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A Real Time Data Sharing over Bluetooth

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ABSTRACT: Smartphones and connectivity on the go have become an fundamental part of our life. There is lack of availability of a convenient system to share data in real time without Internet connection for conducting short and effective presentations without additional infrastructure setup. The Implemented system provides a solution by allowing the smartphone devices to be used as a network of data screens over Bluetooth. Bluetooth is widely used wireless technology. Bluetooth can be used to form networks called piconet and scatternet using which we can share data over that network. This system will be a convenient and handy alternative to bulky projectors and costly portable mini projectors for real time data sharing and conducting presentations in various environments. [7]

KEYWORDS: real time, data, sharing, Bluetooth piconet, scatternet, portable, presentation, tool.

I. INTRODUCTION

Here is a problem that almost everyone face, whenever you want to convey your idea or present it with an effective presentation you may have to struggle to get the projector ready that consumes time also you may face technical inconvenience or instead you just try to express your idea by getting the audience to imagine what you say. It may also happen that you are at place where you don't have appropriate medium to give a presentation. The idea for this project arrived from these inconvenience and unavailability of a system that will enable mobile users to present their ideas and work to a group of people by giving presentation without actually requiring a projector and a huge screen or a separate infrastructure environment setup like presentation room. The immediate solution that one could think of was, using audience's smartphones as a wireless network of screens for viewing the data in real time.

Wireless Technology has improved our life to a great extent. The underlying technology one could use for achieving this was either by Wi-Fi or Bluetooth. Wi-Fi consumes more power as compared to Bluetooth. Bluetooth is the most commonly used wireless technology. It is a wireless technology standard for exchanging data over short distances from fixed and mobile devices and building personal area networks (PANs) [1]. Bluetooth consumes low power as compared to Wi-Fi. This paper introduces a concept of system that would enable to share data in real time over Bluetooth. The main intention of this paper is to succinctly review and summarize recent progress in Bluetooth ad-hoc network formation techniques, Bluetooth piconet formation techniques and algorithms along with discussing how Bluetooth can be used for real time data sharing. [7]

II. BACKGROUND AND RELATED WORK

[7]Bluetooth® technology is a wireless communications technology that is simple, secure, and omnipresent. There are billions of devices having Bluetooth, primarily every smartphone. Bluetooth technology is ubiquitous, consumes low power and is low cost; every smartphones have Bluetooth. Range of Bluetooth devices is application specific. Range may vary depending on class of radio used in an implementation [1]:

- Class 3 radios – have a range of up to 1 meter or 3 feet[1]
- Class 2 radios – most commonly found in mobile devices – have a range of 10 meters or 33 feet[1]
- Class 1 radios – used primarily in industrial use cases – have a range of 100 meters or 300 feet [1].

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The most commonly used radio is Class 2 and uses 2.5 mW of power [1]. Connections between Bluetooth enabled electronic devices allow these devices to communicate wirelessly through short-range, ad hoc networks [1] known as piconets [1].

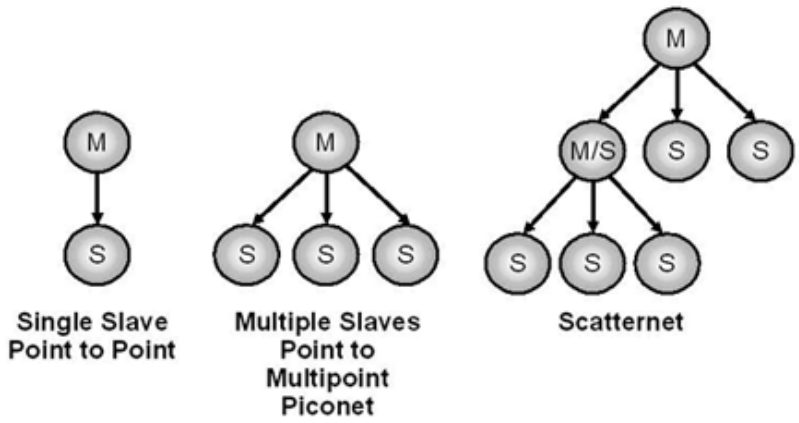

Fig 1: Bluetooth network connections [2]

The piconet is a network of 8 devices consisting of 1 master device and 7 other devices called slaves. The interconnection of piconets is called as scatternet. In figure 1, nodes with M indicate a master and node with S indicate a slave. The bridge between piconets can either be an M or S. Each device in a piconet can also simultaneously communicate with up to seven other devices within that single piconet and each device can also belong to several piconets simultaneously. This means the ways in which you can connect your Bluetooth devices is almost limitless [1].

Hiranmayi Sreenivas and Hesham Ali [3] introduced a Bluetooth scatternet formation protocol that uses a genetic algorithm to calculate and find the best, or "fittest", combination of masters, slaves and bridges in a given Bluetooth network. They have developed and simulated a scatternet formation algorithm that produces scatternets with certain desirable characteristics like minimal delay to the end-users during scatternet formation, minimal number of piconets in order to reduce inter-piconet interference during communication and bounded number of slaves to minimize the overhead associated with slave parking and unparking operations in a given Bluetooth network.

Suhela Madummathodi,and Kasim K [4] created a Mobile ad-hoc network (MANET) using already paired Bluetooth devices. The system is continuously learning. Initially all the devices in the paired lists will be checked for a successful transmission. The paths through which successful transfer takes place are recorded. These paths are tried first for transferring data for the same destinations. If no such device in existing path exists then a message is displayed "unable to connect". Since the intermediate devices are selected from the list of paired devices the security of the system can also be assured.

In [5] a comparative performance of three scatternet formation protocol is studied. The work consists of performance comparison and evaluation among three solutions for forming multi-hop networks of Bluetooth (scatternet formation). The three protocols considered in this paper are BlueTrees, BlueStars and the"New Protocol". From their study the BlueStars is fastest protocol for scatternet formation but have performance trade off and where the "New Protocol" is better option for stable network of piconets.

Ms Prerna Hingle and Ms Shubhangi Giripunje [6] performed a real time communication between two platforms through Bluetooth. A server and a client are formed where the server is in Dot-Net platform and the clients are in the JAVA platform and Dot Net Platform.[7]

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III. IMPLEMENTED SYSTEM

To resolve the problem of unavailability of projector instantly and avoid the required setup time we propose a new approach, 'Real Time Data Sharing over Bluetooth'. This system will emphasis on sharing of images in real time with less power consumption. The system is developed for particularly Android OS devices and having Bluetooth support. The presenter will initiate the system. The system will browse and take input as a image file; it will load each image into image buffer . Loading of images into a buffer will help to transfer the data in lesser amount of time. The piconet protocol is running in the background, if the new user request to join, it will connect to the piconet. Formation of piconet leads to the broadcasting of current image file to all the connected devices. Thus, the image will be received by the entire audience devices in the network.

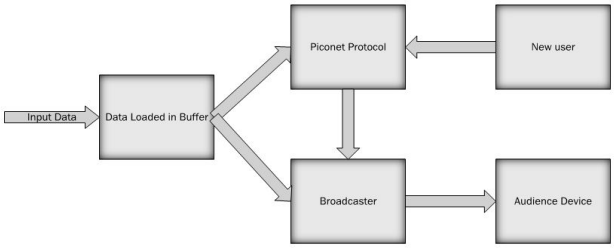

Fig.2. System Block Diagram

A. Steps of implemented system:

1. As shown in Fig 3, Presenter starts the server socket and waits for new node to join. The Server Socket is running in the background and has to be manually invoked to accept new connection.
2. On request from new node it initiates the connection and generate a Bluetooth Socket, which will be used to transfer data.
3. Every new connection is added as a separate thread object in thread pool to be able to transmit data on an event.

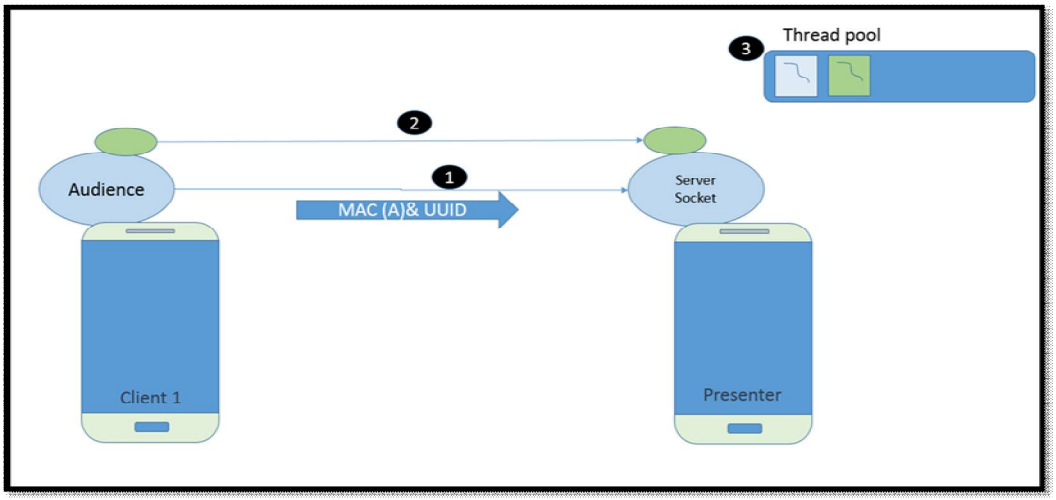

Fig 3: Sequence for socket initiation for a node.

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4. As shown in Fig 4, New Node enters the piconet by requesting connection to ServerSocket thread, for this the server socket should be manually invoked to accept connectins. A unique UUID is required for new node to initiate connection.

5. If the connection is successful the Server Socket returns a socket which handles future data transfer. Similarly any new node can be added in the piconet.

NOTE: the piconet size is limited to 8 nodes(including presenter) because the MAC header in packet header consist of 3 bit 'Ie 000-111' MAC addresses.

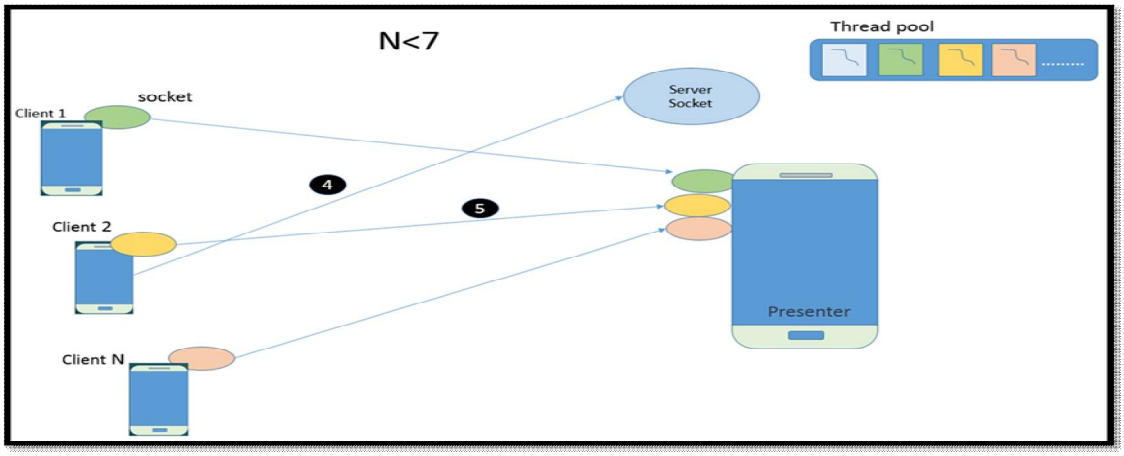

Fig 4: Piconet Formation

6. As shown in fig 5,After all the nodes in the audience are connected to piconet the presenter can start with data transfer.

7. On every pass of data the presenter iterates to all the nodes socket and transmits the data(in this case slide) to nodes sequentially.

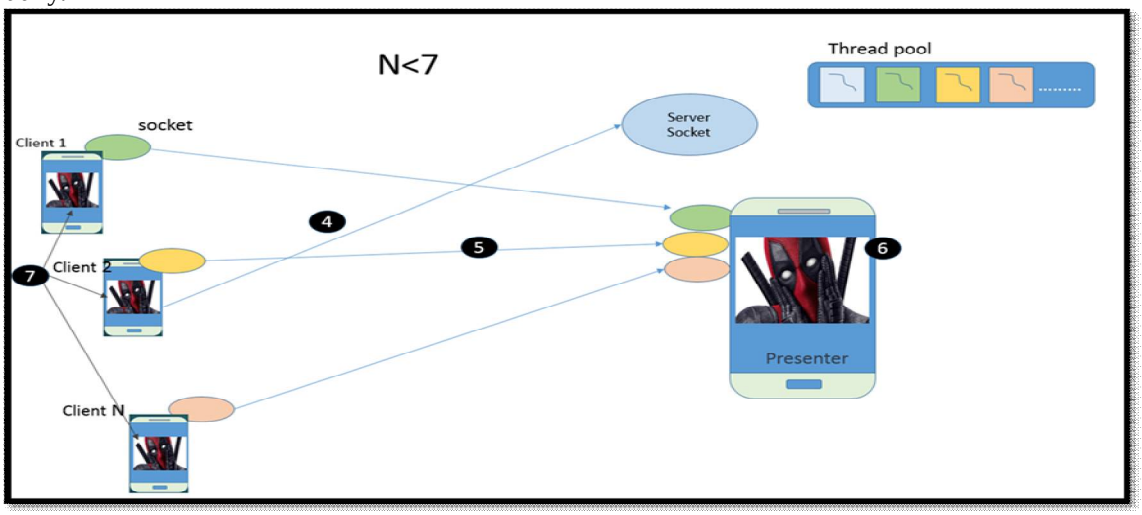

Fig 5 : Execution of output

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B. Algorithms

The following algorithm is used to establish multiple connections and pass each connection as a thread in thread pool

Algorithm 1: Accepting Multiple connections

```
public class Accept implements Runnable {
    private BluetoothAdapter adapter;
    private BluetoothSocket socket;


    @Override
    public void run() {

            Log.d("DEBUG", "Listening with uuid: " + PresenterActivity.uuids[iterator].toString());
            BluetoothServerSocket serverSocket =
        adapter.listenUsingRfcommWithServiceRecord(Integer.toString(iterator),
        PresenterActivity.uuids[iterator]);
            Log.d("DEBUG", "Accepting...");
            socket = serverSocket.accept();
            Log.d("DEBUG", "Connected. Closing server socket.");
            serverSocket.close();

            //TODO: (Accept) Pass the socket to another thread for read/write management.
            Manage thread = new Manage(socket);
            manageThreads.add(thread);
            executor.execute(thread);
        }
}
```

Fig 6 : Algorithm for accepting multiple connection

The below logic iterates to all the socket thread objects and sequentially transmits the data.

Algorithm 2: Send data to multiple sockets

```
ArrayList<Manage> manageThreads = new ArrayList<Manage>();
```

```
for (Manage manageThread : manageThreads) {
                    if (manageThread != null) {

                        Log.d("DEBUG","INSIDE send");
                        bm = BitmapFactory.decodeResource(m.getResources(),R.drawable.arrow);
                        if(bm != null)
                        Log.d("DEBUG" , bm.toString());

                        bos = new ByteArrayOutputStream();
                        bm.compress(Bitmap.CompressFormat.PNG,40,bos);
                        buffer = bos.toByteArray();
//                          String message = "It worked.";

                        manageThread.write(buffer);
                        test = true;
                    }
                }
```

Fig 7 Algorithm for sending data to multiple sockets

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IV. RESULTS AND ANALYSIS

The following are the screenshots of the results of this project.

A. Presenter Screen

Step 1: As shown in Fig 8, Click Presenter Button to start Presenter activity.
Step 2:As shown in Fig 9, Click Set visible button to enable the Bluetooth.
Step 3: Start Server to enable the socket connection between the devices.
Step 4: On clicking the Send button the image would get transfer from presenter to audience screen.

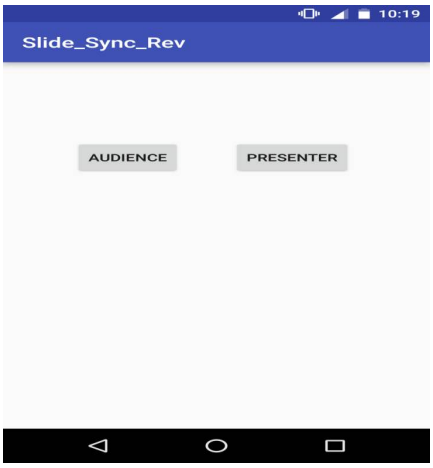

Fig 8: Presenter's Screen

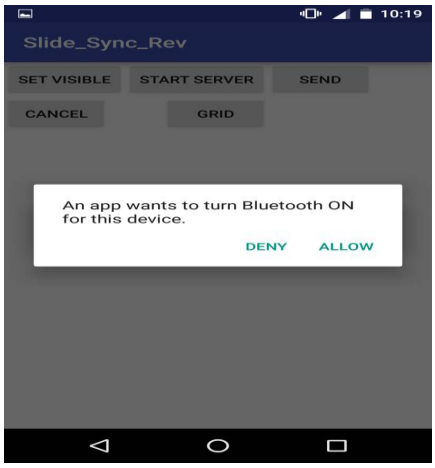

Fig 9: Checking Bluetooth Visiblity at presenter side

B. Audience Screen

Step 1: Click Audience Button to start Audience activity
Step 2: As shown in Fig 10, by clicking on Scan button we scan the devices in the network.fig 11 shows Bluetooth visibility checking.
Step 3: As shown in Fig 12, Click on Stop to get the list of devices.
Step 4: Select on the presenter device name to receive the image.

As shown in Fig 13, audience device receive the image in real time

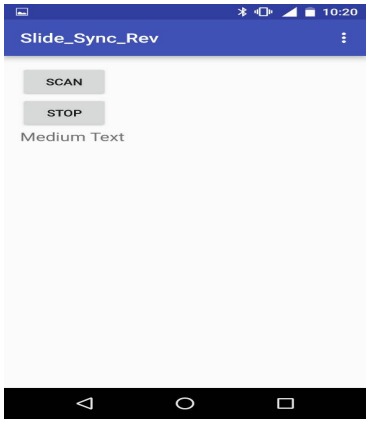

Fig 10: Audience's Screen

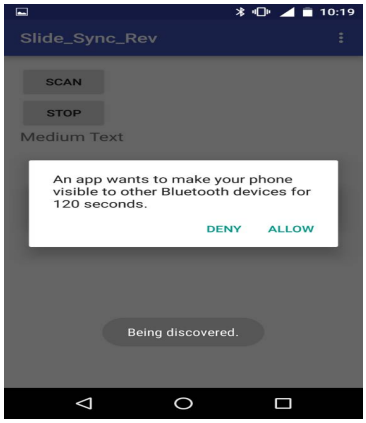

Fig 11 : Checking Bluetooth Visibility at audience side

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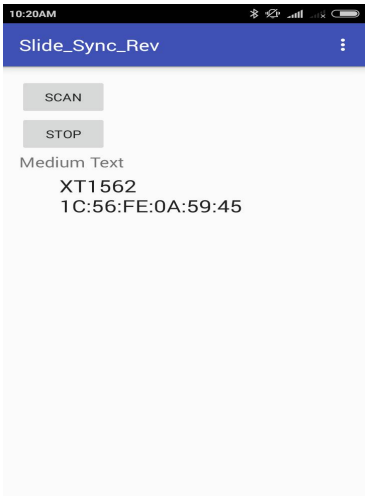

Fig 12: Bluetooth Discoverable Device

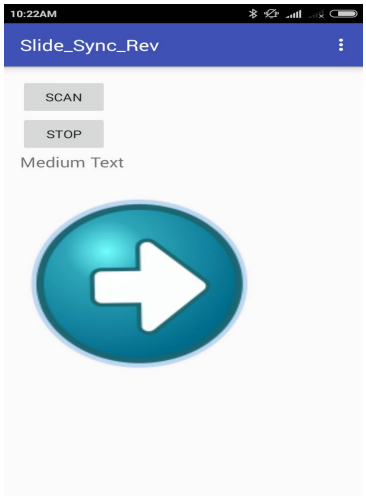

Fig 13: Display of image in real time

V. CONCLUSION AND FUTURE WORK

The implemented system of sharing data over Bluetooth is a novel solution in the scenario where immediate and real time data are needed in meetings, class presentations, practical laboratories, etc. This work can be extended to carry out the slide sharing objective by creating a self-sufficient on demand routing protocol. It can be used to develop applications which require transmitting small data like state change information, even in multiplayer games in android devices.

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