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Stony Brook University
Smart Structures and Soft Electronics Lab

Decoding Silent Speech Cues from Muscular Biopotential Signals for Efficient Human-Robot Collaborations

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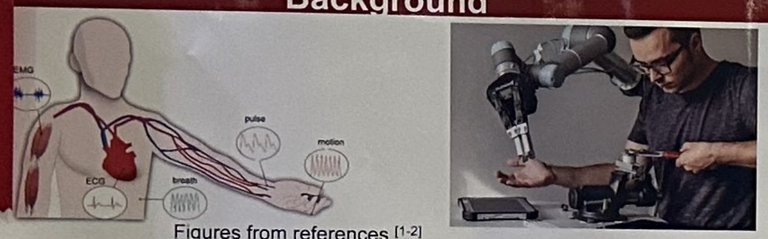
2024 MRS FALL MEETING & EXHIBIT

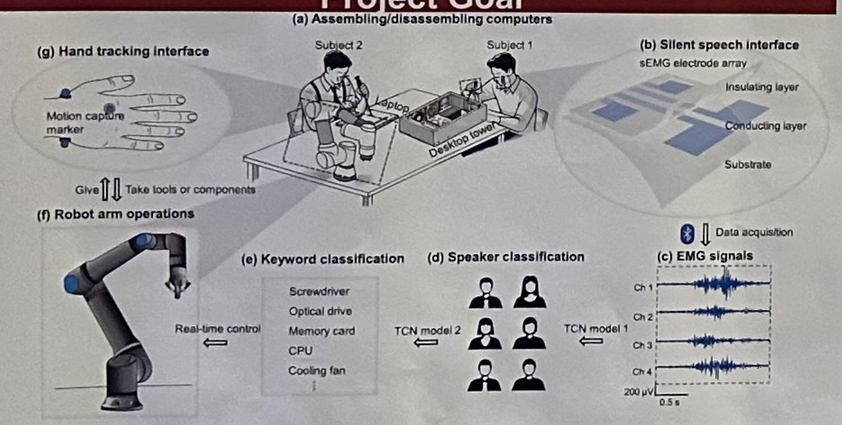
Background



Figures from references [1-2]

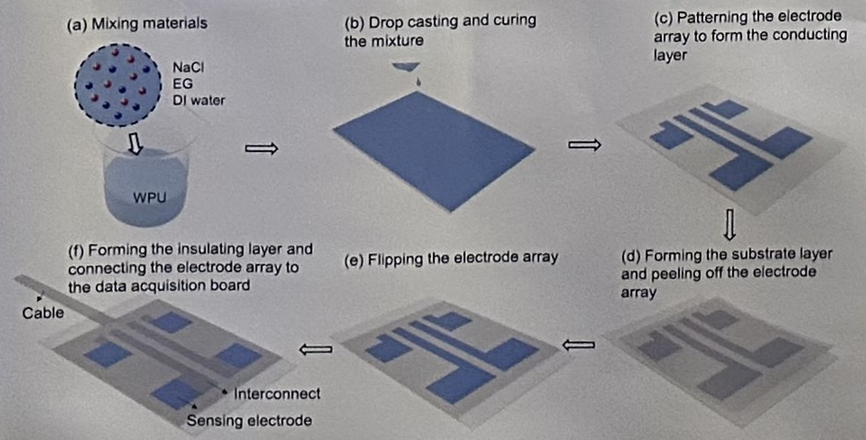
- Facial **Electromyogram (EMG)** signals exhibit a strong correlation with the contents and speaker characteristics of silent speech.
- Unobtrusive silent speech interfaces for human-robot collaborations are in demand.

Project Goal

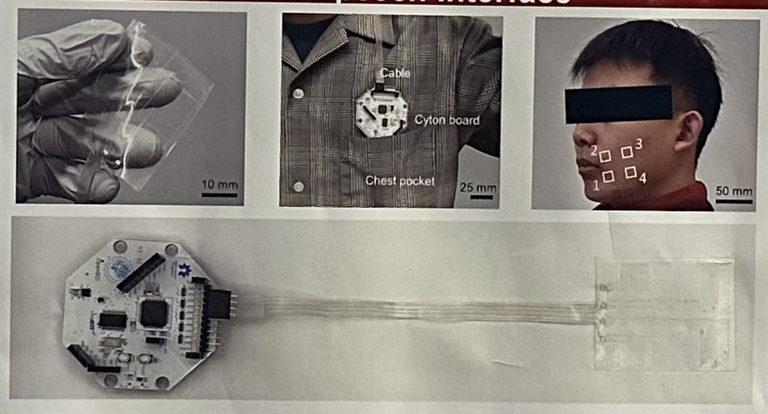


- Develop EMG-based silent speech interfaces and algorithms for speaker recognition and speech content recognition.
- Integrate the silent speech interface into a human-robot collaboration platform for assembling/disassembling processes.[3]

Sensor Fabrication

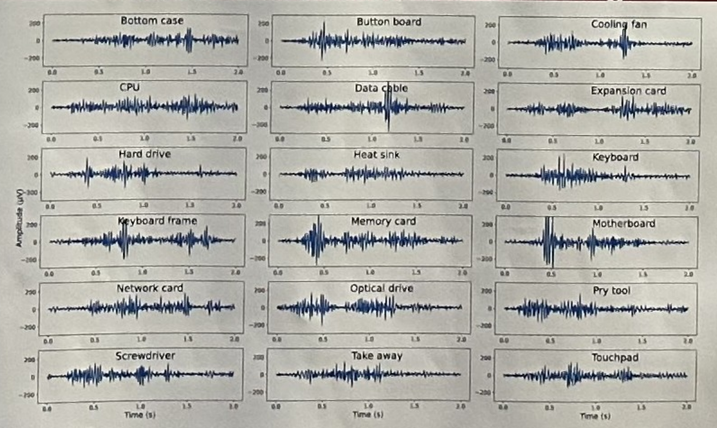


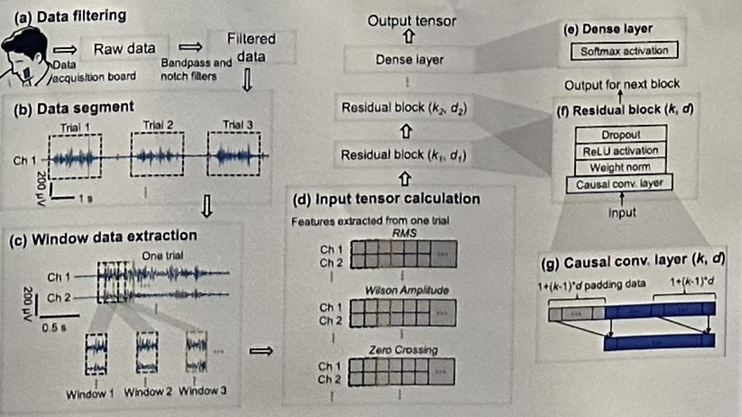
Silent Speech Interface



- The transparent electrode array is connected to the data acquisition board.

Algorithms for Signal Processing





- The temporal convolutional network is used for classifications of speakers and speech contents.

Applications

Human-robot Collaboration:

- Demonstrations illustrating applications of the developed silent speech interface for human-robot collaboration in assembling/disassembling computers.

Conclusion and Future Study

- This work presents an unobtrusive silent speech interface and its applications in human-robot collaboration.
- Looking forward, there is a need for **phoneme-level** silent speech recognition algorithms.

Acknowledgement

- The authors acknowledge NSF for financial support to this project through awards ECCS-2238363 and ECCS-2335863.

References

[1] Wang, S. et al. *ACS Appl. Mater. Interfaces* 17, 20735 (2021).
[2] Gervasi, R. et al. *Int. J. Adv. Manuf. Technol.* 108, 841 (2020).

Publications

[3] Dong, P. et al. Decoding Silent Speech Cues from Muscular Biopotential Signals Towards Efficient Human-Robot Collaborations, *Adv. Mater. Tech.* 2400990 (2024)