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# Open Banking using Voice Enabled Personal Assistants

Tejas Rajurkar[1], Akshata Kadam[2], Piyush Ingle[3], Sharayu Yadav[4], Dr. Madhavi Pradhan[5]
[1, 2, 3, 4] *B.E. Student, Dept of Computer Engineering ,All India Shri Shivaji Memorial Society's College of Engineering, Pune*
[5] *Professor, Dept of Computer Engineering ,All India Shri Shivaji Memorial Society's College of Engineering, Pune*

***Abstract: Open banking is a revolutionized technique of providing banking services to the customer through third party mediums without actually exposing the bank's sensitive data. It implements the RESTful services in form of APIs to encapsulate the data in a JSON format. Open banking coupled with voice enabled services would yield into an efficient method to allow customers to manage their banking tasks with much more ease and hands free manner. Thus this hybrid combination, resulting into Voice-enabled Personal Assistant, serves as a perfect solution to enable banking on the go. Nevertheless, it also proves to be a helpful product for senior citizens and visually impaired people in the banking sector.***
***Keywords: Open banking, Voice enabled services, APIs, JSON, VPA, hybrid***

## I. INTRODUCTION

Today's fast paced world has increased the need to drastically reduce the time required to perform any task/service, irrespective of its domain and complexity. A recent wave of digitization, especially in banking transaction has created numerous opportunities for various tech companies to use access and network technologies to transform the user experience and provision experience of the customers and the banks respectively. In this context, banking institutions can choose either to embrace change through the opportunities that technology offers by interacting with the greater ecosystem of market participants and other service providers, or to defend their position by focusing their efforts on developing competitive solutions for all customer and product segments and limiting access to their systems[1].

Open Banking aims at saving the customer's as well as bank's time needed to invest in banking services. It is a concept of allowing external service providers to integrate various banks services with their own products in a secured and safe manner.

This is possible due to the use of open APIs, developed by the banks, to provide the necessary banking data to the external service provider which only provide an abstract view of the sensitive data to them. These APIs provide a systematic approach to share data and limit its access depending on how and when the data is required. It communicates in a language understood by both the bank database OS and the service provider OS, usually in JSON format.

The service must request the required data and the bank in-turn responds the suitable data to the service. This method of data transfer is coined as "plug in and consume"[1], which encourages modular architecture of the service system. One of the most promising featured of Open APIs is that it supports heterogeneous systems thus allowing the innovators to develop a foolproof platform by reusing the existing services.

Voice-enabled assistants are capable of providing several operations or tasks as a response to speech input, regardless of the voice and accent. One of the most important parts of such an assistant is represented by speech recognition also called speech to text translation because it transforms human voice into a string of data than can be interpreted by the computer. It involves understanding of the spoken language using Natural Language Processor(NLP) and inferring the correct meaning out of it.

There are some open source software packages that allow speech recognition such as Kaldi or Pocket Sphinx [2]. However, recently many cloud based speech recognition systems have been developed which provide faster and more accurate results. Some of the major engines are Google Assistant, Amazon Alexa, Apple Siri, Microsoft Cortana. These engines are capable ofbeing a part of various artificial intelligence, neural networks, deep learning systems etc. The developers have made SDKs (Software Development Kits) open source so as to encourage their implementation for numerous applications and devices.

Implementation of Open Banking using Voice-enabled Personal Assistant opens new possibilities of user-bank interaction that will revolutionize the standard exhausting and time consuming banking methods to a simple, fast yet efficient banking methods. Usage of security measures like OTP ensures authentication of the customers, preventing ransomwares in the system. The ultimate aim of such assistants is to maintain the capabilities of banks and make them hassle-free and available to the customers at their own will.

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## II. LITERATURE SURVEY

The bank transaction services and methods have seen a lot of advancements throughout these recent years. People prefer the internet or mobile banking over standing in a long queue and going through the cumbersome bank process. To enhance this progress a step further, the concept of Open Banking was introduced. Open Banking can be defined as a model in which banking data is shared through an Application Programming Interface (API) to third parties [3]. The concept of Open Banking expands the scope of banking functionality by using the API as a gateway and exposing the necessary customer data from the local internal bank systems to a third-party system. API acts as an enabler where the bank systems can share not only customer- centric data but also the bank processes and application among the partner developers which can be a third-party system or internal system developer for the bank[4]. This whole process takes only after the necessary customer consent is acquired for sharing their data among the service providers. Subsequently, the third-party system performs the necessary data processing and analysis according to the service needed by the customer.

Open API can be broadly classified into different types based on their application and the participants working on the API. These include Partner API, Acquaintance API, Public API. Partner API allows access to only developers and associated partners to work with service API. Acquaintance API makes the development of services possible only by the associations who are validated by the banks or organisations through official documentations. hence the API required by the proposed system can be developed as an Acquaintance API since it deals with transaction sensitive data through third party developers. With Open Banking, new FinTech solutions can be introduced by combining the services provided by multiple partner banks where each service has some significant feature with it. This concept enable the developers to expose the core banking capabilities through open API in a convenient and in an user friendly manner. Where customer-centric data is being exposed to such third party developers , customers expect bank grade security while such applications who access their data from banking systems on their behalf[3].

With the use of Open API the application may become susceptible to cyber-attacks who can either damage the technical structure or various data theft. To overcome such challenges, implementing best security practices becomes a prime requirement for the application.

## III. EXISTING SYSTEMS

Nowadays various monetary transactions are carried out with the help of online mobile applications including GooglePay, Paytm, PayPal and PhonePay. These applications allow users to perform money transfer between different accounts and basic balance check. Also user gets notified whenever there is withdrawal or credit through the user's bank account. Transactions are secured with the help of OTP verifications. Online payments save lots of time by avoiding pen paper based banking.

PayPal is an online payment service which provides alternative to conventional paper based banking. PayPal provides facility of sending receiving and holding money to the millions of users worldwide[6]. Also users are given currency conversion option along with the basic banking activities. With the help of PayPal users can buy or sell different products by performing payments online. It has opened its platform allowing other services to use its infrastructure in order to enable peer to peer online transactions. It provides Web based as well as mobile application interface. PayPal services can be accessed through both the platforms.

Google Pay is a similar mobile payment application. It also allows user to add their bank accounts to the service and transfer money online. Users can send or receive money and pay for the products they are purchasing. Google Pay has added multiple layers of protections over transactions to make online payments more secure[6].

## IV. BACKGROUND STUDY

### *A. API Selection*

The usage of high level REST partner API satisfies the concept ideology. High-level APIs are those that we use generally in REST form where programmers have a high level of abstraction and they are only concerned about performing a limited functionality[4]. Since a pure Open API avails the application data to all users, this won't be suitable in the case where the data is customer or organization sensitive. So to prevent this, a process of documentation and specific validation takes place between the third party developer and the organization, converting these Open APIs in Partner API where any developer falling under the documentation process uses these API as an Open API. This results in restricted access of the API but at the same time ensures that dataflow remains within the recognized associations. Along with the properties of Open API, these micro-services will also behave as Internal service APIs which consist of exposing internal services into REST API[5].

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*B. Voice SDK Selection*

To incorporate voice control to the microcontroller a suitable voice command enabling SDK is required to be installed. There are voice SDKs available including Google assistant and AWS Alexa which can be helpful in providing voice control to various devices. Google assistant SDK understands natural language through natural language processing. It grabs the voice commands generated by the users and sends it to the Google Assistant where it's response is generated and then the response is sent back to SDK at device level so that device can put out the response[9]. Similar service is provided by AWS Alexa. AWS Alexa Skill Kit provides platform for Python, Java and Node.js. It also Requires AWS Lambda for Alexa Skill development[10]. So as compared to Google assistant it needs one more platform which is AWS's Lambda, a paid service. So it's simpler to adopt Google Assistant rather than involving other platform.

*C. Micro-controller Selection*

Selection of an appropriate micro-controller is crucial as it has to satisfy the minimum requirements of the proposed system. The micro-controller must provide sufficient amount of storage required for the SDK (approximately 215 MB), RAM (512 MB), latest Linux/Ubuntu OS support. There are various micro-controllers available in the market such as Arduino Uno, RaspberryPi 3, BeagleBone Black. The following table was used to compare three different micro-controllers.

| CRITERIA | ARDUINO | RASPBERRY PI 3 | BEAGLE BONE BLACK |
|---|---|---|---|
| PROCESSOR | ATmega328 | Broadcom BMC2837 | Sitara XAM3359 AZCZ100 Cortex A8 |
| RAM | 2KB | 1GB | 512MB |
| STORAGE | 32KB | SD Card Support | 4GB |
| OS | None | Raspian/ Linux | Linux |
| WIFI | No | Yes | Yes |
| USB PORT | No | Yes | Yes |
| COST | 1,669 Rs | 2,999 Rs | 4,600 Rs |

Table 1 - Comparison of Micro-controllers

On comparison, it was found that Arduino Uno did not have sufficient RAM and storage memory required for the proposed system. RaspberryPi 3 and BeagleBone Black both satisfied the the requirements and could be used for the implementation. The Google Assistant SDK documents also suggests to use a hardware platform which supports gRPC (Google Remote Procedure Calls) as the working of the SDK depends on it. Both the micro-controllers support gRPC so final selection depends upon the expense require for the proposed system. Therefore, RaspberryPi 3 proves to be the most suitable micro-controller for the proposed system.

## V. PROPOSED SYSTEM

In the proposed system, the customer first requests for the required information via VPA (i.e. voice enabled assistant). The requested voice query is tokenized and analyzed through different possible contexts by the VPA. The VPA then requests the query through the open API to the bank server for fetching the required data. The data is confidentially fetched and provided to the VPA which gives output to the customer in form of voice. The services provided by the proposed system are:

*A.* Account manipulation.
*B.* Checking the account balance.
*C.* Money transfer.
*D.* Getting foreign exchange rates.
*E.* Providing statistical analyses of cash inflow and outflow which helps prompt the user before transactions.

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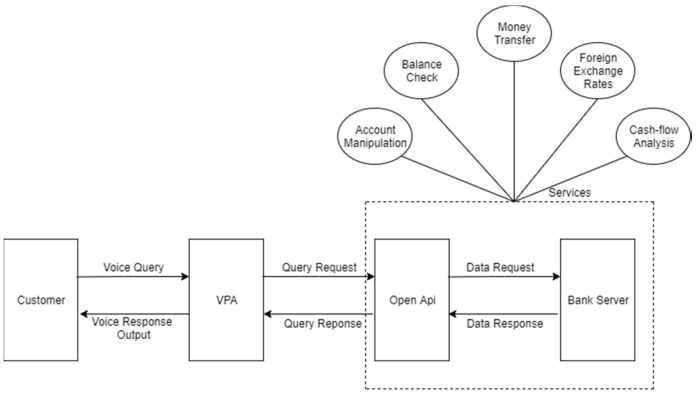


Figure 1- System Architecture

## VI. CONCLUSION

As the proposed system deals with the sensitive data of the customer, the idea of using Acquaintance API is most suitable. On comparing the available SDKs, Google SDK being completely open source provides cross platform support and hence serves as a best solution for the proposed system. For deployment, RaspberryPi 3 micro-controller provides the most optimum configurations to host the desired SDK and services considering the overall performance. In addition, this product will help visually impaired and senior citizens to perform banking tasks with ease.

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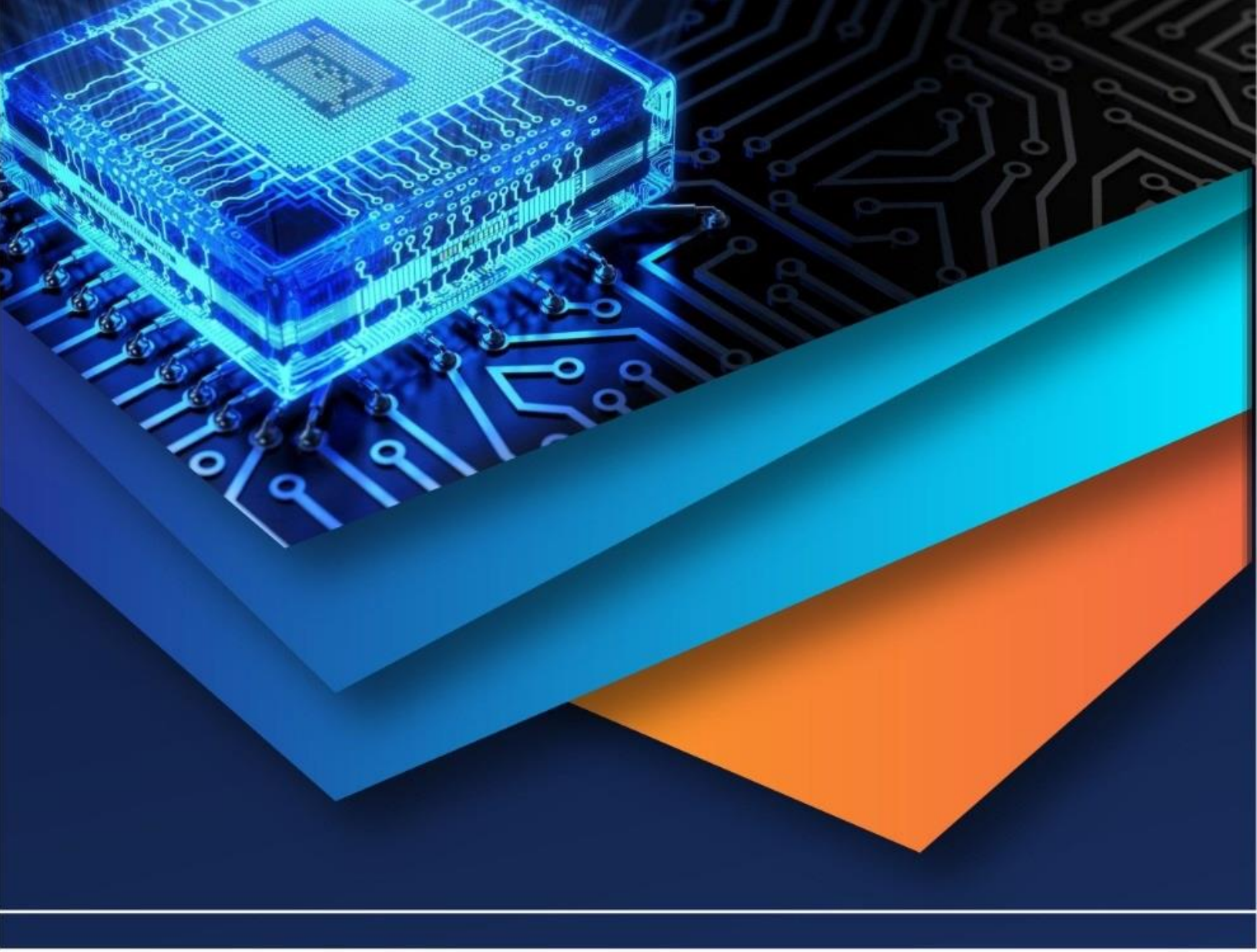

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