48727 Fall 2024 Final Project Proposal

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**SenseBridge: Enhancing Hybrid Communication Through Motion-Aware Interaction**

## ****Preface****

探索human as a agent 在建成空间中的移动（Invisible Data）所代表的情绪，并进一步探索这个情绪的表达方式和价值，意于促进hybrid (physical & virtual world) 交流的效率和深度, exploring the approach method thought tech,

The key of body motion 是有ubi comp的concept在seamessly link btwn virtual & physical

This project builds on the foundational ideas explored in Assignment A6: Hybrid Bodies, which considers the integration of virtual information into daily life through thoughtful design approaches.

By extending the concepts of viewing hybrid as the future 常态 of daily life, the project focuses on reimagining how users engage with and approach information in virtual environments, including the medium/method, the timing of read, and where it was it. (Reference: [2] Proof the “actualness” of virtual world:

*“If virtualization were nothing more than the transition from a realitxcy to a col­ lection of possibles, it would be derealizing. But it im­ plies as great a sense of irreversibility in its effects, indeterminacy in its processes, and creativity in its striv­ing, as actualization.”*

*“Virtualization is one of the princi­pal vectors in the creation of reality.”*

)

Why is (the exploration of 研究hybrid approach) matters? >>>

This project critiques and expands the hybrid lifestyle—remote and in-person interactions—with a specific focus on emotional communication. The goal is to design and demonstrate an XR-based messaging system that transmits and interprets non-verbal emotional cues through motion data, connecting human users seamlessly across physical and virtual spaces. (Reference: [1] Excessive information: the most 还原/accurate data or information is not always good. The important is the accuracy of the sender intention of sending message.

[2] The virtual message is definitely at another time or space scale that is not necessary to (I mean it can be, but it’s free from the physical scale)

“Taking a profoundly actual constraint (time and place) and making it a contingent variable clearly in¬ volves the creation of an effective solution to a prob¬ lematic and thus of virtualization in the sense in which we defined it earlier. It was therefore to be expected that deterritorialization, the escape from the "here" and "now " and "that," would be encountered as one of the royal roads to virtualization.”

“In analogous fashion, different systems of record­ ing and transmission (oral traditions, writing, audiovi­ sual recording, digital networks) construct different rhythms, velocities, and historical qualities. Each new mechanism, each technosocial "m achine" adds a space-time, a special cartography, a singular music, to a kind of elastic and complicated system in which ex­ panses are covered over, deformed, and interconnect­ ed, in which temporalities interact, respond, or are contrasted to one another.”

“Yet the process of virtualization has caused them to follow a tangent. They intersect classical space-time intermittently, escaping its "realist" clichés: ubiquity, simultaneity, massively parallel or distributed systems. Virtualization comes as a shock to the traditional nar¬rative, incorporating temporal unity without spatial unity” (Lévy, 1998, p. 31) )

The product supported by ideas from cybernetics (Assignment A5) and tangible interaction (Assignment A4), which helping bridging the divide through human-centered interaction and advanced technical systems. To complete the design of systems that fluidly connect the physical and virtual worlds.

## ****Concept and Central Questions****

From the preface I mentioned above, I can say that virtual is not only a copy from real-life data, *"the transition from a reality to a collection of possibles."* Instead, it creates new realities by introducing *"irreversibility in its effects, indeterminacy in its processes, and creativity in its striving"*. This project engages this transformative potential by asking:

1. **What is a "good" system for interacting with the virtual world? (Thoughts)**
2. **How can non-verbal, emotional cues be effectively communicated in virtual environments? (Thoughts)**

**What role does motion data play in bridging physical and virtual worlds?**

These questions aim to explore the balance between human-centric design and the technical complexity required for meaningful virtual-physical interaction. Drawing from Lévy’s insights, the work emphasizes the "dialectic between the virtual and the actual" (p. 27), aiming to create systems that enhance human connection while preserving the authenticity of physical presence.

Focus: 亲密关系

## ****Theoretical and Conceptual Framework****

#### **Virtualization as a Creative Force**

Lévy argues that virtualization "fluidizes existing distinctions, augments the degrees of freedom involved, and hollows out a compelling vacuum" (p. 29). This project embodies this principle by breaking traditional barriers in communication. Instead of relying on text or video, it explores motion as a universal, non-verbal language.

#### **The Medium is the Message**

Inspired by Marshall McLuhan’s "the medium is the message," this project investigates how the medium of body motion shapes emotional communication. McLuhan’s idea that "the media with which we interact exert a greater influence on us than the messages contained in the media" (A6-2.pdf) is central to designing a system that prioritizes the medium (motion data) over traditional messages.

#### **Hybrid Spaces and Tangible Interaction**

The system aligns with the hybrid living model described in the course, where "the member of the conventional corporation travels from the private space of his home to the public space of the workplace. In contrast, the telecommuter transforms his private space into a public space and vice versa" (Lévy, p. 35). This duality is reflected in the project’s ability to blend physical gestures into virtual spaces, enabling richer interactions in remote or hybrid settings.

## ****Prototype Description****

The prototype extends ideas from Assignment A6-2, "3D Messenger, the sticky notes” the sender can write a 3D message and pick a location and pose for the receiver. In this enhanced version, the message is enriched with emotional data derived from motion, creating a more immersive experience.

The project involves designing and prototyping a system that captures, analyzes, and visualizes emotional states through motion data. It achieves this by incorporating three critical components:

#### **System Workflow & Features**

The workflow basically is input – understanding data – output.

1. **Input: Data Capture**

Motion data is recorded using normal webcam or kinect to track non-verbal cues, subtle or intentional, such as posture, walking speed for status, and hand gestures. These inputs are encoded into meaningful emotional states using classification algorithms.

The sender is aware of non-verbal signs given by the receiver such as their posture and walking speed. Such information gives clues into the state of the recipient.

(Research support: [5] Research shows that behaviour can reflect one’s working status.

*Sarver, D.E., Rapport, M.D., Kofler, M.J., et al. (2015). Journal of Abnormal Child Psychology, 43, 1219–1232A*)

1. **Processing, semantic understanding : Encode & Decode**

Semantic understanding tools/ program (e.g., if-else statement or TensorFlow, PyTorch) allow the system to analyse and generalize and reconstruct data across users and contexts. (Reference)" Algorithms classify motion patterns into emotions (e.g., happiness, frustration).

* Collect diff dynamic motion or pose pattern, reflect/map them to status

Example: walking speed, frequenzy/timeframe of moving/sitting that reflecting the mood of a person.

* Train based on labelled data
* Test & evaluate accurancy

1. **Output: Visualization and Interaction**

Enhanced Sensory Feedback. The users’ data is translated/map into animations or visual effects, colors, or 3D models in a virtual environment. Haptic feedback or audio cues enhance the sensory experience, allowing users to perceive emotional nuances. (Reference)

Cross-Domain Interaction: Integration of virtual and physical gestures for hybrid scenarios.

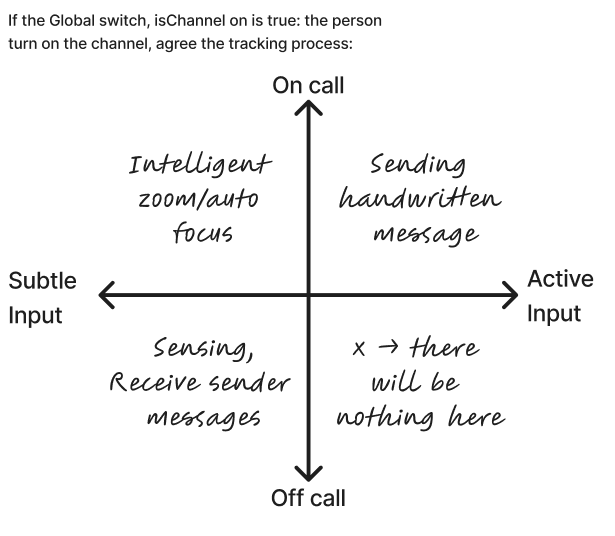
* Way to send noti -> not like spoonfeed but hint unusual

### Plan to work on:

This project taking close relationship in hybrid world as example. It’s a very common relationship in the hybrid world nowadays, long distance close relationship between friends, family or partners,

There are 2 parts for this project. The onCall part using normal webcam and the offCall part use Kinect just tracking the body motion.

I am mapping all the feature into 4 groups by 2 scale (onCall/offCall, subtle Input/ intentional Input)



The 3d messenger, virtual sticky notes, are excploring the “delayed time”

And for the video call enhancer, is exploring the “real-time”

Both key are 探索无/有意识body motion 作为激活input 和virtual world（包括the exact person in the virtual world）进行交流。

Body motion是 ubiComp的concept的一部分，意在于在seamessly link btwn virtual & physical 探索human as a agent 在建成空间中的移动（Invisible Data）所代表的情绪，并进一步探索这个情绪的表达方式和价值，意于促进hybrid (physical & virtual world) 交流的效率和深度

* 3d messenger, virtual sticky notes:

This program allows sender draw/write pattern in the air, by tracking the handtrail in the air, program recorded the handtrail as 3d model message. Then the sender will set the message to a specific receriver “location” & “pose”.   
The program will remember the location, pose and attached the 3d message to the location & pose, and parse the message, give an animation effect to the 3d message.  
When the receiver reach the location and match with the pose, the 3d message will appear as a projection witht the animation (let’s say maybe we are using smart glass etc. If not then on phone interface etc.

Besides, the 3d message also allow the sneder interact with the space of the receiver through a virtual space interface as reference.

What I would like to achieve is the 模拟of “sticky notes” in real life and 探讨 the non-real time message. For example, exactly if someone attach a sticky notes on fridge, you can only seen and found ir when you standed infront of the fridge. Eventho the tech now is able to do real-time but as we mentioned infront, virtual world has diff time zone with physical and the article “too much information” more information and actual data is not the actual 感情the sender might want to send/express.

* Sensing:

This program is based on Kinect too, research shown body motion is able to 表达status of a person. 通过tracking the motion of users, in this program like speed, 侧面表达今天user的状态  
  
The above part is done in the previous A6-2 assignment, and the below part is 补全了我的想法和概念。

The below part is the onCall & subtle motion input system.

* video call enhancer feature:

Build a program, using a framework that can manipulate in python, adapt with webcam recognize the face pose/feature.

The purpose, build a video call plugin program using body motion data as hint, 模拟真实和人面对面的感觉，bridge the virtual & physical world 交流，提升hybrid lifestyle体验。

There are video from webcam and background music.

If faceDetected:

If isTalking:

Bgm = setToLow

Else:

Bgm = setToNormal

If num of face == 1:

if the distance <thresholdHi:

Not zooming in or out normal,

elif the thresholdLo < distance < thresholdHi, and isTalking:

zoom following the face

elif distance < thresholdLo

If fistDetected:

isManualZoom==true

Zoom(toface)++ until max, then zoom—until min and repeat zoom++…

If fistDected is False:

Stop zoom at the currZoom according to the sliding

If num of face > 1:

If on eof the face is talking:

Zoom to the person talking

Else:

Not zooming at all

## ****Impact****

#### **Evaluation Metrics**

1. **Accuracy:** How well the system interprets and communicates emotions.
2. **Usability:** User feedback on interaction intuitiveness and emotional clarity.
3. **Immersion:** The extent to which users feel present and connected.

#### **Critical Potential**

The project challenges traditional communication methods by leveraging XR to create meaningful connections. It underscores the power of virtualization to "intersect classical space-time intermittently, escaping its 'realist' clichés" (Lévy, p. 31).

For futher development, It could be 扩大to other area such as functional usage, for example the usage of video call meetings, industrial hybrid co working scenario etc. The key here is taking the filtered body motion as the subtle clue, pass into the “parse program” in order to完成更加贴近真实且accurate的hybrid 信息交换。

## ****Conclusion****

This project explores how XR systems can humanize virtual communication through non-verbal, motion-based messaging. Rooted in concepts of virtualization, hybrid living, and tangible interaction, it demonstrates the transformative potential of computational design to bridge the gap between physical and virtual worlds. As a technical artifact, it aspires to redefine how we experience and interpret emotional connections in an increasingly digital era.

Reference

1. <https://www.e-flux.com/architecture/intelligence/310403/too-much-information/>
2. Becoming virtual: reality in digital age, Lévy, 1998.
3. The Medium is the Message
4. Critical Multimedia
5. The Computer for the 21st Century, Mark Weiser.