Experiment 05: To implement a Bluetooth network

PART A

A.1 Aim: **To implement a Bluetooth network with application as transfer of a file from one device to another.**

A.2 Objectives: To understand the security algorithms in mobile networks

A.3 Outcome: Students will be able to articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.(LO-2)

A.4 Theory:

Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using UHF radio waves in the industrial, scientific and medical radio bands, from 2.402 GHz to 2.480 GHz, and building personal area networks (PANs). It was originally conceived as a wireless alternative to RS-232datacables.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 35,000member companies in the areas of telecommunication, computing, networking, and consumer electronics. The IEEE standardized Bluetooth as IEEE802.15.1,but no longer maintains the standard. The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks. A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device.

Transfer of words between two phones using Bluetooth is done below.

A.5Code: **Main_Activity.java:**https://github.c**m/vinaynpp/mcc** **package com.example.bluetooth_communication;importandroid.app.Dialog;**

importandroid.bluetooth.BluetoothA
dapter;importandroid.content.Intent;
importandroid.content.pm.PackageMa
nager;import

```
android.content.pm.ResolveInfo;impor tandroid.net.Uri;
            importandroid.os.Environment; import
   androidx.appcompat.app.AppCompatActivity;i
               mportandroid.os.Bundle;
           import
                             android.view.Menu;impor
 tandroid.view.MenuItem;i
 mportandroid.view.View; import
 android.widget.AdapterView;i
mportandroid.widget.ArrayAda
pter;importandroid.widget.Butt
on;import
                         android.widget.EditText;import
     android.widget.ListVie
```

```
importandroid.widget.TextView;i
    mportandroid.widget.Toast;

 importjava.io.File;import
java.util.ArrayList;importj
ava.util.List;

                                    publicclassMainActivityextendsAppCompatActivity{
                              ------------------------------------//CreateObjects-----
   ButtonbuttonopenDailog,buttonUp,send;Te
   xtViewtextFolder;
                                                   EditTextdataPath;
    staticfinalintCUSTOM_DIALOG_ID=0;ListVie
                    wdialog_ListView;
                                               Fileroot,fileroot,curFolder;
   privateList<String>fileList=newArrayList<String>();priva
              te static final int DISCOVER_DURATION =
            300;privatestaticfinal intREQUEST_BLU =1;
                              BluetoothAdapterbtAdatper=BluetoothAdapter.getDefaultAdapter();
   //@Overri de protected void onCreate(Bundle
          savedInstanceState)
    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -


       { super.onCreate(savedInstanceState);setContentView(R.layout.activity
       _main);dataPath=(EditText)findViewById(R.id.FilePath);buttonopenDa
                                           ilog= (Button)
      findViewById(R.id.opendailog);send=(Button)findViewById(R.id.sendB
       tooth);buttonopenDailog.setOnClickListener(newView.OnClickListener
                                                         (){
                                                     @Override
                     public void onClick(View v)
              {dataPath.setText("");showDialog(CUSTO
                                 M_DIALOG_ID);
           }

       });


       root=newFile(Environment.getExternalStorageDirectory().getAbsolutePath());cur
                                                      Folder= root;
       send.setOnClickListener(newView.OnClickListener(){@O
                                        verride
      publicvoidonClick(Viewv){sen
               dViaBluetooth();
      }

   });

}
                                              @Override
protectedDialogonCreateDialog(intid){Dia
                logdialog = null;
                                                  switch(id) { caseCUSTOM_DIALOG_ID:
                           dialog = new
        Dialog(MainActivity.this);dialog.setContentView
           (R.layout.dailoglayout);dialog.setTitle("File
         Selector");dialog.setCancelable(true);dialog.set
                 CanceledOnTouchOutside(true); textFolder
                             = (TextView)
             dialog.findViewById(R.id.folder);buttonUp = (Button)
         dialog.findViewById(R.id.up);buttonUp.setOnClickListener(ne
         wView.OnClickListener(){
                                              @Override
                 public void onClick(View v)
              {ListDir(curFolder.getParentFile());
           }

         });


                                     dialog_ListView = (ListView)
     dialog.findViewById(R.id.dialoglist);dialog_ListView.setOnItemClickListener(newAdapt
                                    erView.OnItemClickListener(){
                                              @Override
                         publicvoidonItemClick(AdapterView<?>parent, Viewview,int
                          position,longid){Fileselected =newFile(fileList.get(position));
              if(selected.isDirectory()){Li
                      stDir(selected);
              }elseif(selected.isFile()){get
                  selectedFile(selected);
                                                 }else {
                                           dismissDialog(CUSTOM_DIALOG_ID);
              }
```

```
                  }

                });


                                              break;
            }

                                           returndialog;
          }



                                            @Override
          protectedvoidonPrepareDialog(intid,Dialogdialog){supe
                    r.onPrepareDialog(id,dialog);
                                               switch(id) { caseCUSTOM_DIALOG_ID:
               ListDir(curFolder);
                   break;
            }
```

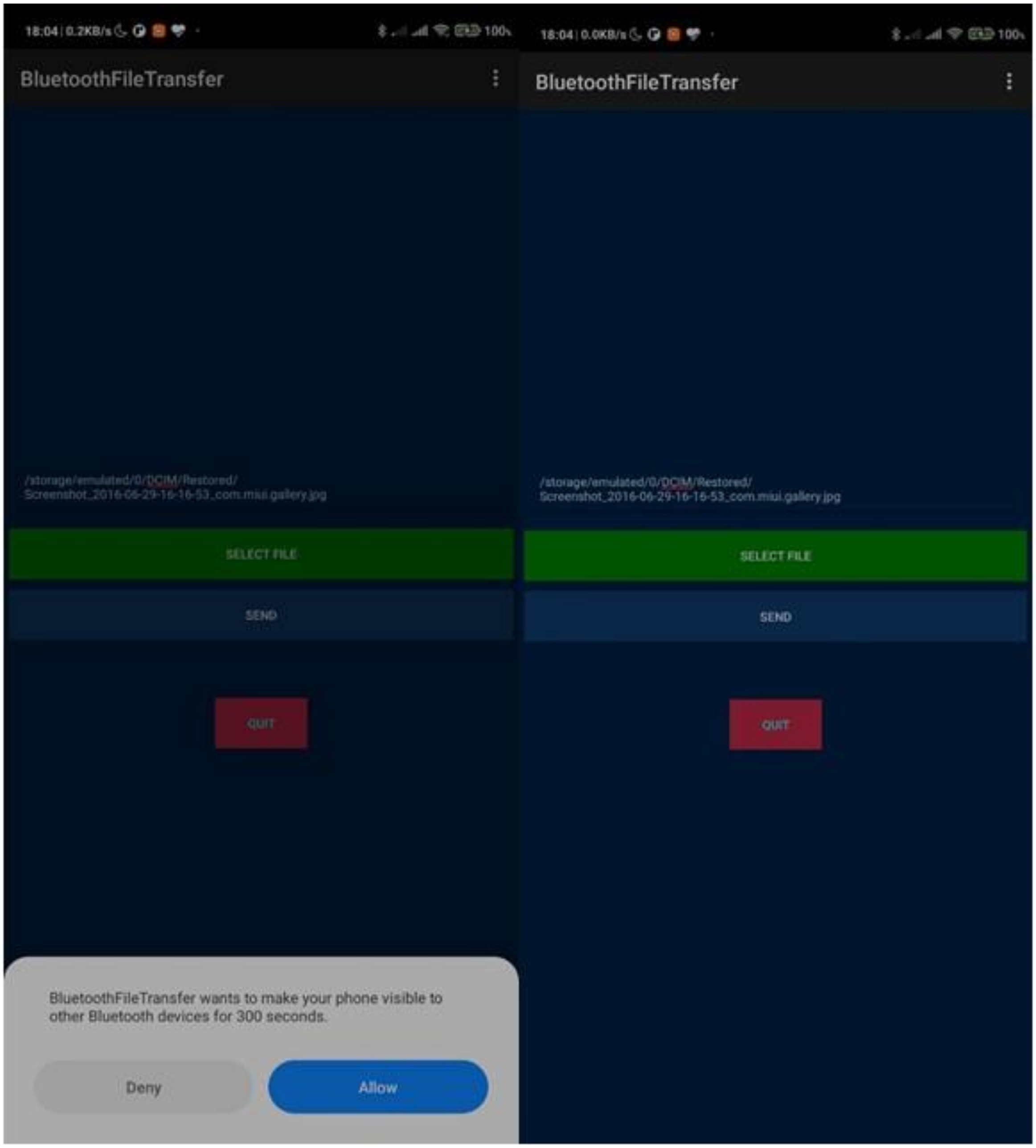
```
        }

                public void getselectedFile(File
        f){dataPath.setText(f.getAbsolutePath());fileLi
        st.clear();dismissDialog(CUSTOM_DIALOG_ID);
      }



      publicvoidListDir(Filef){if(f.
                equals(root)){
                                        buttonUp.setEnabled(false);
                                                    }else { buttonUp.setEnabled(true);
        }

                     curFolder =
        f;textFolder.setText(f.getAbsolutePath());
        dataPath.setText(f.getAbsolutePath());Fi
          le[]files=f.listFiles();fileList.clear();

                   for (File file : files)
                 {fileList.add(file.getPath());
        }

        ArrayAdapter<String>directoryList=newArrayAdapter<String>(this,andr
                     oid.R.layout.simple_list_item_1,fileList); dialog_ListView.setAdapter(directoryList);
      }


                       - - - - - - - - - - - - - - -//exittoapplication- - - - - - - - - - - - - - - - - - -
       public void exit(View V)
         {btAdatper.disable();
                                Toast.makeText(this,"***NowBluetoothisoff...Thanks.
     ***",Toast.LENGTH_LONG).show();finish();}

          //Method for send file via bluetoothpublicvoid
                                         --------------------------------------------------------------------

                sendViaBluetooth(){
        if(!dataPath.equals(null)){i
          f(btAdatper ==null) {
                  Toast.makeText(this,"Devicenotsupport bluetooth",Toast.LENGTH_LONG).show();
                                                    }else { enableBluetooth();
        }
       }else{
```

```
                         Toast.makeText(this,"Pleaseselectafile.",Toast.LENGTH_LONG).show();
           }

        }



        publicvoidenableBluetooth(){In
            tentdiscoveryIntent=new
      Intent(BluetoothAdapter.ACTION_REQUEST_DISCOVERABLE);discoveryIntent.putExtra(BluetoothAdapt
                                         er.EXTRA_DISCOVERABLE_DURATION,
                                            DISCOVER_DURATION);
                              startActivityForResult(discoveryIntent,REQUEST_BLU);
        }


                       //Overridemethodforsendingdataviabluetoothavailability--------------------------
                                                   @Override
                        protectedvoidonActivityResult(intrequestCode,intresultCode,Intentdata){ if
                 (resultCode == DISCOVER_DURATION && requestCode == REQUEST_BLU) {Intenti
                                                  =newIntent();
                 i. setAction(Intent.ACTION_SEND);i.s
                 etType("*/*");
                                   File file = new

                 File(dataPath.getText().toString());i.putExtra(Intent.EXTR

                             A_STREAM,Uri.fromFile(file));

                               PackageManager pm =
                 getPackageManager();List<ResolveInfo>list=pm.queryIn
                          tentActivities(i,0);if(list.size()>0){
                   StringpackageName=null;Str
                     ing className =
                     null;booleanfound=false;
                                                       for(ResolveInfo info : list) {
                                         packageName=info.activityInfo.packageName;
```

```
    if(packageName.equals("com.android.bluetooth")){cl
        a ssName=info.activityInfo.name; found=true;b
        reak;
    }

}

      //CHECKBLUETOOTHavailableornot--------------------------------------------- if(!found){
            Toast.makeText(this,"Bluetoothnotbeenfound",Toast.LENGTH_LONG).show();
                                                }else {
    i. setClassName(packageName,className);
    startActivity(i);
```

```
}
              }

                                                            }else {
                                 Toast.makeText(this,"Bluetoothiscancelled",Toast.LENGTH_LONG).show();
                }

              }



                                                          @Override
                                          publicbooleanonCreateOptionsMenu(Menumenu){
                           //Inflatethemenu; thisaddsitems totheactionbar ifitis
                       present.getMenuInflater().inflate(R.menu.menu_main,menu); returntrue;
              }


                                                          @Override
                                        publicbooleanonOptionsItemSelected(MenuItemitem){
                                           //Handleactionbar itemclickshere.Theactionbarwill
                                       //automatically handleclicks ontheHome/Up button,solong
                   //asyouspecifyaparentactivityinAndroidManifest.xml.intid = item.getItemId();

                  //noinspectionSimplifiableIfStatementif(i
                          d ==R.id.action_settings) {
                                 Toast.makeText(this, "***************\nDeveloper: Santosh Kumar
                  Singh\nContact:superssingh@gmail.com\n***************",Toast.LENGTH_LONG).show();
                                                               returntrue;
                }

                                               returnsuper.onOptionsItemSelected(item);
              }

           }
```

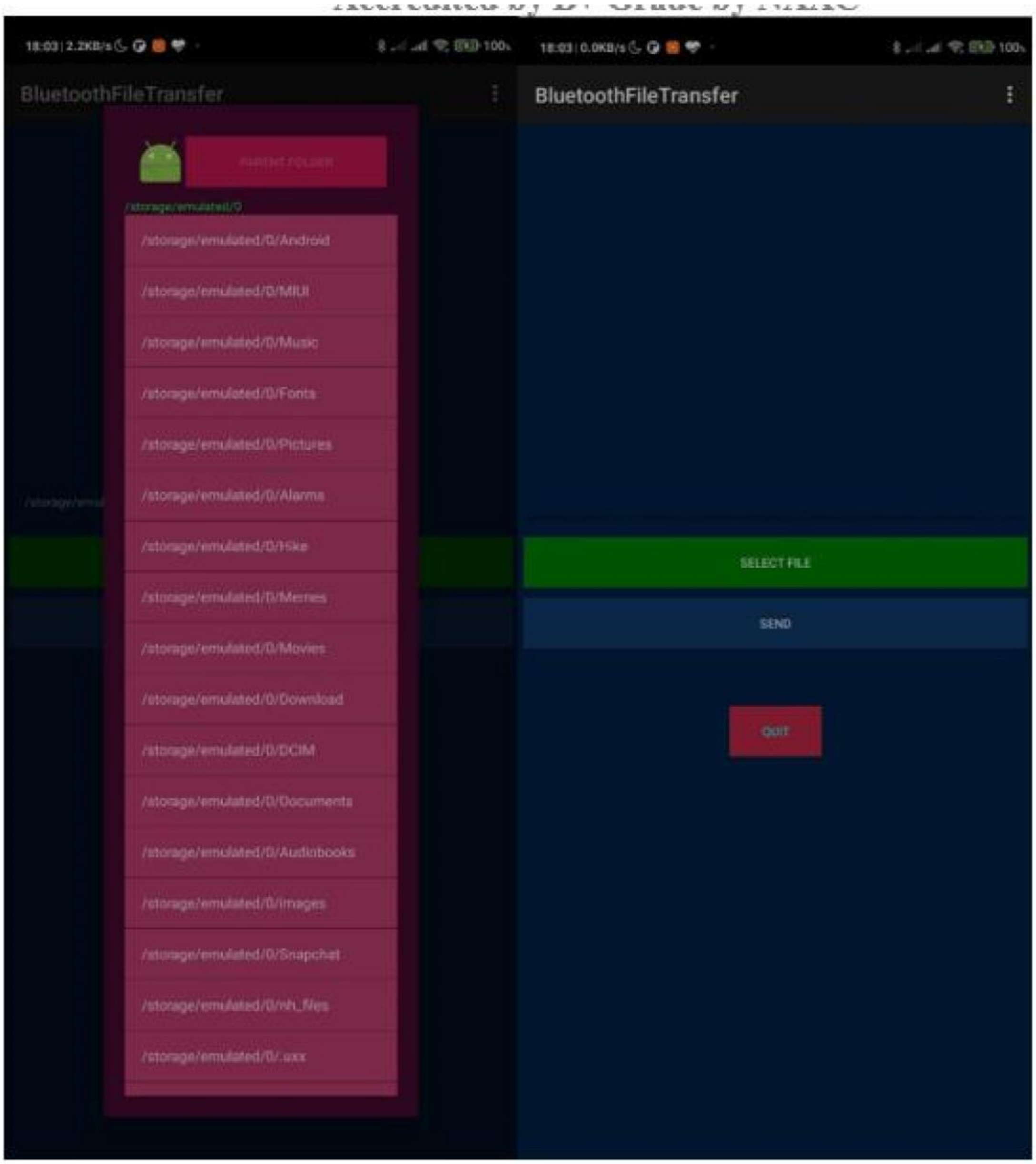
Output:



/storage/emulated/0/DCIM/Restored/
Screenshot_2016-06-29-16-16-53_com.miui.gallery.jpg

BluetoothFileTransfer wants to make your phone visible to other Bluetooth devices for 300 seconds.

/storage/emulated/0/DCIM/Restored/
Screenshot_2016-06-29-16-16-53_com.miui.gallery.jpg



/storage/emulated/0

/storage/emulated/0/Android
/storage/emulated/0/MIUI
/storage/emulated/0/Music
/storage/emulated/0/Fonts
/storage/emulated/0/Pictures
/storage/emulated/0/Alarms
/storage/emulated/0/Hike
/storage/emulated/0/Memes
/storage/emulated/0/Movies
/storage/emulated/0/Download
/storage/emulated/0/DCIM
/storage/emulated/0/Documents
/storage/emulated/0/Audiobooks
/storage/emulated/0/images
/storage/emulated/0/Snapchat
/storage/emulated/0/nh_files
/storage/emulated/0/.sxx

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no Black board access available)

Roll. No. B30	Name: Pranjal Bhatt
Class :TE COMPS B	Batch: B2
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student/steps:

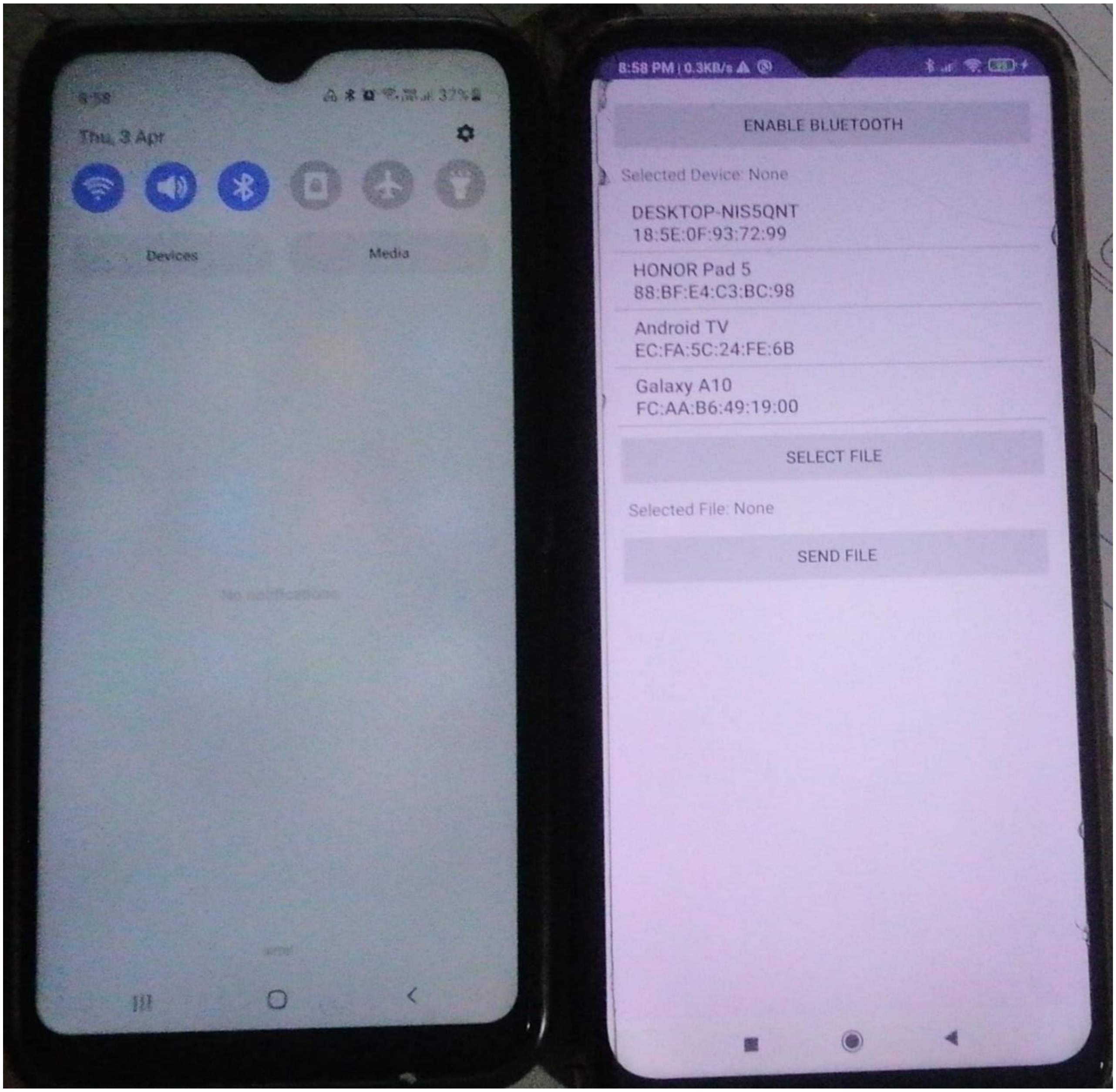
MainActivity.java:

```
package com.example.filetransferbluetooth;

import android.Manifest;
import android.annotation.SuppressLint;
import android.app.Activity;
import android.bluetooth.BluetoothAdapter;
import android.bluetooth.BluetoothDevice;
import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
import android.content.IntentFilter;
import android.net.Uri;
import android.os.Build;
import android.os.Bundle;
import android.view.View;
import android.widget.AdapterView;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.ListView;
import android.widget.TextView;
import android.widget.Toast;

import java.util.Set;

public class MainActivity extends Activity {

    private static final int REQUEST_ENABLE_BT = 1;
    private static final int REQUEST_SELECT_FILE = 2;

    private BluetoothAdapter bluetoothAdapter;
    private ArrayAdapter<String> deviceListAdapter;
    private String selectedDeviceAddress;
    private Uri selectedFileUri;

    private TextView selectedDeviceText;
    private TextView selectedFileText;
    private Button sendFileBtn;

    @SuppressLint("MissingPermission")
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        Button enableBluetoothBtn = findViewById(R.id.enableBluetoothBtn);
        selectedDeviceText = findViewById(R.id.selectedDeviceText);
        ListView devicesListView = findViewById(R.id.devicesListView);
        Button selectFileBtn = findViewById(R.id.selectFileBtn);
        selectedFileText = findViewById(R.id.selectedFileText);
        sendFileBtn = findViewById(R.id.sendFileBtn);

        bluetoothAdapter = BluetoothAdapter.getDefaultAdapter();
        deviceListAdapter = new ArrayAdapter<>(this, android.R.layout.simple_list_item_1);
        devicesListView.setAdapter(deviceListAdapter);

        // Enable Bluetooth
        enableBluetoothBtn.setOnClickListener(view -> {
          if (bluetoothAdapter == null) {
            Toast.makeText(this, "Bluetooth not supported on this device", Toast.LENGTH_SHORT).show();
            return;
          }
          if (!bluetoothAdapter.isEnabled()) {
            Intent enableBtIntent = new Intent(BluetoothAdapter.ACTION_REQUEST_ENABLE);
            startActivityForResult(enableBtIntent, REQUEST_ENABLE_BT);
          } else {
            Toast.makeText(this, "Bluetooth is already enabled", Toast.LENGTH_SHORT).show();
            listPairedDevices();
          }
        });

        // List paired Bluetooth devices
        devicesListView.setOnItemClickListener((adapterView, view, position, id) -> {
          String deviceInfo = ((TextView) view).getText().toString();
          selectedDeviceAddress = deviceInfo.substring(deviceInfo.length() - 17);
          selectedDeviceText.setText("Selected Device: " + selectedDeviceAddress);
        });

        // Select a file
        selectFileBtn.setOnClickListener(view -> {
          Intent intent = new Intent(Intent.ACTION_GET_CONTENT);
          intent.setType("*/*");
          startActivityForResult(Intent.createChooser(intent, "Select File"), REQUEST_SELECT_FILE);
        });

        // Send file
        sendFileBtn.setOnClickListener(view -> {
            if (selectedDeviceAddress == null || selectedFileUri == null) {
                Toast.makeText(this, "Please select a device and file first", Toast.LENGTH_SHORT).show();
                return;
            }
            sendFile(selectedDeviceAddress, selectedFileUri);
        });

        // Register Bluetooth discovery receiver
        IntentFilter filter = new IntentFilter(BluetoothDevice.ACTION_FOUND);
        registerReceiver(bluetoothReceiver, filter);
    }

    @SuppressLint("MissingPermission")
    private void listPairedDevices() {
        @SuppressLint("MissingPermission") Set<BluetoothDevice> pairedDevices = bluetoothAdapter.getBondedDevices();
        deviceListAdapter.clear();
        if (pairedDevices.size() > 0) {
            for (BluetoothDevice device : pairedDevices) {
                deviceListAdapter.add(device.getName() + "\n" + device.getAddress());
            }
        } else {
            deviceListAdapter.add("No paired devices found");
        }
    }

    private void sendFile(String deviceAddress, Uri fileUri) {
        Intent intent = new Intent();
        intent.setAction(Intent.ACTION_SEND);
        intent.setType("*/*");
        intent.putExtra(Intent.EXTRA_STREAM, fileUri);
        intent.setPackage("com.android.bluetooth");
        startActivity(Intent.createChooser(intent, "Send File"));
    }

    @Override
    protected void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);

        if (requestCode == REQUEST_ENABLE_BT && resultCode == RESULT_OK) {
            Toast.makeText(this, "Bluetooth enabled", Toast.LENGTH_SHORT).show();
            listPairedDevices();
        } else if (requestCode == REQUEST_SELECT_FILE && resultCode == RESULT_OK && data != null)
{
            selectedFileUri = data.getData();
            selectedFileText.setText("Selected File: " + selectedFileUri.getPath());
        }
    }

    private final BroadcastReceiver bluetoothReceiver = new BroadcastReceiver() {
        @SuppressLint("MissingPermission")
        @Override
        public void onReceive(Context context, Intent intent) {
            String action = intent.getAction();
            if (BluetoothDevice.ACTION_FOUND.equals(action)) {
                BluetoothDevice device = intent.getParcelableExtra(BluetoothDevice.EXTRA_DEVICE);
                if (device != null) {
                    deviceListAdapter.add(device.getName() + "\n" + device.getAddress());
                }
            }
        }
    };

    @Override
    protected void onDestroy() {
        super.onDestroy();
        unregisterReceiver(bluetoothReceiver);
    }
}
```

AndroidManifest.xml:

```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.filetransferbluetooth">
    <!-- Bluetooth and Storage Permissions -->
    <uses-permission android:name="android.permission.BLUETOOTH" />
    <uses-permission android:name="android.permission.BLUETOOTH_ADMIN" />
    <uses-permission android:name="android.permission.BLUETOOTH_CONNECT" />
    <uses-permission android:name="android.permission.BLUETOOTH_SCAN" />
    <uses-permission android:name="android.permission.BLUETOOTH_ADVERTISE" />
    <uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.MANAGE_EXTERNAL_STORAGE" />
    <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
    <uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION" />

    <!-- Bluetooth features -->
    <uses-feature android:name="android.hardware.bluetooth" android:required="true"/>
    <uses-feature android:name="android.hardware.bluetooth_le" android:required="false"/>

    <application
        android:allowBackup="true"
        android:theme="@style/Theme.Filetransferbluetooth">

        <activity android:name=".MainActivity"
            android:exported="true">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>

    </application>

</manifest>
```

B.2 Input and Output:



8:58 PM | 0.3KB/s

ENABLE BLUETOOTH

Selected Device: None

DESKTOP-NIS5QNT
18:5E:0F:93:72:99

HONOR Pad 5
88:BF:E4:C3:BC:98

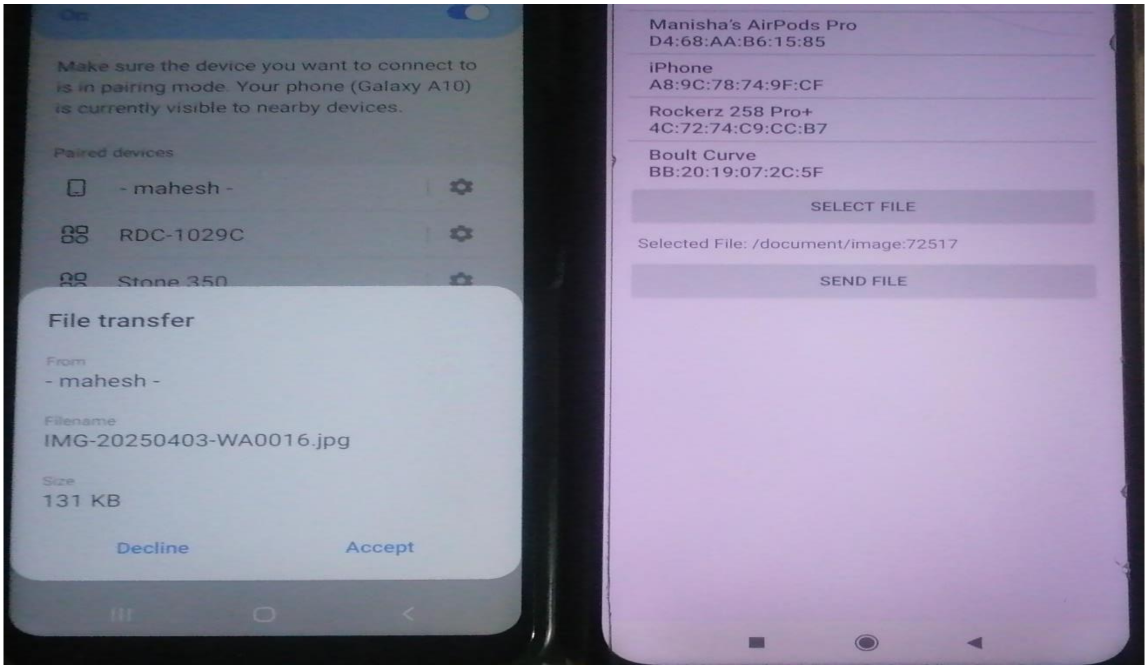
Android TV
EC:FA:5C:24:FE:6B

Galaxy A10
FC:AA:B6:49:19:00

SELECT FILE

Selected File: None

SEND FILE



On

Make sure the device you want to connect to is in pairing mode. Your phone (Galaxy A10) is currently visible to nearby devices.

Paired devices

- mahesh -

RDC-1029C

Stone 350

File transfer

From
- mahesh -

Filename
IMG-20250403-WA0016.jpg

Size
131 KB

Decline Accept

Manisha's AirPods Pro
D4:68:AA:B6:15:85

iPhone
A8:9C:78:74:9F:CF

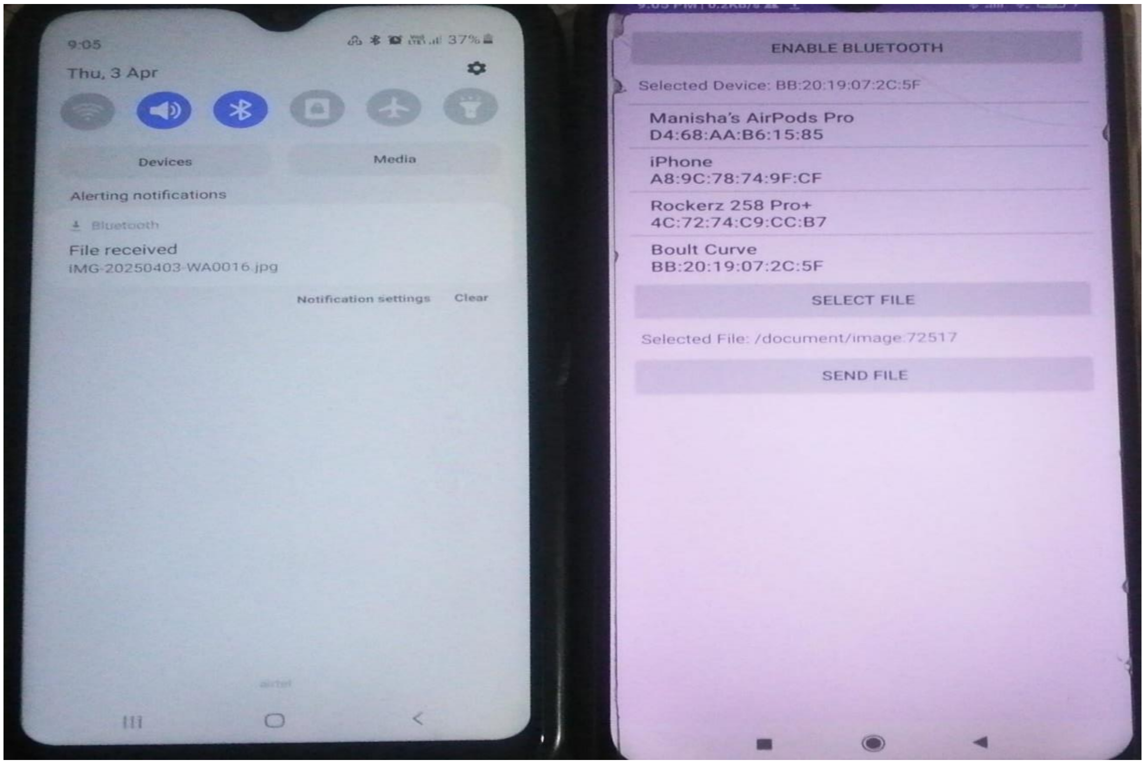
Rockerz 258 Pro+
4C:72:74:C9:CC:B7

Boult Curve
BB:20:19:07:2C:5F

SELECT FILE

Selected File: /document/image:72517

SEND FILE



9:05 37%

Thu, 3 Apr

Devices Media

Alerting notifications

Bluetooth

File received
IMG-20250403-WA0016.jpg

Notification settings Clear

ENABLE BLUETOOTH

Selected Device: BB:20:19:07:2C:5F

Manisha's AirPods Pro
D4:68:AA:B6:15:85

iPhone
A8:9C:78:74:9F:CF

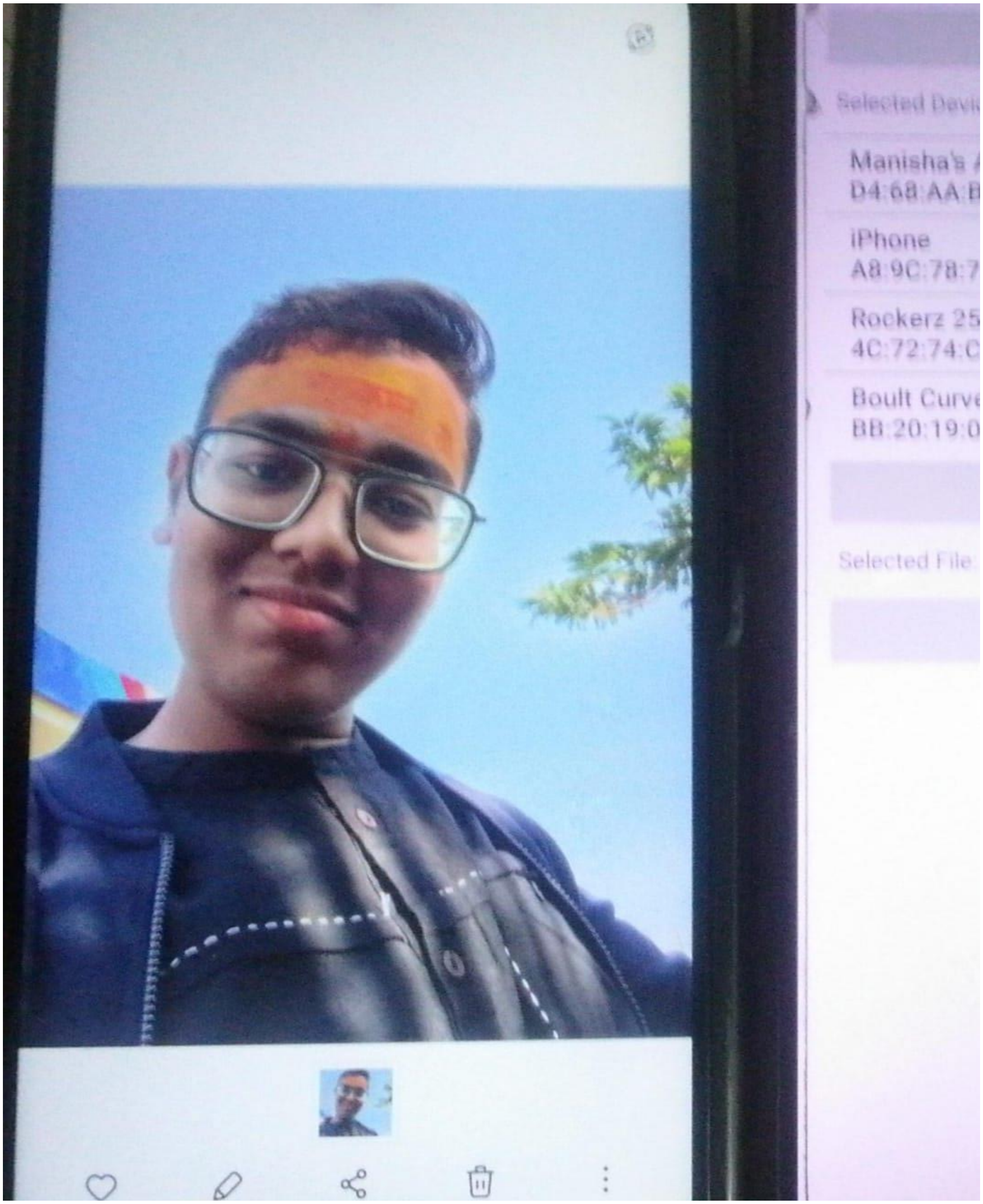
Rockerz 258 Pro+
4C:72:74:C9:CC:B7

Boult Curve
BB:20:19:07:2C:5F

SELECT FILE

Selected File: /document/image:72517

SEND FILE



Selected Devi

Manisha's
D4:68:AA:B

iPhone
A8:9C:78:7

Rockerz 25
4C:72:74:C

Boult Curve
BB:20:19:0

Selected File:

B.3 Observations and learning:

During the experiment, a Bluetooth network was implemented to facilitate the transfer of a file between two devices. The connection was established using Bluetooth pairing, and the file was successfully transferred. Various security mechanisms such as authentication and encryption were observed in action, ensuring secure communication between the devices. Additionally, factors such as range, interference, and transfer speed were noted as affecting performance.

B.4 Conclusion:

The experiment demonstrated the practical application of Bluetooth technology in file transfer. It provided insights into Bluetooth security mechanisms and how they function within mobile networks. Understanding Bluetooth architecture, piconet, and scatternet helped in comprehending the broader application of short-range wireless communication in real-world scenarios.

B.5 Question of Curiosity

1) Explain Bluetooth architecture?

Bluetooth architecture consists of the following components:

1. **Radio Layer** – Responsible for physical transmission using frequency hopping spread spectrum (FHSS).
2. **Baseband Layer** – Handles connection establishment, addressing, and packet formats.
3. **Link Manager Protocol (LMP)** – Manages link setup, authentication, encryption, and power control.
4. **Logical Link Control and Adaptation Protocol (L2CAP)** – Provides connection-oriented and connectionless data services to upper layers.
5. **Service Discovery Protocol (SDP)** – Helps devices discover available Bluetooth services.
6. **Host Controller Interface (HCI)** – Acts as an interface between hardware and software, allowing communication between Bluetooth devices and the host system.
7. **Application Layer** – Includes software applications that use Bluetooth for file transfer, audio streaming, or other functionalities.

2) What is piconet and scatternet?

- **Piconet:** A piconet is a small network consisting of one master device and up to seven active slave devices connected via Bluetooth. The master device controls communication, while the slaves follow its instructions. Piconets are dynamically established and can change as devices join or leave.
- **Scatternet:** A scatternet is a network of multiple interconnected piconets, where a device can act as a bridge by participating in two or more piconets simultaneously. This allows greater coverage and more device connectivity.