MOHAMAD ALSHAHADAT

THE INFRASTRUCTURE-LESS SELF STANDING WIRELESS NETWORK FOR DISASTER AREA

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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
MOHAMAD ALSHAHADAT

In Partial Fulfilment of the Requirements for the Degree of Master of Science in Mechatronic Engineering

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Approval of Director of Graduate School of Applied Sciences

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We certify this thesis is satisfactory for the award of the degree of Master of Science in Mechatronic Engineering

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

It is known that mobile phones are of great importance in disasters. Unfortunately, under such conditions the base stations may be out of operation and may require installation of external equipment. We propose an algorithm of immediate text transmission between the mobiles. Each mobile generates a unique number automatically from the Mac address. Unlike the conventional hotspot transmission the introduced algorithm has the ability to acknowledge the reception of the transmitted text.

In the event of disasters each mobile can instantly broadcast and receive an emergency text continuously. The simulation results indicate the success of such algorithm and have the capacity to provide high relay for the mobiles within the acceptable range.

***Keywords*:** Hot-spot; emergency text; routing protocol; disaster communication; broadcasting messages

ÖZET

Akıllı telefonların doğal afetlerdeki kullanımı büyük önem arzetmektedir. Böylesi durumlarda bu telefonların düzgün çalışması için harici baz istasyonlarına gereksinim duymaktadır. Bu tez'de sunulan yöntemde akıllı telefonların harici eklentiler gerekmiyecek şekilde anında haberleşme sağlamaktadır.

Tez'de yaratılan haberleşme yöntemi simülasyonlar yardımı ile geçerliliği kanıtlanmıştır.

Anahtar Kelimeler: Doğal afet; haberleşme; kısa mesaj; protocol; yönlendirme

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CHAPTER 1
INTRODUCTION

1.1 Introduction

In today's technology, mobile phones are very important in every field of application. It is possible to avoid loss of life with appropriate applications when considering extraordinary circumstances. In such environments, communication infrastructure may not be available. The introduced algorithm ensures the transmission, reception of the text message from a mobile to another identified mobile without a network. The presence of a crowded population with operating mobile phones is assumed to be in the disaster area. The mobile phones serve the role of a router, aim to forward text packets to the destination. The received emergency text will be re-transmitted until it is reached to the final destination with reception of the acknowledgment. Therefore, in such process the intermediate mobiles act as a multiple-hop relay.

This challenging algorithm allows instantaneous communication without extra cost. The mobile users have the freedom to move about in all circumstances; and the system remains connected via other available routes. Such conditions are common, especially for mission-critical applications as in the battlefield communication. The proposed challenging algorithm operates as a new hot spot network and named as self-standing wireless network (SSWN).

In a standard wireless network, mobile phone has the transmitting and relay capabilities. The number of mobile phones can form a wireless network that allows mobile clients to text each other through multi hot-spot communication. Such operation is flexible and does not require any maintenance. The advantage of the SSWN is that it provides limitless emergency text transmission until the mobile is out of power. Therefore, failure of a mobile node has no overall effect on the transmission. The text transmission is automatically detected by the mobile nodes and re-transmitted until an acknowledgement is received from the terminal node. Broadcasting is performing on continuous bases until acknowledgment is received. The acknowledgement should also be transmitted continuously until the broadcasting signal is terminated. Such proposed algorithm operates as a wireless network without the need of the base station and the rest of the operating facilities for the text transmission. Each mobile acts as trans-receiver within standard transmission of IEEE 802.11 (Nuaymi, 2007). The proposed SSWN algorithm has also the advantage of instantaneous connection that is considered as a prime target in such application.

We note that the proposed algorithm relies on the distance between the transmitter and the receiver. It is for this reason that the disaster area was selected. The client at the far distance can only be connected if the intermediate mobiles are within the coverage area specified in the IEEE 802.11 standard. This paper, deals with an application that is live saving for such operation. Alternative methods are not flexible enough to operate within such limited time, hence, may require higher installation cost. The overhead charges may include labor and large broadband access facility. Some alternative methods such as delay tolerant network (DTN), LTE and WiMAX require the additional support network to justify the expensive cost of the deployment. Besides, in such applications the signal coverage relies on the geographical structure of the area. Therefore, there is no guarantee of connection between the mobile nodes within the same coverage area. This may result in undelivered urgent text messages.

The assumption for SSWN is that each mobile node is well equipped with a hot-spot transmission, which is an existing structure in all smart phones. This ensures download facilities for the newly introduced SSWN application. In such operation a mobile node can automatically detect transmission from any other node within the coverage range. The transmitting and receiving mobile nodes are identified by the data information packet that includes the unique number and the preset name. The transmitting mobile forms a route automatically using all the mobile nodes within the coverage range. The target mobile will be identified by the unique number within the transmitted emergency text. The transmission is continuous and will cease when acknowledgment received.

1.2 literature Review

Mobile communication devices have become an essential part in our daily life, they have been widely used by most of people for different services such as voice and video calls, short massages services, digital cameras typically with video capability and internet and social media access. These services can be provided only when the users are connected via cellular phone network infrastructure or internet. However, in some cases such as disaster (earthquake, floods, hurricanes, etc.) or emergency situation the cellular network infrastructure or internet may not be possible to access.

In recent years, there are several disaster cases occurring in many countries around the world and caused a great damage in the infrastructure. For instance, Hurricane Odile and Hurricane Katrina in the American United States in 2014 and 2015 respectively, furthermore, in 2013 Typhoon Haiyan hits the Philippines, Also, the great Sendi Earthquake in Japan in 2011. Moreover, the earthquake in 2010 in Haiti (Miranda et al, 2016). The normal reaction for such disaster situation is to assist civilians.

Communication engineers can also participate in the victim assistance by developing infrastructure-less wireless communication network. This infrastructure-less network allows victims to utilize their mobile communication devices such as smart phones.

There are many challenges facing the classical applications such as the rapidly deployable network (RDN) classified as an independent network in the critical situation. These networks have to meet the basic requirements such as scalability, flexibility, energy efficient, adaptive, self-reconfiguration and minimal human intervention. In the literature, there are several wireless network technologies that can provide the requirements of RDN. They are mostly suitable for post disaster network such as Ad-hoc network. In general, Ad-hoc networks consist of a collection of mobile nodes forming a temporary network. The nodes are free to move and able to communicate with each other directly via wireless connection without relying on existing infrastructure. In an Ad-hoc network, each node operates as a transmitter or receive. Forwarding data between nodes from source to destination require multiple hops; therefore, it is also called “multi-hop wireless ad-hoc networks (Shibata et al, 2003).

Mobile ad-hoc network (MANET) is classified as wireless network that has a significant role in developing the Internet of Things (IoT). It is operating as mobile to mobile communication as well as machine to machine communication.

CHAPTER 2
ROUTING PROTOCOL

2.1 Mobile Ad-Hoc Networks

MANET has Multiple-hop network topology that changes frequently due to mobility of nodes (Shen et al, 2014). Therefore, efficient routing protocols are needed to forward a data packet from source to destination (Nazhad et al, 2017). Routing protocols perform two functions. Firstly, it determines the optimal path of communication. Secondly, it transfers data packets through the network (Wang et al, 2017). There are many routing protocols used in MANET (Royer et al, 1999). All of the routing protocols are well defined and classified as in the table driven, reactive or on the demand routing, hybrid routing and geographical routing. Some of the routing protocols are named as the dynamic source routing (DSR) and Ad hoc on the demand distance vector (AODV) (Hou et al, 2014). These routing protocols are classified under reactive routing protocol (Perkins et al, 2001). DSR is a source routing protocol designed to fix bandwidth consuming issue in proactive routing, which results from keeping updated list of the available routes reaching to the destination. The DSR uses route discovery and route maintenance techniques for the data transmission. In routing discovery phase the source node identifies the route from source to destination, followed by the transmission of the packet including the address of intermediate nodes and destination address. The route maintenance phase used to maintain the established route against rout breakdown resulted from dynamic topology. The AODV is another well-defined reactive routing protocol, or on demand routing protocol. It is an efficient routing protocol which provides routes from source to destination on demand. It can be used for both unicast and multicast routing (Valera et al, 2005). In AODV protocol the request of the source identifies the possible routes and maintain them in operation until source decides otherwise (Abusalah et al, 2008).

In general, Ad hoc networks is a kind of wireless communication networks which consist of a collection of mobile nodes forming a temporally network, these nodes are free to move and able to communicate with each other directly via wireless connection without relying on existing infrastructure. Ad hoc networks, each node can operate in both modes as a host and router to forward data packets to other nodes which might be out of the radio range of transmitted node. Forwarding data between nodes from source to destination require multiple hops; therefore, it is also called “multi-hop wireless ad hoc networks.” (Kopekar et al, 2015) Mobile ad hoc network (MANET) is one type of ad hoc wireless networks which will have a significant role in developing Internet of Things (IoT). Furthermore, this kind of infrastructure less network operates in standalone style and can be connected to the internet or any other fixed infrastructure, each node in MANET can communicate directly with others via wireless connection without any need to base station or other central coordinator (Sakano et al, 2016) .It can be seen that every node can work as host and router at the same time.

The development of remote transmissions and the prominence of compact figuring gadgets have made the fantasy of "correspondence whenever and anyplace" conceivable. Clients can move around, while in the meantime as yet staying associated with whatever remains of the world. We call this portable processing or itinerant figuring, which has gotten serious consideration as of late. For the most part, the majority of the roaming figuring applications today require single bounce availability to the wired system. This is the commonplace cell organize show that backings the necessities of remote correspondences by introducing base stations or access focuses. In such systems, correspondences between two portable has totally depend on the wired spine and the settled base stations. By the by, the wired spine foundation might be inaccessible for use by portable hosts for some reasons, for example, unforeseen catastrophic events and radio shadows. Additionally, it may be infeasible to build adequate settled access indicates due cost and execution contemplations; for example, having settled system framework in wild zones, celebration grounds, or open air congregations, outside exercises is now and then restrictive. In crisis hunt and-save or military moves, a brief correspondence organize additionally should be sent promptly. In the above circumstances, a portable specially appointed system (MANET) can be a superior decision. A MANET comprises of an arrangement of portable hosts working without the guide of the set up framework of concentrated organization (e.g., base stations or access focuses). Correspondence is done through remote connections among versatile has through their radio wires. Because of concerns, for example, radio power restriction and channel usage, a versatile host will most likely be unable to discuss straightforwardly with different has in a solitary jump mold. For this situation, a multi-hop situation happens, in which the bundles sent by the source have must be handed-off by several middle has previously achieving the goal have. Subsequently, every versatile host in a MANET must fill in as a switch. The two helicopters must impart by implication by no less than two jumps. Broad endeavors have been committed to MANET-related research, for example, medium access control, communicate, steering, disseminated calculations, and QoS transmission issues. In this part, we will center on the steering issue, which is a standout amongst the most essential issues in MANET.

2.2 Mobile Ad Hoc Networks (MANET) Characteristics

MANET has several characteristics and advantages which some of them already inherited in other wireless networks. (Zhang et al, 2007) These characteristics are:

Wireless self-organized and independent: MANET is a kind of wireless networks which consist of mobile nodes. These mobile nodes can act both as a host and router and each node communicate with each other without relying on existing infrastructure. Therefore MANET is autonomous network.

Decentralized administration: MANET has no central authentication like traditional network .it based on distributed model for routing operation, host configuration and security

Mobility and dynamic topologies: nodes are liberated, so they can move around in MANET randomly. This will lead to unpredictable and dynamic change in network topology over the time.

Multi-hop:- this characteristic of MANET means when source node wants to forward data packet to destination node and the destination node not in the radio range of the source .multi hop routing can be used in this case.

Minimal human intervention: - MANET requires less human intervention due to its mobility.

Infrastructure- less: nodes in MANET can communicate with each other directly without any need to base station or access point .so it called infrastructure- less wireless network.

MANET has a symmetric environment, because it consist of nodes have the same features, capability and responsibility.

These characteristics make MANET useful for many applications such as disaster scenarios and case of emergency.

On hand, these advantages make MANET are useful for many applications .on the other hand there are many issues and challenges related to design and install these networks for these purposes such as quality of transmission, congestion, energy efficient, routing, and adaptive protocol.

Furthermore, in (Stephan et al, 2013) was mentioned that Wi-Fi radio will be most suitable solution for smart phones in the case of challenge like this. Wi-Fi supports much higher data rate and can offer a comparable or superior range to Bluetooth, in addition most of smart-phones allow the Wi-Fi radio to be operated as a Wi-Fi Access Point (AP). Therefore, it is possible for groups of smart-phones to communicate directly with each another without any infrastructure.

These advantages of MANETs and Wi-Fi radio can be utilized to develop self-independent network system which allows people to communicate with each other and with outside world without any need to connection to cellular network infrastructure or internet.

2.3 Mobile Ad Hoc Networks (MANET) Applications

MANET has several characteristics that make MANET the most appropriate candidates for many applications in different scenarios and /or services. It can be noticed from its characteristics that MANET don't require details or planning for wiring or base station or access point installing like other traditional networks. It can operate in stand-alone fashion and provide connection to the internet .In (Hoebeke et al, 2014) many applications were mentioned as follow

Military field: MANET can be used in military as a tactical network to provide communication service between soldiers, vehicles and other parts of army based on asynchronous transfer mode (ATM) .it can also be used for automated battlefields services.

Emergency services, MANET can be utilized by search and rescue teams operations, policemen and firemen work, doctors and nurses communications in hospital and in disaster area scenario due to its feature which is doesn’t depend on traditional infrastructure network that might be unavailable in this situation.

Educational environmental: - MANET can be used to provide many services such as virtual classes and communication during lectures; additionally it is useful for students to share and spread information during conferences and meetings.

Commercial and Civilians fields like MANET which can play an important role in such environments for instant, E-commerce, business, shopping malls, vehicular services, sports stadiums and visitors networks at the airport .furthermore, MANET can be also used to extend the coverage area of traditional cellular networks which will extend the access to the cellular network to support more users, it can also provide connection to the internet.

2.4 The Types of Communication Routing Protocol

2.4.1 Unicast routing protocols

Steering conventions for a MANET can be delegated proactive (table-driven) and responsive (on-request), contingent upon how they respond to topology changes. A host running a proactive convention will engender directing related data to its neighbors at whatever point an adjustment in its connection state is identified. The data may trigger other portable hosts to precompute their steering tables and further spread all the more directing related data. The measure of data proliferated each time is commonly corresponding to the size of the MANET. Cases of proactive conventions incorporate remote steering convention (WRP) and goal sequenced separate vector (DSDV). Watching that a proactive convention may pay expenses to build courses regardless of whether portable hosts don't have such need, in this way squandering the constrained remote data transfer capacity, numerous scientists have proposed utilizing receptive style conventions, in which courses are just built on-request. Numerous receptive conventions have been proposed in view of such on-request logic, for example, dynamic source steering (DSR), flag steadiness based versatile directing (SSA), impromptu on-request remove vector steering (AODV), and transiently requested steering calculation (TORA). As of late, a half and half of proactive and receptive methodologies, called the zone directing convention (ZRP), has additionally been proposed. Figure 2.1 clarifies the unicast steering convention.

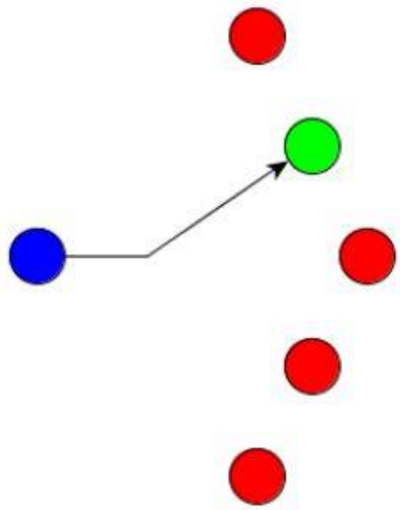


Figure 2.1: Unicast routing protocol

2.4.1.1 Proactive protocol

One agent proactive convention is the goal sequenced separate vector steering (DSDV) convention. It depends on the customary separation vector directing system, likewise called the Bellman– Passage steering calculation, with a few changes to abstain from directing circles. The fundamental activities of the separation vector conspire are as per the following. Each switch gathers the steering data from every one of its neighbors, and afterward registers the most limited ways to all hubs in the system. Subsequent to producing another steering table, the switch communicates this table to every one of its neighbors. This may trigger different neighbors to precompute their steering tables, until the point when directing data is steady. DSDV is improved with opportunity from circles and separation of stale courses from new ones by grouping numbers. Every versatile host keeps up a succession number by monotonically expanding it each time the host sends a refresh message to its neighbors. A course will be supplanted just when the goal arrangement number is not as much as the better and brighter one, or two courses have a similar succession number yet one has a lower metric.

2.4.1.2 On-demand routing protocol

An on-request steering convention just tries to find/keep up courses when vital. As a rule, a steering convention for MANET needs to address three issues: course disclosure, information sending, and course upkeep. At point when a source needs to convey information to the goal hub, it needs to discover a course first. At that point information bundles can be conveyed. The topology of the MANET may change. This may weaken or even disengage a current course while information bundles are being transmitted. Better courses may likewise be framed. This is alluded to as course support. In the accompanying, we audit a few conventions as per these issues.

2.4.2 Broadcasting routing protocol

Broadcasting is a typical activity in a system, used to determine numerous issues. In a MANET specifically, because of host portability, such activities are required to be executed all the more much of the time. For instance, all the above conventions need to do a type of broadcasting in course revelation. Imperative messages/signs may likewise be spread by communicating. A direct way to deal with play out communicate is to utilize flooding. A host, on accepting a communicate message out of the blue, has the commitment to rebroadcast the message. Plainly, this costs n transmissions in a MANET with n has. In a CSMA/CA arrange, on the grounds that radio signs are probably going to cover with others in a geological zone, clear communicating by flooding is typically exorbitant and will bring about genuine excess, dispute, and impact, which we allude to as the communicate storm issue. By excess, we imply that when a versatile host chooses to rebroadcast a communicate message to its neighbors, every one of its neighbors may as of now have the message. In a MANET domain, excess could be intense. Figure 2.2 explains the broadcasting routing protocol.

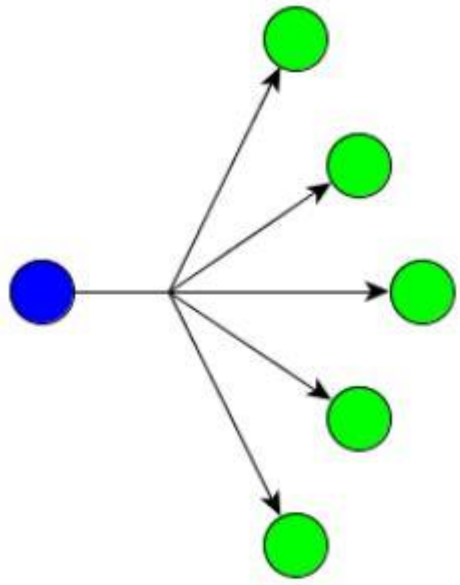


Figure 2.2: Broadcasting routing protocol

2.4.3 Multicasting routing protocol

Past segments have talked about unicast steering and broadcasting conventions. This area will present multicasting conventions. The multicasting conventions can be arranged into two classes in light of how multicast trees are developed: source-based and center based (or gathering shared). The source-based convention tries to keep up for every source multicast tree from each source host to each part in the multicast gathering. Therefore, there may exist different multicast trees in the system. The center based convention, then again, utilizes just a single multicast tree established at a center host. The tree at that point ranges from the center host to each individual from the multicast gathering. In spite of the fact that multicasting can be accomplished by utilizing different unicast steering, the activity may be too high and stifle the system. Thus, numerous multicast conventions have been created with applications embracing multicasting advances. Video conferencing is one imperative case. Multicasting in MANET is considerably more mind boggling than in wired systems in light of host versatility, obstruction of remote signs, and the communicate idea of remote correspondence. In the accompanying, we survey two such conventions. Figure 2.3 explains the multicasting routing protocol.

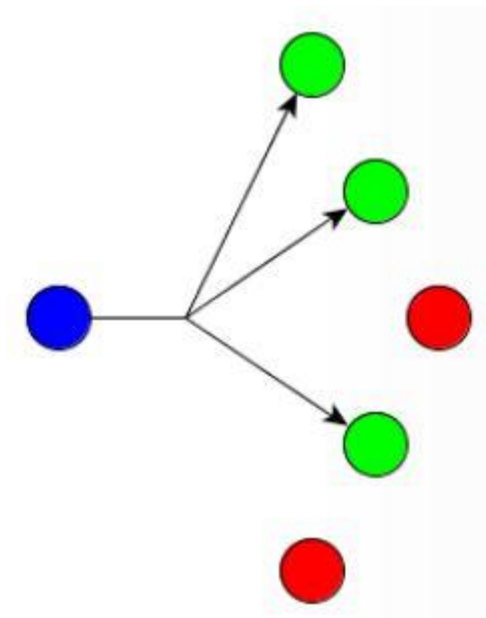


Figure 2.3: Multicast routing protocol

2.5 The Types of Mobile Ad-hoc Network (MANET)

Steering is the route towards transmitting information or parcels from source hub to objective hub. As Specially appointed system changes their topology once in a while and in this way making bundle steering troublesome right then and there. Steering convention controls the flood of data in frameworks and moreover picks the productive method to accomplish the objective. Directing conventions can be ordered on different constructs, for example, in light of the topology of system for steering i.e. proactive and receptive directing conventions, based on correspondence system utilized for transmitting of data from source to goal i.e. unicast, communicate and multicast directing. Directing conventions characterize a sorting of principles which overlook the methodology of message bundles exchange between source and goal in system. Figure 2.4 shows the diverse kinds of MANET directing convention.

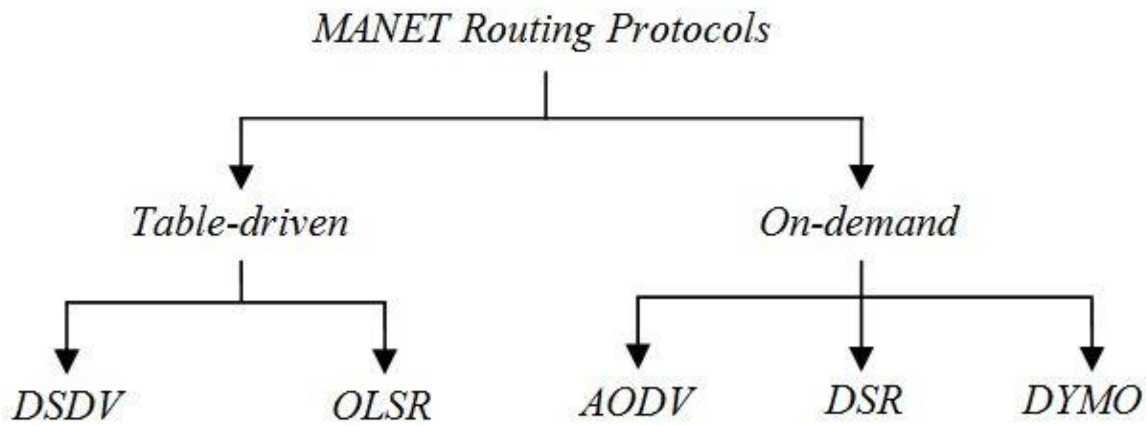


Figure 2.4: Different types of Manet routing protocol

A remote exceptionally named framework is a decentralized sort of remote framework. The framework is extraordinarily delegated in light of the way that it doesn't rely upon an earlier structure, for instance, switches in wired frameworks or access centers in directed (establishment) remote frameworks . Exceptionally delegated frameworks don't have a particular topology or a central coordination point. In like manner, sending and tolerating bundles are more ensnared than structure frameworks. Figure 2.5 demonstrates a case for impromptu system.

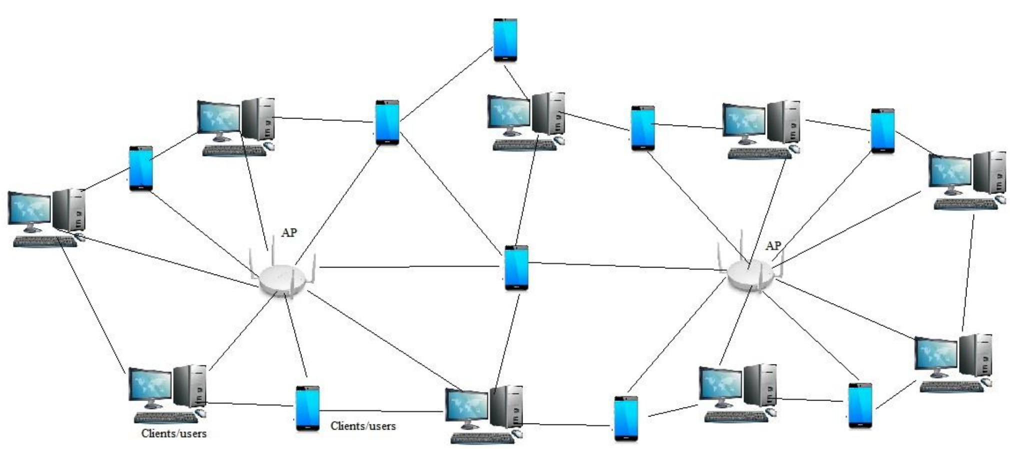


Figure 2.5: Example for ad-hoc network

These days, with the enormous development in remote system applications like handheld PCs, PDAs and mobile phones, scientists are urged to enhance the system administrations and execution. One of the testing configuration issues in remote Specially appointed systems is supporting portability in Versatile Impromptu Systems (MANETs). The versatility of hubs in MANETs expands the unpredictability of the directing conventions and the level of connection‟s adaptability. Be that as it may, the adaptability of enabling hubs to join, leave, and exchange information to the system posture security challenges. A MANET is a gathering of portable hubs sharing a remote channel with no concentrated control or built up correspondence spine. MANET has dynamic topology and every portable hub has restricted assets, for example, battery, handling power and on-board memory This sort of framework less system is extremely valuable in circumstance in which normal wired systems isn't achievable like war zones, cataclysmic events and so forth. The hubs which are in the transmission scope of each other convey specifically generally correspondence is done through middle of the road hubs which will forward bundle thus these systems are additionally called as multi-bounce systems. MANET as appeared in Figure 2.6.

Figure 2.6: Multi-hop network

2.5.1 Ad-hoc on-demand distance vector routing protocol (AODV)

AODV is basically a difference in DSDV. Regardless, AODV is a responsive controlling tradition instead of proactive. It constrains the amount of conveys by making courses in light of intrigue, which isn't the circumstance for DSDV. Right when any source center needs to send a package to an objective, it imparts a course request (RREQ) distribute. The neighboring center points in this manner impart the package to their neighbors and the strategy continues until the point that the moment that the package accomplishes the objective. In the midst of the path toward sending the course request, widely appealing center points record the address of the neighbor from which the essential copy of the convey package is gotten. This record is secured in their course tables, which helps for setting up a pivot way. If additional copies of the same RREQ are later gotten, these groups are discarded. The appropriate response is sent using the pivot way. For course bolster, when a source center moves, it can reinitiate a course disclosure process. In case any center moves inside a particular course, the neighbor of the drifted center point can recognize the association disillusionment and sends an association frustration notice to its upstream neighbor. This methodology continues until the point that the failure see accomplishes the source center point. In light of the got information, the source may decide to re-begin the course disclosure organize. Figure 2.7 shows the assorted kind of pathes.

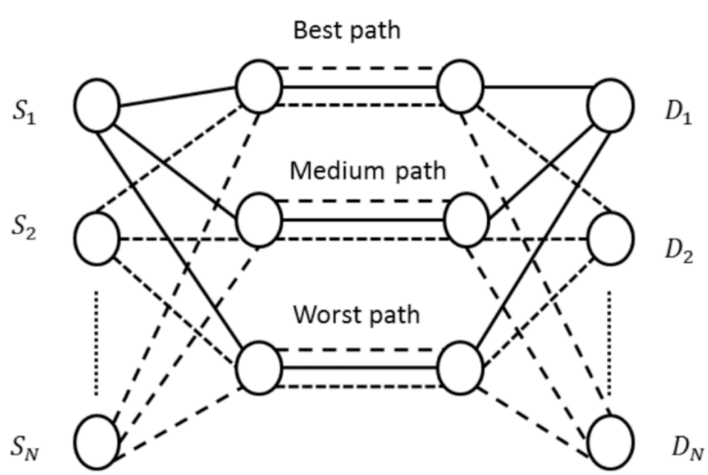


Figure 2.7: The available pathes of trasmision

On ask for or Responsive steering conventions were expected to beat the overhead that was made by proactive directing convention in case of extensive and uncommonly unique system. AODV relies upon Bellman-Passage Separation calculation. It is on-ask for directing convention. In this directing convention, course is finding from source to goal just on ask for commence. AODV is direct full steering convention infers exchanging of hi message to make the relationship with the neighbors. AODV have the distinctive stages like course revelation organize, course support arrange, course table administration and neighborhood network administration. In course disclosure organize the source hub talk with the goal hub through the middle hubs. The course ask for (RREQ) sends by the source hub. This RREQ contain source address, goal address, source arrangement number, goal progression number , impart id and TTL. The source succession number is used to keep up a key separation from the circles. The source arrangement number and the goal progression number are used to keep up the most late information of hubs. The (Source address and convey id) join is used to perceive the RREQ particularly . Right when a hub discover connect break then it conveys course blunder bundles to its neighbors. Figure 2.8 shows an example for AODV routing protocol.

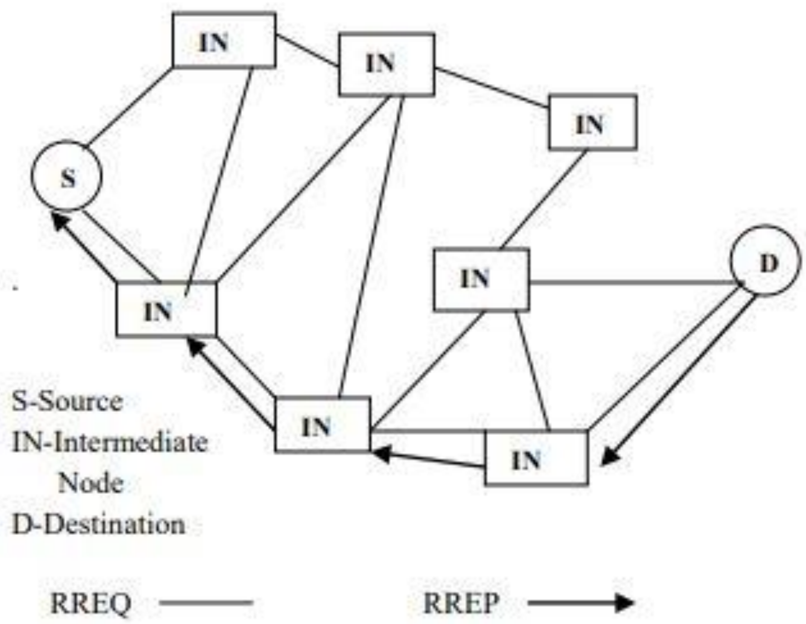


Figure 2.8: AODV routing protocol

Advantages of AODV are loop free routes, used for unicast, broadcast and multicast and route establishment depends on request or demand.

Disadvantages of AODV are bandwidth consumption is more and Routing information not used again.

2.5.2 Dynamic source routing (DSR)

DSR is a Responsive Convention which depends on ask for or on request. In this convention hi parcels are not traded. These welcome bundles are used to caution its neighbors of its quality. At first source hub does not have the course to send the primary parcel to the goal. DSR have two phases initially is course revelation and second is course support. Right when a source hub needs to send a bundle to the goal the principal it check in its course store, if it has honest to goodness course then it send the parcel, however if there is no course available at that point source hub begin the course revelation process by sending the Course Ask for RREQ bundles to all neighbor hubs. Figure 2.9 shows an example for DSR routing protocol.

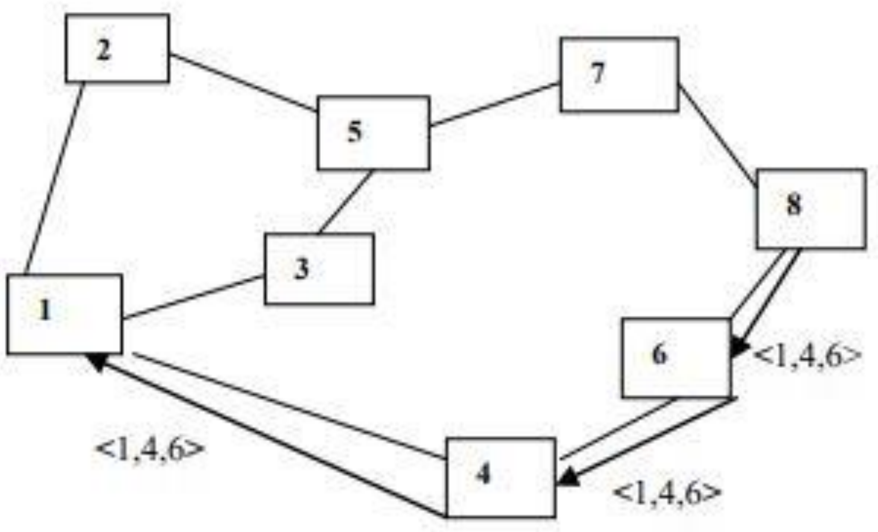


Figure 2.9: DSR routing protocol

To send a bundle from source to goal hub, the sender develops a source course in the parcel's header. This course has the address of every hub in the system through which the bundle will be sent keeping in mind the end goal to achieve the goal hub. The sender transmits the bundle over the system by finding the primary hub in the source course. At the point when a bundle is gotten at have, it checks its header and if this host isn't the last goal of the parcel, it just transmits the parcel to the following hub found in the source course in the bundle's header. As it achieves its last goal, the bundle is conveyed to the system layer of that host . This may bring about high overhead for long ways or huge locations. To abstain from utilizing source steering, DSR convention likewise utilizes a stream id alternative that enables parcels to be sent on a bounce by jump premise. This convention keep up data on portable hubs since it depends on source steering.

It has only two major phases. The first phase is route discovery. Second phase is route maintenance.

Route Reply is produced if the message has achieved the required goal hub and to restore the Course Answer, the goal hub must have a course to the source hub. On the off chance that the course is in the course store of goal hub. This course would be utilized to send course answer. Something else, the hub will invert the course found in the Course Ask for message header. The Course Disclosure Stage is started to decide the most achievable course.

Advantages of DSR:

1.Source-based routing rather than table-based.

2. Route establishment depends on request or demand.

Disadvantages of DSR:

1.Aplicable for small network.

2.Header size increased.

2.5.3 Comparison between AODV and DSR

Main common features:

1- On-request course asking.

2- Route revelation in light of asking for and answering control bundles.

3- Broadcast course revelation instrument.

4- Route data is put away in every single middle of the road hub along the built up way.

5- Inform source hub for a broken connections.

6- Loop free routing.

Main differences:

1- DSR can deal with uni and bi-directional connections, AODV utilizes just bi-directional.

2- In DSR, utilizing a solitary RREQ - RREP cycle, source and halfway hubs can learn courses to different hubs on the course.

3- DSR keeps up numerous backup courses of action to the goal, rather than AODV that keeps up at most one passage for every goal.

4- DSR doesn't contain any unequivocal instrument to lapse stale courses in the reserve , In AODV if a steering table section isn't as of late utilized , the passage is terminated

5- DSR can't incline toward "fresher" courses when confronted various decisions for courses. Interestingly, AODV dependably pick the fresher course (in light of goal arrangement numbers)

6- DSR's RREQ has variable length relying upon the hubs that the parcel has voyage. AODV's RREQ measure is consistent

7- As an outcome DSR's header overhead may increment as more hubs end up dynamic, so we expect that AODV throughput in those situations to be better

Table 2.1 shows the parameters that used to test the performance of AODV and DSR routing protocol

Table 2.2 and Table 2.3 present the performance of results and routing respicteviely.

Table 2.1: Test bench set up

Parameters	Setting
Number of nodes	100 nodes
Bit rate	2 Mb/s
The range of communication	250 m
The moving characteristic	Continuously

Table 2.2: The performance results

Performance metrics	DSR	AODV
Packets delivered /Packets sent (%)	56.88	83.66
Average delay (s)	1.36	0.26

Table.2.3: The routing performance

Routing packets	DSR	AODV
Route requests	37774	228094
Route replies	82710	17753
Route errors	26591	9808
Total	147075	255655

2.6 Cluster-Head Gateway Switch Routing Protocol

The Gathering Head Entry Switch Controlling (CGSR) tradition is a table-driven coordinating tradition. In a bundling structure. Each predefined number of center points are formed into a bundle controlled by a gathering head, which is designated using an appropriated packing count. In any case, with the packing design, a group head can be supplanted once in a while by another center point, for a couple of reasons, for instance, cut down level essentialness left in the center point or a center moves out of contact. With this tradition, each center point keeps up two tables: a gathering part table and a directing table. The bundle part table records the gathering set out toward each objective center point, and the guiding table contains the accompanying bounce to accomplish the objective. Similarly with the DSDV tradition, each center point invigorates its gathering part table on tolerating another revive from its neighbors.

2.6.1 Clustering and routing algorithms

CGSR managing consolidates package organizing, whereby a middle point is required to locate the best course finished assembling heads from the gathering part table. Figure 2.10 demonstrates an example of planning in a zone in which six gatherings have been encompassed. An inside point in gather is transmitting a package to a middle in aggregate F. Focuses inside each get-together course their packs to their own particular related gatherings. The transmitting focus by then sends its bundle to the going with ricochet, as appeared by the coordinating table portion related with that social event head. The bunch head transmits the bundle to another get-together head until the minute that the social occasion pioneer of the target focus point is come to. The planning is made through a development of accessible social affair heads from A to F. Bundles are then transmitted to the goal.

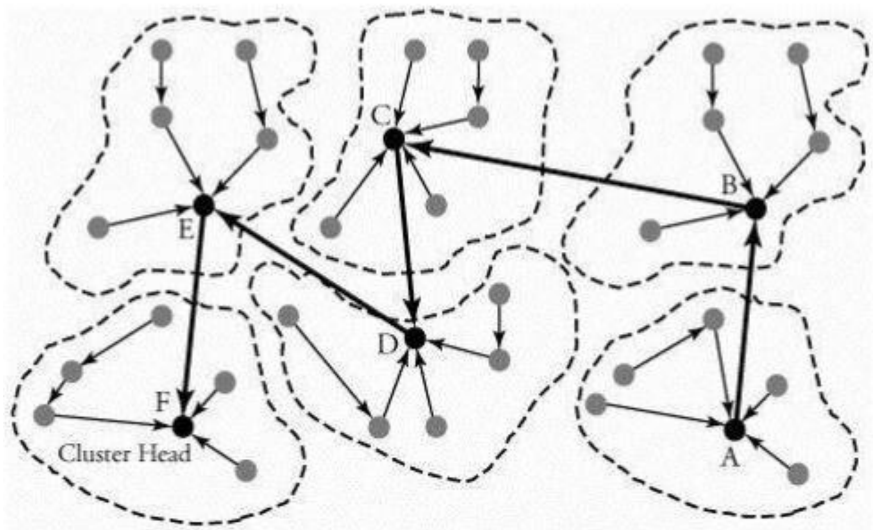


Figure 2.10: Communication with (CGSR) protocol

2.7 Wireless Routing Protocol (WRP)

The Remote Steering Convention (WRP) is a table-based tradition keeping up coordinating information among all center points in the framework. This tradition relies upon the scattered Bellman-Entry computation. The rule favored angle of WRP is that it diminishes the amount of coordinating circles. With this tradition, each center point in a framework keeps up four tables, as takes after:

1. Partition table, which holds the objective, next hop, detachment, and precursors of each objective and each neighbor.
2. Coordinating table, which saves the objective address, next bob, partition, predecessor, and a marker for each objective, showing whether that area thinks about to a clear way.

3. Association cost table, which gives the association cost to each neighbor and besides the amount of intermittent revive periods snuck past since the center point got any bumble free message from it.

4. Message transmission-list table, which records which invigorates in a revive message are to be retransmitted and which neighbors need to perceive the retransmission. The table gives the course of action number of the invigorate message, a retransmission counter, confirmations, and a summary of updates sent in the revive message.

Center points should either impart something particular including the revive message or an Appreciated message to their neighbors. In case a center point has no message to send, it should send an Appreciated message to ensure accessibility. If the sending center is new, it is added to the center's guiding table, and the present center sends the new center point a copy of its coordinating table substance.

When it perceives an alteration in a roadway, a center point sends the revive message to its neighbors. The neighboring center points by then change their detachment segments and scan for new possible routes through various centers. This tradition avoids the incorporate to perpetuation issue demonstrate most uncommonly named framework traditions. This issue is settled by making each center point perform consistency checks of predecessor information uncovered by each one of its neighbors remembering the ultimate objective to oust circumnavigating and make a speedier course converging inside seeing any association or center point dissatisfaction.

CHAPTER 3
PRELIMINARY

3.1 Silent or Off-Grid Wireless Communication Technologies

There are many wireless technologies offering off-grid communication. These technologies are Bluetooth, Wi-Fi Ad-hoc mode and Wi-Fi Direct. Each one of these technologies has its own limitation in terms of transferring data rate with respect to the distance. Bluetooth standards follow as IEEE802.15.1 and has significantly slower data rate up to 3 Mbps (Banerji et al., 2013). The Bluetooth standard is considered to have a lower data transfer rate compare with the Wi-Fi IEEE802.11. Wi-Fi can support data rate transmission up to 54 Mbps or higher. According to the specified standards, Bluetooth covers a distance up to 10 meters, whereas Wi-Fi covers a distance of 15 meters for indoor and 20 meters for outdoor (Liu et al.,2016).
Wi-Fi Ad-hoc and Wi-Fi direct are two different modes of Wi-Fi technology developed by Wi-Fi Alliance Wi-Fi Ad-hoc mode represents the basic Wi-Fi feature which allows nodes to communicate with each other without access point (AP). The Wi-Fi Direct Mode is a new technology and developed by Wi-Fi Alliance.

3.2 Proposed Mobility Model

Suppose there are N total number of mobile units. Each mobile unit within the network is denoted with the variable m_i, $1 \leq i \leq N$. Furthermore; The individual m_i units can be defined as $M = \{m_1, m_2, \ldots, m_i, \ldots, m_N\}$. The number of neighborhood to each mobile unit is G_i. The mobile units *mi* that are within the mobile communication range as $z_{j_{m_i}}$, $1 \leq j \leq G_i$. Each individual $z_{j_{m_i}}$neighborhood units can be defined as, $Z_{m_i} = \{ z_{1_{m_i}}, z_{2_{m_i}}, \ldots, z_{j_{m_i}}, \ldots, z_{G_{m_i}} \}$. The transmitting mobile unit will consider as m_i .The target mobile is represented as D. The limited mobile communication range is represented as R. According to the above presumption, related definitions provided in the following sections. The commonly used variables are defined in Table 3.1.

Table 3.1: Commonly used variables

Variables	Specification
m_i	Mobile i
N	Number of mobiles
M	The set of mobiles
$z_{j_{m_i}}$	The jth Neighbor mobile of mobile i
G_i	The neighbor number of mobile i
z_{m_i}	The set of neighbor mobiles of mobile i
D	The target mobile
R	The limited mobile communication range
H_{m_i}	The data information packet of mobile i
E_{m_i}	The emergency text packet of mobile i
A_{m_i}	The Acknowledgment packet of mobile i

3.2.1 Data information packet

Each mobile broadcast the data information packet to its neighbor's only ones when entered the network. The data information packet include the transmitter's name and unique ID number which is generated from the mac address of the mobile device. Let's now have a new mobile entering the network and broadcasting the data information packet. The data information packet denoted as H_{m_i}= {ID number of m_i, Name of m_i}. Figure 3.1 indicates the data information packet.

Figure 3.1: Data information packet

3.2.2 The neighbor mobiles table

All neighbor mobiles are bounded with the limited mobile communication range *R*. Each neighbor mobile unit $z_{j_{m_i}}$broadcasts the data information packet. The data information packet will be updated only if new mobile unit m_i entered within the grouped of Z_{m_i} .The updated data information packet forms a new table on each mobile unit m_i identifying the new arrival of m_i.This helps to identify if the destination ID number included within the table. Each mobile retransmits the data packet information for as long as changes occur at a table. The changes at a table occurs either leaving or entering into the network. All mobiles broadcast the updated table via data packet information. For example, the updated data packet information of the mobile that has two neighbors displayed as H_{m_i}= {ID number of m_i, Name of m_i, ID number of $z_{l_{m_i}}$, Name of $z_{l_{m_i}}$, ID number of $z_{2_{m_i}}$ Name of $z_{2_{m_i}}$}. Figure 3.2 shows the arrangement for such example.

Transmitter ID Number	Transmitter Name	Neighbor#1 ID Number	Neighbor#1 Name	Neighbor#2 ID Number	Neighbor#2 Name

Figure 3.2: The updated data information packet

Let us now consider another case where new mobile unit m_i belonging to another group of Z_{m_i}. It is classified as new to all the mobile units within neighborhood Z_{m_i}. This forces to update the data packet information to be known as a new arrival. The Equation (1) shows the format of the data packet information. The flowchart in Figure 3.3 explains the operation of the update.

$$Hm_i = \{\text{ID of } m_i, \text{Name of } m_i, \text{ID of } z_{j_{m_{(i+k)}}}, \text{Name of } z_{j_{m_{(i+k)}}}\} \qquad (3.1)$$

where $1 \leq i \leq N$, $1 \leq j \leq G_i$and $-i+1 \leq k \leq N-i$.

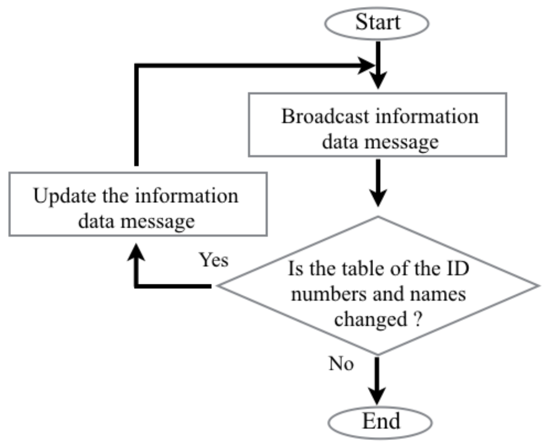


Figure 3.3: Operation of update the data information packet

3.2.3 The emergency text packet (ET)

The aim is to form communication between the mobile units M under emergency conditions. The user at the transmitter checks if the destination D appears on the table, if the destination is included in the table, emergency text (ET) transmitted to the destination ID number. Otherwise, emergency text will be transmitted continuously. The emergency text packet includes ET, the unique ID number, name of transmitter and destination. The emergency text packet denoted as E_{m_i}= {ID number of m_i, Name of m_i, Emergency text, ID number of D, Name of D} as given in Figure 3.4.

Figure 3.4: Emergency text packet ET

3.2.4 The acknowledgment packet (Ack)

The broadcasting will terminate when acknowledgment packet received. The acknowledgment packet will be transmitted from the destination. This confirms the reception of the emergency text packet. The packet of acknowledgment Ack includes the unique ID number, the name of

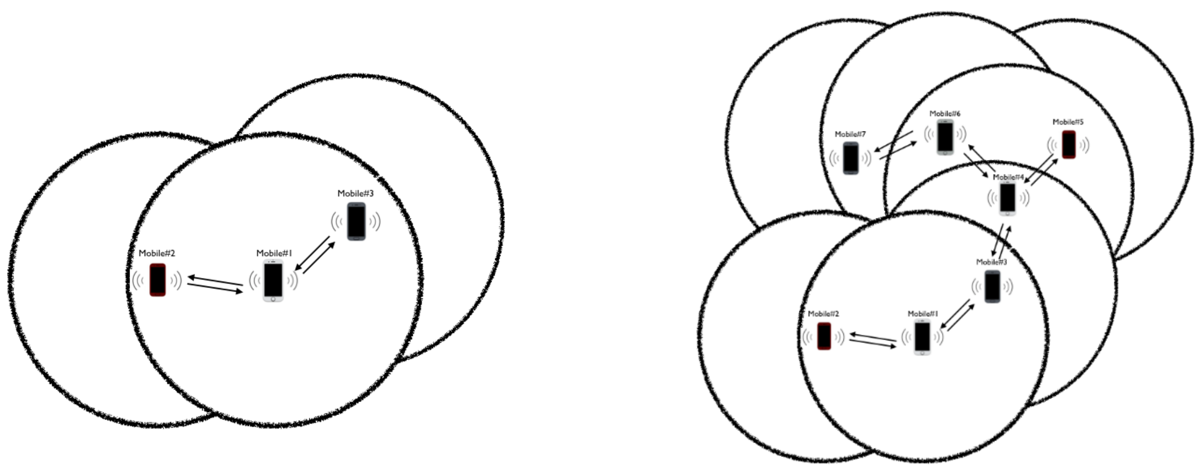
the transmitter and the destination. The emergency text packet denoted as A_{m_i}= {ID number of m_i, Name m_i, message Ack, ID number of D, Name of D} given in the Figure 3.5.
The transmission of the acknowledgment packet will stop when the reception of the emergency text packet terminates.

Figure 3.5: Acknowledgment packet Ack

CHAPTER 4
PROPOSED SYSTEM

4.1 Self-Standing Wireless Network–Based Routing Protocol (SSWN)

SSWN protocol involves two different scenarios. These scenarios are cover all the probabilities that may occur during the communication process. The first scenario includes broadcasting within same Z_{m_i} as in Fig 4.1 a. The second scenario includes broadcasting among different Z_{m_i} as in Fig 4.1 b.



(a) The m_i are within same Z_{m_i} (b) The m_i are within different Z_{m_i}

Figure 4.1: The communication scenarios

4.1.1 The mobiles m_i are within the same group of Z_{m_i}

This scenario aims to make communication between two mobiles within the limited communication range. The transmitter mobile sends the ET directly to the destination. Upon reception of the ET the target mobile sends directly the acknowledgment message to the transmitter mobile.

4.1.2 The mobiles m_i are within the different group of Z_{m_i}

This scenario aims to establish the communication between two mobiles within different limited communication range. There are two different tasks for this scenario. Firstly, identify the ID number of the destination mobile within the neighborhood mobiles. If the ID number of the destination mobile exist within the table of neighbor mobiles then the emergency text packet will be transmitted. Otherwise, the message forwarding (MF) will be activated. MF broadcasts the emergency text packet to all neighbor mobiles. The transmitting mode of the SSWN explained in Figure 4.2.

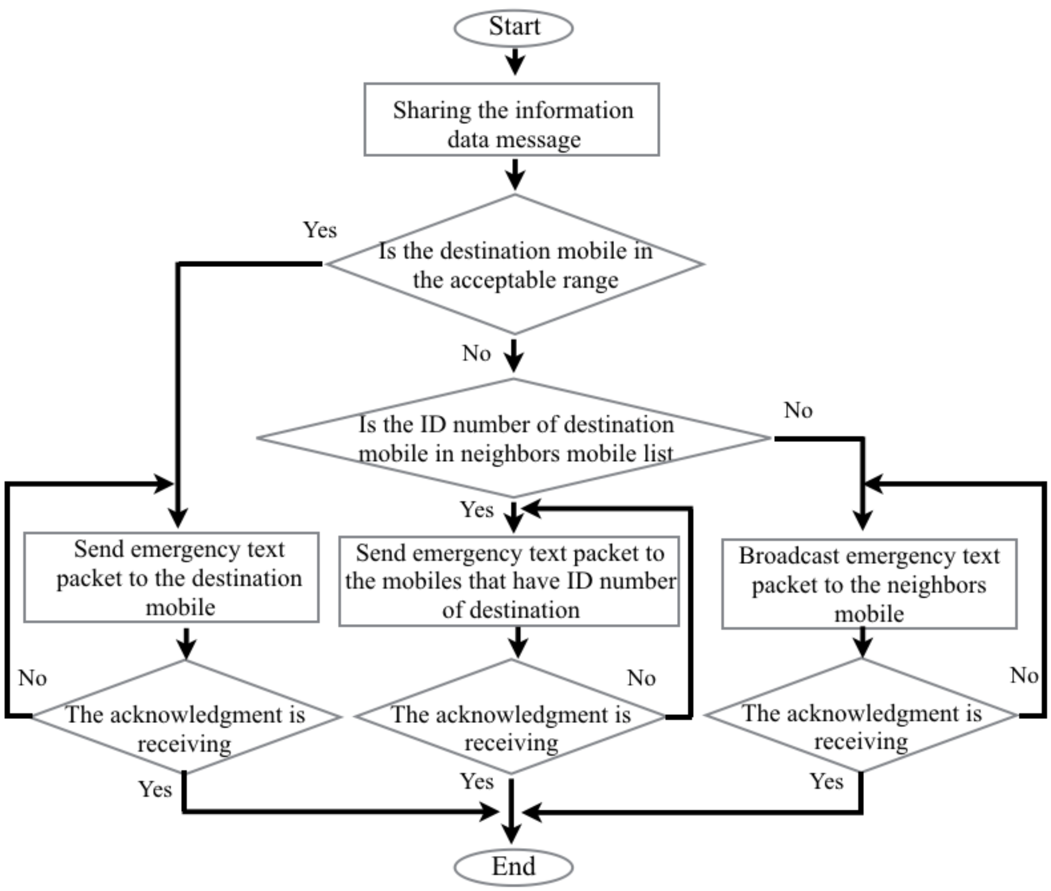


Figure 4.2: Flowchart of SSWN protocol of transmitting mode

The transmitter mobile sends the ET continuously until the reception of the Ack. The destination mobile continuously sends the Ack packet until the broadcasting of the ET terminates. The receiving mode of SSWN explained in Figure 4.3.

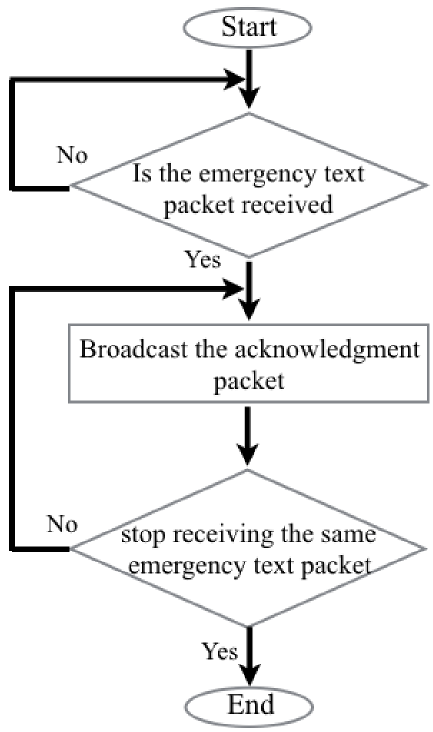


Figure 4.3: Flowchart of SSWN protocol in receiving mode

4.2 Algorithm Section Process

This section explains the Self-standing wireless network–based routing protocol

(1) The initialization procedure.

In this step, the mobile m_i obtains its own information (ID number, Name), the ID number generated from the mac address of the mobile. The user defines a username.

(2) Broadcasting the emergency text packet (ET)

Suppose the user m_i generates ET for broadcasting. The mobile m_i generates the emergency text packet E_{mi} and checks if the neighbors mobile has the ID number of the destination D, if the ID number of the destination is included at the table of neighbors mobile m_i send the E_{m_i} to the neighbor mobiles that have the ID number of the destination. Otherwise, the mobile m_i broadcasts E_{m_i} to all neighbors. This procedure repeat itself unless the ET delivered to *D*.

(3) Broadcasting the acknowledgment packet (Ack)

The mobile sends the acknowledgment packet only if the emergency text packet receive. In this case the mobile broadcast the acknowledgment packet A_{m_i} to all neighborhood mobiles. The mobile continuously broadcast the A_{m_i} until the transmitter mobile stop broadcasting the emergency text packet E_{m_i}.

The SSWN protocol algorithm is shown in Algorithm 1.

Algorithm 1 Self Standing Wireless Network-based routing protocol

Step 1 SSWN initialize, $m_i$initialize $Z_{m_i}$and update the H_{m_i}; initialize the ET

Step 2

if m_i has packet to send to *D* **then**

if m_i does not know the ID number of *D* **then**

go back step 1.

else if G_i ={0} **then**

m_i stores the packet and go back step 1.

else if *D* included within Z_{m_i}**then**

m_i sends emergency text packet to *D*.

else if *D* belong to H_{m_i}**then**

m_i sends emergency text packet to Z_{m_i}which include the ID number of *D*.

else

m_i broadcasts emergency text packet to all Z_{m_i}.

end if

else

go back step 1

end if

CHAPTER 5
SYSTEM ANALYSIS

5.1 Performance Evaluation

The SSWN protocol simulation compared against the existing protocols like ad-hoc on-demand distance vector (AODV) and the dynamic source routing (DSR).The simulation program use network simulator (NS-3) to implement algorithm 1. Figure 9 shows the results of the simulation.

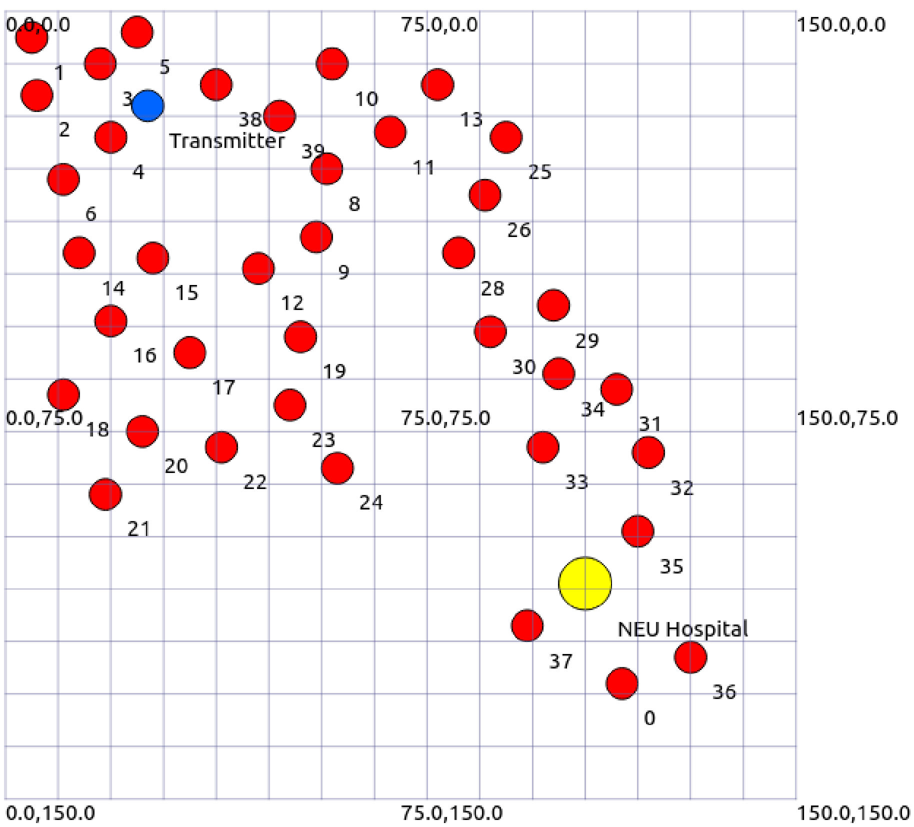
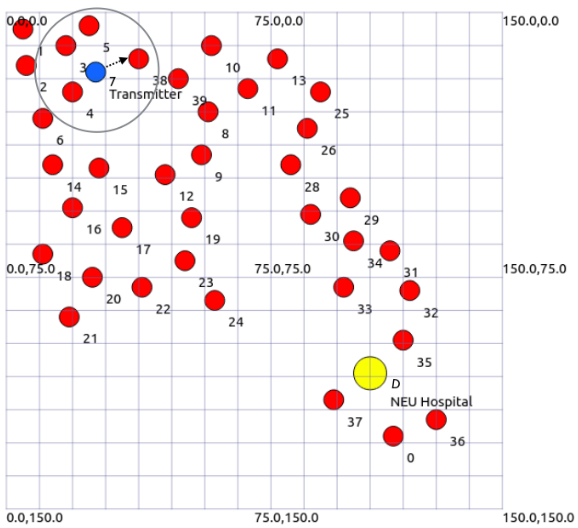
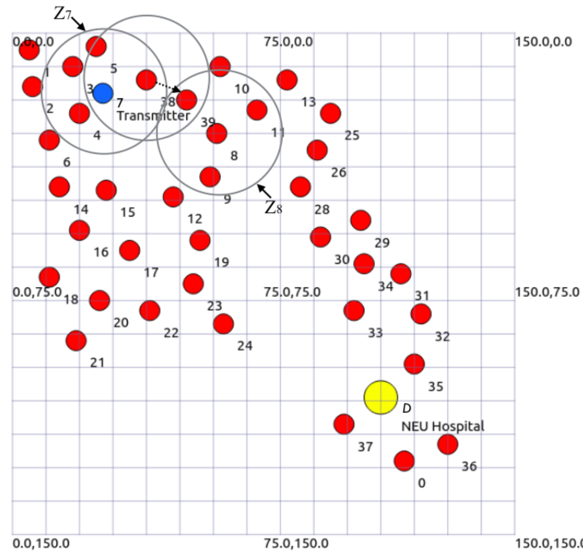


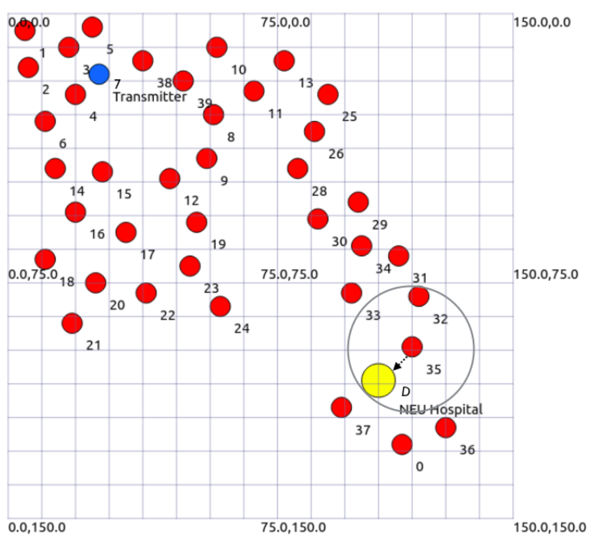
Figure 5.1: Simulation topology to establish communication



(a) First step



(b) Second step



(c) Last step

Figure 5.2: The path of communication

Table 5.1: Simulation variables

Variables	Settings
Simulation area	150 m × 150 m
Mobile numbers	40, 80, 120, 160, 200
Mobile speed	1 m/s, 1.5 m/s
Simulation time	120 s
Time intervals	0.5 s
Communication range	15 and 20 m
Packet size	256 bytes

5.2 Analysis of Packet Delivery Ratio (PDR) and Packet Loss (PL)

The PDR and PL are the most important factors to consider with the efficiency of SSWN. The PDR and PL calculated using Equations below. However, we designed SSWN protocol considering the increased values of the PDR. Figure 5.3 show the different trends in the PDR of AODV, SSWN and DSR protocols with increased mobile units. The considered number of mobiles is in the range of 40, 80, 120, 160, and 200. Increasing the number of mobiles increases the PDR in all routing protocols. The change of PDR is due to changing number of mobiles. The mobiles are not fixed and they have the ability to move at a speed of 1.5 m/s. Therefore, the network topology changes frequently. Increasing the number of mobiles will increase the density of the mobiles and increases the PDR.

$$\mathrm{PDR} = \frac{\text{Packets deliverd}}{\text{Packet trasmitted}} \tag{5.1}$$

$$\mathrm{PL} = \frac{\text{Packets trasmitted} - \text{Packets deliverd}}{\text{Packet trasmitted}} \tag{5.2}$$

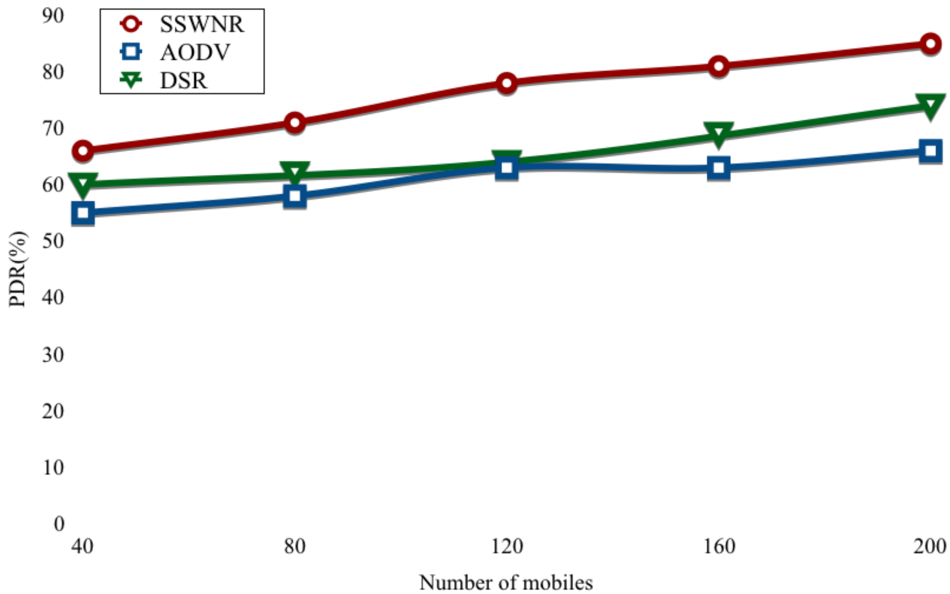


Figure 5.3: The trend of packet delivery ratio with different mobiles number

Figure 5.3 shows the favor achievement of the SSWN protocol comparing with the AODV and DSR protocols. The PDR in AODV protocol is lower than the DSR protocol. The packet loss factor further analyzed and plotted in Figure 5.4.

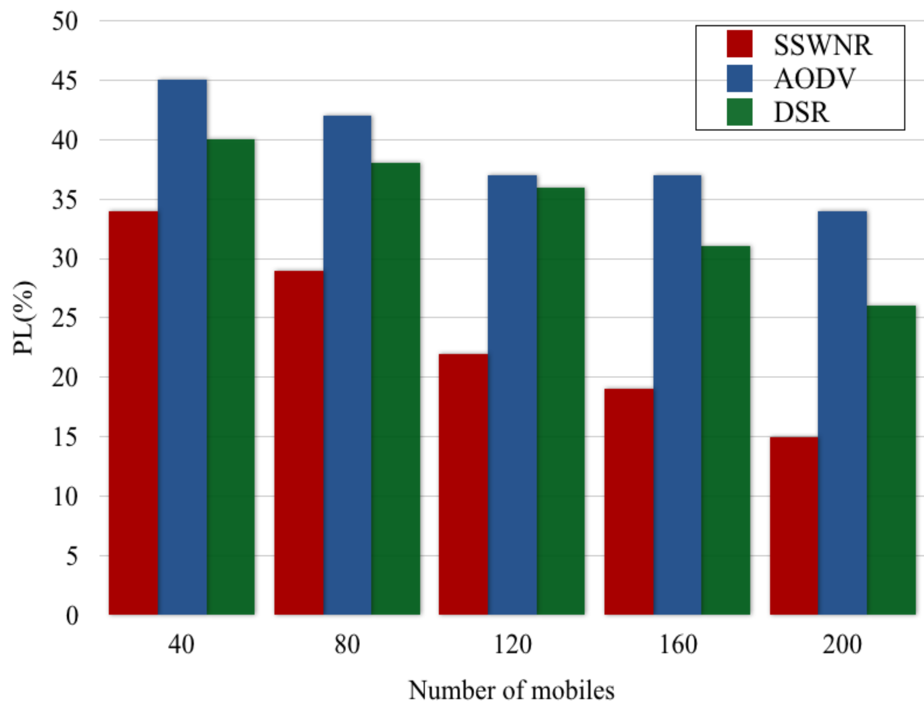


Figure 5.4: The variation between of packet loss and different mobiles number

Figure 5.4 indicates that the newly introduced SSWN routing protocol has the lowest packet loss PL comparing with the existing protocols. This is the desired achievement for standard broadcasting.

CHAPTER 6
CONCLUSION

6.1 Conclusion

It is very important to be able to communicate in a disaster situation where all communication is stopped. There is no-cost effective and instantaneous solution for such application. The targeted user group occupies only a small area which allows transmission without the need for an expensive infrastructure to provide coverage for small text transmission. In this article, we introduced an algorithm called SSWN. The SSWN provides instant text transmission without the requirement of network coverage and does not suffer from the movements. The transmitted message forms a multi path connection. Therefore, miss-connection of few mobiles does not have a big impact on transmission. Full connectivity can be achieved without the need of the external network coverage. We produced a detailed simulation to verify the applicability of SSWN. The results confirm the advanced operation of SSWN. The simulation results also indicate that SSWN is scalable with the number of users. The performance and the required path connection are not affected with increased number of users.

The mobile software application for algorithm 1 it is under test procedure and it will be adaptable to ios and android operating systems.

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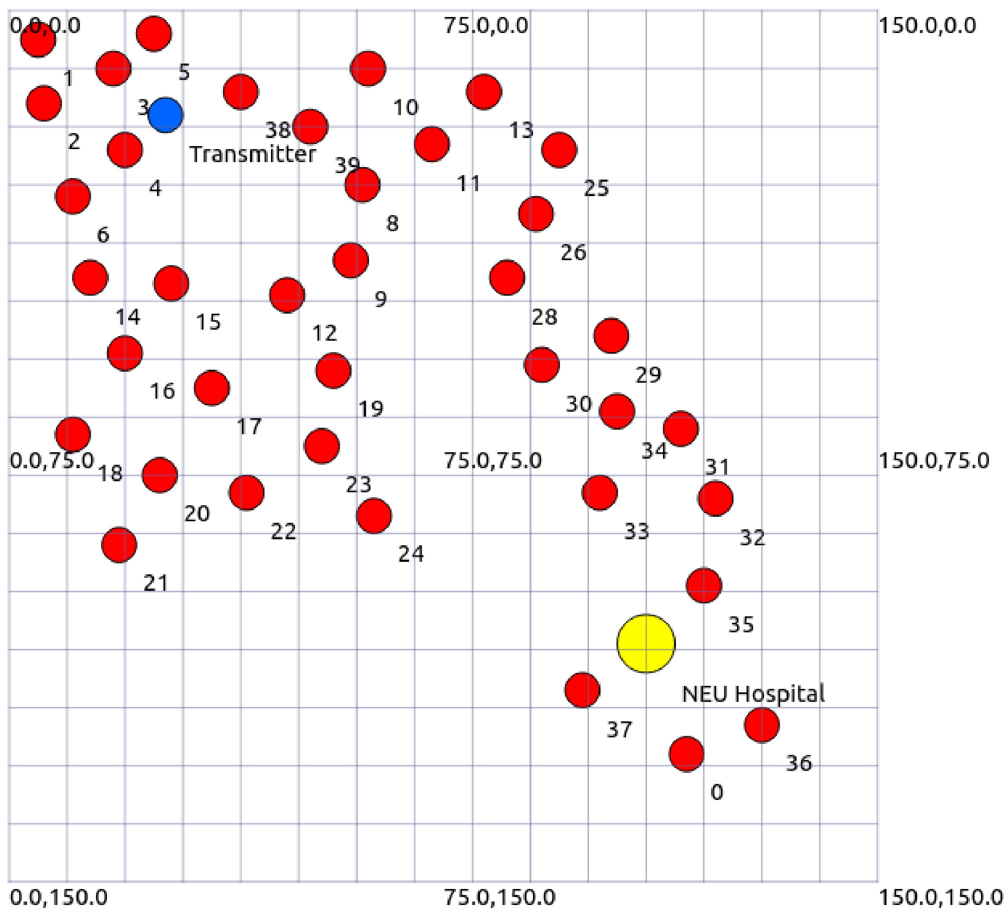
APENDIX 1

STEPS OF THE COMMUNICATION BETWEEN TWO MOBILES IN DETAILS

Simulation topology is establishing the communication between m_7 (transmitter) to D (NEU Hospital), -1- to -14- forming path using the available mobile units.



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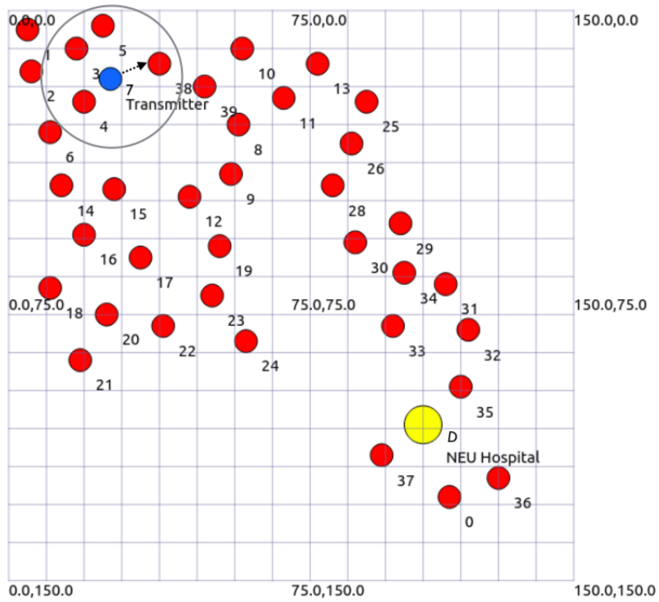
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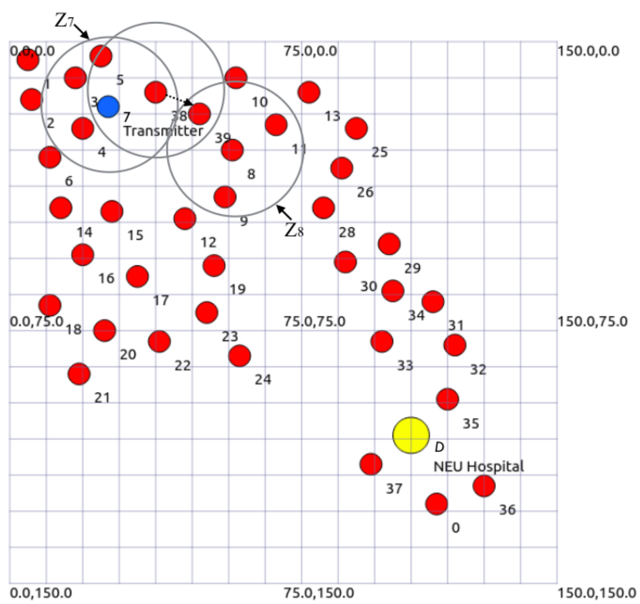
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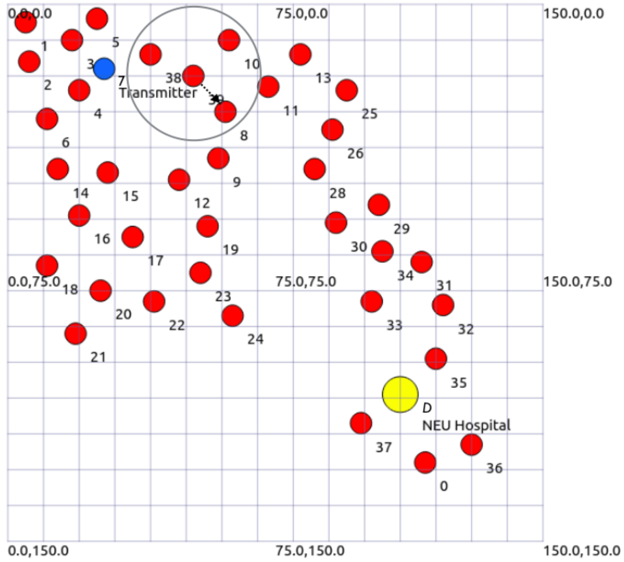
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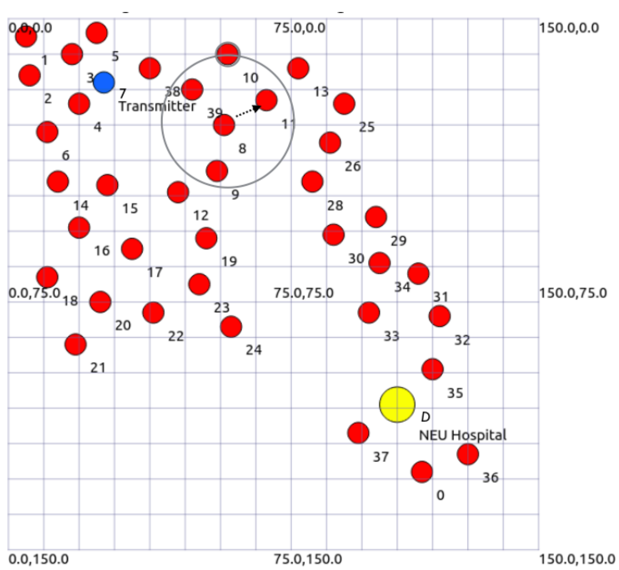
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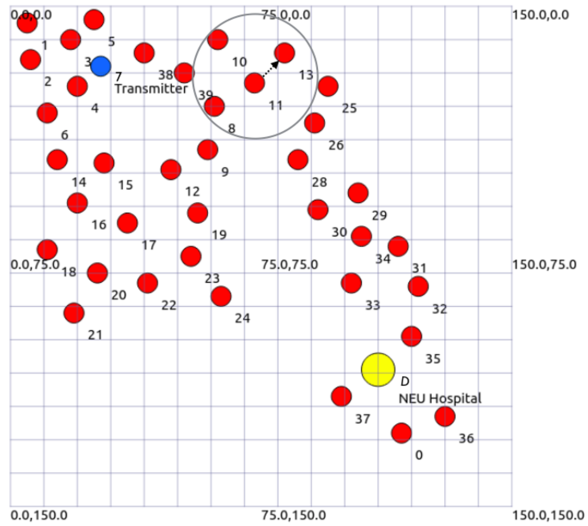
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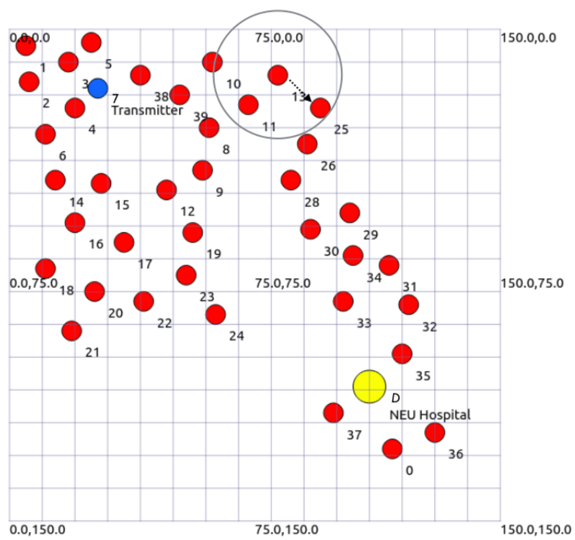
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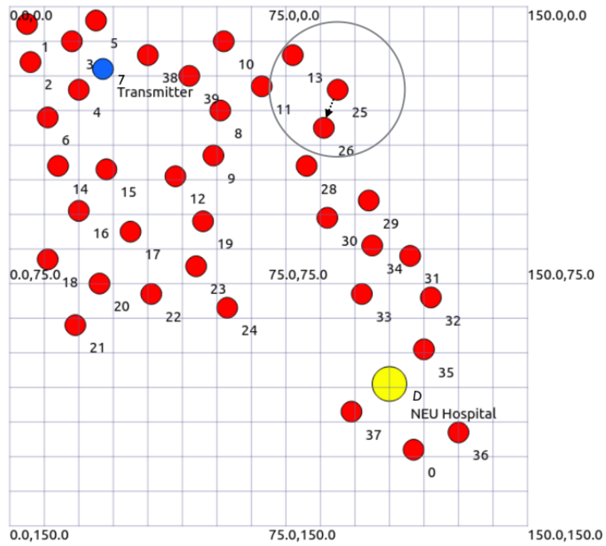
-7-



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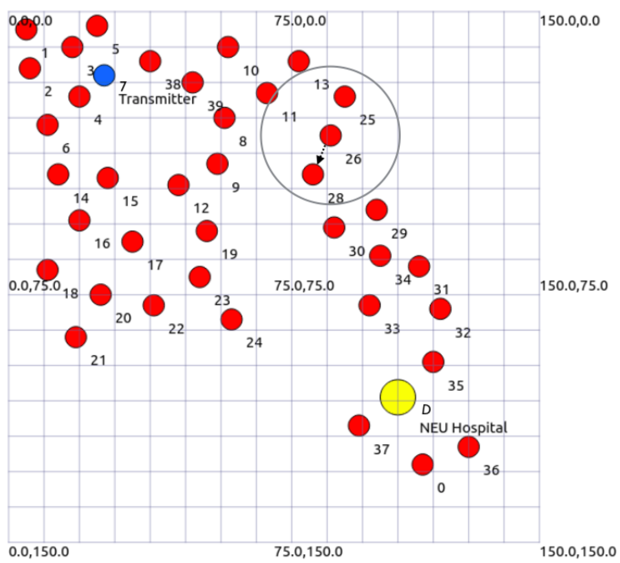

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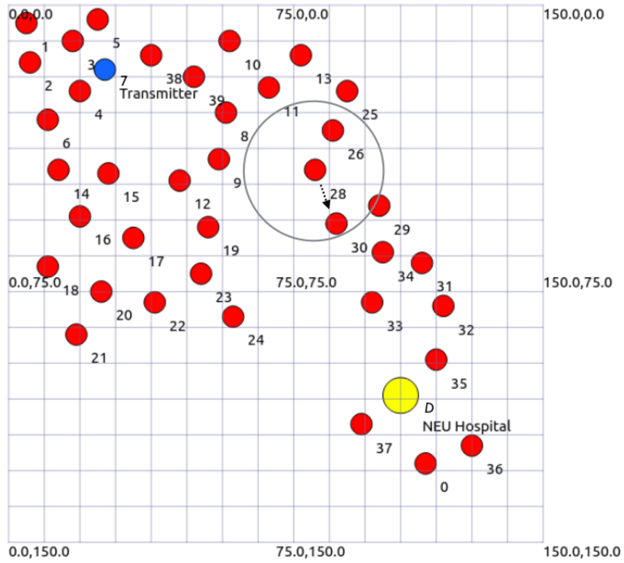
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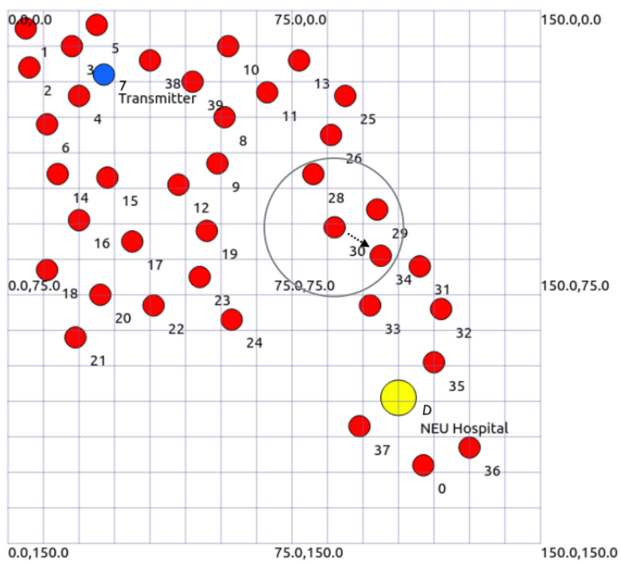
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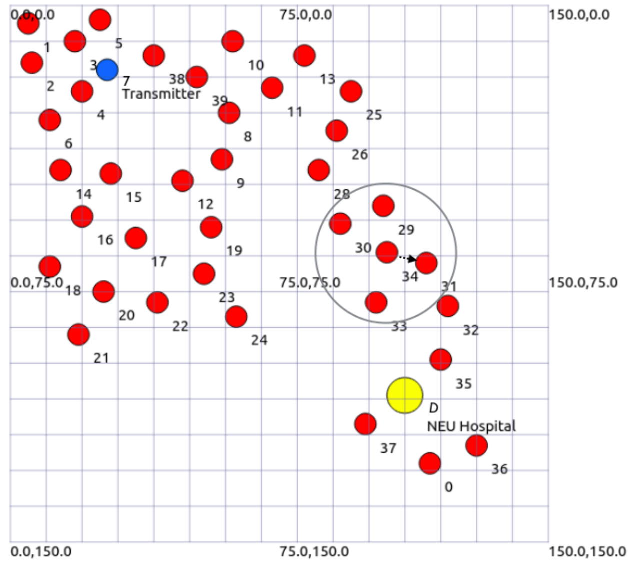
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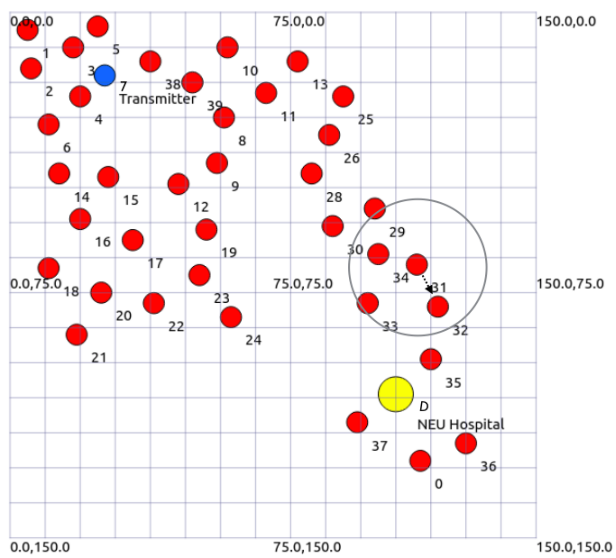
-12-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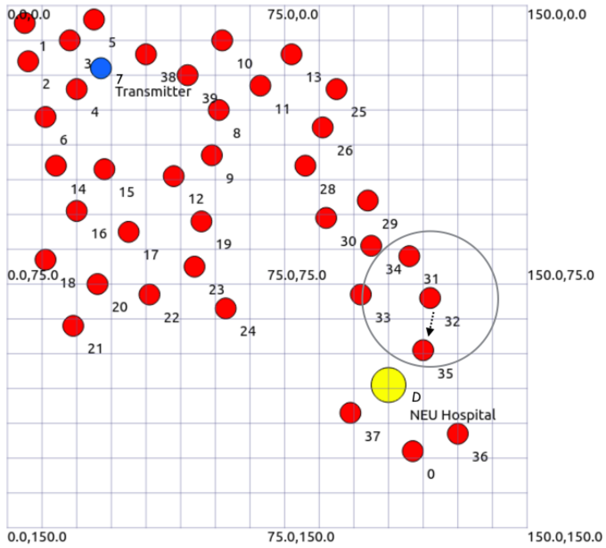
-13-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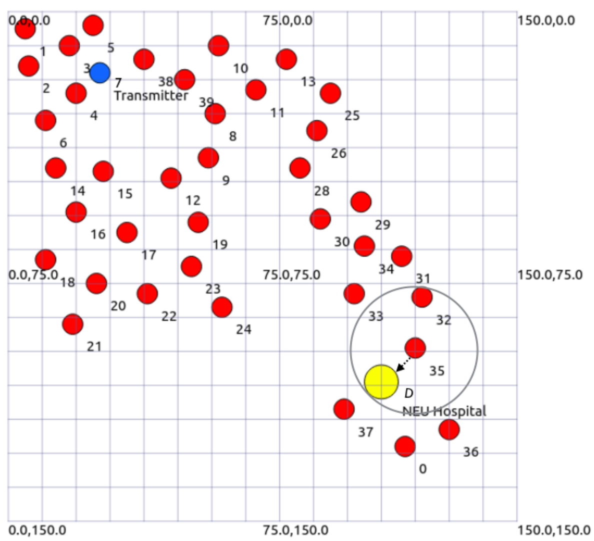
-14-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