Project Mihr: Enabling Gestural Interactions on a Keyboard using a Graphene-based Fabric

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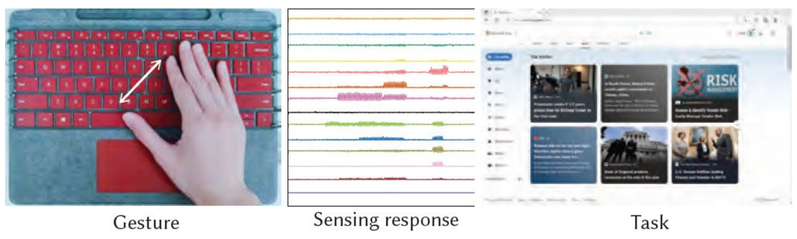
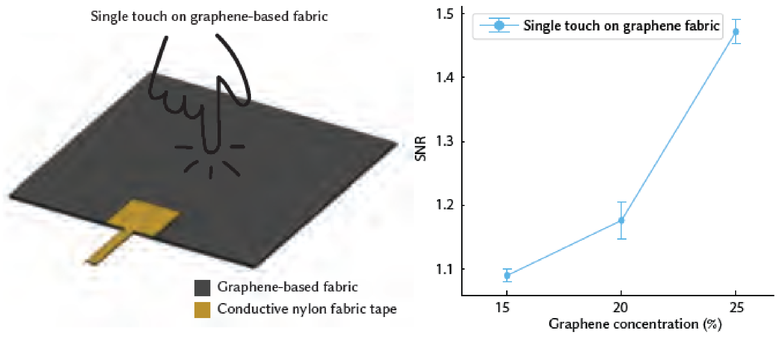
Contribution

- We leveraged passive capacitive sensing to augment a physical keyboard to be touch-sensitive, enabling gestural interactions, which are complementary to tying input, in a seamless and unobtrusive manner.
- We integrated graphene-based textiles to detect and classify rich and expressive gestural interactions over a keyboard.
- We characterize the sensing performance and presenting several different application scenarios that are enabled by our technique over keyboards..



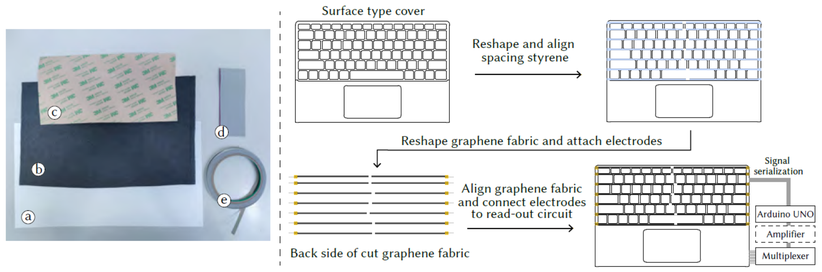
Sensing Principle

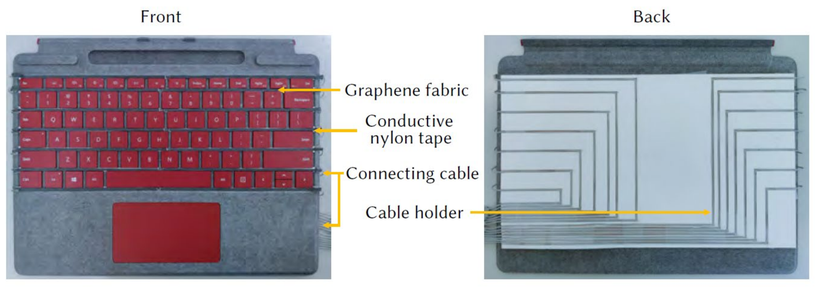
- We integrated passive capacitive touch sensing by graphene-based textiles.
- When the human body is in touch with the semi-conductive graphene fabric, voltage into a receiving electrode increases due to the potential leaking from the human body.
- The existence and location of the touch can be inferred from the voltage amplitude



Implementation

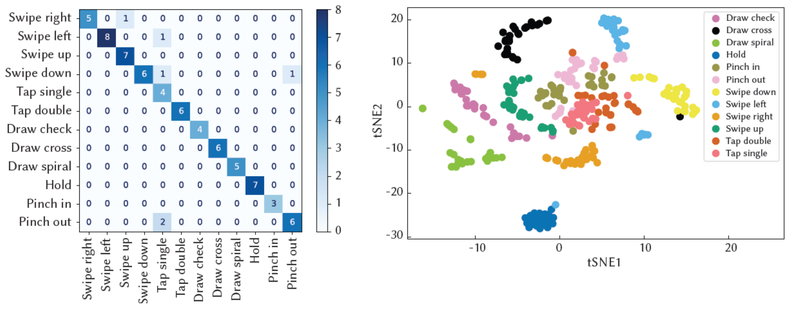
- We integrated the semi-conductive graphene-based fabric into a Microsoft Surface Pro Type Cover keyboard.
- 14 separate sensing areas (7 on the left and 7 on the right), each of which is constructed with a thin graphene-based fabric strip with one electrode at the outer edge.
- The signal from each of the 14 electrodes were multiplexed, optionally amplified, and serialized to a Surface tablet through an Arduino Uno at more than 200 Hz.



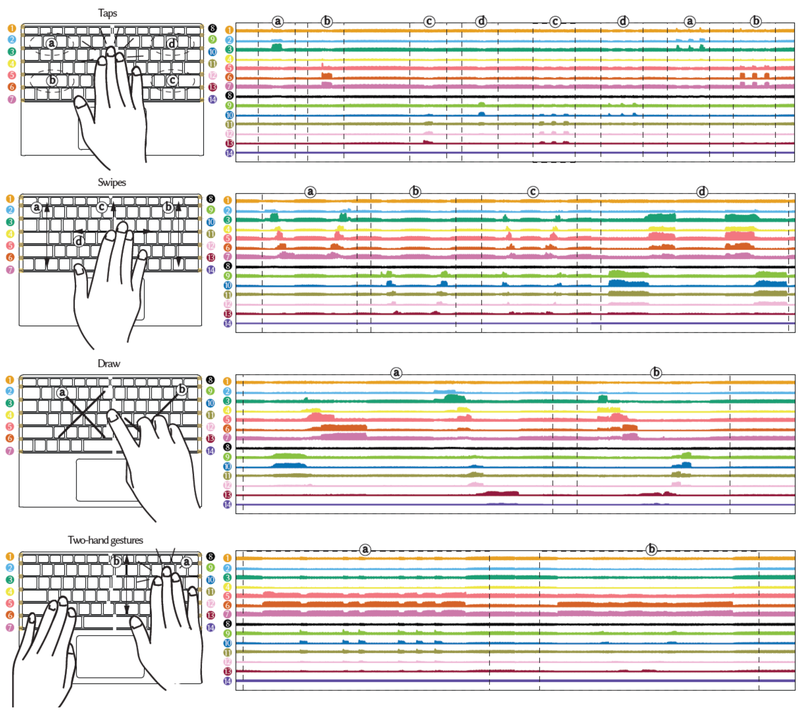


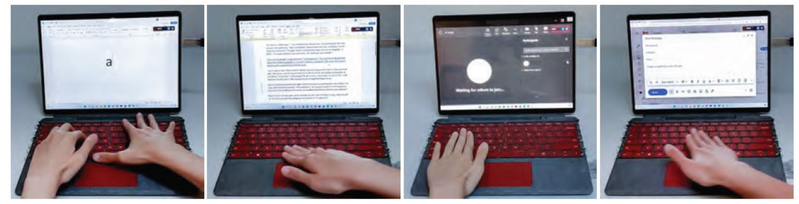
Gestural Interactions over Keyboard

- We used gestural interactions over keyboard as a complementary input technique with traditional text input.
- Data captured on one user performing 12 different gestures over keyboard.
- Across these 12 classes, our system achieved an overall accuracy of 91.7%. With a deployed random forest classifier.
- The 12 classes form separate clusters when projected into 2D space using t-SEN, indicating the discrimination of the signal.



- Our prototype senses and recognizes different gestures, such as pinch out, drawing, and swiping along different directions, to trigger specified text editing commands, such as enlarge font size, accept changes, subscript, superscript, and delete.





Future Work

- Extension to active sensing
- Generalized gestural interaction classification

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