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Device to Device Communication Using Radio Frequency During Disaster Situation

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ABSTRACT

Device-to-Device (D2D) communication is the key technologies that can help to solve the bandwidth unavailability problem of cellular networks. The system first adopts multi-hop D2D relays for routing protocol which achieves success delivery probability. This result shows technology to maintain the necessary communication between user device in case of disaster. The communication during a disaster time period is sustained by implementing a three-tier fortification of the overall network architecture. The basic strategy is adopted before any critical event occurs to make communication system more reliable and scalable. The network architecture strategy for quick service would minimize the physical redundancy and logical redundancy.

Keywords : GSM, Cellular Network, Device-to-Device

I. INTRODUCTION

The main objective of this work is to create the communication setup to manage the connection between multiple devices and to establish the seamless connectivity using the device to device communication during the disaster situation. A Wireless technology is used to do the communication between devices using radio frequency. Wireless means transmitting signals using radio waves as the medium instead of using wires as a medium. A communication network is a cellular network. The network which is distributed over land areas called as cells. The each cell is served by at least one fixed-location transceiver. It provides network coverage to the base station.

Device to Device communication in cellular networks is defined as direct communication between two mobile users. Device to Device communication is generally non-transparent to the cellular network and it can even occur on the cellular frequencies. Qualcomm's FlashLinQ [1] was the first endeavour towards the implementation of device to device (D2D) communication in cellular networks. Fig 1.1 depicts the device to device communication.

The system is to get communication during the natural disaster. As communication resources are often entirely or partially damaged by disasters, the demand for information and communication technology services explosively increases just after the events. D2D communication is a new technology in cellular networks. It allows User Equipment (UE) in close distance to communicate using a direct link through the core network.

Fig. 1.1 Device-to-Device Communication

II. RELATED WORK

Pimmy Gandotra et al.[2] (2017) discussed about "Sector-Based Radio Resource Allocation (SBRRA) Algorithm for Better Quality of Service and Experience in Device-to-Device (D2D) Communication" where they use a competent technology of the fifth-generation networks (5G) for efficiently supporting proximity-based applications is Device-to-Device (D2D) communication, underlying cellular networks. Significant advances have been made till date, for allocating resources to D2D users in cellular networks, such that sharing of spectral resources between cellular and D2D users is carried out in a coordinated manner. A sector-based radio resource allocation (SBRRA) algorithm for resource block allocation to D2D pairs has been proposed, where the number of resource blocks (RBs) is allocated to each D2D pair in an adaptive manner, based on the demanded application by each pair. Different applications demand a varying number of RBs, in accordance with their priority. This algorithm focusses on the use of sectored antennas at the base station, for a better performance and low complexity.

Ramy Amer et al.[3] (2018) explains about "On Minimizing Energy Consumption for D2D Clustered Caching Networks " where they solve the energy minimization problem for a clustered device-to-device (D2D) network with cache-enabled mobile devices. Devices are distributed according to a Poisson cluster process (PCP) and are assumed to have a surplus memory which is exploited to proactively cache files from a library. Devices can retrieve the requested files from their caches, from neighboring devices in their proximity (cluster), or from the base station as a last resort. We minimize the energy consumption of the proposed network under a random probabilistic caching scheme, where files are independently cached according to a specific probability distribution.

Shixiang Shao et al.[4] (2013) discussed about "Radio resource allocation based on greedy algorithm and successive interference cancellation in Device-to-Device (D2D) communication " where they use a greedy algorithm for resource allocation in device to device communication.

Emna et al.[5] (2016) explains about "Enhanced Traffic Offloading with D2D Communications Under Noise Rise Constraint"they use a noise rise parameter which takes into account the cellular link distance, the D2D link distance as well as user's transmit power and his required throughput.

Wei Cao et al.[6] (2017) discussed about "Cellular Offloading in Heterogeneous Mobile Networks With D2D Communication Assistance" they propose a device-to-device (D2D) communication assisted mobile traffic offloading (DATO) scheme, with focus on massive connections for machine type communications (MTC). DATO determines access mode for user equipments (UEs) to offload UEs from macro base stations (MBSs) to small base stations via D2D communications to improve the overall network capacity and mitigate the traffic congestion at MBSs.

Ullah, S et al.[7] (2017) explains about "On Delay Minimization of Layered Video Streaming in ICN Enabled Cellular Networks with D2D Communication" they propose a novel scheme based on matching theory for D2D link establishment in order to reduce the download delay for the H.264/SVC encoded layered video in ICN enabled cellular network.

Najam ul Hasan et al.[8] (20) discussed about "Self-Organized Energy Efficient Channel Assignment for

Cognitive D2D Communication in 5G Networks" they propose a methodto solve an energy efficient channel assignment problem for a D2D network taking into account both the intra and inter link interference for D2D communication. Then, proposed a fully distributed game theory based solution to solve this problem, keeping in view the scalability and self-organization concerns of D2D communication.

III. SYSTEM MODEL

A communication network is a cellular network .The network is distributed over land areas called cells. The each cell is served by at least one fixed-location transceiver. It provides network coverage to the base station.

Cellular networks feature:

- More capacity than a single large transmitter.
- The multiple links can be used for same frequency
- Compared to single transmitter the mobile device uses less power.

When mobile network is on it first search for the network .The network then reaches the cellular tower .There are two types of network they are home network and foreign network . Home network means if a person uses airtel network is called home network and other networks are called foreign network.

Each SIM card have a IMSI which consist of mobile number that are stored in database. Subscription is nothing but a balance which means if a caller wants to make a call they should have enough balance to make an incoming or outgoing call to callee .If the SIM card is not used for 6 months then it is invalid SIM. There are two frequency set they are uplink and downlink. Uplink and downlink are two way communications.

The user types the number (input) and dial to that number then that dialled number goes to the call interference. Then its connect to the base station .It check the activation stage whether the search correspond to the tower it's called routing network or network discovery.

Data transmit through the sender and receiver here the sender work speak to the receiver this also known as encoding or decoding. The communication is done with the uplink and downlink. In this the sender first sends the message to the first receiver then that first receiver send the same message without responding to the second receiver the same procedure is done till its reaches the destination. The message reaches the broad cast and then it reply to the sender from last .the respond message first send to the second receiver to the first receiver then its send the respond message to the sender this is called data transmission through the demodulation or modulation. Fig 3.1 shows the D2D communication system model and fig 3.2 shows the system work flow diagram.

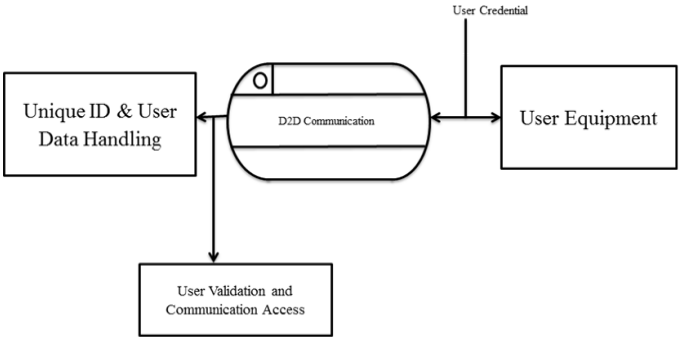

Fig 3.1: D2D communication system model

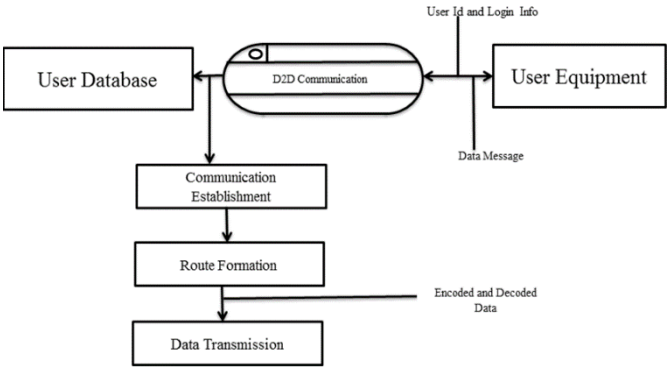

Fig 3.2 Work flow diagram

GSM:

GSM was developed by European telecommunications standard Institute. It is the second generation digital cellular networks and it is used by wireless phones. The GSM standard was developed to replace the analog cellular network (first generation)

GSM have capabilities to include data communication and then the packet data transport via GPRS. GSM developed third generation and fourth generation.

The radio network consists of a large number of BTSs. Each BTS is given an identity. These BTSs are grouped according to location area, also given an identity. Each MSC or VLR serves the BTSs in a number of location areas. The VLR always knows in which location area the GSM subscriber is located in at any given moment. A call request for a GSM subscriber is sent from a mobile phone through the radio path and the base station network .then it collects authentication from MSC or VLR. Then a huge amount of data is transferred. Next, the MSC or VLR request HLR it is the actual location of GSM and the call is established.

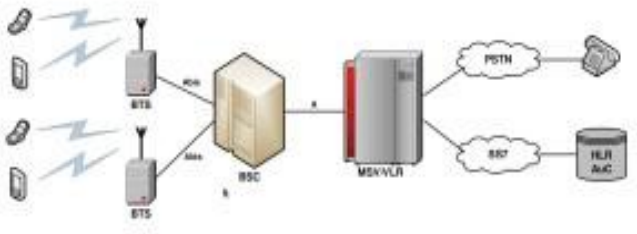

Fig 1.4: GSM Network

Roaming and Accounting

The GSM has defined standard format on calling or billing data.it shall be transferred between the operators. The entire operator shares the data to all or transfer. Data cleaning houses Key attributes include:

- Largest actors: MACH, Roameo, EDS
- data float between operator

Responsibilities are not changed between the operators.

IV. SYSTEM IMPLEMENTATION

The system has the following four modules

1.Providing Unique ID and Device Registration
2.Radio Interface reconfiguration and Establishing Communication
3.Data Transmission Request and Routing Process
4.Data Encoding, Data Transmission and Data Retrieval
5. Sending and receiving voice messages.

1. Providing Unique ID and Device Registration

The communication setup is initiated with the uniform identity provision to the each user .For each user the login credential such as login name and password are maintained in the database. Once the user is registered, the unique identification number is provided to each user upon successful login process. Fig 4.1 shows the registration page for D2D communication.

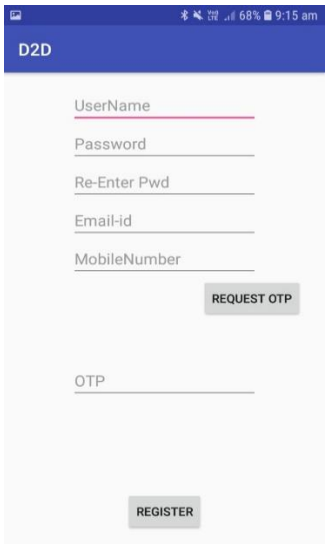

Fig 4.1: Registration

2. Radio Interface reconfiguration and Establishing Communication

In order to establish the communication using the Device to Device methodology, the operating environment is reconfigured in the form of wifi access point is shown in fig 4.2.fig 4.3. The communication can be the form of frequency based communication. This will allocates the uplink and downlink frequency.

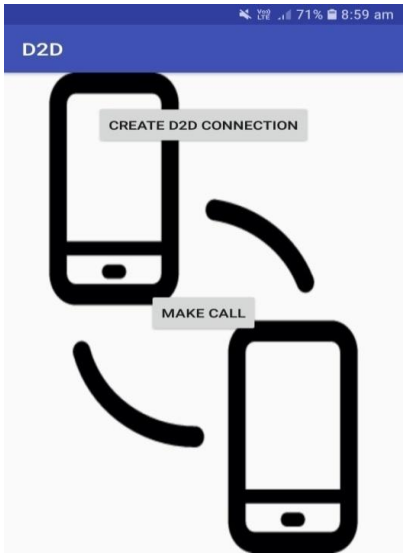

Fig 4.2 : Creating D2D connection

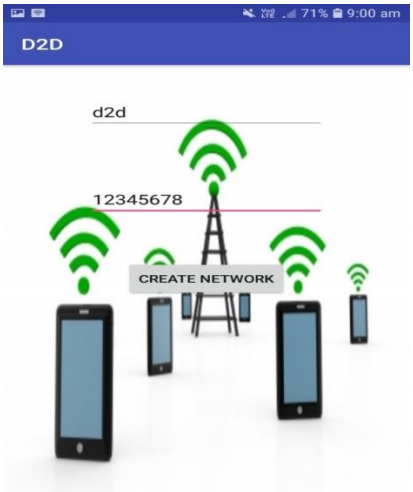

Fig 4.3 : Create network

3. Data Transmission Request and Routing Process

The connection between two or more devices are established using the ad-hoc communication model. Ad-hoc is a communication mode that allows devices to directly communicate with each other. If the sender and the receiver both present in neighborhood range then the communication is established directly. If not present in communication range then the devices establishes the multihop route using the route discovery process.

4. Data Encoding, Data Transmission and Data Retrieval

Upon completion of successful route formation, the data transmission is initiated using the established multihop route. The user interface for transmitter and the receiver both are connected in the application layer level. During the data transmission the data is encoded and transmitted using the wireless medium. The intermediate forwarder devices relays the packet to the intended destination using the established path. Once the data is received by the destination then the message is transmitted in the application level is shown in fig 4.5.

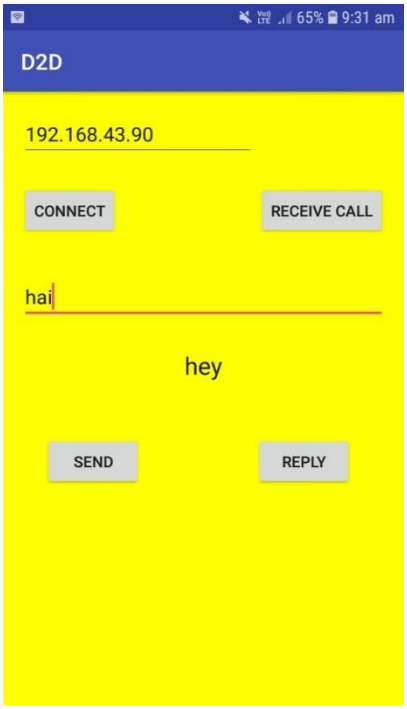

Fig 4.5 : Sending and receiving messages

V. CONCLUSION & FUTURE WORK

D2D Communication solve the communication problem during disaster. With help of this D2D, we

can call to a particular person to inform about our situation .Thus D2D helps us to communicate easily during disaster. The network architecture strategy for quick service would minimize the physical redundancy and logical redundancy. The proposed system can connect the device within the radio frequency of the particular device. The Future work can be extended to connect the devices within the city or state.

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