

Body Measurement Using 2D Camera for Home Fitness

Mechatronics Integration Project

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Part 1 Problem Statement

3D body measurement systems are costly and impractical for home use.

Name	Fit3d	Styku	PMT innovation (shape care)
Data Type	3D	3D	3D
Features	Body measurment BMI 3D reconstruction Data storage	Body measurment 3D reconstruction Data storage Fitness coach	Body measurment BMI 3D reconstruction Data storage
Hardware Configuration	BMI system Display RGB-D camera (3) Turntable	RGB-D camera(2) Turntable	BMI LED lighting RGB-D camera (3) Turntable
측정 시간	40[sec]	35[sec]	-
Accuracy	Slightly better than Styku	0.2[cm]	-
Price	\$42(USD) per scan Purchase: \$7000(USD)	\$59(USD) per scan Purchase: \$6000(USD)	-

Current Commercial Systems



Fit3d



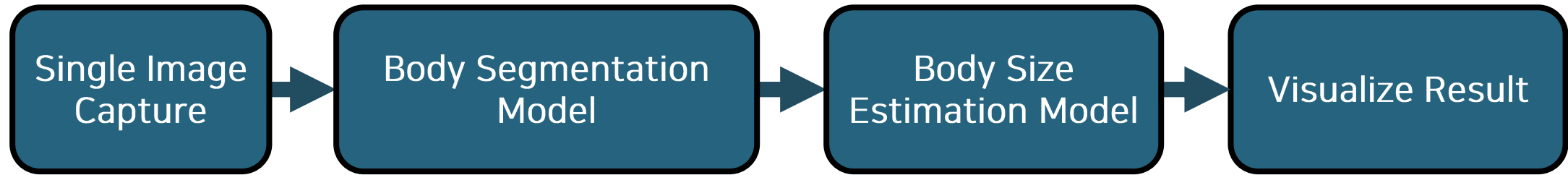
PMT innovation



Styku

“A system for conveniently measuring
body sizes for home fitness”

Part 3 Proposed System



1. Single Image Capture



Fig 1. Capturing Image

- Captures front T pose image through the camera.
- User can watch his or her own pose status through LCD panel.

2. Body Segmentation Model

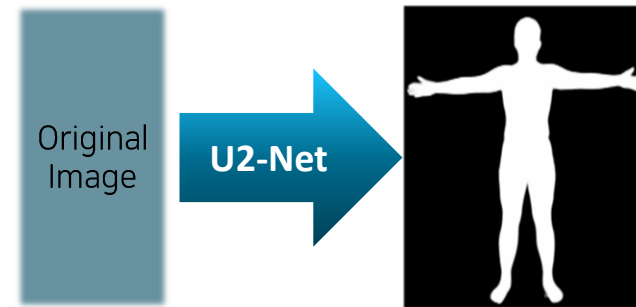
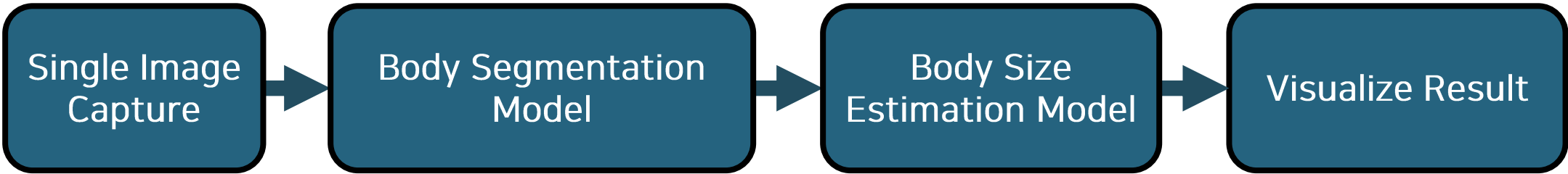


Fig 2. Segmentation with U2-Net

- “U2-Net” highly accurate background segmentation model used for image processing.
- Pretrained model: `u2net_human_seg.pth`

Part 3

Proposed System



3. Body Size Estimation Model

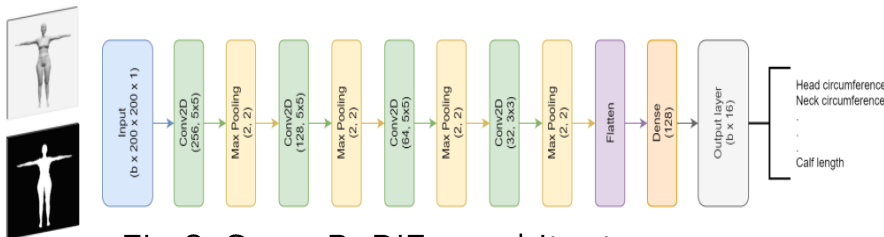


Fig 3. Conv_BoDiEs_architecture

Model	Conv_BoDiEs
Input	Front T pose image
Output	Size of 16 body parts

- The model relies on a single 2D image for estimation, which simplifies implementation

4. Visualization Result

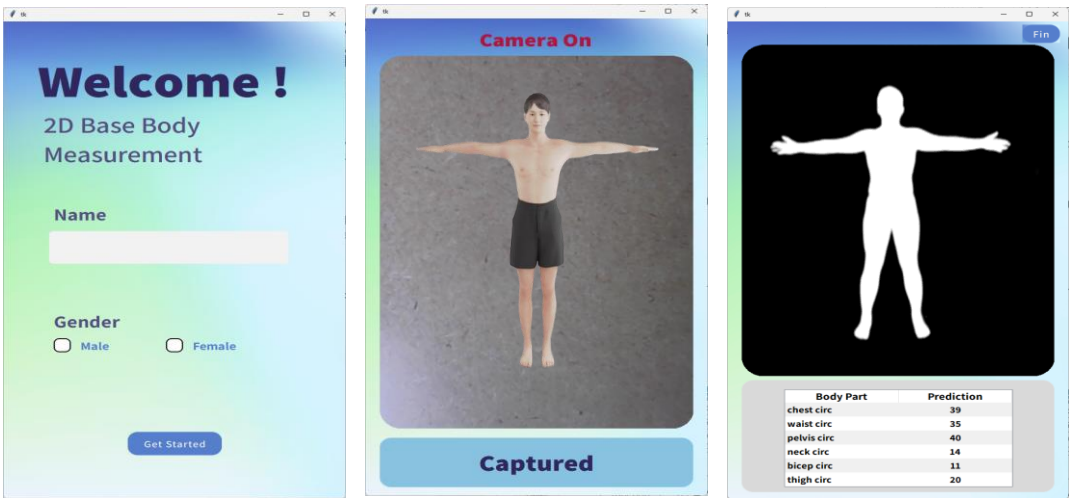


Fig 4. GUI

1. Type name for user result storage
2. Select gender for appropriate "trained model"
3. Results visualized in segmented image with table

Part 3 Proposed System

Hardware

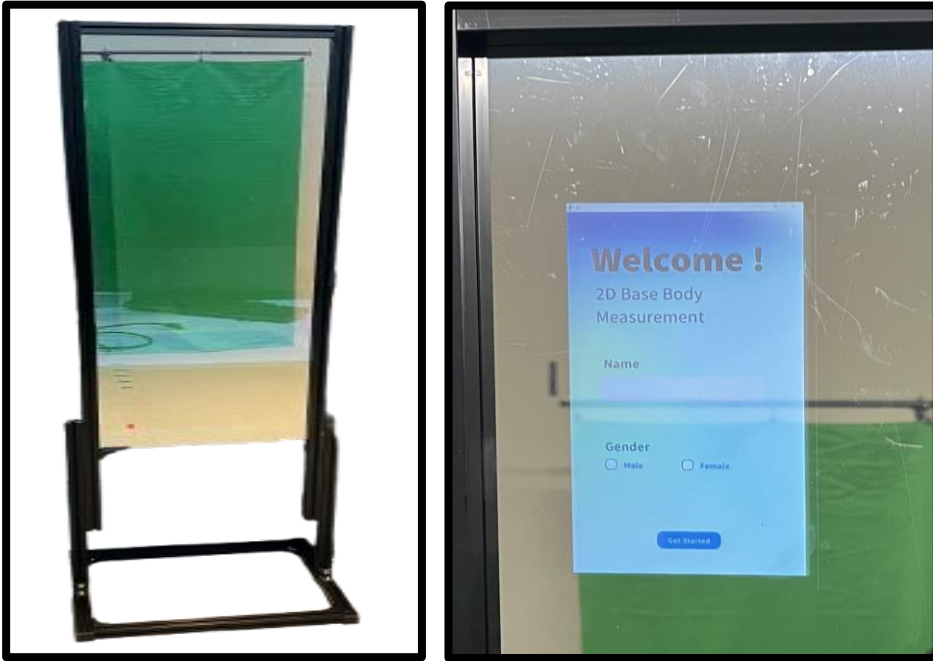


Fig 5. Smart Mirror & LCD Display

- Hardware Specification
Size: 175x54x40[cm]
LCD panel: 7inch (600x1024)
Camera: 1090P web cam
Mirror: 120x40[cm]

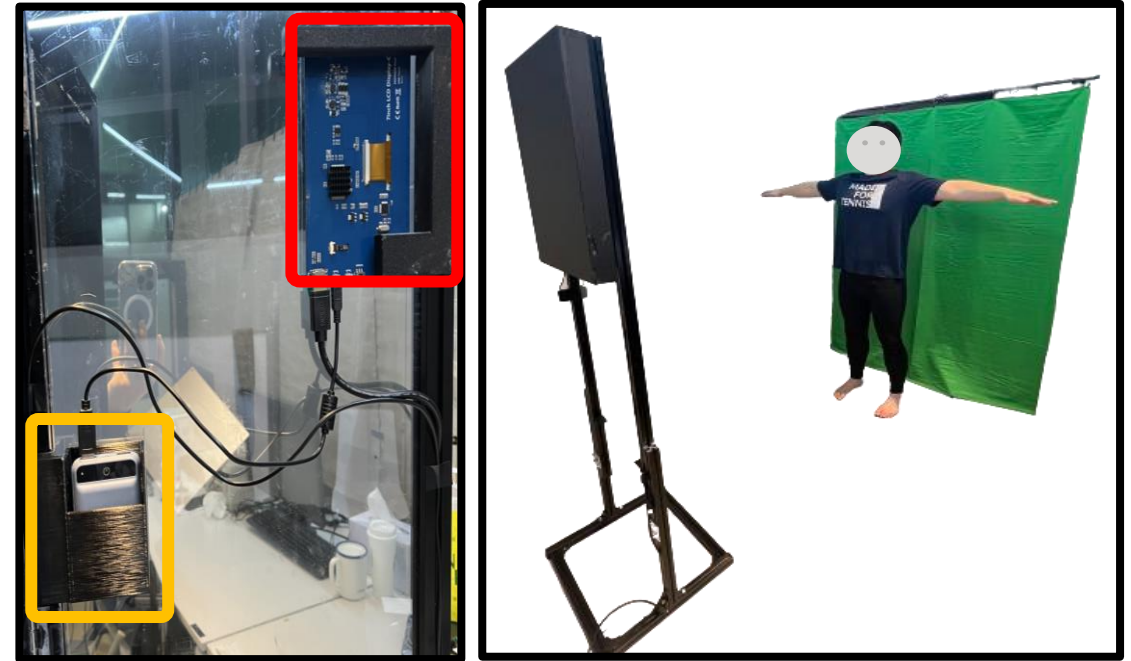


Fig 6. Inner Part & Overall Layout

- Red Box:
LCD pannel with 3D printed holder
- Orange Box:
Barttery with 3D printed holder

Part 4 Result

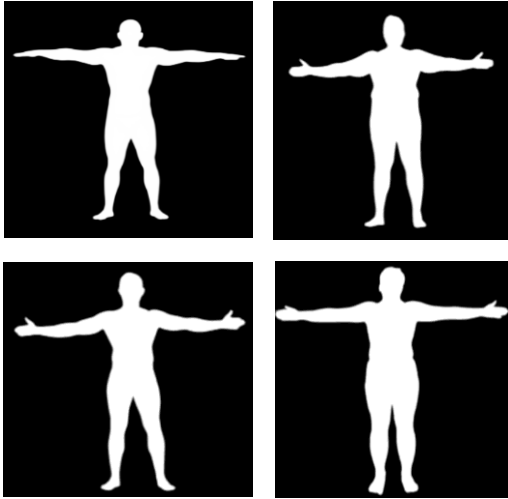


Fig 7. 4 Sample of Test Participant

- Test participants
10 male
- Distance with camera
190[cm]

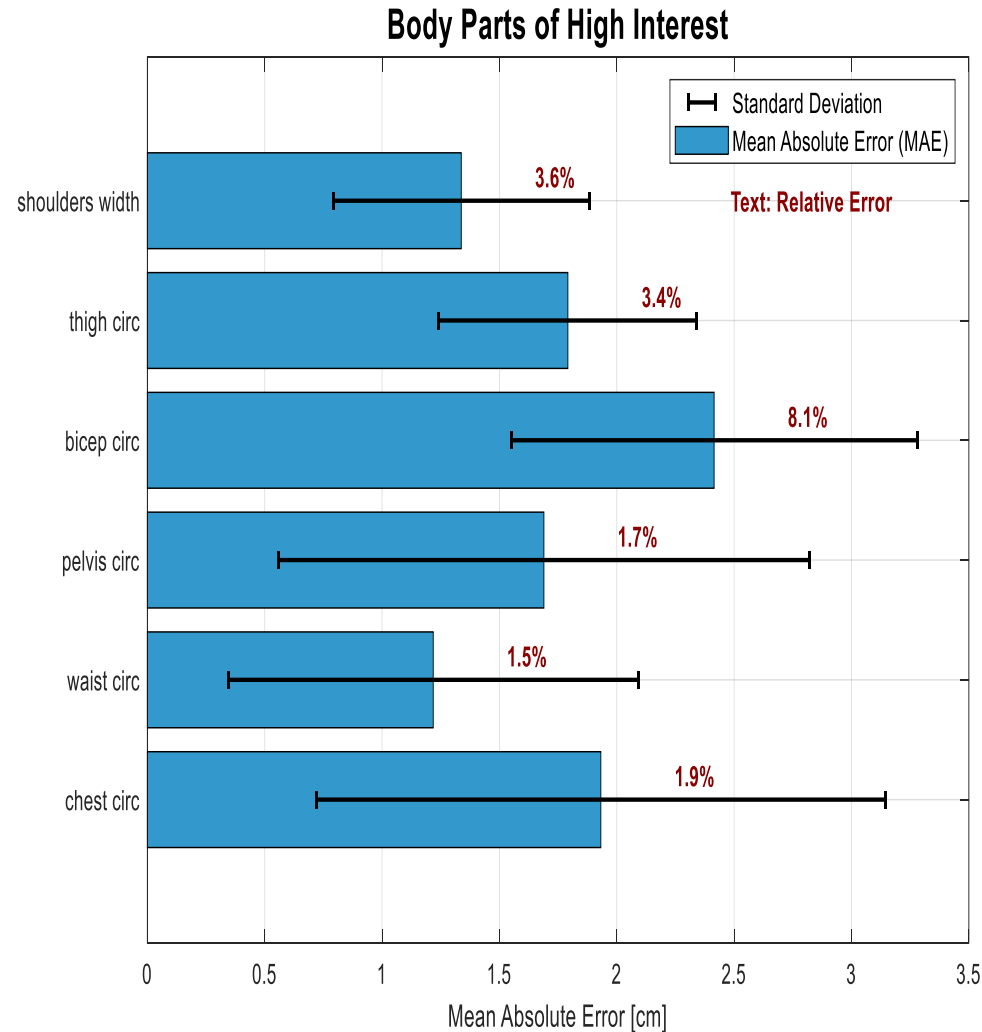
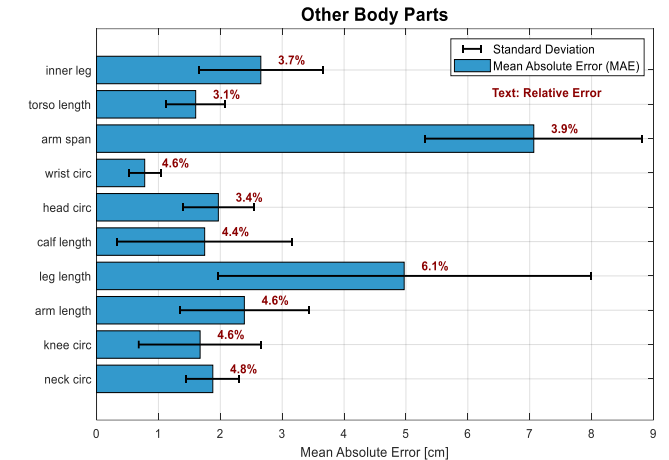


Fig 8. Result of High Interest Body Parts



- Result
Overall MAE: 2.3[cm]
- Future Research:
Enhancement of Accuracy
Visualizing in 3D model

Part 5 Future Work

1. Accuracy improvement
 - Higher resolution for original image
 - Real-life dataset training instead of SMPL data

2. Visualization in 3D mesh



Fig 9. simplify-x

Thankyou
