YUYANG

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2023

PORT
FOLIO

YUXING YANG

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EDUCATION

- Tsinghua University   2019-2023   Bechelor of Engineering

- Univerisity of Warwick   2022   Exchange Program

- Major: Biomedical Engineering

- Minor: Artificial Intelligence Innovation and Entrepreneurship

AWARDS

- Beijing Excellent Undergraduate Thesis
- Tsinghua University Excellent Graduate
- National Scholarship
- National Biomedical Engineering Innovation Design Competition the Second Prize
- Hardware Design Competition the Third Prize

SKILLS

- Technical Skills: C/C++, C#, Python, MATLAB, Java, JavaScript, SQL, Verilog, MIPS, Shader, Markdown, LaTeX,   HTML, CSS, XMind, Simulink, Qt, Unity,Multisim, Vivado, Altium Designer, Arduino, Raspberry Pi, Hololens, FPGA, ESP32/ESP8266

- Designing Skills: Photoshop, Illustrator, Premiere, Canvas, Sketch, iMovie, Procreate, Blender, Figma, Solidworks, Autocad, Processing, Touch Designer, Rhinoceros, KeyShot
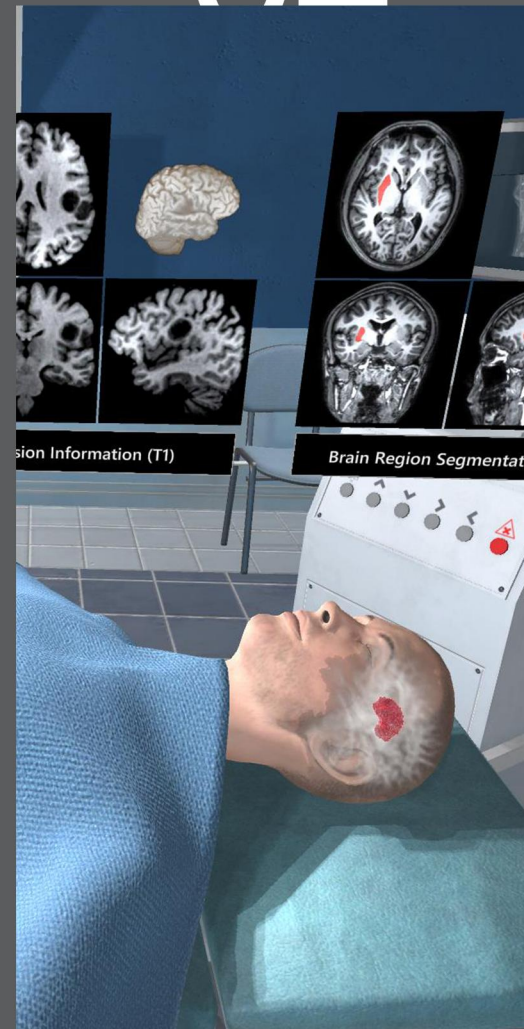
01

02

03

04

Brain Region Segmentation

sion Information (T1)
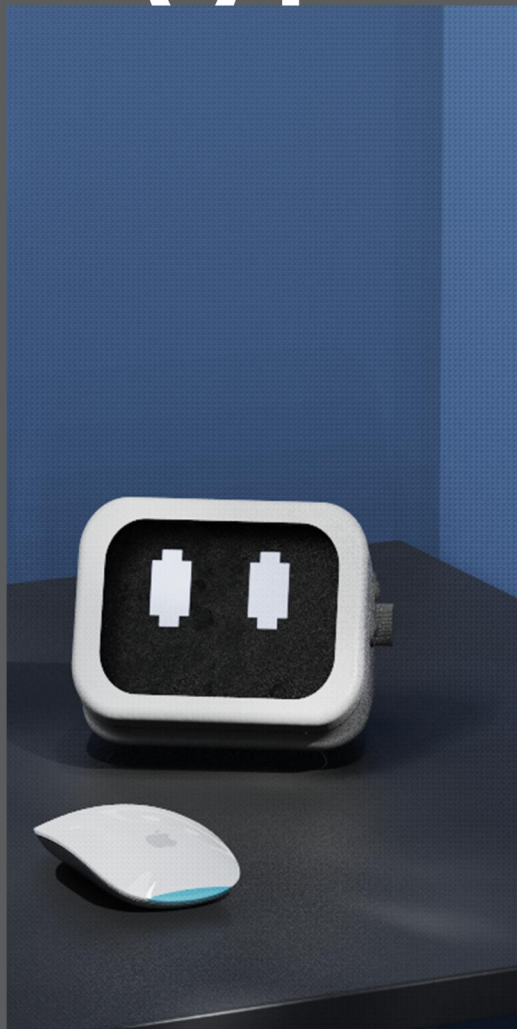
01

Uer

A Deskpet Based on Arduino

Individual Project

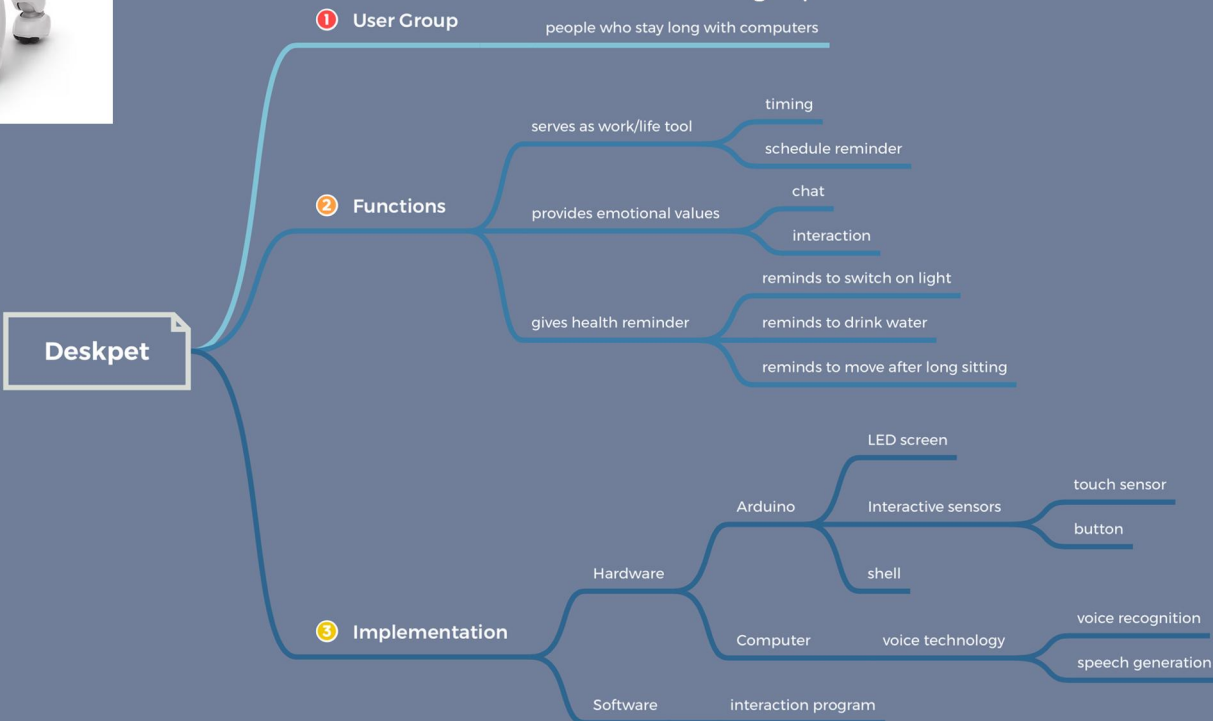4 Months   Link: github.com/Thingamab0b/U-er

BACKGROUND

Nowadays, many people lead fast-paced lives with high work pressure and limited time. Keeping pets requires a significant investment of time and energy, while electronic pets offer an option to experience companionship without the need for actual care. Electronic pets can be tailored to individual preferences and needs, providing a unique experience that aligns with the trend of personalized consumption in contemporary society.
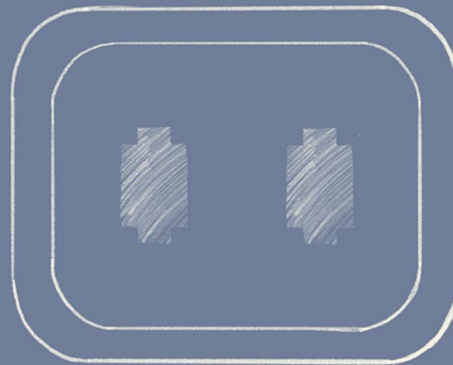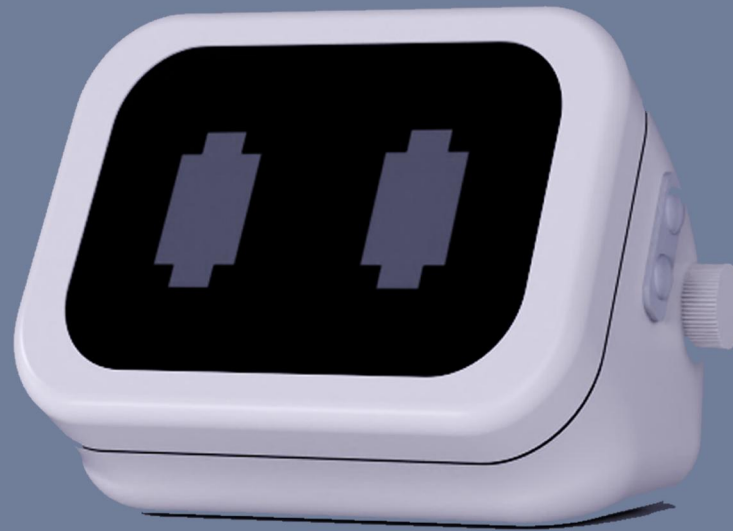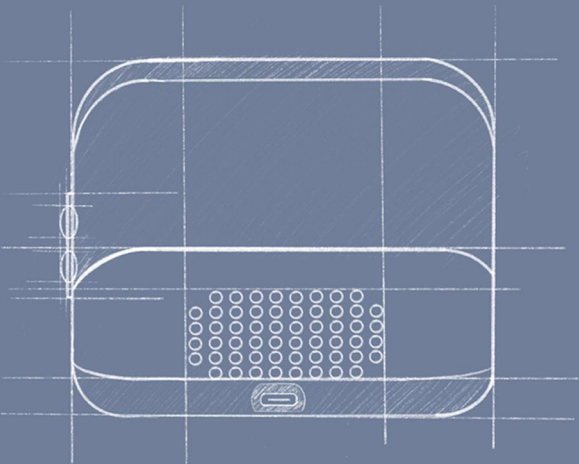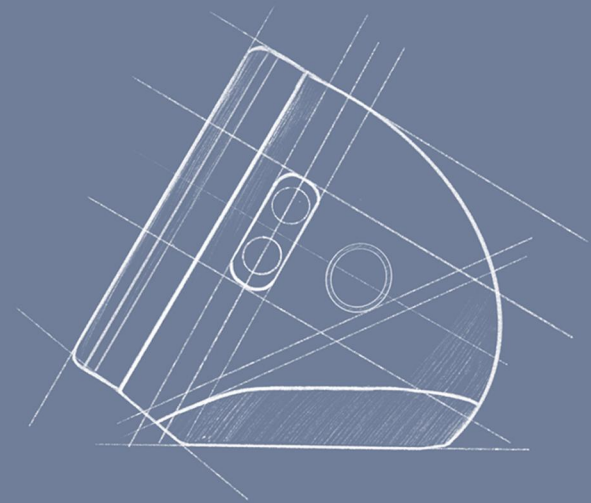

Electronic pets come in various forms, with the most popular late 20th-century example being the Tamagotchi, a egg-shaped handheld game where the virtual pet inside requires feeding and can even die. Tencent's QQ Pet, introduced in 2005, took a similar concept using desktop computers as the platform. Besides, there are lifelike electronic pets such as Sony's Aibo. These electronic pets establish emotional connections with their owners through specific interactive methods.

For those who stay long in front of computers, they might feel lack of social coinnection and lonely, and are under the health risk. So we designed an deskpet using Arduino Uno, which serves as a hardware-based expression medium and utilizes software as the interactive interface, connecting users' events in work and life with the pet to provide emotional value and promote a healthier lifestyle.

Deskpet

❶ User Group — people who stay long with computers

❷ Functions
- serves as work/life tool
  - timing
  - schedule reminder
- provides emotional values
  - chat
  - interaction
- gives health reminder
  - reminds to switch on light
  - reminds to drink water
  - reminds to move after long sitting

❸ Implementation
- Hardware
  - Arduino
    - LED screen
    - Interactive sensors
      - touch sensor
      - button
    - shell
  - Computer
    - voice technology
      - voice recognition
      - speech generation
- Software
  - interaction program

DESIGN & PROCESS

kaomoji

Timing
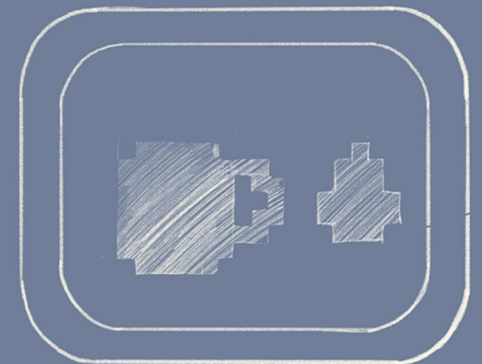
Drinking Reminder

DESIGN & PROCESS

Hardware Connection

Power Supply & Data Exchange

Matrix LED Lattice Display   Arduino UNO   Serial Port Line   Computer
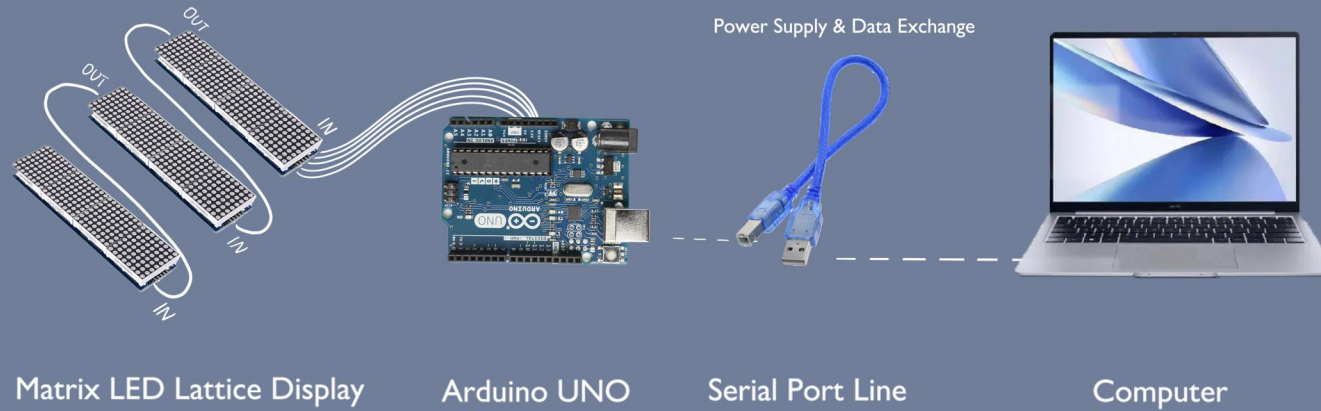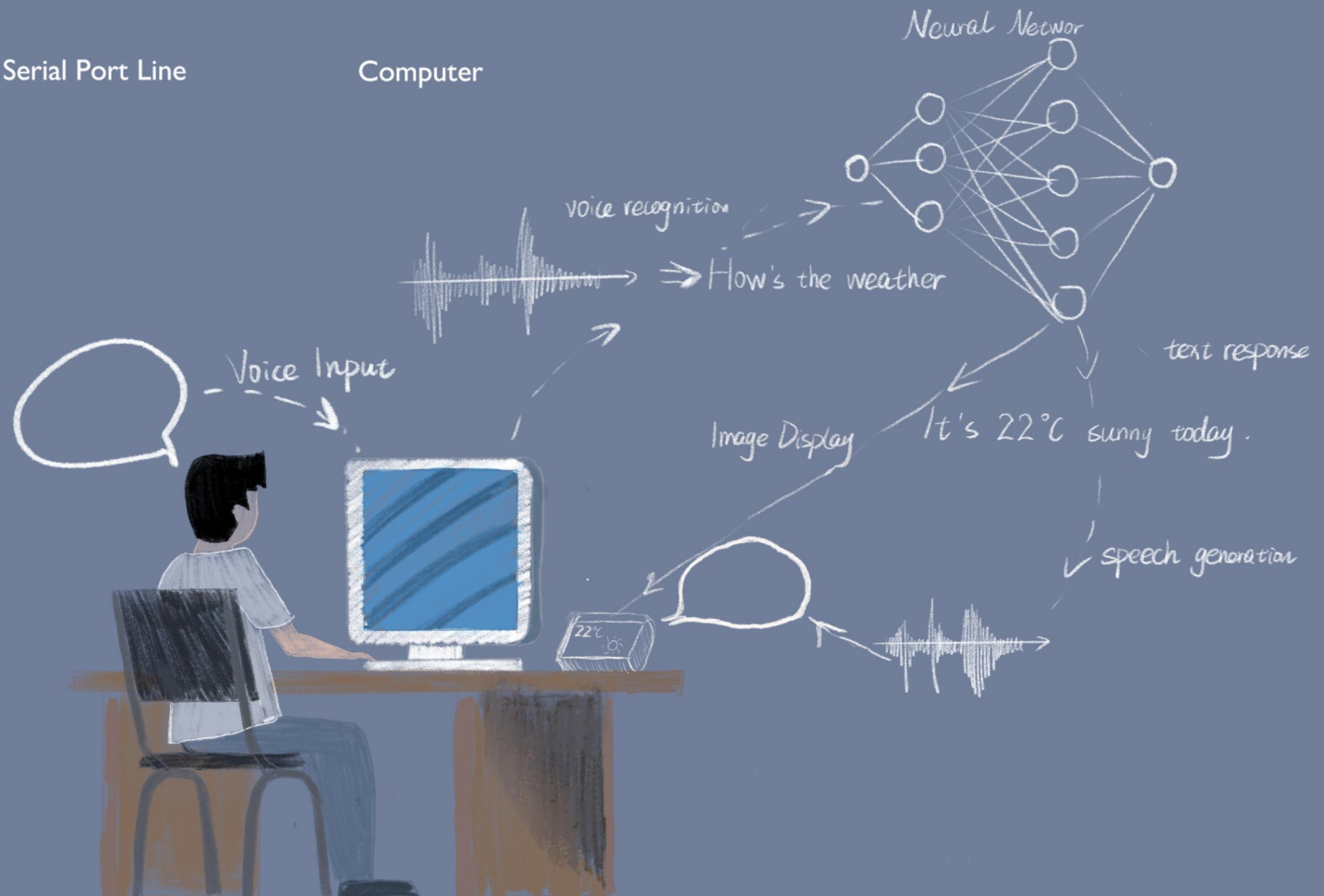
Sofetware Workflow

To complete the conversation process with Uer, there are three main components: voice recognition, text responses, and converting the response text into speech. All computational tasks are handled by the computer, while the Arduino-based hardware is only responsible for displaying functions.

Neural Necwor

voice recognition

How's the weather

text response

Voice Input

Image Display

It's 22°C sunny today.

speech generation

02

Wall

A Narrative-focused Action-adventure
Game Themed around Public Sentiment

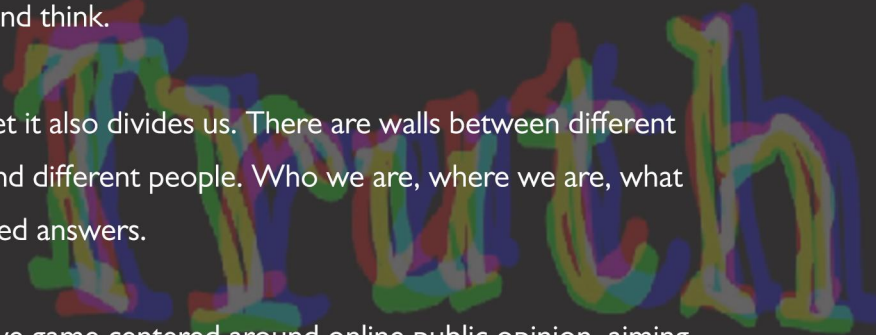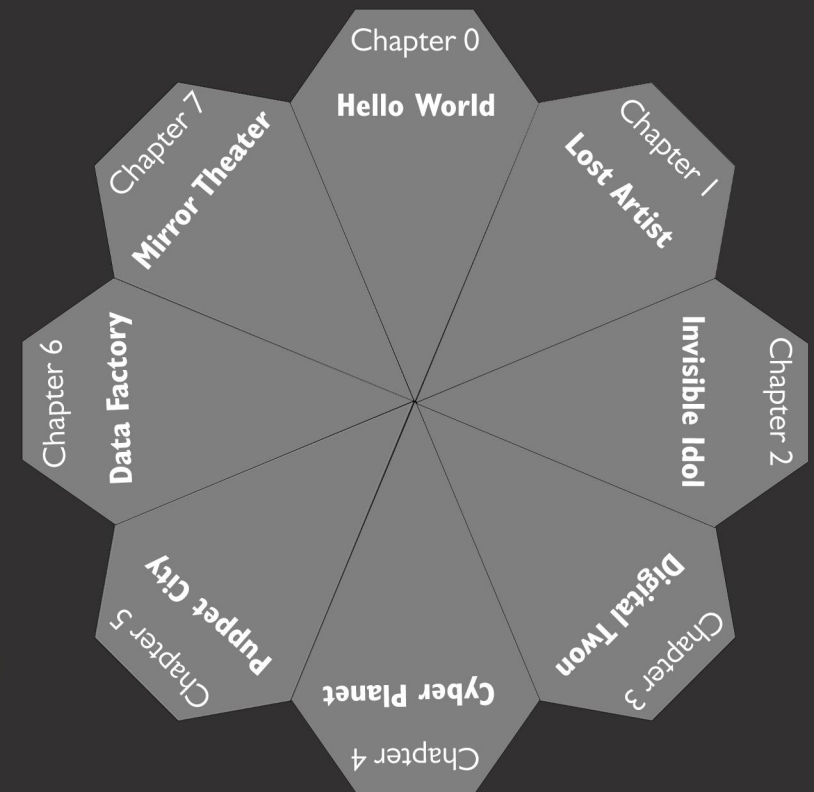Team Project - Game Designer

10 Months

unity

BACKGROUND

The internet is leading us into a post-truth era where opinions and conflicts are amplified. Anyone on the internet can voice their thoughts, and everything can be overheard. You don't know who is behind the mask, you don't know wether the person behind the screen is crying or laughing, you don't know wether you are being manipulated or monitored, you don't know when you might find yourself at the center of public opinion, and you don't know when your words might become a weapon to harm others. Netizens wearing virtual armor are gradually losing their ability to judge and think.

The internet connects us, yet it also divides us. There are walls between different opinions, different voices, and different people. Who we are, where we are, what lies behind the wall – we need answers.

We have designed a narrative game centered around online public opinion, aiming to present to players the "internet environment" we inhabit through the game's diverse narrative style, metaphorical artistic techniques, and exaggerated visual representations. The goal is to provoke players into contemplating the complexities of the online world through an immersive gaming experience.

STORY CHAPTERS

Chapter 0
Hello World

Chapter 1
Lost Artist

Chapter 2
Invisible Idol

Chapter 3
Digital Twin

Chapter 4
Cyber Planet

Chapter 5
Puppet City

Chapter 6
Data Factory

Chapter 7
Mirror Theater

Eight chapters are designed as metaphors for phenomena of gossip, fan culture, web-addiction, cyber-antagonism, cyber-violence, bandwagon effect, privacy disclosure, and short-lived internet memory.

WORLD FRAME

This is a virtual world mirroring the cyber world, and the protagonist is an abandoned digital twin. She accidentally enters a musician's home in the midst of chaos, delving into the musician's memories and gradually unraveling the secrets behind the this world.

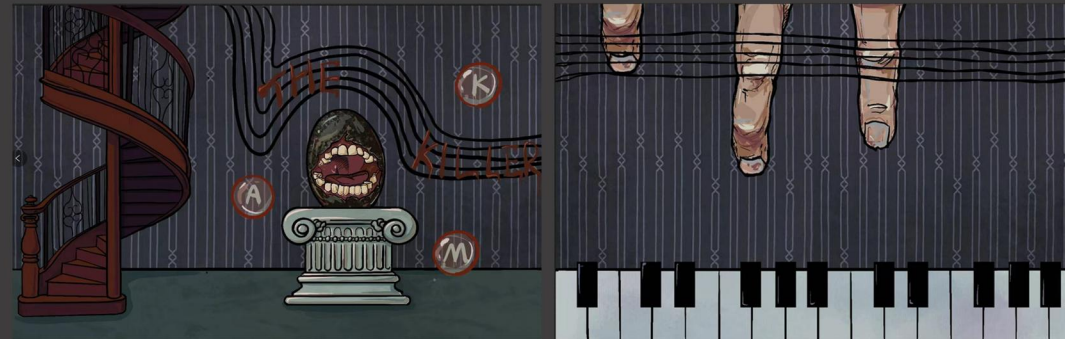Each time she passes through a scene, she receives a shard that restores the world.

She witnesses how the musician is manipulated and propelled to fame by unseen forces, only to later experience online harassment and abandonment. During her adventure, she unexpectedly finds a supporter of the musician who looks exactly like herself.

The world of the girl who resembles her is grayscale, and she experiences isolation, often immersing herself in the online world. In the end, our protagonist discovers that she is the digital twin of the lonely girl.

To find the ultimate truth, she forges ahead, observing how people in this world become divided and witnessing how the unseen force fabricates data to deceive and manipulate people like puppets.
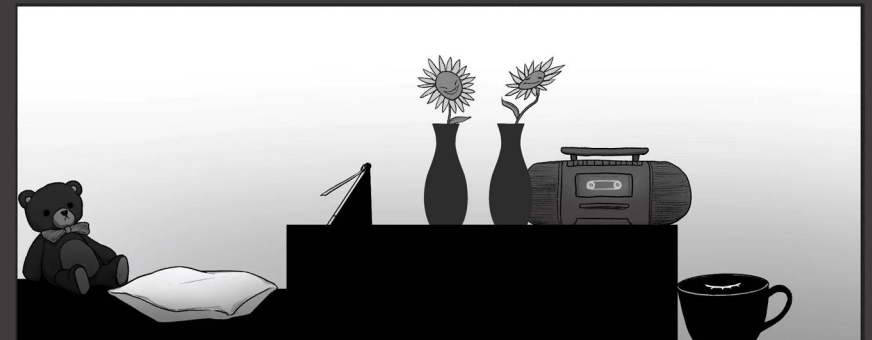

She has already collected six shards: gossip, cyber-violence, web-addiction, cyber-antagonism, bandwagon effect, privacy disclosure. When there is only one missing shard, she falls into a house of mirrors, witnessing a myriad of ugly figures. Breaking the mirrors, she discovers herself at the center of a stage, surrounded by countless eyes. Slowly fading away, she becomes the final shard: forgetfulness. This represents the seven shards that reveal the full picture of the online world.

CAHRACTER DESIGN

The contradiction between figures and professions is designed to symbolize that , people of different backgrounds in real life have the opportunities to engage in what they aspire to do on the internet.

NPC →

Non-player characters are added with elements of network.

03

DormStar

A Sleep Monitoring Wristband Aimed at the Aged

Individual Project

3 Months Link: github.com/Thingamab0b/Dormstar

BACKGROUND

With the coming of aging society, the health problems of the elderly have aroused great concerns in the society, where sleep disorders are the major one. Having done market research, we found that there exists an obvious market vacancy on smart products which solve the sleep problems in the elderly. Based on this requirement, we developed a sleep health monitoring wristband Dormstar. Through monitoring the heart rate, blood oxygen, acceleration, which serve as sleep health indicators and uploading the data to the cloud server for processing and storage feedback will be given to the intelligent interactive system specially designed for the elderly, responding to the sleep behavior of old people. In this way, their sleep quality can be improved, and further, help them maintain physical and mental health.

DESIGN & PROCESS

Dormstar

① User Group & Problems — the aged
- always get up in the night to urinate
- reduction in pulmonary function
- other possible sudden illness

② Functions
- analyses motion status
- connects smart furniture
- monitors physiological measure
- provide health suggestions

③ Features
- Aged-friendly
  - neat function
  - simple operation
- Safe
- wearable

④ Implementation
- Hardware
  - Raspberry Pi
    - LED screen
    - sensors
      - PPG sensor
      - Motion tracker sensor
    - battery
    - shell
  - Smart light
    - Arduino
    - Bluetooth module
    - RGB module
- Software
  - Local server
    - Data storage
    - Data processing
      - Motion detection
      - Sleep cycles classification
      - Sleep quality calculation
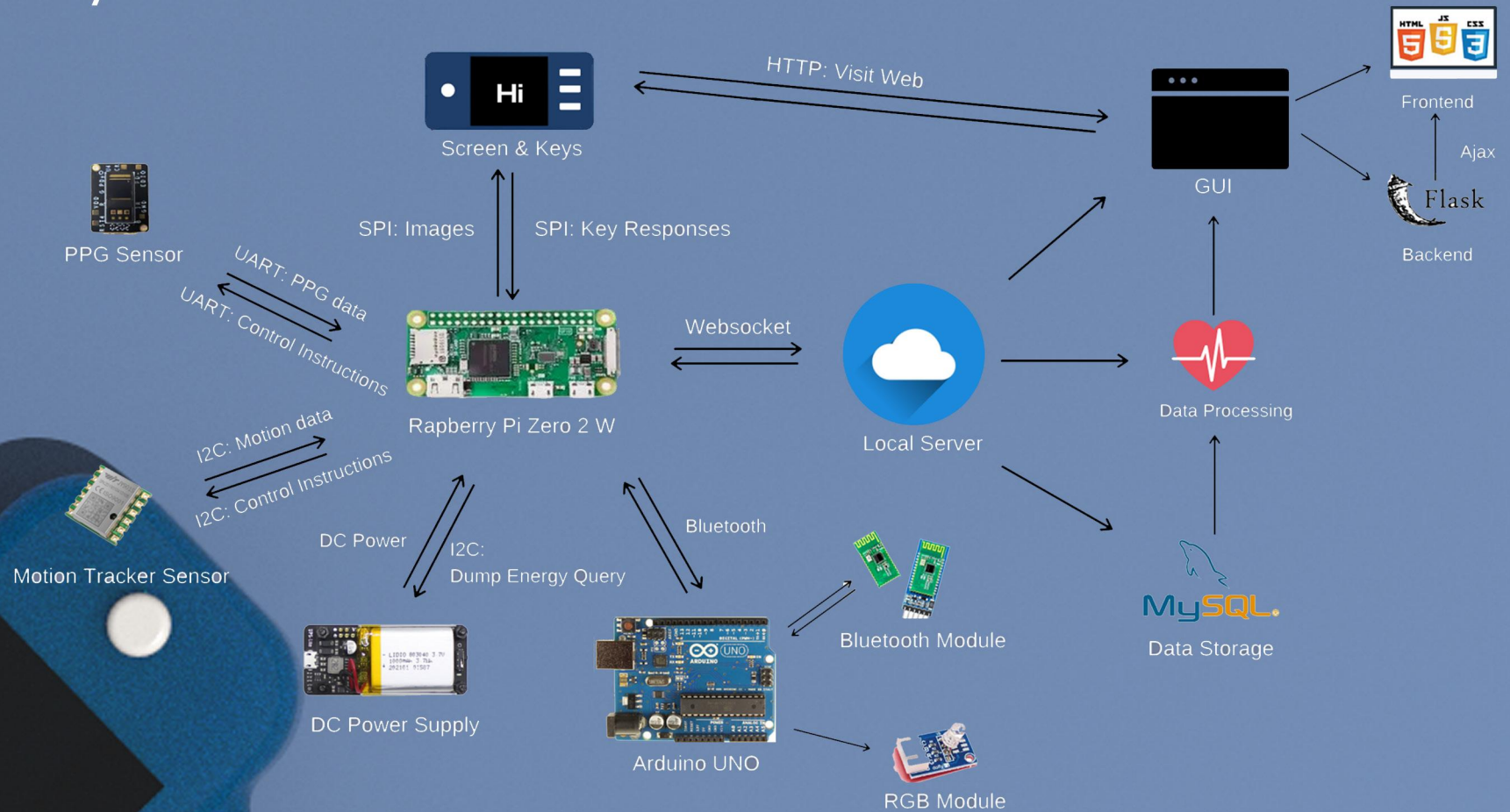   - Emergent event alarm
  - Graphic user interface
    - Front end
    - Backend

DESIGN & PROCESS

System Structure

Screen & Keys

HTTP: Visit Web

GUI

Frontend

Ajax

Backend

Flask

PPG Sensor

SPI: Images

SPI: Key Responses

UART: PPG data

UART: Control Instructions

Websocket

Local Server

Data Processing

Rapberry Pi Zero 2 W

Motion Tracker Sensor

I2C: Motion data

I2C: Control Instructions

DC Power

I2C: Dump Energy Query

Bluetooth

Bluetooth Module

Data Storage

DC Power Supply

Arduino UNO

RGB Module

DESIGN & PROCESS

Workflow

velocity $= \frac{\Delta d}{\Delta t}$

acceleration $= \frac{\Delta v}{\Delta t}$

move $(\Delta x, \Delta y, \Delta z)$

5S
5S
5S

Motion times
Wakeup times

short time

long time

Digital Signal

Analog Signal

ADC

raster

LED   Photodiode

Vessel

07:00 ~08:00
00:00 - 01:00
23:00 - 00:00

long time

real time

Heart rate
Respiratory rate

Sleep time
RAM rate
Deep Sleep rate

GUI

UI Design

22:30
Thursday, May 12

Lock Screen

22:30
Settings   Sleep Tacker   Connecting

Home Screen

67bps / 99%

Function Screen

Sleep Quality

vital signs

respiration | heart rate | HRV

sleep structure

sleep time | RAM rate | deep sleep rate

sleep behavior

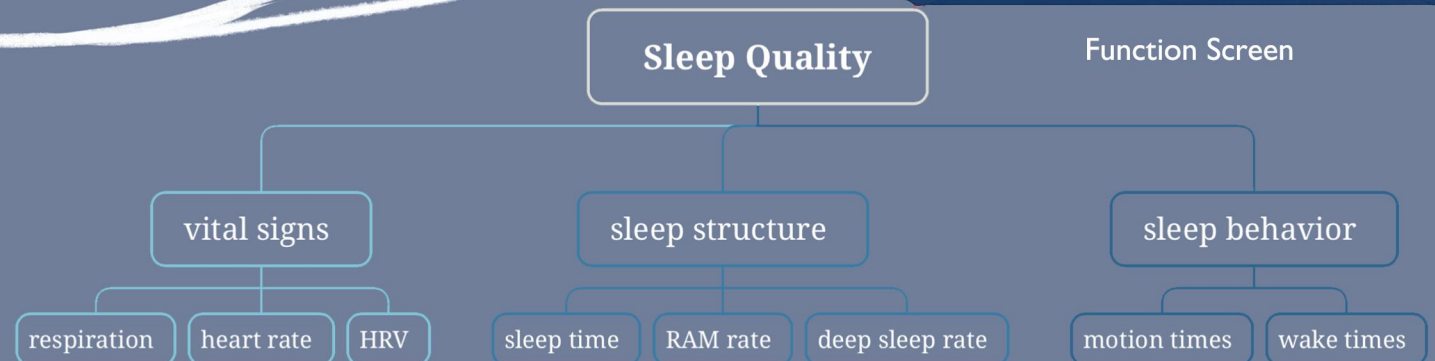motion times | wake times

04

MedAR

An Interactive System for Preoperative
Planning Based on Augmented Reality

Individual Project / Bechelor Thesis

12 Months

BACKGROUND

Preoperative planning enables surgeons to obtain the information of the targeted area and its surrounding tissue before surgery, make a precise surgical plan, and improve the efficiency of surgery. Computer-aided medical image analysis softwares such as 3D Slicer allow users to observe reconstructed 3D images more clearly and intuitively.

However, 2D interface limits the interaction, which leads to low interaction efficiency. The emergence of augmented reality (AR) technology realizes manipulating 3D data in 3D space, so as to further improve the efficiency of observation and operation. As one of display devices of augmented reality, head-mounted displays such as HoloLens 2 can greatly improve users' perception ability and interactive initiative.

Aiming at improving the efficiency and accuracy of preoperative planning and taking the glioma resection as one of application cases, we proposed and achieved
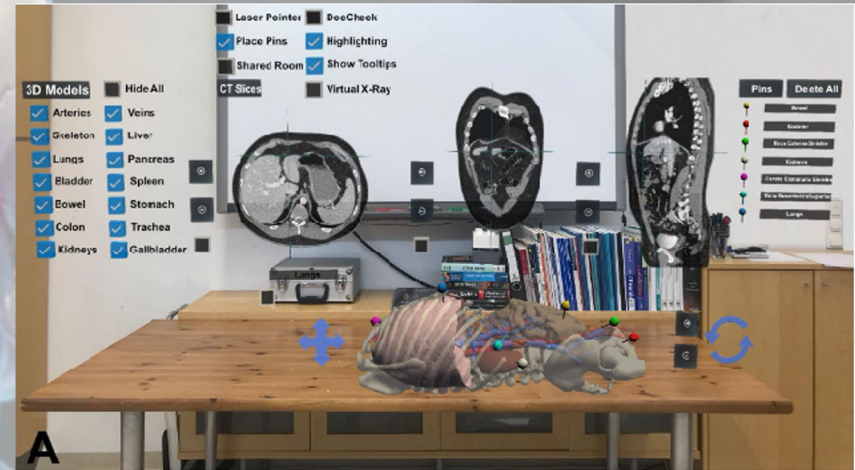
1) High precision multi-face interaction tool based on infrared passive fiducial markers,

2) Collaborative and interactive methods of preoperative planning based on multi-modal preoperative images

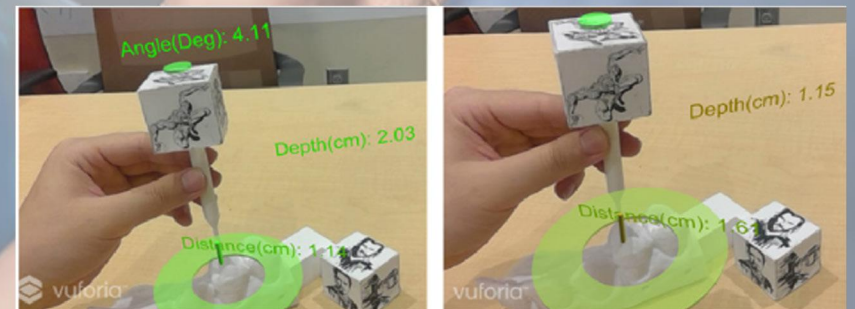3) Collaborative preoperative planning system in augmented reality.
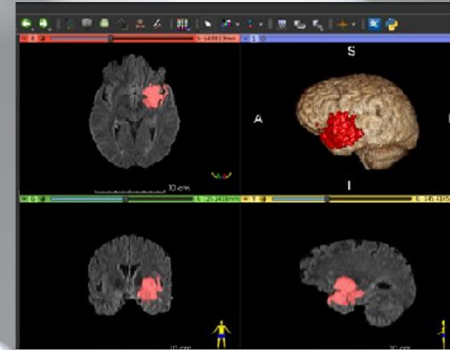
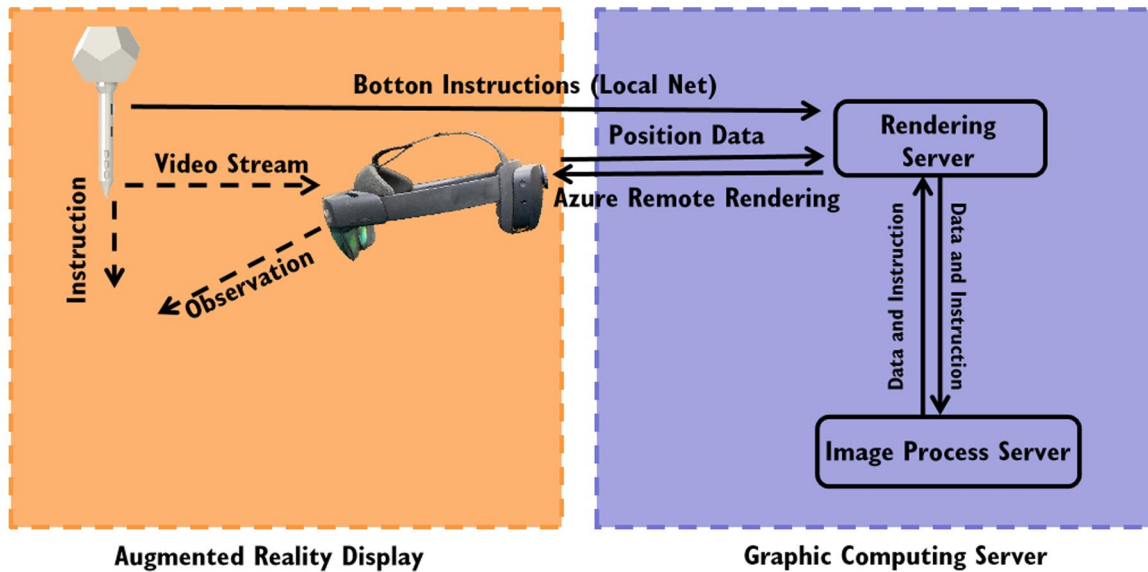
2D Computer-Aided Software
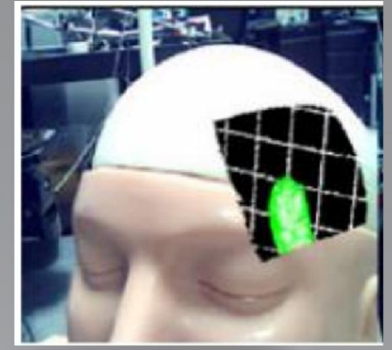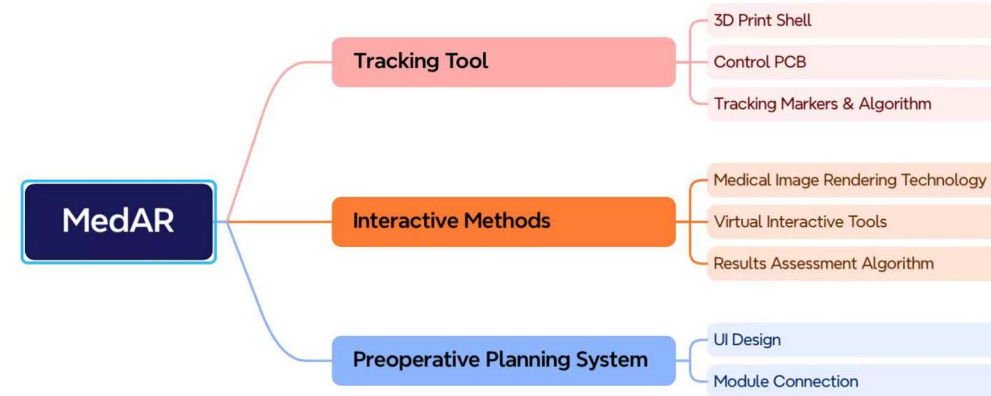

AR for Preoperative Planning

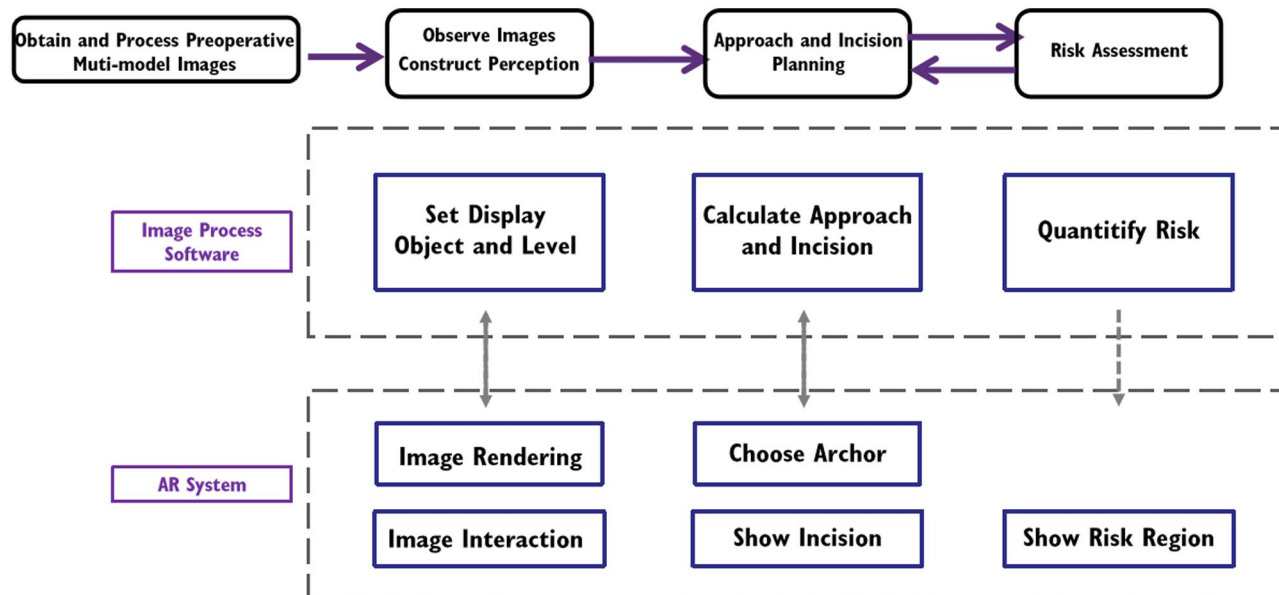AR for Medical Education

AR Tracking Tool

SYSTEM DESIGN & PROCESS

System Structure

Botton Instructions (Local Net)

Position Data

Video Stream

Azure Remote Rendering

Instruction

Observation

Rendering Server

Data and Instruction

Data and Instruction

Image Process Server

Augmented Reality Display

Graphic Computing Server

Mind Map

MedAR

- **Tracking Tool**
  - 3D Print Shell
  - Control PCB
  - Tracking Markers & Algorithm
- **Interactive Methods**
  - Medical Image Rendering Technology
  - Virtual Interactive Tools
  - Results Assessment Algorithm
- **Preoperative Planning System**
  - UI Design
  - Module Connection

Work Flow

Obtain and Process Preoperative Muti-model Images → Observe Images Construct Perception → Approach and Incision Planning → Risk Assessment

Image Process Software
- Set Display Object and Level
- Calculate Approach and Incision
- Quantitify Risk

AR System
- Image Rendering
- Choose Archor
- Image Interaction
- Show Incision
- Show Risk Region

System Prototype

Interactive Tool

SYSTEM DESIGN & PROCESS

Interactive Tool Design

- Tail Marker
- Type-C Interface
- Power Switch
- Button

Tracking Algorithm

| Camera Internal Parameter Calibration | → | Get Depth Sensor Data in Real Time | → | Marker Extraction | → | Mark Point 3D Reconstruction And Feature Extraction | → | Complex Marker Global Definition Generation | → | Tool Tip Coordinates via TCP Calibration |

Data Preparation

Marker Detection

Tool Definition

| Quick Search and Locate Tool Pose and Tip Position | → | Tip Filtering | → | Project into Virtual Space |

Tool Tracking

Interactive Methods

103.6 mm

Result Assessment

High Risk

Low Risk