

Success Story

An AI-enabled mobile app to aid visually and hearing impaired to identify the denomination of Indian currency notes

Customer

Reserve Bank of India (RBI)

Country

India

Industry

Banking

About The Client



भारतीय रिज़र्व बैंक
RESERVE BANK OF INDIA

The Reserve Bank of India (RBI) is the central bank of India that manages all major monetary policies of India and handles the economic stability and growth. RBI was set up in 1935 under the Reserve Bank of India Act, 1934 and since then RBI has been playing an important part in the Development Strategy of the Government of India.

Technology Stack

TensorFlow	Swift	Java
aws	AI	OPEN&AR

Business Situation

The Reserve Bank of India (RBI) issued new currency notes in 2016. These notes in denomination of INR 10, 20, 50, 100, 200, 500, and 2,000 are identified and distinguished using different currency-embedded features.

Tactile markers and embossments on currency notes help the visually challenged ascertain the denominations of the notes. However, since such marks often fade with regular use, the visually challenged people often find it difficult to identify the denominations of the notes. RBI planned to eliminate this problem through technology. The requirement was to develop a mobile application that would help the visually and hearing impaired to identify denominations of currency notes through voice/sonic and vibration patterns.

To execute this initiative, Reserve Bank of India (RBI) zeroed on Unthinkable Solutions after a rigorous partner selection process as their technology partner, who would be responsible for managing the technical and functional aspects of the project.

The Solution

At the inception, team Unthinkable presented a technical proposal, project management plan, software requirement specifications, high-level & low-level design documents, user acceptance test cases to RBI, which were approved by their technical team to proceed for the development process.

To counter for the usage of the app in poor internet connectivity areas, the app was required to work in the offline mode as well. Since the app would not be able to learn by itself due to its offline nature, it was important for the Unthinkable team to train the app for working in offline mode. Unthinkable created a data set of 150,000 images of Mahatma Gandhi series banknotes in the denomination of Rs 10, 20, 50, 100, 200, 500, and 2,000 in order to train the app. Whenever a user scans a note, the app compares the scanned image of the note with 150,000 images in the data set and gives accurate results in the offline mode or low lighting conditions.

Along with this, security compliances such as Vulnerability Assessment & Penetration Testing (VAPT) and Static Application Security Testing (SAST) were a part of the development plan to ensure that the app is secured against vulnerabilities at performance & code level.

The mobile app developed by team Unthinkable is enabling the visually and hearing impaired to perform the following actions:

- ✔ Identifying the denominations of Mahatma Gandhi Series and Mahatma Gandhi (New) series banknote (Rs 10, 20, 50, 100, 200, 500, and 2,000) by scanning front or backside/part of the note including half folded notes at various holding angles and a broad range of light conditions (normal light, low light, daylight, etc.).
- ✔ Identifying the denomination through an audio notification in Hindi/English and non-sonic mode such as vibration (suitable for those with vision and hearing impairment).
- ✔ Navigating the mobile application via Siri and Talkback feature for accessing the application features wherever the underlying device & operating system combination supports voice-enabled controls.

- ✔ Identifying the denomination of the banknotes without the internet. The app works in offline mode and automatically turns on/off the flashlight mode of the smartphone to adjust lights.

Training, Validating, and Testing Machine Learning Models

Artificial Intelligence (Image Classification) is the key technology that helps in identifying the banknotes and distinguish between them. For this, a proprietary data set with more than 150,000 images of Indian banknotes was created by team Unthinkable. This data set contained images of banknotes in different orientations, light, mobile camera, the background to assure maximum accuracy in identification. This data set is further fed to the machine learning models to train them before the app was released.

Considering the time constraints, the transfer learning approach was used to train the ML model, wherein, experiential learning in one or more source tasks is transferred and used to improve the learning of a related task. For this application, Unthinkable used a model that is trained on ImageNet samples. This model is trained on at least one million images and is hand-annotated to indicate what objects are pictured and classifies them into certain categories. The feature learning from the model is transferred to train the custom banknotes dataset, which is divided into the denomination categories, such as Rs 10, 20, 50, 100, etc. This helped the Unthinkable team to achieve maximum accuracy in output in minimum time.

The ML models after training are converted into mobileoptimized models to ascertain that the app works in the offline model. To optimize cost and performance, Amazon Web Services S3 (image storage), EC2 (for scalable computing service) were used and were secured using the AWS Identity and Access Management (IAM) service.

Vibration Mode for Hearing & Visual Impairment

For people with hearing and visual impairments, the app has predefined number of vibrations for different denominations; one vibration for Rs 5, two vibrations for Rs 10, three for Rs 20, four for Rs 50, five for Rs 100, six for Rs 200, seven for Rs 500 and eight for Rs 2,000. In case the app is unable to identify the denomination, it uses a long vibration and asks for the note to be scanned again.

Support and Feedback Setup

The app users are facilitated to get support or share feedback through an SMS and a missed call. These services are provided within the app and are managed by team Unthinkable at the backend. For this, a dashboard was developed that allows the support team to keep a check on issues or suggestions received and implement those for further improvement in the app.



The Impact

The application has been downloaded by more than 1 million users since its launch in January 2020. This initiative has also been lauded by several mainstream media agencies throughout the country. The mobile app developed by team Unthinkable is enabling the visually and hearing impaired to perform the following actions:

- ✔ Identifying the denominations of Mahatma Gandhi Series and Mahatma Gandhi (New) series banknote (Rs 10, 20, 50, 100, 200, 500, and 2,000) by checking front or reverse side/part of the note including half folded notes at various holding angles and a broad range of light conditions (normal light, low light, daylight, etc.).
- ✔ Identifying the denomination through an audio notification in Hindi/English and non-sonic mode such as vibration.
- ✔ Identifying the banknotes denomination without the internet. The app works in offline mode and automatically turns on/off the flash light of the smartphone to adjust lights.
- ✔ Navigating the mobile application via Siri and Talkback feature for accessing the application features wherever the underlying device & operating system combination supports voice-enabled controls.

Is there a digital platform you want to build or take to the next level?

Setup a personalized consultation with our technology expert.

Let's Talk