

SoEs: Attachable Augmented Haptic on Gaming Controller for Immersive Interaction

Yang-Sheng Chen*
Chiao-En Hsieh*

Ping-Hsuan Han*
Kuan-Yin Lu*

Jui-Chun Hsiao*
Chien-Hsing Chou†

Kong-Chang Lee‡
Yi-Ping Hung*

*National Taiwan University

† Tamkang University

{yeti0193275, pinghsuan.han}@gmail.com

hung@csie.ntu.edu.tw

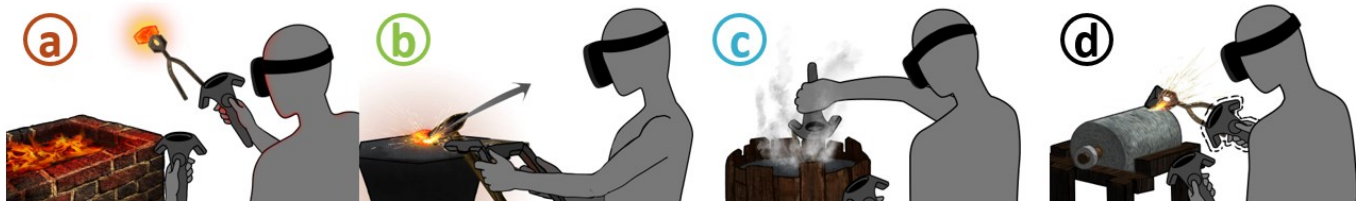


Figure 1. Scenarios of multisensory interactive gameplay through immersive gaming controller

ABSTRACT

We present SoEs (Sword of Elements), an attachable augmented haptic device for enhancing gaming controller in the immersive first-person game. Generally, Player can easily receive visual and auditory feedback through head-mounted displays (HMD) and headphones from first-person perspective in virtual world. However, the tactile feedback is less than those feedbacks in immersive environment. Although gaming controller, i.e. VIVE or Oculus controller, can provide tactile feedback by some vibration sensors, the haptic feedback is more complicated and various, it includes kinesthesia and cutaneous feedback. Our key idea is to provide a low-cost approach to simulate the haptic feedback of player manipulation in the immersive environment such as striking while the iron is hot which the player could feel the heat and reaction force. Eventually, the game makers could utilize the attachable device into their games for providing haptic feedback.

Author Keywords

Augmented Haptic; Haptic Feedback; Immersive Game; Game Controller; Virtual Reality.

INTRODUCTION

Virtual Reality (VR) is an emerging field due to its powerful immersive feeling. To enhance the player experience in immersive game in the state of art, haptic feedback is one of the key feedback.

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To provide a various and low-cost haptic feedback device for game makers, many works have influenced our prototyping. Birdly [1] creates a vivid full-body experience of flying by using a motion platform and a wind-feedback system. Like most of motion platform, they could provide a whole body haptic experience, but the device is expensive. Haptic Turk [2] is another kind of motion platform based on few people, which do not have any cost for machinery, but it could provide similar experiences of haptic feedback. Although these approach have been successful at whole body haptic experience, however, they are not suitable for recreating the touch-related experience.

Therefore, prop-based feedback system could consider another usage. Annexing Reality [3] and Haptic Retargeting [4] provide a prop-based feedback for virtual object. Both design only provide a static tangible interface for user which use real physical object to simulate the tactile sensation of the virtual object. Additionally, OoEs [5] uses an orb-form feedback system which could provide four kinds of active tactile sensation to simulate nature element in the immersive game. Those works make prop-based approaches very stationary and not universally usable. TurkDeck [6] have shown another potential approach by scaling prop-based virtual reality through physical labor. This make prop-based tactile sensation more useful, which it is fun and interesting that having a group of people for doing this. Lopes et al. [7] proposed Impacto which uses a wearable device to simulate the physical impact by combing tactile stimulation with electrical muscle stimulation. Po2 [8] uses gloves to provide an illusion tactile feedback between hands. Although both wearable devices can provide augmented haptic in the immersive virtual reality, player has to wear something which is not usually wear it.

In this work, we present an attachable augmented haptic device for enhancing gaming controller, which is usually included in a HMD set.

IMPLEMENTATION

The hardware design of SoEs is shown on Figure 2. The concept of the device is to design an attachable case for an immersive gaming controller, which is wireless and provide the position tracking of the controller. Therefore, in this implementation, we choice Vive to be our HMD sets, because they already include a gaming controller with position tracking. For combining both multiple haptic feedback and remote-controlled function, SoEs mainly consists of four parts of hardware modules on an attachable case: (1) Arduino Nano, (2) multiple tactile modules, (3) Bluetooth and (4) 12V Battery. Beside the build-in vibration sensor in Vive controller, for providing a multisensory interactive gameplay, we combine other three modules (Figure 2). So, the player can receive the related haptic when they playing in the immersive game through four kinds of tactile sensation. To integrate all of the details described above, we use Unity 5 to be our game engine.

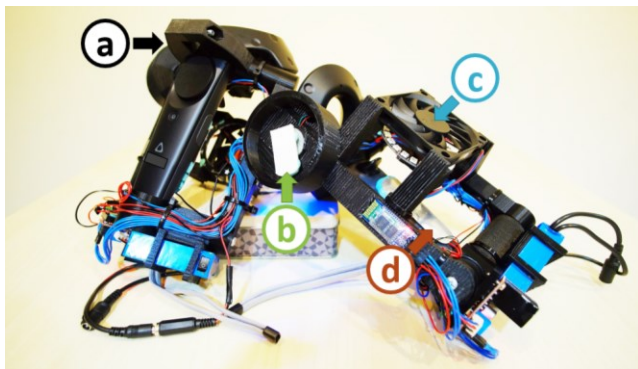


Figure 2. Hardware Design of SoEs: (a) an attachable case on gaming controller, (b) motor module, (c) electronic fan module and (d) thermal module.

APPLICATIONS: IMMERSIVE ADVENTURE GAME

To demonstrate our device, we develop an immersive virtual reality game with augmented haptic, which we called “The ancient maker”. This game scene mainly uses “The Blacksmith: Environment [9]” unitypackage, which is a 3D model of environment. In our game, player is a defender who need to make arrowheads and shoot the arrow to defend the intruder, therefore, we design two phases for player to experience the immersive interaction with augmented haptic: (1) Making arrowheads and (2) Shooting the intruder. In the first phase, we simulate the process of making arrow step by step. Player will receive variant combination of haptic feedback in the process such as heating pieces of wrought iron into the furnace which could feel the heat from the iron, striking while the iron is hot which could feel the heat and reaction force, quenching the

iron into a water sink which could feel the vapour from the water sink, and polishing the iron on the grinding wheel which could feel the vibration and the continues of reaction force. In the second phase, we design two action for player. When player pulling an arrow back on his longbow, he could receive the continues of reaction force. Then, when player releasing the arrow from his hand, he could receive a small wind caused by the arrow flying to the target.

DISCUSSION AND FUTURE WORK

In this work, we provide an attachable solution to enhance the player experience in the immersive game with augmented haptic. Through attaching SoEs on the gaming controllers, player can receive wind, thermal and centrifugal force feedback additionally. Furthermore, applying the concept presented in this work also could be used in other interactive gameplay. Our future work will gather the user feedback to inform researchers, game makers and practitioners the playful uses of this technology.

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