# Privacy-preserving Continuous Authentication

**Team**

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# Problem Statement

- Smarthome devices use data collected from sensors extensively for tasks such as identification and authentication

- Nonetheless, users are concerned that their private information is exposed in this process

- We want to show that even with masked data, we can still carry out identification task

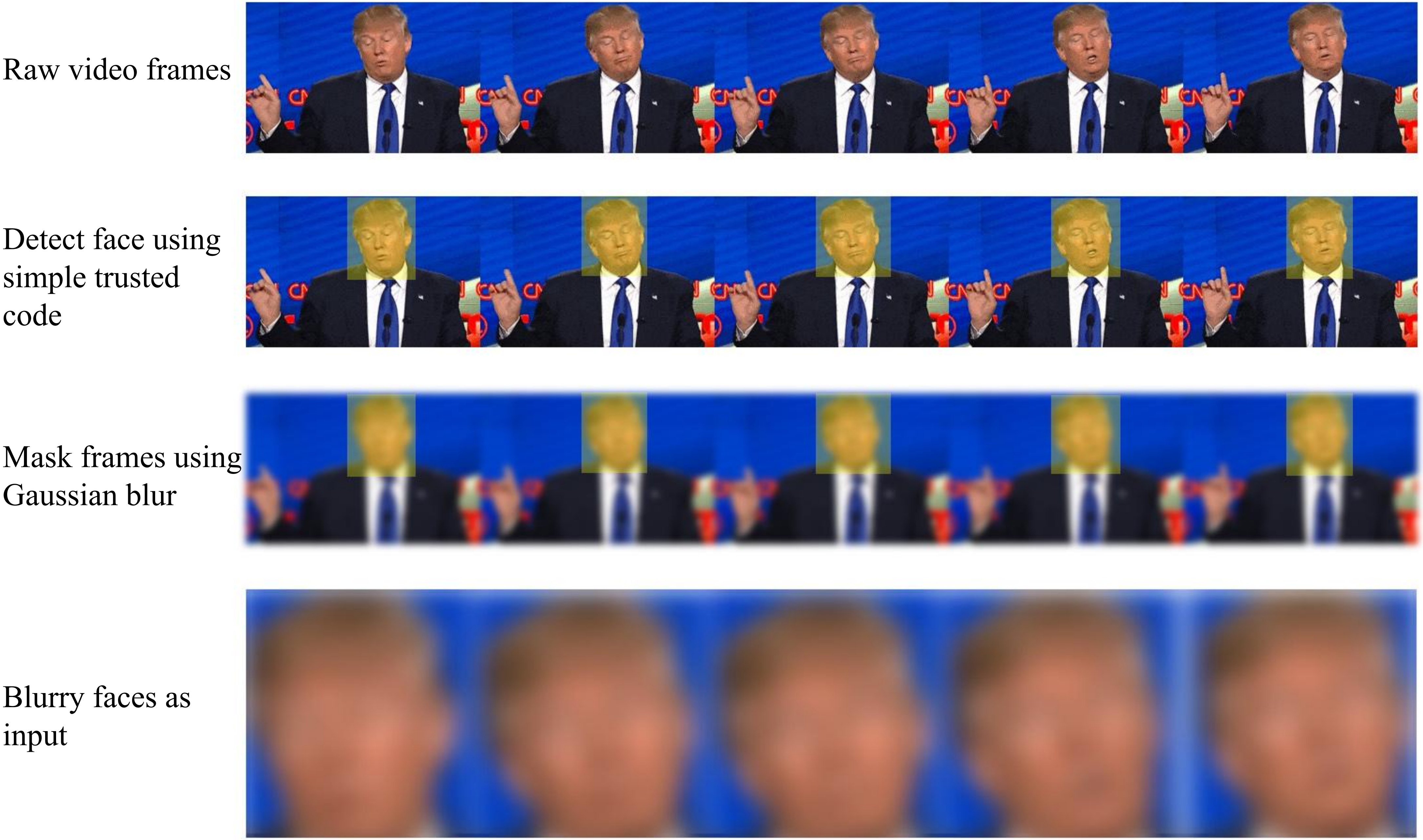
- With the help of continuous data and data from multiple sensors, we can exploit some kinds of information that was not utilized previously (spatio-temporal) to compensate the ‘information loss’ in privacy preserving process and achieve similar or even better performance in above tasks

# Progress Update

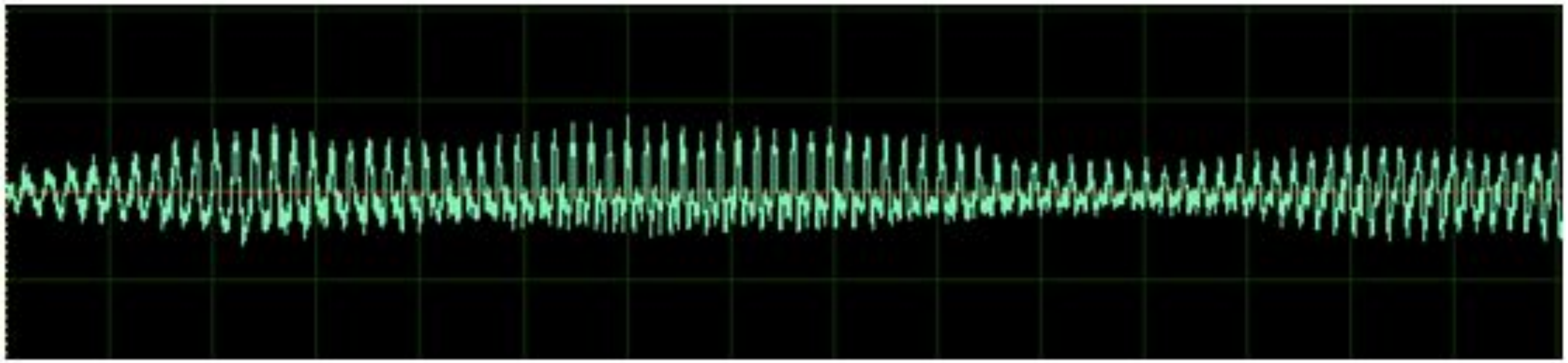
- Refinement of literature survey on PP works in smarthome settings

  - Face identification
  - Speaker recognition

- Definition of experimental setup for both modalities
- We have successfully built a simple testbed for preliminary proof of concept
- We have successfully tested automatic video crawling from YouTube using celebrities' name as query


Raw video frames
Detect face using simple trusted code
Mask frames using Gaussian blur
Blurry faces as input

Raw audio



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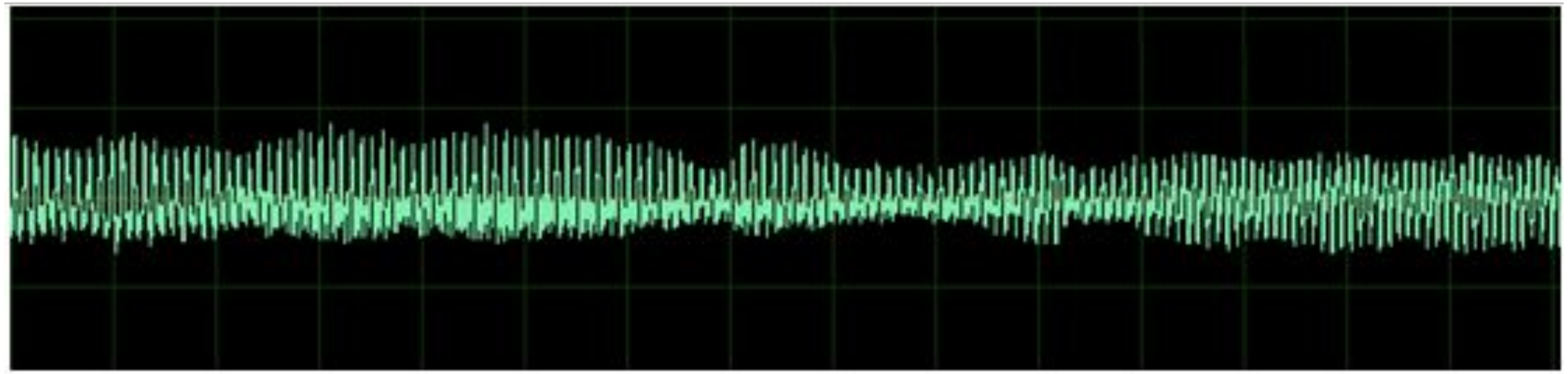

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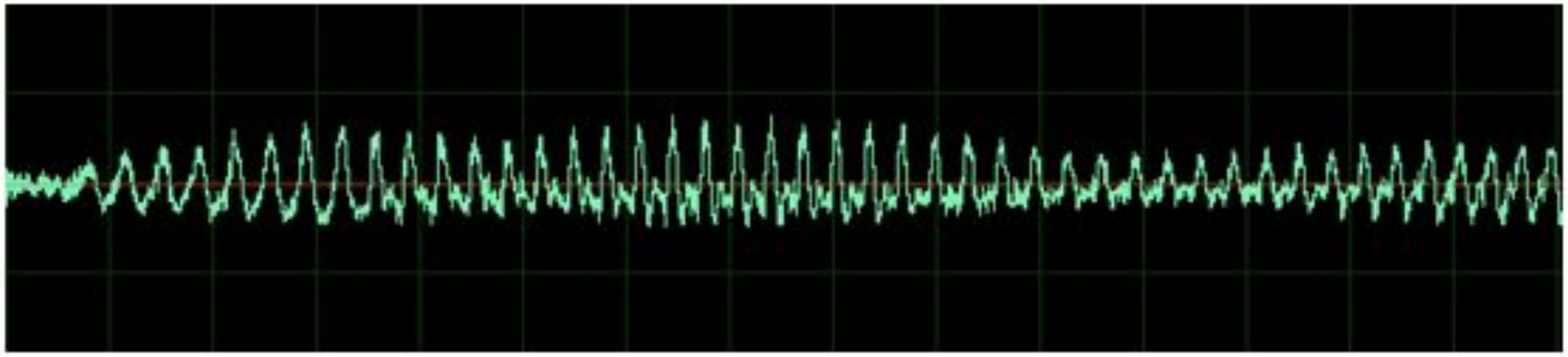

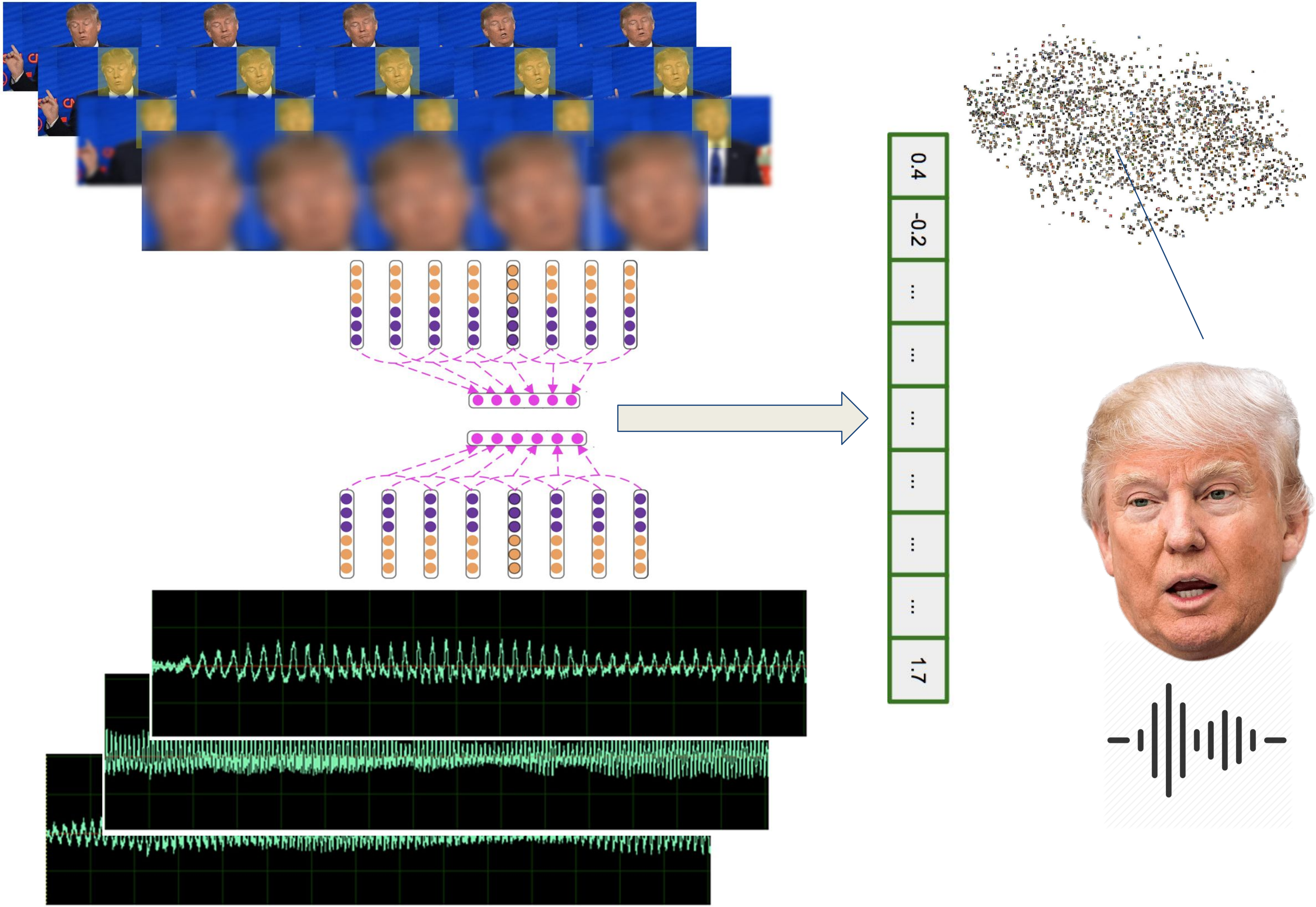
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# Roadblocks and Challenges

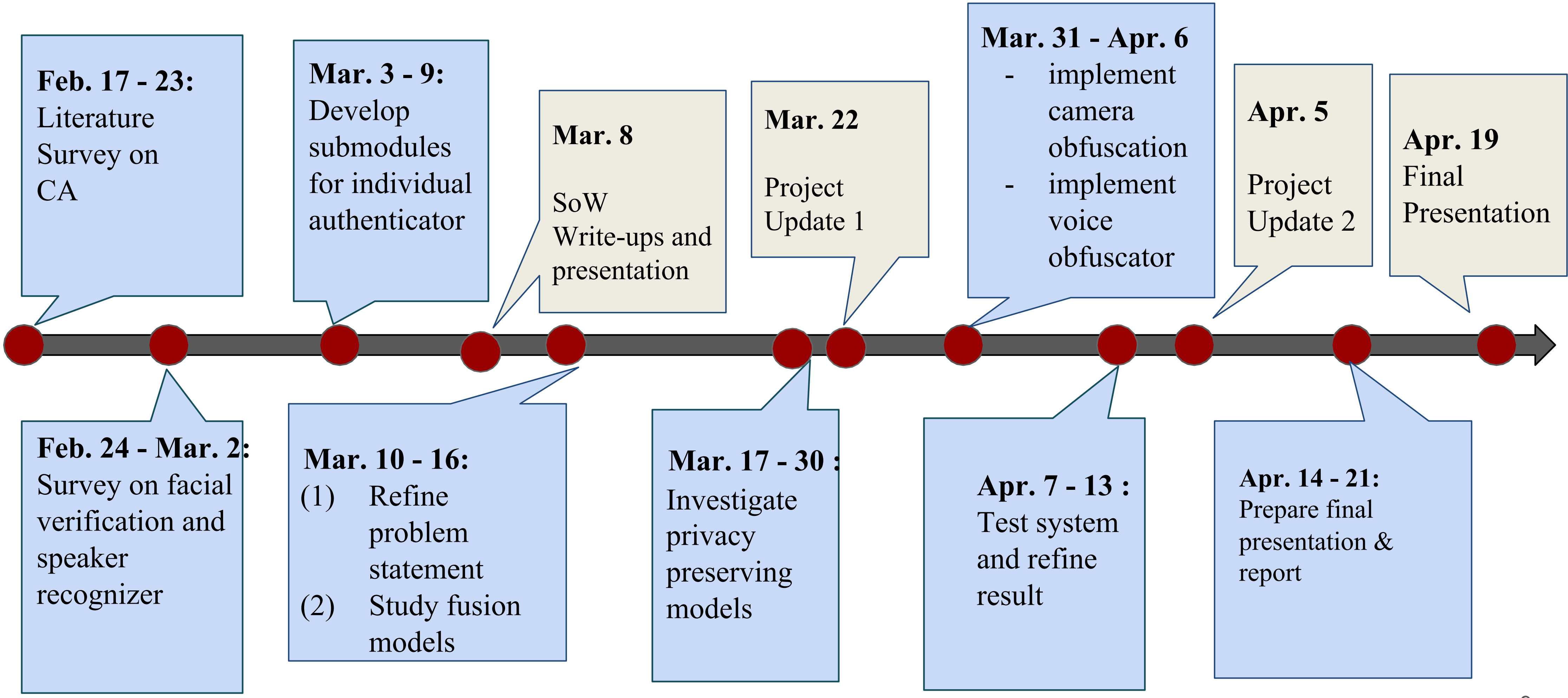
** Privacy Preserving (PP)*

- *PP Facial Identification for smarthomes
    - Identifying people from blurry image is a hard problem
- *PP Speaker verification for smarthomes
    - Few notable *PP voice verification works
    - Requires enrollment phase before verification
        - Need to define what levels of information is adequate for verification without compromising accuracy.
- While there are some promising works in the joint face and voice modality space, there remains little information about how both PP modalities can be fused together for better authentication, while preserving privacy.

# Changes to the Initial Proposal

- We strengthened our motivation for the project frome multimodal continuous authentication using biometric features by considering the privacy space
- Imbuing privacy into the occupant identification process is a new constraint that we added
- This motivates us to consider the ***tradeoff*** between *securing* a smarthome device and maintain the *privacy* of the occupant

# Project Timeline



**Feb. 17 - 23:**
Literature Survey on CA

**Feb. 24 - Mar. 2:**
Survey on facial verification and speaker recognizer

**Mar. 3 - 9:**
Develop submodules for individual authenticator

**Mar. 8**

SoW Write-ups and presentation

**Mar. 10 - 16:**
(1) Refine problem statement
(2) Study fusion models

**Mar. 17 - 30 :**
Investigate privacy preserving models

**Mar. 22**

Project Update 1

**Mar. 31 - Apr. 6**
- implement camera obfuscation
- implement voice obfuscator

**Apr. 5**

Project Update 2

**Apr. 7 - 13 :**
Test system and refine result

**Apr. 14 - 21:**
Prepare final presentation & report

**Apr. 19**
Final Presentation

# Next Steps

- Stage 1: Conduct control experiments for automatic facial de-identification and re-identification
- Stage 2: Leverage on biometric temporal information to improve the occupant identification performance
  - Conduct experiment on non-obfuscated and obfuscated speaker datasets and compare the results
- Stage 3: Draw conclusions on privacy preserving effects and define privacy framework for passive automatic occupant identification.
- Stage 4: Attempt to fuse stage 1 and stage 2 models, and perform continuous authentication using features from stage 2.

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