

Body Measurement using a 2D Camera for Home Fitness

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Introduction

- Problem Statement:**
 - 3D body measurement systems are costly and impractical for home use.
- Objective:**
 - Develop affordable and accessible alternative to traditional 3D systems.
- Goal:**
 - Design and prototype a 2D-based human body measurement system.

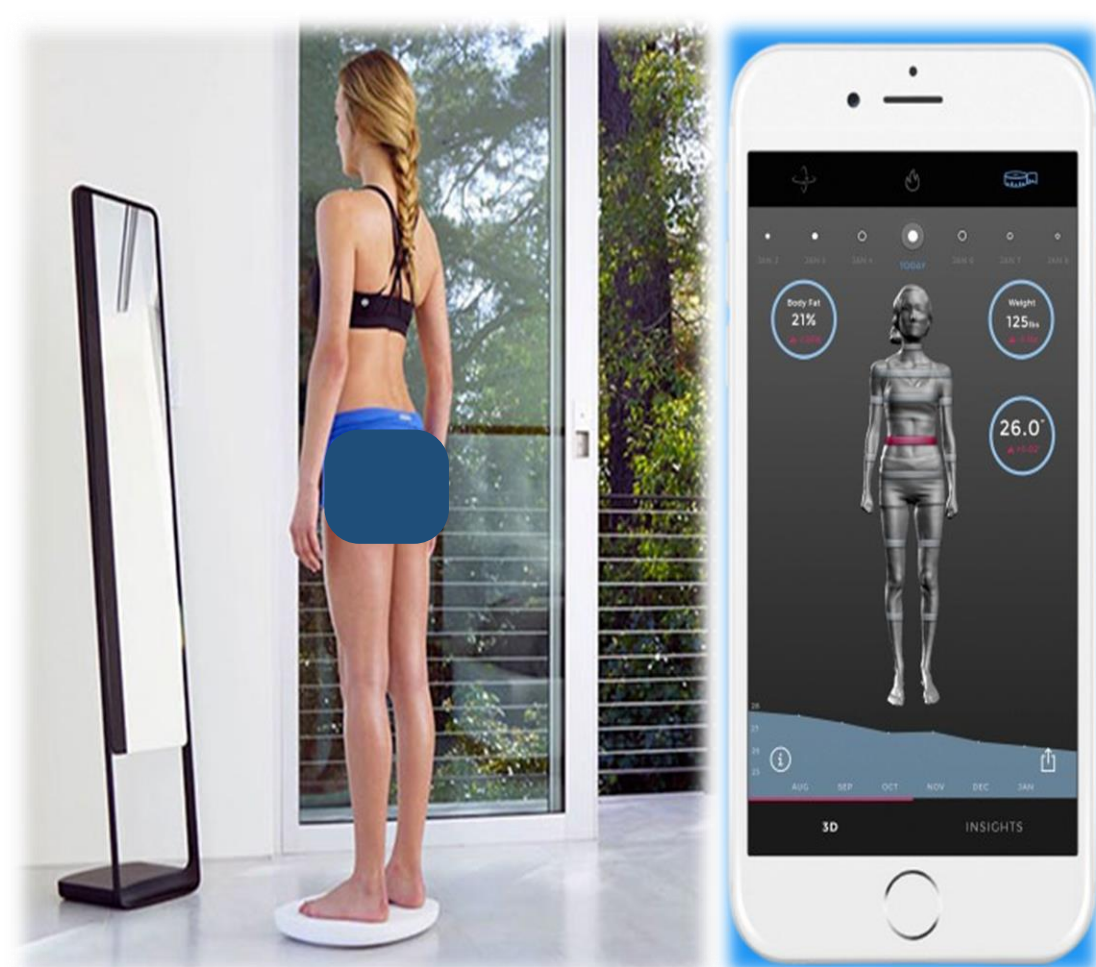
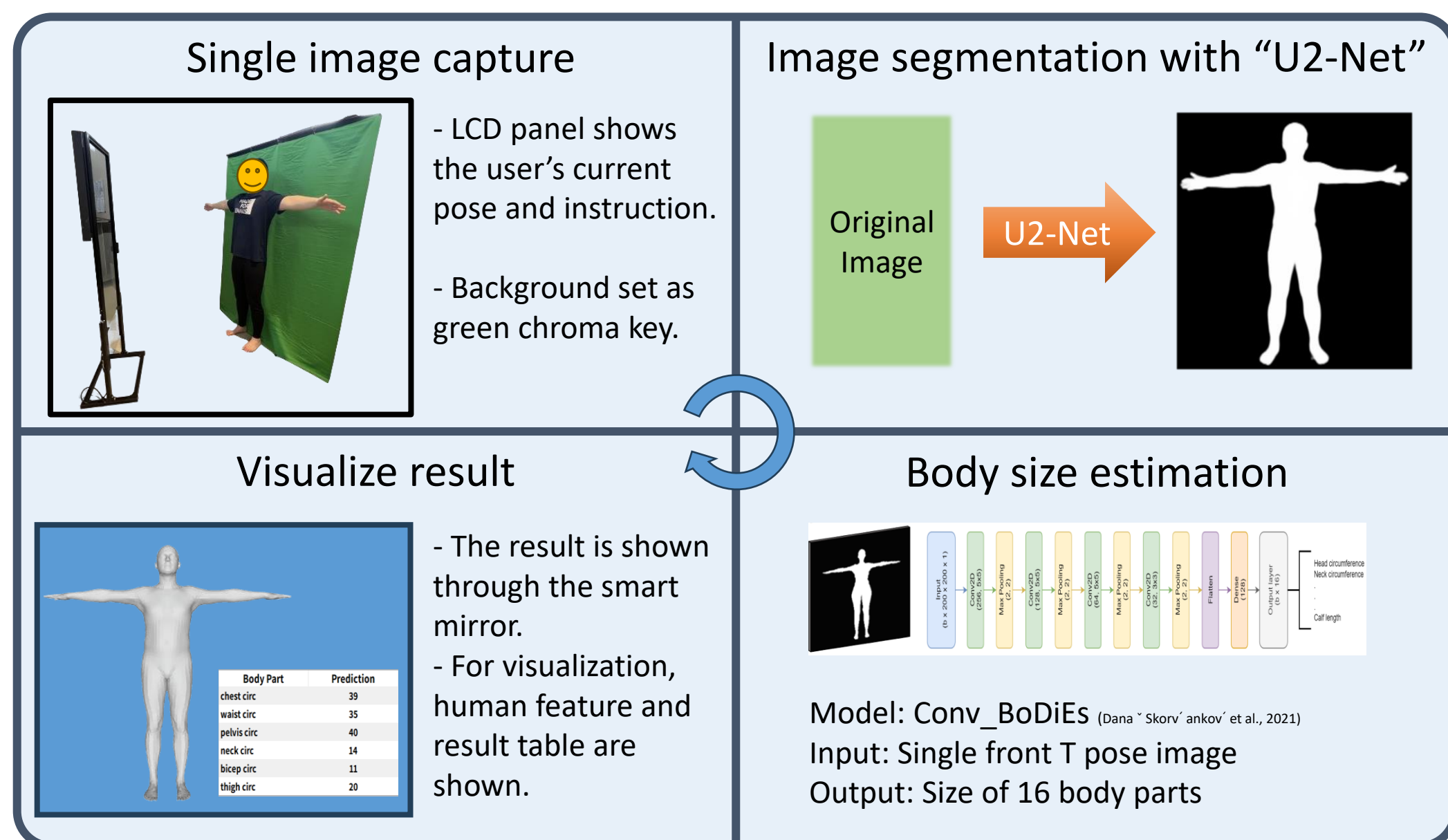


Fig 1. Aimed System Feature

Proposed system

- Interact with the user with smart mirror
- 16 body measurement estimation with single 2D image
- Visualization of results



Conv_BoDiEs: Train Dataset & Evaluation

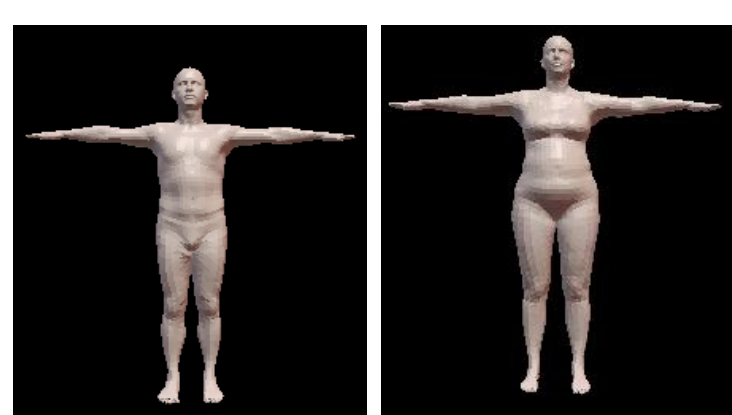


Fig 2. Sample Dataset

Body part	Test Data
chest circ	9.3
waist circ	8.8
pelvis circ	9.2
neck circ	5.8
...	...
MAE(total)	5.537[mm]

Table 1. Test Data Result

- Model and Dataset**
Conv_BoDiEs predicts 16 body measurements.
50,000 *SMPL captured images are used for train and test.
- Evaluation**
The model achieved a 5.537[mm] MAE.

Hardware Design

Hardware designed like a mirror for "Home Fitness".

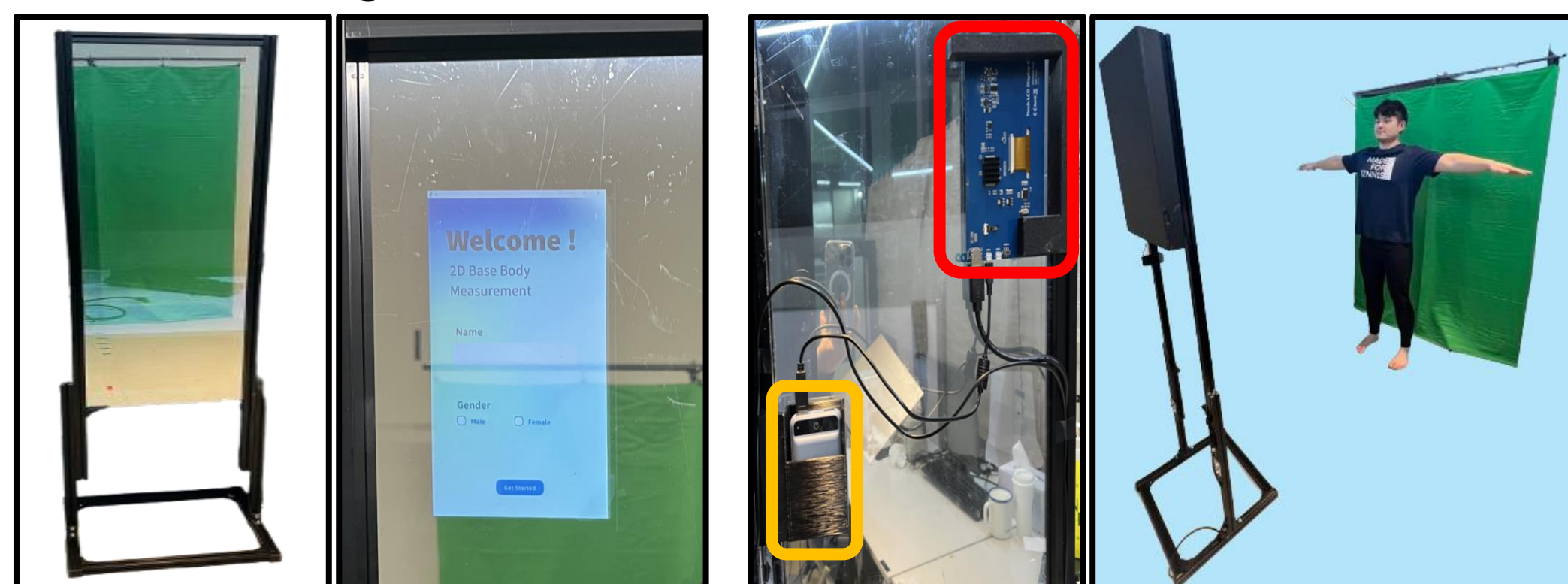


Fig 3. Smart Mirror & LCD Display



Fig 4. Inner Part & Overall Layout

- Hardware Specification:**
 - Height: 175cm
 - Width: 54cm
 - LCD panel: 7inch (600x1024)
 - Camera: 1090P web cam
 - Film: half-mirror 35
- Red Box:** LCD pannel with 3D printed holder
- Orangd Box:** Barttery with 3D printed holder

GUI & System Flow

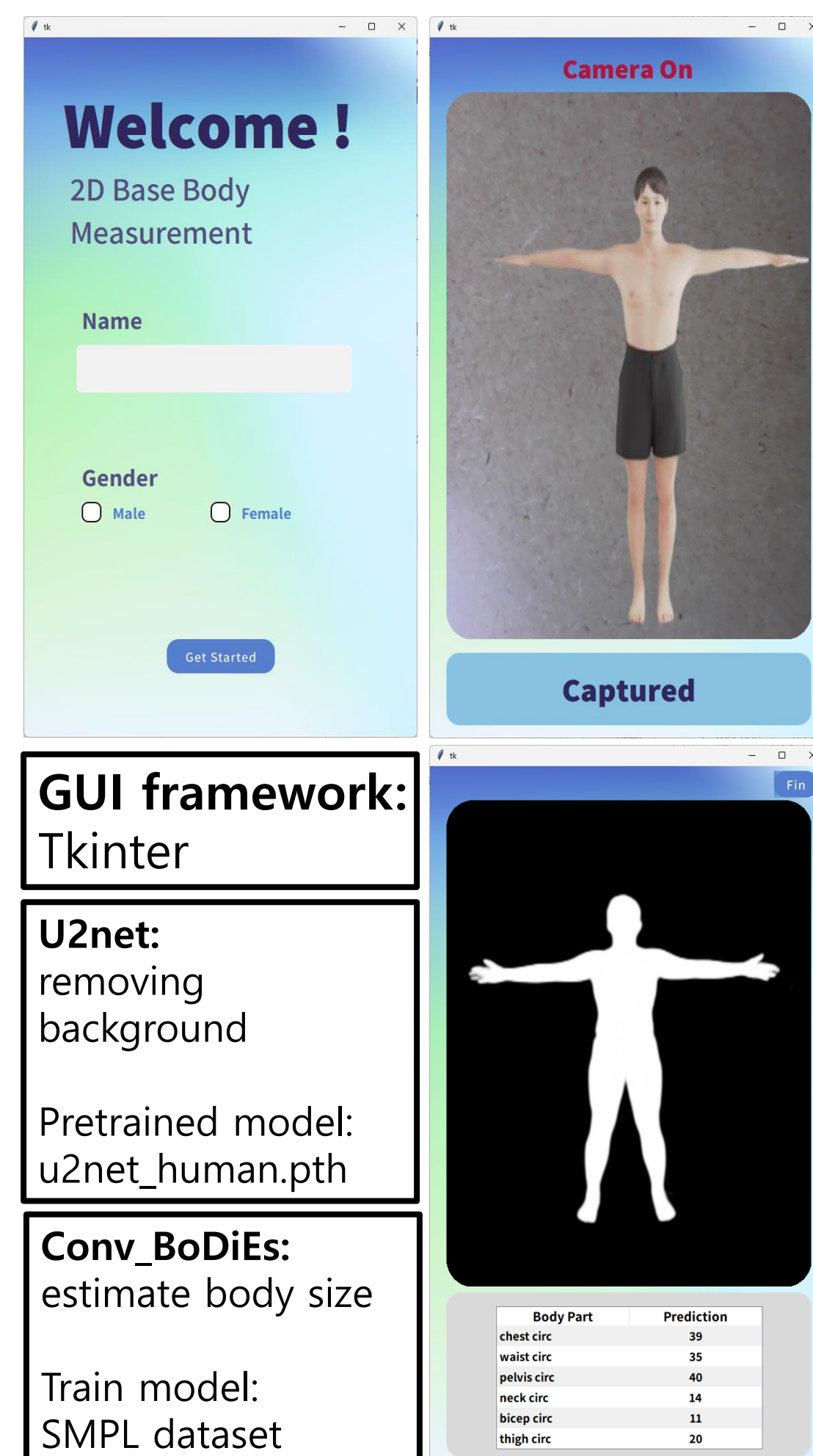
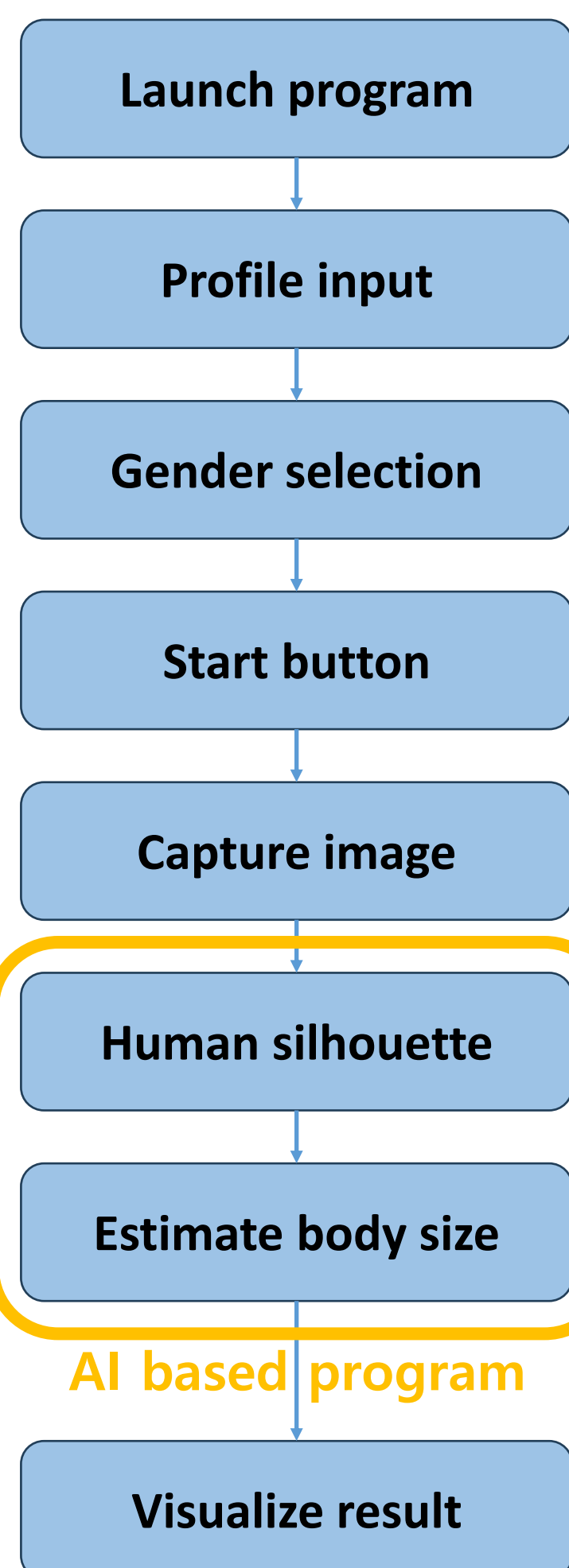


Fig 4. GUI

System Test

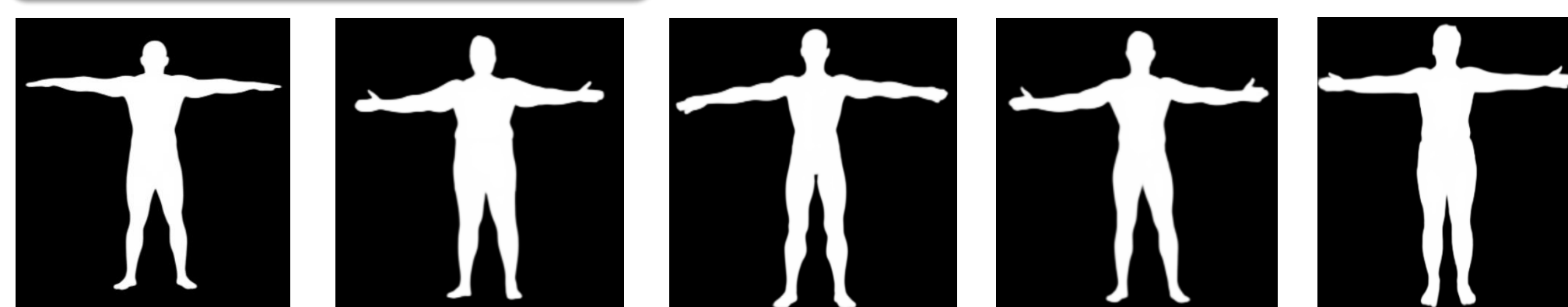


Fig 5. Test participant's silhouette

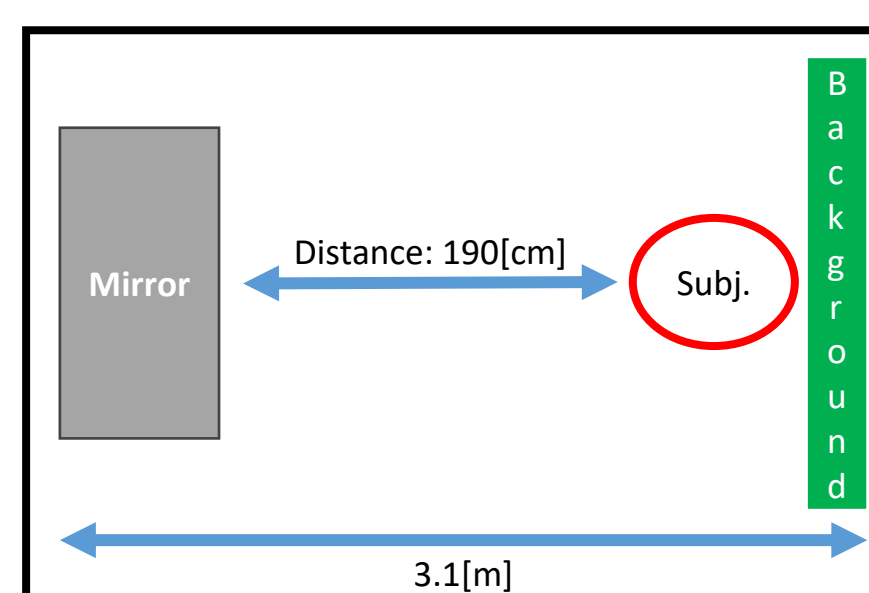
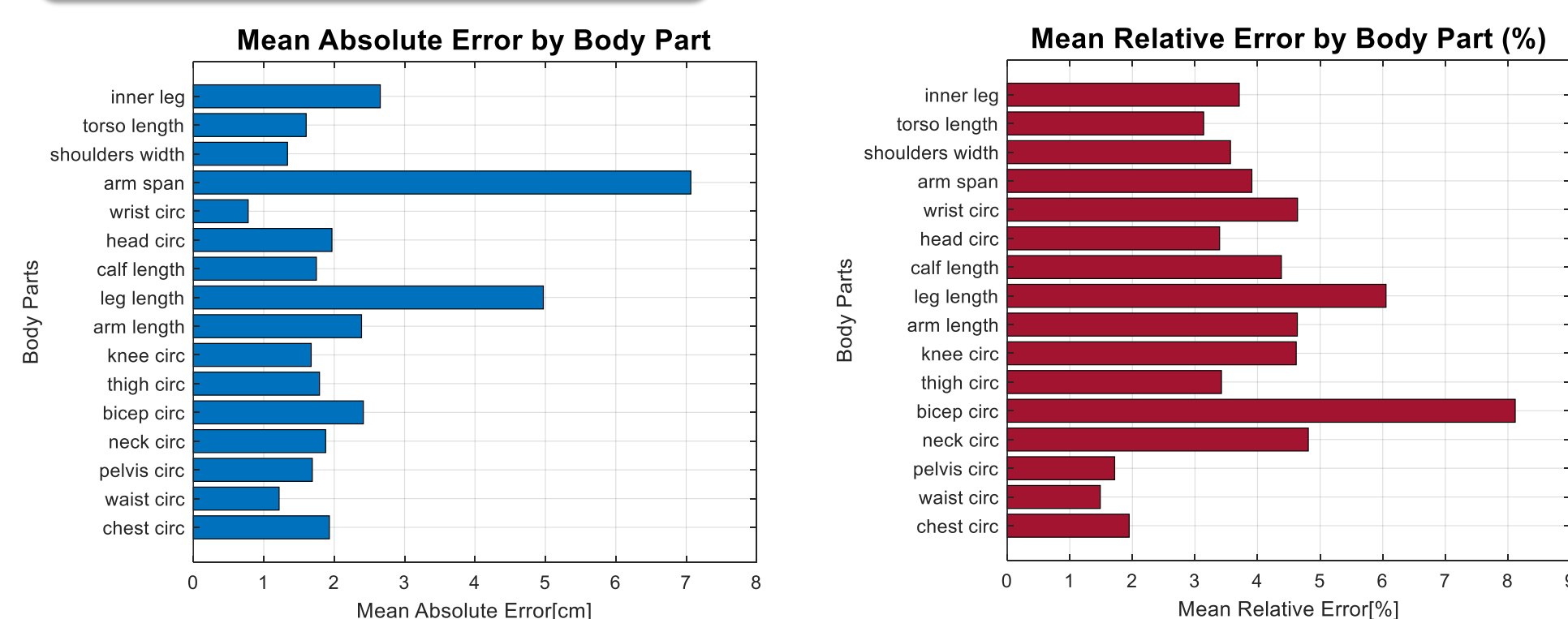


Fig 6. Test layout

- Test participants:** 10 male
- Distance between camera and subject:** 190[cm]
- Overall space layout:**
 - width – 3.1[m]
 - length – 2.2[m]
 - height – 2.5[m]

Result



- Result:**
 - Overall MAE: 2.3196[cm]
 - arm span, bicep circumference and leg length has the worst result

Future Work

- Visualize in 3D features
- Develop accuracy of the model

Reference

[1] Škorvanková, Dana, Adam Riečický, and Martin Madaras. "Automatic estimation of anthropometric human body measurements." arXiv preprint arXiv:2112.11992 (2021).