

Project – Ring Doorbell interface redesign

Arti Chauhan
achauhan39@gatech.edu

1 INTRODUCTION

From a Shark-Tank reject to a billion-dollar acquisition within a span of five year since its conception, story of Jamie Siminoff is awe inspiring. He focused on the *problem* he was trying to solve , rather than on *interface* (legacy doorbells) and consequently came up with an innovative and revolutionary product called Ring Doorbell [1]. Ring Doorbell, a replacement for traditional doorbell , is a Wi-Fi connected video doorbell that allows user to view visitors on their property via a smart-phone (or other Wi-Fi-connected computers).



It detects motion as someone visit your property and sends a notification to property owner on phone, tablet or PC. Owner can see and/or interact with the visitor in real time from anywhere. User can configure motion-detection zone around his property, using Ring App. App also maintains an event-history which allows user to view footage of events (motions and missed rings) at his convenience.



Fig 1 : How Ring doorbell works

Although Ring Doorbell is advertised as Home security device, it doesn't offer professional monitoring services. However, user can watch live streaming if Ring device is hardwired to existing doorbells power supply. User can also choose to monitor his community via Ring's *Neighborhood* feature (a crowdsourced app).

For this project, I will be evaluating Ring doorbell (specifically Ring Pro-2) as a whole and not just the interface and identify redesign ideas that would address any shortcomings in the product and addressing user's current and latent needs.

2 INITIAL NEEDFINDING

2.1 Needfinding plan and execution

For this project I performed two needfinding exercises – examination of existing product /customer reviews and interview.

Product/Consumer review : Since Ring is a popular product, there are thousands of reviews available online that I can leverage to get a better understanding of this product's strengths and weakness and its user's needs. There are 8000+ customer reviews available for [Ring video doorbell 2](#) on amazon. Reviews are rated at five-point scale. Though conventional wisdom says reviews rated as 1 or 5-stars are typically representative of highly opinionated individuals, it was important for me to get perspective from each rating-category. So, I randomly picked 20 reviews from each category for analysis. Since I was dealing with lot of qualitative text, I was watchful of Framing bias. I tried to classify each of the comments into one of the recurring problem categories (shown in section [2.2](#)). This helped me in getting to crux of the problem and not be misguided by wordings. To inform my analysis, I also examined reviews of competing products such as doorbells by Nest, Arlo, August.

Interview : From my M2-assignment experience, I realized directly engaging with the user allows designer to get much deeper knowledge of user's need and especially context. Hence, I chose to perform Interviews as opposed to Survey, which gave me the opportunity to ask follow-up questions. Goal of this exercise was to (1) validate any conclusions I drew based on product reviews (2) discover user's latent needs that product reviews failed to capture (3) get more specifics on customer pain points.

I interviewed 7 people (4 colleagues, 3 friends) out of which 5 owned Ring doorbells. On an average, I spent 15-20 min with each participant. Interview began with some icebreaker questions to build rapport and then explained them purpose of the interview. I had prepared key questions in-advance, however, interview was semi-scripted. I had intentionally left some of the questions open-ended to seek insight into user's motivations and implicit needs. List of interview questions is provided in [Appendix 8.8](#). To avoid confirmation bias, I carefully drafted my questions in a non-leading neutral way and got it reviewed by a fellow student. To control social desirability bias, I was watchful of my tone and facial expressions, to not lead participants in one direction or other.

2.2 Needfinding analysis and conclusions

Results of above exercises are presented in detail as [Data-Inventory](#) (Appendix 8.2). In short, my users are owners of Video doorbell (Ring), mostly adults of age range 18+, proficient with Mobile App usage. Users are where ever Ring product is sold but I have focused on users in USA for this project. Their overarching goal is home security. More specifically they want to be able to monitor/ interact with visitors on their property. Users interact with Ring App in various environments - at home, at work ,while driving or exercising. Needs and improvements identified from these exercises are :

1. Overwhelming majority of users were unhappy about the fact that they have to buy subscription to watch their video-recordings of missed events.
2. Many (40%) were concerned about privacy of videos stored in Ring servers. They want a system that would give them control over where their videos are stored.
3. Many users expressed the need for more informative/intelligent event alerts.
4. ~15% reviews complained about choppy audio and poor video quality. User is not able to decipher if it is poor Wi-Fi connection or overload at Ring Servers or user's cellular connection at fault here. They want App to have better troubleshooting capability.
5. A good portion of users showed dismay regarding vendor lock-in. Ring doorbell integrates with Ring security cameras, but App doesn't allow support for security-cams from other vendors. Ring users who own security-camera from another vendor felt this limitation is 'by design' and were frustrated about it.
6. ~70% of interviewees expressed the desire to have a voice-alerts in Ring App as current interface makes interaction difficult if user is driving.
7. Another interesting idea that came up during interview and while reviewing other products is the ability to display a (preconfigured) message on door-bell in situations where user can't come to the door. E.g. : When Package delivery guy arrives, user is busy in a meeting and hence can't come to the door. In that case, user can display a message 'Leave the package at door' on door-bell display.
8. Two participants questioned the sole reliance on Wi-Fi as access medium between device and Ring servers. Product stops working if Wi-Fi goes out. Why can't we have 'cellular connection' as a backup to Wi-Fi ?

3 HEURISTIC EVALUATION

I've provided some snapshots (8.5, 8.6) of current Ring App to aid following discussion.

3.1 What works and why ?

- a) **Gulf of Execution** – One of the strongest assets of Ring doorbell is ease of setup and use, which was hailed in many product reviews by industry experts and users alike. User can map his intention (*of installing a Ring doorbell*), identifying actions (*press 'setup' button*) and execution with little effort. Device setup is made amazingly simple via step-by-step tutorial within Ring App, aided by short animations and clear description of the steps that user needs to perform. Information presented in these steps communicates clearly and simply in user's own language, avoiding any technical lingo, following principle of Simplicity. E.g. : When user is asked to scan the code, animation shows where to find the code and how to scan it. For battery operated doorbell, it shows location of orange button that needs to be pressed to remove battery. Thus, Set-up process uses multiple modalities - short videos/visuals and text description, to bridge the gulf of execution. Device comes with all hardware needed, and useful extras, which allows user to focus on the task, rather than on collecting tools/artifacts to execute the task. Setup doesn't rush user to complete a step in a fixed amount of time, giving user control of the pace, which further shrinks the gulf.
- b) **Gulf of Evaluation** : One of the most common complaints that popped in user-reviews was device drops off Wi-Fi frequently. Ring-App addressed this issue via 'Device-Health' feature which enabled user to detect and evaluate health of the system in a seamless way. App shows when system performed the last health check and how good signal strength was. In latest version, they have integrated a 3rd party tool ('Bandwidth Place') which allows user to check speed and latency of his Wi-Fi connection. All these features shrink gulf of evaluation when troubleshooting connectivity issue.
- c) **Flexibility** – Ring offers both hardwired as well as battery operated doorbells, which sets it apart from its competitors, who offer only hardwired option. It allows flexibility in where doorbell can be installed. E.g. : If user wants, he can just duct tape doorbell to a post in his front yard.
- d) **Participant view** – Ring has done an excellent job in taking into account Participant view. (1)This product goes beyond the task of just 'watching

- someone at your door'. It addressed implicit need of safe community. App's *Neighborhood* feature allows user to share videos about suspicious activities (captured by their doorbell camera) with other members of *Neighborhood*.
- (2) More recently, Ring came up with a new version of doorbell (called **Door View cam**) that can be placed in door's peephole. This product takes into account user's context in term of 'residence-type' and developed this solution to address needs of users who live in apartments, condos or dorms.
- e) **Consistency** – (1) Widget layout in Ring App follows common design pattern, consistent with many popular Apps. On top-left, 'hamburger' icon shows pull down menu, where are all key options such as *Settings, Account, Help, Dashboard* can be found.(2) Ring video-player uses same control icons (for play, pause ,forward, rewind operations) as other popular video service. This enables user to reuse his knowledge from other systems, thereby reducing learning curve and making interface invisible.
 - f) **Direct manipulation** – user can configure motion zones and neighborhood perimeter by directly manipulating polygon on the map, using fingers.
 - g) **Mapping** : Event history view in App uses clever mapping of icons to convey event-type. Bell icon is used for missed bell event, 'A man on the go' icon depicts motion. These icons signify what type of event user will view, when pressed.
 - h) **Tolerance** – (1) When user presses 'delete' icon for video, App ask user for confirmation. It informs user of consequence of the action that video can 't be recovered once deleted. (2) **PIR** motion sensor is tolerant of false-positives and thus does not overwhelm user with notifications. E.g. : things like shadows from trees blowing in the wind don't trigger a motion alert.

3.2 What doesn't work and why ?

- a) **Feedback** : Quite often user experiences poor audio and video quality when using Ring doorbell-2. It doesn't provide any details beyond an error message '*we are having trouble reaching the servers*' despite the fact that servers just informed user about motion detected. This inconsistent feedback leaves user more confused.
- b) **Perceptibility** : Occasionally when attempting a live-view from cell phone, it shows nothing but a black screen, yet there is no indication of any error. It fails Perceptibility principle as user can't determine state of the system.

- There is no information provided to user to evaluate which leg of communication (Doorbell<->cloud servers <-> cellphone) is having issue and how to recover from it.
- c) **Equity** : Once trial period ends, user can only view recent(live) events and can't access past events without a paid subscription. It is no big deal until one realizes what counts as a "recent event". If button is not pressed within about ~5 secs of getting motion alert, it is marked as past event and user misses his shot. For a person with tremors this poses a big burden.
 - d) **Participant View** : App is very difficult to interact with if user is driving. User has to unlock the phone, provide credentials, log into Ring App (App logs out 'Shared-user' frequently) to talk user the visitor at his door, doing all this while driving.
 - e) **Consistency** : Ring doorbell camera or floodlight camera, when viewed with the Ring App, does not feel real time. This is inconsistent with other products (DVR recording system, IP cameras) that give real time audio/video because they send the feed directly to user's device. In contrast, Ring sends the feed to its servers first and then to user's devices, which increases latency, especially if servers are overloaded. This approach taken by Ring breaks user's expectations.
 - f) **Flexibility** : (1) App provides an option to snooze Hallway chimes for 1-12 hours, but it doesn't provide an option to do it on a recurring basis. E.g. : When taking care of ailing parent, one might want to mute chimes for certain hours every day when they are taking nap. (2) 'Neighborhood' feature allows you to configure only one neighborhood to monitor. It doesn't provide flexibility to configure another neighborhood. E.g. : One might be interested in monitoring their not-so-tech-savvy parent's neighborhood or neighborhood around their child's school.
 - g) **Tolerance** : Ring Device setup is amazingly simple due to a thorough walk-through. However, App acts very finnickily if user abandons the set-up procedure midway. It messes up phones' Wi-Fi connectivity. It asks user if he want to cancel the setup. When said yes, App gets stuck forever, stating *Restoring your Wi-Fi connection'*. Only way to recover is reset phone or explicitly kill the App. It doesn't provide user a clear exit to recovery.
 - h) (Political) **Power** : Ring door-bells requires high-speed reliable internet connection to work. These high-speed connections are available in middle to

high income areas, which are relatively safe [2]. Hence this very design (reliance on Wi-Fi) goes against Ring's mantra of 'Making Communities Safer', because low-income communities are disproportionately excluded, either because they don't have reliable Wi-Fi in their area or can't afford it. One way to address this is to support cellular connectivity (between device and storage servers) as most people have cellular connection these days. Moreover, cellular technology has evolved to support such IoT (Internet of thing) applications efficiently, minimizing the cost for customer.

4 INTERFACE REDESIGN

Insights gained from Heuristic Evaluation, interviews and product reviews led to several [redesign ideas](#), which I clubbed to come up with three big ideas.

1. Video upload to local servers (Fig 4.1)
2. Face Detection enabling Intelligent Alerts (Fig 4.2)
3. Voice-Alerts facilitating touchless interaction (Fig 4.3)

Note : Prototype with better image quality can be found [here](#)

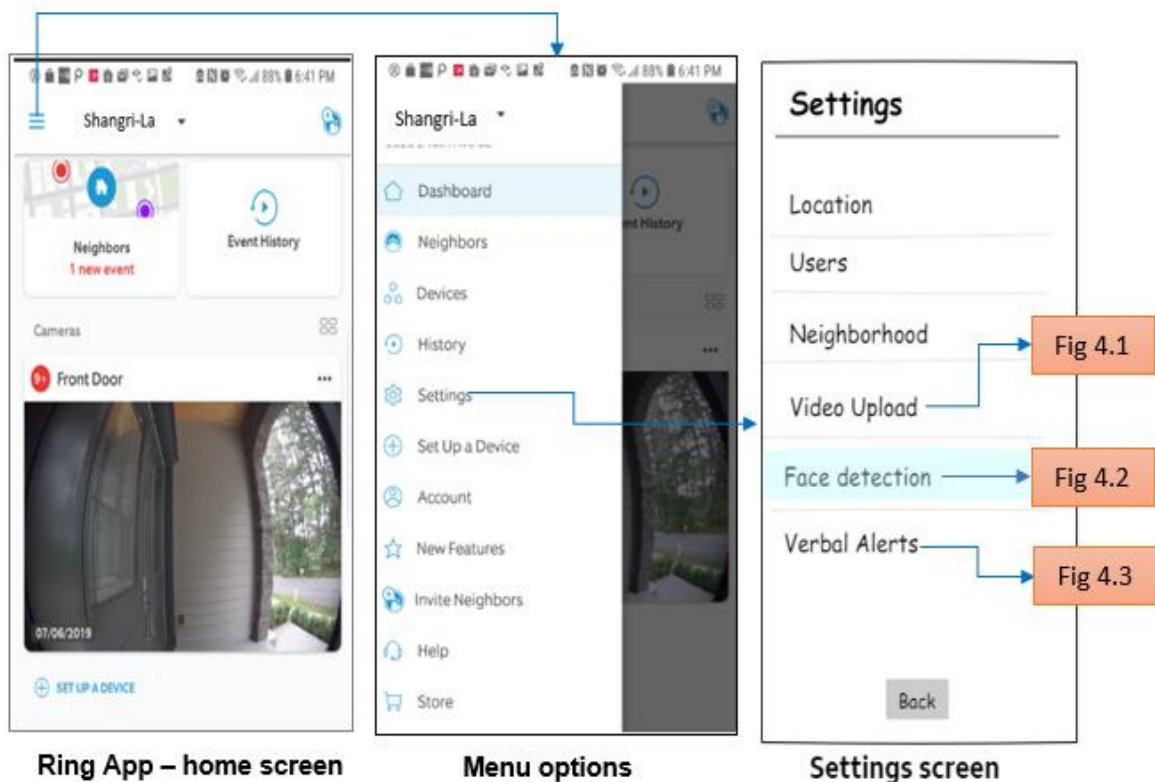


Fig 4 : Ring App's main screen
Three new features introduced in this redesign are integrated in existing 'Settings' option, to make it easily discoverable.

4.1 Video upload to user's server

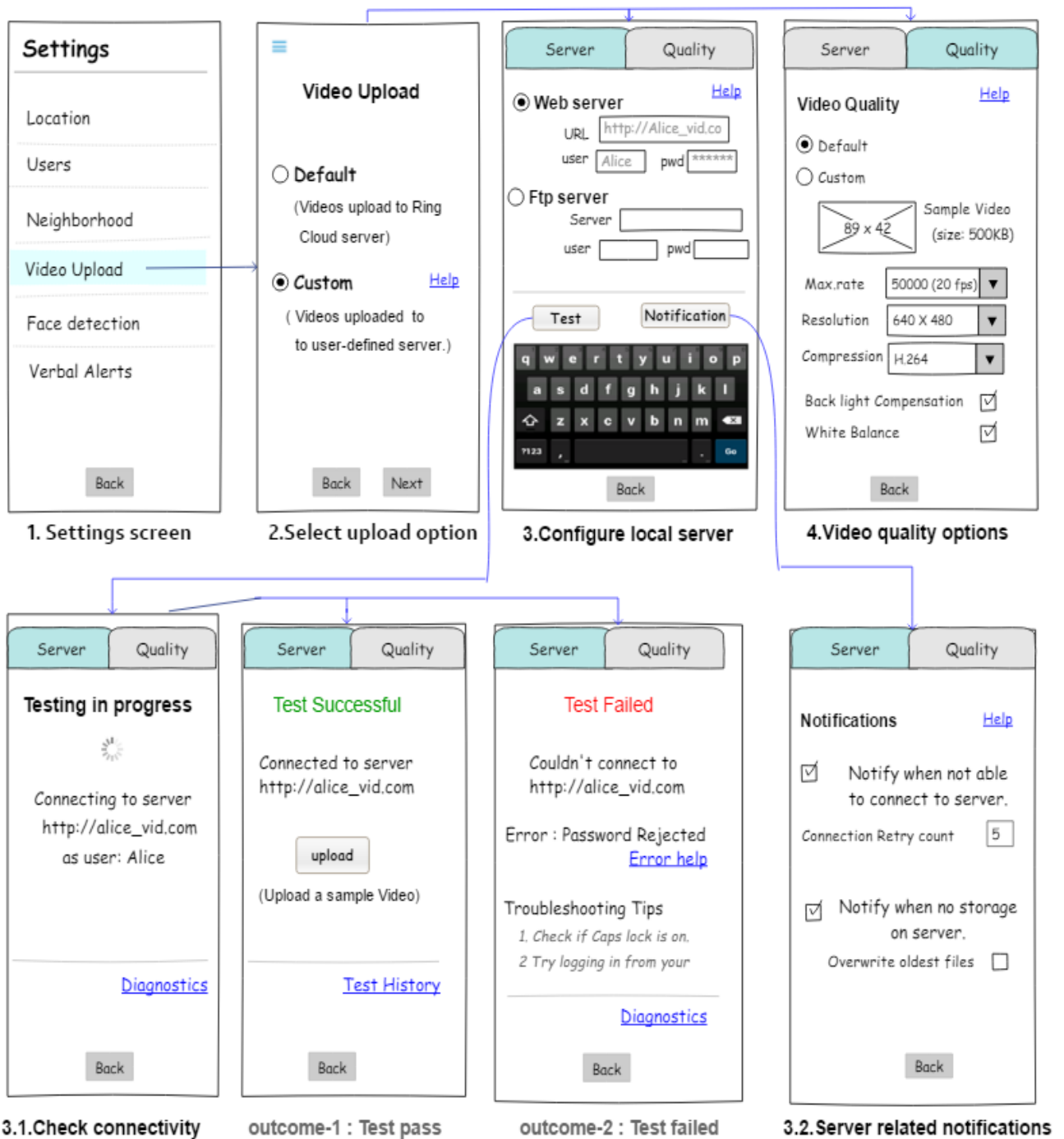


Fig 4.1 : This redesign lets user control where his videos (captured by Ring door-bell) get stored – ‘Custom’ option stores footage in user-defined servers , ‘Default’ option stores videos in Ring’s cloud servers. User is provided flexibility to select server-type (web or ftp) and parameters to control video quality. As user selects certain video quality options, impact of that setting is reflected in sample video, for easy evaluation.

4.2 Intelligent Alerts (using Face-Detection)

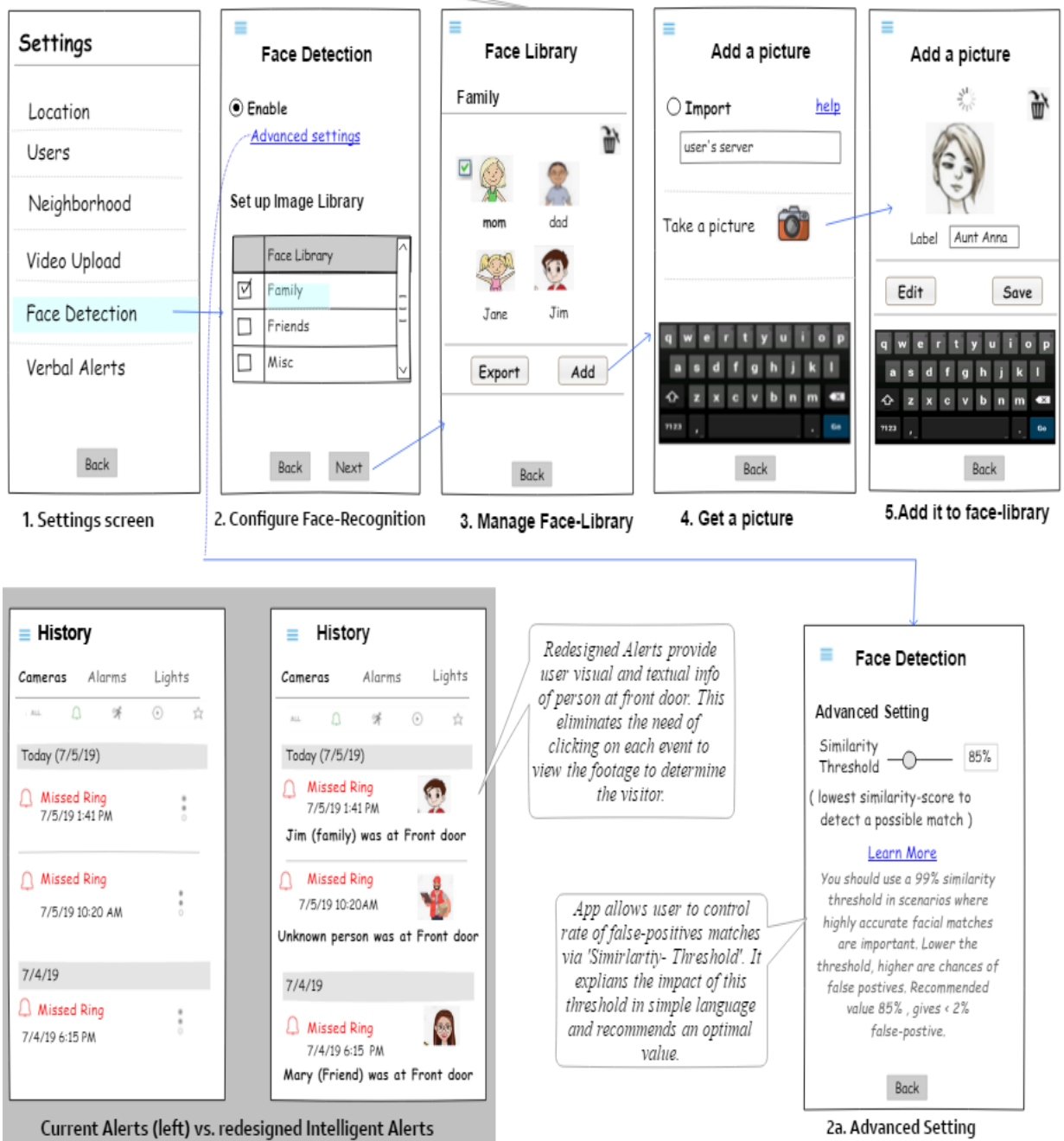


Fig 4.2 : Screen# 1-5 shows process of setting up face-detection feature in the App. Face-library is associated with user's Ring Account and can be shared with other family members linked to that account. Image processing is done in cloud. Right screen (bottom -left) shows 'Intelligent Alerts' where user is informed about who is at the door. Since Face-recognition software is susceptible to false positives, interface also displays visitor's image in the event history.

4.3 Voice alerts enabling Touchless Interaction

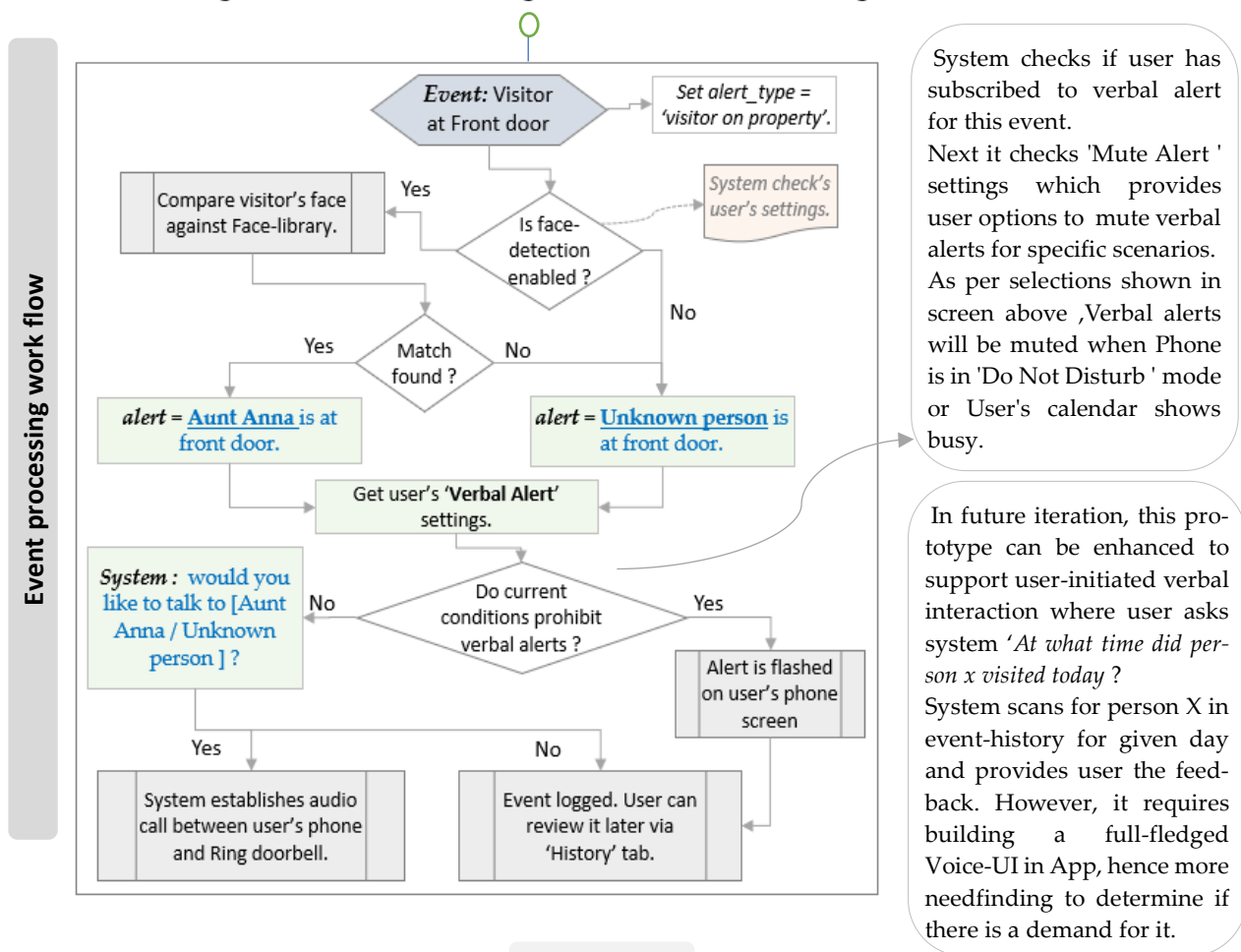


Fig 4.3

5 INTERFACE JUSTIFICATION

Needfinding and heuristic evaluation helped me better understand who my users are and what are their tasks, subtasks, goals and context ([Data-Inventory](#)). This led to development of concrete [Requirements](#) that would address user's core needs. Armed with this knowledge, I [brainstormed](#) (Appendix 8.8) several ideas and came up with the redesign illustrated in section 4. Table below shows mapping of interface 4.1-4.3 to Requirements.

Table 5.1 : *Efficiency/usability and Learnability are assigned a degree– Low(L), Medium(M), High (H).*

Table 5.1: Requirements		sub-design		
		4.1	4.2	4.3
Functionality	R1a Interface should provide mechanism to address user's privacy concern regarding their videos.	☑		
	R1b Provide a subscription-free alternative.	☑		
	R1c Interface should be aware of user's context and incorporate appropriate changes to make interaction smooth.		☑	☑
Efficiency	Usability/Efficiency : With redesigned App, user should be able to accomplish their tasks/sub-tasks more or as efficiently as with existing App .	--	M	H
Learnability	New user must be able to understand the purpose of new features and be able to use them with little to no effort. Options/Controls related to basic subtasks shall be made easily discoverable.	H	H	M
Compatibility	(1) New redesign must seamlessly integrate with existing Ring App. (2) Interface must provide user flexibility to disable new features, if these features are not compatible with user's values.	☑	☑	☑

Interface 4.1 : This interface addresses user's need to have control over his data (video-feeds). Concern regarding privacy and security of video-feeds came up consistently in customer reviews. This widespread apprehension is due to that fact that Ring stores video feeds from its doorbells and cameras unencrypted and grants broad access to them [4]. This prototype is aimed at alleviating this concern.

- This redesign is motivated by 'Value Sensitive Design' principle covered in lecture – it puts user's value (privacy) in front and center and provides him with an interface that is easy to use and compatible with his values.
- It gives user flexibility to store video-feeds on his personal servers, instead of Ring servers.
- By providing user 'Default' option which stores feeds on Ring server (screen#2) , interface maintains consistency with current Ring App.

- Interface establishes equity by catering to both novice and expert. It understands that not all users have expertise to setup their own server for video storage. It guides users to setup a server in an easy to follow manner. At any point user can click on 'help' button to get in-context help. 'Test' button (screen#3) enables user to quickly evaluate results of his actions (of providing login, password and URL) and provides helpful diagnostics.
- As user selects certain video quality options, impact of those settings is shown in sample video (screen# 4) . This helps user determine impact of his selections , further shrinking gulf of evaluation. Pre-populated options in dropdown menu (for Resolution, Compression etc.) act as constraint , preventing problem of erroneous input from user.
- Currently users have to buy subscription if they want to access footage of missed-events. New design provides an alternative to this imposed subscription model, where user can store feed on his server. It fulfills two needs with one deed - privacy of data and subscription-free service, two major concerns raised by users.

Interface 4.2 : This redesign is motivated by user's desire for App to be more 'informative' when providing feedback about visitors on their property. Currently App tells user that 'someone was at the door' instead of informing user 'who was at the door'. It puts the burden on user to determine who the visitor is. User has to click on each event, review the footage and determine if he missed someone of importance.

- This redesign leverages facial-recognition technology to identify the visitor to provide *intelligent* feedback, thus enabling an easier and more efficient interaction. This choice seemed logical as Amazon has full-fledged image/video analytic product [Rekognition](#). Adding this capability will not only bring Ring at par with its competitor (Nest) but also improve user interaction by providing more relevant feedback.
- It reduces cognitive load by offloading the task of determining the identity of visitor from user to interface.
- It also fulfills the requirement of App supporting different user's context ,thereby taking participant view. New representation of alerts is especially useful when user is in a cognitively-demanding environment such as driving or can't expend extra minutes (say, when rushing to a meeting) to view the footage .
- It uses multiple modalities –textual (visitor's name) and visual (visitor's picture) to provide feedback. This helps shrink gulf of evaluation for user. If

- software makes mistake in recognizing the person, image displayed quickly lets user determine who the visitor is.
- Interface is aware of current social divide regarding use of facial-recognition and hence provides user flexibility to disable this feature if desired.
 - Interface takes participant's view, acknowledging that there might be false-positives in face recognition due to environmental factors. It gives user control over rate of false-positives via 'Similarity threshold' setting (screen#2a) . It explains the purpose of this setting in simple language and provides necessary documentation if user wants to learn more about it.

Interface 4.3 : This redesign was chosen to address user's need to have a smoother interaction , especially when user is mobile. It integrates voice capability in Ring App where user is verbally informed that someone is at his front door and prompts user if he wishes to speak with the visitor. Thus, eliminating the need of user having to pick his phone, unlock it, open Ring App, click on event and view the footage to determine visitor. This reduces cognitive load, especially in situation where it's not convenient for user to physically interact with his phone., say when he is biking, driving or exercising.

- Interface minimizes learning curve for this feature by providing all necessary options in one place under 'Verbal Alert' setting (screen#2). Options are neatly structured in different logical groups, which minimizes clutter and lets user focus on main task at hand.
- Keeping simplicity principle in mind, interface explains in non-technical language how this interface works. It uses flowchart representation (instead of long textual description) to help user build mental model of how this feature works. (Flowchart will also help me clearly convey my underlying design to user during evaluation-phase). Once user has right mental model of this feature, it will be easy for him to evaluate the outcome of a given action in future.
- Interface takes participant view, taking into account different contexts in which App is used and hence provides user flexibility to customize settings as per his need. There are scenarios where verbal alerts will be nuisance such as when user is in a meeting or phone is in 'Do not disturb' mode. User is given control to mute alerts in those scenarios.
- Interface uses direct manipulation to let user configure polygon of interest (for which he wants to receive verbal alerts) by dragging the points on the map itself, making interface invisible.

Ring is a mature and well-respected product. Above redesign aims at innovating the product and complementing its existing functionality , thereby preserving its widespread appeal.

I will briefly touch upon why some of the concerns that were discovered during needfinding (2.2) were not pursued in this iteration.

- Connectivity troubleshooting : In recent version, Ring App has made several enhancements to provide user information regarding system's health and signal strength.
- Vendor lock-in : This is by design to preserve business profit. If Ring exposes its API , it can be integrated with home-security Apps from other vendors. It doesn't need a significant redesign per se.
- Displaying a text on Ring door bell , Implementing Cellular-access as fallback when Wi-Fi fails : Both would require hardware changes . It may increase the cost of the solution and hence I need to do additional needfinding before pursuing it.

6 EVALUATION PLAN - QUALITATIVE EVALUATION

Content and Recruitment

I will be performing qualitative evaluation (interview) of my aforementioned redesign, as it will give me an opportunity to not only evaluate it from usability perspective in great detail but also probe user's thought on value-sensitivity of this design. The latter is important to me as one of the components of my redesign involves Face-recognition ,which has lately come under criticism for misidentifying people of color. Hence, I would like to get a deeper understanding of how user views usefulness (Intelligent Alerts) over value.

Main selection criteria for this evaluation is that participant must have experience with a video door-bell (preferably Ring) or some other home-security device. I will reach out to colleagues and friends to participate in this evaluation who satisfy above criteria. I will try to recruit participants whom I don't know personally such as parents from my son's school and fellow CS 6750 students. My goal is to have enough diversity in my pool of participants, so that I can gauge external validity (generalizability) of my redesign.

Interview can take place online or in-person, based on participant's convenience. To prepare for interview, I will print copies of my wireframes and list of questions mentioned in section below. I will maintain a notebook and will try to capture

each subject's response in as much detail as possible, avoiding any summarization during the interview. I will start with some warm up questions and then present the redesign to participant, divulging only necessary information regarding 'what to do' and not 'how to do'. Interview will be semi-structured, to allow spur of the moment questioning from both parties.

Evaluation Criteria : To what extent does this redesign fulfill functional, efficiency, learnability and compatibility requirements.

Interview script : My main goal of interview is to evaluate above-mentioned criteria. Below is a snapshot of Interview questions. Complete script can be found in Appendix 8.4.

8.4 Qualitative Evaluation – Interview Questions

1. This redesign adds three new features to Ring App. From Fig-4, how easy was it for you to spot these new features ?
2. Fig 4.1 shows a series of wireframes. (*Evaluate how easily user can determine what wireframe does.*)
 - a) Would you be able to describe flow of information based on Fig 4.1 ?
 - b) What do you make of 'custom' option in snapshot#2 ?
 - c) How difficult was it for you determine what snapshot#3 is doing ?
 - d) Interface provides a mechanism for user to test connectivity to his per-

However, Interview may not capture 'Efficiency' requirement very accurately. It is better suited for empirical evaluation, which I have laid out in Appendix 8.7. Once I increase the fidelity of my prototype, I will invite a larger set of participants and perform hypothesis testing to derive conclusive results regarding 'Efficiency'.

Bias Control

- To avoid *confirmation bias*, I will ensure my interview questions are non-leading and neutral. I will have my interview questions reviewed by fellow CS6750 classmates as they are already aware of biases and by my colleagues/friends.
- I have some preconceived notions about problems my design will solve, and these notions can cloud my thinking. To avoid this, I'll strictly adhere to my interview script. Since I have already established goal of my evaluation and

developed interview-questions around that goal, it will keep me honest and further avoid any *confirmation bias*.

- In this exercise I will be dealing with lot of qualitative data and could potentially fall victim to *framing bias*. When interpreting results of my evaluation, I will stay as objective as possible (may be codify the response to a problem category) to get to the crux of the problem.
- As designer of this interface, I may suffer from *expert-blindspot* and might not have fully considered the cognitive burden user may experience. To overcome this, I will pay extra attention to slips or mistakes user makes or if user hesitated to make a choice or looked confused or frustrated.
- I must be mindful of *Voluntary Response Bias* as my interview is semi-structured. I must watch out for any strong opinions and not to let them interfere with my analysis.
- I must be cognizant of *Social desirability bias*, especially when interviewee is someone I know personally. To overcome this, I will aim to recruit participant from outside my social circle.

Reflection

This redesign is not complete by any means. There were some difficult questions that came up as I was brainstorming /redesigning and didn't have a clear answer. More research is required to addresses these questions.

- This design focused on users who own Ring doorbell. But what about indirect stakeholders - *visitors*. How do they feel about their image getting captured, without their consent ? How can we redesign this system to accommodate secondary stakeholders' privacy concerns ?
- Does this design (and product as a whole unintentionally emboldens UI-adversary by facilitating spying. How can this design avoid IPV (Intimate Partner Violence) abuse scenarios ?
- 'Safe-communities' shouldn't be a luxury just for privileged. Can replacing Wi-Fi requirement with Cellular-access extend the reach of this product in low-income areas where broadband is not available or is too expensive ? More research is required on technical feasibility and associated cost.

7 REFERENCES

1. <https://shop.ring.com/pages/doorbell-cameras>
2. <https://www.pewinternet.org/fact-sheet/internet-broadband/>
3. Ring store your video feed unencrypted.
4. A security flaw leaves Ring doorbells and cameras vulnerable to spying

8 APPENDIX

8.1 Re-design Prototype

Prototype with better image quality can be found [here](#)

8.2 Data Inventory

Data Inventory		source
Who are the users ?	Users are owners of Video doorbell (Ring), mostly adults of age 18+. They are proficient with Mobile App usage and have basic to advanced exposure to Home security systems.	Customer Reviews
Where are the users ?	Users are where ever Ring product is sold. However, for my needfinding I have focused on users residing in USA.	Customer Reviews
What are their goals?	Their overarching goal is home security. More specifically they want to be able to monitor/ interact with visitors on their property.	Customer Reviews
What is the context of the task?	users interact with Ring App in various environments - at home, at work , at gym , while on the move (driving, biking or running) .	Customer Reviews, Interview
What do they need?	(a) Most users are concerned about privacy of their videos uploaded in Ring Servers.They need an option to have control over their videos. (b)They want an interface that makes interacting with App less cumbersome, especially when user is mobile (driving). (c) Users want an alternative to 'subscription' model. (d) Users want reliable audio/video and better troubleshooting capability in App. (e) Some users want Ring doorbell to be compatible with home-security devices from other vendors.	Customer Reviews, Interview, Heuristic Evaluation
What are their tasks?	a) They check their event history (motion alerts or missed rings) regularly. b) They interact with the visitor on their property (assuming he rings the bell) via Ring app. c) Some users also monitor neighborhood alerts for any crime or suspicious activity.	Customer Reviews, Interview, Heuristic Evaluation
What are their subtasks?	subtasks include unlocking phone,opening Ring App,scanning event history .To check who visited the property or what caused motion-alert, user clicks on individual event to view the footage. To speak to the visitor on property, user need to press the call button.	Customer Reviews, Interview, Heuristic Evaluation

8.3 Requirements

Below is list of requirements for redesigned Ring App interface based on information gathered from my needfinding exercises (Consumer/Product reviews , Interview and Heuristic evaluation).

- **Functionality :**
 - Interface should provide mechanism to address user's privacy concerns regarding their videos and provide a subscription-free alternative.
 - Interface should be aware of user's context and incorporate appropriate changes to make interaction smoother.
- **Usability :** With redesigned App, user should be able to accomplish their tasks/sub-tasks more or as efficiently as with existing App .
- **Learnability :** User must be able to understand the purpose of new features and use them with little to no effort. Options/Controls related to new features must be easily discoverable.
- **Compatibility :**
 - New redesign must seamlessly integrate with existing Ring App.
 - Interface must provide user flexibility to disable new features, if these features are not compatible with user's values.

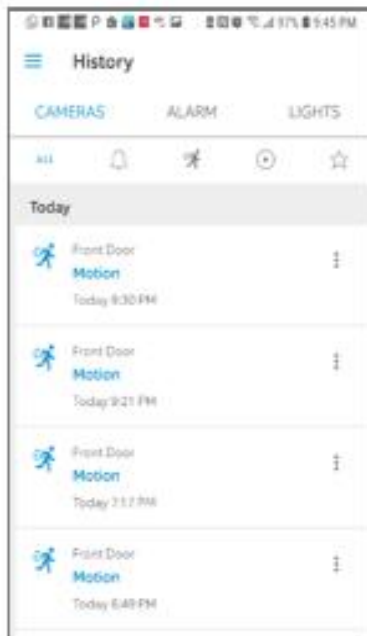
8.4 Qualitative Evaluation – Interview Questions

After some icebreaker questions, ask following.

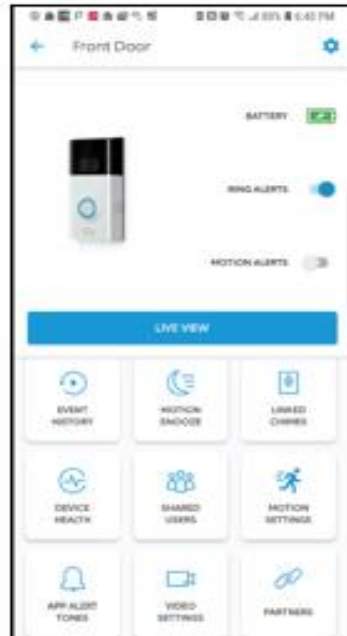
1. This redesign adds some new features to Ring App. From Fig-4, how easy was it for you to discover these new features ?
2. Fig 4.1 shows a series of wireframes. (*Evaluate how easily user can determine what wireframe does.*)
 - a) Would you be able to describe flow of information based on Fig 4.1 ?
 - b) What do you make of 'custom' option in screen#2 ?
 - c) How difficult was it for you determine what screen #3 is doing ?
 - d) Interface provides a mechanism for user to test connectivity to his personal server from Ring App. Is there any other information you would like interface to provide in the event of test-failure ?
 - e) Are there any other options that you would like to see or removed from 'Video Quality' tab ?
 - f) How likely do you see yourself using 'custom' option ?

- g) Do you feel this interface provides a reasonable option for user's who don't want their video-feeds to be stored in Ring Servers (due to privacy concerns) or don't want to buy monthly subscription ? Why ? Why not ?
 - h) What improvements, if any , you would like to see in this interface ?
3. Show user wireframes in Fig 4.2
- a) Would you be able to describe what this interface is doing ?
 - b) Can you describe how you would add or delete a picture in image library ?
 - c) Ask user to focus on screen titled '*Current Alerts*' and '*Intelligent Alerts*' – What do you like about this new way of visualizing alerts ? Is there anything that you don't like about it. ?
 - d) Do you have any reservations or concerns about this feature using Facial Recognition technology ?
 - e) How tolerant you would be of occasional errors (say 1 in 50) interface makes in identifying a person ?
 - f) If user is not very tolerant of identification-errors , probe him regarding '*Similarity Threshold*' (screen# 2a) and if he finds that useful.
 - g) Any other thought that you would like to share regarding this interface ?
4. Show user Fig 4.3
- a. Does this interface provide you enough information to convey purpose of '*Verbal Alerts*'?
 - b. If not, what changes would you like to see ?
 - c. Do you see yourself using this feature ? if yes, in what scenarios ?
 - d. If not , why not ?
 - e. Given screen#2 , would you say interface has taken care of different contexts in which user wouldn't want to use verbal alerts ?
 - f. If not, can you elaborate on those contexts ? What improvements, if any , you would like to see in this interface ?
5. Any parting thoughts / recommendations on overall design of these features?

8.5 Screenshots of current Ring App - What works ?



User can view events from Camera , Alarms or lights - all in one place.



Clean grid layout, with icons makes options discoverable and easy to use.



Step up procedure shows animation (in addition to text) to guide user.



Direct Manipulation – user can drag blue points on the screen to define polygon of interest.

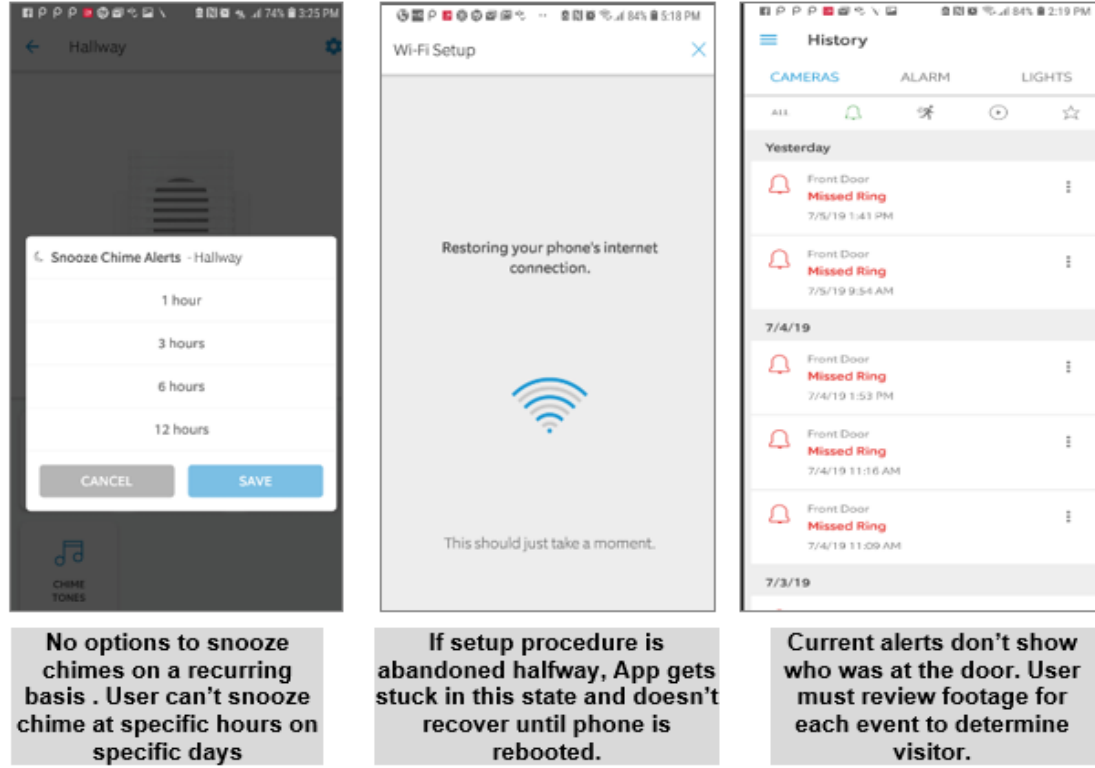


Slider allows user to define motion-zone. App shows zone coverage as slider is moved , for easy Evaluation



This representation builds on user's mental model and shows where in defined polygon a particular event occurred.

8.6 Screenshots of current Ring App - What does NOT work ?



8.7 Empirical Evaluation

In this evaluation I will be testing efficiency of my prototype, which will be accomplished by comparing metric '*Time_Spent*' for new interface vs existing interface. *Time_Spent* metric is defined as amount of time it takes for user to accept the Ring call when user is mobile (driving, running etc)

$$Time_Spent = t_b - t_a, \text{ where}$$

t_a = timestamp when user's phone receives Ring Alert

t_b = timestamp when user is connected to visitor (via Ring App)

Hypothesis

Hypothesis testing will confirm validity of assumption that new interface (verbal alerts) reduces *Time_Spent* on accomplishing the task of connecting to the visitor on property.

H_{Null} : mean of *Time_Spent* is same for both interfaces.

$$\mu_{verbal-alerts} = \mu_{current-interface}$$

$H_{Alternate}$: mean of *Time_Spent* is not same (is lower) when new prototype (Verbal_Alert) is used.

$$\mu_{verbal-alerts} \neq \mu_{current-interface}$$

Treatments

Experiment will have following two treatments and 'Within-subjects' method will be used. Metric *Time_Spent* is dependent variable, while interface category (new vs existing) will be independent variable. Subjects will be assigned treatment randomly to avoid any 'ordering effect'.

- Treatment A : User is given new interface with Verbal Alerts enabled. User is driving and receives a Ring alert (visitor on property). Measure time elapsed between t_a and t_b
- Treatment B : User is given existing interface. User is driving and receives a Ring alert (visitor on property). Measure time elapsed between t_a and t_b .

Analysis and lurking variable

To analyze this data, I will perform paired Student's t-Test, assuming collected data is normally distributed. If that doesn't turn out to be true, I will perform non-parametric test (Mann-Whitney) but this test might have less statistical power than its parametric equivalent.

Results of this experiment can be confounded by the amount of cognitive load experienced by user while driving, which is influenced by many factors – 1) traffic condition 2) user's expertise in driving. E.g. Novice driver may find it more difficult to interact with App while driving. 3) user's familiarity with the area he is driving in. If user is driving in unfamiliar area, then interaction with GPS may take additional cognitive resource and impact *Time_Spent* metric. 4) user is time-pressed to reach destination. One can try to control these factors by simulating a car-drive in lab setting, but it will compromise the external validity of this interface.

8.8 Needfinding - Interview questions

Icebreaker questions :

1. how has been your day so far ?
2. Did you get to enjoy some sunshine this weekend ?

Core questions

Part-1 : Gauging user's general perception regarding smart door-bells.

1. Do you own a smart (video) door-bell or any other smart home-security device ?
2. If not, what are your top reasons for not adopting this new technology ?
- *Concern about privacy , Cost , too complex to use , just not interested, other*

Part-2 : (More specific questions – applicable to RING doorbell owner)

3. In a typical week, how many times a day do you have visitor at your door (kid's friends, neighbors , mailman, salesmen, porch-pirates) ?
4. In general , how is the voice quality when interacting with the visitor via Ring App ?
5. How do you feel about Ring's video-recording subscription plan ?
6. How many times in past week did you have to answer your door bell (via Ring App) when you were driving ?
 - o Did you take the call ?
 - o If yes, how easy was it for you to take the call i.e. fetch your phone-> unlock phone-> access ring App and tap call button ?
 - o If no, why not ?
7. How many times in past week did you have to answer your door bell (via Ring App) when you were in a meeting ? [same sub-questions as Q6.]
8. Do you feel the need to scan through all your Ring events and video footages ? If yes, why ? If not, why not ?
9. What feature(s) you wish this product had that would increase your productivity and/or convenience ?
10. Any other parting thoughts ?

8.9 Brainstorming Notes

1. Expose Ring APIs which will allow user to get the feed from doorbell.
2. Integrate Ring App with 3rd party vendors such as BlueIris to allow videos to be uploaded on personal servers
3. Redesign App to allow user to configure personal server for upload.
4. Give user control to use either ftp or web server for upload.
5. keep default option (automatic upload to Ring servers) for novice
6. Allow doorbell to use cellular connection when Wi-Fi fails.
7. One image-library for all family members - use existing 'Shared-User' concept of App.
8. Image processing in cloud - fast but privacy concerns
9. Image processing done locally - need more horse power in phone
10. Allow image-library to learn on its own as and when new faces are seen - may violate privacy of secondary stakeholder (visitor)
11. Verbal alerts to enable interaction without touching the phone.
12. Gesture based interaction with Ring App when user is mobile. - high cost \$\$
13. Consider cases when voice alerts are undesirable - user on call or in a meeting or with a date
14. Allow Verbal Alert settings to be set/changed via voice commands.
15. Text to speech for verbal alerts
16. Can Alexa APIs be leveraged here ?
17. Use 3rd party for text-to-speech app to read notifications
18. Use phones native text-to-speech capability but will require coordination with Push Notification servers.
19. Integrate doorbell with smart-lock to open front door.
20. Support user-initiated voice commands - what time did mailman came today ?

Just for giggles, a novel use-case of Ring doorbell -

https://www.youtube.com/watch?v=sxD9UKw_tmM