Project Report of

Audio-visual based mobile banking for elderly, illiterate and less educated users

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Rationale and Goals

According to Census of India 2011, India had 104 million elderly, a number that is expected to double by 2050. Additionally, India had 250 million illiterate adults and 189 million adults with less than 5 years of schooling. This project aimed to provide more usable mobile banking services to these 533 million adults, whom we refer to as “emergent” users, as they have only recently started using information and communication technologies.

Smartphone adoption in India has increased in recent times. Several middle-income elderly users have switched to smartphones. While feature phones are currently popular among the less educated and illiterate, the smartphone penetration, coupled with 4G (and now 5G) internet is rapidly increasing in this demographic as well. Soon, we expect that almost all mobile devices will be equivalent to what we call smartphones today. People with varying levels of education have started using applications such as WhatsApp, YouTube and Hotstar on smartphones.

And yet, one key application remains out of reach of emergent users is mobile banking. This implies that this group of users needs to visit bank branches to do tasks that they might have done on smartphones, thereby wasting time, increasing the crowds in bank branches, and limiting services for everybody.

The Interaction Design for Indian Needs lab in the IDC School of Design, IIT Bombay has been involved in research with emergent users. In the current project, we proposed to design a mobile banking application user interface that will be usable by elderly, illiterate and less educated people. We proposed to do this with the help of audio-visual interfaces, making use of voice and touch as input and audio and visuals as output. The goal was to create a usable and secure product.

Process and Project Timeline

The project was approved in March 2020, almost at the same time when Covid-related lockdowns were imposed throughout the country. Therefore, the process followed in the project evolved continuously in response to the emerging situation that limited field work. All the same, we followed an iterative, user-centred design process. On the whole, we prototyped the designs and evaluated them with users in three versions and four iterations. In each iteration, we redesigned the prototype based on the feedback. The study ended with a summative evaluation.

We created a protocol for the study in August 2020. The ethics clearance for the project was received in November 2020. Originally we had planned to start with an exploratory study to understand needs and concerns of the user. But given the still bad Covid situation, we instead started with an initial design. The initial design went through two rounds of heuristic evaluations by January 2021 and the first round of localisation in Hindi and Marathi. We call this **Version 1**. The main design philosophy was to minimise features that could confuse users and to ensure clarity. Through brainstorming, feedback from BoB stakeholders and designers, and using our own experience from prior projects, we prioritised these key tasks: logging in, checking bank balance, reviewing bank statements,

sending and receiving money over UPI, and making a fixed deposit. Our argument was that while other features could remain available to more advanced users, these features would essentially determine whether or not an emergent user will get going with mobile banking. The design rationale was that if a usable design was pinned down with only these features, other features could be added in the depth of the product.

In this period, while work had resumed in offices, it was yet not considered safe to be close enough to users (especially elderly users) to observe them use the app during an evaluation. Hence, we developed a special setup consisting of software and hardware that allowed the evaluators to stay far from the users during the study and yet observe them closely. From July 2021, the 2nd wave of Covid had abated sufficiently, and we conducted our evaluation of Version 1 with the first set of users. This evaluation was with 16 elderly users (10 in Delhi, 6 in Mumbai). The findings are summarised below.

The analysis of the emerging data led to valuable insights and we redesigned the prototype from October 2021 to January 2022. We call this **Version 2**. Apart from minor changes, this version had two key improvements over Version 1, both of which were rooted in the findings from our studies. Version 2 introduced three detailed interfaces to browse the transactions, and it supported the use of the app through training videos and in-app audio prompts. We also decided to standardise the names of the three PINs ("login password", "UPI password" and "MPIN password").

The detailed interface for browsing past transactions came as a keen requirement from the users. One view of the interface gave a *summary of income and expenditure*, and allowed the user to drill down into each category. Another view showed the user a traditional *passbook*. A third view allowed the user to see *all transactions of a specific individual*. The in-app audio prompts were derived from the prompts that we needed to support the elderly during their interactions with Version 1. The contents for the training videos were derived from the instructions that we needed to give the users before they started using Version 1.

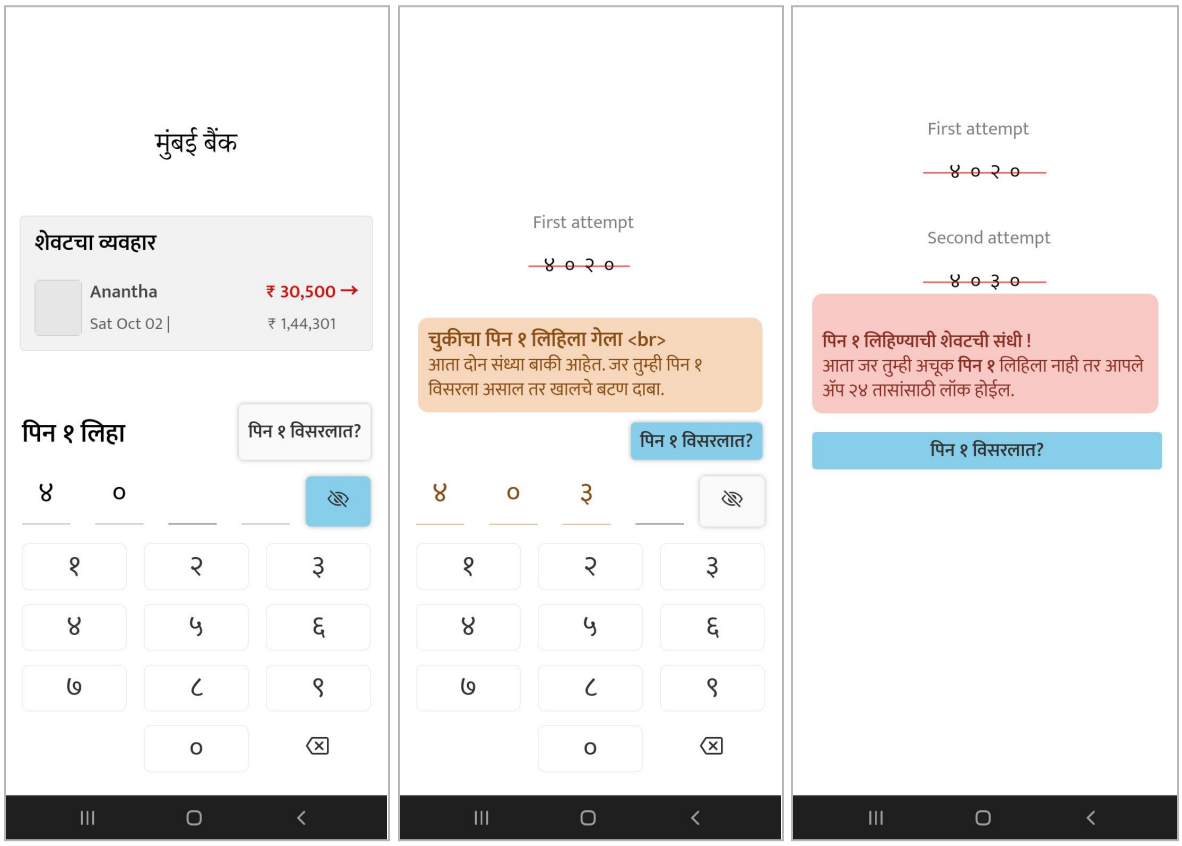
The income-expenses view called us to conduct an additional think aloud study to identify a suitable classification schema for incomes and expenses. We also created video and audio scripts, recorded these, edited them, and integrated within the app. These activities were conducted from January 2022 to May 2022.

From June 2022 to July 2022, we conducted another detailed formative evaluation of Version 2 with 20 users (10 users over 60, and 10 users between 30 to 60, but with lower levels of education). This led to some minor changes, especially in the new parts of the app, namely the income-expenditure view, and in the audio and video scripts. We redesigned the version (called **Version 3**) and conducted a final summative evaluation with 10 users from August to September 2022. Among these, 4 were over 60 and 6 were between 40 and 60. The final design evaluations showed that about half the users could carry out tasks without either audio or video aids. However, about 90% of the users were able to carry out tasks with the help of either aid.

Version 1 and evaluation

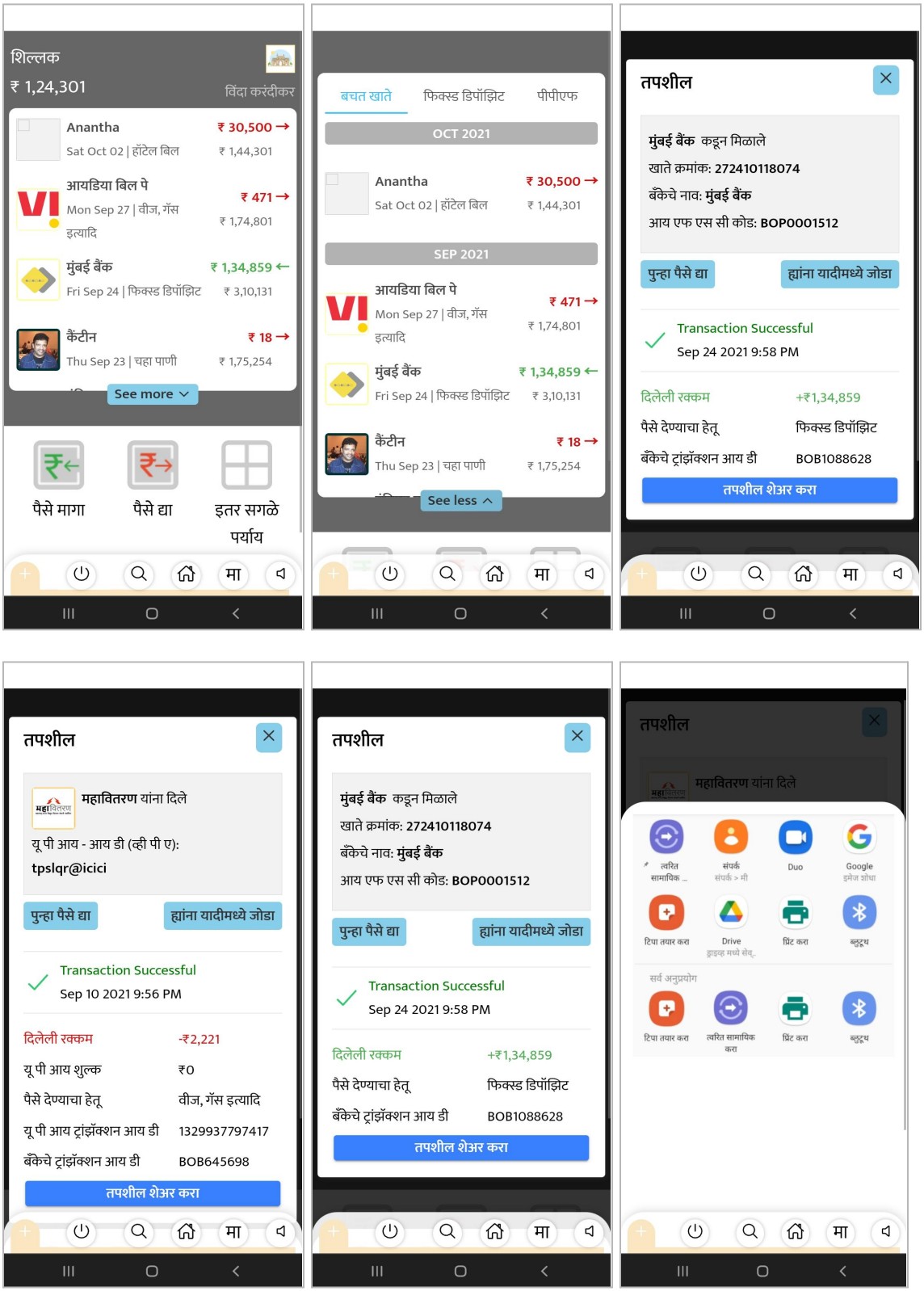
Version 1 was deliberately designed as a “provocative” prototype to understand the limits that such a design could be pushed to. Here, we first document the design of version 1, followed by the formative evaluation with 16 users, followed by the key findings with respect to the design.

Pre-login screen



The landing screen displayed the most recent transaction and the balance without logging in. Also, several options for wrong PIN entry and recovery were explored.

Landing screen and Review statements

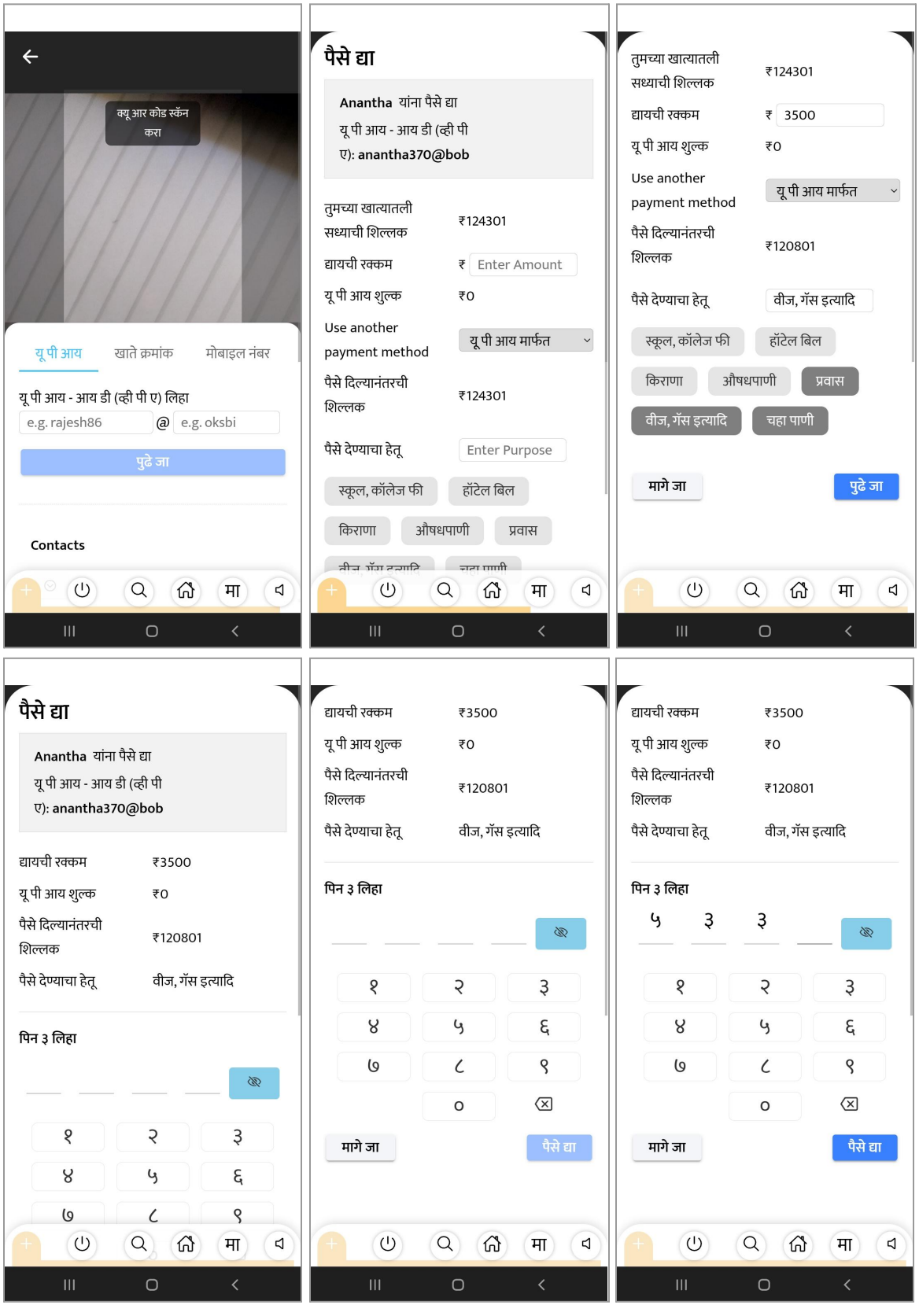


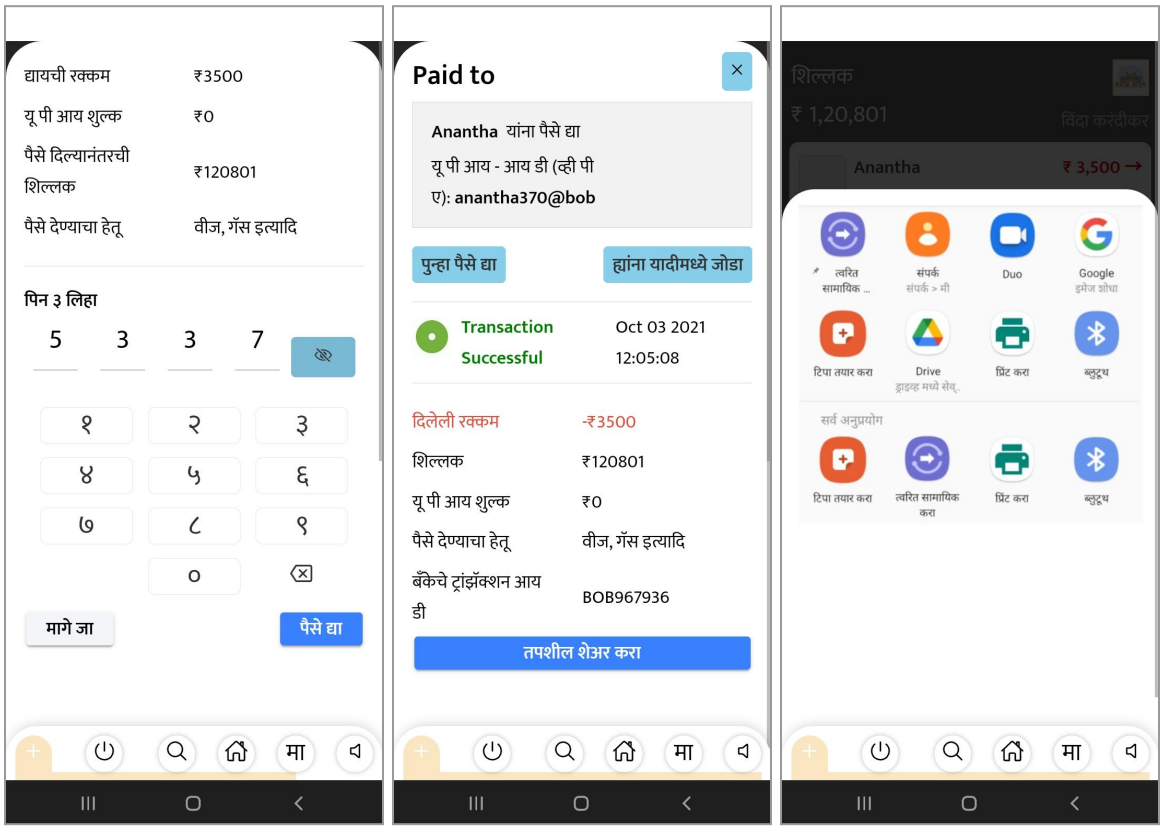
The post-login landing screen displayed a mini statement with the most recent transactions. This was considered to be the most important element of a bank account

and was brought up-front. The other two key buttons on the landing screen were to ask for money (wherein, the user could show his QR code, bank account details, UPI etc.) and pay money (which led the user to a payments screen).

Expanding the mini-statement automatically took the user to the passbook, FD, PPF and other accounts the user may hold. Tapping on any transaction led the user to a transaction details screen, which also had shortcuts to pay the same user again, or to add them to the payee.

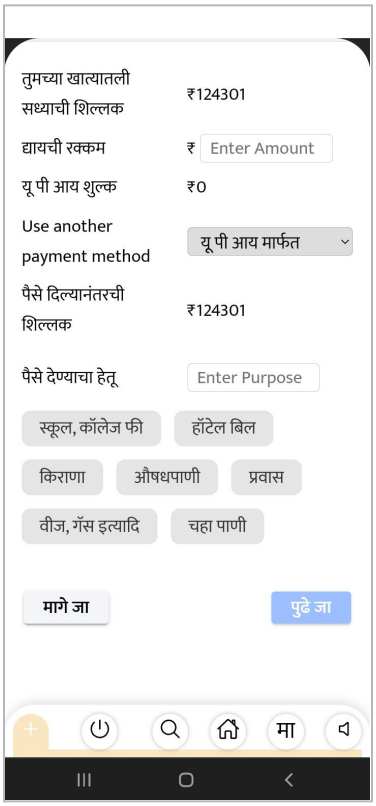
Pay by QR code scanning

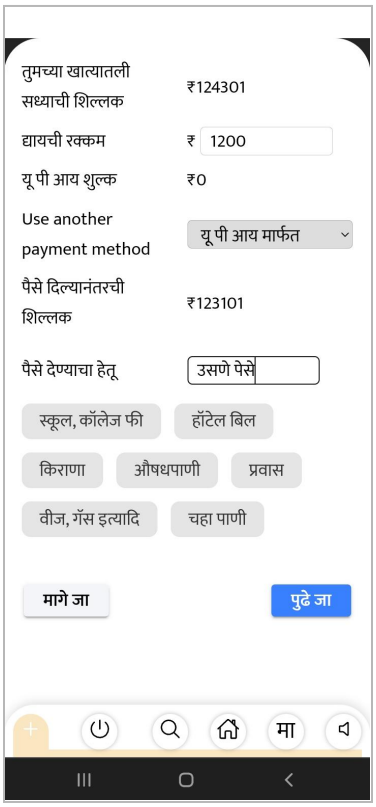


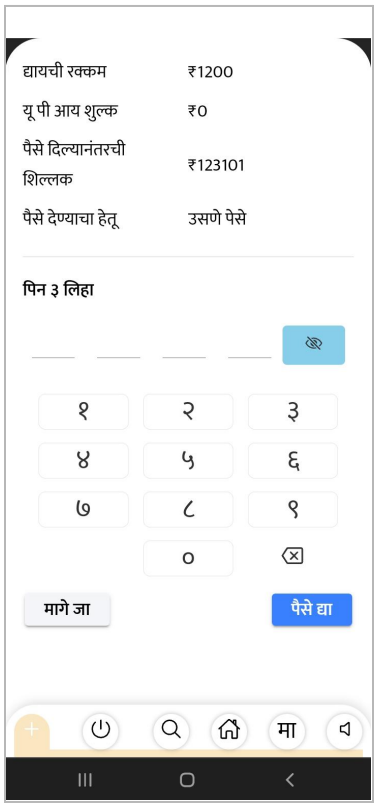


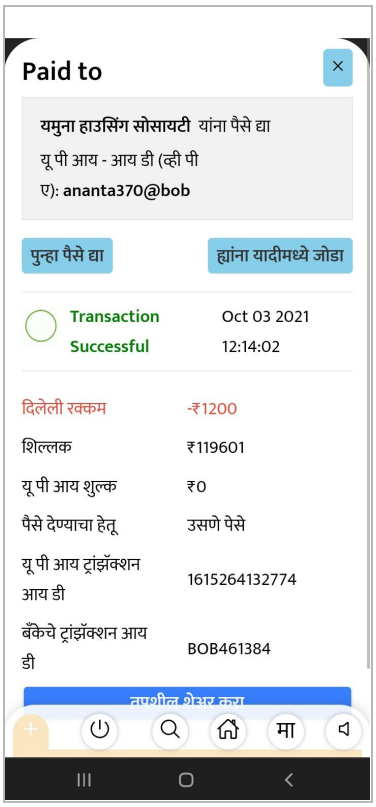
In the Pay Money screen, we prioritised the pay by UPI and tried to integrate the camera and UPI id screens into a single screen. We tried to identify common “purpose” tags that can be attached to the debit transaction, and even detect the same automatically. On the UPI PIN screen, we reminded the user of the amount being paid and the balance that will remain after the payment. On the post-transaction screen, we displayed a receipt, gave an option to share the receipt, pay the same payee again, and to add the payee to the list. This last screen was deliberately made to look similar to the transaction details screen discussed above.

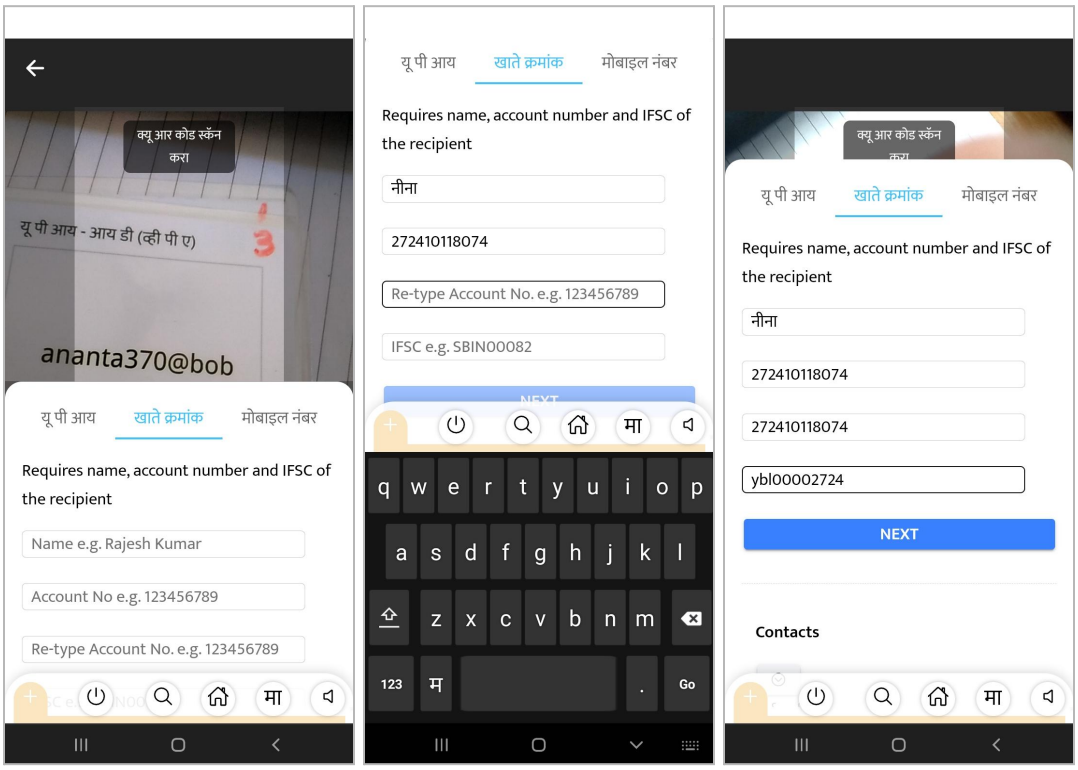
Pay by UPI ID / IFSC + Account number

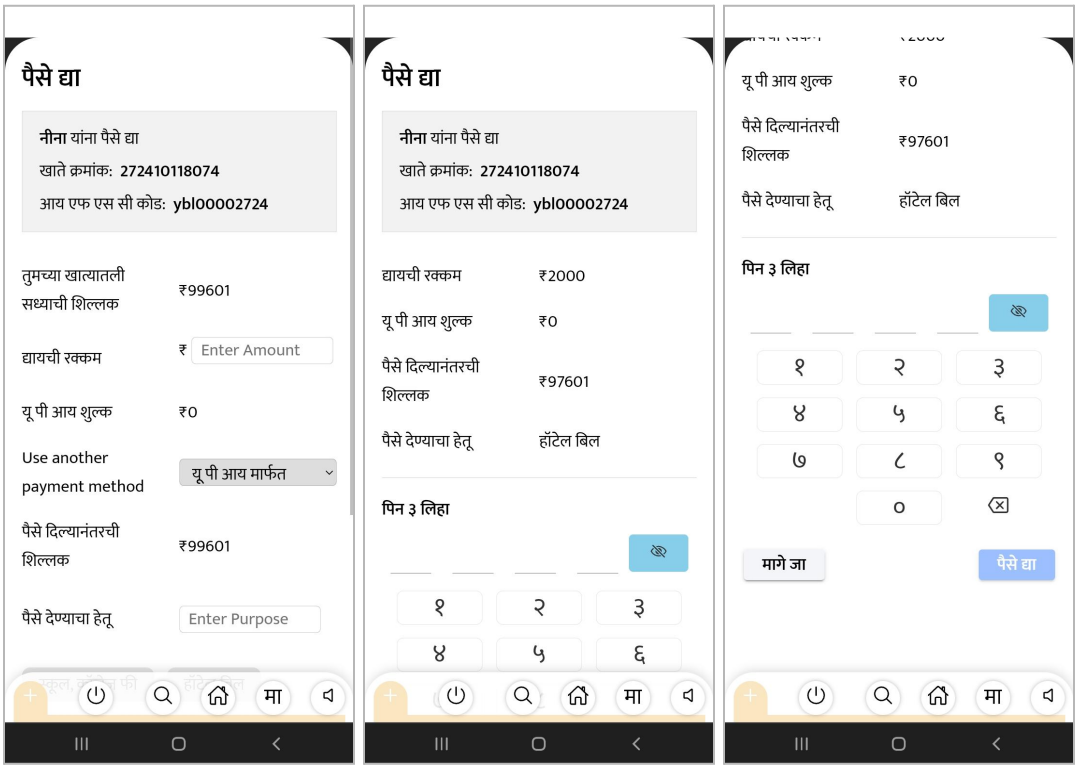









क्यू आर कोड स्कॅन करा
यू पी आय - आय डी (व्ही पी ए)
ananta370@bob
यू पी आय
खाते क्रमांक
मोबाइल नंबर
Requires name, account number and IFSC of the recipient
Name e.g. Rajesh Kumar
Account No e.g. 123456789
Re-type Account No. e.g. 123456789
नीना
272410118074
Re-type Account No. e.g. 123456789
IFSC e.g. SBIN00082
ybl00002724
NEXT
Contacts


पैसे द्या
नीना यांना पैसे द्या
खाते क्रमांक: 272410118074
आय एफ एस सी कोड: ybl00002724
तुमच्या खात्यातली सध्याची शिल्लक
₹99601
द्यायची रक्कम
₹ Enter Amount
यू पी आय शुल्क
₹0
Use another payment method
यू पी आय मार्फत
पैसे दिल्यानंतरची शिल्लक
₹99601
पैसे देण्याचा हेतू
Enter Purpose
द्यायची रक्कम
₹2000
पिन ३ लिहा
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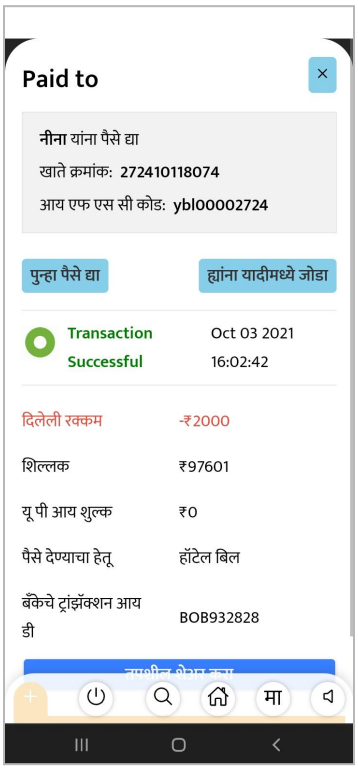
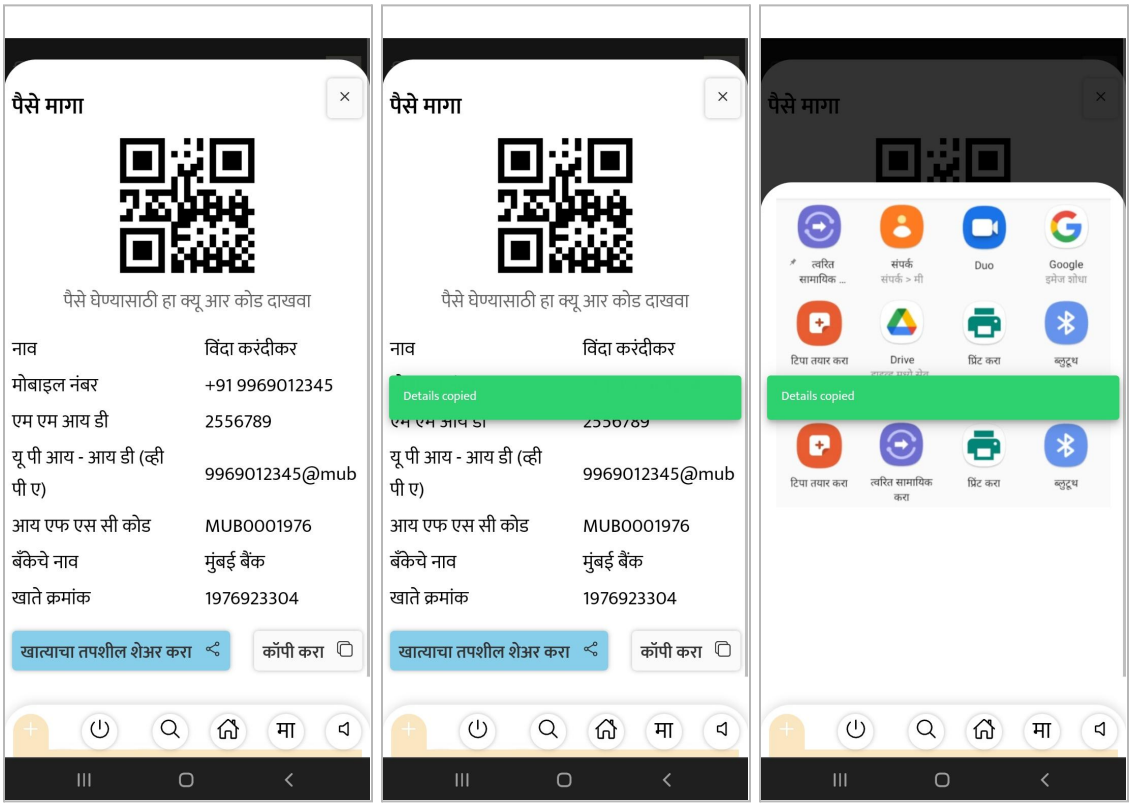
मागे जा
पैसे द्या



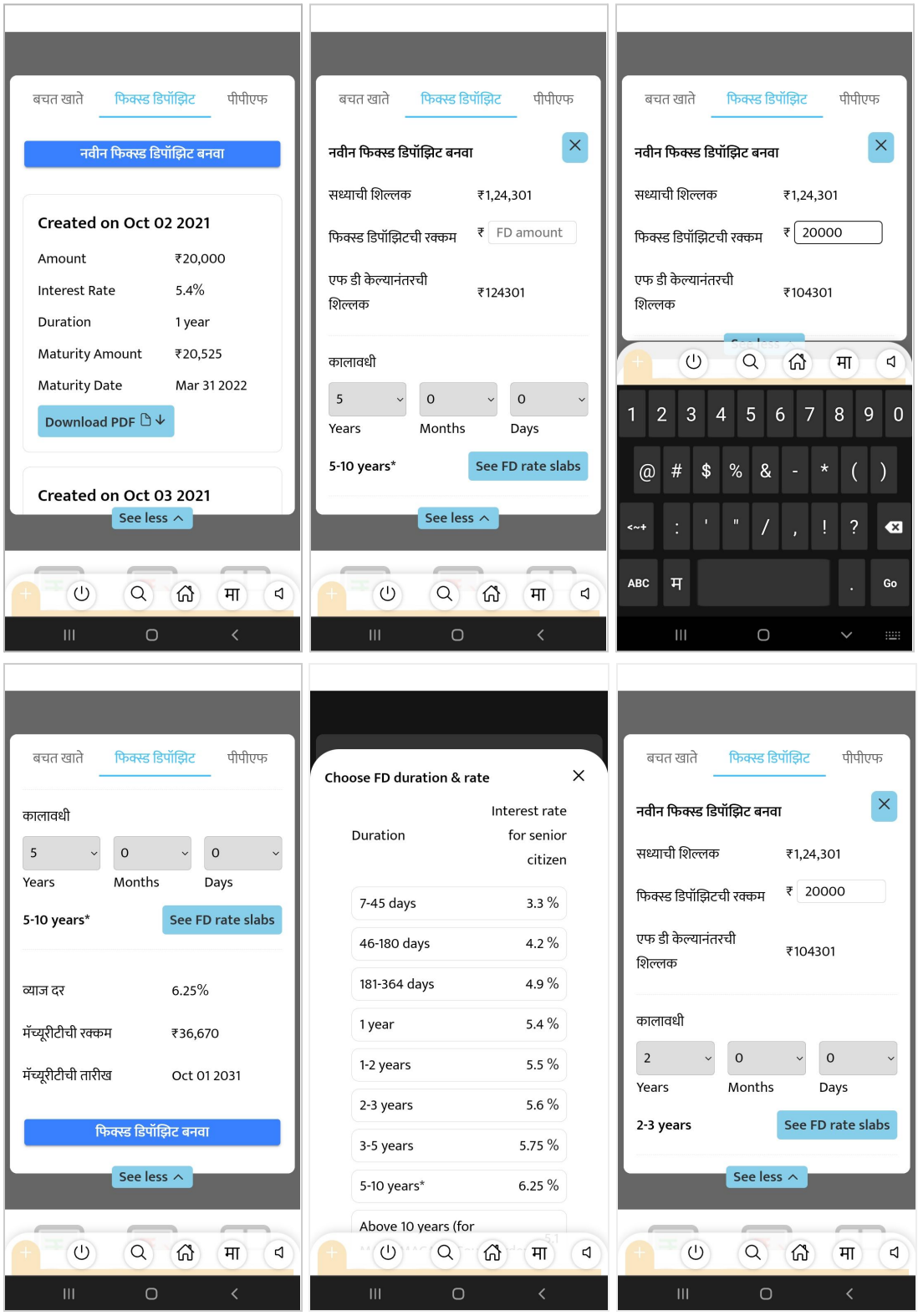
We designed similar screens to pay by UPI manually and to pay by account number and IFSC code.

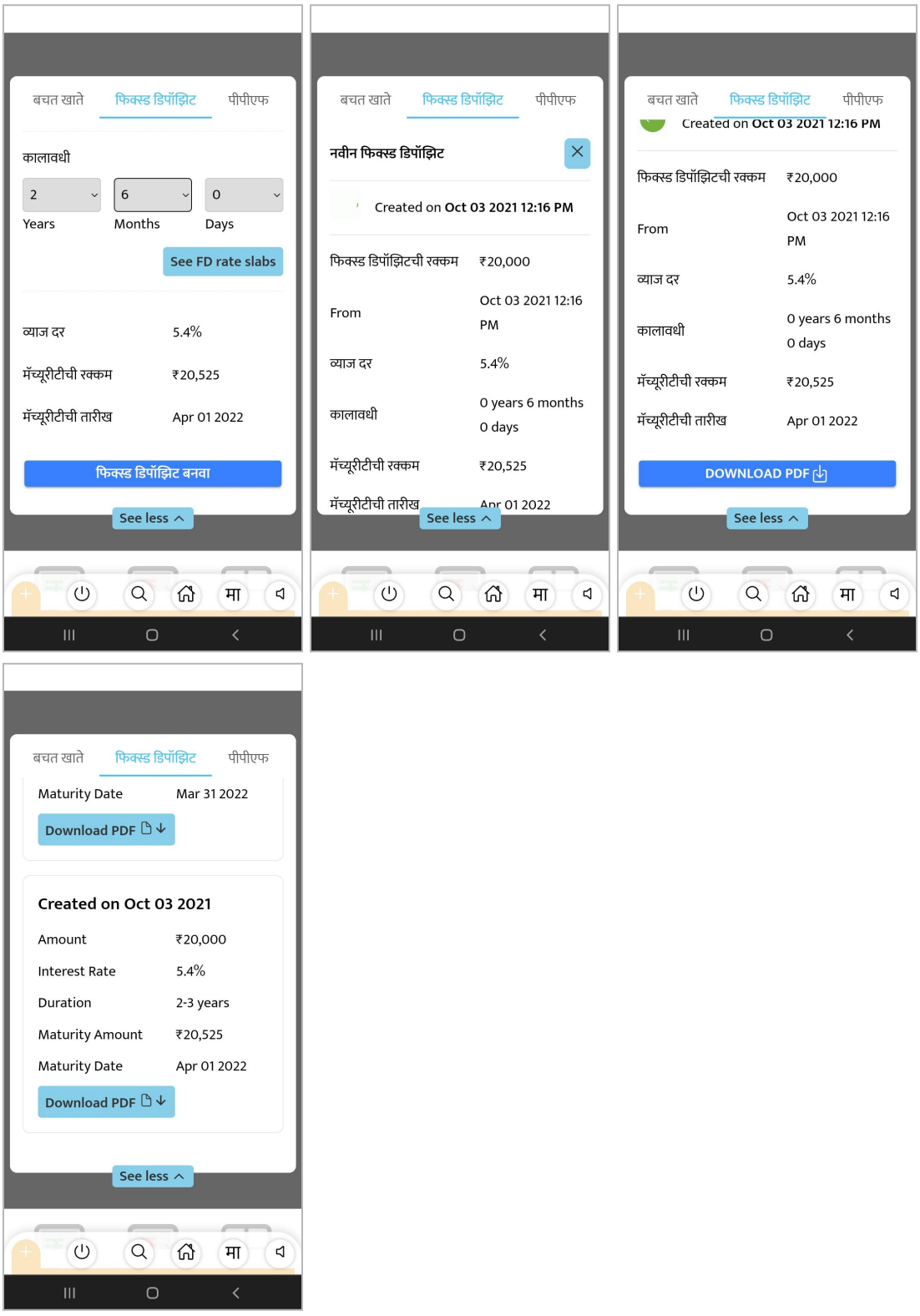
Receive money



We designed a special screen to include all information that a user might need to receive money from someone. This included the person's QR code that someone could scan from their UPI app, the name, mobile number, UPI ID etc. We also included options to copy the information on clipboard or to share through the Android share mechanism.

List of existing FDs, create new FD

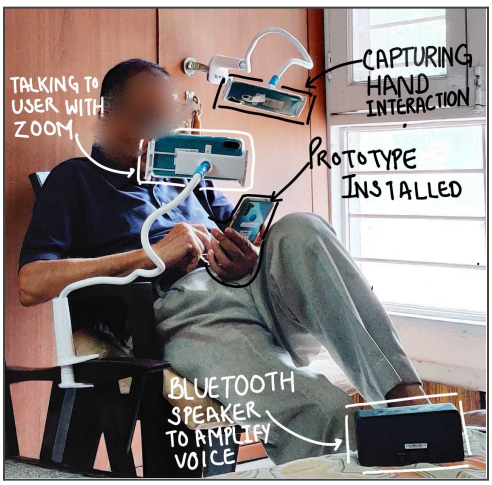


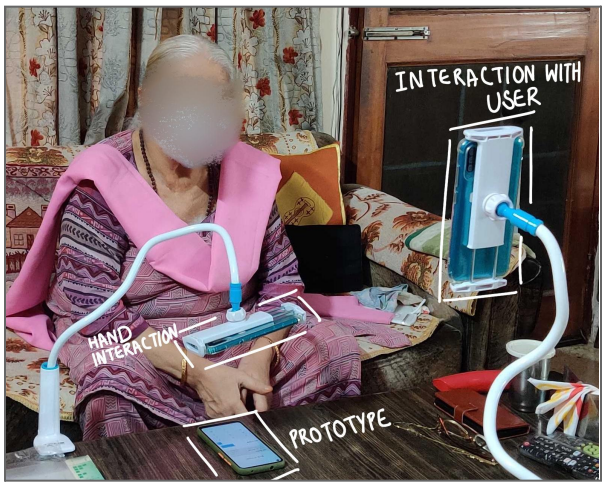


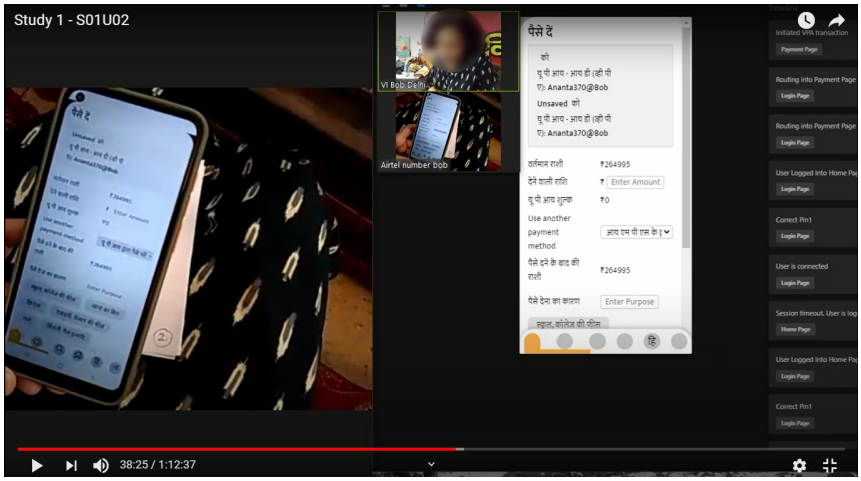
These screens helped users to view existing FDs and to create new FDs, including screens to view interest rates, dynamically adjust the maturity amount and date, the FD receipt, and an option to download the FD receipt PDF.

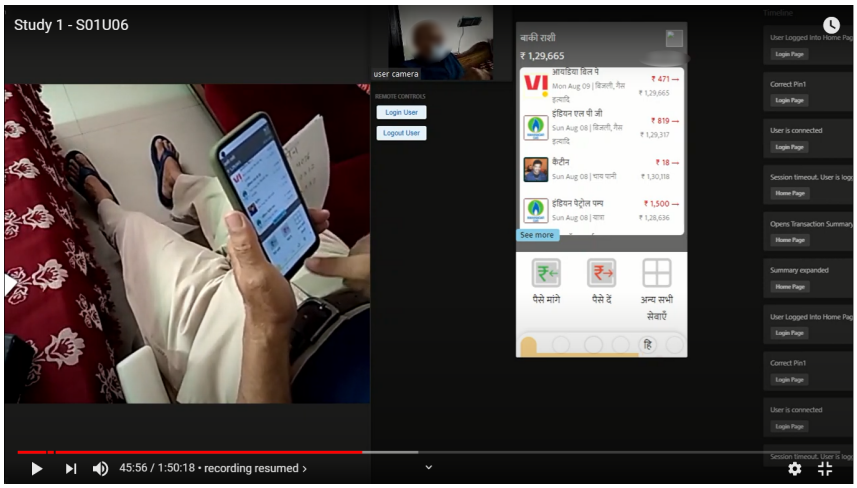
Setup to conduct remote / socially distanced interviews

We had to create special setups including special software and hardware to conduct the study with the users during Covid. This section describes the setup.







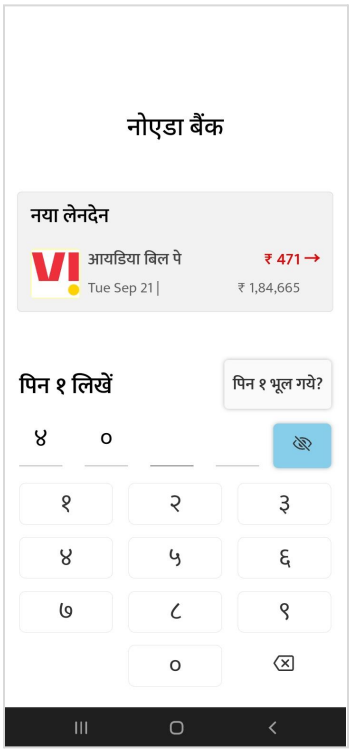


The setup had three phones at the user end. The phone in the user's hand was used to conduct the usability evaluation tasks. One of the phones mounted on the stand was used to capture user's interaction with the app during the tasks and the other stand-mounted phone was used to run a video call over Zoom between the user and the moderators during the evaluation. During the initial pilots we found that the audio quality was not sufficiently clear . A disposable headphone or bluetooth speaker was used for the video-call setup. We created a custom dashboard and a custom mirroring tool for our app that showed what the user was seeing.

The links below document the tasks that were given to the users, the label localisation that we had done for Hindi and Marathi and the slides that capture our findings from May 2021 and September 2021 meetings:

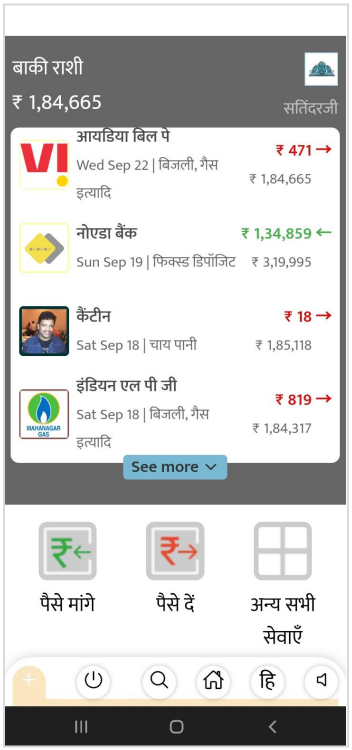
UT tasks , Label localisation , Internal Review May 2021 , Project review meeting September 2021

Key findings per screen of version 1



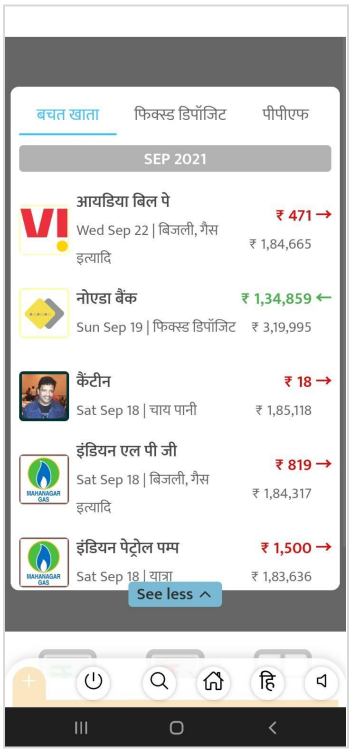
Pre-login screen

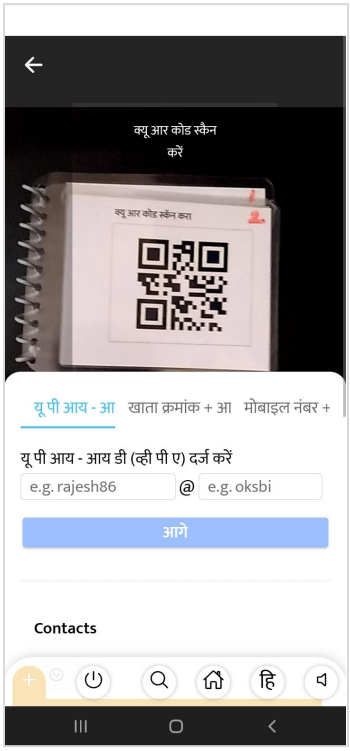
- Roman numerals were preferred (but most of our users were well-educated. Not sure how this might generalise for less educated users.)
- On probing, many users were OK with showing the latest transaction (unless it was a large transaction), “but surely don’t show the balance”
- People remembered the PIN after one or two attempts, though some looked it up from our booklet
- Timeout of 3 minutes was too less (so we made it 7 minutes), although this needs to be probed contextually, i.e. not during an evaluation
- Users had no feedback on better names for PIN 1, PIN 2, PIN 3

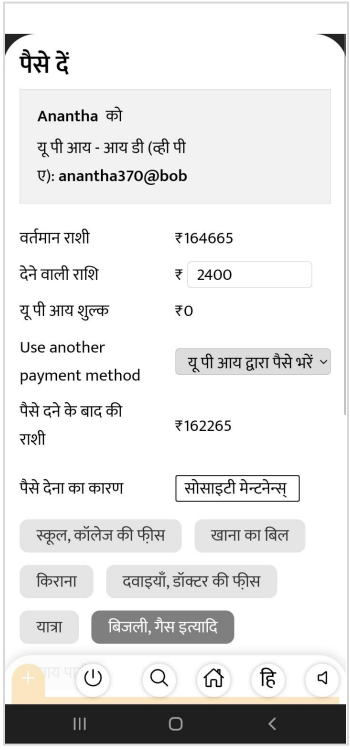


Landing screen

- Current balance was confusing because it was at the top. It is better to sort the transactions such that the most recent transaction is at the bottom and the current balance is below that.
- More generally, the labels need to bring in more context through expansive labelling - because of limited screen size, this may be better given through audio prompts
- पैसे मांगे term was confusing (शेअर डीटेल्स might be better) - did not understand the concept of asking for money digitally - could be clarified through audio prompts
- Red / green arrow confusing between the mini statement and the buttons below - +/- seems to be better in the statement for some - needs exploration

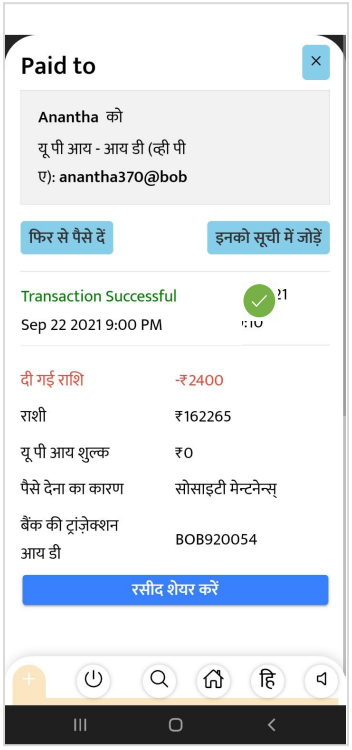
	• People could not easily locate the FD option - some expected it to be under 'अन्य सभी सेवाएं'
	Statement • People browse statements frequently in real life • People liked the purpose visibility in the statement: "like maintaining an expense diary" (and asked "how did this come?") • Amount and balance together prompted the users to check the transactions • This design of the statement had low browsability and other usability issues • Users need to see a longer list of transactions (5-6) years, to filter by financial year, amount, type of expense, type of income etc. Action item: explore ideas about how this can be improved for the next version • Questions people ask: "how much did I earn last year/month?" "how much was interest income?" • Design idea: Segregate by type e.g. income (pension, interest), expenses (discretionary vs. non-), savings (total saving, fresh saving, differentiated from capital and interest income), sort by payees / recipients • Transaction purpose: "Can they add the purpose later", "Can they add purpose to an incoming payment" • Action item: include a card sort activity to understand how to make the statement more browsable





Transactions

- This is a hard task (partly because of bugs)
- People still don't know what is UPI id - include in training video
- "e.g." not obvious **यहाँ लिखें**, move it below (disappears on typing)
- People thought that a QR code was a new method of payment - update training video
- Users worry over the amount entered - audio could be used to prompt (but also in words, commas, dynamic typography while entering amount)
- Confusion - purpose text box and readymade tags



Transaction confirmation

- फिर पैसे क्यों दें ? - “did the transaction fail? Will this set up a biller whom I pay regularly? Why will I pay the same amount again?”
- इनको सूची में जोड़ें nobody understood this feature, but liked it when explained
- The transaction successful notice is not noticed first - too low
- रसीद शेअर करें - “can I do by Whatsapp? Feature is useful”

Get money

- People were sceptical about sharing their bank account number with others “Why do I need to share bank details?” “Can I choose what to share?” “Which one is safe to share?” “Will only share with trusted person”
- People were okay to share the UPI ID instead of bank account details after we explain

Version 2 and evaluations

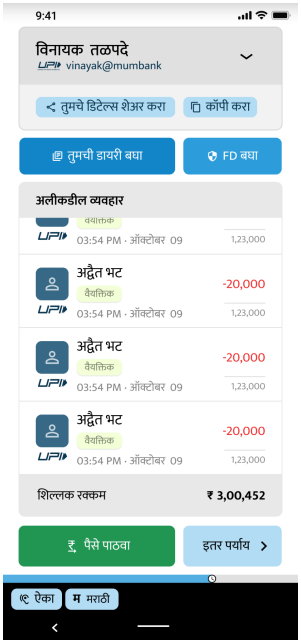
(Oct 2021 to Jul 2022)

Evaluation of the first version with Elderly users gave us valuable insights into how to redesign the application. The version 2 saw a complete redesign of the first version. We present the screens designed in the second version along with findings during evaluation for the respective screens.

The evaluations for the design were conducted with 20 users:

1. Age 30-60
    a. 4 females and 6 males
    b. Education - 5 to 7th
2. Age 60-80
    a. 6 females and 4 males
    b. Education - 7 to 10th

In this section we describe the parts of the version 2 that were changed while designing version 3. These changes were made based on the evaluation of version 2. For the full design document, refer to Version 3.



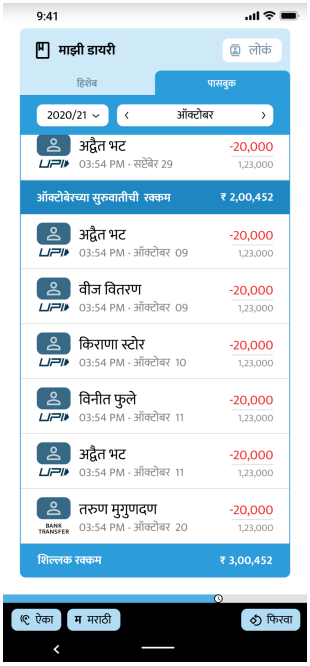
Landing Page:

The landing page included an information card of the user and recent transactions along with buttons for 'view diary' (तुमची डायरी बघा), 'view FD' (FD बघा), 'send money' (पैसे पाठवा), and 'other options' (इतर पर्याय). The screens were complemented by audio prompts that described the options on the screen starting from the top left to the bottom right.

Evaluation Findings:

The evaluation of this version revealed that the order of the element lent itself to the users remembering the initial items accurately as opposed to the items towards the end. A direct consequence of this was users forgetting the 'send money'(पैसे पाठवा) option at the bottom during the transaction task.

To fix the same, in the later versions, we moved the 'send money'(पैसे पाठवा) option to the top — next to the 'see FD'(FD बघा) option.



Diary:

The ‘My diary’ (माझी डायरी) screen included two top level tabs:

‘tally’(हिशेब) and ‘passbook’ (पासबुक). The passbook tab

included a chronological view of all the transactions, separated by a monthly separator. The tally view, on the other hand, included a ‘income’ and ‘expense’ comparison view.

Along with the two high level tabs, the ‘my diary’ view included a ‘people’ (लोकं) tab. This tab displayed transaction clubbed by transactors.

Evaluation Findings:

Our evaluation revealed that users found the two level hierarchy with ‘people’ at the same level as ‘my diary’ and ‘tally’ and ‘passbook’ on the same level, one under the former. To resolve this issue, we moved the ‘people’ tab at the same level as ‘tally’ and ‘passbook’; as it too is a way of grouping transactions.

Income-expenditure View:

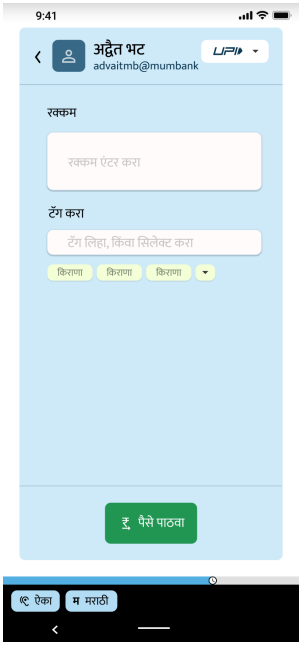
The hisheb or income-expenditure view had two collapsable sections for income(जमा) and expenditure (खर्च) split vertically. The user could collapse the income pane if they wanted to dig deeper into the expenditure and vice versa. The user could also compare the income and expenditure of the month through the split view.

Users could also choose the month or choose the entire year to view income and expenditure for that specific time frame.

Under income and expenditure, transactions of that month were clubbed under categories such as pension, interest etc. These categories were defined based on a card sorting exercise and evaluated in version 3. (process for the same is described in detail in the coming section)

Evaluation Findings:

As our users belonged to a population that had recently been introduced to smartphone interfaces, the split view turned out too advanced an interface for them to effectively make use of. Instead, the interface confused the participants, making it harder for them to complete the task at hand. To solve that, we

	redesigned the hisheb view with two separate horizontal tabs for income and expenditure. Here only one of the two would be visible at a time and comparison was not possible.
	Payment Menu: The payments menu included a 'tag' filed along with the 'amount' field. Here the user could type in the amount they want to send and tag the transaction based on the purpose of the transactions. Evaluation findings: We found that giving users too much choice by asking them to type out custom categories discouraged users from tagging transactions at all. To counter this, through out card sorting exercise, we defined 6 categories and asked user to select one of the category instead of typing it. Secondly, we also shifted the category menu to the top of the amount field. This encouraged users to tag transactions.
	High level design: 1. Borders: We observed that the border took up too much screen real estate without serving a particular function, while cluttering the display. In our attempt to simplify and declutter the applicaion after the first evaluatiion, we got rid of the borders. 2. Screen time-out: Partciapnts construed the time-out bar as a loading bar, due to its visual similarity to the same. To mitigate this misunderstanding, we redesigned the visual representation of the screen time out to the screen progressively dimming after a minute of inactivity until it went completely blank and returned to the login screen. 3. Colour scheme: For version 3, we changed the colour scheme to match the barnd identity of Bank of Baroda.

Card sorting exercise for transaction categories:

Before the evaluation of version 2, we also conducted a card sorting exercise for determining the transaction categories in the 'tally' (हिशेब) view. Following this, while

evaluating version 2, we also evaluated the categories we had generated through the card sorting exercise.

Discovering the transaction categories: We visited 6 elderly users for this exercise. We asked users to list down the transactions they have made this week; followed by transactions they have made this month and the transactions they have made this year. We probed users with different examples to elicit more transaction examples. We typically were able to elicit 20-25 unique transactions.

Following this, we asked users to group these transactions by type. We did not have pre-defined tyes for this exercise; we let users come up with category names. Users typically came up with 5-6 categories. We also asked users to categorise transactions based on their frequency (i.e., weekly, monthly, yearly etc.)

We finalised the following categories from out initial card sorting exercise:

Debit categories	Credit categories
1. नियमित (daily needs) 2. चैन (discretionary) 3. इमर्जंसी (emergency) 4. भेट (gift) 5. खर्च नाही (not-expense) 6. इतर (other)	1. पगार / पेंशन / नफा (salary / pension / profit) 2. व्याज (interest) 3. भेट (gift) 4. उत्पन्न नाही (not-income) 5. इतर (other)

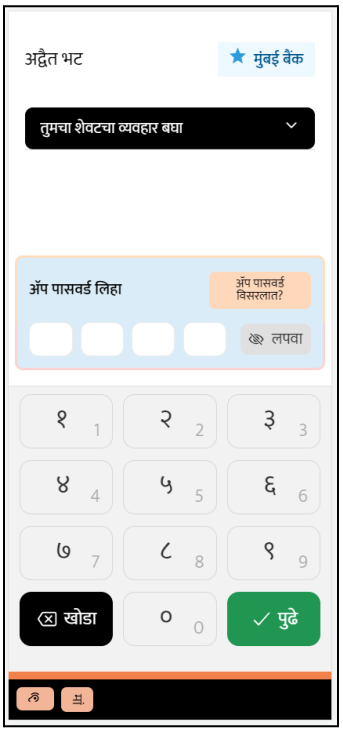
Evaluating the transaction categories: While evaluating the version 2 designs, we also evaluated the categories we had generated from the card sorting exercise with all 10 users. The exercise largely validated the categories we had generated in the card sort, but added a new category to the debit section: किरकोळ (insignificant/small transactions).

Steering committee meeting February 2022

Project review meeting July 2022

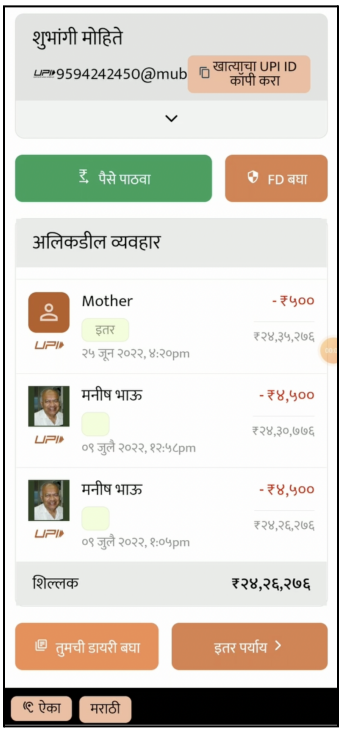
UT tasks & script - app v2

Version 3 - Final Design Description



Password Screen:

The password screen is the first screen the user lands on. It features a keypad and a blue password entry card that is identical to the physical password card provided to the user.



Landing Screen:

The landing screen features the user's information card on the top that can be expanded to view user details.

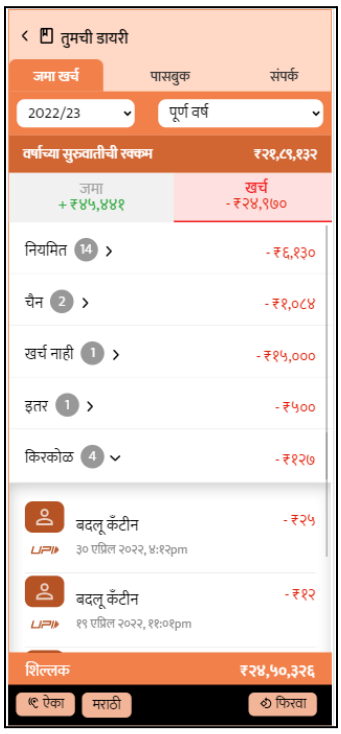
The recent transactions quick-view is placed in the centre of the page, right below the 'send money' button in green and the 'create FD' button next to it. The bottom features a button for viewing the 'diary' along with other options next to it.

The bottom-most black bar houses the 'hear' button—which enables the audio prompts—and the button to change UI language.

Diary:

The diary includes three high-level tabs: ‘Income-expenses view,’ ‘Passbook view,’ and ‘Contact view.’ Each of these views displays transactions organised in different formats.

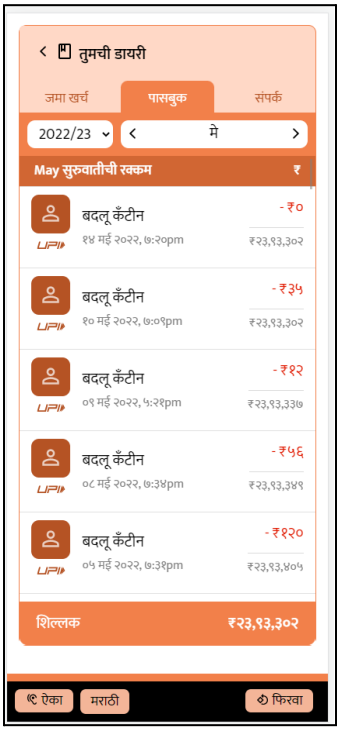
The Income-expenses view features two sub-tabs: Income and Expenses. Each of these tabs has transactions grouped according to meaningful categories that are auto-assigned at the time of the transaction. This auto-assignment system uses ‘smart defaults’ where users can also change the category at the time of the transaction or at a later point.



Income categories include pension / salary, interest, non-income and others. Expense categories include regular, petty, discretionary, non-expenses and others. Contacts or businesses with whom the user has many transactions are also presented as a separate category.

Based on a card-sorting exercise, we sorted user transactions into several categories under the umbrellas of credit and debit. These categories included ‘regular expenses’, ‘gifts’, ‘emergency expenses’ etc under debit and ‘Pension’, ‘interest’ etc under credit. Under these categories, users could find appropriate expenses - for eg., a payment to a grocery shop could be found under regular expenses.

The top of the income-expenses view features an option to select the financial year and a choice between a full-year view or a view for a specific month. The tab also shows the balance at the beginning of the chosen period at the top and the current balance at the bottom.



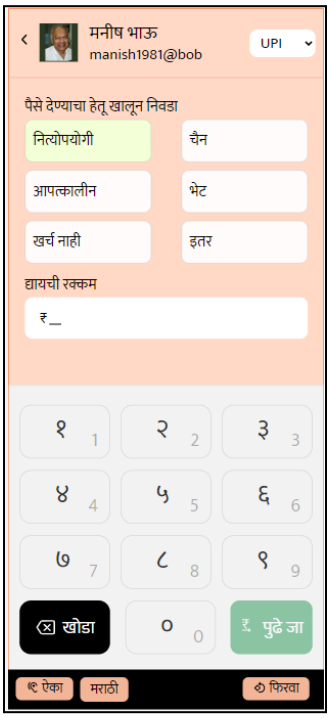
The next tab is a traditional Passbook view with transactions chronologically listed one after the other.

The Contacts tab lists all contacts that the user has previously transacted with.

When the user clicks on a particular contact, the user sees the transaction history like a chat interface, where receipts are left-aligned and the payments are right-aligned. There is an option to pay the contact at the bottom.

Payment menu:

Upon selecting the ‘send money’ option from the landing screen, the user enters the payment screen. Here, the user can either select an existing contact, scan a QR code or type out a new UPI ID (or exercise other payment options).



The payment screen features the payee contact's name along with their UPI ID on the top. By default, the UPI mode of payment is selected without any user input. If the user wishes to change (e.g. NEFT, RTGS etc.), a dropdown is available. (The current prototype does not detail out these modes.)

Below that, the user can select the category they want to put their current transaction in. The most appropriate transaction category related to this contact is smartly selected by default. The screen's lower half houses the keypad to enter the payment amount with the payment amount input field placed right above the keypad.

The app includes three aids:

A0: Conceptual video aid: This is a brief conceptual video that explains what an app is, what passwords are and what UPI is.

Conceptual video | Conceptual video script

A1: Audio aid - screen-based aid: The bottom-most black bar of each screen of the app has

a 'hear' button . When the user taps this button, the app plays audio prompts while highlighting relevant parts of the screen to guide the user on what actions can be taken using which element on the current screen. The audio is played on the same screen as the app. User can interact with the screen elements while the prompts are playing, or stop the audio prompts.

Audio aid script

A2: Video aid - task-based aid: The app is accompanied by videos to show how to do common tasks (such as how to make a UPI payment or how to check out the income and expenses). As of now, these videos are independent of the app (e.g. these could be uploaded on Youtube). Alternatively, these could also be linked from the app through a menu.

Task 1 video | Task 2 video | Video scripts

Instructions to use the prototype app:

- For the final prototype of the application, please head to https://mod.bob-proto.com/.

- On this website, you can start a session for a particular user(for the existing user) by clicking in ‘start’ next to the user
- Alternately, you can upload data for a user on your own and create a user.
- Once you start a session for a new user or for one of the existing user, you can use the ‘app link’ to open the app prototype. You can also share the app link so that the prototype is accessible on other devices.
- Following is an example of the user data for an existing user:

Name: Abha Jain

Age: 75

Mobile: 9969012345

Balance: 147523

App Language: Hindi

Mmid: 2556789

Acc No.: 1976923304

Bank: Bank Of Powai

Ifsc: Bop0001976

Vpa: 9969012345@Bop

Pin1: 2121

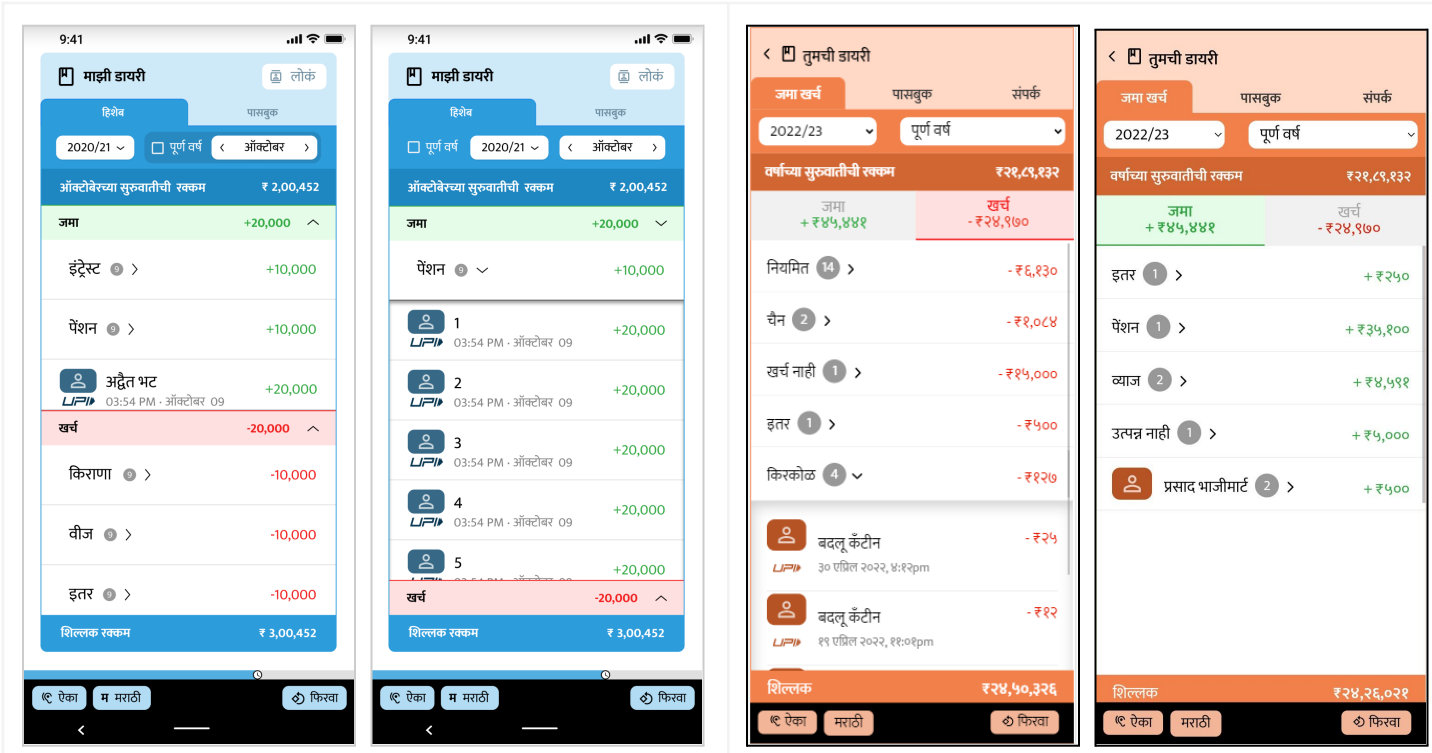
Pin2: 2323

Pin3: 2424

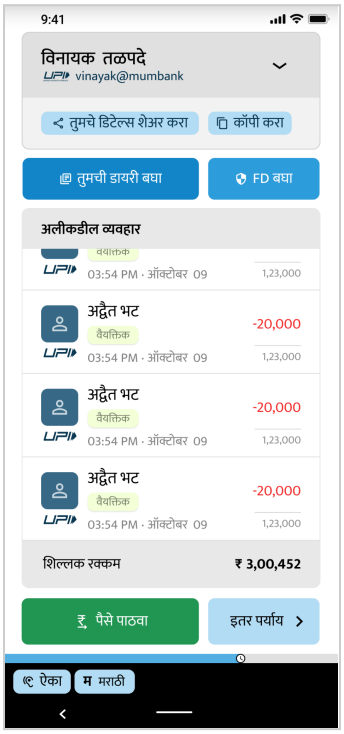
Dp Url:
Https://Res.Cloudinary.Com/Bankofbaroda-Protos/Image/Upload/V1625829313/Entity-Images/Avatar13_alui41.Png

Final evaluations

We conducted two pilots to test our protocol and method. Through the pilots, we refined our design and study protocol. The initial pilot was conducted with eight users. This pilot gave us helped us do a preliminary evaluation of the interface and the audio-video aids. We identified various problems in the design of the interface, the key ones being the design of the dairy view along with interaction issues with date selection. Users found the vertically divided diary view to be confusing. Our initial motivation to have both expense and income on the same page was so that users could compare the two at one glance. However, through our first pilot, we realized that the users could not use this feature. This led to a tab-based redesign. Along with that, instead of having a horizontal month-switching design, we shifted to a drop-based month selection menu, with full-year being a part of the same menu. A comparison of both has been shown below.



The second significant problem we identified was the order of elements on the home screen when using audio prompts. In our initial pilot, we found users using the audio prompts extensively. However, we found users forgetting important elements towards the end of an audio prompt. This was primarily due to users only being able to remember around 6-7 items at a time in their working memory. To resolve this issue, we rearranged the elements in the home screen to move ‘pay’ button on top as it was often missed by users. The changes in the design can be seen in the screens below.


9:41
विनायक तळपदे
vinayak@mumbank
तुमचे डिटेल्स शेअर करा
कॉपी करा
तुमची डायरी बघा
FD बघा
अलीकडील व्यवहार
03:54 PM · ऑक्टोबर 09
1,23,000
अद्वैत भट
वैयक्तिक
-20,000
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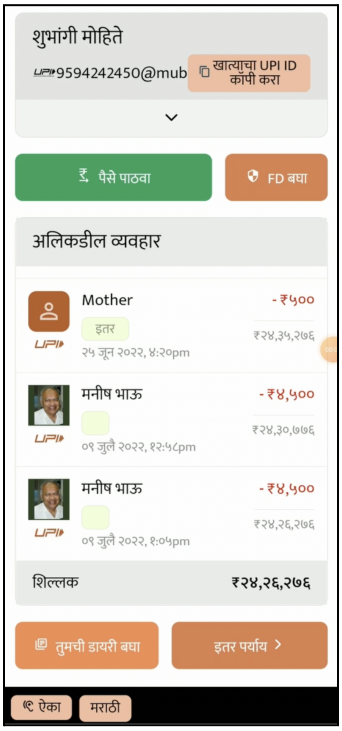
इतर पर्याय
ऐका
मराठी


शुभांगी मोहिते
9594242450@mub
खात्याचा UPI ID कॉपी करा
पैसे पाठवा
FD बघा
अलिकडील व्यवहार
Mother
- ₹५००
इतर
२५ जून २०२२, ४:२०pm
₹२४,३५,२७६
मनीष भाऊ
- ₹४,५००
०९ जुलै २०२२, १२:५८pm
₹२४,३०,७७६
मनीष भाऊ
- ₹४,५००
०९ जुलै २०२२, १:०५pm
₹२४,२६,२७६
शिल्लक
₹२४,२६,२७६
तुमची डायरी बघा
इतर पर्याय
ऐका
मराठी

Method and Study Design for Evaluation

Tasks:

In this evaluation, all users were asked to perform 2 tasks:

T1: Payment task - The user is given a QR code that belongs to an imaginary housing complex, and the user is asked to pay the society a monthly maintenance bill of Rs. 500. This was considered a close-ended task.

T2: Diary browsing and transaction finding task - The user is asked to browse the 'diary' view and find the payment made to a local grocery shop in the month of June. This was a task that required the user to do exploration through the information architecture to find specific information.

To identify how many users can do tasks without aids, and which of the two aids (audio/video) are more effective, we ran a cascading study design with three potential steps. In the first step, the user attempted to do the task without any aid other than the conceptual video. If the user completed the task without any aid, she stopped there. If the user could not complete the task without aid in 5 mins, in the second step she was given the first aid (either audio or video). If the user completed the task with the first aid, he stopped there. Else, in the third step she was given the other aid. Each step was time-bound, where a user was given upto 5 mins to complete the task at each step. At every step, the previous step acted as a purposive sampling strategy. Thus, the conditions in case of failure at the first step were:

C1: Audio-first: Audio is provided in step 2, and video is provided in step 3

C2: Video-first: Video aid is provided in step 2, and audio is provided in step 3

Steps:

Step 1:
First, the users were shown a conceptual video (A0). This was shown to all users. After that, the user was given the first task and 5 mins to finish the task without any other aid. If they could finish the first task, they were given the second task. Users who could complete both the tasks without any aid left the study here. The user who could not complete either task were randomly divided into two groups for the two conditions - C1 and C2.

Step 2:
C1: Users were given audio aid (A1) and another 5 mins to finish the task with this aid. Users who can complete both tasks with this aid leave the study here. The ones who cannot move to the next step.

C2: Users are given the video aid (A2) and another 5 mins to finish the task with this aid. Users who can complete both tasks with this aid leave the study here. The ones who cannot move to the next step.

Step 3:
C1: Users are given 5 minutes to finish the task with the video aid (A2) after they couldn't

finish it with the audio aid (A1). Users who can complete the task leave the study. The ones who cannot fail the task.

C2: Users are given 5 mins to finish the task with the audio aid (A1) after they couldn't finish the task with the video aid (A2). Users who can complete the task leave the study. The ones who cannot fail the task.

Qualitative Findings

We ran the studies with 2 groups of users. One group had education between 7 to 10 years and were more than 60 years of age. The other group had education between 4 and 7, and were between 40 to 60 years of age.

- The current design was evaluated with a total of 26 users
- With the first 14 users, a pilot evaluation was done. In these evaluations, the audio and video scripts were improved iteratively. Also, the protocol was fine-tuned until we reached the protocol described above.
- The above protocol was strictly run for the final 12 users

Qualitative findings from the evaluation (including the pilot) are detailed in the sections below.

Task-wise Findings

Payment Task:

In this task, we asked the user to pay maintenance charges to the residential society. They had to pay these charges using a QR code provided to them.

While users performed this task, we observed that the users were familiar with the visual of QR codes as they had seen these images at multiple places like stores, petrol pumps, etc. However, they were unaware that this image is called a 'QR code.' While most of them knew these were for payments, they did not have a clear mental model of how QR codes work; pointing at the QR codes to scan them was unclear to most users. We observed that the video aid worked better in explaining how to use QR codes than audio prompts. This was likely because while audio prompts only described what particular UI elements on the screen did, video aid provided users with a description and a demonstration of how QR codes were supposed to be used for payments.

Browsing Task:

In this task, we asked the user to locate the grocery expenses paid to the store during a specific month.

When users were performing this task, we observed that users spent substantial time on the home screen to figure out how to get to the transaction within the 'My diary' screen. They would often try looking for the required transaction by scrolling down recent transactions but failed as the recent transactions were limited to the last five transactions. Audio prompts proved to be useful on the home screen, as they helped users navigate to the 'my diary' screen.

After entering the 'my diary' screen, we expected participants to use the categorized income / expenses view to locate the required transaction. Contrary to our expectations, several participants used the passbook view to scroll down and look for the transaction they were asked for.

For users who tried locating the transaction in the income / expenses view, audio prompts helped users distinguish between ‘income tab’ and ‘expense tab’. However, it was not very helpful in explaining how categories worked. This was probably because of unfamiliarity with the categories we had used in the income / expenses view. What did not help was that we had not explained these categories in the audio prompts. (We had only explained them in the payments screen.) We feel that repeating the explanations on the income / expenses view will allow people to explore that view more meaningfully. Users found it difficult to locate the required transaction from the present set of categories as it wasn't clear to them that transactions were clubbed inside these categories. While the audio aid helped users browse around in the app, video aid was more effective in identifying categories as it explicitly explained the categories with examples. If the same had been done in audio, that would have worked well too.

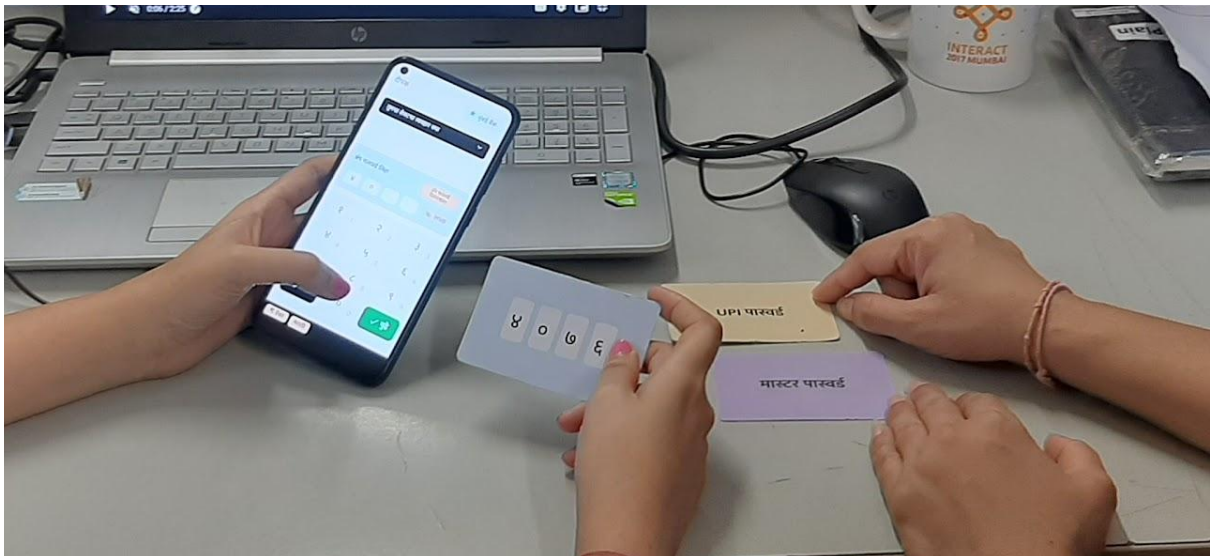
Audio Prompts vs. Video Aids

Our main conclusion from the study is that audio prompts are better at explaining what the user sees on their screen. On the other hand, videos are task-based – they explain how to do a particular task. Videos were not restricted to a particular screen and hence were useful in explaining mental models/ information architectures.

The following example illustrates a distinction between where audio prompts work as compared to video prompts:

As part of our second task, ie. finding how much money was spent on groceries in the month of June, users had to explore the ‘diary’ interface and locate a specific transaction. Most users in our user test were not able to complete this task without audio or video aid. This is perhaps because users are not used to exploring interfaces on their own. In those, we found video aids worked because our video aid explains how information is organised in these categories. Based on our initial analysis, we found users stumbled the most in exploring these subcategories using audio prompts as audio prompts did not explain the mental model of the ‘diary’. Videos on the other hand explained the users organisational schema of the diary and clarified how it could be explored for finding a particular transaction. This was also evident from the fact that users who were given audio prompts preferred using the traditional passbook view for locating a transaction.

Colored passwords helped users identify and input passwords correctly.



We found that having colour-coded password cards with references to the same in the interface helped users identify passwords correctly. We added a colour adjective to each password in the interface and users started referring to those passwords by their names while also including the colour tag. For example, we had labelled the UPI Pin as the “Yellow UPI Password”. The password entry field was also coloured with the appropriate yellow. When users would reach the screen involving password entry, they would pick the physical password card and use it as a reference to enter the pin.

This, however, did not help users remember the passwords. We believe at the cost of this downside, providing users with colored cards for entering passwords is a useful and potent strategy. We acknowledge that this implementation will need scaffolding to teach users how to securely store their password cards and provide them with new cards if they lose the old ones.

Summary

The following table summarises the findings from the 10 users x 2 tasks = 20 tasks.

	Age 40-60 (12 tasks)	Age 60+ (8 tasks)	Total (20 tasks)
Successful without aid	7	3	10
Successful with audio only	1	1	2
Successful with audio+video (in that order)	1	2	2
Unsuccessful with audio+video (in that order)	0	0	0
Successful with video only	1	1	2
Successful with video+audio (in that order)	0	1	1
Unsuccessful with video+audio (in that order)	2	0	2
Total	12	8	20

Conclusions and Recommendations for Deployment

Here, we summarise the key learnings and recommendations from this project:

- Minimise the number of options that the user is presented with on the first screen. By the time the audio prompts reached the 7th element on the screen, people began to lose their attention.
- Focus on UPI for the payments by default. Do not burden novice users with more complex interfaces with other forms of payments (e.g. NEFT, RTGS etc.). Keep these options only for advanced users.
- Standardise names and colours of PINs/passwords and use them consistently across all channels of communication.
- Make account information browsable with multiple ways of viewing the data. We recommend three ways, namely an income-expenditure view, a traditional passbook view, and a user-wise view
- In the income-expenditure view, automatically categorise each transaction as a best guess using intelligent algorithms to enable users to get useful summaries without any input. Give users an option to change the category of transactions. Use such inputs to improve the algorithm.
- Through simplification of the interface, better layouts, our participants could complete about 50% of the tasks without either aid (audio or video). Thus audio and video prompts helped a substantial number of users to complete tasks. The two aids between them could help participants complete another 40% of the tasks. Overall, with and without aid, users could complete about 90% of the tasks.
- Support each version of the app with task-oriented video aids. Video aids are useful in orienting the users and giving them an idea about how to do a particular task. Thus video-aids need to be task-oriented.
- Support the app with embedded audio aids synchronised with coach marks. These aids help users understand features on a specific screen. Thus audio-aids and coach marks need to be screen-oriented.