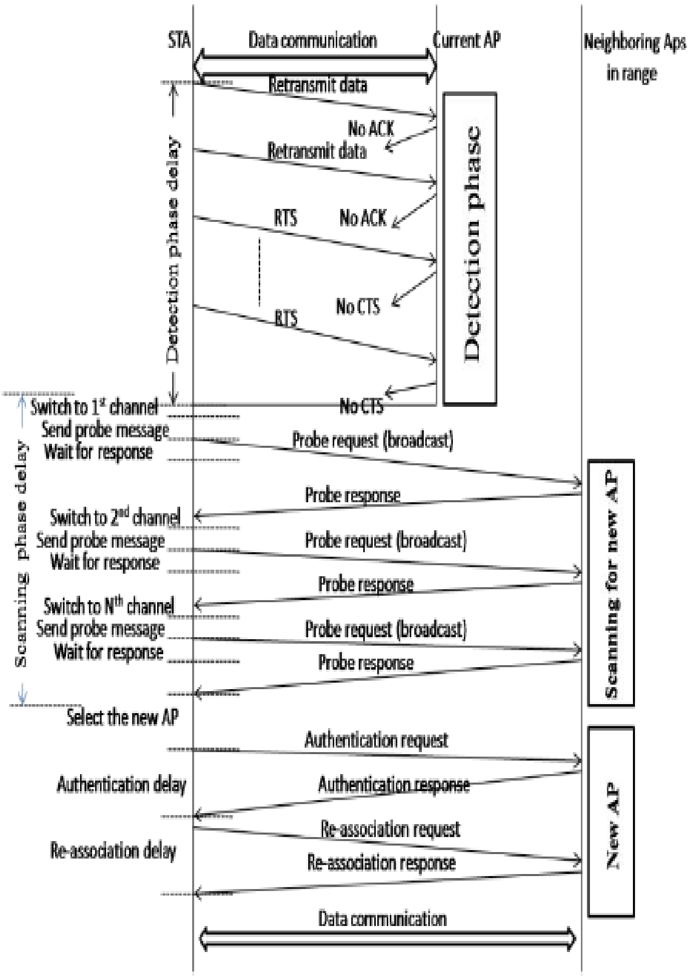

Fig. 4: handoff method

- **Re-Association**: This is a technique of the

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associations from the previous AP to the new AP[10].

Here, we discuss about two types of scanning scheme. But in our algorithm we use any one of the following scheme:

1. Pre-active Scanning scheme

The scanning phase consumes almost 90% of the total handoff delay time. By using Pre-active Scanning [12], which operates over a normal connective environment, we can decrease the handover delay during channel detection and search phase. This technique gives STA the advantage of traffic load-sharing without delaying execution phase during the detection and search phase, STA decides to start transferring the system to the new AP that provides higher quality than its previous AP system. Due to reserve time during this arrangement to stream the '***Probe Request***'[12] frame and wait for ' ***Probe Response***'[12] frame from (to) neighboring Access Points betwwen the coverage area, the traffic load is increased.

2. Selective Channel Scan scheme[5]

When less number of channels are needed to be scanned, handoff delay time is often reduced during the scanning stage.The use of certain criteria is often selected to scan the limited number of channels and is called selective channel scanning. Orthogonal principle is often applied because the selection criteria [5]. In the spectrum of IEEE 802.11, channels Ch1, Ch6, and C11 are non-overlapped, as shown in Fig. 5[5] are called orthogonal channel.

Here, from Equation (1) if f (n) = 1[5];Actual channels will be only scanned and then f(n) will decide whether or not to scan a channel number n.

$$f(n) = \begin{cases} 1, & if\ n = 1,6,11 \\ 0, & otherwise \end{cases} \qquad \text{------------------ (1)}$$

Selective channel scan scheme has the following advantages[5]:

i. This saves the time for scanning, by doing this it reducing overall handoff delay time.
ii. It gives non-overlapping channels interference-free communication.
iii. Reduces the loss of packets due to collisions as a result of this reduced transmission requirement.
iv. Nearly all APs are often reached due to the fact that most APs work on these orthogonal channels.

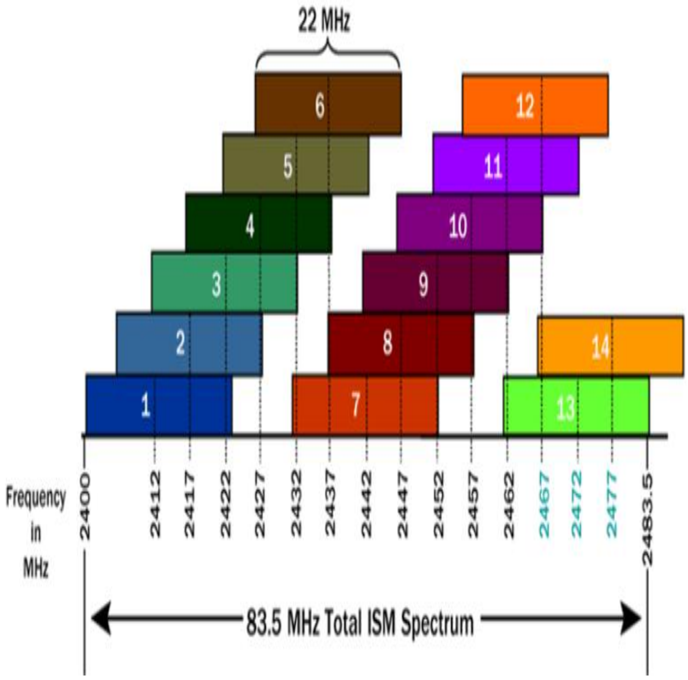

Fig. 5: Non-Overlapped channels

As the last section of the introduction provides organization of the remaining paper, section I contains the introduction of handoff, wherever we talk about different types of handoff, channel distribution in cells, and two scanning methods. For channel selection of IBS, we tend to use one of the 2 techniques. Section II contains related papers, We are describing our proposed work in Section III, section IV justify simulations. Section V concludes an analysis work with future directions, section VI is accreditation to my revered Guide. Lastly, we present a comprehensive list of references that has been of great assistance to us.

II. RELATED WORKS

Recently, an outdated amount of research is underway to improve the handoff technology of the mobile networks and several advanced networks based on IEEE 802.11. In recent years a number of neighbor graph [5] and AP geo-location strategies have been proposed[8][9], wherever selective channel mechanisms have been proposed by the author[5]. In [6] Li Jun et. al. Proposed a method for sending probe requests one by one to the APs and handoffs immediately upon receipt of the reply from any AP. This makes it possible to scan fewer channels. It should be selective, or all the APs could also be scanned of those processes involving the scanning of APs. These strategies take time and have a certain likelihood of failure to handoff. Authors use GPS maps primarily for handoff handling in [7] and [8]. A previously projected handoff using BS received signal strength (RSS).

III. PROPOSED WORK

Proposed methods in the literature have used 2 parameters :-
1)The mobile station must be situated on the handoff initiation region.
2)The mobile station's speed direction.

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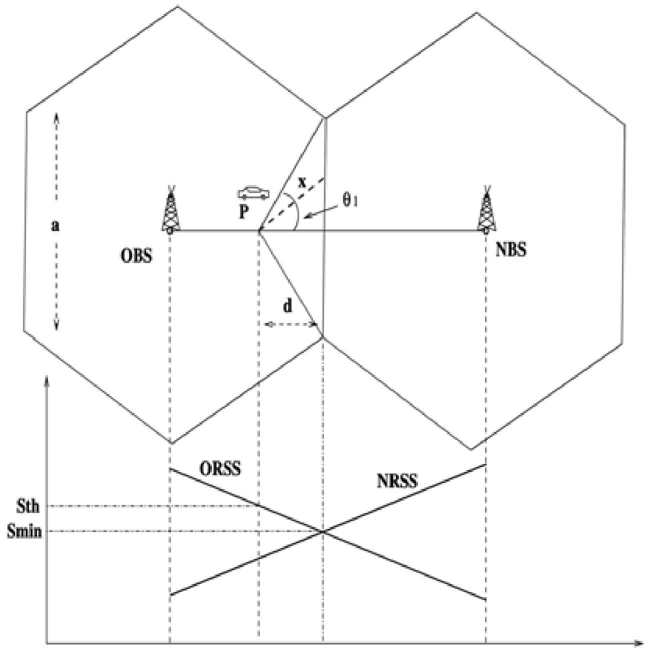

Fig. 6 : handoff method

Let OBS be the old base station, NBS be the new base station and P be the mobile terminal(MT).The mobile terminal moves any direction. The MT moves towards the cell boundary then its Received Signal Strength(RSS) is reduced due to move away from the OBS and it increases if the MT moves closer to the OBS.When the MT is moves from one cell to another handoff initiation is necessary.The entire working principle is shown in Fig. 6.

In our proposed work, before handoff initiation or in other word, before reach to the cell boundary, the MT checks the availability of channels.If channel is available then,there is no need to wait,immediately initiate handoff.Otherwise, we place another base station between the overlapping area of OBS and NBS. If there is no free channel available in NBS then the cell of OBS has to be wait.In general, a signal of a cell can wait for channel only few miliseconds and then it lost.So for this reason after few milisecond, call automatically drop.To prevent this call drop we place another base station.This intermediate base station (IMS) [Fig. 7] capture the signal when there is no channel available and signal of the OBS have to wait.

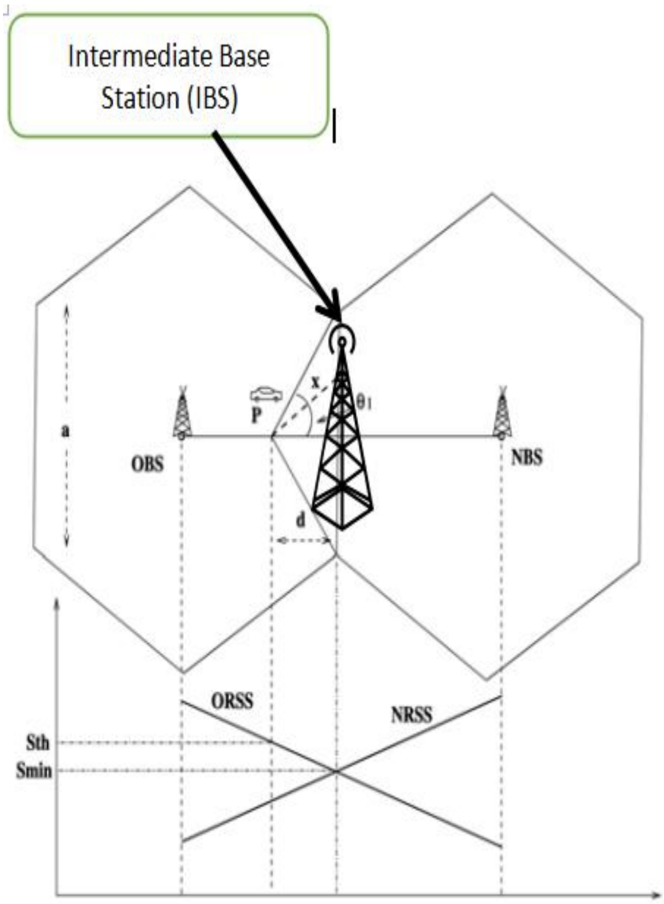

Fig. 7 :Proposed Handoff Process

In the intermediate base station,we also install a checker machine that checks the MS's speed's direction, and the angle management of the cell.Angle management of the cell is required, because if the signal strength of the cell is out of the range of the intermediate base station then it could not capture the signal of the cell.To avoid this we have to do the angle management. The cells are check the availability of channel and then take a decision based on the following proposed algorithm:

The Algorithm which Proposed:

1) A cell of OBS checks for available channel in another cell of NBS.

2) The checker machine check the direction of the velocity of MT ,when a signal of a MT is out of range from the intermediate base station ,then we have to perform angle management and return back the signal into the range of the intermediate base station.

3) If free channel available then initiate handoff, else store the signal to the intermediate base station.

4) Frequently checking for free channel using **Pre-active Scanning Scheme or Selective Channel Scan technique** and when channel available, handoff initiation takes place.

The work flow diagram of our evaluated algorithm is shown in Fig. 8:

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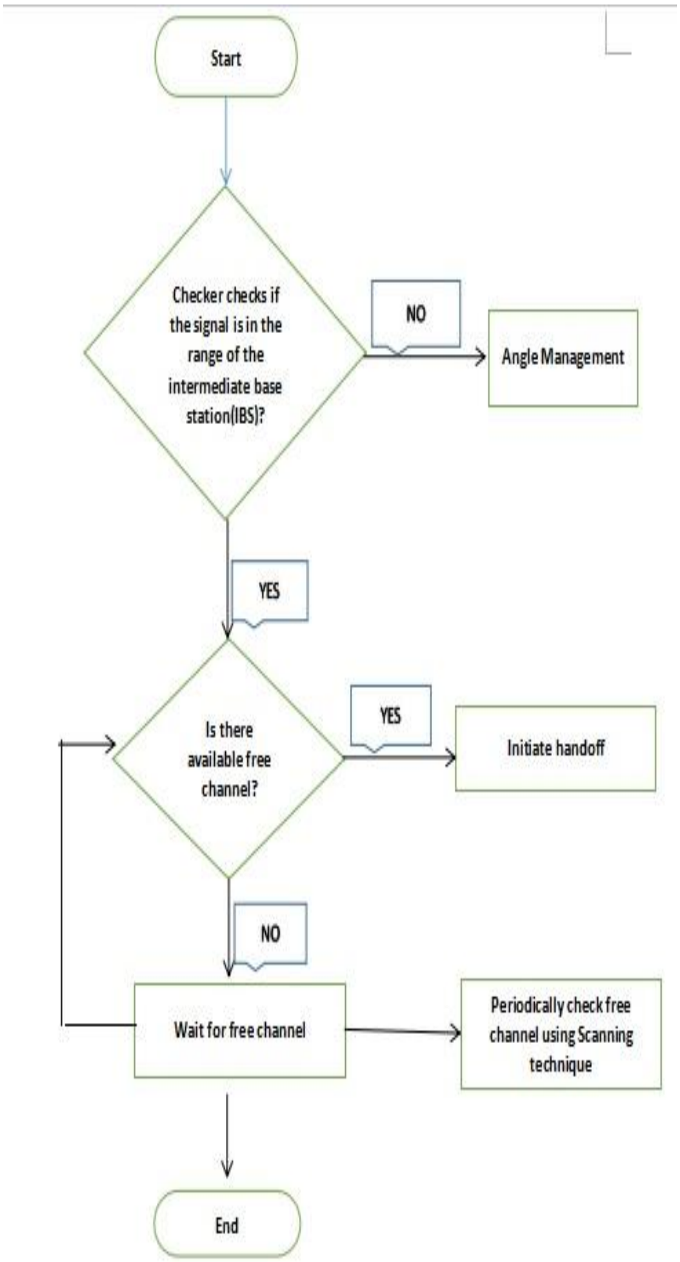

Figure 8: Work flow diagram of the Proposed Algorithm

IV. SIMULATION RESULT

When we install an Intermediate Base Station(IBS) between the overlapping area of OBS and NBS,the number of available free channels is increased. For this reason,the incoming Mobile Terminals (MTs) have not to be wait.So, no. of channels is inversely proportional to the handoff initiation time.The graph is shown in Fig. 9 :

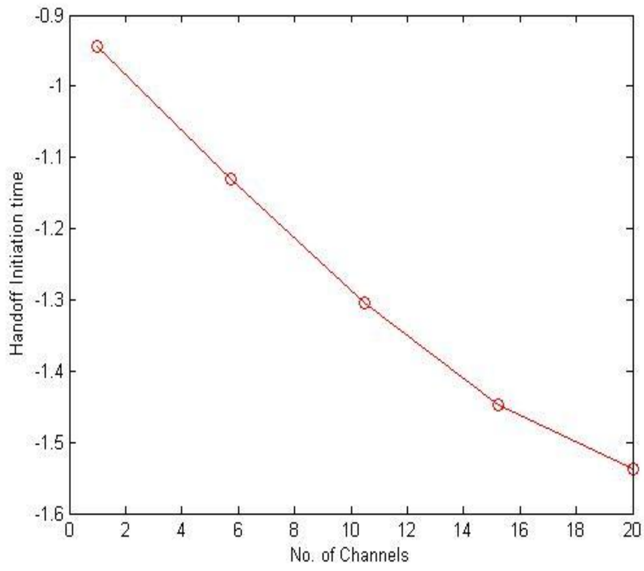

Fig. 9 :Handoff Initiation Time vs Nunber of available channels

At the same time ,the probability of handoff failure is also controlled the speed of the mobile station (MS). If the speed of a MS ,say MS1 is higher than another MS,say MS2 , then MS1 is reachs to the cell boundary before MS2,and Perform Handoff Initiation technique.And when MS2 is reaches to the cell boundary,MS1 is already completed it's handoff process.So,MS2 need not to be wait or not to stay in channel queue.That means Call drop is ignored by this way. But, here is a bound about the speed of the MS. If the speed of MS is Very high then the base station is failed to capture the signal of the MS and for reason Call drop may occurs.

So from the above explanation,we can say that, Handoff failure is reduce when increasing the speed or velocity of MS.That means, Handoff failure probability is inversely proportional to the speed of MS.The graph is shown in Fig. 10:

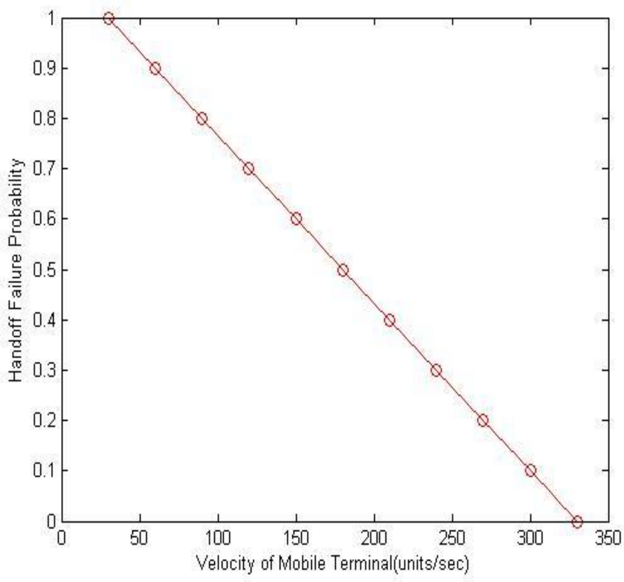

Figure 10:Handoff Failure Probability vs. Speed of MS(units/sec)

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V. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, at first, we discuss the types of handoff in mobile communication. After that, we proposed our algorithm for reducing Handoff Failure Probability .In our algorithm we used an intermediate base station(IBS) between the coverage area of OBS and NBS.Which is used to capture signal when there is no free channels are available.In our proposed algorithm , we also includes the working principles of **Pre-active Scanning Scheme and Selective Channel Scan techniques to reduce handoff latency during probing phase.**handoff Based on this analysis, The probability of handoff failure can be kept constant and limited.

As per simulation results, number of channel is inversely proportional to Handoff Initiation Time and Handoff Failure Probability is also inversely proportional to the velocity of MS, but when the velocity is measured not much high.

In future we will more careful about the velocity of MS. Which is a drawback in our recent paper. This requires further research. In addition, the probability of handoff failure increased when cell size decreases may also present a problem that opens up a wide range of future research.

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