A REPORT ON

DIGITALIZATION & AUTOMATION IN BANKING SERVICES TO REDUCE TAT

BY

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AT

BANK OF MAHARASHTRA, PUNE

A Practice School-I station of

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

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ABSTRACT

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE

PILANI (RAJASTHAN)

Practice School Division

Station: Bank of Maharashtra Centre: Shivajinagar, Pune

Duration: From: 21/5/19 To: 13/7/19

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Title of the Project: Digitalization and automation to reduce TAT in banking services.

ID No./Names/Disciplines of the students:

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Name and designation of the expert: Mr. D. Janardhan, Sr. Manager, HRM Pune city zone

Name of the PS Faculty: Dr. Chandra Shekhar

Key Words: Cloud computing, Blockchain, Chatbot, Encryption

Project Areas: Machine Learning, Java, Natural Language Processing

Abstract: The report analyzes the improvements that can be done in banking services like reducing TAT(turnaround time) with the help of digitization and automation. It discusses the importance of data and what can be done to improve efficiency in its verification. Further it discusses about chat bots and how they can improve the overall banking experience. The latter part contains some conclusions based on the report.

Signatures of Students Signature of PS Faculty

Date: 11/07/19 Date: 11/07/19

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1. INTRODUCTION

In recent times banking services have been heavily becoming digitalized. TAT is the turnaround time i.e. the time taken by the bank to process an application and sanction/approve the service to the customer.

The report sheds light on some of the various methods and implications banks can use to improve their TAT for various banking services like credit or loan processing. The report also talks about customer data integration and its importance.

Further, the report talks about digitizing of business processes in public sector banks. Further, the report sheds light on the verification process and how it can be improved significantly with the use of algorithms. The later part of the report consists of some suggestions and conclusions based on the report.

2. TAT

Turn Around Time in the context of banking services is the time taken by the bank to process an application and sanction/approve the service to the customer. Now different banks and financial institutions have varying TAT and this report aims to find, analyse and then make suggestions on the factors that come into play to decide TAT.

Some of the primary questions raised when considering the time required to process an application from a customer are proper documentation, eligibility, and authenticity. The three are relevant to varying degrees depending on the service. For instance, retail loans will have require perfect scores on all three parameters while financial advice might be offered to a wider customer base. In addition the way different banks handle tackle the three parameters also varies. The process of verifying the authenticity of a customer as well his eligibility is dealt with in different ways by banks.

In the modern digital age, there is an increased demand for being able to handle the three parameters digitally so as to provide banking services with minimum hassle to an e-customer base. This in turn requires that banks are able to verify the identity of customers digitally and provide services in a secure manner. A multitude of options are now being developed and implemented to provide faster and more secure banking services that have been discussed in this report.

3. The Objective: DATA INTEGRATION

Banks cannot afford to leave their customer data in silos now that clients are raising expectations and interacting with them through various disparate touch points. Banks need to make use of data integration to gain meaningful and valuable information from customer data.

Along with this comes the responsibility to ensure this data is well verified and correct. As we raise standards, security issues increase too. Hence it is very necessary to create a balance so that both the banks and customers can coexist happily.

Data integration gives the financial institution an edge over others as it saves time and effort making all processes quite efficient. Here in our project we are concerned about the TAT of loans. Often incorrect or insufficient documents cause queries to be raised and hence TAT increases which is very undesirable. It is a loss-loss situation for both banks and customers. A system is required to covey all the information to customers about all necessary documents. This would decrease the load of banks. But data integration can let you get al the information about certain customer provided you have some basic information about a person.

Till now the idea we have thought is to have a platform that contains all information and documents of a customer and it can only be accessed with the permission of the client.

In India, digilocker is a step towards data integration which is linked to both your aadhar card and cell phone and stores all documents. It eliminated the use of physical documents saving on time, money and paper. All documents can be attested and verified. Banks could directly access

data from here to verify it's client before sanctioning of loans. Obviously there will be a threat of cyber security that would be a challenge that we could find a solution to.

4. Digitalization of business processes in public sector banks

Digitalization connotes the use of electronic means and ways to conduct banking. It encompasses products and services that bank customers can typically access using their mobile devices or computers. Today's demand of banking requires robust, innovative and ready to meet expectations of empowered and tech-savvy customers.

To meet client desires, banks must quicken the digitization of their financial procedures. But they should go beyond simply automating the existing process. They must reinvent the entire banking process, including reducing the number of steps required, developing automated decision making, reducing the number of documents, and dealing with fraud and regulatory issues. Data models should be adjusted and rebuilt to enable a better performance tracking, decision making and customer insights.

Methods and strategies which could be adopted

- Digitalization as a part of banks' mission and vision:

Convention bound banks usually state customer centricity and experience as their motto. Since digitalization will be all encompassing in the days to come, banks ought to consider incorporating it in their mission and vision as this will impact their budget as well as their outlook.

- Becoming a data driven organization:

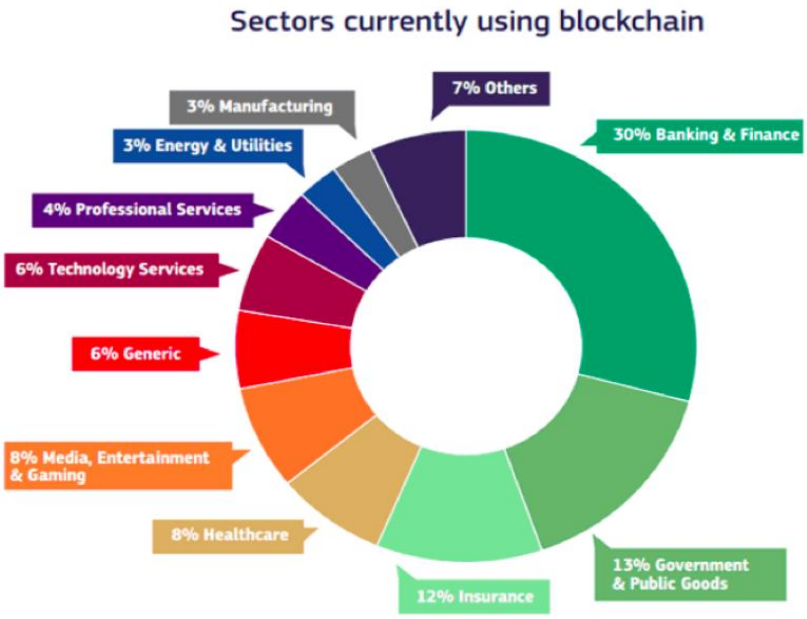
In the digital age, cost, speed, ease and seamlessness of operations matter the most to banks and their clients. Banks will need to leverage analytics technologies to gather insights as they offer multiple products and services. Hence it is fundamental for banks to invest in training their employees to become a data driven organization and must offer accentuation to big data analysis.

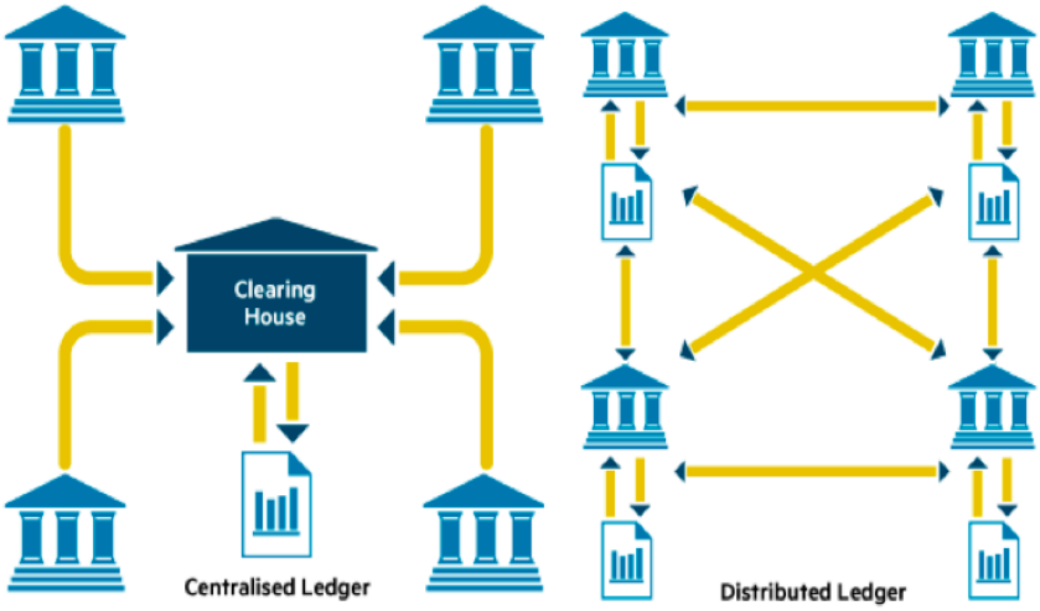
- Adopting Automation:

Digital services present opportunities for banks to automate operations in a number of ways. Although there is a caveat that human touch should not be lost, the very nature of digital technologies lends themselves to automation for example, the e-wallet.

- Blockchain Technology:

Another case in point is the blockchain technology which is set to revolutionize digital transactions as banks will have to look at the entire chain of operations and identify repetitive tasks. It's a technology that uses distributed databases and cryptography to record transactions. A blockchain functions as an open, decentralized ledger that keeps track of transactions between two parties effectively in a permanent and verifiable way. Financial and banking institutions could benefit a lot from blockchain such as fraud reduction, clearings and settlements. This technology also helps banks to sanction loans faster as it reduces the time for Know Your Customer (KYC) and customer due diligence regulations thus reducing the turnaround time (TAT). The following pictures depicts that banks are becoming more active in embracing blockchain technology and how decentralization in banking industry is a guarantee of stability and reliability respectively.





· <u>Implementation of cloud technology:</u>

The adoption of cloud technology has been accelerating drastically. The financial services industry is also realizing the benefits that this technology brings. These benefits are not confined

to cost efficiencies such as faster processing and reduced risk. Adoption of cloud technology also brings about an increase in revenue with higher number of loan applications, improved conversion rates, and better pricing. Cloud computing creates a multi-channel relationship with the clients at every aspect of the service such as storing, backup, updating and recovering huge data for the organization thus reducing the banks' turnaround time. One important application of cloud technology is the cloud-based Core Banking Solution (CBS). Currently, only a small percentage of banks have transitioned their core banking systems to cloud-based platforms although there is hope that in the near future, it will gain enough market traction to become a regular part of a bank's RFP processes. Cloud-based CBSs enable financial institutions to accelerate their growth in unparalleled ways as they can modernize their existing technology enabling them to automate operations and workflows, resulting in increased efficiency, better security and decrease in costs. Cloud-based core banking may not be booming right now, but banks should take note of the trend since it can deliver clear benefits and will likely grow more prominent. But every technology has its pros and cons and in cloud computing, limitations can be considered as precautions. In cloud technology, security is considered to be the main issue. Maintaining the security and confidentiality of financial information of customers and internal company data is crucial in banking and finance institutions. If proper precautions are not taken, the entire confidential data will get corrupted. This could be avoided by encrypting the cloud service and storage of confidential information in private storage which can help in managing the risk.

5. Verification of users by bank employee and vice versa

Whenever a conversation needs to be done between bank and a user/customer it needs to be as secure as possible. Even if the messages are encrypted it needs to be verified whether the bank is talking to the correct person or not.

The following scenarios depict some illegal cases:

1.Suppose I took a loan from a bank and all conversation I did was online, but now I am unable to pay the loan, so I can say that I never had such conversations, I never took loan it was someone else who masqueraded my identity and escaped.

2.Suppose someone actually interfered between the conversation.

To tackle such scenario we will use a concept from public key cryptography, the Diffie hellman key exchange.

DH is usually utilized when you encrypt data on the Web utilizing either SSL (Secure Socket Layer) or TLS (Transport Layer Security). The Secure Shell (SSH) protocol also uses DH.

Obviously, in light of the fact that DH is a piece of the key exchange mechanism for IPSec, any VPN based on that technology uses DH too.

The algorithm explained:

Suppose Alice and Bank are the two people having the conversation so they first verify themselves in the following way:

This algorithm requires public key components and private key components(for a particular session) :

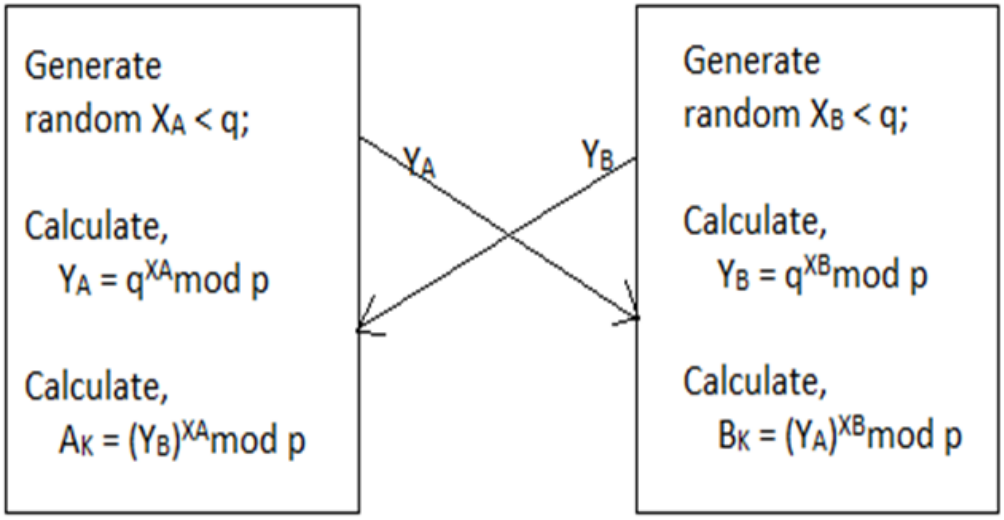
Public key components(to be announced by bank):

Q & P :

Such that P is very very very very very very large prime and G is generator, i.e. when G^a mod P is not equal to G^b mod P for all a != b

Private Key components :

Chosen by both bank and user, require a random Xa chosen by alice and a random Xb chosen by bank.



3. Issues and Security:

Biggest issue is the man in the middle attack.

Suppose I impersonate both as bank to the user and as user to the bank, now there and do the whole process again but with different random variables for bank and user, now in the actual research paper of Diffie Hellman key exchange it was mentioned that man in the middle attack is impossible to tackle but in our scenario since we have some information about the user we can use to exploit this shortcoming.

4. Verifying that the user only has sent messages and it has not been altered in the network :This we can do by using the concept of digital signatureAlgorithm :

- We can have shared global public key values (p,q,g):
  - choose a large prime p with $2^{L-1} < p < 2^{L}$
    - where L= 512 to 1024 bits and is a multiple of 64
  - choose q with $2^{159} < q < 2^{160}$
    - such that q is a 160 bit prime divisor of $(p-1)$
  - choose $g = h^{(p-1)/q}$
    - where $1<h<p-1$ and $h^{(p-1)/q} \bmod p > 1$
- users choose private & compute public key:
  - choose $x<q$
  - compute $y = g^{x} \bmod p$

- to **sign** a message M the sender:
  - generates a random signature key k, k<q
  - nb. k must be random, be destroyed after use, and never be reused
- then computes signature pair:
  - $r = (g^k \bmod p) \bmod q$
  - $s = [k^{-1}(H(M) + xr)] \bmod q$
- sends signature (r, s) with message M

- having received M & signature (r, s)
- to **verify** a signature, recipient computes:
  - $w = s^{-1} \bmod q$
  - $u1 = [H(M)w] \bmod q$
  - $u2 = (rw) \bmod q$
  - $v = [(g^{u1} y^{u2}) \bmod p] \bmod q$
- if v=r then signature is verified

The following is the implementation of above idea:

```
//package blockchain;
import java.util.*;
import java.security.MessageDigest;
```

```
import java.text.SimpleDateFormat;

class StringUtil {
	//Applies Sha256 to a string and returns the result.
	public static String applySha256(String input){
		try {
			MessageDigest digest = MessageDigest.getInstance("SHA-
256");
			//Applies sha256 to our input,
			byte[] hash = digest.digest(input.getBytes("UTF-8"));
			StringBuffer hexString = new StringBuffer(); // This
will contain hash as hexidecimal
			for (int i = 0; i < hash.length; i++) {
				String hex = Integer.toHexString(0xff & hash[i]);
				if(hex.length() == 1) hexString.append('0');
				hexString.append(hex);
			}
			return hexString.toString();
		}
		catch(Exception e) {
			throw new RuntimeException(e);
		}
	}
}

class CreateBlock
{
    private String name;
    private String aadharNumber;
    private String age,date,msg,custName;
    String hash;
```

```
    String previousHash;
    private int nonce=0;
    private String pid;

    CreateBlock(String name,String aadharNumber,String pid,String
age,String date,String msg,String custName,String previousHash)
    {
        this.name=name;
        this.aadharNumber=aadharNumber;
        this.pid=pid;
        this.age=age;
        this.date=date;
        this.msg=msg;
        this.custName=custName;
        this.previousHash=previousHash;
        this.hash=calculateHash();
    }
    public void print()
    {
      System.out.println("Employee name is "+name);

      System.out.println("CustomerName "+custName);
      System.out.println("Encryption code(public) is "+age);
      System.out.println("Date "+date);
      System.out.println("msg is "+msg);
      System.out.println("Hash of current block "+hash);
    }

    String data=name+aadharNumber+age+date+msg+previousHash;
    public String calculateHash() {
      String calculatedhash = StringUtil.applySha256(
```

```
                previousHash +Integer.toString(nonce) +
                data
                );
      return calculatedhash;
    }

    public String patientID(){
      return pid;
    }
    public void mineBlock(int difficulty) {
          String target = new String(new
char[difficulty]).replace('\0', '0'); //Create a string with
difficulty * "0"
          while(!hash.substring( 0, difficulty).equals(target))
          {
                nonce ++;
                hash = calculateHash();
          }
          System.out.println("Block Mined!!! : " + hash+" "+nonce);
      }
}

public class block2 {

      public static ArrayList<CreateBlock> blockchain = new
ArrayList<CreateBlock>();
      public static ArrayList<String> doctorIdentity=new
ArrayList<String>();
      public static ArrayList<String> patientIdentity=new
ArrayList<String>();
```

```
	public static void main(String[] args)
	{
		//Doctor Database :
		doctorIdentity.add("501");
		doctorIdentity.add("502");
		doctorIdentity.add("503");
		patientIdentity.add("201");
		patientIdentity.add("202");
		patientIdentity.add("203");
		patientIdentity.add("204");
		patientIdentity.add("205");
		int P = 23;
		int g=9;
		String name;
	String ID;
	String pid;
	String age,msg="",custName;
	Scanner sc=new Scanner(System.in);
	SimpleDateFormat formatter = new SimpleDateFormat("dd/MM/yyyy
HH:mm:ss");
	Date date=new Date();

	String dt=""+formatter.format(date);
	int z=1;
	while(z!=0)
	 {
		System.out.println("Enter your name");
		name=sc.next();
		System.out.println("Enter your ID");
		ID=sc.next();
		if(verifyTransaction(ID,doctorIdentity,1)!=true) {
```

```
                    System.out.println("Unable to Provide correct
ID,Terminating Program");
                    break;
                }
                System.out.println("Enter Customer ID : ");
                pid = sc.next();
                if(verifyTransaction(pid,patientIdentity,1)!=true) {
                    System.out.println("Unable to Provide correct
ID,Terminating Program");
                    break;
                }
                System.out.println("Enter your Customer's name");
                custName=sc.next();
                System.out.println("Enter your public encryption
code");
                age=sc.next();
                System.out.println("Enter any message you want to
send");
                msg=msg+sc.next();

                if(blockchain.size()==0)
                    blockchain.add(new
CreateBlock(name,ID,pid,age,dt,msg,custName,"0"));
                else
                    blockchain.add(new
CreateBlock(name,ID,pid,age,dt,msg,custName,blockchain.get(blockchain.
size()-1).hash));
                int a;
                System.out.println("Enter 0 to exit else press 1");
                a=sc.nextInt();
```

```
                while(a==1) {
                      System.out.println("Enter any message you want to
send");
                      msg=msg+" "+sc.next();

                      if(blockchain.size()==0)
                            blockchain.add(new
CreateBlock(name,ID,pid,age,dt,msg,custName,"0"));
                      else
                            blockchain.add(new
CreateBlock(name,ID,pid,age,dt,msg,custName,blockchain.get(blockchain.
size()-1).hash));

                      System.out.println("Enter 0 to exit else press
1");
                      a=sc.nextInt();
                      z=a;
                }
          }

          String user;
          do
          {
                System.out.println("Do you want to view conversation?
Y N ");
                user = sc.next();
                if(user.equals("Y"))
                      viewUser();
                      else
                      System.out.println("Terminating program");
          }while(!user.equals("N"));
```

```
	}


	public static void viewUser()
	{
			Scanner sc=new Scanner(System.in);
			System.out.println("Enter customer ID : ");
			String pid=sc.next();
			try
			{
				int t=0;
			for(int i=0;i<blockchain.size();i++)
			{
				CreateBlock current=blockchain.get(i);
				//System.out.println("pid:
"+current.patientID());
				String temp=current.patientID();
				if(temp.equals(pid))
				{
					t=1;
					System.out.println("Block "+(i+1)+":");
					current.print();
				}
			}
			if(t==0){
				System.out.println("Data of user not available");
			}
			}
			catch(Exception e)
```

```
                {
                        System.out.println("Data of user not available");
                        System.out.println("Try with other id");
                        viewUser();
                }
        }

        public static Boolean isChainValid() {
                CreateBlock currentBlock;
                CreateBlock previousBlock;
                int difficulty=5;
                String hashTarget = new String(new
char[difficulty]).replace('\0', '0');

                //loop through blockchain to check hashes:
                for(int i=1; i < blockchain.size(); i++) {
                        currentBlock = blockchain.get(i);
                        previousBlock = blockchain.get(i-1);
                        //compare registered hash and calculated hash:

        if(!currentBlock.hash.equals(currentBlock.calculateHash()) ){
                        System.out.println("Current Hashes not equal");

                        return false;
                }
                //compare prev ious hash and registered previous hash

        if(!previousBlock.hash.equals(currentBlock.previousHash) ) {
                        System.out.println("Previous Hashes not equal");
                        return false;
                }
```

```
                //check if hash is solved
                if(!currentBlock.hash.substring( 0, difficulty).equals(hashTarget)) {
                      System.out.println("This block hasn't been mined");
                      return false;
                }
          }
          return true;
     }


     public static Boolean verifyTransaction(String password,ArrayList<String> al,int x) {
          int P=23;
          int g=9;
          int id=Integer.parseInt(password);
          Random rand=new Random();
          int r=rand.nextInt(P-1);
          int h=g;
          int y=g;
          for(int i=1;i<id;i++){
                y=y*g;
                y=y%P;
          }
          y=y%P;
          //System.out.println(" y = "+y);
          for(int i=1;i<r;i++){
                h=h*g;
                h=h%P;
          }
```

```
h=h%P;
//System.out.println("h = "+h);

int b=rand.nextInt(2);
//System.out.println("b = "+b);
int s=(r+b*id)%(P-1);
int k=g;
for(int i=1;i<s;i++){
      k=k*g;
      k=k%P;
}
k=k%P;
//System.out.println("k = "+k);

int c=y;
if(b==1){
      c=y;
}
else{
      c=1;
}
//System.out.println("c = "+c);
c=h*c;

c=c%P;

if(c==k){
      int t=0;
      for(int i=0;i<al.size();i++) {
            //System.out.println(al.get(i));
            if(al.get(i).equals(password)) {
```

```
                        t=1;
                        break;
                    }
                }
                if(x==3 && t==0) {
                    return false;
                }
                if(t==1) {
                    return true;
                }
                else {
                    System.out.println("Please Provide a correct ID :
");
                    Scanner sc=new Scanner(System.in);
                    password=sc.next();
                    return verifyTransaction(password,al,x+1);
                }
            }
            else{
                return false;
            }
        }
}
```

Explanation of code:

We store every conversation between bank employee and customer using blockchain.

Blockchain implementation helps here as every conversation done between bank employee and customer is secured (Until 51% of bank employee decide to cheat) using this ensures that conversations are also free from third party interruptions and can also help in developing trust in

customer. Also this asks for customer id and employee id then verifies using public key cryptography that this is indeed the two person talking and no one has hacked the system.

Here is the snapshot of a example conversation:

```
Enter your name
Sanand
Enter your ID
507
Please Provide a correct ID :
501
Enter Customer ID :
201
Enter your Customer's name
Anand
Enter your public encryption code
17
Enter any message you want to send
Hello
Enter 0 to exit else press 1
1
Enter any message you want to send
Bye!
Enter 0 to exit else press 1
0
```

```
Do you want to view conversation? Y N
Y
Enter customer ID :
205
Data of user not available
Do you want to view conversation? Y N
Y
Enter customer ID :
201
Block 1:
Employee name is Sanand
CustomerName Anand
Encryption code(public) is 17
Date 08/07/2019 12:45:25
msg is Hello
Hash of current block e85d6db04753b884f10c661d9375a0cdc851a774819f1ab8882a7be1de77bb70
Block 2:
Employee name is Sanand
CustomerName Anand
Encryption code(public) is 17
Date 08/07/2019 12:45:25
msg is Hello Bye!
Hash of current block 08f8acb27406c98e97423b7355a80741b712c6db6875f76fa27461e4b36bcf25
Do you want to view conversation? Y N

N
Terminating program
```

6. Digitizing Customer Care using Chatbots

Banking is a labor-intensive job with ever increasing customers and traffic. The existing systems can only take it so far and they are bound to become inefficient and error-prone.

HSBC, American Express, American bank, HDFC almost all major banks today are investing in AI-based bots for more efficient customer services.

Chatbots are efficient, convenient and more reliable than helpdesks, faqs or call center services. The steeply increasing demand for banking services has made it clear that customer care can no longer be carried out in the traditional way and technology needs to intervene.

Major advantages using of chatbots:

1. Bypassing verbal communication can help in overcoming communication gap due to differences in languages and accents.

2. Complete knowledge:

The personal incompetency of customer service representatives is often a problem. They can misguide a customer or deliver incomplete information. Since the flow of information is verbal, often they cannot be held accountable.

On the other hand, well-programmed chatbots deliver correct and much more detailed information and hence reduce the chance any misguidance.

3.Time constraints

It’s no news that customer service representatives are hard to reach and deal with. The hotlines are invariably busy or out of service. Also due to time constraints and a large number of people

to handle the representatives aren't able to listen to the customers very patiently. Hence people often avoid using them.

But a chatbot provides a very personalized experience. It can be used for as long and as many times as a customer wants, that too 24*7

4.Other functions:

Bots can do much more than just laying out info. They can be used to take appointments, register complaints, provide step by step troubleshooting, issue new documents, cancel requests and much more. They can easily replace choppy and hard to navigate websites and faq pages.

5. Most importantly they can be trained:

Machine learning can make Chatbots smart. The more they are used, the smarter they become. Hence there is no need to hard code them and generally, they do not become obsolete.

Following are some of the most well-developed bots which are being used by banks:

1.Erica-Bank of America

As a market leader in both mobile banking use and AI implementations in the U.S., Bank of America introduced its AI-based virtual assistant Erica to send notifications to customers, provide account information, gives suggestions to save money, give credit report updates, pay bills and help customers with simple transactions. Since the introduction, the capabilities of Erica have expanded as an advanced virtual assistant to help clients make smarter decisions.

Erica integrated with Bank of America mobile banking app. Customers can get help via voice or text regarding their banking problems. It offers personalized recommendations, after analyzing the customer's data. It can also send educational videos on finance.

2. Capital One

Eno is Capital One's text-based chatbot that helps customers to manage their finances using phones.

Eno can adapt itself to customer behavior and modify itself according to their requirements.

Clients can get their account balances, transaction summary and other info in the form of text messages. They can also pay bills using the bot. The chatbot can also process emojis and thumb signs.

Capital One has another AI based bot based on Amazon Alexa which takes voice input he .This bot enables Capital One clients to know about upcoming payments, check account balances, and pay their credit card bill using their voice.

3.JPMorgan Chase

JPMorgan is using bots to streamline its back end operations.The bank launched COIN to analyze complex contracts quicker and more proficiently than human lawyers. According to JPMorgan Chase, the organizations has saved more than 360,000 hours of labor.

The chatbot additionally utilizes the innovation to parse messages for representatives, enable access to programming frameworks, and handle fundamental IT solicitations like resetting

passwords. Going ahead, the bank has demonstrated the expectation to continue utilizing bots to discover wellsprings of salary, approaches to diminish costs and better approaches to lessen the chance.

4.Ally Bank

Ally Bank was one of the main banks to execute a chatbot, with the dispatch of Ally Assist in 2015. Partner Assist is a remote helper inside the Ally Mobile Banking application. Ally Assist can be gotten to by means of voice or content to perform capacities, for example, making installments, moves, P2P exchanges and stores.

A client can likewise demand a record outline or exchange history just as screen sparing and spending designs. Through AI, Ally Assist can anticipate client needs by dissecting records and exchanges to give significant assistance subjects and messages The collaborator likewise utilizes characteristic language to address basic client administration questions.

Understanding NLP

Natural language processing (**NLP**) is a subfield of computer science, information engineering, and artificial intelligence dealing with the interactions between computers and human (natural) languages.

The particular concern is to program computers to process and analyze large amounts of natural language data. This is the foundation of developing interactive bots and voice assistants like Alexa, Siri etc.

Statistical Machine Learning

In the early days, language-processing systems were designed by hand-coding a set of rules. However, this meant that they were incompatible to variation in natural language.

But now the natural language processing research relieies heavily on machine learning.

The machine-learning paradigm calls instead for using statistical inference to automatically learn such rules through the analysis of large *corpora* of typical real-world examples (a *corpus* (plural, "corpora") is a set of documents, possibly with human or computer annotations).

For example if there is some change in a banks' policies the bot can learn that directly from the banks' website. There is not need to explicitly code it into the bot.

Many different classes of machine-learning algorithms have been applied to natural-language-processing tasks. These algorithms take as input a large set of "features" that are generated from the input data. Some of the earliest-used algorithms, such as decision trees, produced systems of hard if-then rules similar to the systems of hand-written rules that were then common. Increasingly, however, research has focused on statistical models, which make soft, probabilistic decisions based on attaching real-valued weights to each input feature. Such models have the advantage that they can express the relative certainty of many different possible answers rather than only one, producing more reliable results when such a model is included as a component of a larger system.

Systems based on machine-learning algorithms have many advantages over hand-produced rules:

- The learning procedures used during machine learning automatically focus on the most common cases, whereas when writing rules by hand it is often not at all obvious where the effort should be directed.

- Automatic learning procedures can make use of statistical inference algorithms to produce models that are robust to unfamiliar input (e.g. containing words or structures that have not been seen before) and to erroneous input (e.g. with misspelled words or words accidentally omitted). Generally, handling such input gracefully with hand-written rules—or, more generally, creating systems of hand-written rules that make soft decisions—is extremely difficult, error-prone and time-consuming.
- Systems based on automatically learning the rules can be made more accurate simply by supplying more input data. However, systems based on hand-written rules can only be made more accurate by increasing the complexity of the rules, which is a much more difficult task. In particular, there is a limit to the complexity of systems based on hand-crafted rules, beyond which the systems become more and more unmanageable. However, creating more data to input to machine-learning systems simply requires a corresponding increase in the number of man-hours worked, generally without significant increases in the complexity of the annotation process.

Proposed Uses of chatbots in Banking:

:

1. Inquiring account details, getting information about services /schemes, requestig for documents, etc.
2. Ordering/Renewing, checkbooks, passbooks, credit cards, etc.requestig for
3. Canceling services, cards, etc.
4. Registering complaints

Webhook code for linking chatbot to the cloud database:

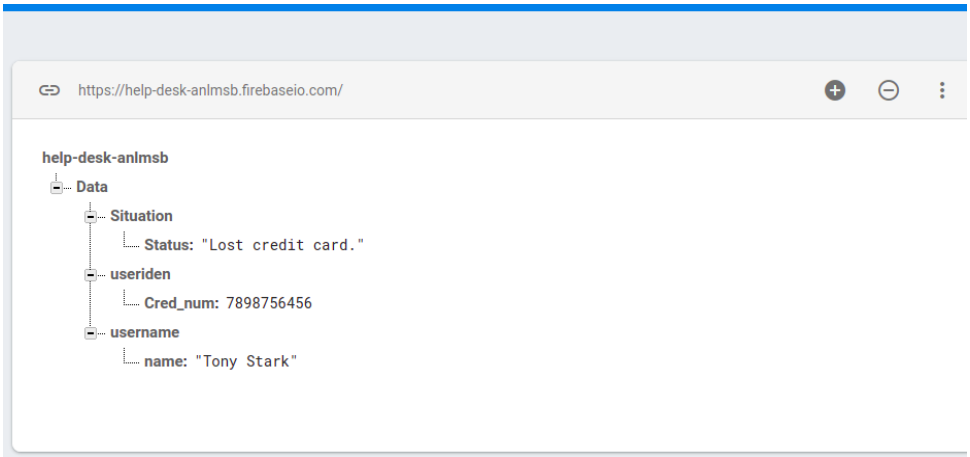
```
const functions = require('firebase-functions');
const admin=require('firebase-admin');
const {WebhookClient} = require('dialogflow-fulfillment');
const {Card, Suggestion} = require('dialogflow-fulfillment');

admin.initializeApp({
                credential:admin.credential.applicationDefault(),
                databaseURL:'ws://help-desk-anlmsb.firebaseio.com/'
});
process.env.DEBUG = 'dialogflow:debug'; // enables lib debugging statements

exports.dialogflowFirebaseFulfillment = functions.https.onRequest((request, response)
=> {
  const agent = new WebhookClient({ request, response });
  console.log('Dialogflow Request headers: ' + JSON.stringify(request.headers));
  console.log('Dialogflow Request body: ' + JSON.stringify(request.body));

  function welcome(agent) {
    agent.add(`Welcome to my agent!`);
  }

  function fallback(agent) {
    agent.add(`I didn't understand`);
```

```
  agent.add(`I'm sorry, can you try again?`);
 }

function handlename(agent)
          {         const name= agent.parameters.Name;
         return admin.database().ref('Data/username').set({name: name});
   }

function handlenumber(agent)
 {

  const number= agent.parameters.number;
 return admin.database().ref('Data/useriden').set({Cred_num:number});
 }

 function enterstatus(agent)
 {
   const status='Your complaint has been aknowledged.';
   return admin.database().ref('Data/Situation').set({Status:status});

 }

 function handlestatus(agent)
 {
```

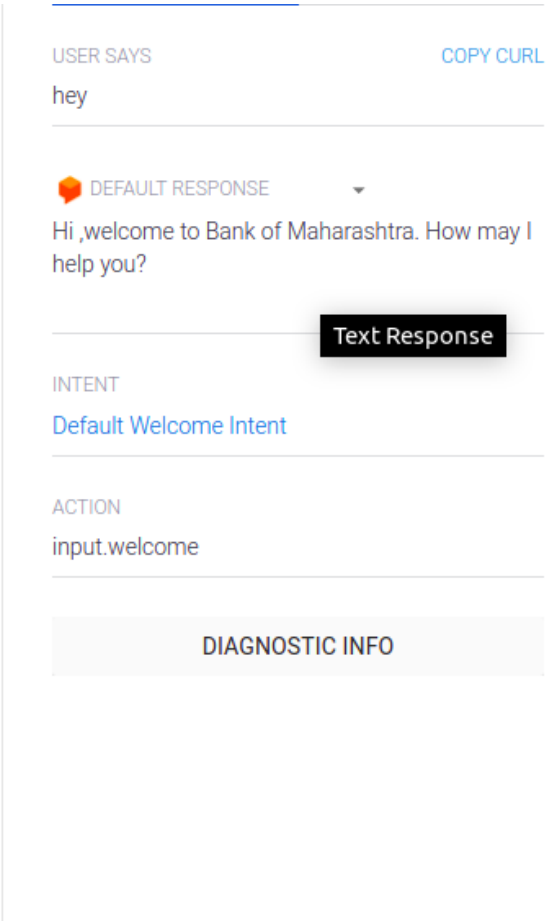
```
        return admin.database().ref('Data/Situation/').once('value').then ((snapshot)=>{
    var value= snapshot.child('Status').val();

    agent.add(`${value}`);

  });
 }

let intentMap = new Map();
 intentMap.set('Default Welcome Intent', welcome);
 intentMap.set('Default Fallback Intent', fallback);
 intentMap.set('Get_name', handlename);
 intentMap.set('Credit card number', handlenumber);
 intentMap.set('entry_taken',enterstatus);
 intentMap.set('Status',handlestatus);

 agent.handleRequest(intentMap);
});
```

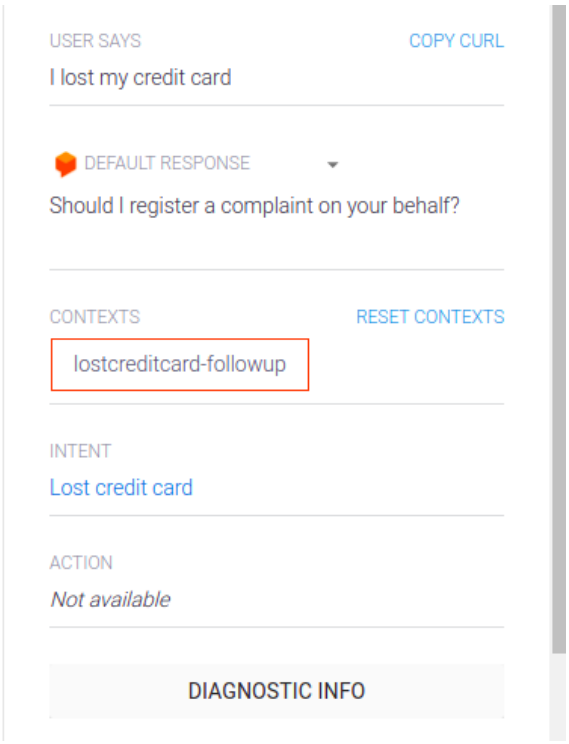
Suppose that a guy named Tony loses his credit card. Then he can register his complaint using with an interactive session with the banks' chatbot. He can check the status of his complaint using the same bot.

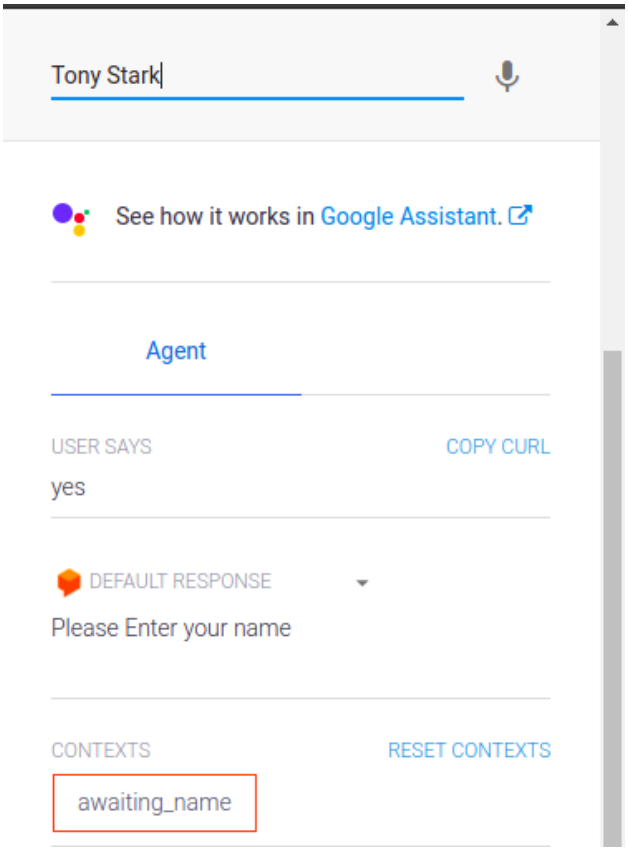
Bankers End : This is what the the cloud complaint register look like:

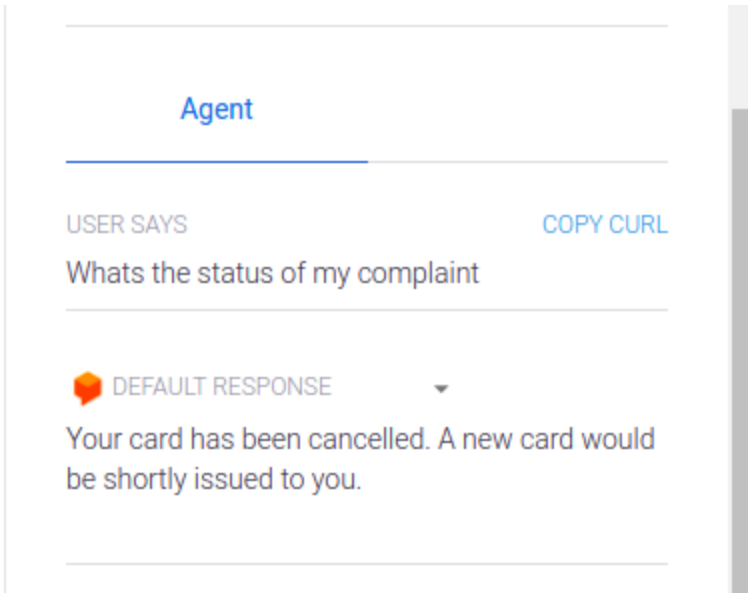


Customer's End:




USER SAYS
COPY CURL
I lost my credit card
DEFAULT RESPONSE
Should I register a complaint on your behalf?
CONTEXTS
RESET CONTEXTS
lostcreditcard-followup
INTENT
Lost credit card
ACTION
Not available
DIAGNOSTIC INFO


Tony Stark
See how it works in Google Assistant.
Agent
USER SAYS
COPY CURL
yes
DEFAULT RESPONSE
Please Enter your name
CONTEXTS
RESET CONTEXTS
awaiting_name



7. CASE STUDY: WORKING OF IDBI BANK

A brief conversation with a Deputy General manager (Ajanta Phatowali) at IDBI, Belapur helped me understand the business model of their bank. Historically, IDBI started with it's major focus on industrial lending which it still continues to do. This is one of it's USP.

According to her the paperless system at their bank was a major step towards TAT improvement. It allows fast transfer and verification of files and things become a lot more transparent.

IDBI has an online portal where people can apply for loans (except business /corporate loans) sitting at home. They try to get most of the documents online itself (which are digitally verified). They too have a third party due diligence system. People via this portal can track their loan progress anytime.

According to her, the 59 minutes MSME loan proposal (PSB 59) in Budget 2019 has always been followed at their bank.

8. Conclusions

- ➢ TAT in processing loans can be significantly improved with the help of modern technology, digitalization and automation.
- ➢ Data integration gives a bank edge over other banks by saving time and efforts, also services like digilocker aid the same.
- ➢ Blockchain and cloud technology can assist the bank and save lots of human resources and get work done more efficiently and quickly.
- ➢ Digitizing verification gives an added measure of security and helps reduce TAT.
- ➢ Chat bots in banks can help to provide better overall customer experience.

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