



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

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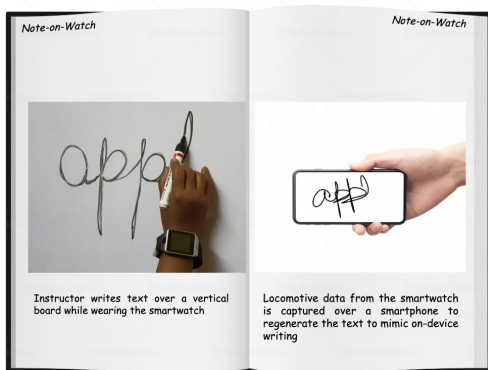
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Note-on-Watch



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

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

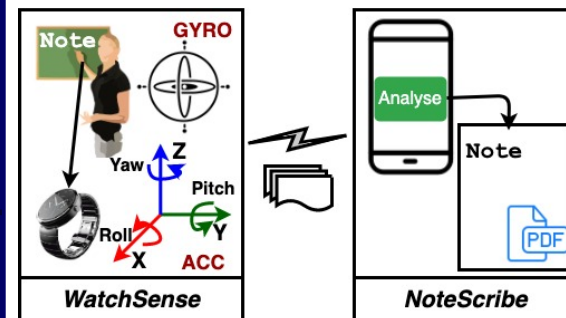
State-of-the-art

- 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

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



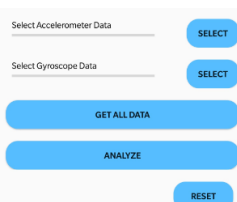
- WatchSense - Data Collection** Component: logs raw IMU data from smartwatch and transfers to the connected smartphone
- NoteScribe - Data Processing** Component: generates the scribes by extracting the relevant data from the received preprocessed-data

System Implementation



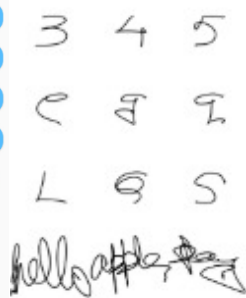
WatchSense application

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



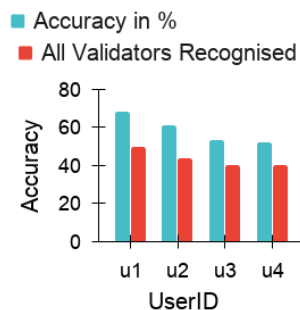
NoteScribe application

- 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)



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 alphanumerics** 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.