

A Framework for Cloud-Based EHR Security Using Hybrid Cryptographic Methods of AES and ECC

MSc Research Project

MSc Cybersecurity

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MSc Project Submission Sheet
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Configuration Manual

Vansh Arora
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1 Introduction

The purpose of the configuration guideline is to furnish a concise summary of the necessary prerequisites for constructing the application, while also serving as a guide for the systematic steps involved in its proper development, operation, testing, or replication. The remainder of the document is divided into five modules, with Module 2 focusing on system configuration, Module 3 outlining the required libraries, Module 4 discussing database tables, Module 5 addressing Electronic Health Record implementation, and Module 6 covering Cloud Deployment.

2 Configuration of System

2.1 ASP .Net Environment Setup

The entire application was coded using the C# language and developed on the Visual Studio platform. The Visual Studio platform can be downloaded and set up for free from the Microsoft website, making it a desirable choice due to its compatibility with various platforms and ability to support several programming languages. For this project, Visual Studio Community 2019 (version 16.11) was the preferred text editor.

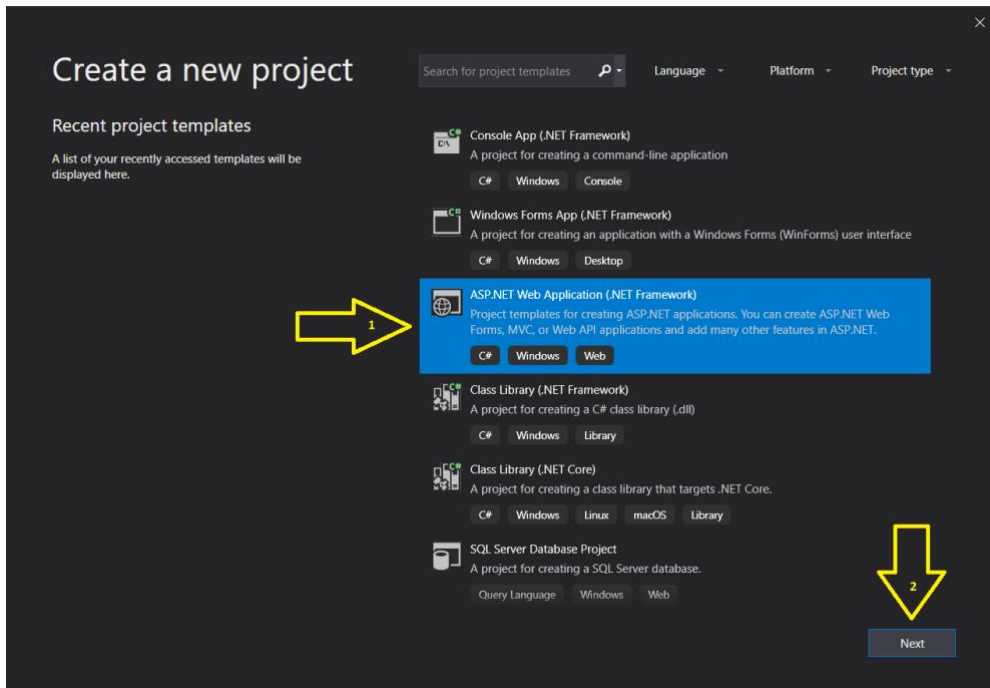


Figure 1: Download page of Visual Studio

2.2 Database Server Setup

The project employs Microsoft SQL database to store application data, which enables us to connect to both local and cloud data storage. The version of Microsoft SQL Management Studio utilized in the project is 19.0.2. To access the database, the user must provide authentication credentials. Open-source versions of the SQL Management tool can be obtained online at no cost.

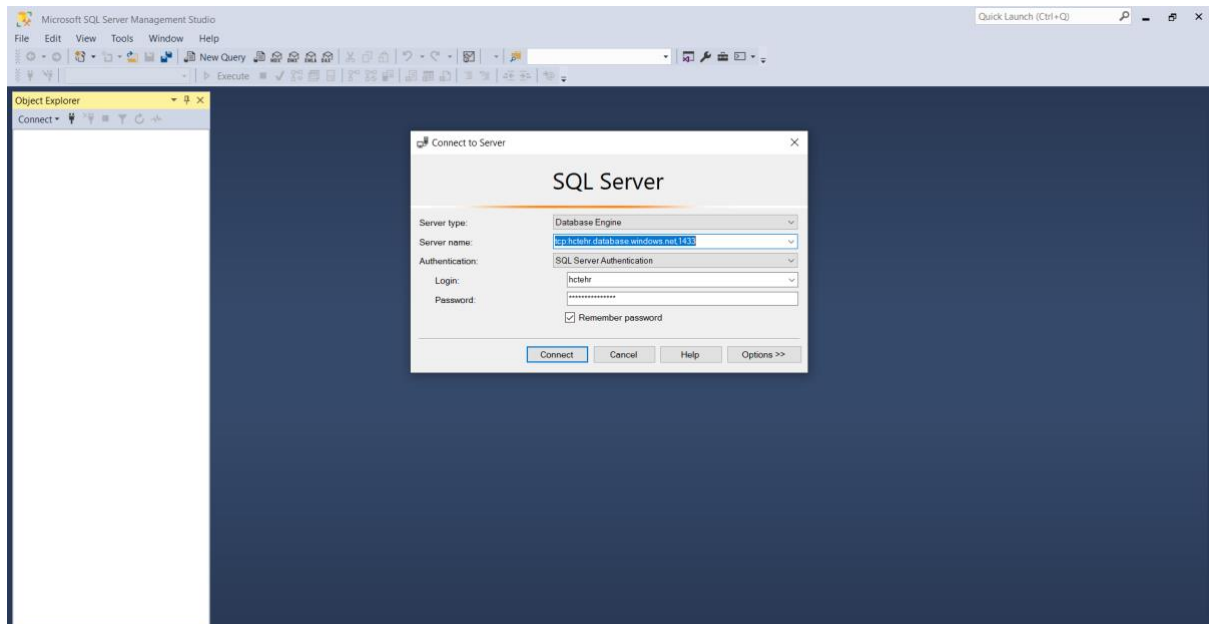


Figure 2: Microsoft SQL Management

2.3 Hardware specifications

- RAM: 8 GB
- Processor: Intel Core i5
- Hard Disk Drive: 20 GB HDD

2.4 Software specifications

- OS Used: Microsoft Windows 10
- Language: C# .Net
- IDE used: Visual Studio Code

3 Libraries Used

The web application was developed using various libraries and import statements, which are highlighted in the list below as the primary ones.

```

1  using System;
2  using System.Collections.Generic;
3  using System.Configuration;
4  using System.Data;
5  using System.Data.SqlClient;
6  using System.IO;
7  using System.Linq;
8  using System.Net.Mail;
9  using System.Security.Cryptography;
10 using System.Text;
11 using System.Web;
12 using System.Web.UI;
13 using System.Web.UI.WebControls;
14

```

Figure 3: Imported Libraries

```

1  using System;
2  using System.Collections.Generic;
3  using System.Configuration;
4  using System.Data;
5  using System.Data.SqlClient;
6  using System.Diagnostics;
7  using System.IO;
8  using System.Linq;
9  using System.Net.Mail;
10 using System.Security.Cryptography;
11 using System.Text;
12 using System.Web;
13 using System.Web.UI;
14 using System.Web.UI.WebControls;
15

```

Figure 4: Imported Libraries

4 Database Tables Used

	Id	Full_Name	Degree	Specialist	Email	Phone	Password	Address
1	3	Pravin Patel	M.B.B.S	Heart, Diabities	pp62@gmail.com	8657482459	9Qm1kEVx	North Delhi
2	2	Sunil Dixit	M.B.B.S	Heart	sunil1971@gmail.com	9878856932	DOIY1Vsc	East Delhi
3	4	Gautam Kapoor	ME	HEart	spsahab97@gmail.com	8028989796	AOxljvBm	South Delhi
4	5	Rajat Dua	MBBS	Spec	dua100rajat@gmail.com	9293322122	123456	West Delhi

Figure 5: Doctor Table

Patient_Id	Doc_Id	Full_Name	Password	Contact_no	Email_id	Address	Description	Remark	Date
1	3	Vansh Arora	Wd8mUU15	9227986929	vanshsir202...	Delhi	Diabetes Su...	Blood Repo...	2023-04-12
2	4	Poonam Ar...	lI3qURoa	9989823997	poonam877...	Delhi	Flu	Bed Rest	2023-03-24
3	2	Praveen Aro...	PpaaVgYf	9479224154	p.arora@g...	Delhi	Fever and c...	Blood Repo...	2023-03-26
4	3	Kunal Arora	qaeMqcNe	8560021057	kunalmiki@...	Delhi	Covid	Test	2023-03-20
5	5	Kanika Arora	tKubluDj	9097765213	kanikashinu...	Delhi	Blood Press...	Balanced Di...	2023-03-22
6	4	Palak Pahwa	zvPITh8H	9988776600	palakkanu@...	Delhi	Full body ch...	Heart Patient	2023-03-29
**	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Figure 6: Patient Table

Id	Date	File_Name	File_Path	Patient_Id	Description	doc_id	File_enc	Key_Value
1	2023-03-29	pswanvna-83years.pdf	C:\Medical\MedicalWeb\MedicalWeb\Doctor\Fiearjwalam...	2	sample test	4	C:\Medical\MedicalWeb\MedicalWeb\Doctor\Fiearjwalam...	402g3p7D70d7Pc-2P9k6Cdl-QyehE-Hu6C-79kX931+
2	2023-03-29	TMCC_bank_details.pdf	C:\Medical\MedicalWeb\MedicalWeb\Doctor\Fiearjwalam...	6	Blood report	4	C:\Medical\MedicalWeb\MedicalWeb\Doctor\Fiearjwalam...	US6HfH6a-1z68M6rMaeedCdq7+uQMSX1VwKevA+
3	2023-04-17	Free_Test_Data_1MB_DOCX-1.docx.doc	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	word file docx	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	+H1kRk7RRRAXFwKJUA9E1s94kaMazy02gju+
4	2023-04-17	word 1.doc	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	word file 1	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	c3u0kAZ3v0w077182D2WvncC0K2m0iQh8+
5	2023-04-17	Free_Test_Data_1MB_PDF-2.pdf	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	pdf file	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	Xp9p9JALJTR1U6P4N193R831W6h6u6a6u6u6u6+
6	2023-04-17	Free_Test_Data_1MB_PPTX.pptx.ppt	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	ppt	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	vg3+e5LDqo+u52JmH4M8M1R92Qd4Y1v6RyW6W6+
7	2023-04-17	Free_Test_Data_1MB_XLS.xls	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	xls file	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	u1mB30z0k0WdYJN3JpF1NDD0m1e1F6S1o3zG+
8	2023-04-17	png-1mb.png	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	png	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	n07Jgu76aM4wepqGd41w3aZHM8M8W04042Q+
9	2023-04-17	word2.doc	F:\EHRTMedicalWeb_AES_ECCMedicalWeb\Doctor\Fiear...	1	word doc	3	F:\EHRTMedicalWeb_AES_ECCMedicalWeb\Doctor\Fiear...	VOR1v7G90k89g9u00K0K8w1W000u1P01yq8T+
10	2023-04-17	Free_Test_Data_1MB_IPG-2.jpg	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	jpg file	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	OCN9uALQ1+em03W6u6K6A7J9d9F6d5y9dMCA+
11	2023-04-17	ppfile.pdf	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	1	pdf file	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	Z4uJ8T1TGFH9k0u6FuF6J30TVMYQ9uYD+
12	2023-04-17	1.19.pdf	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	4	pdf 1.19 mb	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	e4NRRAJUT81AN6Jw+RQU1Qv9u1M4z0nN402qk6+
13	2023-04-18	17.9.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	17.9mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	P+49C3Z4805+OozwB3P+eRLLuZwLwW0u1B+
14	2023-04-18	10.7.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	10.7mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	8u4G0zampYTL6p9BMap1J4H0KwC0V0R4U7H+
15	2023-04-18	7.14.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	7.14mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	8k19E03kEewpFVQZ8w+3E3Ck3aA6z0k9KLA+
16	2023-04-18	7.13.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	7.13mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	8M6D1MwQ2t6C0kG0TGP1U1Xkw1L6pDuB0+
17	2023-04-19	sample-2mb-test-file.txt	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	1mb.txt	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	CvWteeh71m1uU0k0JLwVBE3eBZ+ApXz0B+
18	2023-04-19	3.57.pdf	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	4	3.57 mb	3	F:\new_sessionnew_session\MedicalWeb_AES_ECCMedi...	8qz4WpF908em1H4pFD929K8J0y0B90jag7+
19	2023-04-18	28.5.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	28.5mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	76uMFW1u02FVH6C1L1L31uH+HALSHW8B+
20	2023-04-18	21.4.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	21.4mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	Q09R8yqE3Xw1m44Q2L0D3A515KCFZ3hempLm+
21	2023-04-18	24.6.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	24.6mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	+4vZw+W4WFW9p+eRv18z9pQwRC0p6B43w+
22	2023-04-18	1mb.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	1mb.pdf	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	04E0T1Q1o77h0YbcaE9q7wApQeTouVh8B+
23	2023-04-18	7.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	7.13mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	U44d4EJ6N0ak0zpfAE08T7uF8LrL21u4u0+
24	2023-04-18	17.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	17.9mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	QLRRZw6A4puck43k6w161T70E8E+va4d+
25	2023-04-18	28.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	27.1mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	00W0YqYq9L8D0LTPFH3HmAgTRFKH+fg+
26	2023-04-18	25.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	25mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	8E0DwGm12G12m1u4E8E8R4L3e32K00uA8B+
27	2023-04-18	28.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	24mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	058pPw6Wk.B9p7Q6z04R826Dm0J0p7p4h1C1+
28	2023-04-18	24.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	24mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	X0v0v1y+u01u0v0v0v0v0v0v0v0v0v0v0v0v0+
29	2023-04-18	1.18.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	1.18mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	82uJ0w3pQZw0wmu1KKEE3kH648m1U1yH8+
30	2023-04-18	26.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	4	24.6mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	X0xg6uLzP2P8Fm+246z4E8W66L1Jw4J3T+
31	2023-04-18	3.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	3.57mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	Gh5d4h1zQ9R0T4L020z7u6D4dWkac77P7Y78+
32	2023-04-18	10.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	10.7mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	7F8461PTJpR0D1y65D0w9RmKum1Wagw+
33	2023-04-18	21.pdf	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	1	20.3mb	3	F:\MedicalWeb\EHRTMedicalWeb_AES_ECCMedicalWeb...	c70b61qDw4Lh6a3C3vD3d14R6v0w6QpQe+

Figure 7: File Upload Table

5 Implementation of Electronic Health Record

The screenshot shows a web browser window with the URL localhost:57713/Signup.aspx. The page title is 'Medical'. The main content is a 'Sign up' form with the following fields:

- Name:
- Degree:
- Email:
- Mobile No:
- Password:
- Confirm Password:
- Address:
- Specialist In:

At the bottom of the form, there are two buttons: 'Sign up' and 'Already Registered? Login Here'.

Figure 8: Signup Page

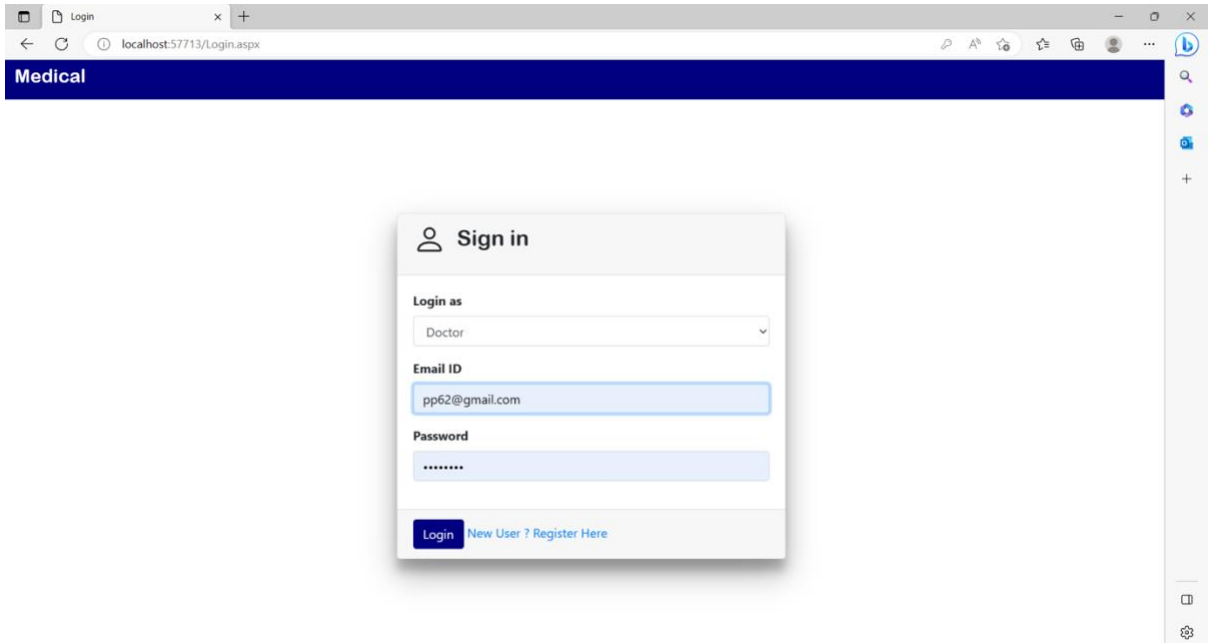


Figure 9: Doctors/Patient Login Page

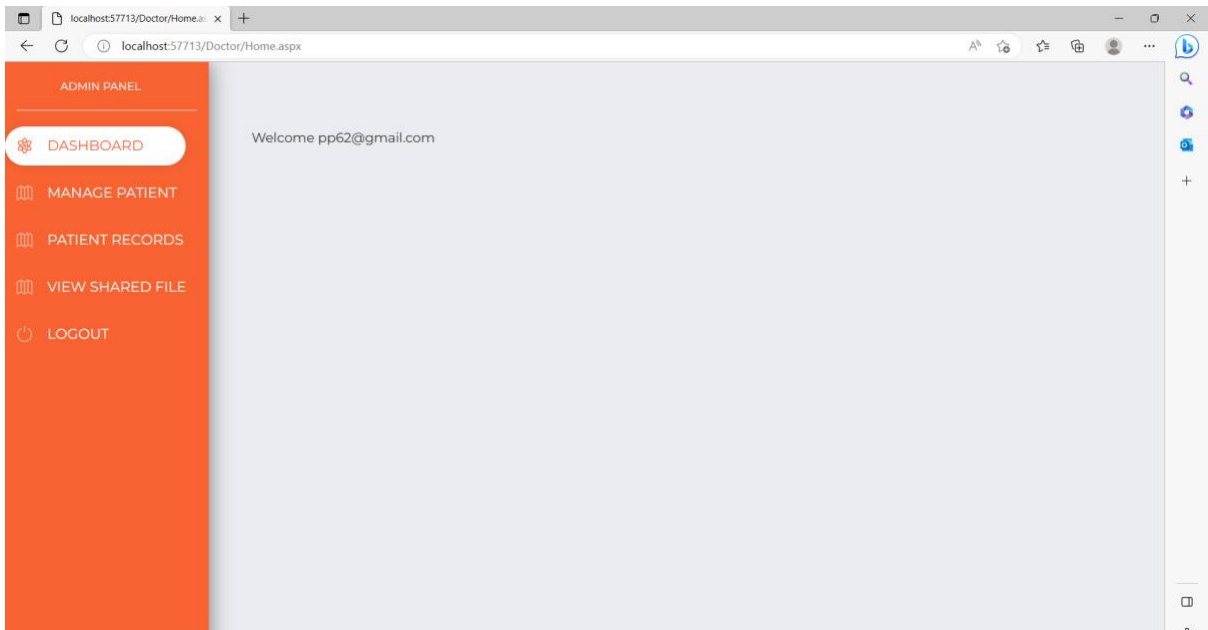


Figure 10: Doctor Dashboard

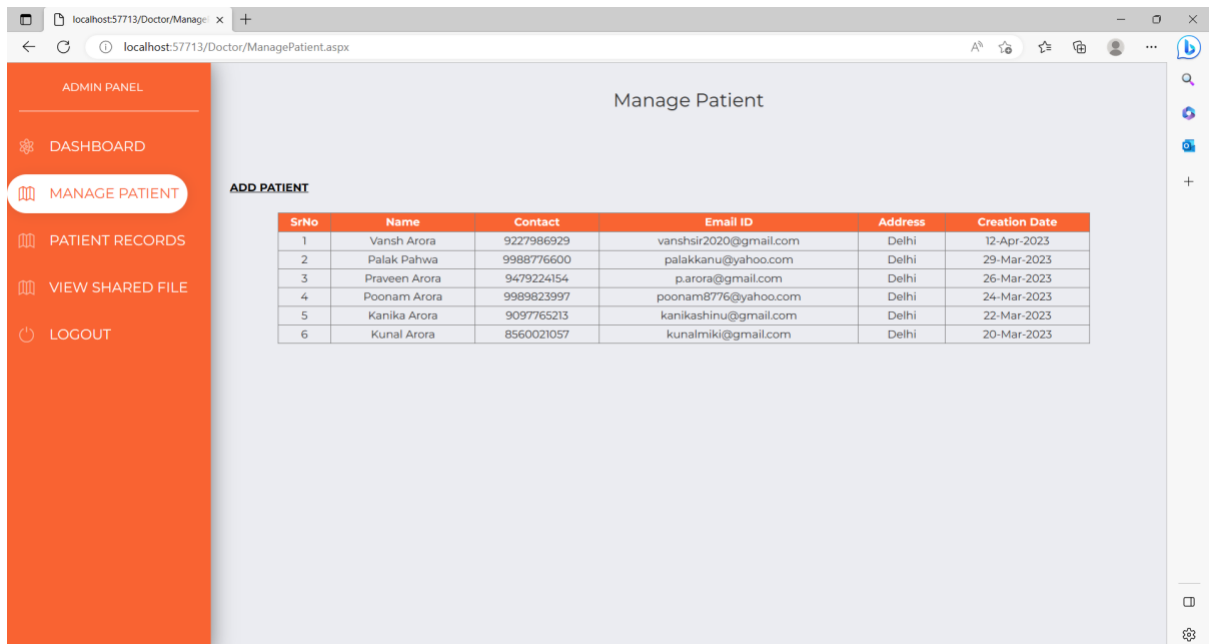


Figure 11: Manage Patient

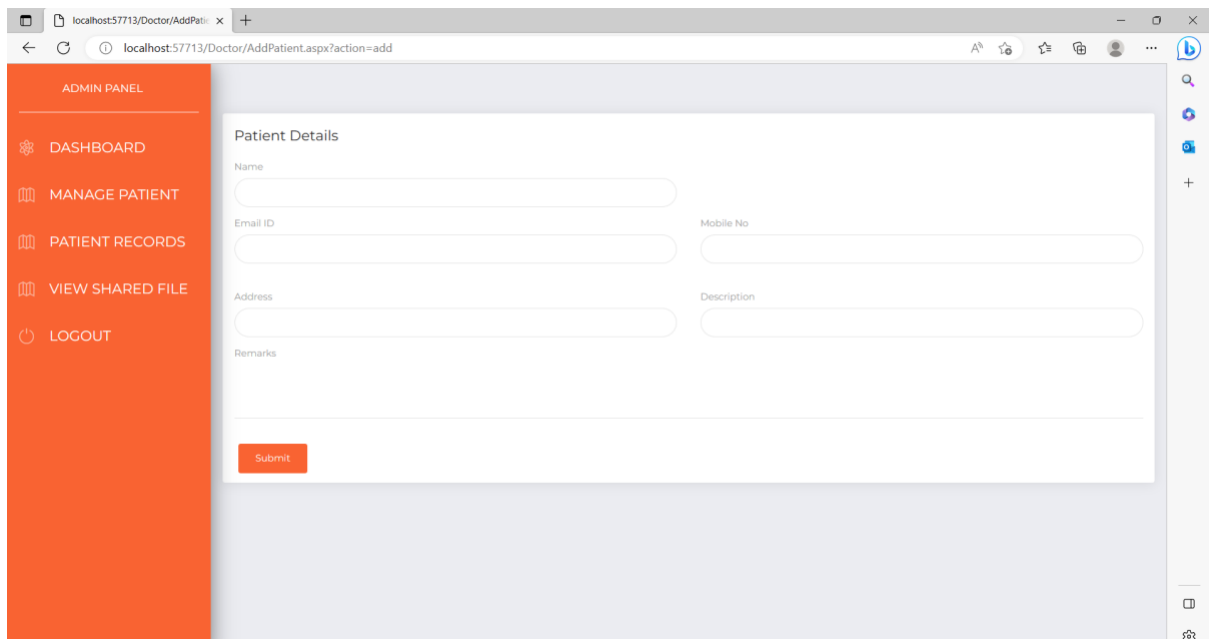


Figure 12: Add patient details

ADMIN PANEL

- DASHBOARD
- MANAGE PATIENT
- PATIENT RECORDS**
- VIEW SHARED FILE
- LOGOUT

Manage Patient Records

UPLOAD FILE

SrNo	Patient	File Name	Description	Creation Date
1	Vansh Arora	word2.doc		19-Apr-2023
2	Vansh Arora	sample-2mb-text-file.txt	1mb txt	19-Apr-2023
3	Vansh Arora	26.pdf	24.6mb	18-Apr-2023
4	Vansh Arora	28.pdf	27.1mb	18-Apr-2023
5	Vansh Arora	21.pdf	20.3mb	18-Apr-2023
6	Vansh Arora	17.pdf	17.9mb	18-Apr-2023
7	Vansh Arora	10.pdf	10.7mb	18-Apr-2023
8	Vansh Arora	7.pdf	7.13mb	18-Apr-2023
9	Vansh Arora	3.pdf	3.57mb	18-Apr-2023
10	Vansh Arora	1mb.pdf		18-Apr-2023
11	Kunal Arora	1.18.pdf		18-Apr-2023
12	Kunal Arora	24.pdf	24mb	18-Apr-2023
13	Kunal Arora	24.6.pdf	24.6mb	18-Apr-2023
14	Kunal Arora	7.13.pdf	7.13mb	18-Apr-2023
15	Kunal Arora	7.14.pdf		18-Apr-2023
16	Kunal Arora	10.7.pdf	10.7mb	18-Apr-2023
17	Kunal Arora	17.8.pdf	17.8mb	18-Apr-2023
18	Kunal Arora	21.4.pdf	21.4mb	18-Apr-2023
19	Kunal Arora	28.6.pdf		18-Apr-2023
20	Kunal Arora	25.pdf	25mb	18-Apr-2023
21	Kunal Arora	28.5.pdf		18-Apr-2023
22	Kunal Arora	3.57.pdf	3.57 mb	17-Apr-2023
23	Kunal Arora	1.18.pdf	pdf 1.18 mb	17-Apr-2023

Figure 13: Patient records file

ADMIN PANEL

- DASHBOARD
- MANAGE PATIENT
- PATIENT RECORDS
- VIEW SHARED FILE
- LOGOUT

Patient Details

Patient:

Remarks:

No file chosen

Figure 14: Doctor uploads patient file

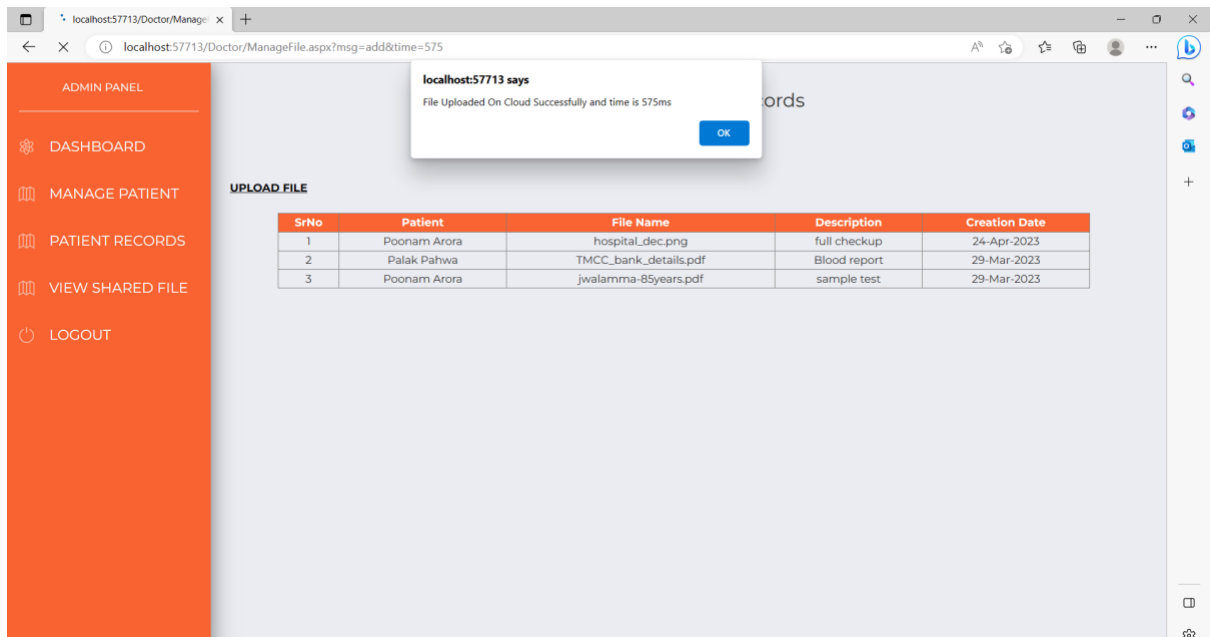


Figure 15: Time taken in file uploading

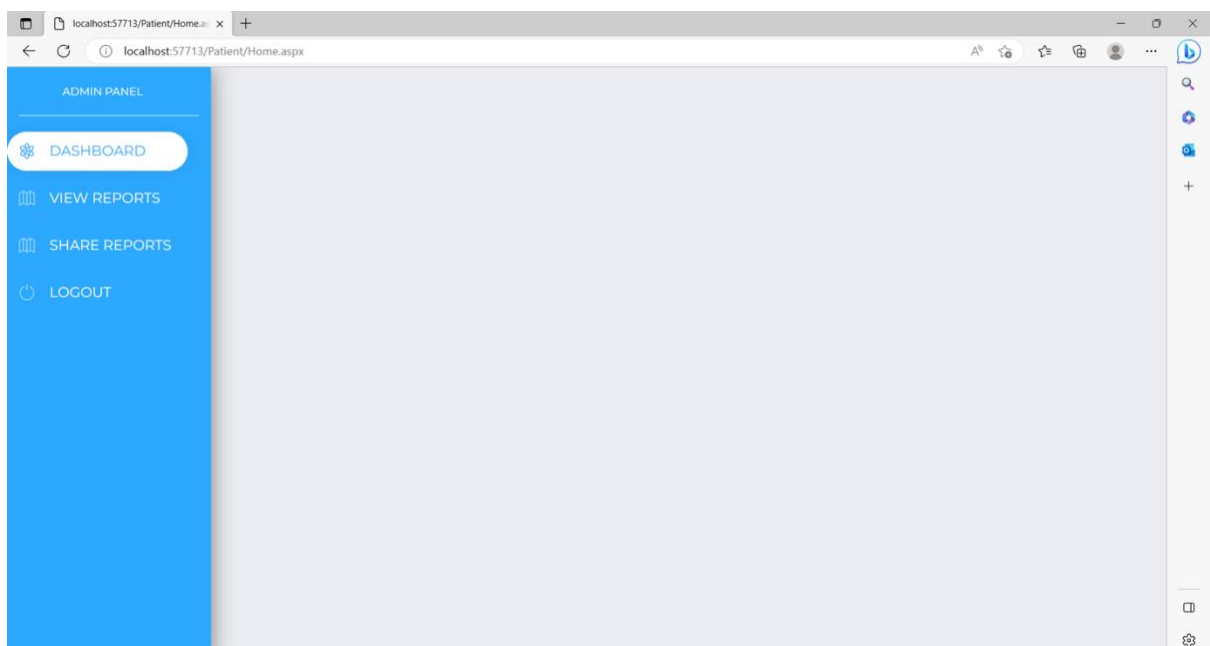


Figure 16: Patient Dashboard

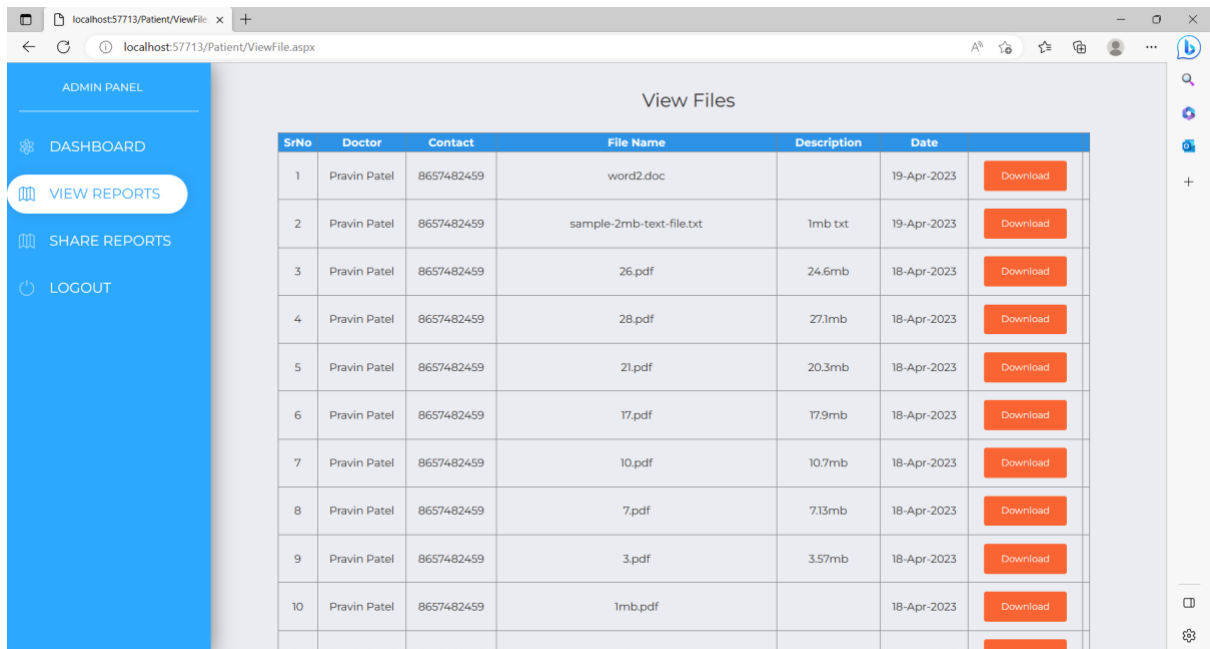


Figure 17: View reports of patient uploaded by doctor

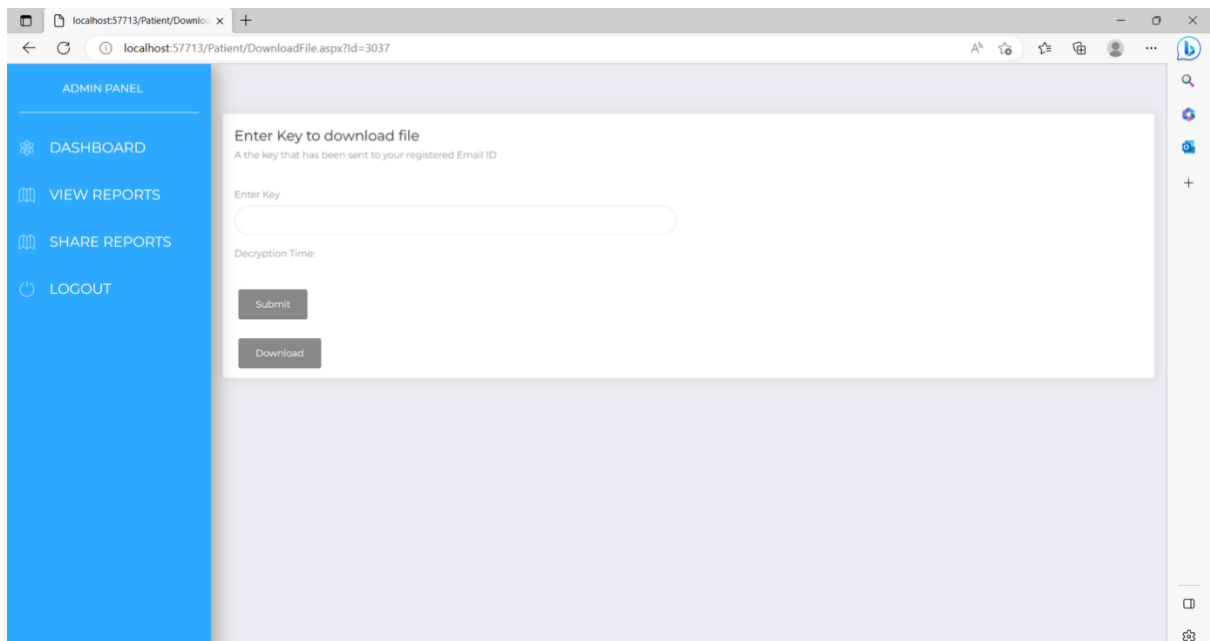


Figure 18: Enter Key for file downloading

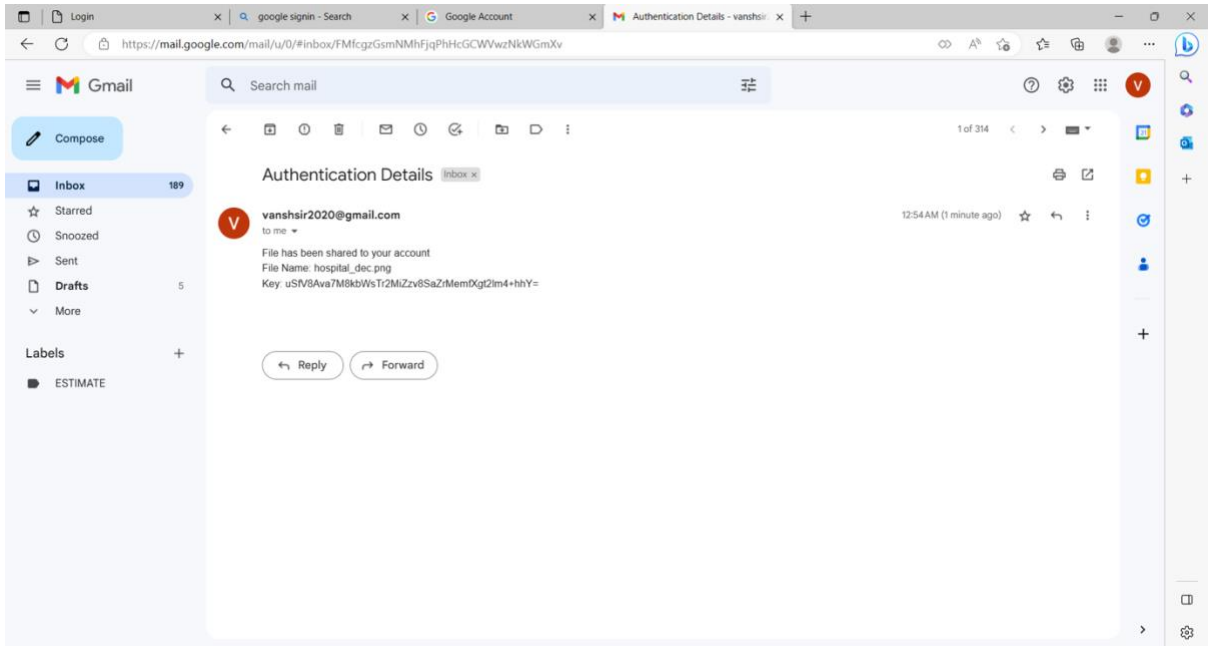


Figure 19: Key received in email immediately after uploading the patient file by doctor

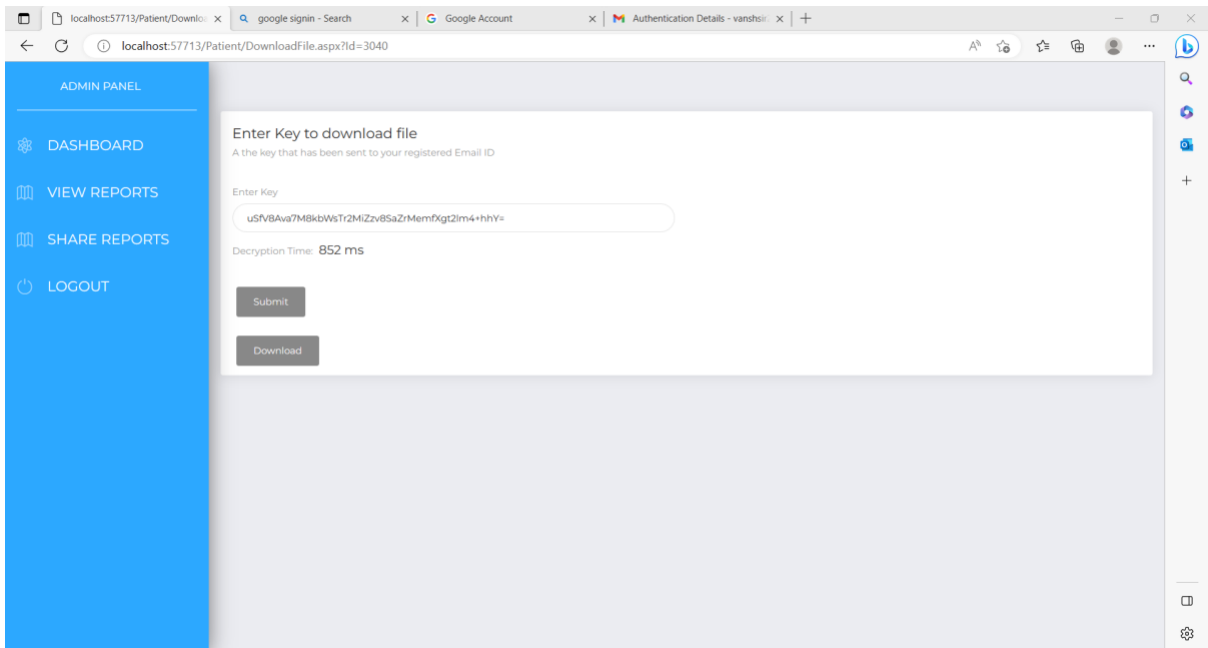


Figure 20: File downloading and Calculating the time for decryption

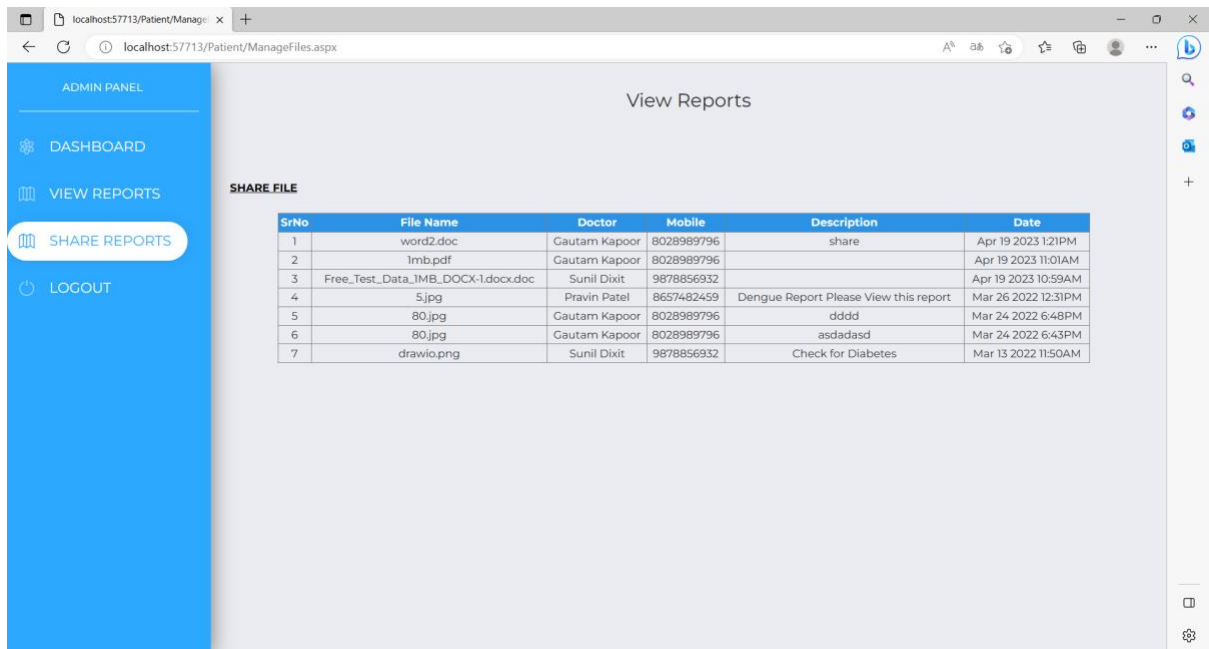


Figure 21: Patient share reports by other doctors

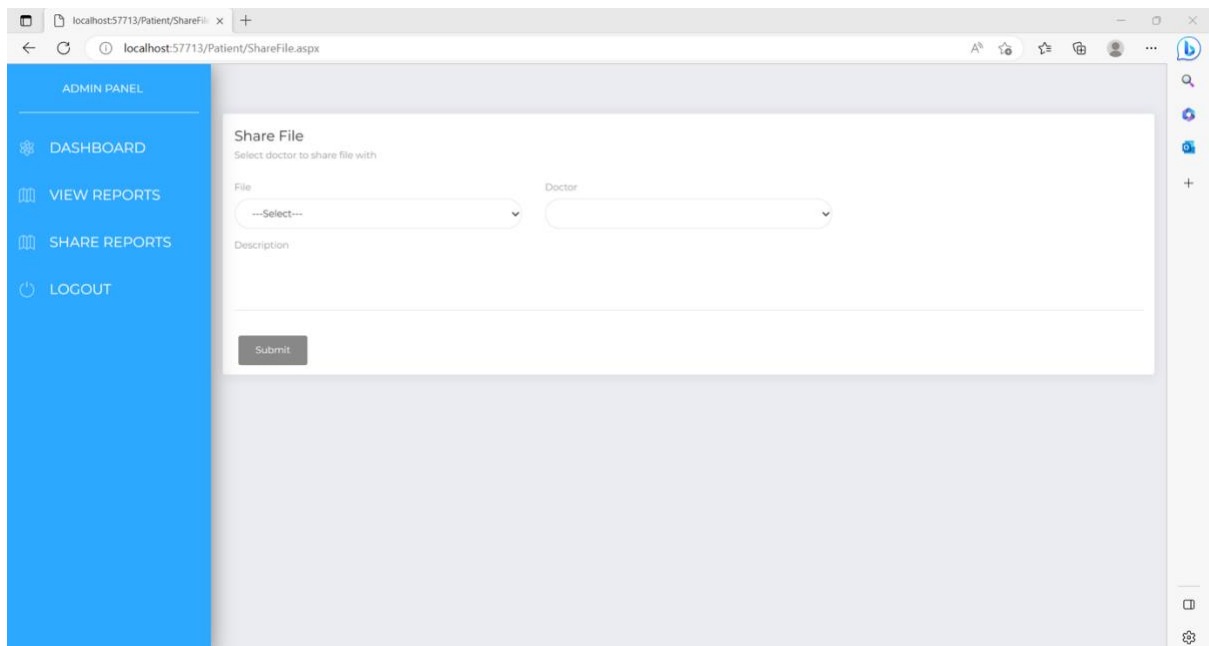


Figure 22: Choose file and doctor for sharing reports

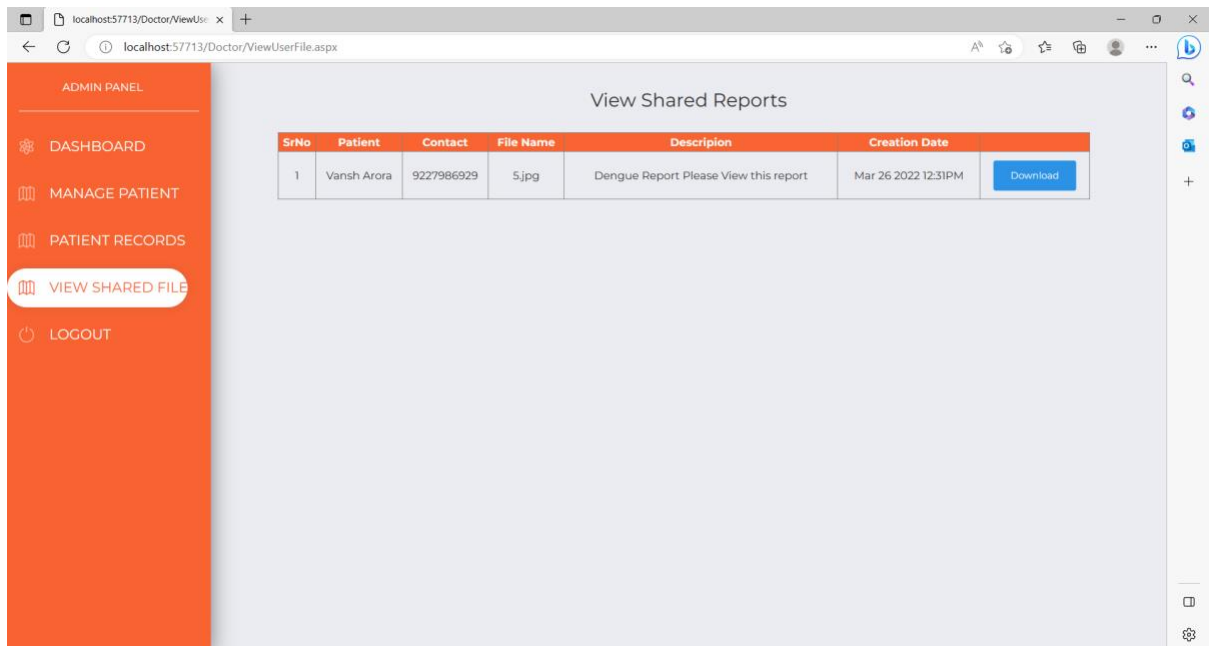


Figure 23: File shared by patient to other doctor

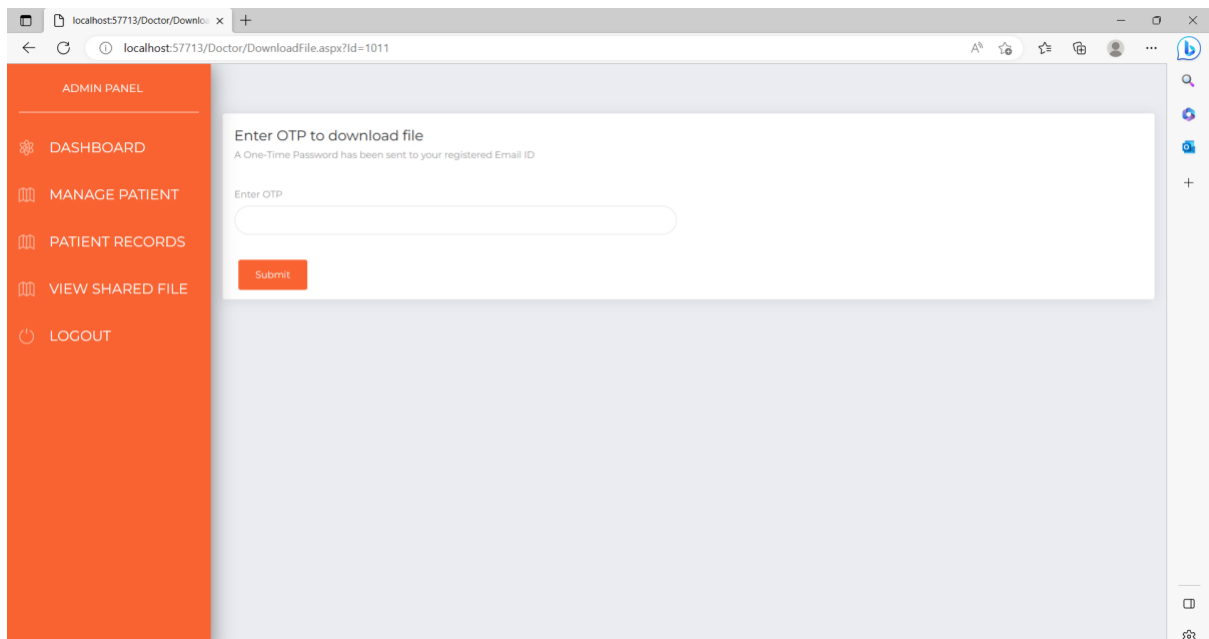



Figure 24: Authentication for downloading the share report

 File Access details
To: spsahab97@gmail.com

File name: word 1.doc
Otp:QyZzLt

Figure 25: OTP received on shared doctor registered email ID

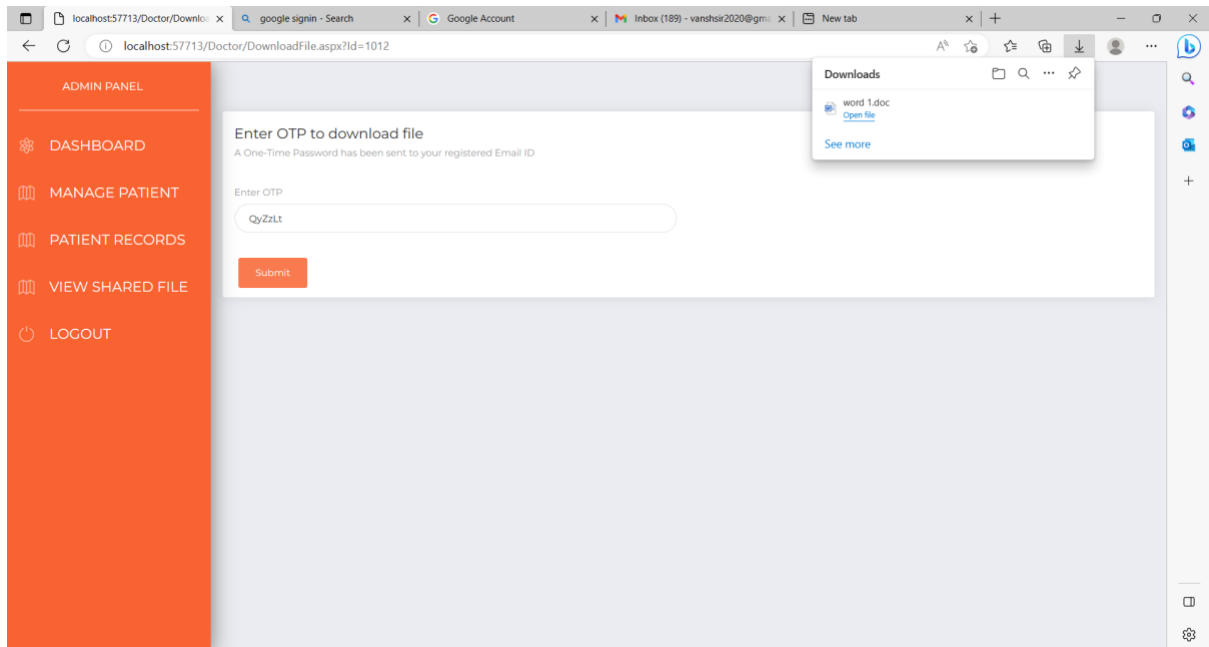


Figure 26: File downloaded after submit the correct OTP

6 Cloud Deployment

6.1 New Application Creation

The complete application is deployed on the cloud, utilizing the Windows Azure cloud service, which supports public cloud-based services and can be developed in multiple programming languages. To develop a new application in the Azure cloud, the user must first log in to the cloud environment and then select the App service. After the application is created, a cloud access URL is issued for the program.

6.2 Create Cloud Database

The Azure Cloud provides an option to create a database, as shown in the screenshot below. However, the database connection details may differ when using the cloud platform.

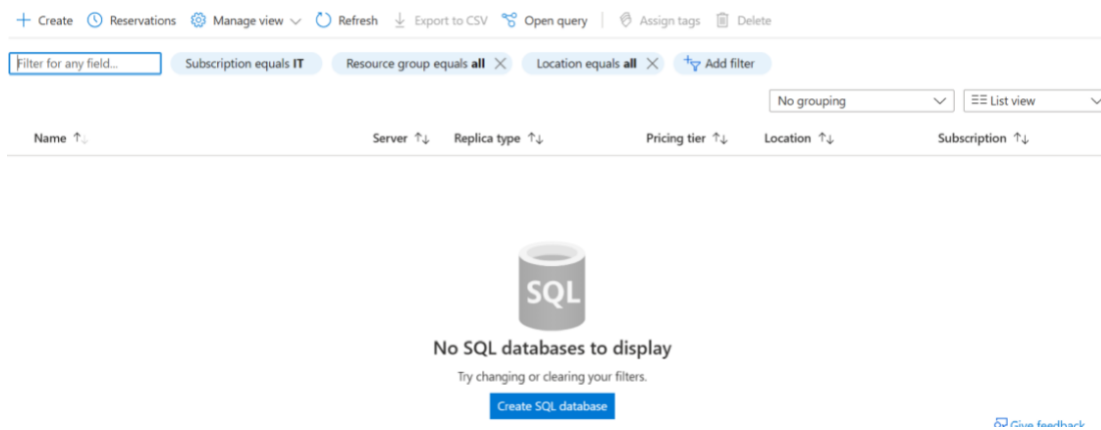


Figure 27: Create Cloud Database

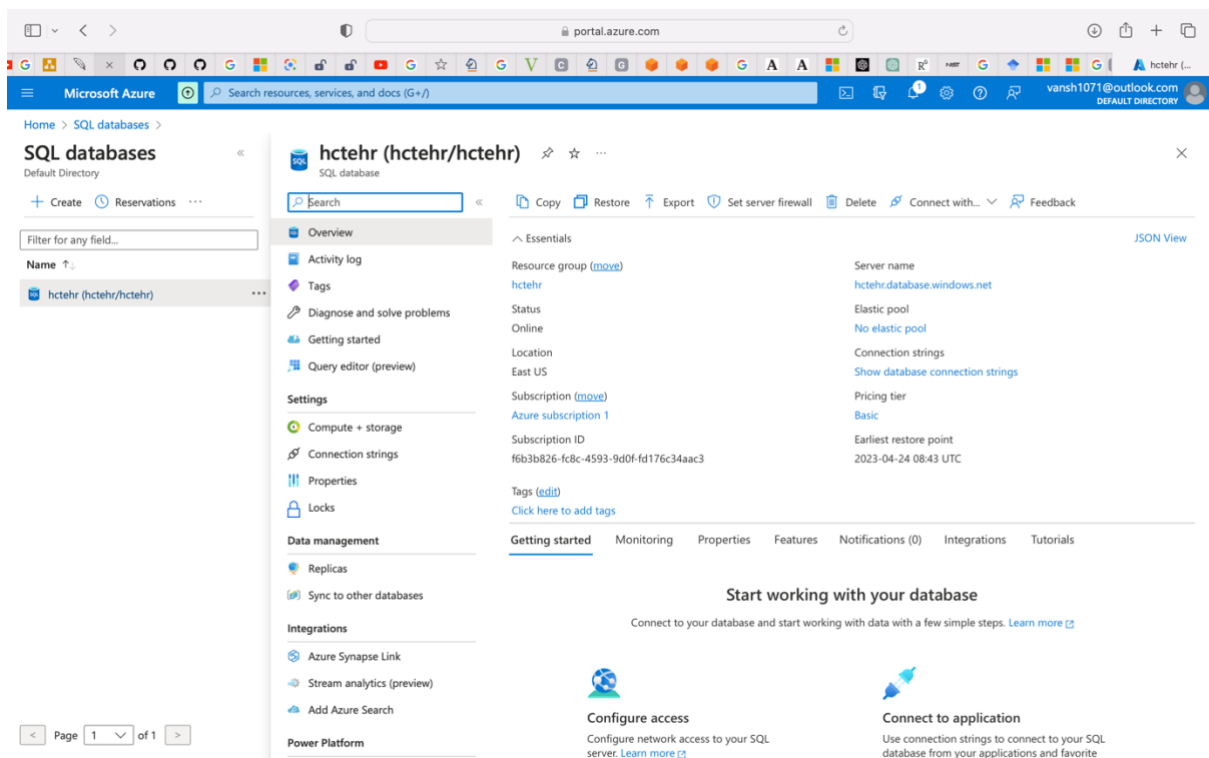


Figure 28: Database created for Application in Cloud

6.3 Publish Updated details in Cloud Environment

If there are any modifications to the current code base, it is recommended to publish them on the cloud. Local changes can also be updated in a cloud environment. The below Fig:29 illustrates an option for publishing changes from the local machine to the cloud environment.

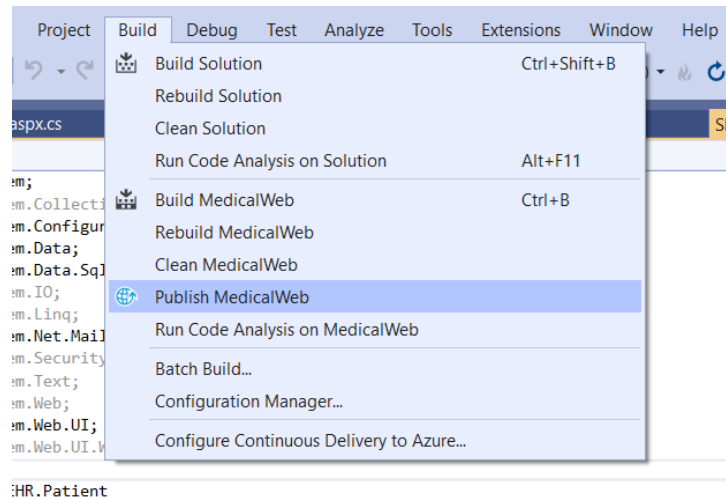


Figure 29: Publish Code Changes in Cloud

6.3 Electronic Health Record Web Application URL

<https://hctehr.azurewebsites.net/Login.aspx>