



TOUCHSCREEN MALAYALAM TEXT INPUT FOR BLIND

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Under the guidance of

Prof. Anirudha Joshi

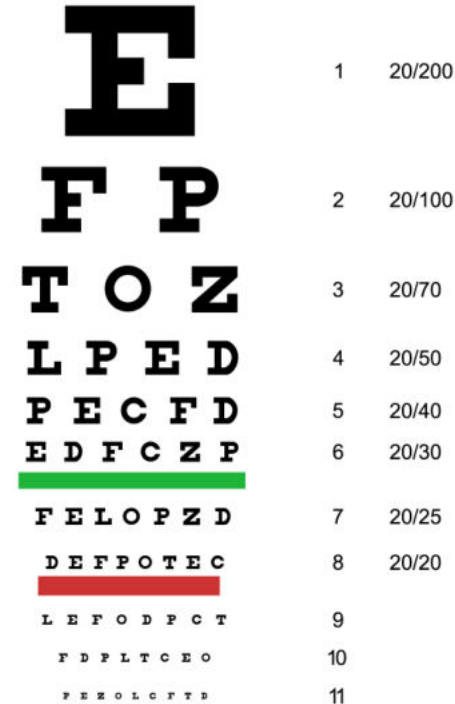
Prof. G V Sreekumar

Structure

- Introduction to the topic
- Process I followed
- User studies
- Findings and Implications that led to Design
- Ideation
- Concept
- Evaluation
- Final design

What is Blindness?

- Total absence of sight
- Visual acuity (clearness of vision) not exceeding 6/60 or 20/200
- Limitation of the field of vision subtending an angle of 20 degree or worse.



- Image source: http://en.wikipedia.org/wiki/File:Snellen_chart.svg

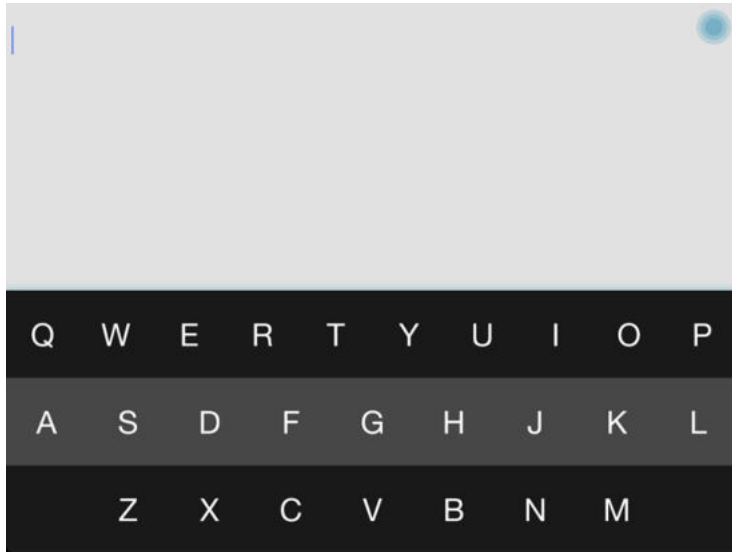
Why do we need a Touchscreen keyboard in Malayalam?

- 1% of 15 million are literate.
- Limited Schools and non accessibility
- Declining braille & advent of Screen readers and talking phones.
- enabling a tool: saving a contact, searching a contact, typing a text message, email on a touchscreen using Malayalam.
- Why smart phone? (Smartphone ~ Touchscreen)

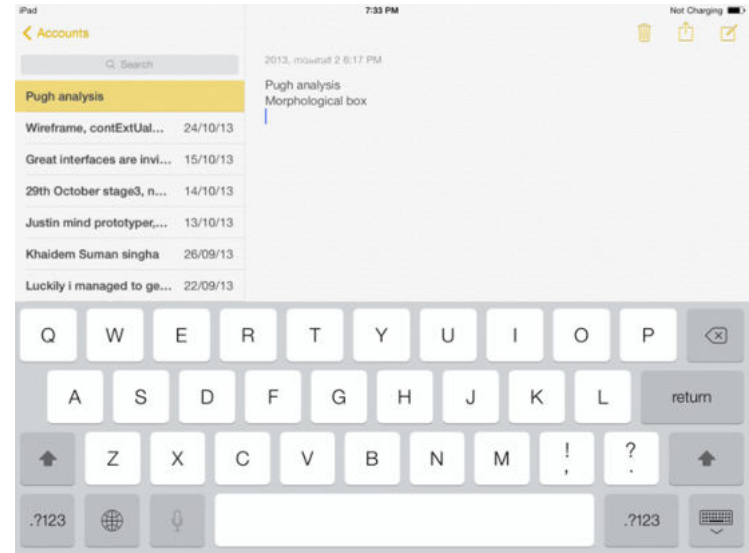
- BLIND LITERACY by National Initiative for the Blind(NIB), Tamil Nadu,
- EYE PROBLEMS - MAJOR CONCERNS by Dr. Anuja. U, Assistant Professor of Community Medicine, Medical College, Trivandrum.

State of Art

Fleksy



Voiceover



Process followed

- Study on Blind: Read, write, phone usage, Text input
- Analysis, ideation, Concept generation
- Prototyping
- Evaluation.

User Study



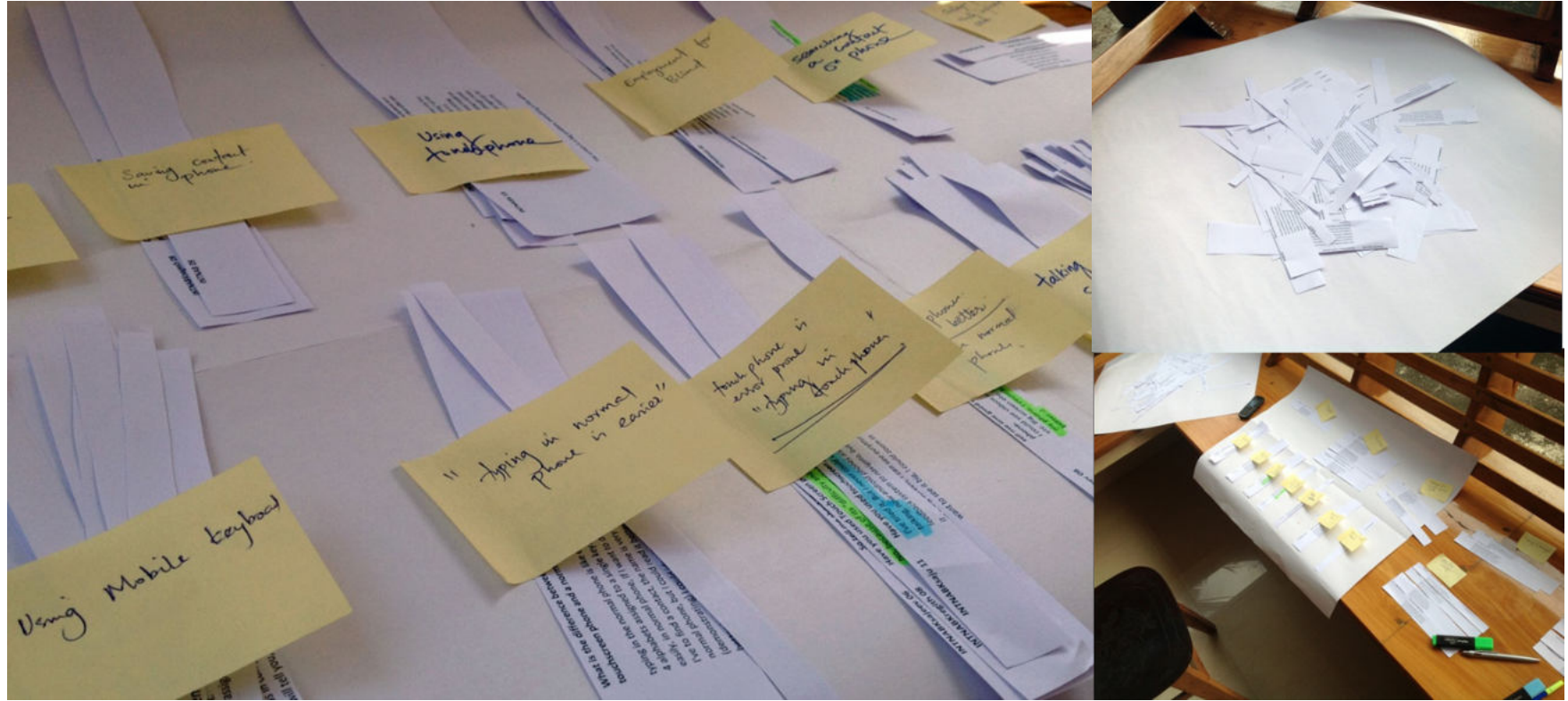
Questionnaire

- Name, Age, Education
- Do you read and type in Malayalam? If so, how?
- Tasks you do with your Mobile phone?
- Do you use a Computer?
- Have you used a Touchscreen before?
- Master apprentice model
- Experiments + Validation

Users

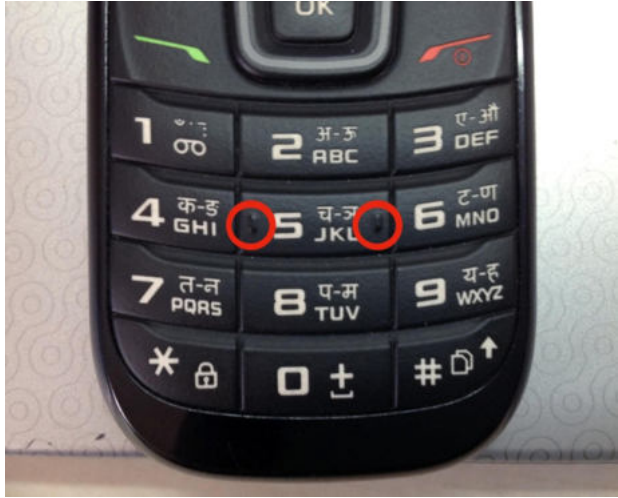
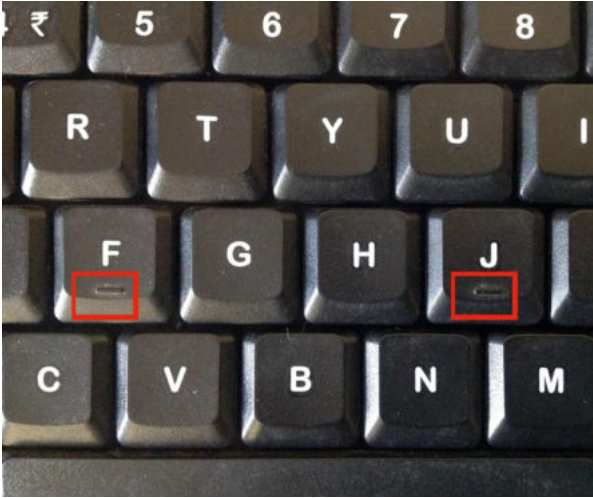
- 9 users(2 from Mumbai, 7 from Trivandrum)
- Education: All users are educated
- Tech Savvy: All users could use computer with JAWS and ILTTS (4 users could type emails & use both English and Inscript Keyboard)
- Mobile phone usage: All users use Mobile phones. (One user had a touch phone with Voice over)

Affinity Mapping



Findings

- If trained, Blind users can use Computers and Inscript Keyboards (using JAWS, ILTTS)
 - Issues in using an Inscript keyboard for Text entry.(Navigating, construction of glyph)
 - Switching languages on an Inscript Keyboard (remember Malayalam layout over english)
- Mobile phones with keypad are more usable than Touchscreen
 - Touchscreen is a very bad interface for Blind (Flat/ No tactile markings)
 - Touchscreen keys are small and error prone



Findings

- Voice feedback can make the user annoyed in long term use(“shouting both wanted & unwanted”).
- The Blind user needs assistance for setting up his mobile device(Voice tag, Speed dial, Keyboard Shortcuts)

Findings & Implications towards design

- How a blind person use Mobile Phone with keypad
 - Talking software
 - Keys for accepting call, disconnecting, Navigation, shortcuts
 - Different keys of shape and size, Markings on keypad
 - Speed dial, Voice tags, different ringtones for different contacts
 - Depends on others to read personal messages or set their shortcuts on phone.

Shortcuts, different sounds, tactile feedback of the buttons can increase the experience



Findings & Implications towards design

- How a blind person use a Computer Keyboard
 - JAWS and ILTTS
 - Starting point and Locating keys
 - Keyboard shortcuts for accessing different S/w
 - Switching layouts between English and Inscript keyboard
 - Training needed

Providing starting point / Physical markings onscreen for locating keys with adequate voice feedback: what I'm going to enter, and what I've entered



Findings & Implications towards design

- Challenges in using Touch Phones
 - The screen is flat, No tactile markings hence cant create a mental model
 - Virtual keys are small and very sensitive
 - One user had iphone, she used it with the help of Voiceover
 - Voice support annoying: *“reads out both wanted and unwanted”*

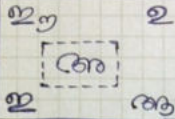
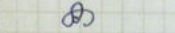
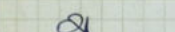
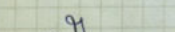
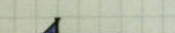
Providing tactile feel on a keyboard over a touchscreen, using haptic feedbacks , what user has entered, a starting point where the user can follow a mental model of keyboard,

Structure of Malayalam

- 15 Vowels or *Swaraaksharanga*
- 36 consonants or *Vyanjanaaksharanga*
- 20+ consonant ligatures (combination of two consonants with *chandrakala*) or *Kootaksharanga*
- 6 *Chillu* alphabets (Alphabets independent of vowel sounds) or *Chillaaksharanga*

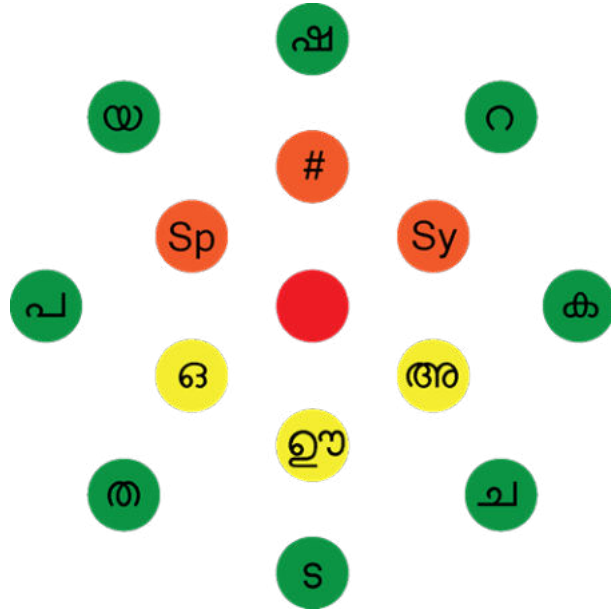
Concepts

- All alphabets can be entered
- (or) Remove *chillu* and consonant ligatures from keyboard, replace the combinations after they are entered.
- (or) Provide the first letter of each *vargam*, thereby reducing the number of alphabet on the keyboard, and easy navigation.

123	Symbols	Special Characters
	உ	உ
	உ	உ
	உ	உ
	உ	உ
	உ	உ

20

Ideation

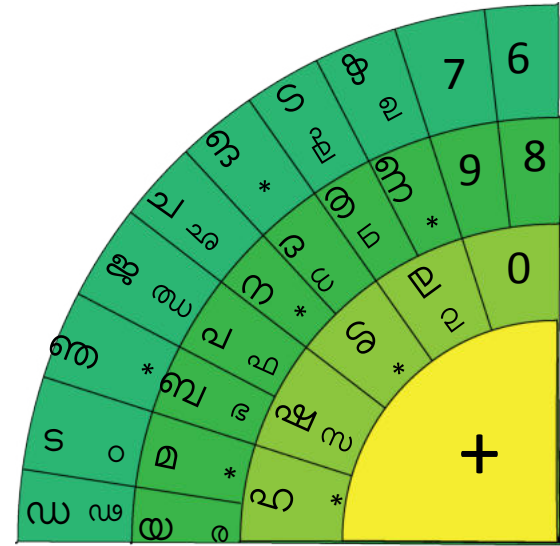
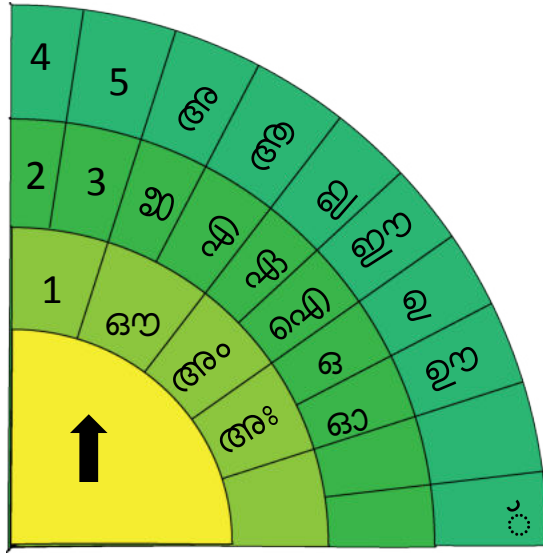


Concept 3



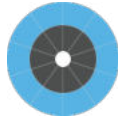
Concept 4

Ideation



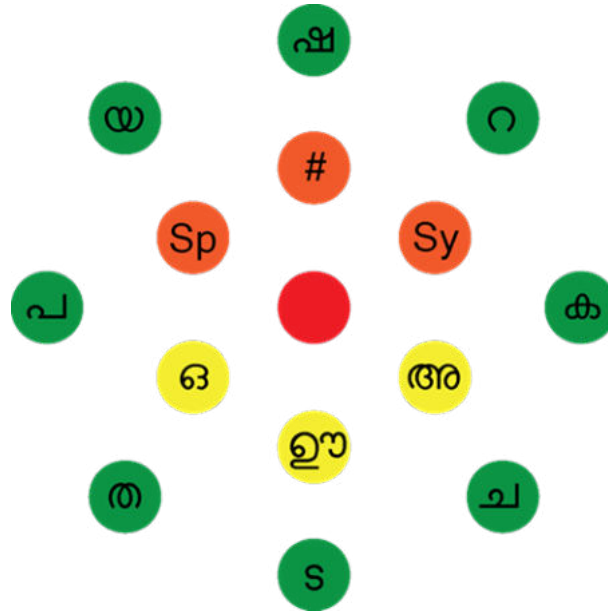
Concept 5

Theoretical Modeling

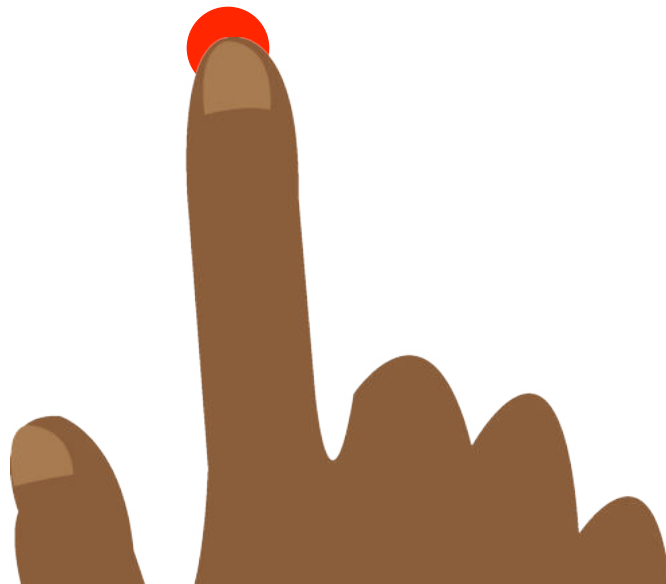


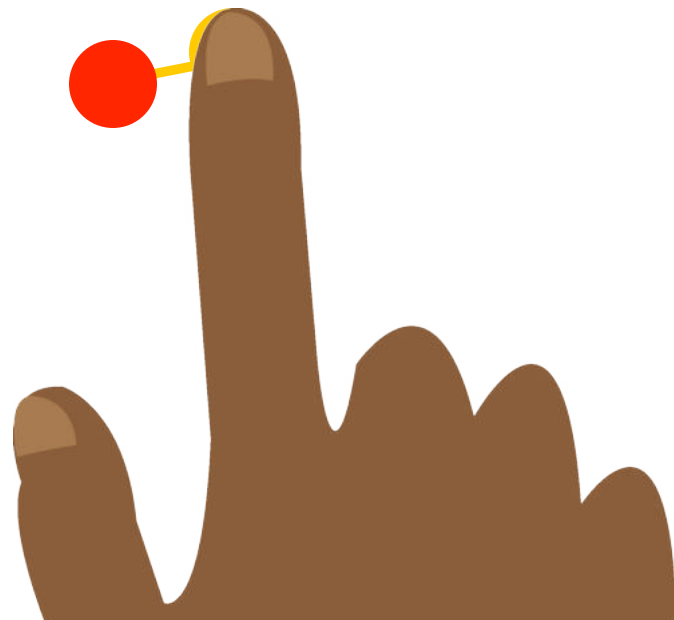
Keypress	Concept 3	Concept 4	Concept 5	Inscript Malayalam (Windows XP)
മലയാളം	17	18	14	7
മുന്നറിയിപ്പ്	32	46	38	13
അതിർത്തിക്കുള്ളിൽ	36	52	50	21
അംഗഭംഗം	17	22	18	9
Total	102	138	120	50
Average	25	34	30	12

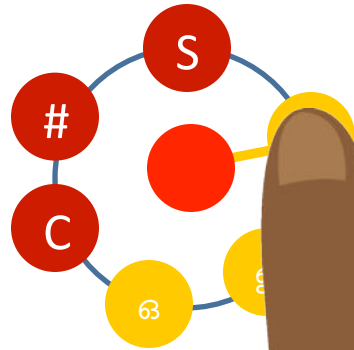
Concept 3: **Iteration**

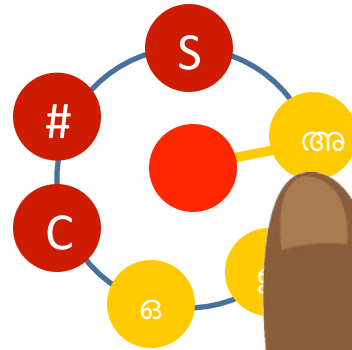


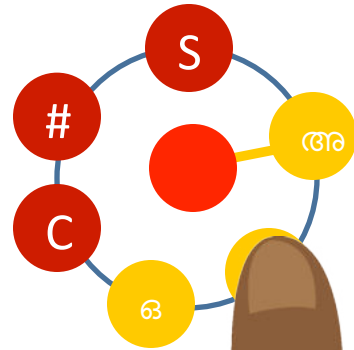


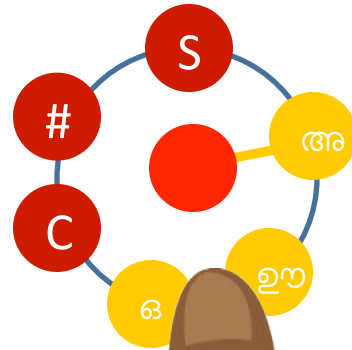


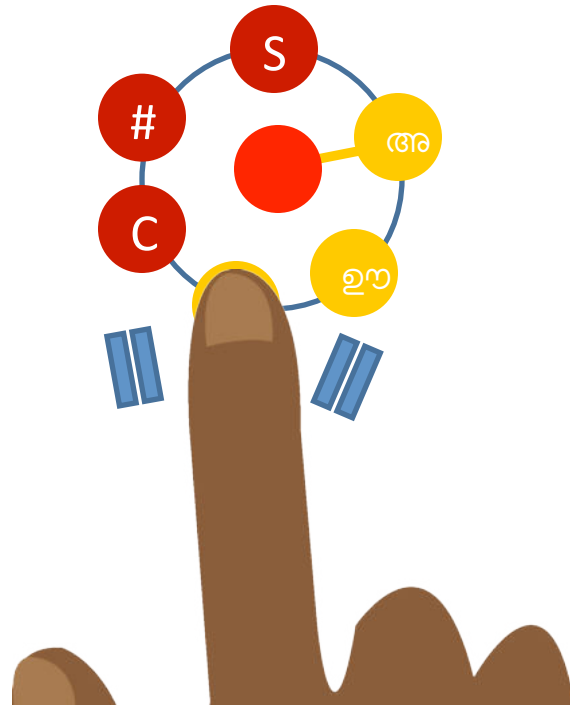


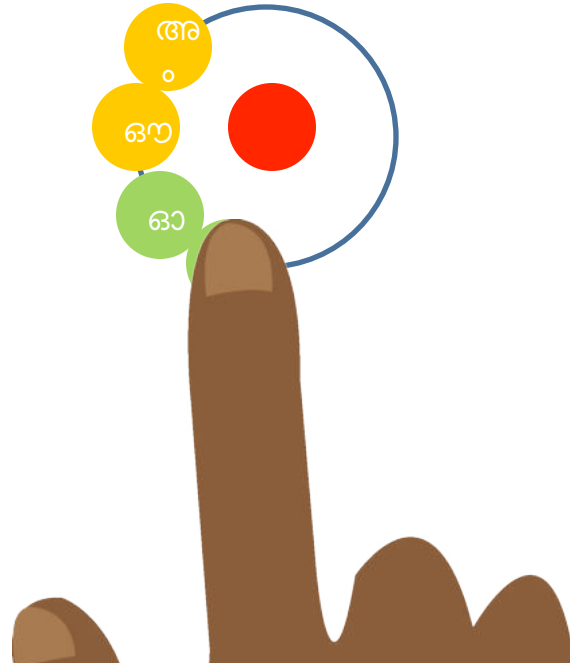


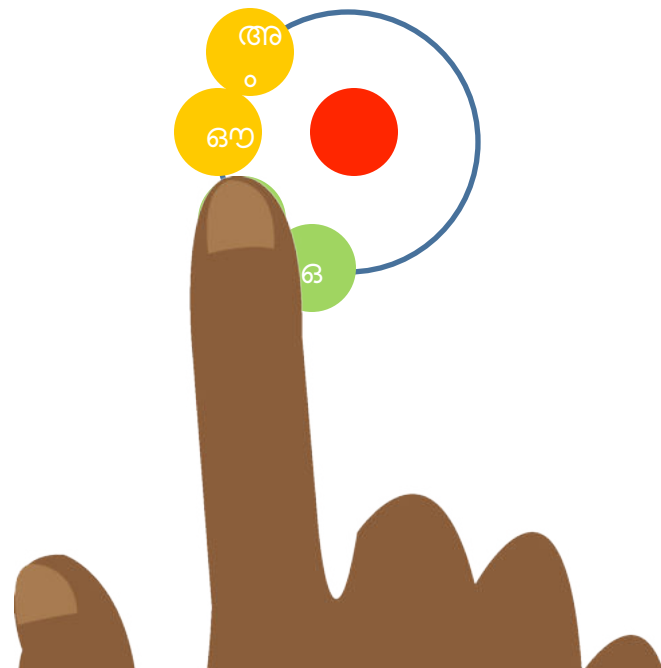


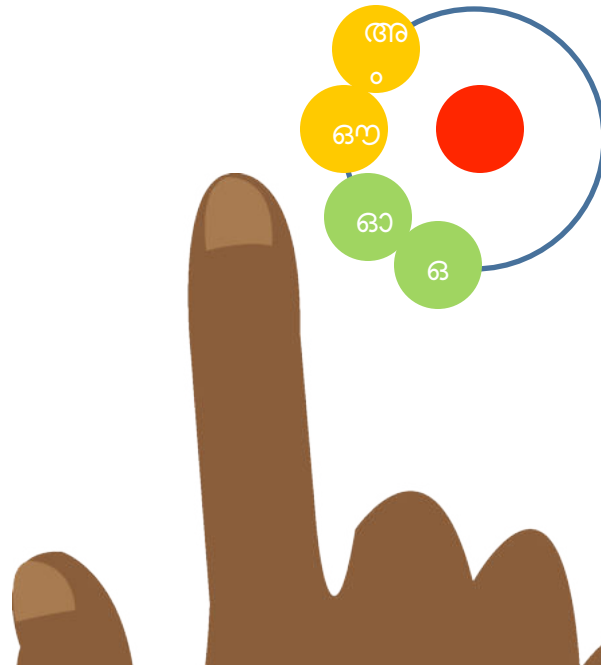


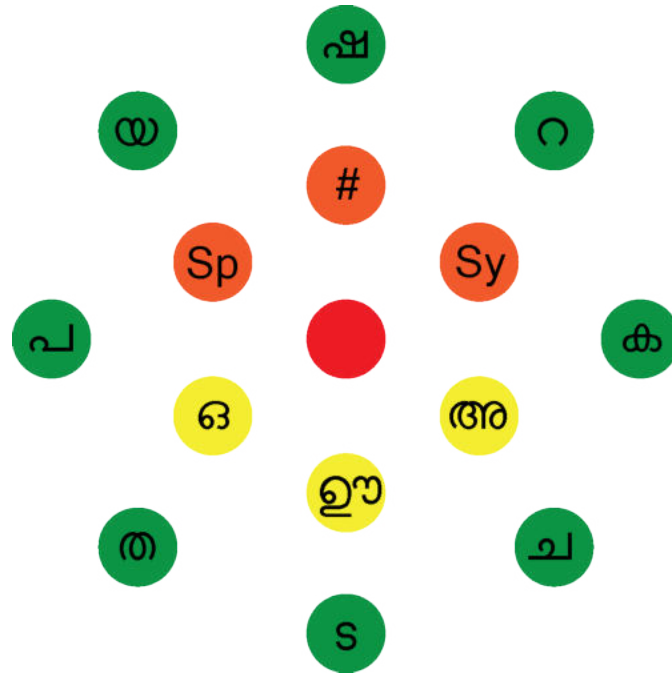








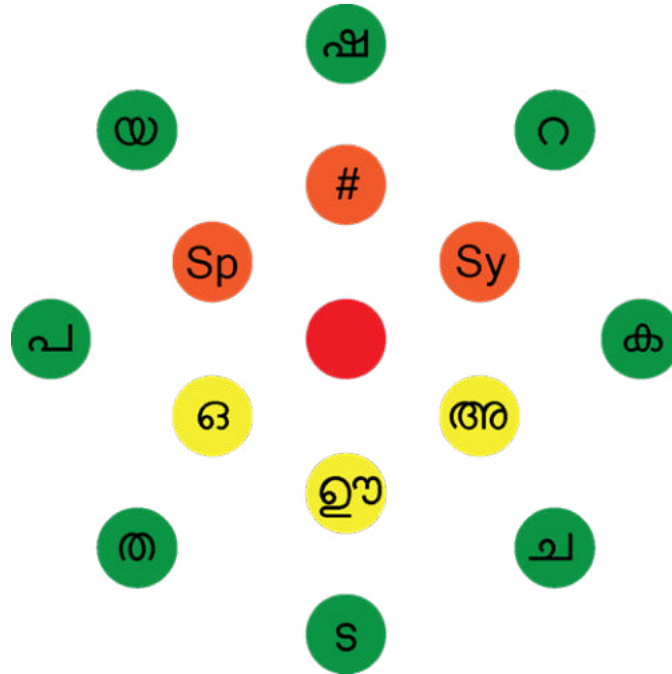


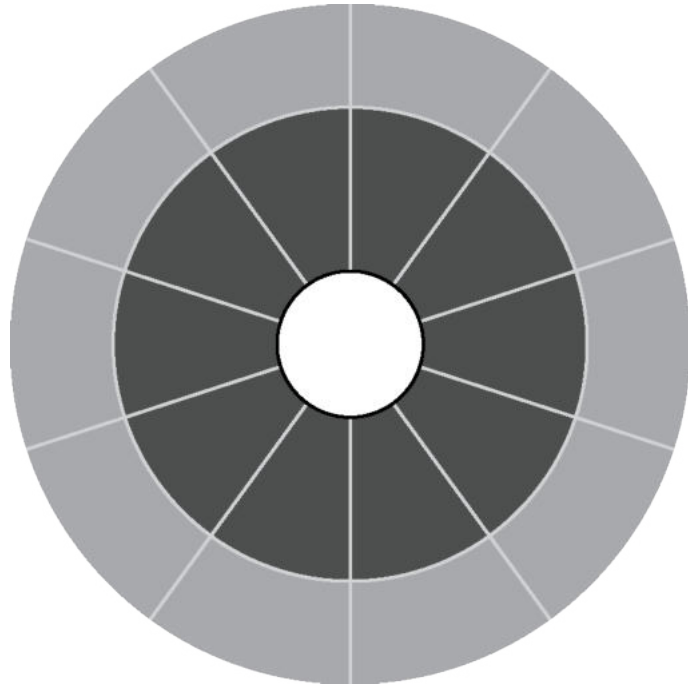


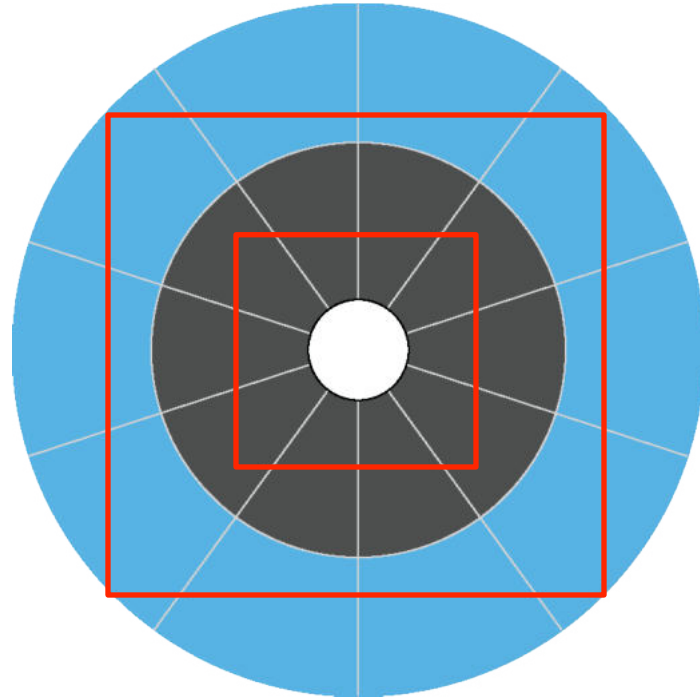
Concept 3 : Iteration

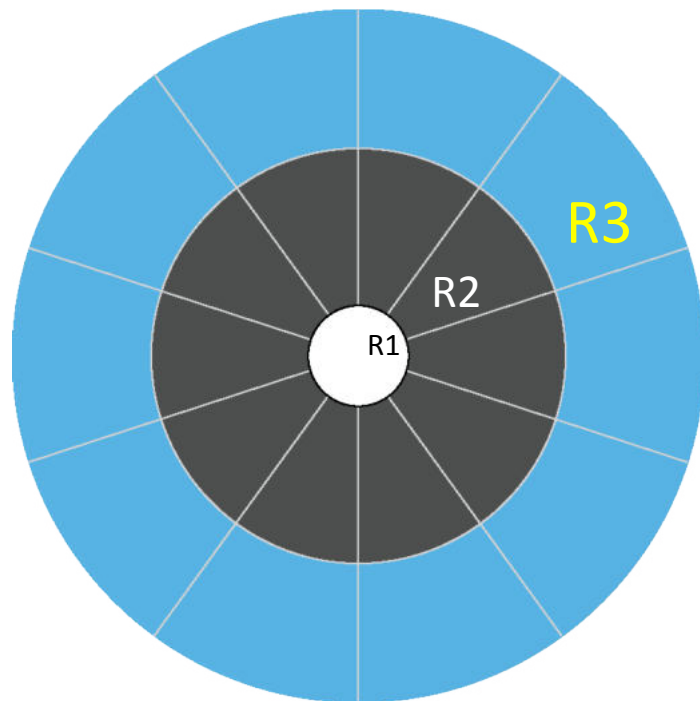
- Advantages
 - Start point
 - Close proximity
 - Sequential distribution
 - Voice support, Haptic feedback
- Disadvantages
 - Mental model
 - Ambiguity/ disconnect between each buttons
 - Lesser area
 - Double tap wont work!

Concept 3 : Iteration

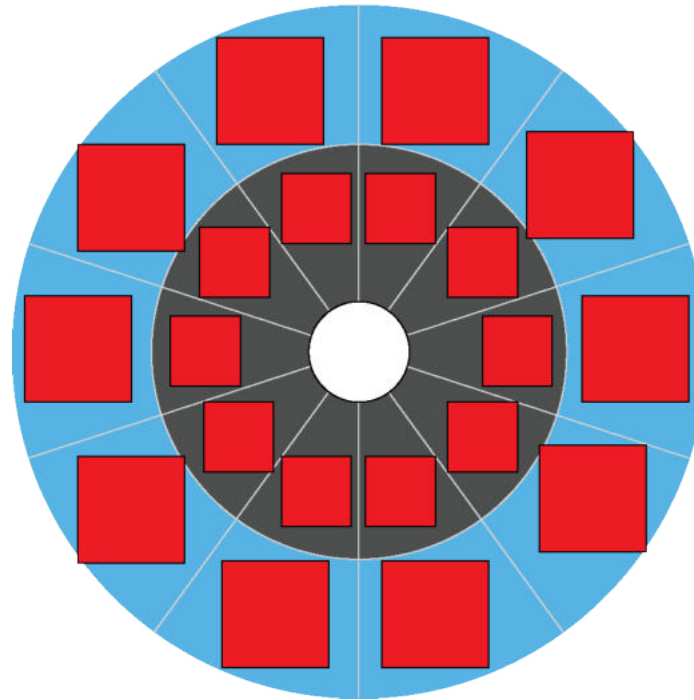








R3 : 223 pixels
R2 : 133 pixels
R1 : 32 pixels



16 mm

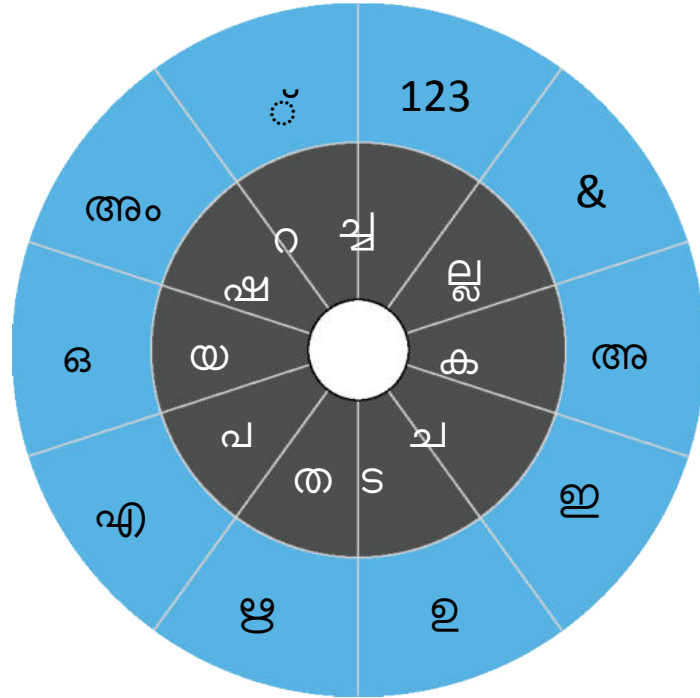


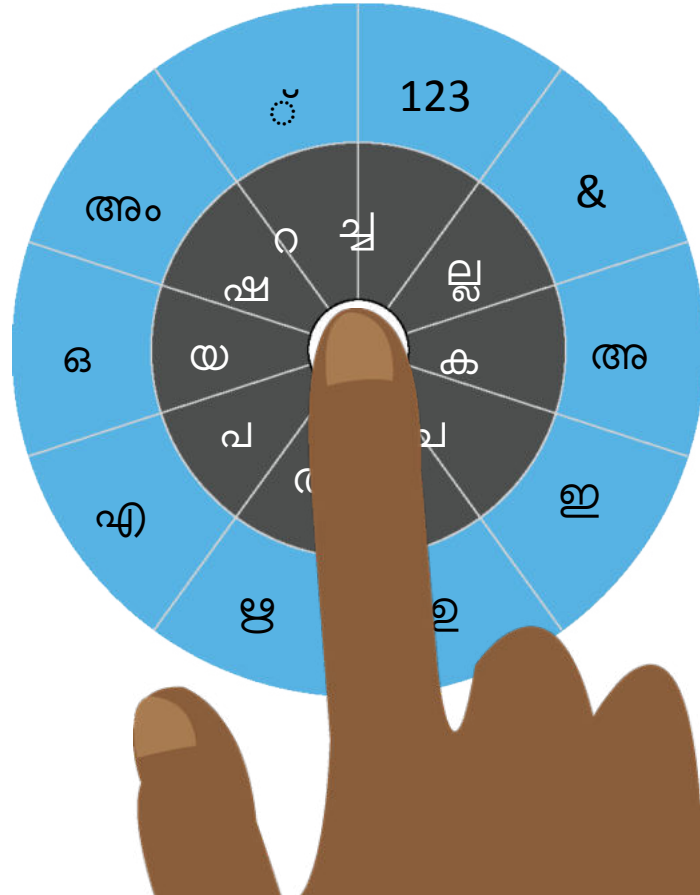
45 X 45 pixels



69 X 69 pixels

Source: 3-D Finite-Element Models of Human and Monkey Fingertips to Investigate the Mechanics of Tactile Sense





Concept 3 : **Prototyping**

- Developed the keyboard in Android platform
 - To test the feedback mechanisms
 - To test how a blind user responds to the design
- Duration of prototyping: 1 Month
 - Lack of skills, Took help, edited layout, replicated the code, added feedbacks and sound.

Usability Evaluation

- Typing speed with three blindfolded Malayalam Users(including me)
 - Training given: different time duration
 - With/without TTS
- Think aloud test with a blind user
 - Training
 - Think aloud

Usability Evaluation: Results

User	Training time	Result	Speed	TTS support	Errors
User 1(self)	3+ hrs	21 words in 19 : 43	1.05 word/minute	No	6
User 2	30 mins	11 words in 21 : 06	0.52 word/minute	No	9
User 3	30 mins	11 words in 34 : 21	0.3 word/minute	yes	0

- Cause for errors
 - Lack of TTS support
 - User couldn't get feedback what he has entered.
 - User couldn't get feedback what he has deleted.

Think Aloud

- Think aloud test with a completely Blind user
 - Hints for the interactions
 - Familiar only with the rectangular keyboard, getting familiar with circular keyboard alone takes time. Need adequate training.
 - “tak tak” sound feedback for buttons
 - Need feedback for letter entered, last word after space entered
 - Need feedback for last letter that is deleted
 - Switch between different modes, Alphabetical mode, number mode etc.
 - Adequate training needed for moving in circles.



Future Scope

- Sighted and non sighted users
- Illiterate users
- Can fit any screen size

Special Thanks,

Prof. Anirudha Joshi and Prof.G. V. Sreekumar for the guidance

Girish Dalvi Sir for teaching me how to do the Theoretical Modeling

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