Mobile Application Development Mini Project

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Aim:

To create a password managing application with industry standard encryption of AES GCM and Google KMS Envelope Encryption.

Challenge:

The application needs to be build in such a way that even if application logic is leaked, the data cannot be compromised

Procedure:

1. Create a new Android Studio Project
2. Design necessary layouts with the help of xml files.
3. Create Firebase Project and enable Firestore and Firebase Authentication with Google Sign-In.
4. Create Google Cloud Project and obtain Google Key Management System API Key.
5. Create a REST API using NodeJS to facilitate Envelope Encryption for KeysetHandle of AES GCM
6. Create relevant classes to encrypt and decrypt the information securely.

Tools Used:

Android Studio, Google Cloud Platform, Google Key Management System, Google Tink, Firebase Firestore, Firebase Authentication, Google reCaptcha v2, NodeJS, Express JS, JSON, Sublime

Guide:

Mr. H. Riasudheen

Android Application:

Manager/PasswordItem.java

```
package com.mycrolinks.passwdmgr.manager;

import android.annotation.SuppressLint;

import org.json.JSONObject;

import java.io.Serializable;
import java.text.DateFormat;
import java.text.SimpleDateFormat;
import java.util.Calendar;
import java.util.Date;

public class PasswordItem implements Serializable {
    JSONObject passwordItem;

    public PasswordItem(String title, String password, String timestamp) {
        passwordItem = new JSONObject();
        try {
            passwordItem.put("title", title);
            passwordItem.put("password", password);
            passwordItem.put("timestamp", timestamp);
        } catch (Exception e) {
            e.printStackTrace();
        }
    }

    public PasswordItem(String title, String password) {
        passwordItem = new JSONObject();
        try {
            Date today = Calendar.getInstance().getTime();
            @SuppressLint("SimpleDateFormat") DateFormat df = new
SimpleDateFormat("dd/MM/yyyy HH:mm:ss");
            passwordItem.put("title", title);
            passwordItem.put("password", password);
            passwordItem.put("timestamp", df.format(today));
        } catch (Exception e) {
            e.printStackTrace();
        }
    }

    public PasswordItem(JSONObject passwordItem) {
        this.passwordItem = passwordItem;
    }

    public String getTitle() {
        try {
            return passwordItem.getString("title");
        } catch (Exception e) {
            e.printStackTrace();
        }
        return null;
    }

    public String getPassword() {
        try {
            return passwordItem.getString("password");
        } catch (Exception e) {
            e.printStackTrace();
        }
        return null;
    }
```

```java
    public String getTimestamp() {
        try {
            return passwordItem.getString("timestamp");
        } catch (Exception e) {
            e.printStackTrace();
        }
        return null;
    }

    public JSONObject getJSONObject() {
        return passwordItem;
    }
}
```

Manager/PasswordItemList.java

```java
package com.mycrolinks.passwdmgr.manager;

import com.google.crypto.tink.KeysetHandle;
import com.google.firebase.firestore.DocumentReference;
import com.google.firebase.firestore.FirebaseFirestore;

import org.json.JSONArray;
import org.json.JSONException;
import org.json.JSONObject;

import java.util.Arrays;

public class PasswordItemList {

    JSONArray passwordItemList;
    String documentName;
    KeysetHandle keysetHandle;

    public PasswordItemList() {
        passwordItemList = new JSONArray();
        PasswordItem dummy = new PasswordItem("Dummy", "example password");
        add(dummy);
    }

    public PasswordItemList(byte[] passwordItemList) {
        try {
            this.passwordItemList = new JSONArray(new String(passwordItemList));
        } catch (JSONException e) {
            e.printStackTrace();
        }
    }

    public void delete(int index) {
        passwordItemList.remove(index);
        saveToDB();
    }

    public void add(PasswordItem passwordItem) {
        passwordItemList.put(passwordItem.getJSONObject());
        saveToDB();
    }

    public void update(int index, PasswordItem passwordItem) {
        try {
            passwordItemList.remove(index);
            passwordItemList.put(index, passwordItem.getJSONObject());
            saveToDB();
        } catch (JSONException e) {
            e.printStackTrace();
        }
    }

    public byte[] toByteArray() {
        return passwordItemList.toString().getBytes();
    }


    public int getSize() {
        return passwordItemList.length();
    }

    public PasswordItem getPasswordItem(int index) {
        try {
            return new PasswordItem((JSONObject) passwordItemList.get(index));
        } catch (JSONException e) {
            e.printStackTrace();
        }
        return null;
    }

    public void saveToDB() {
        if (documentName != null) {
            byte[] passwordListByteArray = toByteArray();
            byte[] encryptedData = Encryptor.encrypt(keysetHandle,
passwordListByteArray);
            FirebaseFirestore db = FirebaseFirestore.getInstance();
            DocumentReference documentReference =
db.collection("root").document(documentName);
            documentReference
                    .update("data", Arrays.toString(encryptedData))
                    .addOnSuccessListener(aVoid -> System.out.println("DocumentSnapshot
successfully updated!"))
                    .addOnFailureListener(e -> System.out.println("Error updating
document" + e.getMessage()));
        }
    }

    public void setDocumentName(String documentName) {
        this.documentName = documentName;
    }

    public String getDocumentName() {
        return documentName;
    }

    public void setKeysetHandle(KeysetHandle keysetHandle) {
        this.keysetHandle = keysetHandle;
    }

}
```

Manager/Encryptor.java

```
package com.mycrolinks.passwdmgr.manager;

import com.google.common.primitives.Bytes;
import com.google.crypto.tink.Aead;
import com.google.crypto.tink.CleartextKeysetHandle;
import com.google.crypto.tink.JsonKeysetReader;
import com.google.crypto.tink.JsonKeysetWriter;
import com.google.crypto.tink.KeyTemplates;
```

```java
import com.google.crypto.tink.KeysetHandle;
import com.google.crypto.tink.aead.AeadConfig;

import java.io.ByteArrayInputStream;
import java.io.ByteArrayOutputStream;
import java.io.IOException;
import java.io.ObjectInputStream;
import java.io.ObjectOutputStream;
import java.security.GeneralSecurityException;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
import java.util.ArrayList;
import java.util.Arrays;
import java.util.List;


public class Encryptor {

    private static String bytesToHexString(byte[] bytes) {
        StringBuilder sb = new StringBuilder();
        for (byte aByte : bytes) {
            String hex = Integer.toHexString(0xFF & aByte);
            if (hex.length() == 1) {
                sb.append('0');
            }
            sb.append(hex);
        }
        return sb.toString();
    }

    private static String hash(String password, String salt) {
        MessageDigest digest;
        String hash;
        try {
            digest = MessageDigest.getInstance("SHA-256");
            digest.update((password + salt).getBytes());
            hash = bytesToHexString(digest.digest());
            return hash;
        } catch (NoSuchAlgorithmException e1) {
            e1.printStackTrace();
        }
        return null;
    }

    public static String hash_wrapper(String password) {
        String hash = password;
        for (int x = 0; x < password.length(); x++) {
            hash = hash(hash, password.charAt(x) + "");
        }
        return hash;
    }

    public static KeysetHandle generateKey() {
        KeysetHandle keyHandle = null;
        try {
            AeadConfig.register();
            keyHandle = KeysetHandle.generateNew(KeyTemplates.get("AES128_GCM"));
        } catch (Exception e) {
            e.printStackTrace();
        }
        return keyHandle;
    }

    public static String keyToString(KeysetHandle keysetHandle) {
        try {
            ByteArrayOutputStream baos = new ByteArrayOutputStream();
            ObjectOutputStream oos = new ObjectOutputStream(baos);
            CleartextKeysetHandle.write(keysetHandle,
JsonKeysetWriter.withOutputStream(oos));
            oos.close();
            return Arrays.toString(baos.toByteArray());
        } catch (Exception e) {
            e.printStackTrace();
        }
        return null;
    }

    public static byte[] ToByteArray(String array) {
        array = array.replace("[", "").replace("]", "").replace(" ", "");
        List<Byte> list = new ArrayList<>();
        String[] splitArray = array.split(",");
        for (String x : splitArray) {
            list.add((byte) Integer.parseInt(x));
        }
        return Bytes.toArray(list);
    }

    public static KeysetHandle stringToKey(String keysetString) {
        byte[] data = ToByteArray(keysetString);
        System.out.println(data.length);
        try {
            ByteArrayInputStream bais = new ByteArrayInputStream(data);
            ObjectInputStream ois = new ObjectInputStream(bais);
            KeysetHandle keysetHandle =
CleartextKeysetHandle.read(JsonKeysetReader.withInputStream(ois));
            ois.close();
            return keysetHandle;
        } catch (IOException e) {
            data[5] = (byte) -16;
            return stringToKey(Arrays.toString(data));
        } catch (GeneralSecurityException e) {
            e.printStackTrace();
        }
        return null;
    }

    public static byte[] decrypt(KeysetHandle keyHandle, byte[] cipher) {
        try {
            AeadConfig.register();
            Aead aead = keyHandle.getPrimitive(Aead.class);
            return aead.decrypt(cipher, ("password-manager").getBytes());
        } catch (Exception e) {
            System.out.println(e.getMessage());
            e.printStackTrace();
        }
        return null;
    }

    public static byte[] encrypt(KeysetHandle keyHandle, byte[] data) {
        try {
            Aead aead = keyHandle.getPrimitive(Aead.class);
            return aead.encrypt(data, ("password-manager").getBytes());
        } catch (Exception e) {
            System.out.println(e.getMessage());
        }
        return null;
    }


}
```

Manager/EnvelopeEncryption.java

```java
package com.mycrolinks.passwdmgr.manager;

import android.os.StrictMode;

import java.io.IOException;
import java.util.Objects;

import okhttp3.FormBody;
import okhttp3.OkHttpClient;
import okhttp3.Request;
import okhttp3.RequestBody;
import okhttp3.Response;

public class EnvelopeEncryption {
    public final static String domain = "http://192.168.0.8:8080";

    private static void threadOverride() {
        StrictMode.ThreadPolicy policy = new
StrictMode.ThreadPolicy.Builder().permitAll().build();
        StrictMode.setThreadPolicy(policy);
    }

    public static String encrypt(String text) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("text", text).build();
        Request request = new Request.Builder().url(domain +
"/encrypt").post(formBody).build();
        try {
            Response response = client.newCall(request).execute();
            return Objects.requireNonNull(response.body()).string();
        } catch (IOException e) {
            e.printStackTrace();
        }
        return null;
    }

    public static String decrypt(String cipher) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("cipher", cipher).build();
        Request request = new Request.Builder().url(domain +
"/decrypt").post(formBody).build();
        try {
            Response response = client.newCall(request).execute();
            return Objects.requireNonNull(response.body()).string();
        } catch (IOException e) {
            e.printStackTrace();
        }
        return null;
    }
}
```

Manager/MasterPassword.java

```
package com.mycrolinks.passwdmgr.manager;

import android.os.StrictMode;

import java.io.IOException;
import java.util.Objects;

import okhttp3.FormBody;
import okhttp3.OkHttpClient;
import okhttp3.Request;
import okhttp3.RequestBody;
import okhttp3.Response;

public class MasterPassword {
    private static void threadOverride() {
        StrictMode.ThreadPolicy policy = new
StrictMode.ThreadPolicy.Builder().permitAll().build();
        StrictMode.setThreadPolicy(policy);
    }

    public final static String domain = "http://192.168.0.8:8080";

    public static boolean isUserExists(String email) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("email", email).build();
        Request request = new Request.Builder().url(domain +
"/isUserExists").post(formBody).build();
        try {
            Response response = client.newCall(request).execute();
            return Objects.requireNonNull(response.body()).string().equals("true");
        } catch (IOException e) {
            e.printStackTrace();
        }
        return false;
    }

    public static boolean checkCredentials(String email, String password) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("email",
email).add("password", password).build();
        Request request = new Request.Builder().url(domain +
"/checkCredentials").post(formBody).build();
        try {
            Response response = client.newCall(request).execute();
            return Objects.requireNonNull(response.body()).string().equals("true");
        } catch (IOException e) {
            e.printStackTrace();
        }
        return false;
    }

    public static void setUser(String email, String password) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("email",
email).add("password", password).build();
        Request request = new Request.Builder().url(domain +
"/setUser").post(formBody).build();
        try {
            client.newCall(request).execute();
        } catch (IOException e) {
            e.printStackTrace();
        }
    }

    public static void delUser(String email) {
        threadOverride();
        OkHttpClient client = new OkHttpClient();
        RequestBody formBody = new FormBody.Builder().add("email", email).build();
        Request request = new Request.Builder().url(domain +
"/delUser").post(formBody).build();
        try {
            client.newCall(request).execute();
        } catch (IOException e) {
            e.printStackTrace();
        }
    }
}
```

Manager/CustomAdapter.java

```
package com.mycrolinks.passwdmgr.manager;

import android.annotation.SuppressLint;
import android.content.ClipData;
import android.content.ClipboardManager;
import android.content.Context;
import android.content.Intent;
import android.database.DataSetObserver;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.EditText;
import android.widget.ListAdapter;
import android.widget.TextView;
import android.widget.Toast;


import androidx.appcompat.app.AlertDialog;

import com.google.android.gms.auth.api.signin.GoogleSignIn;
import com.google.android.gms.auth.api.signin.GoogleSignInAccount;
import com.mycrolinks.passwdmgr.R;
import com.mycrolinks.passwdmgr.vault;

import java.text.DateFormat;
import java.text.SimpleDateFormat;
import java.util.Calendar;
import java.util.Date;

public class CustomAdapter implements ListAdapter {
    PasswordItemList passwordItemList;
    Context context;
    GoogleSignInAccount signInAccount;
    DateFormat df;

    @SuppressLint("SimpleDateFormat")
    public CustomAdapter(Context context, PasswordItemList passwordItemList) {
        this.passwordItemList = passwordItemList;
        this.context = context;
        signInAccount = GoogleSignIn.getLastSignedInAccount(context);
        df = new SimpleDateFormat("dd/MM/yyyy HH:mm:ss");
    }

    @Override
    public boolean areAllItemsEnabled() {
```

```java
        return false;
    }

    @Override
    public boolean isEnabled(int position) {
        return true;
    }

    @Override
    public void registerDataSetObserver(DataSetObserver observer) {
    }

    @Override
    public void unregisterDataSetObserver(DataSetObserver observer) {
    }

    @Override
    public int getCount() {
        return passwordItemList.getSize();
    }

    @Override
    public Object getItem(int position) {
        return position;
    }

    @Override
    public long getItemId(int position) {
        return position;
    }

    @Override
    public boolean hasStableIds() {
        return false;
    }

    @SuppressLint({"InflateParams", "SetTextI18n"})
    @Override
    public View getView(int position, View convertView, ViewGroup parent) {
        PasswordItem pwdItem = passwordItemList.getPasswordItem(position);
        if (convertView == null) {
            LayoutInflater layoutInflater = LayoutInflater.from(context);
            convertView = layoutInflater.inflate(R.layout.list_row, null);
            TextView title = convertView.findViewById(R.id.list_title);
            title.setText(pwdItem.getTitle());
            convertView.setOnClickListener(v -> {
                final View alertBox =
layoutInflater.inflate(R.layout.password_item_dialog, null);
                AlertDialog.Builder alertDialog = new AlertDialog.Builder(context);
                alertDialog.setTitle("Credentials");
                alertDialog.setView(alertBox);
                EditText itemTitle = alertBox.findViewById(R.id.alert_title);
                itemTitle.setText(pwdItem.getTitle());
                EditText itemPwd = alertBox.findViewById(R.id.alert_password);
                itemPwd.setText(pwdItem.getPassword());
                TextView itemTime = alertBox.findViewById(R.id.alert_time);
                itemTime.setText("Last Modified : " + pwdItem.getTimestamp());
                alertDialog.setIcon(R.drawable.lock_key);
                alertDialog.setPositiveButton("Save",
                        (dialog, which) -> {
                            Date today = Calendar.getInstance().getTime();
                            passwordItemList.update(position, new
PasswordItem(itemTitle.getText().toString(), itemPwd.getText().toString(),
df.format(today)));
                            Toast.makeText(context, "Credentials Saved",
Toast.LENGTH_SHORT).show();
                            Intent intent = new Intent(context, vault.class);
                            intent.putExtra("data",
passwordItemList.getDocumentName());
                            context.startActivity(intent);
                        });
                alertDialog.setNeutralButton("Copy",
                        (dialog, which) -> {
                            ClipboardManager clipboard = (ClipboardManager)
context.getSystemService(Context.CLIPBOARD_SERVICE);
                            ClipData clip = ClipData.newPlainText(pwdItem.getTitle(),
pwdItem.getPassword());
                            clipboard.setPrimaryClip(clip);
                            dialog.cancel();
                            Toast.makeText(context, "Password Copied to Clipboard",
Toast.LENGTH_SHORT).show();
                        });
                alertDialog.setNegativeButton("Delete",
                        (dialog, which) -> {
                            passwordItemList.delete(position);
                            Toast.makeText(context, "Credentials Deleted",
Toast.LENGTH_SHORT).show();
                            Intent intent = new Intent(context, vault.class);
                            intent.putExtra("data",
passwordItemList.getDocumentName());
                            context.startActivity(intent);
                        });
                alertDialog.show();
            });

        }
        return convertView;
    }

    @Override
    public int getItemViewType(int position) {
        return position;
    }

    @Override
    public int getViewTypeCount() {
        return passwordItemList.getSize();
    }

    @Override
    public boolean isEmpty() {
        return false;
    }
}
```

Main_Activity.java

```java
package com.mycrolinks.passwdmgr;

import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;

import com.google.android.gms.auth.api.signin.GoogleSignIn;
import com.google.android.gms.auth.api.signin.GoogleSignInAccount;
import com.google.android.gms.auth.api.signin.GoogleSignInClient;
import com.google.android.gms.auth.api.signin.GoogleSignInOptions;
import com.google.android.gms.common.api.ApiException;
import com.google.android.gms.tasks.Task;
import com.google.firebase.auth.AuthCredential;
import com.google.firebase.auth.FirebaseAuth;
import com.google.firebase.auth.FirebaseUser;
import com.google.firebase.auth.GoogleAuthProvider;
import com.mycrolinks.passwdmgr.manager.MasterPassword;

import java.util.Objects;

public class MainActivity extends AppCompatActivity {
    GoogleSignInClient mGoogleSignInClient;
    private static final int RC_SIGN_IN = 1000;
    private FirebaseAuth mAuth;
    FirebaseUser currentUser;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        mAuth = FirebaseAuth.getInstance();
        // Configure Google Sign In
        GoogleSignInOptions gso = new
GoogleSignInOptions.Builder(GoogleSignInOptions.DEFAULT_SIGN_IN)
                .requestIdToken(getString(R.string.default_web_client_id))
                .requestEmail()
                .build();

        mGoogleSignInClient = GoogleSignIn.getClient(this, gso);
    }

    @SuppressWarnings("deprecation")
    public void sign(View v) {
        Toast.makeText(this, "Signing you in", Toast.LENGTH_SHORT).show();
        Intent signInIntent = mGoogleSignInClient.getSignInIntent();
        startActivityForResult(signInIntent, RC_SIGN_IN);
    }

    @Override
    public void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);
        if (requestCode == RC_SIGN_IN) {
            Task<GoogleSignInAccount> task =
GoogleSignIn.getSignedInAccountFromIntent(data);
            try {
                GoogleSignInAccount account = task.getResult(ApiException.class);
                firebaseAuthWithGoogle(account.getIdToken());
            } catch (ApiException e) {
                Toast.makeText(this, e.getMessage(), Toast.LENGTH_SHORT).show();
            }
        }
    }

//    @Override
//    public void onStart() {
//        super.onStart();
//        currentUser = mAuth.getCurrentUser();
//        if (currentUser != null) {
//            vaultRedirect();
//        }
//    }

    private void firebaseAuthWithGoogle(String idToken) {
        AuthCredential credential = GoogleAuthProvider.getCredential(idToken, null);
        mAuth.signInWithCredential(credential)
                .addOnCompleteListener(this, task -> {
                    if (task.isSuccessful()) {
                        System.out.println("Logged in");
                        currentUser = mAuth.getCurrentUser();
                        vaultRedirect();
                    } else {
                        Toast.makeText(MainActivity.this, "Sorry, Authentication 
Failed", Toast.LENGTH_SHORT).show();
                    }
                });
    }

    private void vaultRedirect() {
        if 
(MasterPassword.isUserExists(Objects.requireNonNull(currentUser.getEmail()))) {
            startActivity(new Intent(getApplicationContext(), vault_pin.class));
        } else {
            startActivity(new Intent(getApplicationContext(), create_vault.class));
        }
    }
}
```

Create_vault.java

```java
package com.mycrolinks.passwdmgr;

import android.content.Intent;
import android.os.Bundle;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;

import com.google.android.gms.auth.api.signin.GoogleSignIn;
import com.google.android.gms.auth.api.signin.GoogleSignInAccount;
import com.google.crypto.tink.KeysetHandle;
import com.google.firebase.firestore.FirebaseFirestore;
import com.mycrolinks.passwdmgr.manager.Encryptor;
import com.mycrolinks.passwdmgr.manager.EnvelopeEncryption;
import com.mycrolinks.passwdmgr.manager.MasterPassword;
import com.mycrolinks.passwdmgr.manager.PasswordItemList;

import java.util.Arrays;
import java.util.HashMap;
import java.util.Map;

public class create_vault extends AppCompatActivity {
    EditText pass_new, pass_conf;
    Button create;
    GoogleSignInAccount signInAccount;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_create_vault);
        pass_new = findViewById(R.id.pass_new);
        pass_conf = findViewById(R.id.pass_conf);
        create = findViewById(R.id.create);
        create.setOnClickListener(view -> {
            if (pass_new.getText().toString().equals(pass_conf.getText().toString())) {
                signInAccount = GoogleSignIn.getLastSignedInAccount(this);
                assert signInAccount != null;
                String email = signInAccount.getEmail();
                String rawPassword = pass_conf.getText().toString();
                String hashPassword = Encryptor.hash_wrapper(rawPassword);
                String documentName = Encryptor.hash_wrapper(email + hashPassword);
                Map<String, Object> document = new HashMap<>();
                PasswordItemList passwordItemList = new PasswordItemList();
                KeysetHandle keyHandle = Encryptor.generateKey();
                byte[] passwordListByteArray = passwordItemList.toByteArray();
                byte[] encryptedData = Encryptor.encrypt(keyHandle,
passwordListByteArray);
                String keyString = Encryptor.keyToString(keyHandle);
                String encryptedKey = EnvelopeEncryption.encrypt(keyString);
                System.out.println("keyhandle text : " + keyString);
                System.out.println("cipher text : " + encryptedKey);
                document.put("key", encryptedKey);
                document.put("data", Arrays.toString(encryptedData));
                document.put("author", email);
                FirebaseFirestore db = FirebaseFirestore.getInstance();
                db.collection("root").document(documentName).set(document)
                        .addOnSuccessListener(aVoid -> {
                                    Toast.makeText(this, "New Vault Created",
Toast.LENGTH_SHORT).show();
                                    MasterPassword.setUser(email, hashPassword);
                                    Toast.makeText(this, "Vault created successfully",
Toast.LENGTH_SHORT).show();
                                    startActivity(new Intent(this, vault_pin.class));
                                }
                        )
                        .addOnFailureListener(e -> {
                            System.out.println("Error writing document" +
e.getMessage());
                            startActivity(new Intent(this, create_vault.class));
                        });
            } else {
                Toast.makeText(this, "Passwords Didn't Match",
Toast.LENGTH_SHORT).show();
            }
        });
    }
}
```

vault_pin.java

```
package com.mycrolinks.passwdmgr;

import android.annotation.SuppressLint;
import android.content.Intent;
import android.os.Bundle;
import android.widget.Button;
import android.widget.CheckBox;
import android.widget.EditText;
import android.widget.Toast;

import androidx.annotation.Nullable;
import androidx.appcompat.app.AppCompatActivity;

import com.google.android.gms.auth.api.signin.GoogleSignIn;
import com.google.android.gms.auth.api.signin.GoogleSignInAccount;
import com.google.android.gms.common.api.GoogleApiClient;
import com.google.android.gms.common.api.Status;
import com.google.android.gms.safetynet.SafetyNet;
import com.google.firebase.auth.FirebaseAuth;
import com.mycrolinks.passwdmgr.manager.Encryptor;
import com.mycrolinks.passwdmgr.manager.MasterPassword;

@SuppressWarnings("deprecation")
public class vault_pin extends AppCompatActivity implements
GoogleApiClient.ConnectionCallbacks {
    GoogleSignInAccount signInAccount;
    Button unlock, logout, delete;
    CheckBox checkbox;
    GoogleApiClient googleApiClient;
    String SITE_KEY = "6LcbWZgbAAAAAGj9z9VVweX8s5htypF-5ykAzM5V";

    @SuppressLint("MissingPermission")
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_vault_pin);
        unlock = findViewById(R.id.signin);
        logout = findViewById(R.id.log_but);
        delete = findViewById(R.id.del_but);
        checkbox = findViewById(R.id.checkbox);
        signInAccount = GoogleSignIn.getLastSignedInAccount(this);
        googleApiClient = new
GoogleApiClient.Builder(this).addApi(SafetyNet.API).addConnectionCallbacks(vault_pin.th
is).build();
        googleApiClient.connect();
        //checkbox.setSelected(true);
        checkbox.setOnClickListener(v -> {
            if (checkbox.isChecked()) {
                SafetyNet.SafetyNetApi.verifyWithRecaptcha(googleApiClient,
SITE_KEY).setResultCallback(recaptchaTokenResult -> {
                    Status status = recaptchaTokenResult.getStatus();
                    if (status.isSuccess()) {
                        Toast.makeText(vault_pin.this, "Captcha Verified Successfully",
Toast.LENGTH_SHORT).show();
                    } else {
                        checkbox.setSelected(false);
                    }
                });
            }
        });

        logout.setOnClickListener(view -> {
            FirebaseAuth.getInstance().signOut();
            Intent intent = new Intent(getApplicationContext(), MainActivity.class);
            startActivity(intent);
        });
        unlock.setOnClickListener(view -> {
            EditText passwordEditText = findViewById(R.id.password_editText);
            String hashPassword =
Encryptor.hash_wrapper(passwordEditText.getText().toString());

            if(checkbox.isChecked()){
                String email = signInAccount.getEmail();
                if (MasterPassword.checkCredentials(email,hashPassword)) {
                    Intent intent = new Intent(getApplicationContext(), vault.class);
                    String documentName = Encryptor.hash_wrapper(email + hashPassword);
                    intent.putExtra("data", documentName);
                    startActivity(intent);
                } else {
                    Toast.makeText(this, "Wrong Password", Toast.LENGTH_SHORT).show();
                }
            } else {
                Toast.makeText(this, "Verify ReCAPTCHA", Toast.LENGTH_SHORT).show();
            }
        });

    }


    @Override
    public void onConnected(@Nullable @org.jetbrains.annotations.Nullable Bundle
bundle) {

    }

    @Override
    public void onConnectionSuspended(int i) {

    }
}
```

vault.java

```
package com.mycrolinks.passwdmgr;

import android.annotation.SuppressLint;
import android.content.ClipData;
import android.content.ClipboardManager;
import android.content.Context;
import android.content.Intent;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ListView;
import android.widget.Toast;

import androidx.appcompat.app.AlertDialog;
import androidx.appcompat.app.AppCompatActivity;

import com.google.android.gms.auth.api.signin.GoogleSignIn;
import com.google.android.gms.auth.api.signin.GoogleSignInAccount;
import com.google.crypto.tink.KeysetHandle;
import com.google.firebase.auth.FirebaseAuth;
import com.google.firebase.firestore.DocumentReference;
import com.google.firebase.firestore.DocumentSnapshot;
import com.google.firebase.firestore.FirebaseFirestore;
import com.mycrolinks.passwdmgr.manager.CustomAdapter;
import com.mycrolinks.passwdmgr.manager.Encryptor;
import com.mycrolinks.passwdmgr.manager.EnvelopeEncryption;
import com.mycrolinks.passwdmgr.manager.MasterPassword;
import com.mycrolinks.passwdmgr.manager.PasswordItem;
import com.mycrolinks.passwdmgr.manager.PasswordItemList;

import java.text.DateFormat;
import java.text.SimpleDateFormat;
import java.util.Calendar;
import java.util.Date;
import java.util.Objects;

public class vault extends AppCompatActivity {

    GoogleSignInAccount signInAccount;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        FirebaseFirestore db = FirebaseFirestore.getInstance();
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_vault);
        signInAccount = GoogleSignIn.getLastSignedInAccount(this);
        final ListView list = findViewById(R.id.list);
        String documentName = getIntent().getStringExtra("data");
        DocumentReference documentReference =
db.collection("root").document(documentName);
        documentReference.get()
                .addOnCompleteListener(task -> {
                    if (task.isSuccessful()) {
                        DocumentSnapshot document = task.getResult();
                        if (document.exists()) {
                            String encryptedPasswordList = (String)
Objects.requireNonNull(document.getData()).get("data");
                            String encryptedKeysetHandle = (String)
Objects.requireNonNull(document.getData()).get("key");
                            System.out.println("encrypted" + encryptedKeysetHandle);
                            String decrypted =
EnvelopeEncryption.decrypt(encryptedKeysetHandle);
                            System.out.println("decrypted" + decrypted);
                            KeysetHandle keysetHandle =
Encryptor.stringToKey(decrypted);
                            PasswordItemList passwordItemList = new
PasswordItemList(Encryptor.decrypt(keysetHandle,
Encryptor.ToByteArray(encryptedPasswordList)));
                            passwordItemList.setDocumentName(documentName);
                            passwordItemList.setKeysetHandle(keysetHandle);
                            CustomAdapter customAdapter = new CustomAdapter(this,
passwordItemList);
                            list.setAdapter(customAdapter);
                            Button exit = findViewById(R.id.exit);
                            exit.setOnClickListener(v -> {
                                FirebaseAuth.getInstance().signOut();
                                Intent intent = new Intent(getApplicationContext(),
MainActivity.class);
                                startActivity(intent);
                            });
                            Button add = findViewById(R.id.add);
                            add.setOnClickListener(v -> {
                                LayoutInflater layoutInflater =
LayoutInflater.from(this);
                                final View alertBox =
layoutInflater.inflate(R.layout.password_item_dialog, null);
                                AlertDialog.Builder alertDialog = new
AlertDialog.Builder(this);
                                alertDialog.setTitle("Credentials");
                                alertDialog.setView(alertBox);
                                EditText itemTitle =
alertBox.findViewById(R.id.alert_title);
                                EditText itemPwd =
alertBox.findViewById(R.id.alert_password);
                                alertDialog.setIcon(R.drawable.lock_key);
                                alertDialog.setPositiveButton("Save",
                                        (dialog, which) -> {
                                            Date today =
Calendar.getInstance().getTime();
                                            @SuppressLint("SimpleDateFormat")
DateFormat df = new SimpleDateFormat("dd/MM/yyyy HH:mm:ss");
                                            passwordItemList.add(new
PasswordItem(itemTitle.getText().toString(), itemPwd.getText().toString(),
df.format(today)));

                                            Toast.makeText(this, "Credentials Saved",
Toast.LENGTH_SHORT).show();
                                            Intent intent = new Intent(this,
vault.class);
                                            intent.putExtra("data", documentName);
                                            this.startActivity(intent);
                                        });
                                alertDialog.setNeutralButton("Copy",
                                        (dialog, which) -> {
                                            ClipboardManager clipboard =
(ClipboardManager) this.getSystemService(Context.CLIPBOARD_SERVICE);
                                            ClipData clip =
ClipData.newPlainText(itemTitle.getText().toString(), itemPwd.getText().toString());
                                            clipboard.setPrimaryClip(clip);
                                            dialog.cancel();
                                            Toast.makeText(this, "Password Copied to
Clipboard", Toast.LENGTH_SHORT).show();
                                        });
                                alertDialog.show();

                            });
                            Button delete = findViewById(R.id.del_but);
                            delete.setOnClickListener(view ->
documentReference.delete()
                                    .addOnSuccessListener(aVoid -> {

MasterPassword.delUser(signInAccount.getEmail());
                                        Toast.makeText(vault.this, "Vault successfully
deleted!", Toast.LENGTH_SHORT).show();
                                        exit.performClick();
                                    })
                                    .addOnFailureListener(e -> {
                                        Toast.makeText(vault.this, "Error deleting
vault", Toast.LENGTH_SHORT).show();
                                        System.out.println(e.getMessage());
                                    }));
                        } else {
                            System.out.println("No such document");
                        }
                    } else {
                        System.out.println("get failed with " + task.getException());
                    }
                });


    }
}
```

activity_create_vault.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    tools:context=".create_vault"
    android:layout_margin="10dp">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:gravity="right"
        android:orientation="horizontal">
        <Button
            android:id="@+id/create"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="Create Vault"
            android:layout_margin="10dp"/>
    </LinearLayout>
    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="Create Vault"
        android:textSize="20sp" />
    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />

    <ImageView
        android:layout_width="150dp"
        android:layout_height="150dp"
        android:layout_gravity="center"
        android:src="@drawable/lock_key" />

    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />
    <EditText
        android:id="@+id/pass_new"
        android:layout_width="325dp"
        android:layout_height="wrap_content"
        android:hint="New Password"
        android:layout_gravity="center"
        android:inputType="textPassword"
        />
    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />
    <EditText
        android:id="@+id/pass_conf"
        android:layout_width="325dp"
        android:layout_height="wrap_content"
        android:hint="Confirm Password"
        android:layout_gravity="center"
        android:inputType="textPassword" />
</LinearLayout>
```

Activity_main.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <Button
        android:id="@+id/button2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentTop="true"
        android:layout_centerHorizontal="true"
        android:layout_marginTop="514dp"
        android:gravity="center"
        android:onClick="sign"
        android:background="@color/colorPrimary"
        android:text="Sign In with Google"
        />

    <ImageView
        android:id="@+id/imageView"
        android:layout_width="150dp"
        android:layout_height="150dp"
        android:layout_centerHorizontal="true"
        android:layout_centerVertical="true"
        app:srcCompat="@drawable/fui_ic_googleg_color_24dp" />

</RelativeLayout>
```

Activity_vault.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:paddingLeft="16dp"
    android:paddingTop="16dp"
    android:paddingRight="16dp"
    android:paddingBottom="16dp"
    tools:context=".vault">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:gravity="right"
        android:orientation="horizontal">

        <Button
            android:id="@+id/del_but"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_margin="10dp"
            android:layout_gravity="right"
            android:text="Delete Vault" />

        <Button
```

```
            android:id="@+id/add"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="right"
            android:layout_margin="10dp"
            android:text="Add" />

        <Button
            android:id="@+id/exit"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="right"
            android:layout_margin="10dp"
            android:text="Exit" />

    </LinearLayout>

    <ListView
        android:id="@+id/list"
        android:layout_width="wrap_content"
        android:layout_height="600dp"
        android:divider="#000"
        android:dividerHeight="1dp"
        android:footerDividersEnabled="false"
        android:headerDividersEnabled="false"
        android:isScrollContainer="true"
        android:scrollbarAlwaysDrawVerticalTrack="true" />


</LinearLayout>
```

Activity_vault_pin.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    tools:context=".vault_pin">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_margin="10dp"
        android:gravity="right"
        android:orientation="horizontal">

        <CheckBox
            android:id="@+id/checkbox"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_margin="10dp"
            android:text="I'm not a robot" />

        <Button
            android:id="@+id/log_but"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_margin="10dp"
            android:text="Logout" />

        <Button
```

```
            android:id="@+id/signin"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_margin="10dp"
            android:text="Unlock" />
    </LinearLayout>

    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="Master Password"
        android:textSize="20sp" />

    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />

    <ImageView
        android:layout_width="150dp"
        android:layout_height="150dp"
        android:layout_gravity="center"
        android:src="@drawable/lock_key" />

    <Space
        android:layout_width="wrap_content"
        android:layout_height="20dp" />

    <EditText
        android:id="@+id/password_editText"
        android:layout_width="325dp"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:hint="Enter Master Password"
        android:inputType="textPassword" />

</LinearLayout>
```

List_row.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:padding="5dip">
        <TextView
            android:id="@+id/list_title"
            android:layout_width="match_parent"
            android:layout_height="match_parent"
            android:textSize="25sp"
            android:gravity="center"
             />
</LinearLayout>
```

Password_item_dialog.xml

```xml
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:orientation="vertical">
    <EditText android:inputType="textAutoComplete"
        android:textSize="20sp"
        android:id="@+id/alert_title"
        android:scrollHorizontally="true"
        android:layout_height="70dp"
        android:hint="Title / Username"
        android:layout_width="250dp"
        android:layout_gravity="center"
        android:autofillHints="username" />
    <EditText android:inputType="textVisiblePassword"
        android:textSize="20sp"
        android:id="@+id/alert_password"
        android:scrollHorizontally="true"
        android:layout_height="70dp"
        android:hint="Password"
        android:layout_width="250dp"
        android:layout_gravity="center"
        android:autofillHints="password" />
    <TextView
        android:textSize="20sp"
        android:id="@+id/alert_time"
        android:scrollHorizontally="true"
        android:layout_height="70dp"
        android:layout_width="250dp"
        android:layout_gravity="center"
        android:autofillHints="password" />

</LinearLayout>
```

Manifest.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    package="com.mycrolinks.passwdmgr">
    <uses-permission android:name="android.permission.INTERNET" />
    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:networkSecurityConfig="@xml/network_security_config"
        android:theme="@style/Theme.PasswordManager">
        <activity android:name=".vault" />
        <activity android:name=".create_vault" />
        <activity android:name=".vault_pin" />
        <activity android:name=".MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>
</manifest>
```

NodeJS REST API:

App.js

```
const dotenv = require('dotenv');
dotenv.config();
const asymmetricEncryption = require("./asymmetricEncryption")
const express = require('express');
const cors = require('cors');
const fs = require("fs");
const app = express();
const port = 8080

// noinspection JSCheckFunctionSignatures
app.use(cors({
    origin: '*'
}));

app.use(express.urlencoded({
    extended: true
}))

function parseKeySet(text) {
    let byteArray = text.toString().replace(/]/, "").replace(/\[/, "").split(",");
    console.log(byteArray.length)
    byteArray.splice(0, 6);
    console.log(JSON.stringify(byteArray))

    let jsonString = ""
    byteArray.forEach(element => jsonString +=
String.fromCharCode(parseInt(element.trim())))
    console.log(jsonString)
    let json = JSON.parse(jsonString)
    return {primaryKeyId: json.primaryKeyId, value: json.key[0].keyData.value}
}

function stringToByteArray(string) {
    let myBuffer = [-84, -19, 0, 5, 119, -18];
    const buffer = Buffer.from(string, 'utf8');
    for (let i = 0; i < buffer.length; i++) {
        myBuffer.push(buffer[i]);
    }
    myBuffer.push(10)
    return myBuffer
}

function constructKeyset(keysetValues) {
    keysetValues = JSON.parse(keysetValues)
    let keyset = {
        "primaryKeyId": keysetValues.primaryKeyId,
        "key": [{
            "keyData": {
                "typeUrl": "type.googleapis.com/google.crypto.tink.AesGcmKey",
                "value": keysetValues.value,
                "keyMaterialType": "SYMMETRIC"
            }, "status": "ENABLED", "keyId": keysetValues.primaryKeyId,
"outputPrefixType": "TINK"
        }]
    }

    let jsonString = JSON.stringify(keyset)
    console.log(jsonString)
    return stringToByteArray(jsonString)
}
```

```
app.post('/encrypt', function (req, res) {
    res.setHeader('Content-Type', 'application/json');
    let keysetValues = parseKeySet(req.body.text)
    console.log(keysetValues)
    asymmetricEncryption.encrypt(Buffer.from(JSON.stringify(keysetValues), 'utf8'))
        .then(cipher => {
            console.log("Encryption : " + cipher)
            res.end(JSON.stringify({cipher}))
        })
        .catch(err => {
            console.log("There was an error", err)
        })
});
app.post('/decrypt', function (req, res) {
    console.log("decrypt", req.body)
    res.setHeader('Content-Type', 'application/json');
    let byteArray = JSON.parse(req.body.cipher).cipher.data
    console.log(byteArray.length)
    asymmetricEncryption.decrpyt(Buffer.from(byteArray)).then(keysetValues => {
        let keyset = constructKeyset(keysetValues)
        console.log(keyset.length)
        console.log("Decryption : " + JSON.stringify(keyset))
        return res.end(JSON.stringify(keyset))
    }).catch(err => {
        console.log("There was an error", err)
    })
});

app.post('/isUserExists', function (req, res) {
    console.log("isUserExists", req.body)
    res.setHeader('Content-Type', 'application/json');
    const data = require("./masterPassword.json")
    console.log(data[req.body.email], data[req.body.email] !== undefined);
    return res.end((data[req.body.email] !== undefined).toString())
});

app.post('/checkCredentials', function (req, res) {
    console.log("checkCredentials", req.body)
    res.setHeader('Content-Type', 'application/json');
    const data = require("./masterPassword.json")
    return res.end((data[req.body.email] === req.body.password).toString())
});

app.post('/setUser', function (req, res) {
    console.log("setUser", req.body)
    res.setHeader('Content-Type', 'application/json');
    const data = require("./masterPassword.json")
    data[req.body.email] = req.body.password
    fs.writeFile("masterPassword.json", JSON.stringify(data), err => {
        if (err) {
            console.log(err)
            return res.end(JSON.stringify({result: false}))
        } else {
            return res.end(JSON.stringify({result: true}))
        }
    });
});

app.post('/delUser', function (req, res) {
    console.log("delUser", req.body)
    res.setHeader('Content-Type', 'application/json');
    const data = require("./masterPassword.json")
    delete data[req.body.email];
    fs.writeFile("masterPassword.json", JSON.stringify(data), err => {
        if (err) {
            console.log(err)
            return res.end(JSON.stringify({result: false}))
        } else {
            return res.end(JSON.stringify({result: true}))
        }
    });
});

app.listen(port, () => {
    console.log(`Password-Manager Server listening at http://localhost:${port}`)
})
```

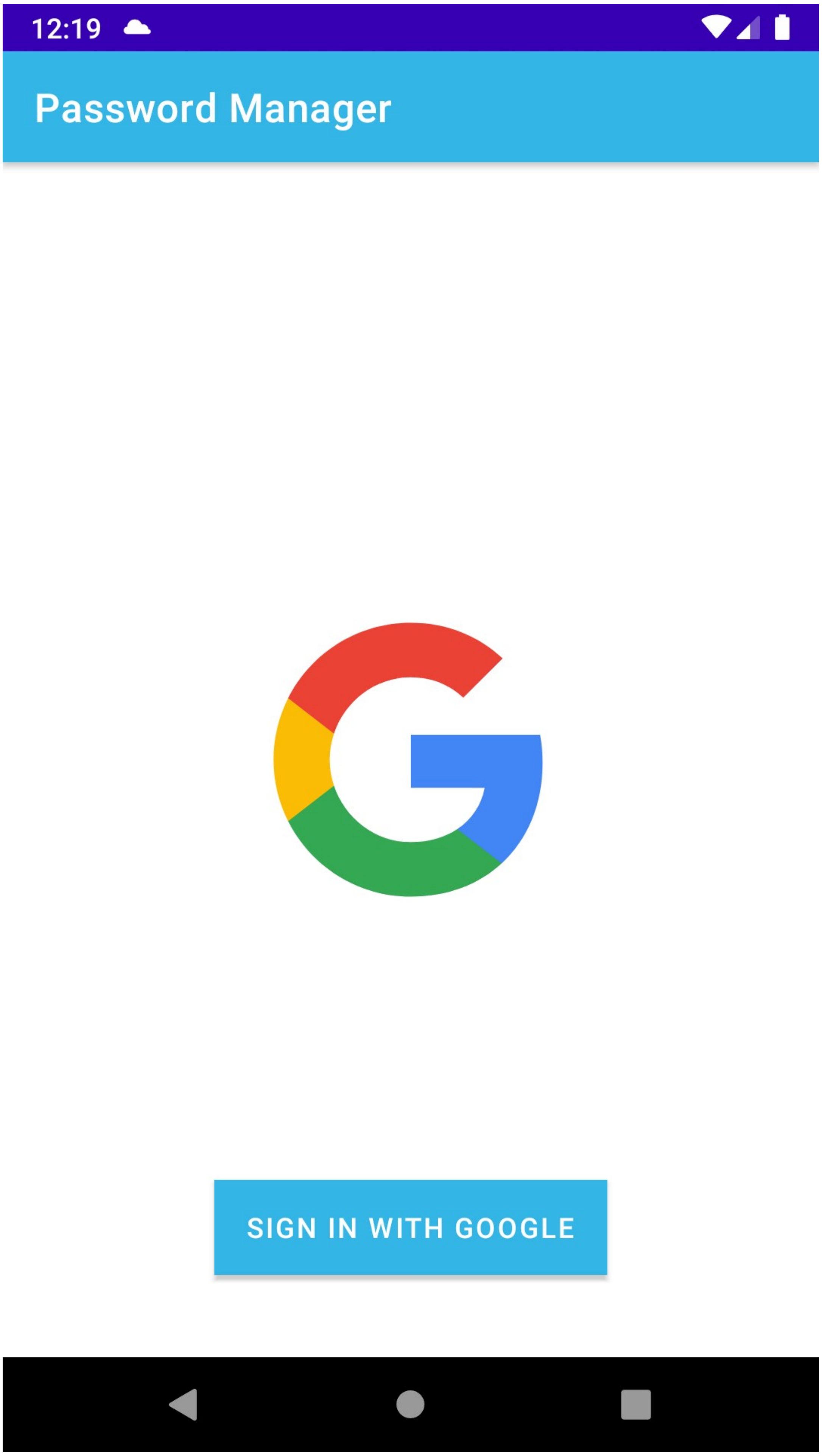
asymmetricEncryption.js

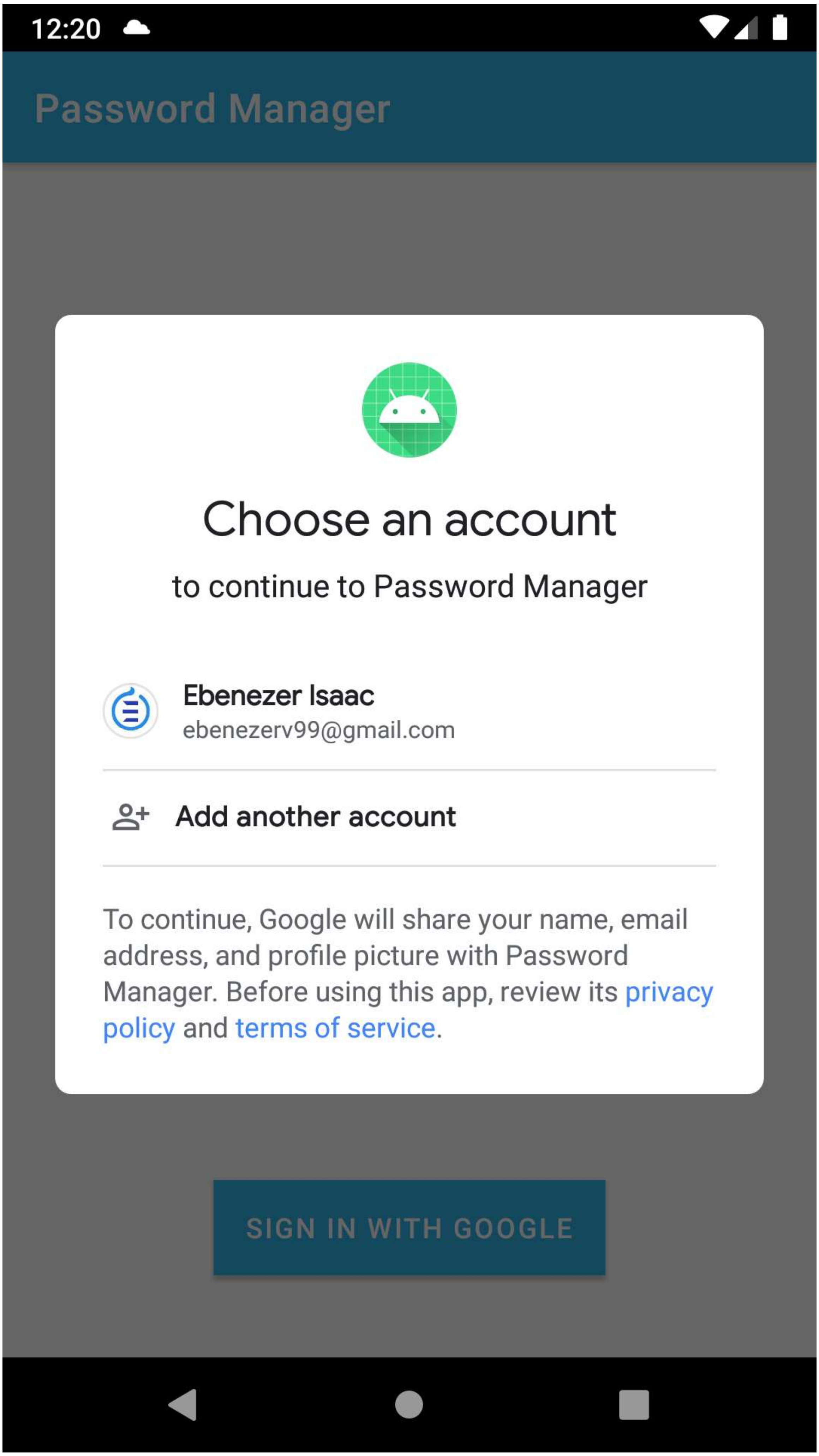
```
const projectId = 'premium-bloom-319904';
const locationId = 'global';
const keyRingId = 'password-manager';
const keyId = 'password-manager';
const versionId = '1';
const {KeyManagementServiceClient} = require('@google-cloud/kms');
const client = new KeyManagementServiceClient();
const versionName = client.cryptoKeyVersionPath(
    projectId,
    locationId,
    keyRingId,
    keyId,
    versionId
);
const crc32c = require('fast-crc32c');

async function decrypt(ciphertext) {

    const ciphertextCrc32c = crc32c.calculate(ciphertext);

    async function decryptAsymmetric() {
        const [decryptResponse] = await client.asymmetricDecrypt({
            name: versionName,
            ciphertext: ciphertext,
            ciphertextCrc32c: {
                value: ciphertextCrc32c,
            },
        });
        if (!decryptResponse.verifiedCiphertextCrc32c) {
            throw new Error('AsymmetricDecrypt: request corrupted in-transit');
        }
        if (
            crc32c.calculate(decryptResponse.plaintext) !==
            Number(decryptResponse.plaintextCrc32c.value)
        ) {
            throw new Error('AsymmetricDecrypt: response corrupted in-transit');
        }
        return decryptResponse.plaintext.toString();
    }

    return decryptAsymmetric();
}

async function encrypt(plaintextBuffer) {
    async function encryptAsymmetric() {
        console.log(0)
        const [publicKey] = await client.getPublicKey({
            name: versionName,
        });
        console.log(1)
        if (publicKey.name !== versionName) {
            throw new Error('GetPublicKey: request corrupted in-transit');
        }
        if (crc32c.calculate(publicKey.pem) !== Number(publicKey.pemCrc32c.value)) {
            throw new Error('GetPublicKey: response corrupted in-transit');
        }
        const crypto = require('crypto');
        return crypto.publicEncrypt(
            {
                key: publicKey.pem,
                oaepHash: 'sha256'
            },
            plaintextBuffer
        );
    }

    return encryptAsymmetric();
}

module.exports.encrypt = encrypt;
module.exports.decrpyt = decrypt;
```

package.json

```
{
  "name": "backend",
  "version": "1.0.0",
  "description": "",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "Ebenezer Isaac",
  "license": "ISC",
  "dependencies": {
    "@google-cloud/kms": "^2.8.1",
    "dotenv": "^10.0.0",
    "express": "^4.17.1"
  },
  "devDependencies": {
    "constants": "0.0.2",
    "cors": "^2.8.5",
    "fast-crc32c": "^2.0.0"
  }
}
```

Screenshots:





12:20

Password Manager

Choose an account

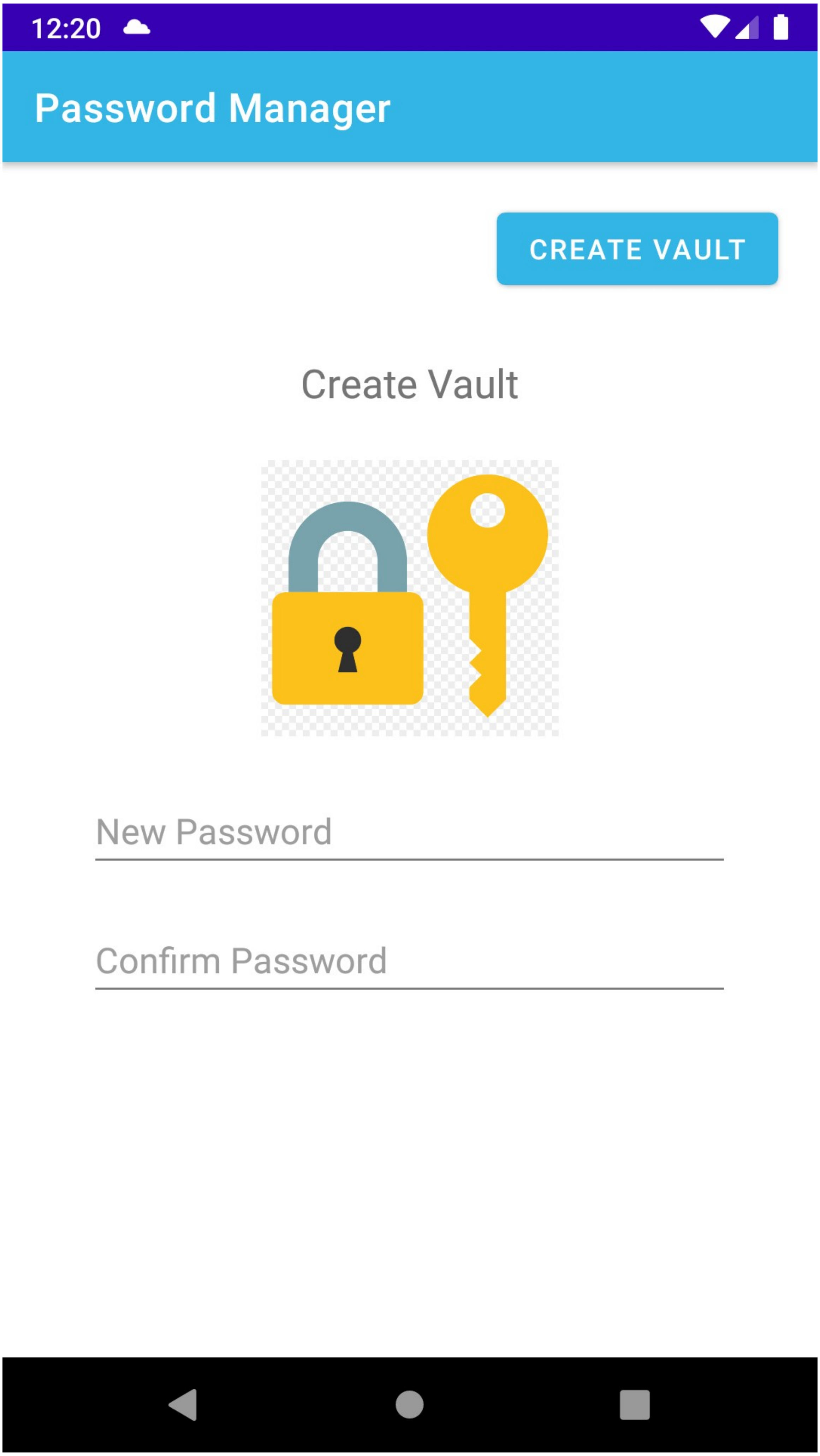
to continue to Password Manager

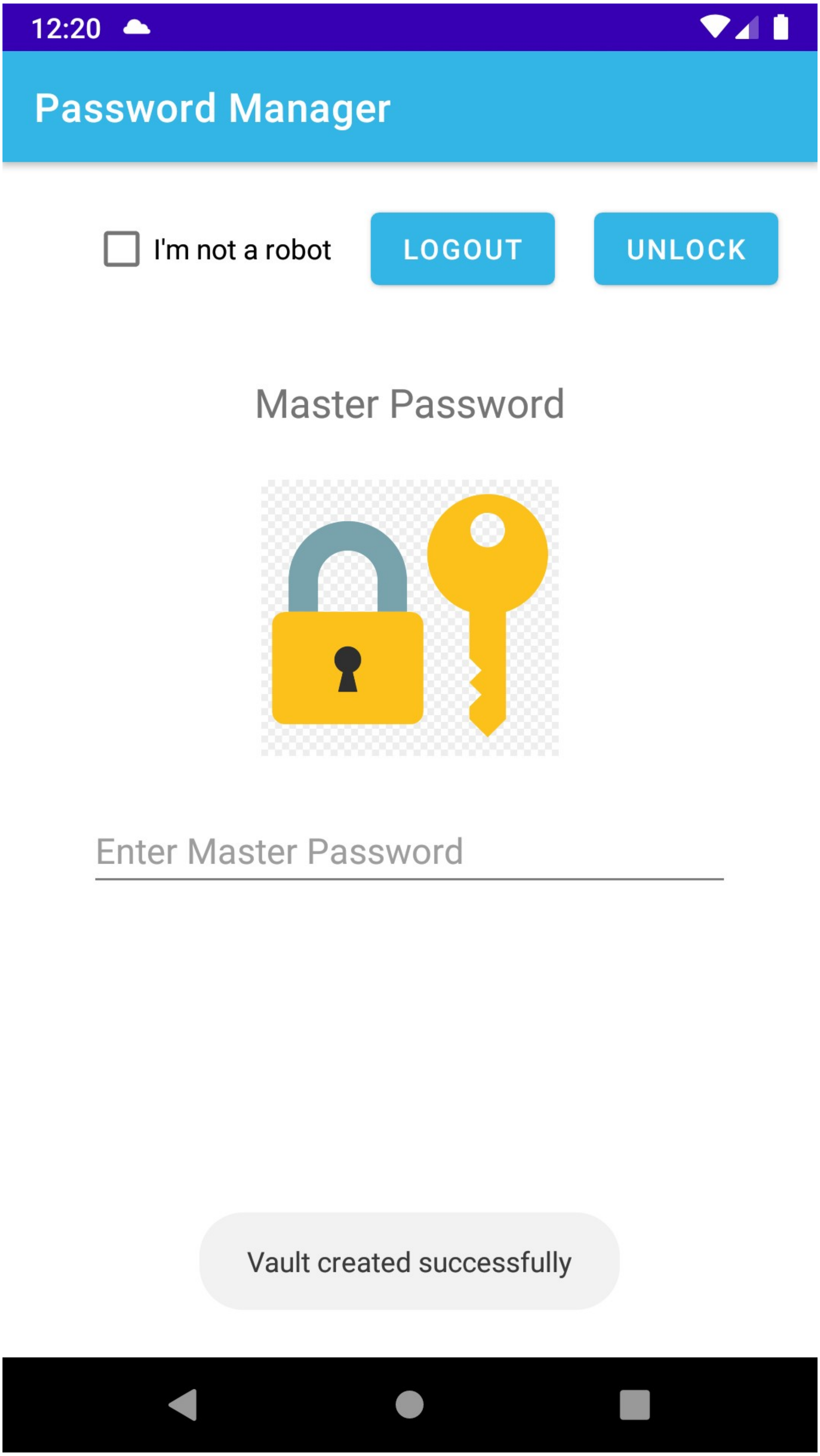
Ebenezer Isaac
ebenezerv99@gmail.com

Add another account

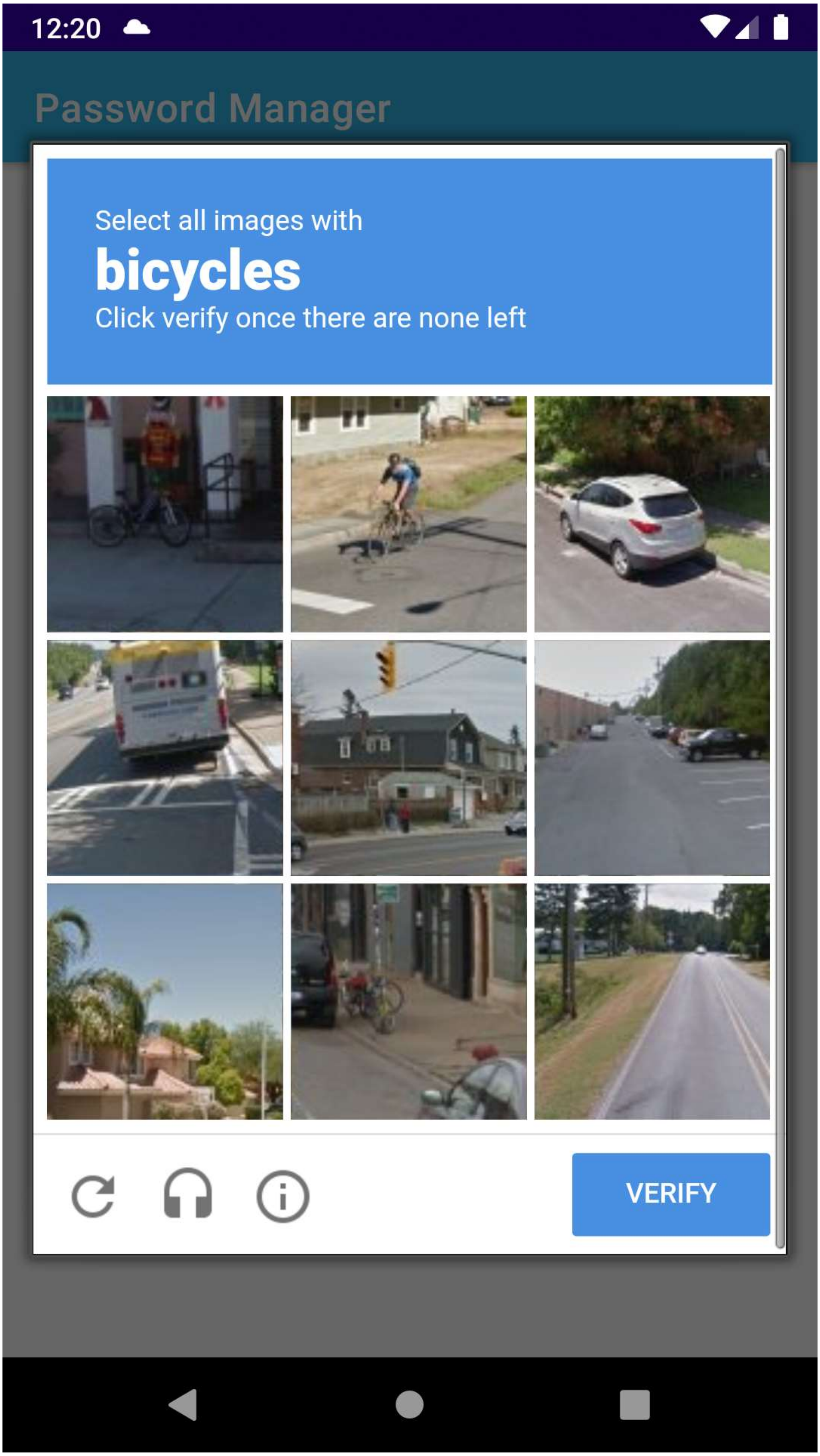
To continue, Google will share your name, email address, and profile picture with Password Manager. Before using this app, review its privacy policy and terms of service.

SIGN IN WITH GOOGLE


12:20
Password Manager
CREATE VAULT
Create Vault
New Password
Confirm Password



Vault created successfully



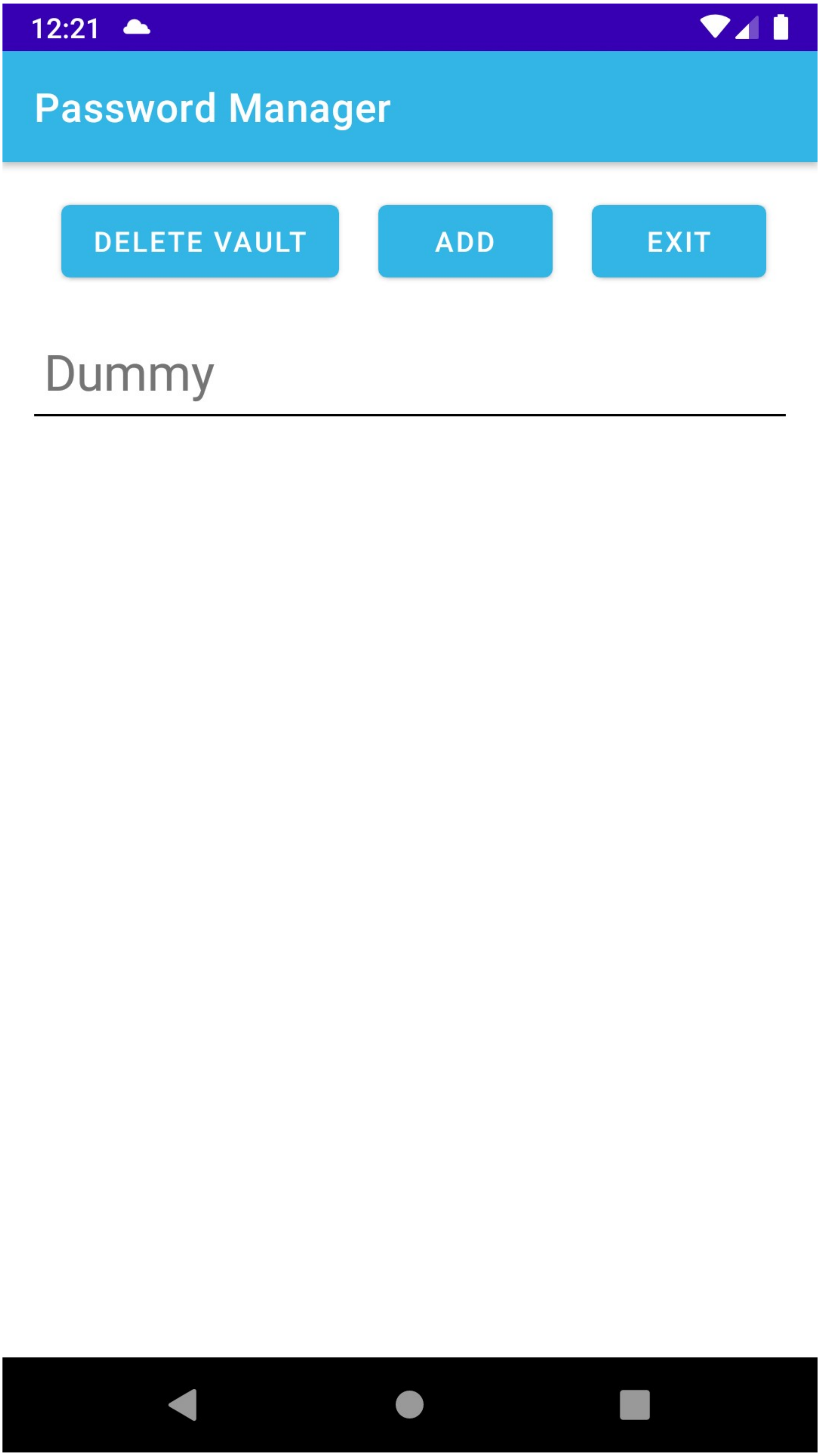
12:20

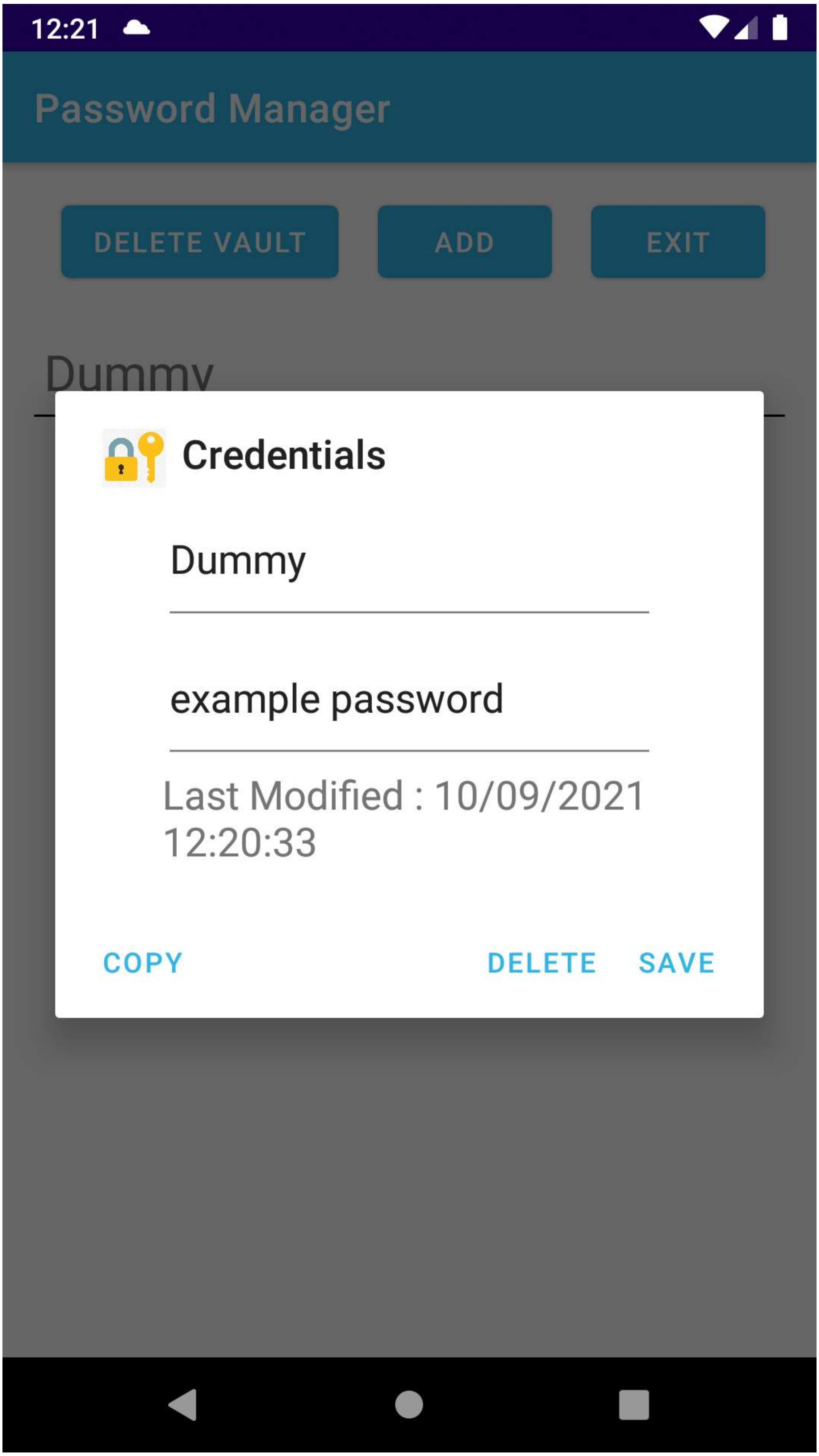
Password Manager

Select all images with

bicycles

Click verify once there are none left

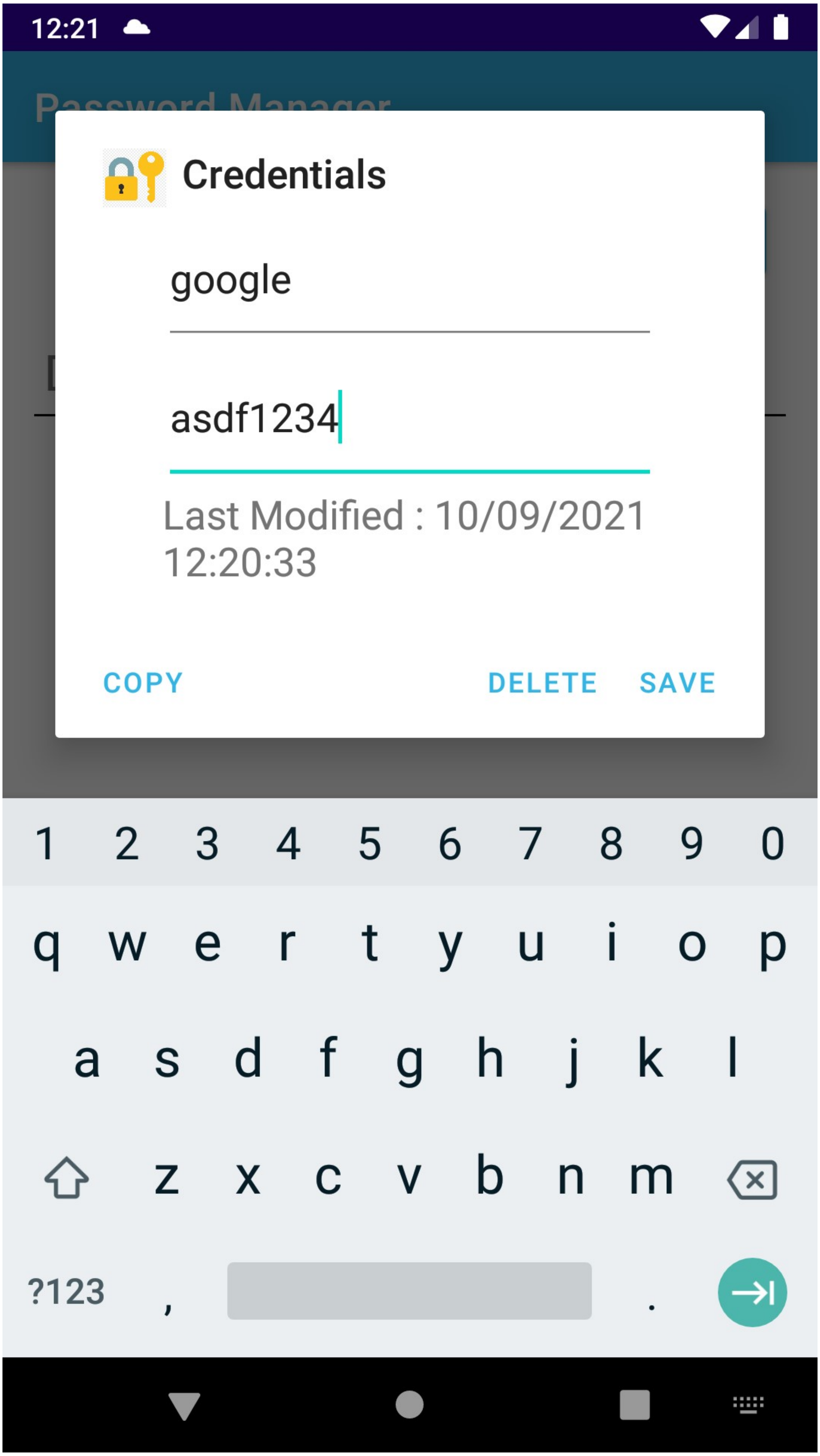

12:21
Password Manager
DELETE VAULT
ADD
EXIT
Dummy

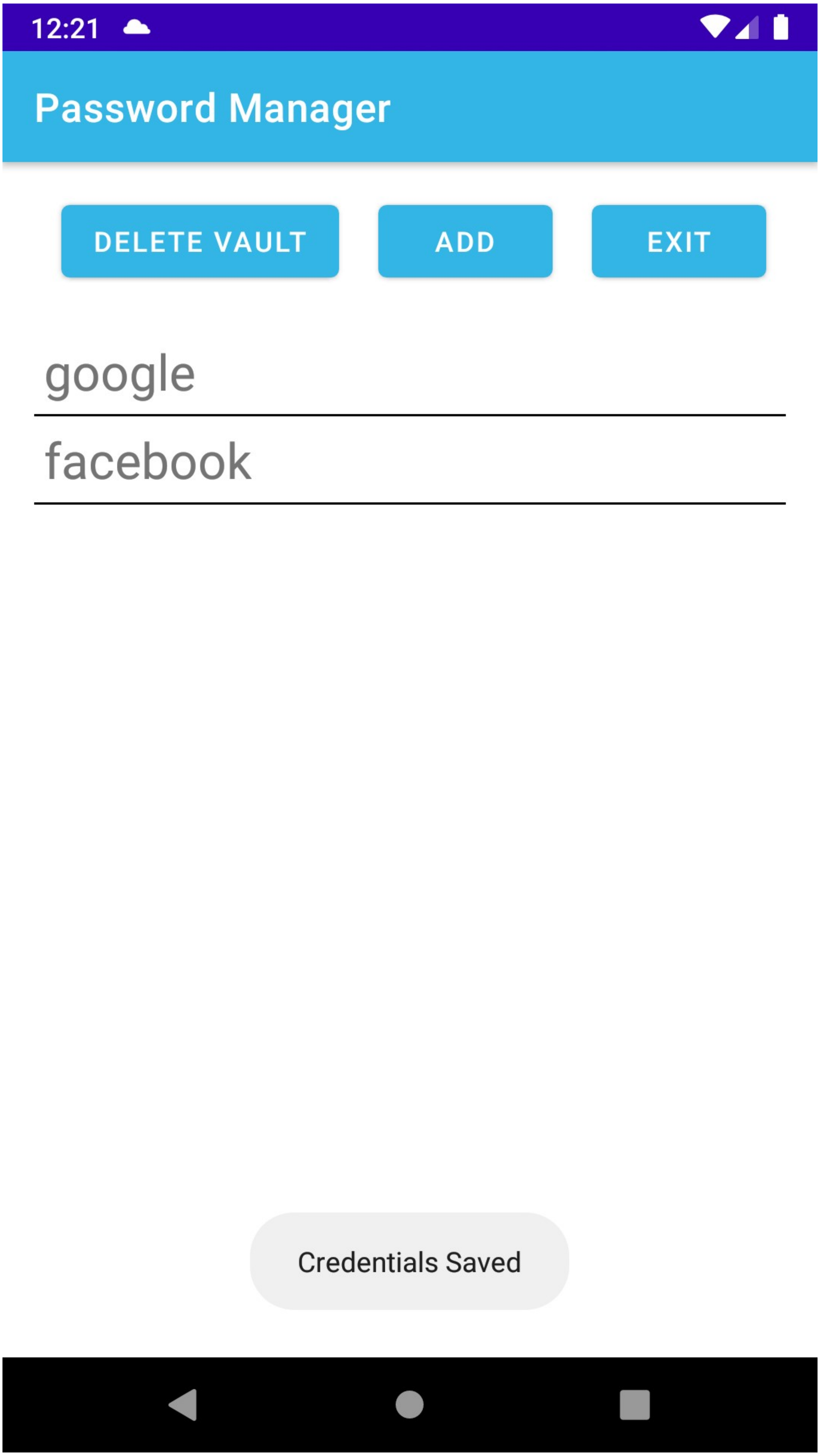


Dummy

example password

Last Modified : 10/09/2021 12:20:33


12:21
Password Manager
Credentials
google
asdf1234
Last Modified : 10/09/2021 12:20:33
COPY
DELETE
SAVE

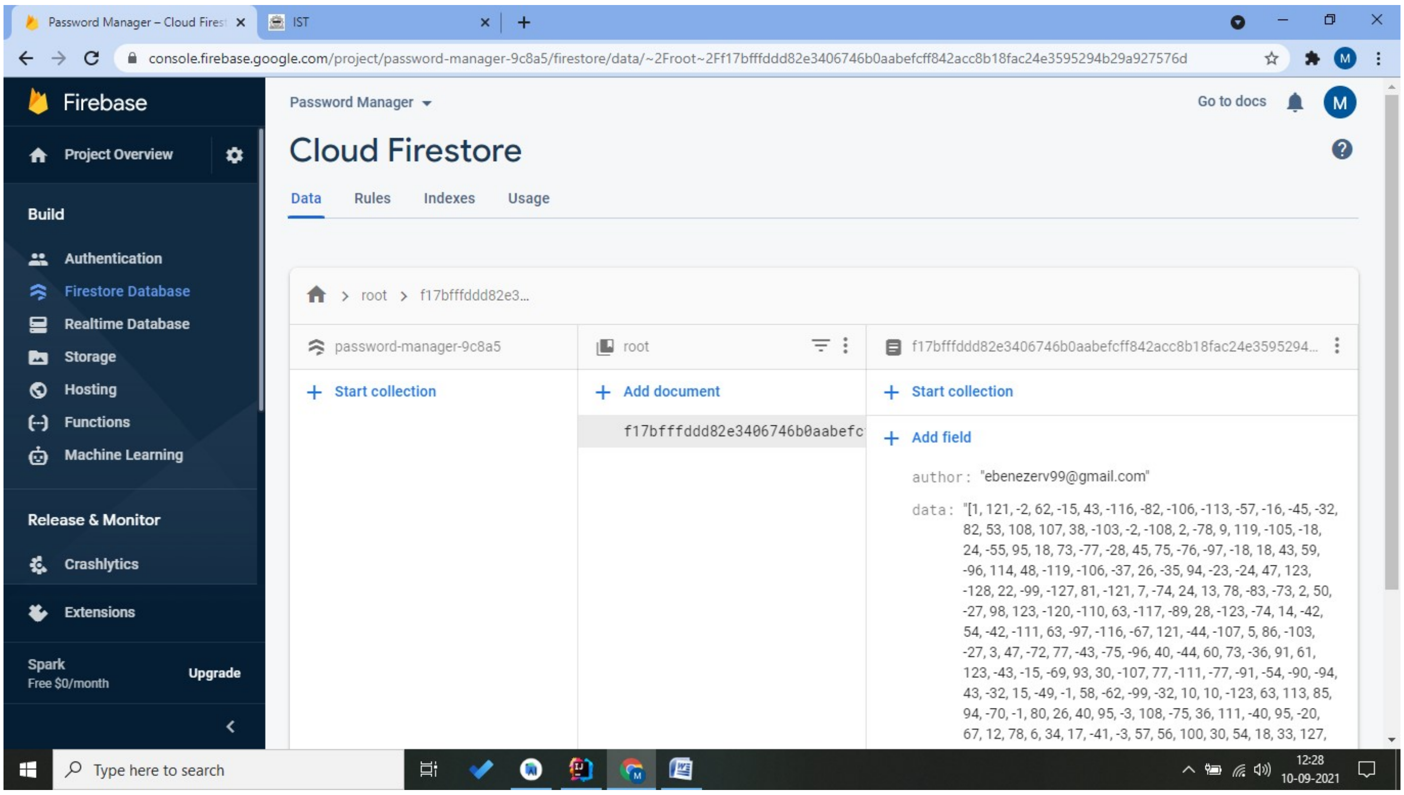


google

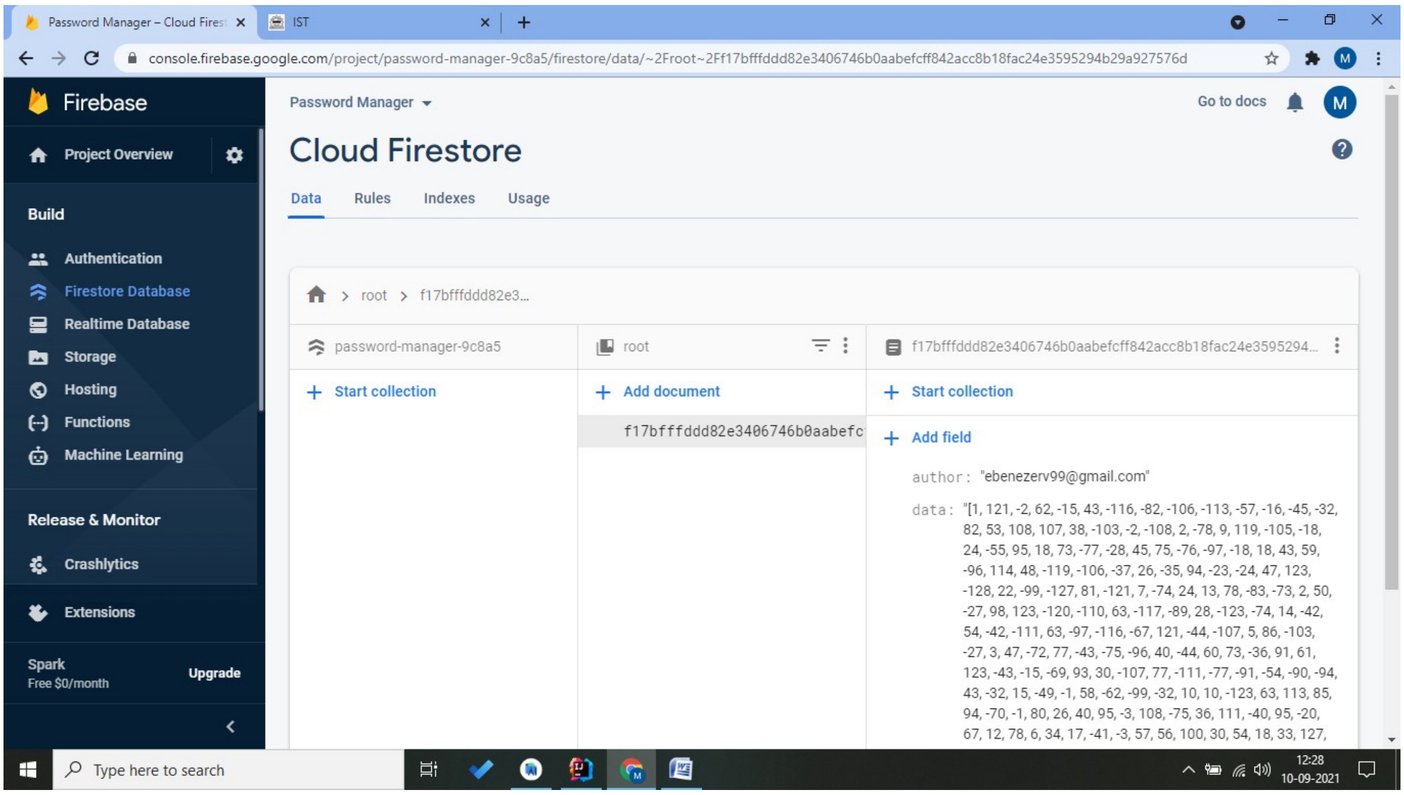
facebook

Credentials Saved

Firebase Console:



```
root
f17bfffddd82e3406746b0aabefc
f17bfffddd82e3406746b0aabefcff842acc8b18fac24e3595294...

author: "ebenezerv99@gmail.com"
data: "[1, 121, -2, 62, -15, 43, -116, -82, -106, -113, -57, -16, -45, -32,
      82, 53, 108, 107, 38, -103, -2, -108, 2, -78, 9, 119, -105, -18,
      24, -55, 95, 18, 73, -77, -28, 45, 75, -76, -97, -18, 18, 43, 59,
      -96, 114, 48, -119, -106, -37, 26, -35, 94, -23, -24, 47, 123,
      -128, 22, -99, -127, 81, -121, 7, -74, 24, 13, 78, -83, -73, 2, 50,
      -27, 98, 123, -120, -110, 63, -117, -89, 28, -123, -74, 14, -42,
      54, -42, -111, 63, -97, -116, -67, 121, -44, -107, 5, 86, -103,
      -27, 3, 47, -72, 77, -43, -75, -96, 40, -44, 60, 73, -36, 91, 61,
      123, -43, -15, -69, 93, 30, -107, 77, -111, -77, -91, -54, -90, -94,
      43, -32, 15, -49, -1, 58, -62, -99, -32, 10, 10, -123, 63, 113, 85,
      94, -70, -1, 80, 26, 40, 95, -3, 108, -75, 36, 111, -40, 95, -20,
      67, 12, 78, 6, 34, 17, -41, -3, 57, 56, 100, 30, 54, 18, 33, 127,
```



```
root
f17bfffddd82e3406746b0aabefc
f17bfffddd82e3406746b0aabefcff842acc8b18fac24e3595294...

author: "ebenezerv99@gmail.com"
data: "[1, 121, -2, 62, -15, 43, -116, -82, -106, -113, -57, -16, -45, -32,
      82, 53, 108, 107, 38, -103, -2, -108, 2, -78, 9, 119, -105, -18,
      24, -55, 95, 18, 73, -77, -28, 45, 75, -76, -97, -18, 18, 43, 59,
      -96, 114, 48, -119, -106, -37, 26, -35, 94, -23, -24, 47, 123,
      -128, 22, -99, -127, 81, -121, 7, -74, 24, 13, 78, -83, -73, 2, 50,
      -27, 98, 123, -120, -110, 63, -117, -89, 28, -123, -74, 14, -42,
      54, -42, -111, 63, -97, -116, -67, 121, -44, -107, 5, 86, -103,
      -27, 3, 47, -72, 77, -43, -75, -96, 40, -44, 60, 73, -36, 91, 61,
      123, -43, -15, -69, 93, 30, -107, 77, -111, -77, -91, -54, -90, -94,
      43, -32, 15, -49, -1, 58, -62, -99, -32, 10, 10, -123, 63, 113, 85,
      94, -70, -1, 80, 26, 40, 95, -3, 108, -75, 36, 111, -40, 95, -20,
      67, 12, 78, 6, 34, 17, -41, -3, 57, 56, 100, 30, 54, 18, 33, 127,
```