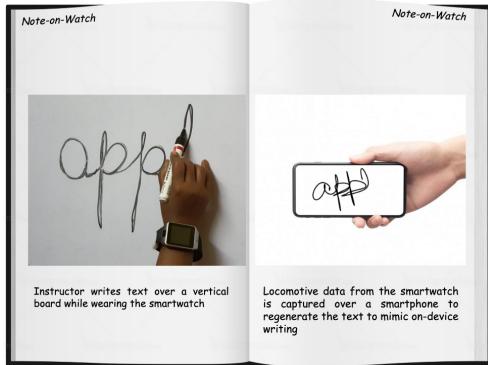




Note-on-Watch: Live Scribing from Board-works to Class-notes

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Note-on-Watch



Developing a **live system for scribing classroom** board-works to a digital form using commercial-off-the-shelf devices (**smartphones & smartwatch**)

Motivation

- ⌚ Need of **online mode** of teaching due to pandemic situation
- ⌚ **Lack of modern teaching infrastructures** to the instructors

State-of-the-art

- ⌚ **IMU sensor embedded smartphones**^[1] and **wearables**^[2] for capturing handwritten text by erasing the need of additional devices
- ⌚ **WatchPen**^[2], a smartwatch mounted on a passive capacitive stylus for sensing the usage context

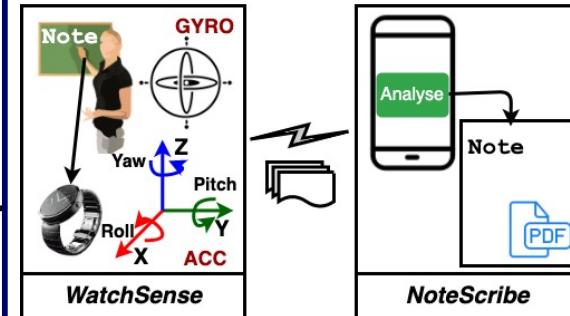
Challenges

- ⌚ Getting **visual clarity** of writing irrespective of the **camera** and hand position
- ⌚ Achieving the essence of **classroom** teaching environment using manual **course material** transfer
- ⌚ Carrying an **additional writing device** like stylus, scanner pen to the instructors

Limitations

- ⌚ Multiple **camera-based live recording** incurs huge **transfer cost**
- ⌚ Writing using **smartphone** is **not user-friendly**
- ⌚ Attaching **smartwatch with pen** creates **distraction** to the instructors for continuous writing

System Design

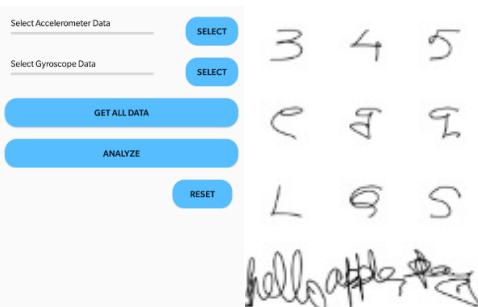


- ⌚ **WatchSense - Data Collection Component:** logs raw IMU data from smartwatch and transfers to the connected smartphone
- ⌚ **NoteScribe - Data Processing Component:** generates the scribes by extracting the relevant data from the received preprocessed-data

System Implementation



WatchSense application
 ⌚ **inertial sense listener:** senses locomotive data
 ⌚ **local storage manager:** stores sensed data to local storage
 ⌚ **upload manager:** uploads stored data to smartphone

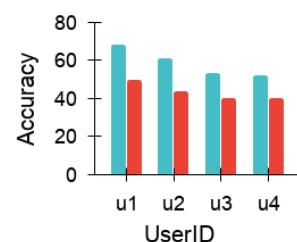


NoteScribe application
 ⌚ **network & storage manager:** capture data from smartwatch and store locally
 ⌚ **data analysis manager:** processes the collected data through the python tool

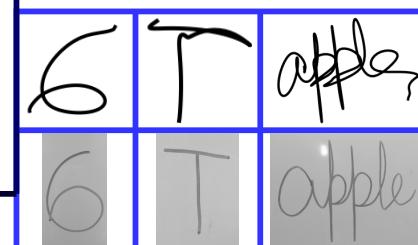
Exp. Setup

- ⌚ **No. of users:** 4
- ⌚ **Writing language script:** English (26 upper case alphabet, 26 lower case alphabet, 10 numerics, and a few words)

■ Accuracy in %
 ■ All Validators Recognised



Results



- ⌚ Majority of **script legible**
- ⌚ Lower case ('z', 'c', 's') recognised as upper case ('Z', 'C', 'S')
- ⌚ ('l', 't', 'p') may **not be legible but readable** within word
- ⌚ Accuracy of the system at most **68.28%**

Conclusion

- ⌚ Develop **light-weight smartwatch & smartphone-based system** – Note-on-Watch
- ⌚ Collect and share the sensory preprocessed-data during writing on board wearing a wrist-worn smartwatch
- ⌚ Generate a live impression of the board-works from **IMU sensor stream** on smartphone
- ⌚ Show promising results over the **English alphanumeric** as well as words

References

- Thomas Deselaers, Daniel Keysers, Jan Hosang, and Henry A Rowley. 2014. GyroPen: Gyroscopes for pen-input with mobile phones. IEEE Transactions on Human-Machine Systems 45, 2 (2014), 263–271.
- Michael Hung, David Ledo, and Lora Oehlberg. 2019. WatchPen: Using Cross-Device Interaction Concepts to Augment Pen-Based Interaction. In ACM MobileHCI. 1–8.