AYUSHI SURI

Ayushi is currently pursuing her degree of Bachelor of Design (B.Des.) at Delhi Technological University (Formerly known as Delhi College of Engineering).

She is a keen and self-motivated learner focused on User Experience, Interaction & Industrial Design. Her creativity combined with her focus on user research & analysis helps her make user-driven decisions that lead to better and meaningful experiences for people.

She's not only a dreamer but also a doer and goes to great lengths to convert those dreams into reality. Other than that she can be seen rocking to different beats.

Mimansa Tripathi

Mimansa was born and brought up in New Delhi, India. She did her schooling at The Somerville School, New Delhi where she developed her keen interest in fine arts and science which later helped her decide to become a designer. Currently pursuing her Bachelor's degree in the field of Interaction Design from the Delhi Technological University. Her area of interest lies in translating digital experiences into life-like interactions. She loves to bake and learn to play the synthesizer in her spare time.

***Arshia Gupta** is currently a student in the course B. Design of Delhi Technological University. She did her schooling from Delhi Public school, Vasant Kunj, New Delhi.Her hobbies are to travel, listen to music, read books and watch movies. An observant girl who desires to achieve perfection in everything she does, through hard work and determination. She believes that anything done with passion has the spark that speaks for itself.*

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Rethinking the EVM based election process with due respect to the concerns of the voters

Ayushi Suri, Mimansa Tripathi, Arshia Gupta, Prof. Lalit Kumar Das

The core concepts of the Design Project were to be inclusivity and universality in design. So, what better topic to choose than the "Biggest Festival of Democracy- Indian Elections".

Indian elections were also known as the biggest festival of democracy including people from every possible background, starting from the age of 18. The ECI tries to ensure full participation by making provisions in the system and providing assistance wherever required for every person.

This project was aimed at making the whole election system more universal. This topic was chosen after a lot of contemplation and hesitation. The fact that the topic was one dealing with a major chunk of the Indian population made it one to be worried about, that it would be quite a time consuming and would have to be worked upon in-depth, which felt a bit difficult during the Covid-19 pandemic. But after persuasion and assurance from the side of Prof. Lalit Das, that it could be worked upon, the team decided to go ahead with it.

Introduction/Need Statement

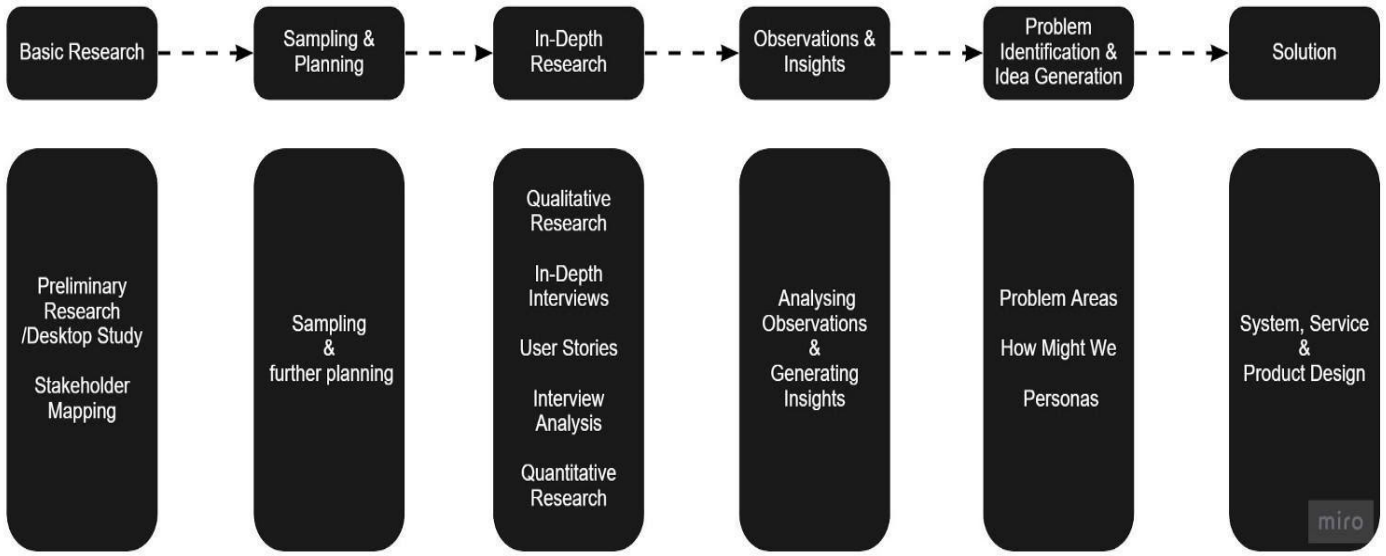
Through the project, the user experience of the Indian Elections from Voter Registration, Verification as well as Vote Tabulation & Tallying was re-designed to make it more inclusive, user-friendly,

secure, error-free & efficient for its major stakeholders—Voters & Election Officials through Service & Product Design.

For a developing and highly populated nation like India that has the largest population of illiterate adults in the world—287 million, which is 37% of the global total, devising a service/solution that is mindful of their abilities was imperative.

The Process

The approach taken was based on the 'Double Diamond Design Process'. According to the needs of this project, the process got tweaked and a new approach of how to proceed got developed.



Preliminary Research

The project research started with some desktop study on the pre-existing methods used for conducting elections in India. These insights were very broadly recorded in a mind map.

Some topics of interest include:

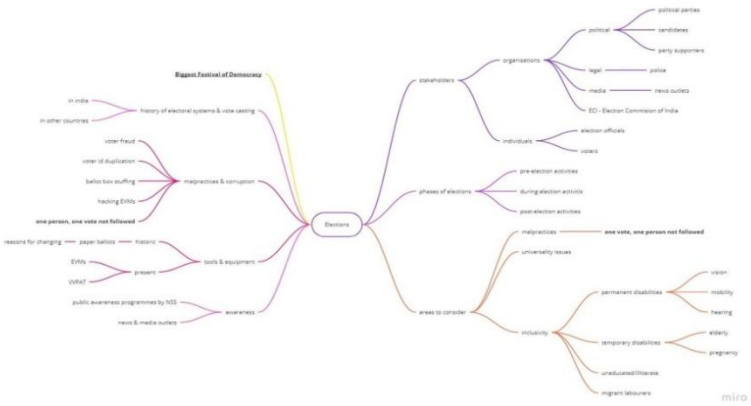
1. ***History of Elections and their conduct in India.***
2. ***Pros Vs Cons of Election conduction in India and other countries.***
3. ***Tools and Equipment used in Elections & their comparison with each other.***
4. ***Various focus areas like that of Inclusivity, Accessibility, and Malpractices in Elections.***
5. ***Read up the ECI's Election Accessibility Guidelines which according to the document have been implemented Pan-India.***

   Guidelines for inclusion of wheelchairs, volunteers to help Pwd, allowing assistants for Pwds, making the space disability-friendly by ensuring the presence of ramps and railings of specific dimensions, and inclusion of braille on EVMs and voter slips.

   Link: https://ceobihar.nic.in/pwd/Breaking Barriers_WEB.pdf

6. ***Broad understanding of the user flows of both election officials and voters through the 3 electoral phases; Pre,***

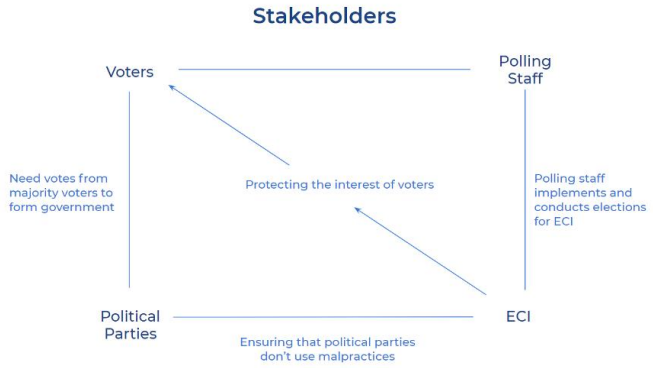
Electoral, and Post-Electoral phases.



Caption- Mind Map of the Desktop Study

Stakeholder Mapping

Through the preliminary research, the major stakeholders involved got mapped. This helped in Sampling the Users for further In-depth Research.



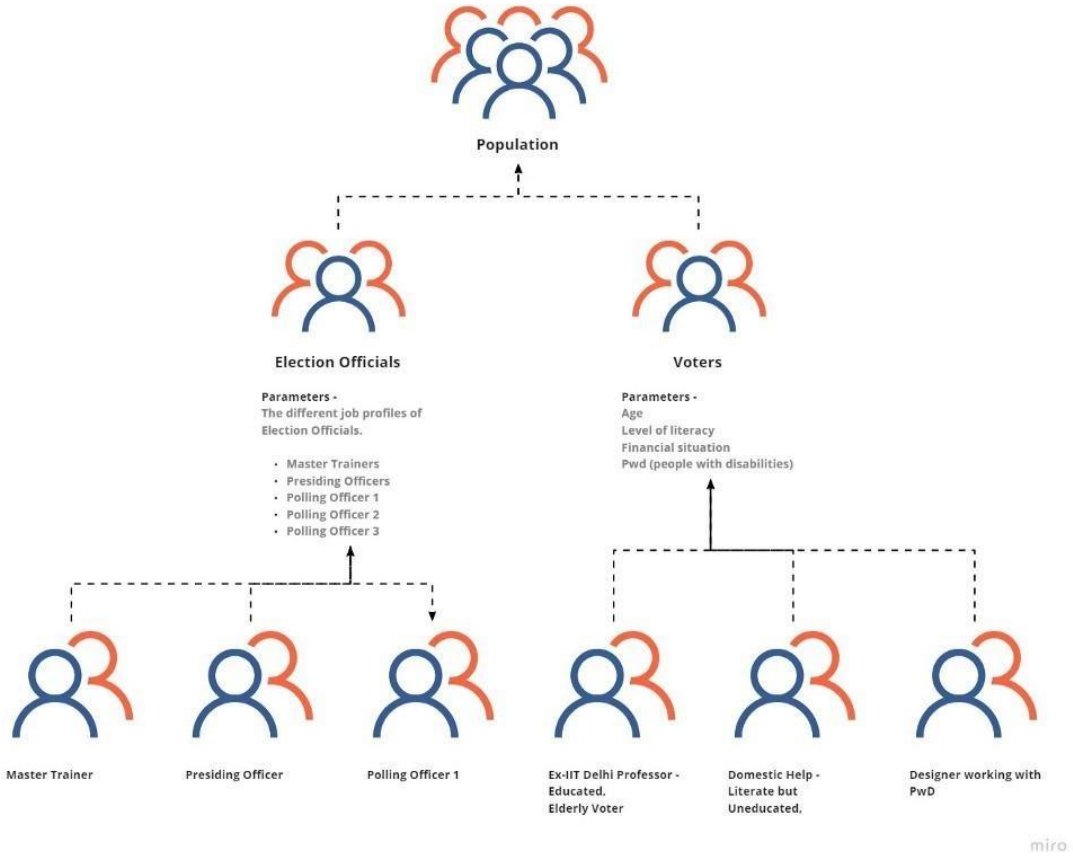
Caption- Stakeholder Mapping

Note: Since there are a lot of direct and indirect stakeholders involved, designing for all of them would be a behemoth feat and very time-consuming. So, the project's focus got narrowed down to only the election officials and voters.

Sampling

A Non-Probability Method of sampling i.e. Quota Sampling was used to split the two groups of desired stakeholders, i.e. Election Officials and Voters into different subsets according to certain parameters.

Individuals from each of these subsets were then chosen to conduct In-Depth Interviews and acquire Qualitative Insights



Caption- Sampling of Users using certain parameters

Note: Sampling was done to get qualitative data on a sample that best represented the majority of the desired stakeholders, i.e. all the different types of Election Officials as well as the 900 million eligible Voters Pan-India.

Qualitative Research

Sampling the users provided an audience to further continue with In-depth Research which included User Interviews, User Stories, Interview Analysis etc.

In-Depth Interviews

In-depth Interviews of 8 users, 5 Election Officials, and 3 Voters were conducted, using open-ended questions to know and understand their own experiences, stories, and behaviours towards the Election System.

Open-Ended Questions were asked majorly to get Qualitative data which along with Quantitative Research were imperative in discovering real user needs and challenges.

Objective: To gather Qualitative data about the stakeholders' experience with Elections and their activities.

Platforms: In-Person, Google Meet

Average Duration: 20- 40 mins

Interview Analysis

All the interviews were analyzed again to get a deeper understanding of what the users feel about Elections and its different phases. The following shows some of the major observations we concluded.

	OCCUPATION	ROLES	RESPONSIBILITIES	OWN ELECTION EXPERIENCES	EXPERIENCES WITH VOTERS	PROBLEM AREAS
Mr. Ravindra Singh	college professor	master trainer - shahbad dairy (village area, uneducated people mostly)	Manage Polling and Presiding officers. Giving them occupational training according to ECI guidelines.	Finds relaying information to officials really troublesome. Very complex way in which EVMs and VVPATs work together. CRC is very complex and oficials often forget to properly make use of it because of it. Accessibility issues in the overall space design of the polling stations and booths, specially in rural village areas. Had known of an election official who suffered a stroke and died due to the high stress environmet that is created for the election officials. The scope of human error is very high, specially in the pre-electoral and electoral activities which can cause highly stressed officers to make mistakes that can have very serious consequences, even losing their own job. Lot of scope of improvement of elecctions.	when gone to a village to spread awareness about elections and how to cast vote; an elderly, uneducated village man did not press the button corresponding to the party but actually tried to press the party's symbol. This particular voter had previously voted.	Pre-election activities Occupational training electoral phase activities complexity of the machines Scope of human error in the different election activities
Mr. Partha Das	college professor	master trainer - old delhi (urban area with motly educated voters)	Manage Polling and Presiding officers. Giving them occupational training according to ECI guidelines.	Finds relaying information to officials really troublesome. Very complex way in which EVMs and VVPATs work together. A lot of election officials are not receptive to occupational training as they feel they already know most of it through being Polling/Presiging officers in previous elections. has personally observed Accessibility issues in the overall space design of the polling stations and booths, specially in rural village areas. Feels accessibility guidelines are not properly implemented pan-india.	Most of the voters are able to understand how to cast votes and work the EVM machine in urban areas. It is the elderly, uneducated and diabled voters who dont grasp/understand the system.	Pre-election activities Occupational training Better educational material for occupational training should be provided by the ECI.
Mr. Neeraj Sharma	college professor	master trainer - rohini	Manage Polling and Presiding officers. Giving them occupational training according to ECI guidelines.	Says prior information about the names of PwD is given to polling stations. Says accessibility guidelines were followed according to the resources granted in the polling stations under his constituency.	Said EVMs can be better designed as som voters, elderly and illiterate need assistance before voting.	electoral phase- EVM design vote casting can be made easier for some voters as there is possibility of voter error while casting their vote
Mr. Subhash	govt. school teacher	Presiding Officer	To assist polling officers solve hiccups during voter verification and cross checking. To investigate if any case voter fraud happens in his poling station.	Has personally witnessed a lot of time, cases where names of eligible voters have not been mentioned in the electoral roll and he had to refuse those eligble voters entry into the polling station. No prior information is given to the Presiding and Polling officers about any voters with disabilities that might be allotted their polling station. So, often times they try to make the polling station as accesible as they can with the resources that they are given. ECI's accessibility guidelines are not followed all the way. Acc. to him, Electoral roll does not mention any disabilities that a voters might have.	Has personally witnessed cases where names of eligible voters have not been mentioned in the electoral roll and the voters have been refused to eneter the polling booth and cast their votes.	Pre-electoral activities- electoral roll mis-information, in terms of names of deceased people being being kept in the electoral roll and names of eleigible voters not being there in the electoral roll. elections not being accessible in terms of not mentioning disabilities of voters in the polling station.
Mr. Manish	govt. school teacher	polling officer 1. Had been Presiding Officer previously also.	First person in-line of duty at the polling booth. Verifying voter ID and cross checking legitimacy.	A lot of chance of mis-identification of voters by the poling booth. He has himself made the mistake of mis-ientifying a voter due to which duplicate voting happened.	Has personally mis-identified a voter which caused duplicate voting to happen, i.e. somebody else voter in place of the original eleigible voter. Police had to be called to rectify this issue. Very often, he has had to ask polical party agents to verify the identity of a voter as the voter ID card had a very old, grainy, black and white image of the voter which was unrecognisable. The polling officer in this case simply asks the voter very basic questions that anybody that wishes to commit duplicate voting can easily know, and sometimes asks the political party agents to verify the identity of the voters.	

Caption- A sheet showing all the observations collected during the interviews of the Election Officials

Of Election Officials-

1. ***2/3rd (Master Trainers) of them had trouble performing operational training (relaying instructions & rules and guidelines of the Polling Officer's job responsibilities) to the Polling Officials; majorly about how EVM-VVPAT machines connected, how they work together, are sealed, etc.***

2. ***2/3rd of them felt instructional documents & videos put out by ECI on the web & youtube respectively for operational training are not very helpful and can be made better.***

3. ***All of them preferred EVMs over Paper Ballots as they feel it adds a layer of security to the whole vote casting process and reduces chances of electoral malpractice, like booth capturing. It is also more efficient than Paper Ballots according to them.***

even though EVMs add more to their work in terms of conducting mock polls with 50 votes per machine as a measure of checking the functioning of the machines.

4. ***4/5 officials who were teachers &/or professors could not teach their students for several months because of their mandatory election duty.***

5. ***Almost all of them believe cases of voter fraud and malpractice are more common in village and slum areas due to personal experiences or hearing other officials' experiences.***

6. ***Most of the observed cases of electoral fraud in village and slum areas where the less educated voters lived.***

7. ***All of them believe the majority of the polling stations in urban areas in Delhi follow majorly all the Accessibility Guidelines for PwD set by the ECI. The same cannot be said for village and slum areas which have a lot of illiterate/less educated people.***

8. ***2/6 of them personally experienced cases of electoral malpractice.***

   One mis/wrongly-identified voter caused voter fraud; i.e. another man voted on behalf of the original voter.

   The other had to reject entry to an eligible voter into the polling station because his name was not in the electoral

roll. This particular eligible voter, as a result, lost his right to vote.

	occupation	are they eligible voters	are they registered voters	have they voted before	if not, why?	experiences with elections	problem areas
mr. lalit das	Ex-IIT Delhi Professor	yes	voter id card has been made but name has not been in the electoral roll for the past 20 years. So, has not been able to exercise his right to vote.	yes, but not for the past 20 years since a hiccup on the ECI's end	voter id card has been made but name has not been in the electoral roll for the past 20 years. So, has not been able to exercise his right to vote.	Has tried troubleshooting the electoral roll issue himself multiple times but no succcess. Contacted a master trainer to see if she could get the issue resolved but she couldn't either. Blames the ECI and does not find it and the election system reliable or credible anymore. Lack of transparency on the functioning of the election system. Thinks the electoral roll issue is because of an inside job and that somebody has intentionally not put his name in the electoral roll in exchange for something.	Pre-Election voter registration malpractices and electoral fraud elections not being transparent and inclusive of people
Mrs. Kiranti	Domestic Worker (Migrant)	yes	no	no, never before but really wants to	hasn't gotten her voter id card made because she has no permanent address of proof even though she's been living in the same constituency for about 10 years. So, her voter id card can only be made of her hometown where she has a permanent address proof and not of the constituency she wants to vote in.	Has never voted before because of govt.'s inconsideration in getting her voter id card made and her employers not granting her leaves to go to her hometown to cast votes, even if she voed to cast her vote that is. Because of this, she has lost trust in the govt. in ensuring people like her are able to vote and noe very easily believes the false claims other people and media make.	Pre-Election voter registration elections not being inclusive of people like her
mr. nekram upadhyay	Designer working with Pwd	yes	yes	yes	-	because he's a designer that works for Pwds, he's got a keen eye for observing if something is accessible, inclusive and disability friendly. Through both personal experience and experience of PwD, he says that although aceessibility guidelines are provided by the govt. and ECI, they are not being implemented pan-india. says elections are very inconsiderate when it comes to PwD and accesibility.	Electoral phase - space design majorly

Caption- A sheet showing all the observations collected during the interviews of the Voters

Of Voters-

1. ***Most of them either knew somebody who had bad experiences with Elections or had had them themselves.***
2. ***Most of them feel elections are not universal, accessible, and voter-friendly due to either their own experiences or through knowing somebody else's experiences.***
3. ***These experiences have made most of them lose their trust in the ECI and Elections and question their credibility.***

4. ***Most of them feel elections are not universal, accessible, and voter-friendly due to either their own experiences or through knowing somebody else's experiences.***

User Quotes and Stories

Through the In-Depth Interviews, we gathered some interesting things users exclaimed during the interviews as User Stories.

These user stories gave rise to some contradictions as well as shattered some hypotheses that we had developed during the preliminary research we had conducted.

Following are the User Stories accompanied by their corresponding User Quotes:

> ***"We know of an election official who suffered a stroke on the job and died because of all the stress"***
> ***- Mr. Ravindra Singh, Master Trainer***

Said while talking about just how stressful the election duty is for the officials. Said that there is a lot of scope of an error on their part while on election duty which can lead to them even losing their jobs. Said every official is scared and fearful of making mistakes which is why most of them don't conduct their duties efficiently.

"We have missed out on teaching my students for 2 months straight. Itna loss hua unn bachho ka"

(The children have experienced a lot of loss in terms of studies because we missed out on teaching them for 2 months straight as we were the election official)
- Mr. Ravindra Singh, Master Trainer

Said while talking about how the election system is so extensive that it requires a lot of manpower to conduct. This is why even essential workers like healthcare workers and professors/teachers are not safe from election duty.
"Although he had voted before, he couldn't cast his vote correctly"
- Mr. Ravindra Singh, Master Trainer
Said while talking about a personal experience he had with an illiterate, village man who when asked to conduct his vote didn't press the button corresponding to the party on the EVM but tried pressing the party's symbol instead.

This is a contradiction to what was in an article during the preliminary research which said that-

"In EVMs, the voter has to simply press the blue button against the candidate and symbol of his choice, and the vote is recorded._Rural and illiterate people had no difficulty in recording their votes and they have welcomed the use of EVMs."
- Dr.. S. Y. Quraishi, Former Election Commissioner

(Source:https://www.business-standard.com/article/economy-policy/booth-capturing-is-history-now-thanks-to-evms-109082503018_1.html)

"Prior information about the names of PwD is provided to the Polling Station"

- Mr. Neeraj, Master Trainer

This quote/experience is a complete contradiction to what Mr. Subhash, Presiding Officer said during the interview. ***"Mera toh na hi kabhi voter ID card bana hai, na toh kabhi banega"***

(I have never had a voter ID card made and will also not be able to get one made in the future)

- Mrs. Kiranti, Domestic Worker, Migrant, Living in Delhi as a migrant for >10 years.

Said Mrs. Kiranti, a domestic help in Delhi who is also a migrant. She has been living in the same constituency for 10+ years but has never been able to vote as she lives in a temporary place of residence and doesn't have a valid proof of residence to get her voter ID card made.

If she wishes to get registered as a voter, she'll only be able to cast her vote in her hometown of Bihar where she has proof of a permanent place of residence.

"Mene khud dekha hai, voter ka Electoral Roll me naam hi nahi tha. Toh usko entry thodi de paaye hum"

(I have seen myself that a voter didn't have their name in the electoral roll, so we couldn't let him enter the polling station)

- Mr. Subhash, Presiding Officer

Said while talking about one of his interesting experiences with a voter in his polling station. He was an eligible voter with a proper voter ID card but because his name was not in the electoral roll, the voter was not granted entry into the station hence, losing his right to vote.

Said that incidents like this happen all the time but there is nothing the officials can do about it. They need to perform their duty and follow ECI's guidelines.

"Mere saath khud hua hai. I wrongly identified the voter in the polling station aur phir voter fraud ho gaya. Me kya hi karta? Itni grainy, black & white photo this voter ID me"

(It happened to me as well. I wrongly identified the voter in the polling station leading to a fraud being executed. What could I have done? The photograph on the voter ID was very grainy and was black & white)
- Mr. Manish, Polling Officer 1

Said also while talking about an incident he had with Electoral Malpractice. He misidentified & verified the wrong person which led that person to cast his vote in place of the actual voter.

This mistake came to light when the actual voter came afterwards to cast his vote but couldn't as somebody else had already cast his vote in his name.

The police had to be called to resolve the issue, and the actual voter had to use a paper ballot to cast his vote in the

end. During all of this, he felt extremely fearful and stressed but also resigned.

"I've not been able to vote for the past 20 or so years even though I have a valid Voter Id card made. My name is just not there on the Electoral Roll. Yeh koi inside job hai, somebody has committed this malpractice from the inside of the organization"

(I've not been able to vote for the past 20 or so years even though I have a valid Voter Id card made. My name is just not there on the Electoral Roll. I believe this is an inside job, somebody has committed this malpractice from the inside of the organization)
- Mr. Lalit, Ex-IIT Delhi Prof., Eligible Voter

Said while talking about his bad experiences with Elections. Said he's tried to troubleshoot this problem various times, and also asked a Master Trainer to try to resolve it but to no avail.

Said he's completely lost trust in the Election System and feels that ECI is a corrupt organization because of his bad experience.

"ECI ne nikali hongi accessibility guidelines aur sabh, but what's the use when they're not being implemented pan-India?"

(ECI might have prescribed things like accessibility guidelines, but what's the use when they are not being

implemented pan-India?)

- Mr. Nekram Upadhaya, Designer for PwD at Indian Spinal Injuries Centre, Voter

Said while talking about his experience as well as the experiences of PwD with Elections.

As he is a designer who works for PwDs, he's got a keen eye for observing if something is accessible, inclusive, and disability friendly.

Through both personal experience and experience of PwDs, he says that although accessibility guidelines are provided by the govt. and ECI, they are not being properly implemented pan-India.

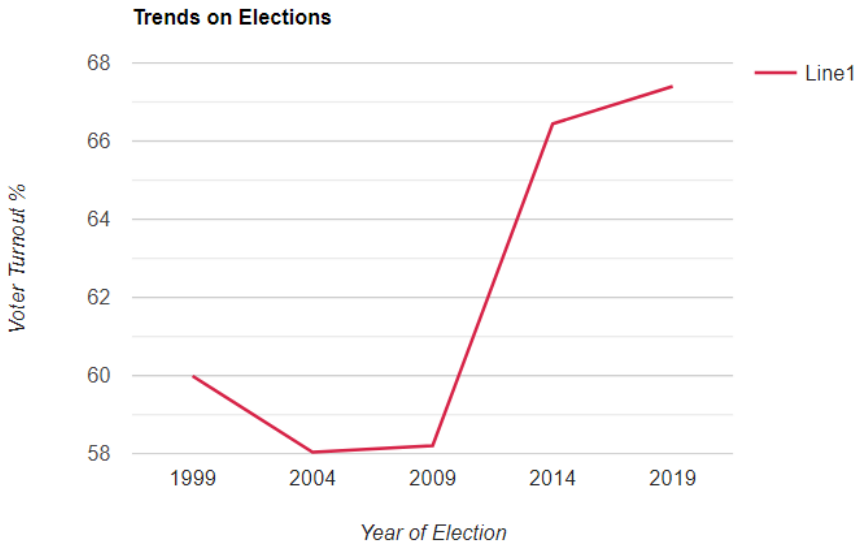
He also mentioned Elections are very inconsiderate when it comes to PwD and accessibility.

Quantitative Research

After the In-Depth Interviews and gathering Qualitative Insights from various stakeholders, Qualitative Research was conducted in terms of some statistics and trends to:

1. ***Try and validate if those observed insights were felt by the majority of the population or not.***
2. ***See if those insights could be converted into actionable user-driven insights.***

Statistics and Trends



Caption: The trend of Voter Turnout % (1999–2019)

Major Observations from this Trend:

1. ***Before 2004, the voter turnout % was on a steep decline.***
2. ***Since 2004, voter turnout has been on an incline. This can be because of the introduction of EVMs that were introduced to replace Paper Ballots for added security and reduction in malpractices like booth capturing.***
3. ***Although 2019 observed an increase in voter turnout %, it was only 0.96% which is minuscule compared to that of 2014 which observed an increase of 8.23%.***
4. ***2019 recorded the highest ever voter turnout % (67.40%), but in 2019 alone there were multiple cases of electoral fraud like voter duplication, mistaken identity, etc. This leads me to believe that a considerable amount of votes***

> ***casting happened through fraudulent means that got included in the voter turnout % for the 2019 Election.***

New Delhi : Last week, a 10- member team comprasing officials from the Election Commission of India, led by former deputy commissioner Vinod Zutshi reached Andhra Pradesh to audit the state voter list, following allegations by the YSRCP that about 59 Lakhs entries in the voter list are false.
The allegation is significant as there are about 3.67 crore eligible voters in the state , which means the alleged ' fake voters' constitute about 16 percent of the total electorate.

Case of Fraudulent Electoral Roll listing in Andhra Pradesh in 2019

> ***"As per my assessment, there are about 12 percent errors in the voter rolls across India today."***
> ***- Mr. Jaya Prakaksh Narayana, founder of Lok Satta Party***

(Source:https://www.news18.com/news/india/the-curious-case-of-voter-fraud-and-duplicate-voters-in-andhra-pradesh-2055237.html)

(***Source:https://www.moneycontrol.com/news/politics/17-lakh-fake-voters-found-in-madhya-pradeshs-53-assembly-segments-congress-2868071.html)***

Case of Non-Inclusivity in the voter registration process

(Source: https://thelogicalindian.com/news/voter-card-dog-photo-20008?infinitescroll=1)

West Bengal: Man Gets Voter ID Card With Dog's Photo Instead Of His Own

Sunil Karmakar on March 4 said that he had applied for a correction in his voter ID card and the revised card had a dog's photo instead of his own.

Debarghya Sil

India | 5 March 2020 / Updated : 5 March 2020 7:11 PM

Editor : Prateek Gautam | By : The Logical Indian Crew

- ***The total number of internal migrants in India, as per the 2011 census, is 45.36 crore, or 37% of the country's population. Hence, I needed to be mindful of the whole migrant population while redesigning the election system in terms of it being Universal.*** **(Source:https://indianexpress.com/article/explained/cor**

onavirus-india-lockdown-migran-workers-mass-exodus-6348834/)

Only 51,750 (5%) of the total VVPATs used in elections, which are 1.035 million, are tallied and corroborated against its corresponding EVM machine to check for claims of hacking of EVMs. This minuscule number is not enough to get an accurate picture and in turn, greatly reduces the election's transparency.

(Source:https://qz.com/india/1591214/indian-election-2019s-voters-polling-booths-and-candidates/amp/)

11 Million: **Election personnel being deployed to conduct 2019 Election polls.**

This statistic perfectly corroborates what Mr. Ravindra, Master Trainer & Govt. College Professor was saying during the interview.

(Source: https://qz.com/india/1591214/indian-election-2019s-voters-polling-booths-and-candidates/amp/)

The Findings

After all the research, Insights were generated based on the Observations & personal Knowledge to club the research and move towards building a solution.

1.**There is a lot of scope for human-induced error in the election conduction process; especially in the pre-electoral and electoral phases**.

These errors can and has had:

- ***detrimental legal ramifications for the Election Officials and induce fear in them.***
- ***voters lose their right to vote and reduce the transparency of the election system.***
- ***voters lose trust and credibility in ECI and the Election System.***

Pre-electoral phase-

1. Getting registered as voters by generating valid voter ID cards is troublesome and often error-filled for the voter; especially for the elderly and uneducated. ***(as seen with the old village man with the voter id card photo of a dog)***

2. **Generating the electoral roll is also error-filled.**

Oftentimes, eligible voters lose their right to vote because their name fails to appear in the official electoral roll.

Other times, names of deceased voters remain written in official electoral rolls which give rise to electoral malpractices like voter fraud and booth capturing.

Caption: Experience of an eligible voter's name not being in the electoral roll

(Source: Review of PwD App by ECI in Play Store)

Electoral phase-

1. **Mis-identification of voters by 'Polling Officer 1' in polling stations due to manual voter authentication that takes place.**

   The pictures on voter ID cards are almost always black & white, grainy, and old which makes it very difficult for Polling Officers to correctly identify and authenticate the voter. They often resort to just asking some very basic identifying questions about the voter which can easily be answered by somebody else who's not the voter- Mr. Manish, Polling Officer 1.

This erroneous voter identification increases the chances of electoral fraud like duplicate voting.

Caption: Example of grainy, b&w photos on Voter ID Card (Source: https://www.etawahonline.in/city-guide/important-documents-etawah)

Elections are *not inclusive* and not everybody can exercise their right to vote *(as seen in the case of the migrant domestic help & the voter whose name was not in the electoral roll).* Election conduction is an *extremely slow process* due to some of the major electoral and post-electoral *activities being manually done*.

Voter verification, recording, and tallying of verified voters in the electoral roll as proof as well as tabulation and tallying of VVPAT slips against the digitally computed votes in the EVM are all hectic, time-consuming, and manually done tasks that have a lot of scope for human-induced error.

This leads to a lot of problems like-

- ***A lot of manpower is required to conduct these activities, and most of this manpower is govt.***

teachers and professors who are unable to teach for the duration of the election.

- ***Causing voters discomfort by waiting in long queues to get verified and be able to cast their votes.***
- ***Election Officials are experiencing a lot of fear of making a mistake and possibly losing their jobs (like in the case of voter misidentification leading to voter fraud and voter duplication.***
- ***Election Officials losing efficiency and not working to their fullest potential (seen as only 5% (51,750) of VVPAT results get tallied against their corresponding EVMs)***

4. Voters' lack trust in the Election System and Election Process due to

- ***Personal bad experiences with Election, for example:***
  - ***a. no accessibility guidelines followed thoroughly pan-India for PwD.***
  - ***b. inclusivity issues for migrant voters.***
- ***Mis-identification of voters by Polling Officers***
- ***Name not mentioned of eligible voters in the electoral role forcing them to lose their right to vote***
- ***Names of deceased people still mentioned in the electoral roll sometimes causing electoral fraud-***

booth capturing, voter duplication.

- ***Lack of tallying of VVPATs. Only 5% of VVPATs get tallied against its corresponding EVMs- around 57,000 VVPAT machines only out of the 1.035 million used to tally votes.***

This has led to *voters blaming the ECI* as an institution and *Elections losing their credibility and reliability (observed in the case of Mr. Lalit*)

As a result, voters are now *more susceptible to believing negative/false claims that the 'Media' might raise* (observed in the case of the uneducated migrant worker who is unable to get her Voter ID card for her constituency).

5. Election Officials will prioritize security and reduction in mistakes/voter fraud over efficiency if it came down to it, it was observed.

Problem Areas

After the Research and Insights generation, problem areas that negatively impacted most of the stakeholders got discovered and defined. After which, some were prioritized due to certain parameters.

The problem areas highlighted in blue are the ones that were prioritized.

Pre-Electoral Phase	Electoral Phase	Post-Electoral Phase
VOTER REGISTRATION- not inclusive difficult to conduct by users sometimes error filled	**VOTER VERIFICATION-** mis-identification voter ids with old, grainy pictures lots of official induced errors - due to slow manual processing leads to malpractices - voter fraud, duplicate voting, booth capturing waiting in long queues	**COUNTING AND TABULATION OF VOTES-** make it easier, convenient and less time consuming only 5% VVPATS being counted against their corresponding EVMs reduces trust of voters on elections & eci reduces transparency EVM DESIGN make it intuitive and more secure to reduce allegations of it being tampered with
OCCUPATIONAL TRAINING- difficult to conduct by officials scope of improvement of educational material on occupational training on the web as well as what is sent out by the ECI	ACCESSIBLE SPACE DESIGN accessibility guidelines ae not being properly followed pan-india	

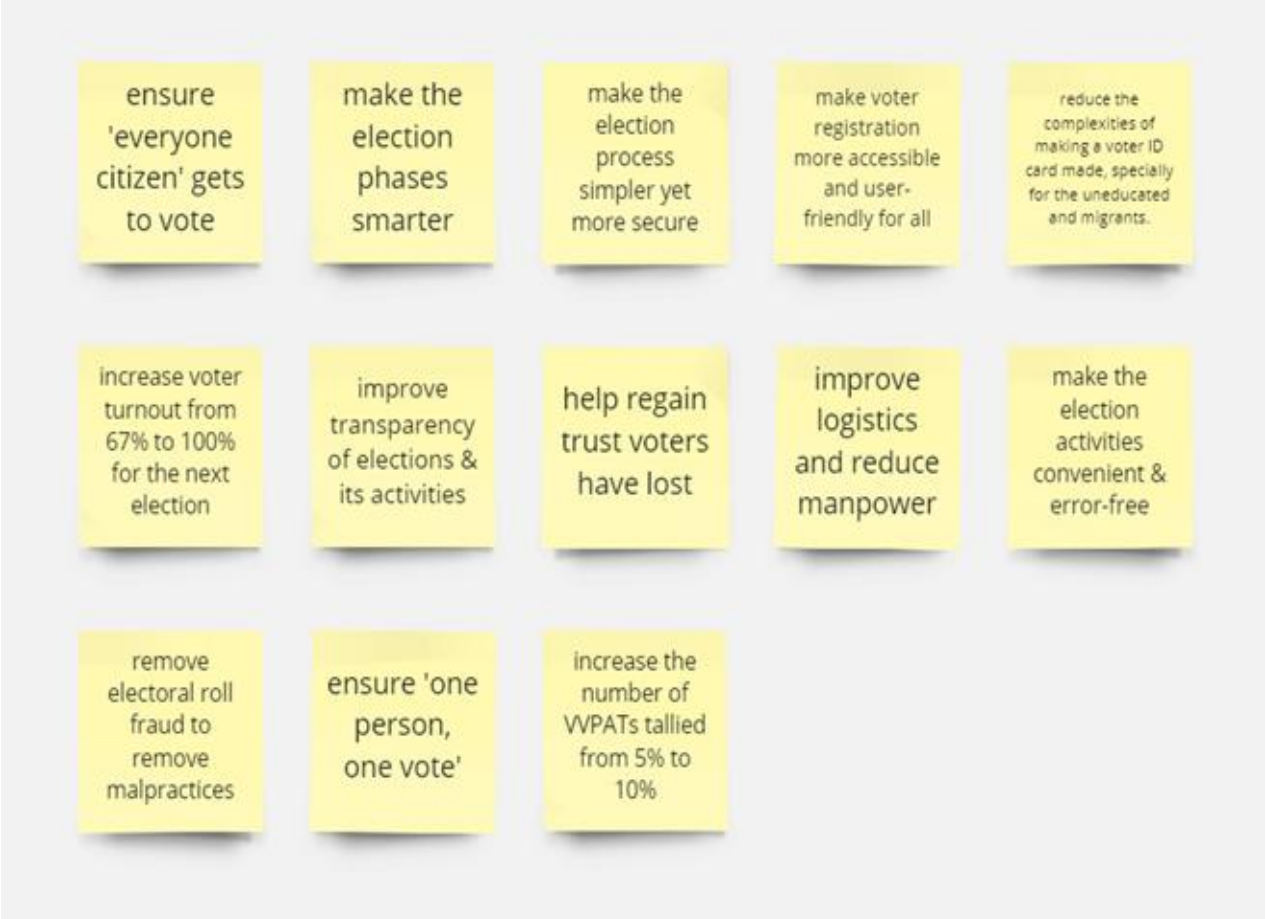
Caption- Highlighted Problem Areas

Note: Areas like 'occupational training', 'improving awareness/educational material for said training' and 'accessible space design were not taken forward because of:

1. ***Difficulty in getting an in-depth understanding of these topics due to it being full lockdown during the making of this project.***
2. ***Difficulty in conducting spatial studies to fully understand the 'Accessible Space Design' problem seeing as it was not 'Election Time'.***

'How Might We' Statements

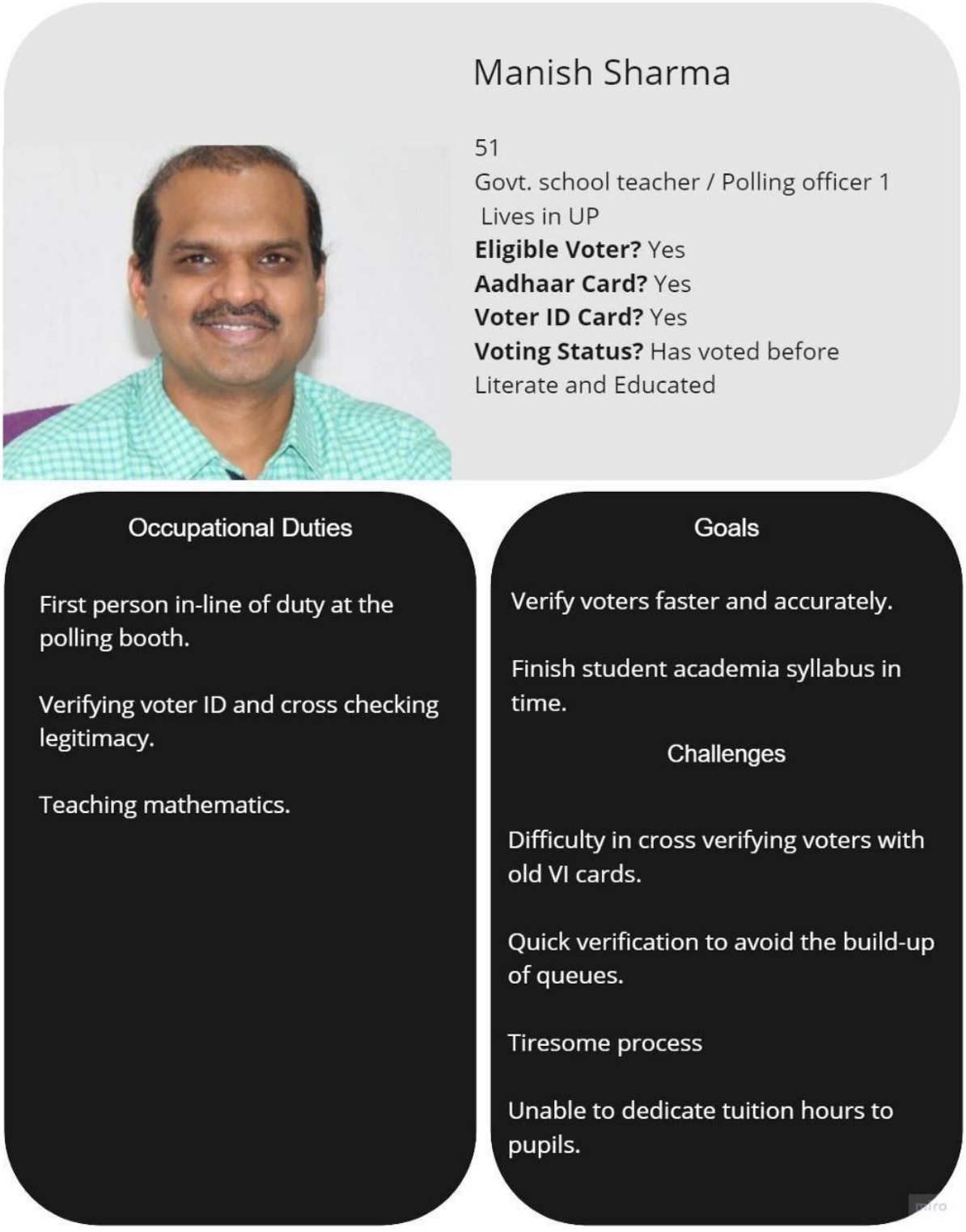
To further define and prioritize the problems that needed to be fixed, 'How Might We' statements were used to define and prioritize project goals.



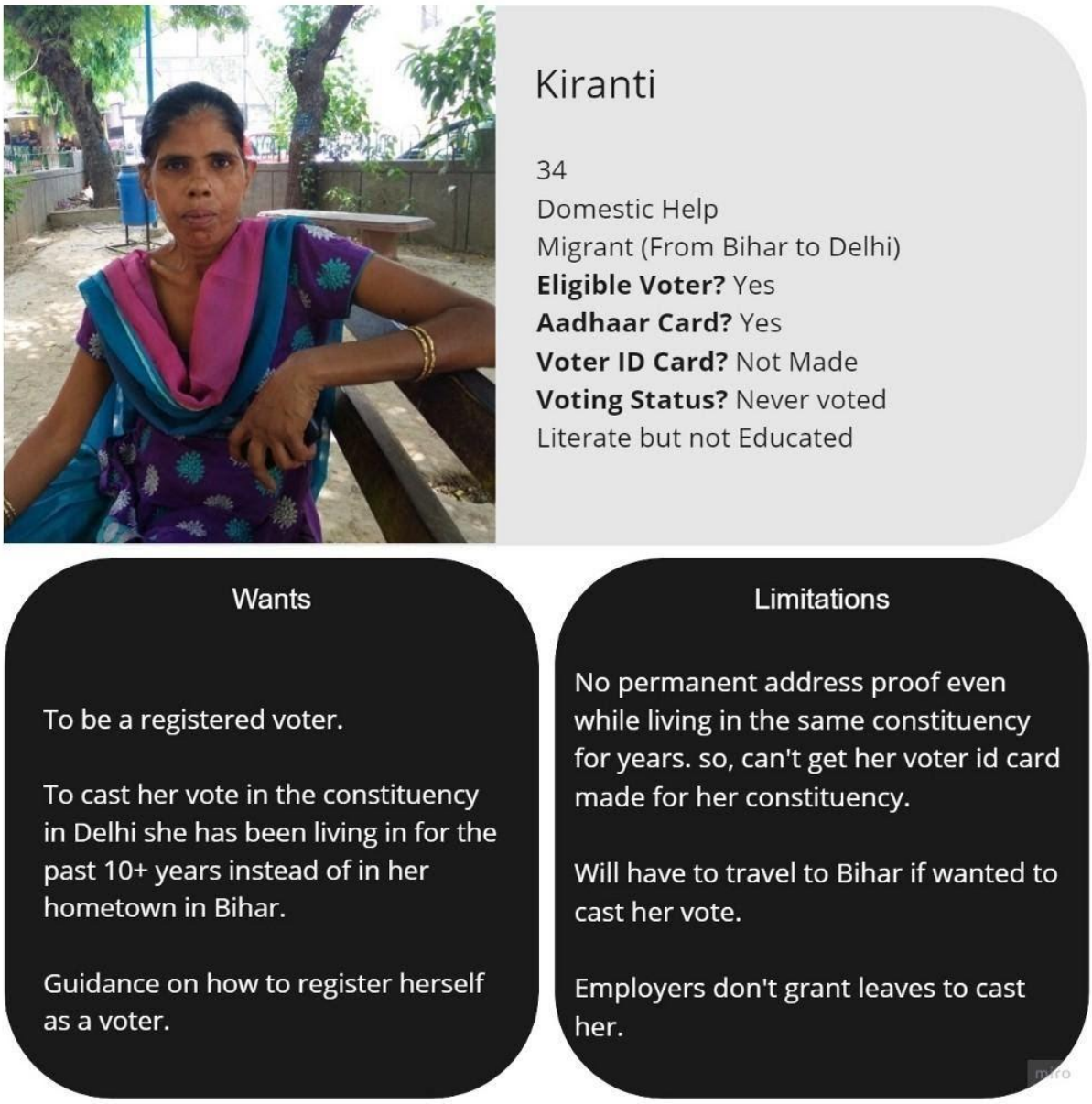
Caption- 'How Might We' statements

Personas

Finally, User Personas were created to club all the needs of both the stakeholders and design accordingly.



Caption- Persona of Polling Officer 1



Caption- Persona of Voter (Domestic Worker, Migrant)

Solution

The final solution has these four primary goals-

1. ***Make the Elections more universal and accessible.***
2. ***Increase transparency of the election conduction system to regain the trust and credibility it lost by the voters.***

3. ***Make the three electoral phases simpler, efficient, majorly errorless, and user-friendly without compromising its security.***
4. ***Improving the logistics; reducing the manpower required to conduct Elections and increasing the voter turn-out.***

The solutions will be based on these three problem areas-

1. ***Pre-Electoral Phase- Voter Registration***
2. ***Electoral Phase- Voter Verification***
3. ***Post-Electoral Phase- Vote Tabulation & Tallying***

Following are the design solutions that came up-

1. An automatic voter registration system backed by Aadhaar (For Voter Registration)

The concept:

Through this, citizens will no longer need to get a voter ID card made to get themselves registered as voters because their already existing Aadhaar Card will act as their new Voter ID card. Their Unique Aadhaar Number will become the new EPIC Number (Electors Photo Identity Card Number) and completely replace the Voter Id Card, i.e, voters will not have to go through the cumbersome process of getting their Voter Id Card made/updated anymore to get themselves registered/re-registered respectively.

Note: The Aadhaar Number is a 12-digit number issued by the Unique Identification Authority of India (UIDAI). This number

is unique to every person who gets an Aadhaar card made by taking into account the person's biometric details such as iris scan and fingerprints, and demographic information like date of birth and address proof.

Aadhaar Number acts as a proof of one's proof of identity, proof of address as well as proof of age anywhere in India.

Citizens aged 18 or above on 1st of January who satisfy the following parameters are considered to be eligible to vote. These parameters include :

- ***The citizen should not be declared to be of an unsound mind.***
- ***The citizen should not have performed corrupt practices or any illegal activities relating to elections.***

Through the concept of Automatic Voter Registration, all eligible voters who already have their Aadhaar Cards made will have their names included in the electoral list automatically by the ECI as the new electoral roll will be backed up by data from UIDAI's Aadhaar Card data.

This automatic registration of eligible voters by the ECI will be done through 3 filtration steps, namely, Eligibility Filtration, Mortality Filtration, and Criminality Filtration.

1. **Eligibility Filtration**

   The Election Commission of India (ECI) of India will get access to the total population eligible as voters on the basis of their age (18 years and above by 1st January

of election year) from CIDR (Central Identities Data Repository), which contains all Aadhaar numbers issued to Aadhaar number holders along with the corresponding demographic information and biometric information .

2. Mortality Filtration

The ECI will receive information about the deceased people in the eligible voter population from the National Population Register (NPR) and remove them from the electoral roll.

3. Criminality Filtration

The ECI will receive information of the convicted criminals from the Crime records bureau (CRB), and remove them from the electoral roll.

Caption: Data Flow diagram for Automatic Voter Registration

Benefits/Pros of the concept:

- **Similar Criteria and Same Proofs to get both Voter Id Cards as well as Aadhaar Cards made:**

  Since to acquire an Aadhaar Card, valid proofs of identity and address are required which is the exact same criteria that is used to acquire a Voter Id Card, it makes more sense to replace the Voter Id card which is an election specific document/card with the Aadhaar Card, which is a very versatile and universally acceptable government-issued document/card that can be used to avail a multitude of Govt. Services, Programmes and Schemes like Acquisition of Passports, Opening of Bank Accounts, and Availing LPG Subsidy to name a few. This versa

- **Reduction in the steps required to become a registered voter:**

  By replacing the Voter Id Card/EPIC Number with Aadhaar Card/UIDAI Number is beneficial as first-time voters/new voters who register for the very first time and/or existing voters who re-register from a different constituency due to them changing their location (Military and Migrant Workers) will simply get their Aadhaar Card successfully made and updated respectively, and their name will automatically be added to the electoral roll.

This 'Automatic Voter Registration System backed by Aadhaar' concept will save voters from going through the hassle of getting a whole new Id card made, i.e, get a Voter Id card made for an event that happens once every 5 years.

The concept, hence, will make the registration process much simpler, shorter and user friendly for all the voters, especially the ones who are uneducated, migrant workers who lack a valid proof of address of the constituency they have migrated to as they generally live in illegal settlements (as they can get an Aadhaar Card made with the help of either, an introducer's or their head of family's Aadhaar Card credentials), and people who quite often move to different places.

Statistics that favour Aadhaar Cards replacing Voter Id Cards:

- ***95% of adults already have Aadhaar.***
- ***92% of people are satisfied by Aadhaar.***
- ***90% of the people trust that their data is safe in the Aadhaar system.***
- ***49% of citizens used Aadhaar to access one or more services for the first time.***

2. Voter Verification System through Biometric Verification

On the day of the election, the first step is to always check the legitimacy of the eligible voters through voter identification and verification by the 1st Polling Officer. Upon successful verification,

the voters are allowed to step inside the polling station and eventually cast their vote in the polling booth that they are assigned.

This manual verification of the voters against the old, grainy and often black & white photos on their Voter Id Card had been quite erroneous in the past. One of the Polling Officers that was interviewed mentioned wrongly identifying and verifying a voter as the photo in his Voter Id Card was grainy, monotone and not identifiable.

The concept:

On the day of elections, the 1st Polling Officer will identify and verify eligible voters by matching their biometric data (either fingerprints or iris scan) against the unique biometric data stored in the CIDR corresponding to the voter's Aadhaar Card Number at the polling station entrance. Only those eligible voters who have readable and verifiable biometrics will be allowed to enter the polling station and go to their allotted polling booth to cast their vote.

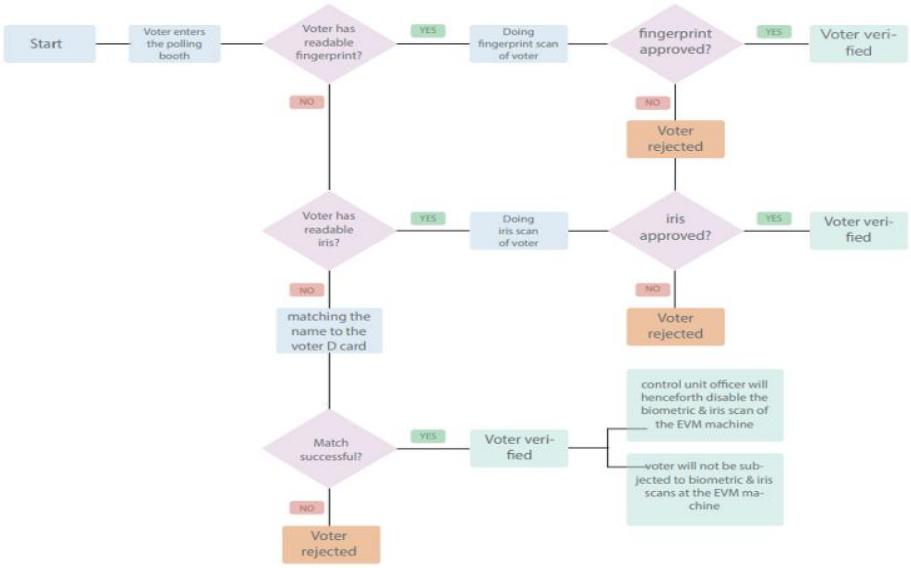
The eligible voters who do not have readable biometrics (both fingerprints and iris scan) will undergo manual verification by the Polling Officer by getting their face matched with the picture stored in the Aadhaar Card data. Once verified through this manual scan, they will be allowed to enter the polling station and cast their vote in the allotted polling booth.

The Polling Officer will not have the Aadhaar data stored of every eligible voter for that particular election pan-india to identify and

verify the voters against, but only of those specific eligible voters who have been allotted the same polling station that the 1st Polling Officer is in command of.

This inclusion of only specific biometric data per polling station adds the 1st layer of security in the electoral process, i.e, the Voter Verification and Vote Casting processes.
This will make sure only verified and actual voters cast their votes, which will further ensure 'One voter, One Vote' right is preserved and voter's trust in the Election system and conduction is regained.
Adequate Leniency is provided for voter authentication as fingerprints of any of the fingers of the voter should match in order to get verified at the polling station.

Counter measures are also provided in the form of Iris scan and manual verification. The voters can undergo these verification measures in case they can't opt for fingerprint verification.



Caption: User Journey for Biometric Voter Verification

Benefits/Pros of the concept:

- ***The process of voter verification will become efficient, quick and secure.***

- ***There will be no cases of mis-identification by the polling officers and human-induced errors will be a non-issue anymore.***

- ***Voter identification problems currently faced by 1st polling officers will be resolved.***

- ***By introducing biometric enabled voter verification, the responsibilities of Polling Officer 2, which is re-checking the identity of the voter once they enter the polling booth and putting indelible ink on the fingers of successfully verified voters, will get removed from the system, which will save 1.035 Million Govt. Employees the trouble of doing Election Duty.***

  Most of these Election Officials are Govt. School and College professors who miss out on teaching their students for months on end. This way, ECI will greatly reduce the manpower it needs to conduct elections.

- ***One vote per voter right will be preserved.***

3. Vote Casting through Biometric Verification & EVM-VVPAT Hybrid

After voter identification & verification, the next step is vote casting on the EVM machine by the voter. This vote casted on the EVM machine is validated by a machine called the VVPAT (Voter Verifiable Paper Audit Trail). Every EVM machine has a corresponding VVPAT machine alongside it.

After a vote is casted on the EVM, the VVPAT prints out a paper slip which reflects the party symbol and party name of the chosen party candidate, in both Hindi and English. This slip remains in view of the voter for a span of 7 seconds as a form of visual feedback, after which it falls into the collecting bin.

After all the votes from the voters in the polling booth are casted, both the EVM and VVPAT are locked and sealed, and are transported elsewhere in order to start tabulating the votes.

Problems with the current vote casting and vote tabulation system:

For the election officials-

1. **Both the EVM and VVPAT machines are very bulky and difficult to transport to the polling stations pan-india.**
2. **EVM is not a secure machine as there are still cases where booth capturing has taken place, and voter fraud happened by threatening the officials with violence.**

For the voters:

1. ***EVM's interface is visually confusing. There are no cues to help voters make connections between the candidate paper slip on the EVM and its corresponding button.***
   This confusion and lack of visual cues increases cognitive load on the voter which can result in a faulty/wrong vote being registered.
2. ***The placement of the VVPAT machine at the side and at a lower level to the EVM makes it difficult for voters, especially first time voters, illiterate voters, and elderly voters to view the VVPAT's paper slip which shows the selected party.***
3. ***Only 51,750 (5%) of the total VVPATs used in elections, which are 1.035 million, are tallied and corroborated against its corresponding EVM machine to check for claims of hacking of EVMs. This minuscule number is not enough to get an accurate picture and in turn, greatly reduces the election's transparency.***

To combat all of the aforementioned problems, the concept of EVM-VVPAT Hybrid was developed. This hybrid makes sure of three things, namely, added legitimacy and security of the votes casted through the inclusion of biometrics, improving voter-friendliness of the vote casting process, and improving transparency of the vote tabulation and tallying process.

The EVM-VVPAT Hybrid has four iterations, out of which one was selected. The general concept of all four iterations is the same with minor differences across them.

Also, the Hybrid works on batteries and not electricity, and on internal SD/Memory Cards and not the internet. This is done to make sure the machine can work in a non-electricity environment and is hack-proof.

The concept:

For the EVM part of the EVM-VVPAT Hybrid-

In case of Iterations 1 to 3, the EVM has 16 fingerprint enabled buttons for each of the 16 candidate categories & an iris scanner at the top of the EVM.
In case of Iteration 4, which is the final solution, the EVM has 1 fingerprint sensor in the shape of a button, and 16 physical, tactile buttons for each of the 16 candidate categories & an iris scanner at the top of the EVM.

Four such EVMs can be placed together to accommodate a maximum of 64 candidates in a constituency.

Each EVM machine contains an SD/Memory Card which contains the biometric data (fingerprint and iris) stored of those 1400 eligible voters that have been allotted the polling booth in which the EVM-VVPAT Hybrid is kept.
This acts as the second level of security and authentication of the voters during the electoral phase, i.e, in the voter verification and vote casting phase as only those voters whose biometric data matches the one stored in the EVM-VVPAT Hybrid in the particular polling booth will be able to cast their votes.

Case 1:

If the voters have readable biometrics, then they will authenticate themselves by either,

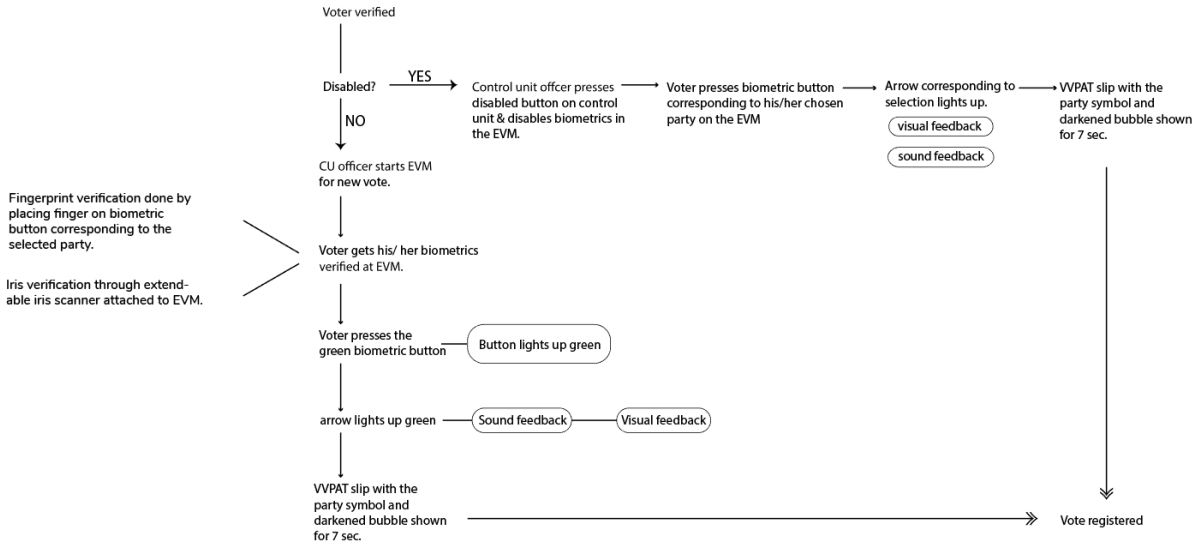
1. ***(in case of iterations 1 to 3) simply placing their finger on the fingerprint enabled button corresponding to the candidate they want to vote for. If the fingerprint is verified, then the fingerprint enabled button will light up green and they can press the lit-up button to cast their votes, and (in case of iteration 4) placing their finger on the biometric sensor at the top of the other 16 buttons. If the fingerprint gets verified, then the fingerprint sensor will light up green and they can press the physical button corresponding to the candidate they want to cast their vote for. Upon pressing the button, it, along with the arrow besides it will light up green and the voter will get an audio cue to represent the successful recording of the vote by the EVM machine or,***
2. ***by getting their iris authenticated with the help of the extendable iris scanner attached to the EVM. After getting their iris authenticated, (in case of iterations 1 to 3), the fingerprint enabled button corresponding to the candidate they want to vote for will light up green and they can press the lit-up button to cast their votes, and (in case of iteration 4), the biomentric sensor will light up green and they can press the button corresponding to their preferred candidate to cast their vote.***

Case 2:

If the voter does not have readable biometrics, then the 3rd Polling Officer will disable the biometric scans (both fingerprint and iris) in the EVM machine and the voter will simply press the button corresponding to the candidate they want to vote for without having to go through biometric verification.

Upon pressing the biometric buttons for both of the aforementioned cases, the corresponding arrows will light up green and an audio cue will be heard. Hence, both visual and audio feedback will be provided once the vote is recorded in the EVM machine.

The recorded vote will then be reflected on the VVPAT thermal paper slip for some time as a way for the voter to validate and tally it with the recorded vote.



Caption: User Journey for Vote Casting on the EVM machine

For the VVPAT part of the EVM-VVPAT Hybrid-

The VVPAT has been re-designed to work on the 'Dual Thermal Roll Model'. It consists of 2 rolls; one full thermal roll (5.6 cm X 30 meters) and the other, empty.

This continuous thermal paper slip can print results of 1400 votes, the maximum no. of voters allowed in a polling booth.

In this, instead of separating each VVPAT slip for every vote cast, a continuous thermal roll will reflect the party's symbol and name for the voters to tally their vote with.

Mechanism of the Dual Thermal Roll Model

1. ***The unwinding of 1st thermal paper roll after the vote is cast and recorded in the EVM.***

2. ***Thermal printer prints party symbol and name (in both Hindi and English) and darkens one of the 64 number bubbles corresponding to the party the voter has cast their vote for.***

   64 is the maximum number of parties allowed in a constituency.

3. ***Each slip will have dimensions of 5.6cm X 10cm.***

4. After the voter slip gets showcased to the voter behind a transparent plastic casing over the VVPAT machine for 7 seconds, this unwinded roll will get re-winded onto the 2nd roll.

5. After all the votes are cast, the thermal paper roll will get completely un-winded from the 1st roll and get re-winded onto the second roll.

The VVPAT Slip

The VVPAT slip is part of a continuous roll of thermal paper and each slip has the dimensions of 5.6cm X 10cm.

Each slip consists of the selected party's symbol and name (in both Hindi and English). It also has 64 bubbles, numbered from 1 to 64 respectively. These numbered bubbles correspond to the party the voter has cast their vote for. Each slip will have one of these numbered bubbles darkened.

Caption: Graphic of the designed VVPAT slip with its dimensions

EVM-VVPAT Hybrid Iterations

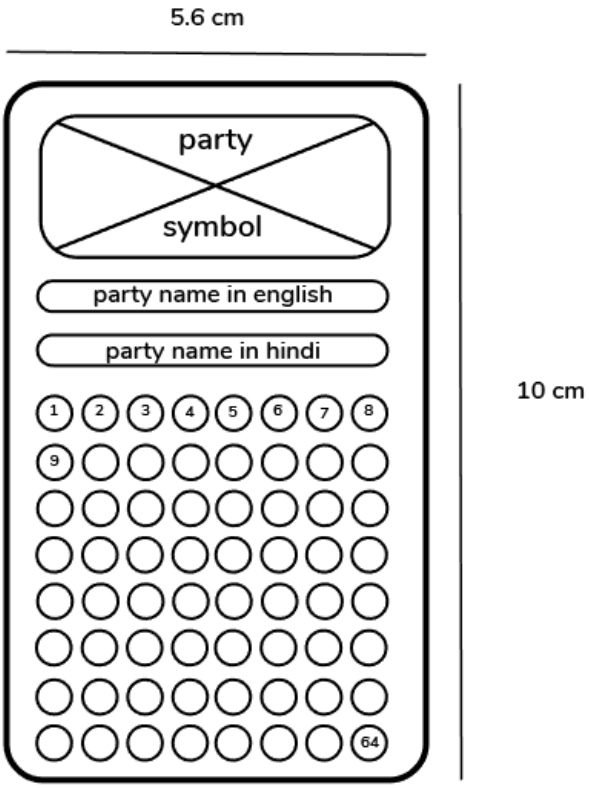
Iteration 1

Additional features-

- ***The housings of both the thermal rolls protrude from the top surface of the VVPAT machine. The housing for the 1st thermal roll is made of clear plastic and for the 2nd one, is of white plastic.***

- ***The protrusions were made to give the voters some idea of the mechanism of the working of the VVPAT machine, in hopes to increase the transparency of the vote casting process. This would make the voters feel like their vote matters and will, henceforth, help regain trust in the election conduction, its result and the ECI.***

Tabulation and counting of votes



vvpat slip
(5.6 cm x 10 cm)

The continuous VVPAT thermal roll will be taken out of the VVPAT machine and put through a light-sensitive thermal scanner which will tabulate the number corresponding to the 64 number bubbles on the VVPAT thermal paper roll.

These 64 number bubbles will correspond to the 64 parties that can be there in a polling constituency.

The light-sensitive thermal scanner will pass light rays through the continuous thermal paper roll and whichever numbered bubble is darkened in each VVPAT slip and does not let light pass through it, will be considered as a vote. This will make it very easy, quick and efficient to tabulate and tally all of the VVPAT votes against its EVM counterpart's votes. Hence, instead of 5% of the total VVPAT machines being tallied against its corresponding EVM's, now, 100% of the VVPAT machines can be tallied against its corresponding EVM's.

Pros of iteration 1

Visual Cues on the Interface of the EVM's Candidate-Party Panel (to lessen the voter's cognitive load)

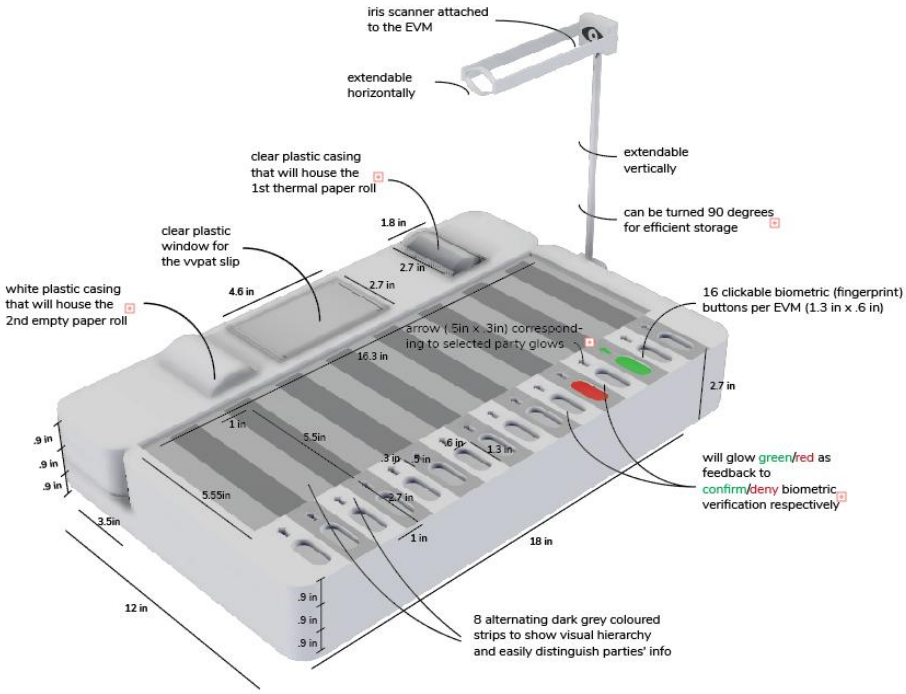
Cons of iteration 1

- ***These protrusions would result in a visual bias in the minds of the voters regarding the candidates by taking and forcing their attention onto the candidates placed against these protrusions.***

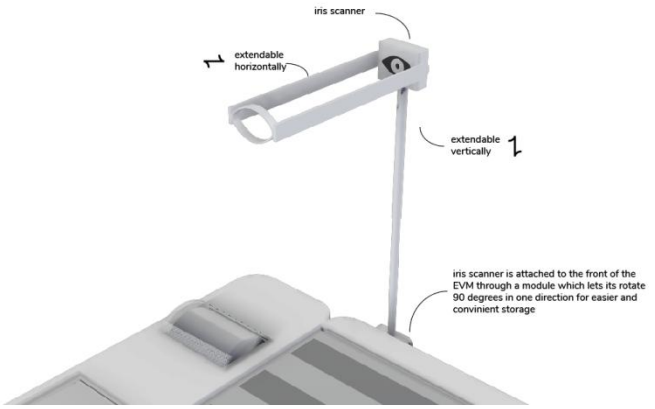
- ***The visual perception of the voters regarding the candidates should not be altered in any way by the machine. Each candidate should be on a level playing field.***

Because of the aforementioned reasons, iteration 1 was rejected.

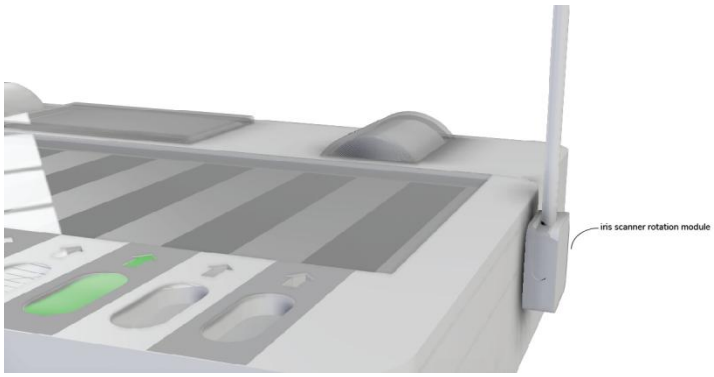
Caption: Existing EVM & VVPAT machines



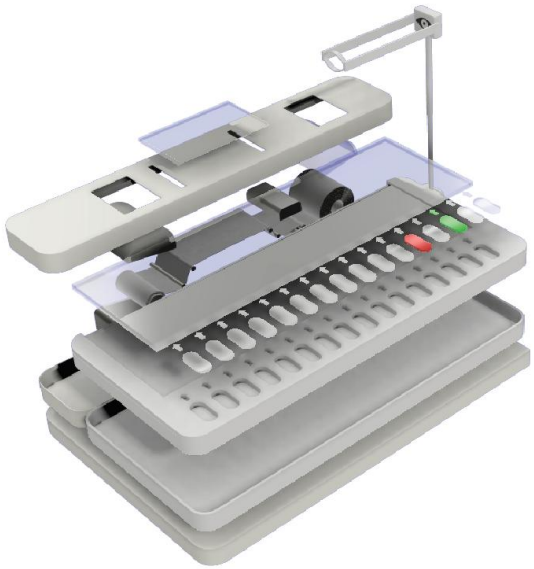
Caption: Re-designed EVM-VVPAT Hybrid (considerable size difference from the existing EVM & VVPAT machines for better portability)



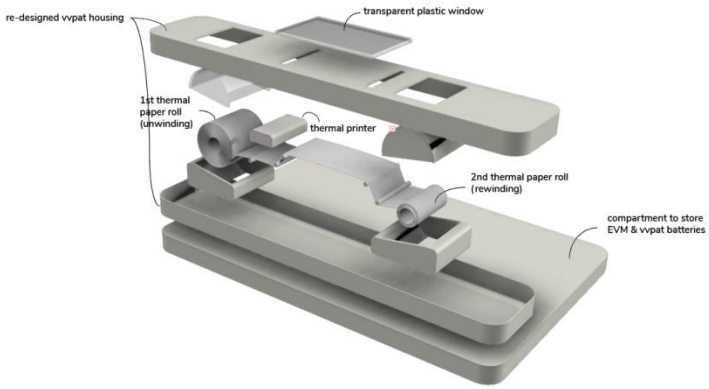
Caption: Iris Scan Module of the EVM-VVPAT Hybrid



Caption: Iris Scan Module of the EVM-VVPAT Hybrid



Caption: Exploded View of the EVM-VVPAT Hybrid



Caption: Iris Scan Module of the EVM-VVPAT Hybrid

Caption: Visual Cues on the Interface of the EVM's Candidate-Party Panel (to lessen the voter's cognitive load)

Iteration 2

Additional features-

- ***The VVPAT assembly was placed down in its housing to make the VVPAT's top surface as flat as possible in order to get minimal possibilities of visual cues that could change the voter's visual perception towards certain candidates.***

- ***The concept of 'Reverse Unwinding' was added to this iteration. In this, a light-sensitive thermal scanner was embedded in the VVPAT module itself. Hence, there would be no need to take the rol lout of the VVPAT assembly in order to tabulate votes. After all the votes have been cast, the 2nd thermal roll would be put through the embedded light-sensitive thermal scanner which will tabulate the number corresponding to the 64 number bubbles on the VVPAT thermal paper roll, just like in iteration 1, and eventually tabulate the votes in the VVPAT slip.***

- ***The concept of 'VVPAT Vote Confirmation' was added to this iteration. A proximity sensor was put behind the transparent plastic casing of the VVPAT machine. After the voters cast their vote on the EVM machine, the VVPAT slip containing their selected party's symbol and name will be showcased to them. If the party reflected on the slip matches with the party they cast their vote for, the voter will place their hand on top of the transparent plastic casing with the proximity sensors in it to confirm the vote. Only after the voter confirms the vote, will the vote be successful and recorded.***

Pros of iteration 2-

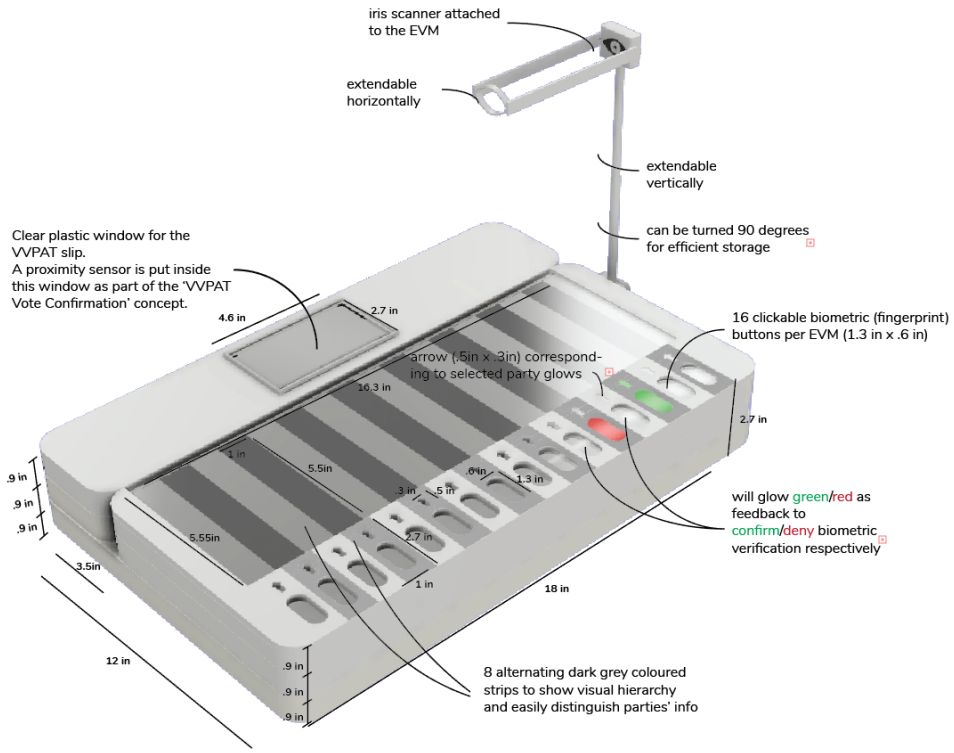
- ***The concept of Reverse Unwinding negates the need to get the 2nd thermal roll out of the VVPAT machine to put it through a light-sensitive thermal scanner as seen in iteration 1.***

- ***Visual Cues on the Interface of the EVM's Candidate-Party Panel (to lessen the voter's cognitive load)***

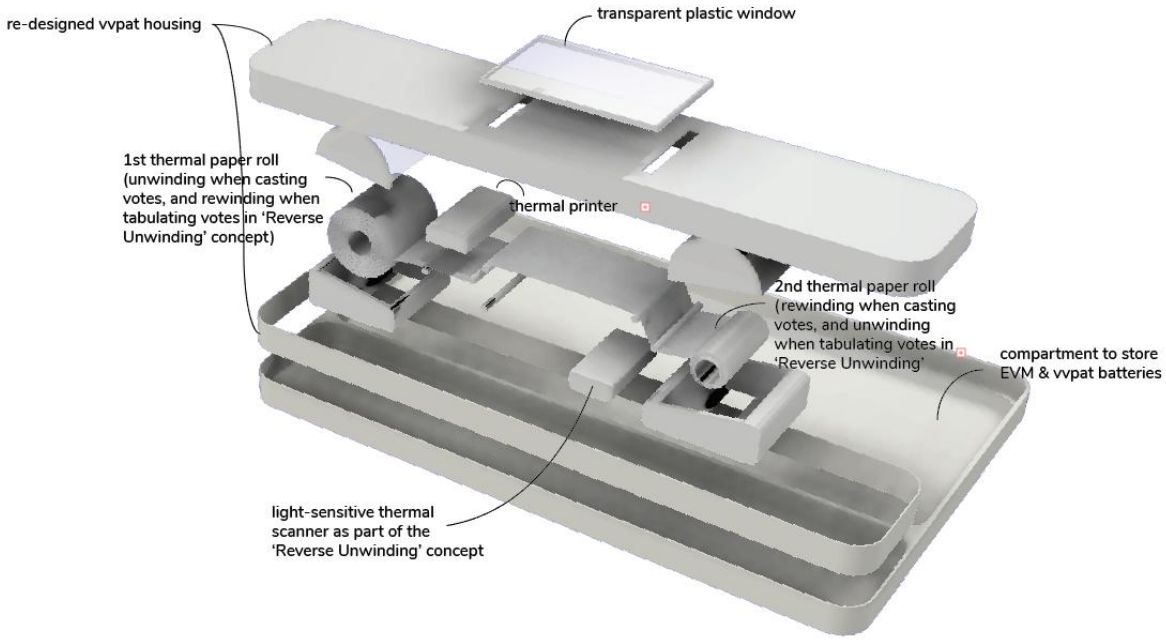
Cons of iteration 2-

Although the feature of VVPAT Vote Confirmation is beneficial for the users as it gives them a sense of control over the vote casting process, the use of proximity sensor inside the transparent VVPAT casing to get voters to confirm their vote seems a little gimmicky.

Because of the aforementioned reason, iteration 2 was rejected.



Caption: Re-designed EVM-VVPAT Hybrid (considerable size difference for better portability)



Caption: Exploded View of the VVPAT with Reverse Unwinding concept

Iteration 3

Additional features-

- ***The VVPAT assembly was placed down in its housing to make the VVPAT's top surface as flat as possible in order to get minimal possibilities of visual cues that could change the voter's visual perception towards certain candidates.***

- ***The concept of 'Reverse Unwinding' was continued from the previous iteration.***

- ***The concept of 'VVPAT Vote Confirmation' was added to this iteration, with some minor changes. Now, a button was placed below the transparent plastic casing of the VVPAT machine. After the voters cast their vote on the EVM machine, the VVPAT slip containing their selected party's symbol and name will be***

showcased to them. If the party reflected on the slip matches with the party they cast their vote for, the voter will press the button below the transparent plastic casing to confirm the vote. Upon successfully pressing the button, it will light up green as a visual feedback to the confirmation of the vote. Only after the voter confirms the vote, will the vote be successful and recorded.

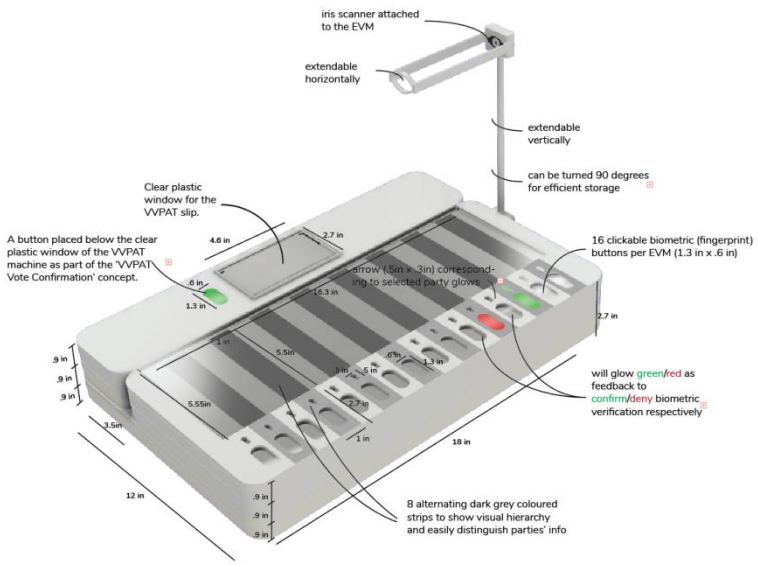
Pros of iteration 3-

- ***The concept of Reverse Unwinding and the re-designed concept of VVPAT Vote Confirmation.***
- ***Visual Cues on the Interface of the EVM's Candidate-Party Panel (to lessen the voter's cognitive load)***

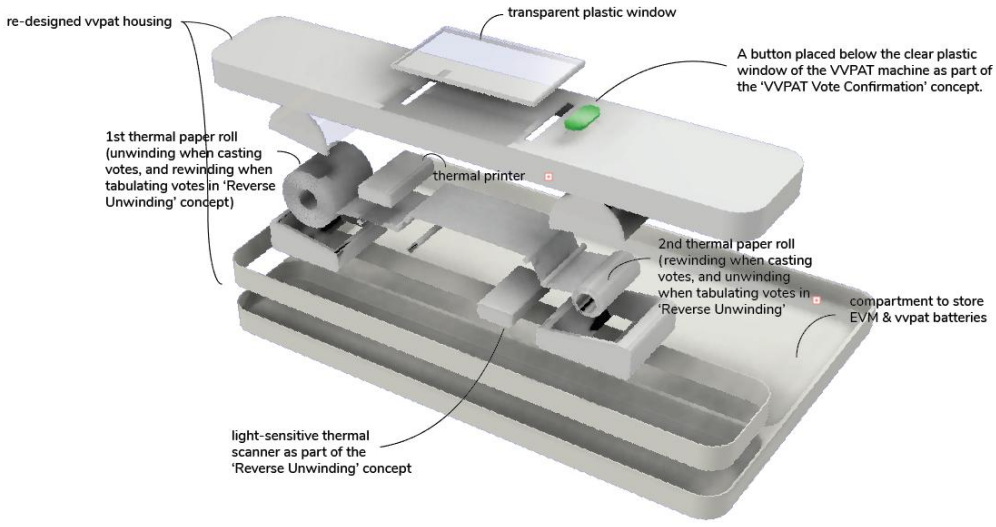
Cons of Iteration 3-

- ***The concept of 'VVPAT Vote Confirmation' making use of a physical, tactile button can be a cause of visual bias in the minds of the voters regarding the candidates by taking and forcing their attention onto the candidates placed against the 'VVPAT Vote Confirmation' button. This is not acceptable as one of the core needs of this machine re-design is to make sure that each candidate should be on a level playing field and that the visual perception of the voters regarding the candidates should not be altered in any way by the machine.***

Because of the aforementioned cons, iteration 3 was rejected.



Caption: Re-designed EVM-VVPAT Hybrid (considerable size difference for better portability) with Reverse Unwinding concept and iterated VVPAT Vote Confirmation Concept



Caption: Exploded View of the VVPAT with Reverse Unwinding concept and iterated VVPAT Vote Confirmation Concept

Iteration 4

Additional features-

- ***The EVM machine has a single, separate fingerprint sensor and 16 physical, tactile buttons that correspond to the 16 candidates on the machine instead of the 16 biometric enabled buttons seen in the previous iterations. This seperate biometric sensor will make sure that the anonymity of the votes remains, which is the core fundamental of elections.***

- ***The VVPAT assembly was placed down in its housing to make the VVPAT's top surface totally flat as compared to 'as flat as possible' observed in iteration 3, in order to get absolutely no possibilities of visual cues that could change the voter's visual perception towards certain candidates.***

- ***The upper housing of the VVPAT machine of the EVM-VVPAT Hybrid is now made up of frosty grey acrylic sheets. This is done to make sure that the VVPAT Vote Slip can only be seen by voters when the slip is illuminated from behind, within the VVPAT housing. This illumination will only happen after the voter has cast their vote on the EVM machine. This frosted grey acrylic sheet will become translucent in appearance only when it gets illuminated from behind.***

  The change in the material of the housing and the usage of illumination after the vote has been cast has been made sure to ensure that there are no visual elements in the form of the VVPAT Slip housing, buttons and roll housing protrusions to

create visual bias in the minds of voters that bring about a change in the visual perception of them towards candidates.

- ***The concept of 'Reverse Unwinding' was continued from the previous iteration.***

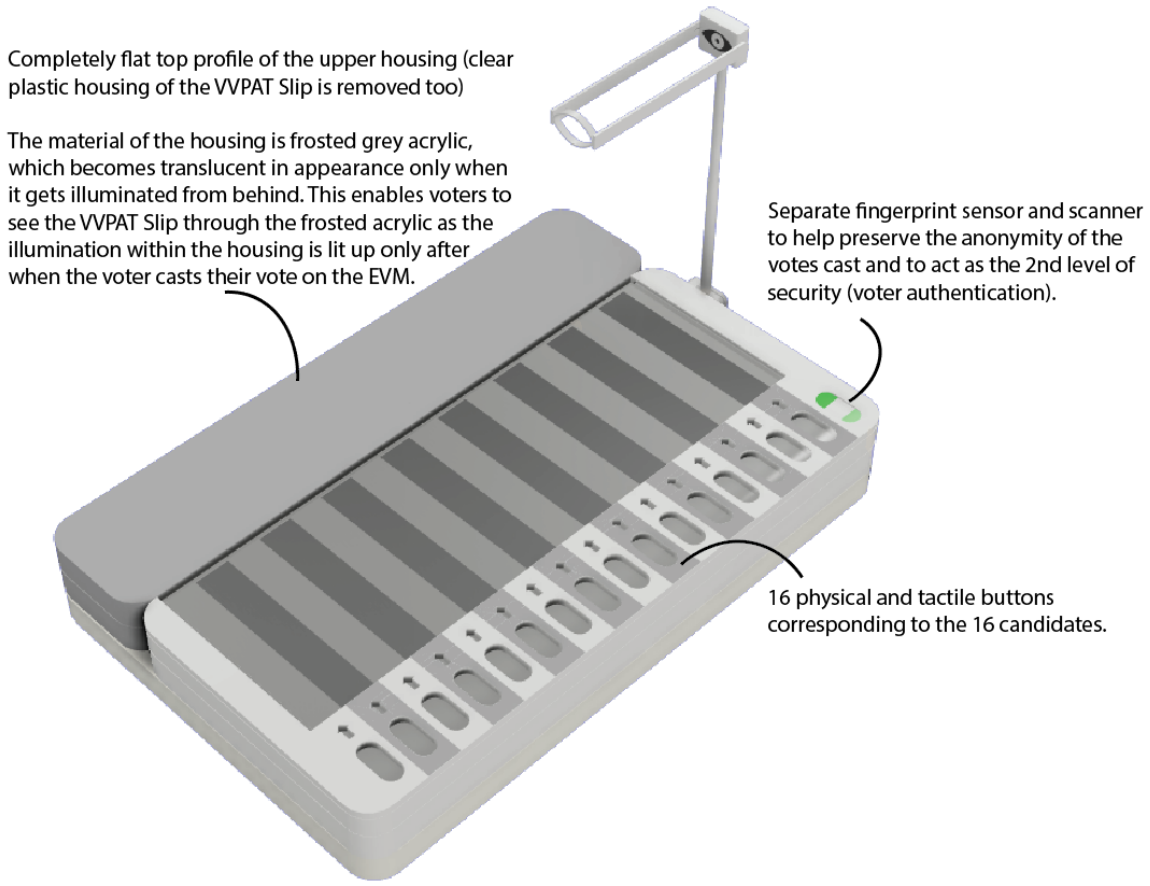
- ***The concept of 'VVPAT Vote Confirmation' continued from the previous iteration, but with some minor changes. Now, the transparent plastic casing of the VVPAT machine has been removed and the whole surface has been made flat. After the voters cast their vote on the EVM machine, the VVPAT slip containing their selected party's symbol and name will be showcased to them by turning on the illumination behind the VVPAT Slip (the voters will be able to see what is behind the frosty grey acrylic sheet only when there is illumination behind it). If the party reflected on the slip matches with the party they cast their vote for, the voter will press anywhere on the top surface of the VVPAT's upper housing to click a tactile button which is placed underneath the top sheet and within the VVPAT housing to confirm the vote. Upon successfully registering a tactile click of the button underneath the top surface, the vote will be confirmed and recorded as the final vote of that voter.***

Pros of iteration 4-

- ***The concept of Reverse Unwinding and the re-designed concept of VVPAT Vote Confirmation.***

- ***There is no more worry of changing the voter's perception about candidates as the top of the VVPAT is completely flat and devoid of any visual cues.***
- ***Visual Cues on the Interface of the EVM's Candidate-Party Panel (to lessen the voter's cognitive load)***
- ***The separate fingerprint scanner makes sure anonymity of the votes is preserved.***

Because of the aforementioned pros, iteration 4 was accepted.



Caption: EVM-VVPAT with the separate fingerprint scanner, iterated VVPAT Vote Confirmation Concept before vote casting on the EVM.

Caption: EVM-VVPAT after vote casting on the EVM, showing its iterated 'VVPAT Vote Confirmation' concept, wherein the voter is able to see the VVPAT Slip from behind the translucent frosted grey acrylic sheet only when there is illumination from within the VVPAT housing after the vote has been cast on the EVM.

Benefits of Vote Casting through Biometric Verification & EVM-VVPAT Hybrid:

- ***The introduction of biometrics (fingerprint buttons & iris scanner) in the EVM-VVPAT Hybrid adds a second level of security to the electoral phase, i,e, the Voter Verification and Vote Casting processes.***

  This will again make sure only verified and actual voters cast their votes, which will further ensure 'One voter, One Vote' right is preserved.

- ***Adequate Leniency is provided for voter authentication as fingerprints of any of the fingers of the voter should match in order to get verified at the polling station.***

- ***Counter measures are also provided in the form of Iris scan and manual verification. The voters can undergo these verification measures in case they can't opt for fingerprint verification.***

- ***Voter casting will become a lot more secure.***

- ***The re-designed VVPAT Hybrid will make sure that all the votes from 100% of all the VVPATs used will be tallied against their corresponding EVMs.***

- ***The re-designed VVPATs 'Dual Thermal Roll Model' design will not only very quickly tabulate the votes recorded in the VVPATs against its corresponding EVMs but will also benefit in its transportation by considerably reducing the re-designed VVPATs size.***

  This 100% tallying of votes will squash all claims of EVM hacking and tampering, as well as help regain the trust ECI and Election has lost.

Conclusion and Learnings

The solution brings a lot of value with it in terms of increased transparency in the working of the elections and its conduction, help to regain the lost trust of the voters in the ECI and Elections which will make them respect the final result of the Election, improved

logistics in terms of reduced manpower required to conduct the elections, improved security measures to make the election conduction more robust to claims of fraudulent voting and mishappenings.

All of this will make sure that the ECI resumes its place as 'Referee/Umpire' between the citizens and the Govt.

Following is the value that the proposed solution brings to the election conduction and its processes:

- ***The simplicity of the proposed Automatic Voter Registration concept makes it so that voter registration becomes much more universal and accessible in nature. Through the inclusion of the Aadhar Card in this process, the majority of the eligible voters will be able to exercise their right to vote as seen in the case of illiterate voters, migrant workers and voters who very often move places, who previously, could and/or did not exercise their right to vote.***

- ***These multi-levelled security measures adopted through the inclusion of biometrics make sure that the election process is being conducted with greater transparency and legitimacy, which in turn makes the voter develop faith in the election, its result and the ECI.***

- ***Due to the inclusion of biometrics from the Aadhaar data to carry out biometric voter verification, the responsibilities of polling officer 2 will get removed from the system, i.e, ECI will greatly reduce the manpower it needs to conduct elections.***

Introducing biometric voter verification will save 1.035 Million Govt. Officials the trouble of doing Election Duty, most of which are Govt. School and College professors who miss out on teaching their students.

- ***The re-designed VVPAT Hybrid will make sure that all the votes from 100% of all the VVPATs used will be tallied against their corresponding EVMs, hence, squashing all claims of EVM hacking and tampering, as well as help regain the trust ECI and Election has lost.***

Following are the learnings from this project:

- ***This project solidified in my mind just how crucial good user research is for any design project, especially to get an idea of genuine and accurate problems that plague the stakeholders.***
- ***I realized just how different opinions and experiences seemingly similar people can have on the same topic.***
- ***I also got to understand how important it is to validate hypotheses against user-driven data to come up with design decisions that actually yield good, meaningful experiences for the stakeholders involved.***