CARD PAYMENT SECURITY USING RSA

A project report submitted for J component of CSE4003 - Cyber Security

School of Computer Science and Engineering

By

RUDRA PRATAP 18BCE2250

KARTHICK S 18BIT0443

VAISHALI S 18MIS0082

VAIBHAV SINGH 18BCE2313

SAMIN M - 19BME0219

Under the Guidance of,
Prof. MADHU VISWANATHAM V.

VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

OCTOBER, Fall Semester 2020-21

ABSTRACT

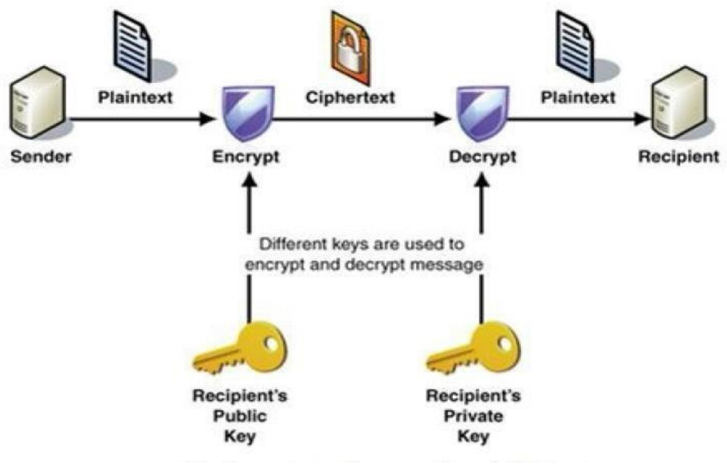
RSA algorithm is asymmetric cryptography algorithm. Asymmetric actually means that it works on two different keys i.e. Public Key and Private Key. As the name describes that the Public Key is given to everyone and Private key is kept private. This project proposed an implementation of a complete and practical RSA encrypt/decrypt solution on CARD PAYMENT SECURITY, the study of RSA public key algorithm. In addition, the encrypt procedure and code implementation is provided in details.

INTRODUCTION

Due to increasing e-commerce activity nowadays, there is a need for some encryption technique to ensure security and a way to ensure that the user's data are securely stored in the database. Thus, the system introduces RSA for this purpose. The RSA algorithm is a kind of asymmetric encryption algorithm which appeared in 1978. The algorithm is public key encryption algorithm which is a widely accepted and implemented by public. The use of RSA in this the system makes the process more secure. Now the bank transactions can be done securely without worrying about attacker getting access to the database as the data will be in encrypted form.

RSA is the first algorithm known to be suitable for signing as well as encryption, and one of the first great advances in public key cryptography. It is named for the three MIT mathematicians who developed it — Ronald Rivest, Adi Shamir, and Leonard Adleman.

RSA is very widely used today for secure Internet communication (browsers, S/MIME, SSL, S/WAN, PGP, and Microsoft Outlook), operating systems (Sun, Microsoft, Apple, Novell) and hardware (cell phones, ATM machines, wireless Ethernet cards, Mondex smart cards, Palm Pilots). Prasit sangaree and his colleague Krishnamurthy have analysed the Energy Consumption of RC4 (RSA) and AES Algorithms in Wireless LANs in the year 2003.They have evaluated the performance of RC4 and AES encryption algorithms in [9]. The performance metrics were encryption throughput, CPU work load, energy cost and key size variation. Experiments show that the RC4 is fast and energy efficient for encrypting large packets. However, AES was more efficient than RC4 for a smaller packet size.



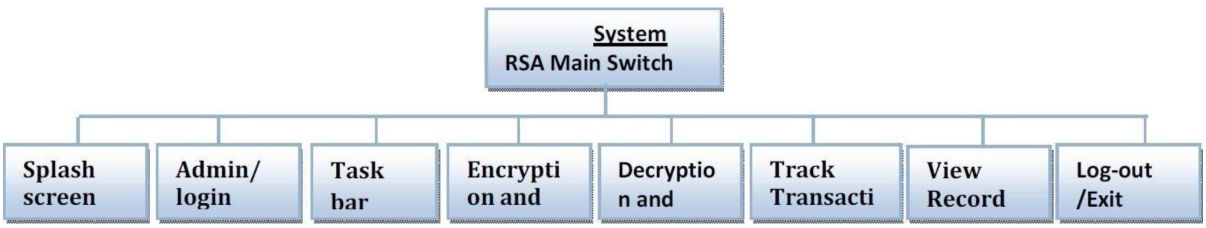
The design of the RSA security software partly evolved from the need for an all-embracing information security system and partly from the need for a user-friendly package that can fulfil any large ecommerce organization's information security needs.

LITERATURE SURVEY

Sistu Sudheer Kumar, A. Srinivas Reddy (May -2015) Authentication is a critical part of any trustworthy computing system which ensures that only authorized individuals can log on to the system. Here, ATM Security has always been one of the most prominent issues. ATM machines generally authenticates by using ATM card and PIN number to perform transactions. This paper discusses design of ATM system that will improve the authentication of customer while using ATM. Here is possible scenario that an individual's ATM card falling into wrong hands by knowing PIN number and forget ATM card is difficult to perform ATM transaction. So to clear all these problems we are implementing this system using "One Time Password (OTP)" and "Personal Identification Number (PIN)" combination in order to imp rove authentication of customer using ATM machine to perform transaction without having any ATM cards. Ezeofor C. J, Ulasi A. G. (December 2014) [2], this paper presents an analysis of network data encryption and decryption techniques used in communication systems. In network communication systems, exchange of information mostly occurs on networked computers, mobile phones and other internet based electronic gadgets. Unsecured data that travels through different networks are open to many types of attack and can be read, altered or forged by anyone who has access to that data. To prevent such an attack, data encryption and decryption technique is employed

Nentawe Y. Goshwe (July 2013), one of the principal challenges of resource sharing on data communication network is its security. This is premised on the fact that once there is connectivity between computers sharing some resources, the issue of data security becomes critical. This paper presents a design of data encryption and decryption in a network environment using RSA algorithm with a specific message block size. The algorithm allows a message sender to generate a public key to encrypt the message and the receiver is sent with a generated private key using a secured database. An incorrect private key will still decrypt the encrypted message but to a form different from the original message.

DESIGN



A Modular is a system component that provides services to other components but would not normally be considered as a separate system as in. A separable component is one that is interchangeable with others for assembling into units of differing size, complexity or function as in. Therefore, RSA cryptosystem is designed along modular techniques.
This necessitated the decomposition of the system into clearly defined subsystems such that the initial requirements specifications were met. The software system comprises the following subsystems: splash-screen subsystem, Admin/login subsystem, Task bar/Key generation subsystem, Encryption subsystem, Decryption subsystem, Track Transaction subsystem, View record subsystem, Log out/Exit subsystem.

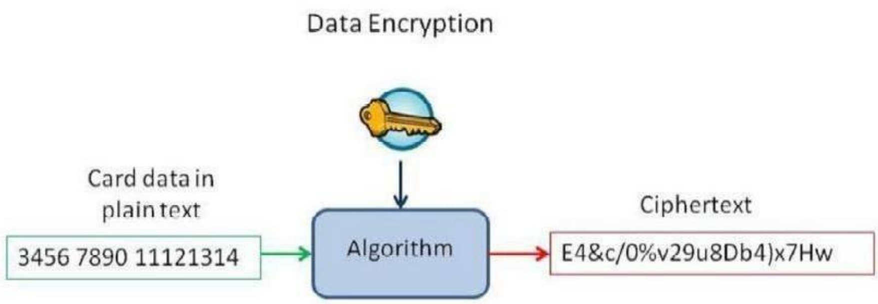


Fig. 4: Symmetric Data encryption

The public key can be freely distributed without the key management challenges of symmetric key since it only encrypt and never decrypt data.

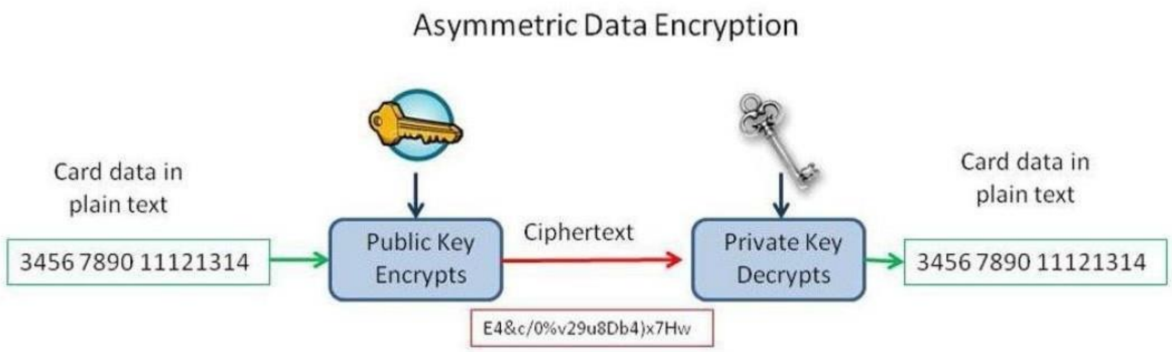


Fig. 5: Asymmetric Data encryption

In a payment environment, the public key can be distributed to a merchant or to the end POS device, and that device can store the key in hardware or software. Even if that key is extracted by someone who shouldn't have rights to it, all that the person can do is encrypt data with the key; he can't decrypt anything. On the other hand, the corresponding private key where the decryption occurs must be handled very securely.
The RSA algorithm is the most commonly used public key encryption algorithm in asymmetric cryptography.
Two keys are used: Public Key and Private Key.

Key generation:

RSA involves a public key and a private key. The public key can be known by everyone and is used for encrypting messages.

Messages encrypted with the public key can only be decrypted in a reasonable amount of time using the private key.

The keys for the RSA algorithm are generated the following way:

Choose two distinct prime number p and q.

For security purposes, the integers p and q should be chosen at random, and should be of similar bit-length.

Prime integers can be efficiently found using a primality test.

Compute $n = pq$.

n is used as the modulus for both the public and private keys.

Its length, usually expressed in bits, is the key length.

Compute $\varphi(n)= \varphi(p)\varphi(q)=(p-1)(q-1)=n -(p+ q-1)$, where φ is Euler’s totient function.

Choose an integer e such that $1 < e <\varphi(n)$ and $\gcd(e, \varphi(n)) = 1$; i.e., e and φ(n) are coprime.

e is released as the public key exponent.

e having a short bit-length and small Hamming weight results in more efficient encryption – most commonly 216 + 1 = 65,537. However, much smaller values of e (such as 3) have been shown to be less secure in some settings.

Determine d as $d \equiv e-1 \pmod{\varphi(n)}$; i.e., d is the multiplicative inverse of e (modulo φ(n)).

This is more clearly stated as: solve for d given $d\cdot e \equiv 1 \pmod{\varphi(n)}$

This is often computed using the extended Euclidean algorithm.

Using the pseudocode in the Modular integers section, inputs a and n correspond to e and φ(n), respectively.

d is kept as the private key exponent.

The public key consists of the modulus n and the public (or encryption) exponent e.

The private key consists of the modulus n and the private (or decryption) exponent d, which must be kept secret. p, q, and φ(n) must also be kept secret because they can be used to calculate d as in

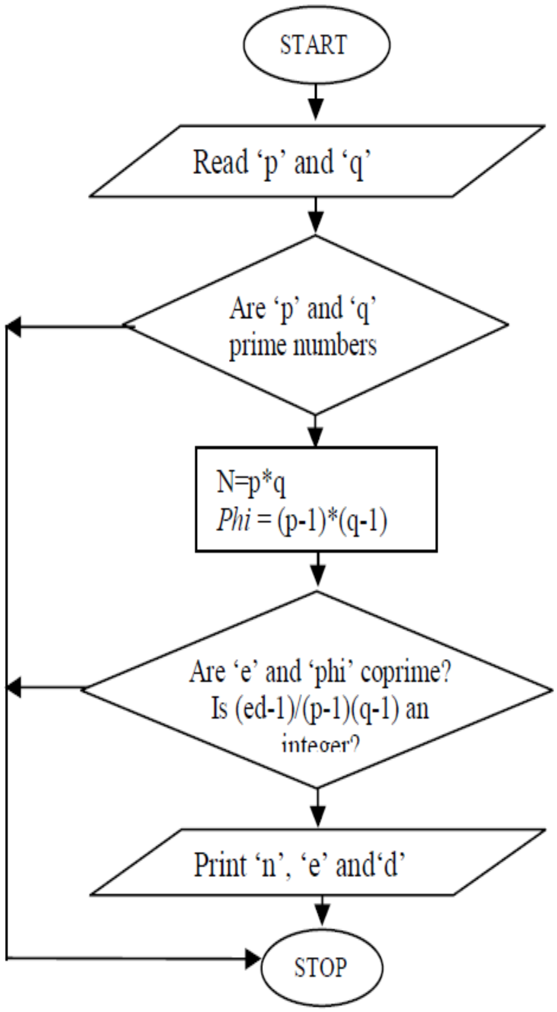


Fig. 6: flow chart illustrating the RSA Key generation

After getting the public and private key the main thing is how to encrypt and decrypt using RSA.

RSA Encryption:

Alice transmits her public key (n, e) to Bob and keeps the private key d secret. Bob then wishes to send message M to Alice. He first turns M into an integer m, such that $0 \leq m < n$ by using an agreed-upon reversible protocol known as a padding scheme. He then computes the ciphertext c corresponding to

$$c \equiv m^e \pmod{n}$$

This can be done quickly using the method of exponentiation by squaring. Bob then transmits c to Alice.

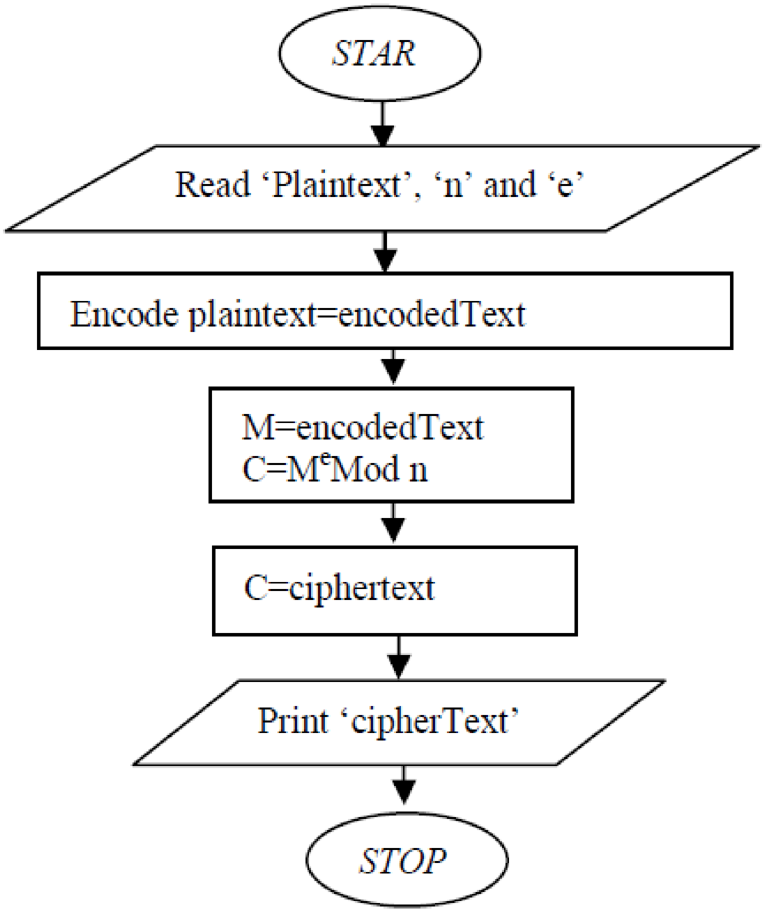


Fig.7: A flow chart illustrating the RSA Encryption Algorithm

RSA Decryption:

Alice can recover m from c by using her private key exponent d via computing

$$m \equiv c^d \pmod{n}$$

Given m, she can recover the original message M by reversing the padding scheme.

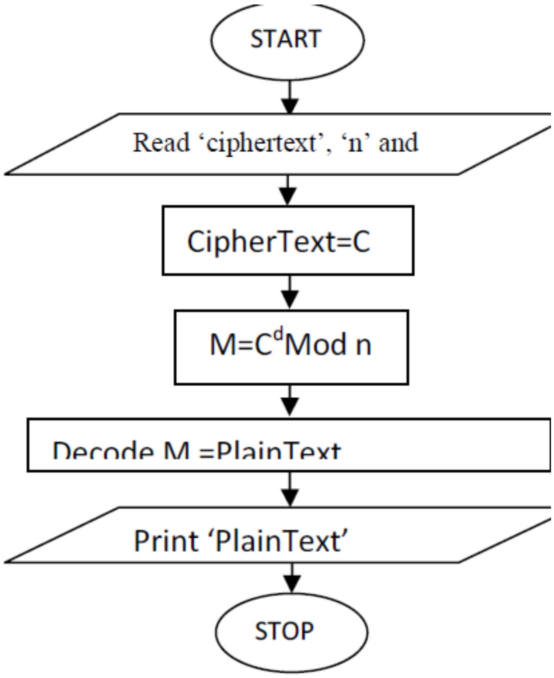


Fig. 8: Flow Chart illustrating the RSA Decryption Algorithm

Modules

Register: User will have to register in order to get access to the system.

Login: User will have to provide his username and password in order to login to the system.

Product Listing: Here all the products can be viewed by the user along with its other details like short description, cost, and also image of the product.

Payment: In order to perform any transaction here the user needs to provide his bank information like his Account no, Card no, CVV no and PIN no to make the payment.

Encryption: The PIN, Account No, CVV no are encrypted using RSA

Advantages

RSA is very high speed of encryption.

Your sensitive details like your bank details are now secured using RSA.

Now the bank transactions can be done securely without worrying about attacker getting access to the database as the data will be in encrypted form.

Application

This system can be used in any online activity which requires users to perform payment online.

Code:

```
//#include<iostream>
//#include<string.h>
# include <stdio.h>
//# include <fstream>
# include <string.h>
# include <iostream>
# include <stdlib.h>
# include <ctype.h>
# include <conio.h>
using namespace std;

struct user
{
string user_id;
string user_name;
int user_ccn;
string user_address;
int user_balance;
string user_password;
struct user *next;
}*first=NULL;

void enqueue();
//void updation();
void display();
void user_account();

int gcd(int a,int b)
{
return b==0? a:gcd(b,a%b);
}

int check_banker_id(string id)
{
string check_id; int count=0;
cin.ignore ();
cout<<"ENTER BANKER ID: ";
```

```
getline(cin,check_id);

if(id.length()==check_id.length())

{
for  (int i=0;i<id.length();i++)
{
if(id[i]==check_id[i])
count++;
else

break;

}
if(count==id.length())
return 1;
else
return 0;

}
else

return 0;

}

int check_banker_password(string password)
{
string check_password; cout<<"Enter 10 digit password: "; char a;

for(int i=0;i<10;i++)
{
a=getch(); check_password=check_password+a;

cout<<"*";

}
int count=0;

if(password.length()==check_password.length())

{
for(int i=0;i<check_password.length(); i++)
{
if(password[i]==check_password[i]) count++;

else

break;

}
if(count==check_password.length()) return 1;
```

```
else
return 0;

}
else

return 0;


}
int main()
{

string banker_id="2345";
char password[11]="incredible";

char a;

string check_password;
int check;

//if k==1 then true else false int select;

while(1)
{
cout<<"\nselect 1 for banker , 2 for user, 3 for exit: ";

cin>>select;

if(select==1)
{
check=check_banker_id(banker_id);

if(check==1)

{
check=check_banker_password(password);
if(check==1)
{
    system("cls");

cout<<"\t\t\t...............................................................ADMINISTRATOR PAGE";

cout<<"\n\n"; while(1)

{

cout<<"\nChoose from the following option:\n1. add user\n2. update user\n3.view user details\n4.
Main Page\n\nENTER THE OPTION: ";

cin>>select; switch(select)

{
```

```
case 1:
{
enqueue(); break;
}
/*case 2:
{
updation(); break;
}*/
case 3:
{
display(); break;
}
case 4:
{
main();
}
default:
{

cout<<"\nINVALID INPUT!!!!!!\nTRY AGAIN";

}

}

}

}
else
{

cout<<"\nWronng Password...................................................... \n";

}

}
else
{

cout<<"\nWrong Banker id ............................................\n";

}

}
else if(select==2)
{
user_account();
```

```
}
else
exit(0);

}
return 0;

}

void enqueue()
{
int p, q, n, toitent, c, msg, e, z, k, i, d;
cout<<"enter two large prime numbers(p and q): ";

cin>>p>>q;

n=p*q;
toitent=(p-1)*(q-1);

cout<<"select the value of e: "; for(i=1;i<toitent;i++)

{
z=gcd(i+1,toitent);

if(z==1)

cout<<i+1<<" ";
}
cout<<" "; cin>>e;

string id, name;
string address, password; int ccn, balance=0; system("cls");

cout<<" ............................................................ ADD USERS."<<endl;
cout<<"Enter the following details";

cout<<"\nUser Name: ";

cin.ignore();

getline (cin, name); cout<<"User id: ";

//cin.ignore(); getline(cin,id); cout<<"Enter ccn: "; cin>>ccn;

cout<<"Enter Address: "; cin.ignore(); getline(cin, address);

cout<<"Create new password(5): ";
//cin.ignore();
//getline(cin, password); cin>>password;

cout<<"enter the initial balance: "; cin>>balance;

struct user *temp;
//temp=(struct user *)malloc(sizeof(struct user));
//      int msg; msg=ccn;
```

```
for(int i=0;i<e;i++)
{
k=k*msg; k=k%n;
}
//cout<<"\nencrypted ccn: "<<ccn;
cout<<"\nencrypted ccn is : "<<k<<endl;


temp=new(struct user); temp->user_id=id;
temp->user_name=name; temp->user_address=address;
temp->user_ccn=ccn;
temp->user_balance=balance; temp->user_password=password;
temp->next=NULL;
    if(first==NULL) first=temp;
else
{
struct user *s;
//s=(struct user*)malloc(sizeof(struct user));


s=new(struct user);
s=first;
while(s->next!=NULL) s=s->next;
s->next=temp;

}

}


void display()
{
struct user *temp;
temp=(struct user*)malloc(sizeof(struct user));
if(first==NULL)
  cout<<"\nNo records available\n";
  else
{
int num;
cout<<"press 1 to see all the records, 2 for specific record: ";
```

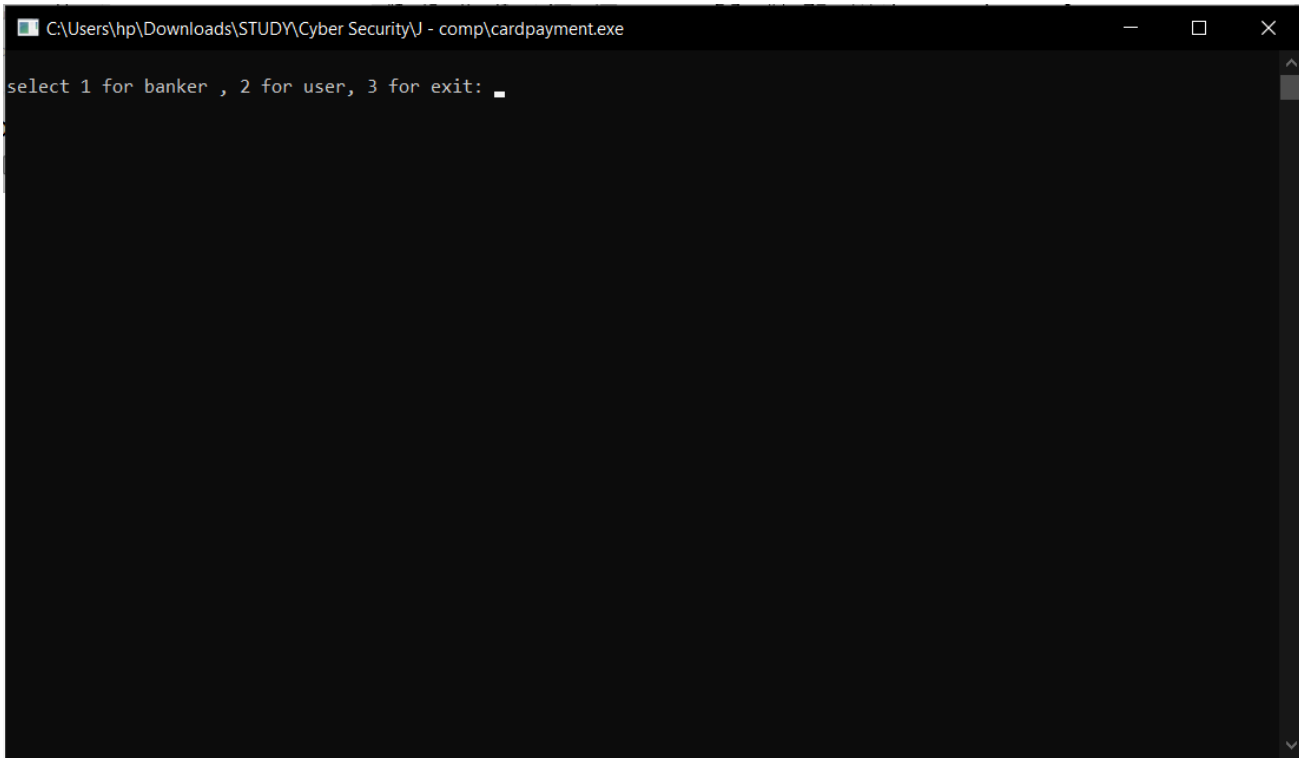
```
cin>>num;

if(num==1)
{
temp=first; while(temp!=NULL)

{
cout<<"\nuser id: "<<temp->user_id;

cout<<"\nuser_name: "<<temp->user_name;

cout<<"\nccn: "<<temp->user_ccn;

cout<<"\naddress: "<<temp->user_address;

cout<<"\nBalance: "<<temp->user_balance;

cout<<"\nPassword: "<<temp->user_password;

cout<<"\n\n\n"; temp=temp->next;

}

}
else if(num==2)
{
int flag=0; string want_id;

cout<<"\nEnter the id: ";

cin.ignore();

getline(cin,want_id);

temp=first; while(temp!=NULL)

{
if(temp->user_id==want_id)
{
cout<<"\nRECORD FOUND!!!";
cout<<"\nuser id: "<<temp->user_id;

cout<<"\nuser_name: "<<temp->user_name;

cout<<"\nccn: "<<temp->user_ccn;

cout<<"\naddress: "<<temp->user_address;

cout<<"\nBalance: "<<temp->user_balance;

cout<<"\nPassword: "<<temp->user_password;

cout<<endl;

flag=1; break;

}
temp=temp->next;
```

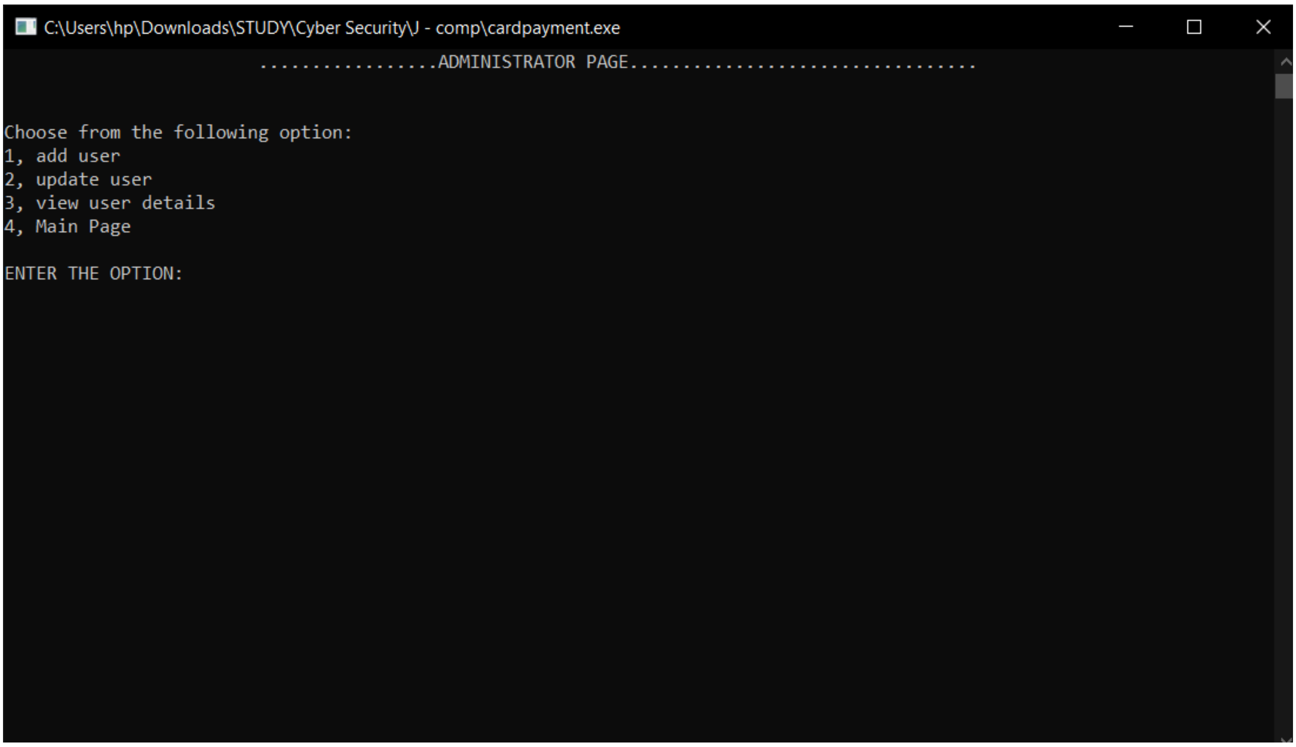
```
}
if(flag==0)
  cout<<"\nRECORD NOT FOUND\n";
}
else
{
cout<<"Wrong Input, TRY AGAIN!!!"; display();

}

}

}

int check_user_id()
{
string id;
struct user *temp; temp=new(struct user);

cout<<"Enter the user id : ";

cin.ignore();

getline(cin,id);

int flag=0;

}

void user_account()
{
if(first==NULL)
  cout<<"\nNo user record!!!"<<endl;

  else

{
int flag=0; string id;

struct user *temp; temp=new(struct user);

cout<<"\nEnter the user id : ";

//cin.ignore();
//getline(cin,id);

cin>>id;

temp=first;

while(temp!=NULL)

{
if(temp->user_id==id)
```

```
{
flag=1; break;

}
else
temp=temp->next;
}
if(flag==0)
   cout<<"\nUser id NOT FOUND\n";

   else

{
flag=0;
string password;
cout<<"\n enter the 5 digit password: ";
/*cin.ignore(); char a;

for (int i=0;i<5;i++)
{
a=getch(); password=password+a;

//cout<<"*";
}*/ cin>>password;

while(temp!=NULL)
{
if(temp->user_password==password)
{
flag=1; break;

}
temp=temp->next;
}
if(flag==0)
   cout<<"\nInvalid password "; else

{
cout<<"user found";
cout<<"\nuser id : "<<temp->user_id;

cout<<"\nuser name: "<<temp->user_name;

cout<<"\nuser ccn: "<<temp->user_ccn;

cout<<"\nuser address: "<<temp->user_address; int num;

cout<<"\npress 1 for payment process, 2 for main menu, any number for exit ";

cin>>num;

if(num==1)
{
string id;
cout<<"\nenter the credit card number";
```

```
cin>>id;
//getline(cin,id); struct user *target;
target= new (struct user);
target= first; flag=0;
while (target! =NULL)
{
if(target->user_id==id)
{
flag=1; break;
}
target=target->next;
}
if(flag==0)
{
cout<<"\nINVALID credit card NUMBER.";
}


else
{
int amount;
cout<<"Enter the amount want to pay: ";
cin>>amount;
if (amount > temp->user_balance) cout<<"\nInsufficient balance";
else
{
temp->user_balance-=amount; target->user_balance+=amount;
}


}

}
}

}

}

}
```

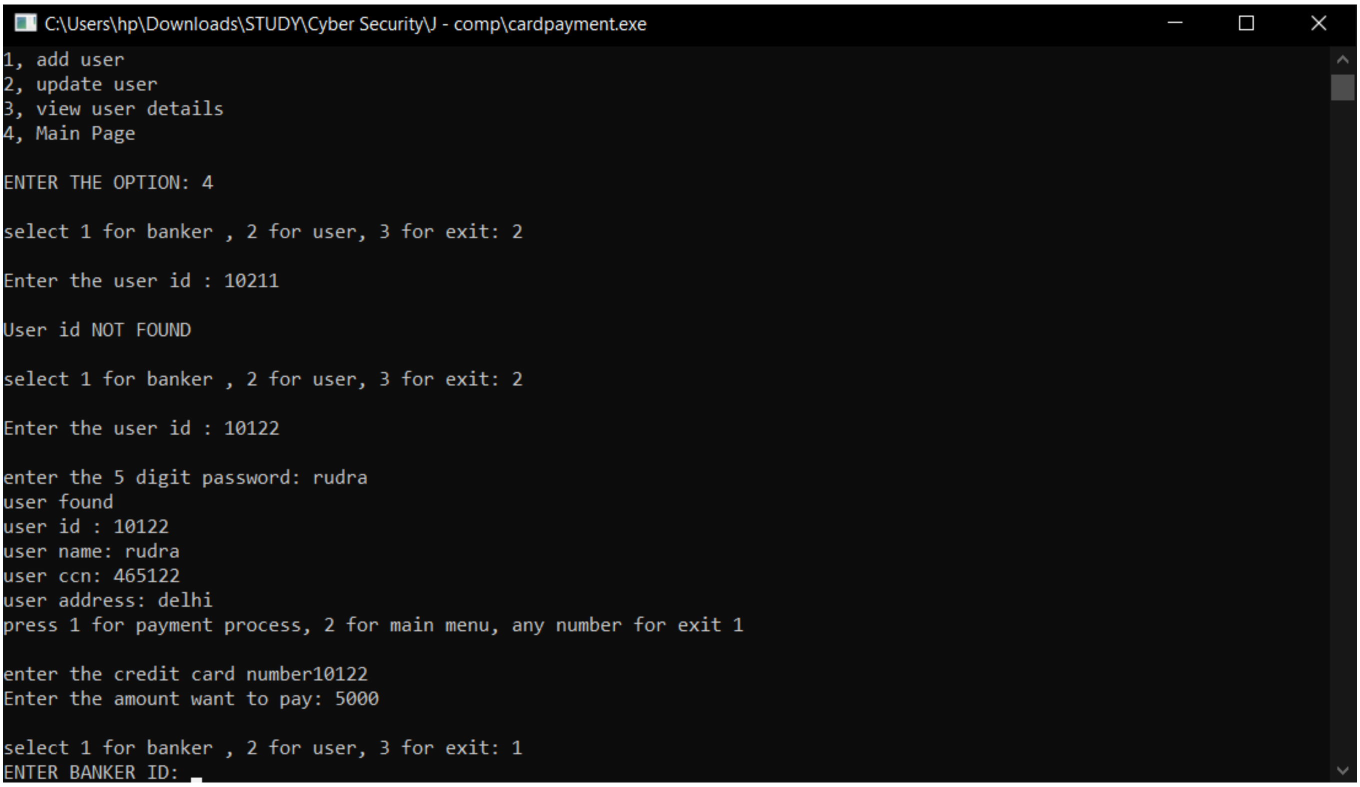
Output:


C:\Users\hp\Downloads\STUDY\Cyber Security\J - comp\cardpayment.exe
select 1 for banker , 2 for user, 3 for exit:


C:\Users\hp\Downloads\STUDY\Cyber Security\J - comp\cardpayment.exe
................ADMINISTRATOR PAGE................................
Choose from the following option:
1, add user
2, update user
3, view user details
4, Main Page
ENTER THE OPTION:

```
C:\Users\hp\Downloads\STUDY\Cyber Security\J - comp\cardpayment.exe
...........................................................ADD USERS.......................................................
..............
Enter the following details
User Name: amanek
User id: 10233
Enter ccn: 234822
Enter Address: delhi
Create new password(5): amank
enter the initial balance: 25000

encrypted ccn is : 70

Choose from the following option:
1, add user
2, update user
3, view user details
4, Main Page

ENTER THE OPTION:
```

```
C:\Users\hp\Downloads\STUDY\Cyber Security\J - comp\cardpayment.exe
4, Main Page

ENTER THE OPTION: 3
press 1 to see all the records, 2 for specific record: 1

user id: 10122
user_name: rudra
ccn: 465122
address: delhi
Balance: 20000
Password: rudra



user id: 10233
user_name: amanek
ccn: 234822
address: delhi
Balance: 25000
Password: amank



Choose from the following option:
1, add user
2, update user
3, view user details
4, Main Page

ENTER THE OPTION:
```



```
C:\Users\hp\Downloads\STUDY\Cyber Security\J - comp\cardpayment.exe
1, add user
2, update user
3, view user details
4, Main Page

ENTER THE OPTION: 4

select 1 for banker , 2 for user, 3 for exit: 2

Enter the user id : 10211

User id NOT FOUND

select 1 for banker , 2 for user, 3 for exit: 2

Enter the user id : 10122

enter the 5 digit password: rudra
user found
user id : 10122
user name: rudra
user ccn: 465122
user address: delhi
press 1 for payment process, 2 for main menu, any number for exit 1

enter the credit card number10122
Enter the amount want to pay: 5000

select 1 for banker , 2 for user, 3 for exit: 1
ENTER BANKER ID:
```

REFERENCES

[1] Sistu Sudheer Kumar, A. Srinivas Reddy, May-2015, “A survey on theft prevention during ATM transaction without ATM cards”, eISSN: 2319-1163 | pISSN: 2321-7308 Volume: 04 Special Issue: 06 | NCEITCS-2015 | May- 2015.

[2] Ezeofor C. J, Ulasi A. G., December 2014, “Analysis of Network Data Encryption & Decryption Techniques in Communication Systems” International Journal of Innovative Research in Science Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 12, December 2014 ISSN: 2319 -8753.

[3] Sivakumar T, Gajjala Askok, k. Sai Venuprathap, August 2013, “Design and Implementation of Security Based ATM theft Monitoring system”, International Journal of Engineering Inventions e-ISSN: 2278-7461, p-ISSN: 2319-6491 Volume 3, Issue 1 (August 2013) PP: 01-07.

[4] Nentawe Y. Goshwe, July 2013, “Data Encryption and Decryption Using RSA Algorithm in a

Network Environment” IJCSNS

[5] Boneh, Dan (1999). "Twenty Years of attacks on the RSA Cryptosystem". Notices of the American Mathematical Society. 46 (2): 203–213. "Further Attacks ON Server-Aided RSA Cryptosystems", James McKee and Richard Pinch,

[6] http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.33.1333 A Course in Number Theory and Cryptography, Graduate Texts in Math. No. 114, Springer-Verlag, New York, 1987. Neal Koblitz, Second edition, 1994. p. 94 "common factors in (p − 1) and (q − 1)”, Viktor Dukhovni, open ssl-dev Digest, Vol 9, Issue 4,

[7] https://www.mail-archive.com/openssl- dev%40openssl.org/msg39736.html, https://www.mail-archive.com/openssl- dev%40openssl.org/msg39725.html

[8] Johnson, J.; Kaliski, B. (February 2003). "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1". www.ietf.org. Network Working

[9] Soe Moe Myint, Moe Moe Myint, Aye Aye Cho [2019], A Study of RSA Algorithm in Cryptography

[10] Sanjeev Kumar Mandal,A R Deepti[2018], A Secure Cryptosystem by using Euler Totient Function and Modified RSA

[11] Swati Verma and Birendra Kumar Sharma. [2013], An Efficient Proxy Signature Scheme Based on RSA Cryptosystem

[12] Nikita Somani, Dharmendra Mangal, [2014], An Improved RSA Cryptographic System

[13] Ahmed Eskander Mezher(2018), Enhanced RSA Cryptosystem based on Multiplicity of Public and Private.

[14] D.Angeline Benitta and S.P.Victor Xin Zhou and Xiaofei Tang[2011], Conjunctional Tuning of Information Security approach for Critical Data in Big Data Using Enhanced and Extended RSA.

[15] Xin Zhou and Xiaofei Tang [2011], Research and Implementation of RSA Algorithm for

Encryption and Decryption.

[16] B.Persis Urbana Ivy, Purshotam Mandiwa. Mukesh Kumar [2012], A modified RSA cryptosystem based on ‘n’ prime numbers.

[17] Ching-Chao Yang, Tian-Sheuan Chang, and Chein-Wei Jen1998, A New RSA Cryptosystem Hardware Design Based on Montgomery’s Algorithm.

[18] R.L. Rivest, A. Shamir, and L. Adleman, A Method for Obtaining DigitalSignatures and Public-Key Cryptosystems.