Design of Japanese Character Input Screen for Smartwatch

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Background

～ Conventional character input method ～

Touch

- Input similar to smartphones
- Intuitive input

Problem

Small screen

- Small Button
  → Fat Finger Problem
- High input screen occupancy

Voice

- Vocal input ← Easy

Problem

- Resistance to use in public
- Operating environment (noise x)

Background

～Touch input (Japanese)～

Japanese Input

←Consonants

わ	ら	や	ま	は	な	た	さ	か	あ
を	り		み	ひ	に	ち	し	き	い
ん	る	ゆ	む	ふ	ぬ	つ	す	く	う
	れ		め	へ	ね	て	せ	け	え
	ろ	よ	も	ほ	の	と	そ	こ	お

Vowels→

Consonants: 10 types
Vowels: 5 types

Requires
about 60 choices

Problem

Small screen

- Small Button
  → Fat Finger Problem
- High input screen occupancy

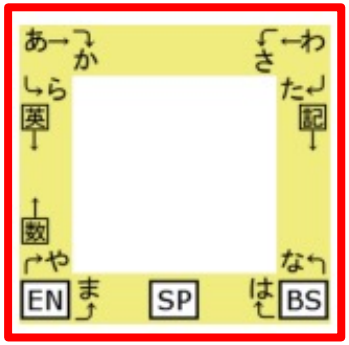
<Input Method>
Consonants: Touch
Vowels: Slide

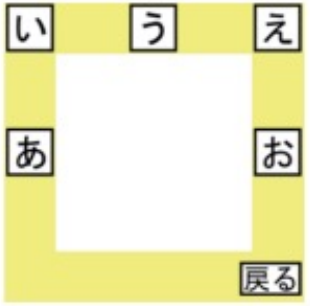
Improved input screen design

Previous Study

～Input screen design for smartwatches～

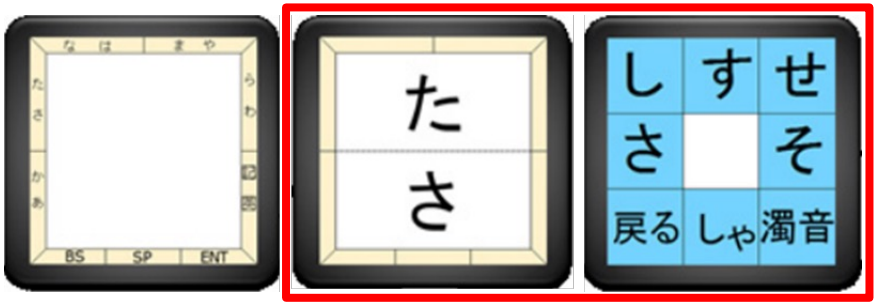
◎Stroke gestures and taps





× Regularity

◎Slide-in character input



× Screen Occupancy

◎BubbleSlide:Circular design

× Screen Occupancy

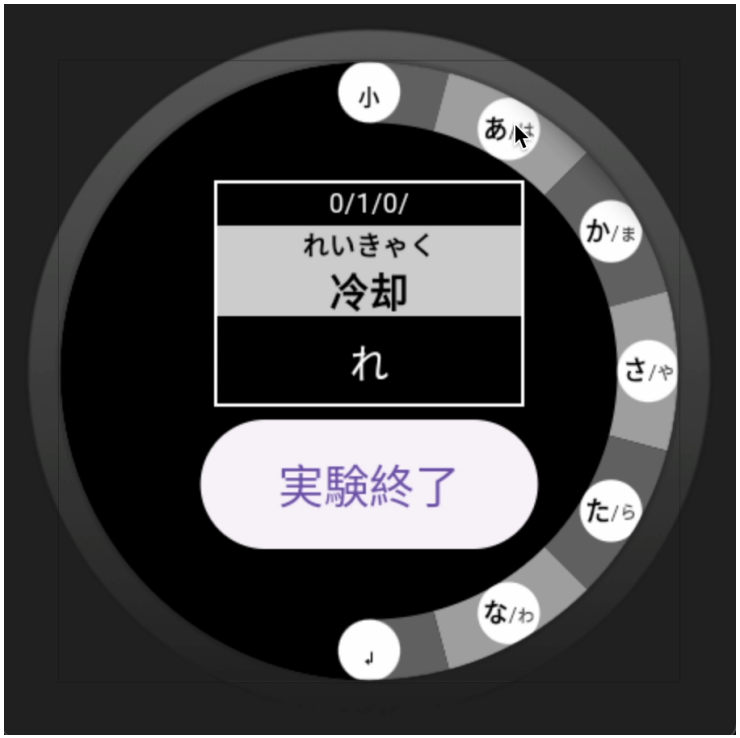
Ideal screen design

- Regular key layout ← Intuitive input
- Low screen occupancy

Proposed Method

Screen design

Ring



Half Ring

Proposed Method

○Key layout : Edge of screen and Circular

Low screen occupancy

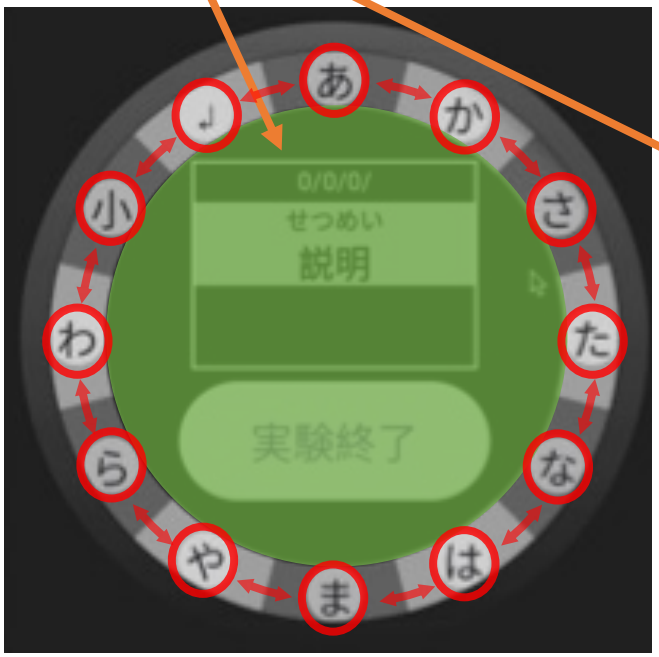
Information Presentation Screen

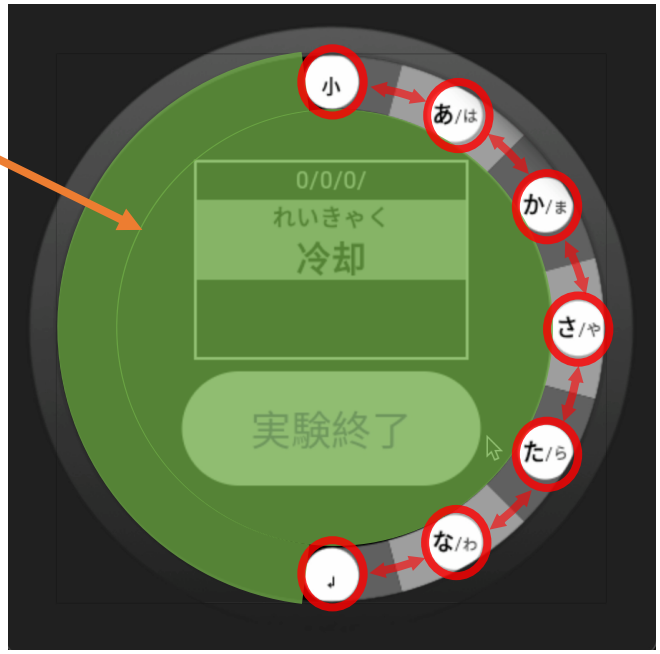
Reduce <u>erroneous input</u>

- Largest layout
- No more two adjacent keys

Clockwise alignment

- Regular arrangement
- Designed to fit smartwatches





Proposed Method

Itakura & Mizuno Lab.
Human Computer Interaction

Ring

Consonant selection

Touch
←Consonants

わ	ら	や	ま	は	な	た	さ	か	あ
を	り		み	ひ	に	ち	し	き	い
ん	る	ゆ	む	ふ	ぬ	つ	す	く	う
	れ		め	へ	ね	て	せ	け	え
	ろ	よ	も	ほ	の	と	そ	こ	お

Touch

Vowel selection

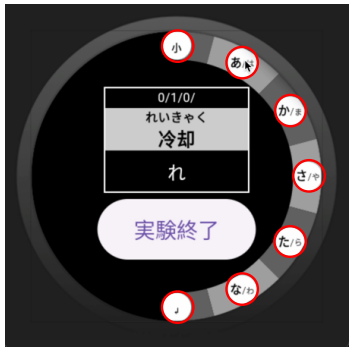
Slide
Vowels→

わ	ら	や	ま	は	な	た	さ	か	あ
を	り		み	ひ	に	ち	し	き	い
ん	る	ゆ	む	ふ	ぬ	つ	す	く	う
	れ		め	へ	ね	て	せ	け	え
	ろ	よ	も	ほ	の	と	そ	こ	お

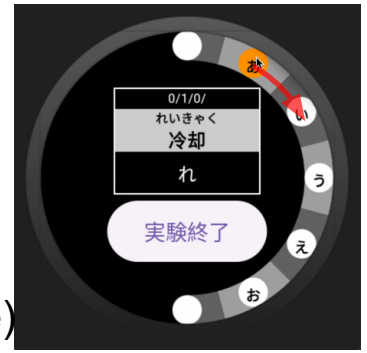
Slide
(Clockwise)

Half Ring

Touch



Slide
(Clockwise)



Double Touch

Slide
(Counterclockwise)

Experiment

◎Method

- Subject : 8 persons (Different subjects in experiments Haptic and Visual)
- Device : **Google Pixel Watch 2**
- Wearing the device on the non-dominant arm
- Seated state

<Task>

- Input words : **2 set**
  1 set = 30 words
  1 word = 4 ~ 6 characters

→ **Total : 300 characters**

<Measurement Data>

○Touch log

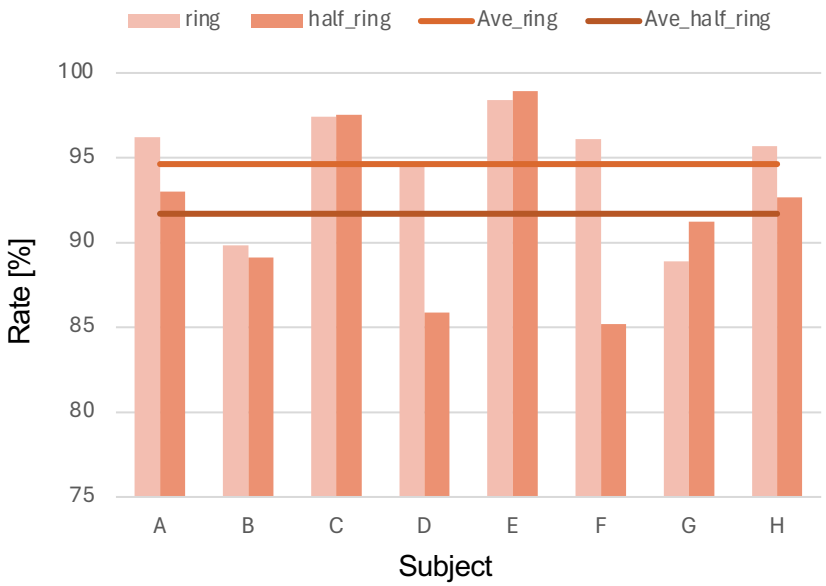
- Time
- Input Character
- Touch Coordinates

etc.

→ **CPM (Character Per Minute)**

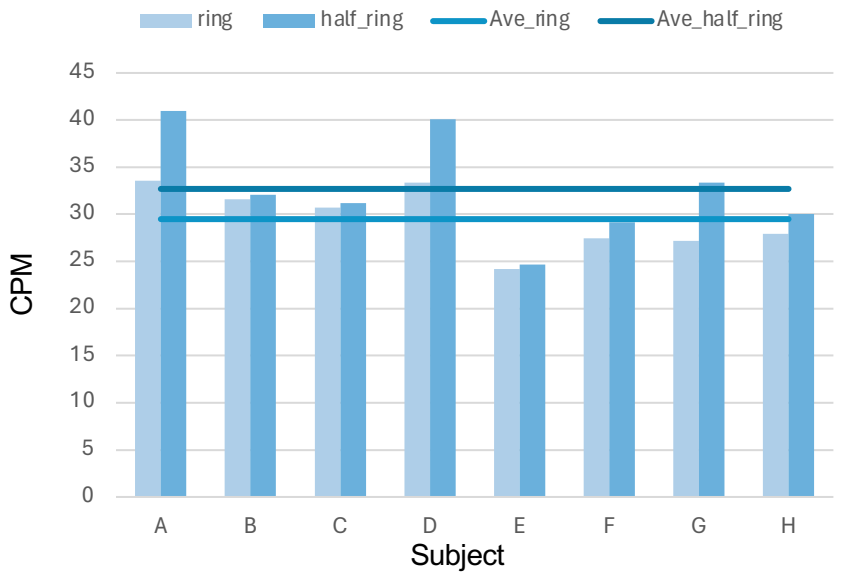
Input Rate

Result



Input Rate

- Ring tend to be higher than Half Ring
- Large difference between subjects D and F



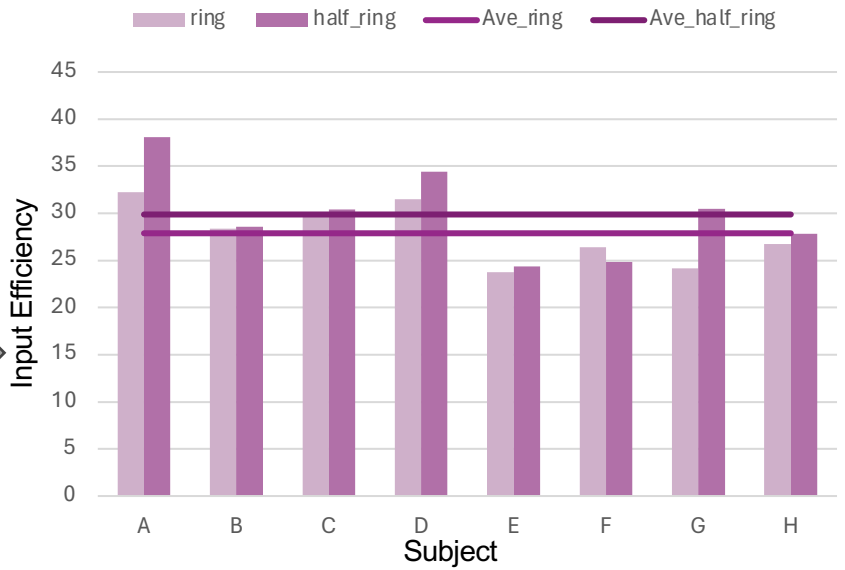
CPM
(Character pre minute)

- Half Ring higher than Ring for all subjects

Result

[**Input Efficiency**]
= [Input Rate] * [CPM]

- Ability to input characters accurately and quickly
- Comprehensive evaluation of the user's input ability.



Input Efficiency

Comparison with conventional methods

	Stroke gesture	SliT	Bubble Slide	Proposed Method	
				Ring	Half Ring
CPM	18.2	28.7	28	29.5	32.7
Input Rate	94.4	95.3	92	94.6	91.7
Input Efficiency	17.2	27.4	25.8	27.9	30.0

- Ring tended to have higher input efficiency than Half Ring.
- The two proposed methods have higher performance than conventional methods.

Consideration

◎Input Rate, CPM, Input Efficiency

- Input Rate : Ring > Half Ring trend
  <Ring>
  - Clockwise key arrangement → Intuitive Input

  <Half Ring>
  - Use of touch or double touch for consonant selection
- CPM : Ring < Half Ring (All Subject)
  <Ring>
  - Slide left side with right hand → Finger covers screen

  <Half Ring>
  - Half Ring has only one side of input area → shorter slide distance
- Input Efficiency : Ring < Half Ring trend
  - Half Ring has better design potential

◎Proposed method and Conventional method

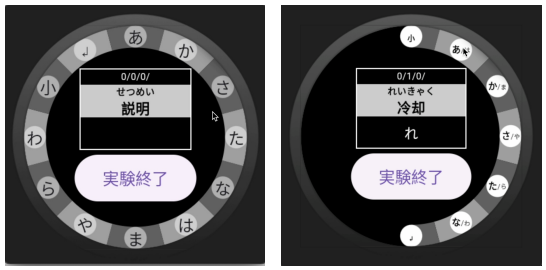
- Input Efficiency : Proposed method > Conventional method
  → Usability of Proposed method

Conclusion

Purpose

- Design of the input screen design to make it easier to input characters on a smartwatch.

Proposed Method



	Ring	Half Ring
CPM	29.5	32.7
Input Rate	94.6	91.7
Input Efficiency	27.9	30.0

- Half Ring has higher CPM, Input Efficiency, and is possibly superior.
- The performance of the two proposed methods is superior to that of the conventional method.

Future Prospect

- Collect data on more subjects, identify and solve problems
- Investigation of character input screen design for other languages

Thank you for your attention.