



# DISTRIBUTED VISUAL INERTIAL ODOMETRY IN A MULTIUSER ENVIRONMENT

## Introduction

Head-mounted displays typically use a visual-inertial odometry system (VIO), which relies on the headset's camera combined with inertial measurement units. While effective, this setup fails if the camera is obscured or if the environments lacks features. Addressing this, the paper proposes a novel distributed tracking method that uses the positions of other users and creates a network or “daisy chain” of user locations, enhancing position tracking accuracy.

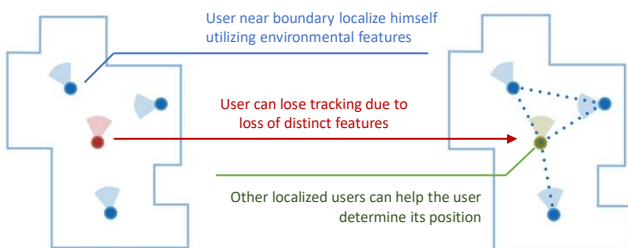


Figure 1: Use case for distributed visual inertial odometry

## Methodology

- The depth map and the 2D image are send from the HMD to the server
- The depth map is transformed to a 3D point cloud
- From the 2D image, the users are detected along body landmarks using YOLO and mediapipe
- The relative position of every users is found based on the 2D landmarks combined with the 3D point cloud
- The final position of the users will be compared with 3D coordinates obtained the VIO system

## Result

- Real-time system  $\rightarrow$  185.07ms per position calculation
- Accuracy  $\rightarrow$  +/- 10% of distance between users
- Further optimization in pose estimation can provide better results

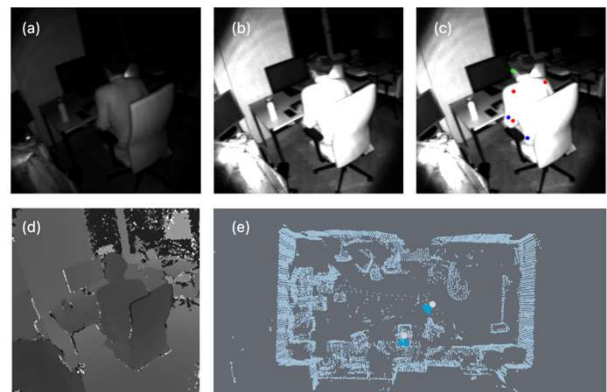
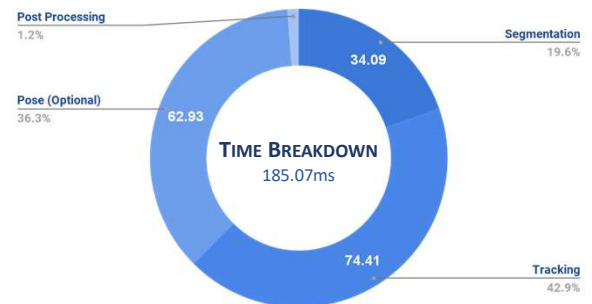


Figure 3: The original image (a), the adjusted image (b), the person with tracked landmark (c), the depth map (d) and the result (e).

## Next Step

- Combination of the system with VIO
- 3D-Pose based humanoid tracking system in addition to current positional tracking system
- Performance optimization with on-device recognition