ShadowRine: Accessible Game for Blind Users, and Accessible Action RPG for Visually Impaired Gamers

Masaki Matsuo
Dept. of Computer Science
Tsukuba University of Technology
Tsukuba, Japan
mm122311@cc.k.tsukuba-tech.ac.jp

Takahiro Miura
Graduate School of Information Science and Technology
the University of Tokyo
Tokyo, Japan
miu@iog.u-tokyo.ac.jp

Masatsugu Sakajiri
Dept. of Computer Science
Tsukuba University of Technology
Tsukuba, Japan
sakajiri@g.tsukuba-tech.ac.jp

Junji Onishi
Dept. of Computer Science
Tsukuba University of Technology
Tsukuba, Japan
ohnishi@g.tsukuba-tech.ac.jp

Tsukasa Ono
Dept. of Computer Science
Tsukuba University of Technology
Tsukuba, Japan 305-8521
ono@cs.k.tsukuba-tech.ac.jp

Abstract—Though some games for visually impaired persons have been developed, most of games that use only auditory information present challenges for sighted persons. Moreover, unfortunately, it is still difficult for visually impaired persons to play the same game with sighted persons and for sighted and visually impaired persons to share a common subject. Thus, we developed a barrier-free game that both sighted and visually impaired persons can play using their dominant senses including visual, auditory and tactile senses.

Index Terms—Visually impaired persons; inclusive game, 2D representation; tactile map; integrated game development environment for the blind

I. INTRODUCTION

Computer games are becoming increasingly diversified; they are popular in a variety of formats, such as commercial arcade games, home console games, and personal computer games. It is impossible for the blind persons to visually recognize screen displays or to play any game at a satisfactory level. Sighted persons are able to visually recognize information displayed onscreen that indicates the status of the game, such as maps or text. Totally blind persons must instead rely primarily on auditory information to discern what is occurring on screen. These circumstances made it necessary for the author to devise means for understanding the status of a game by associating the sound effects and background music with game status or by memorizing the sequential arrangements and hierarchical structures of menus. Furthermore, the author required the collaboration of sighted friends to play games that contained scenes where progress was not possible without obtaining visual information.

However, there has also been progress in developing games intended for visually impaired persons. A report covering games that can be played by visually impaired persons, on their own or with assistance of others, was featured by the website AudioGames.net [1]. This website is a collection of information on games for the visually impaired. These games are called audio games, which the visually impaired can play using a screen reader. However, audio games are challenging for those with even normal vision to play, and these games offer more options to choose from. The issue is there are barely any games that the visually impaired and people with normal vision can play together.

According to several studies of game accessibility for the visually impaired, Yuan et al. reported on audio games and other types of games [2]. Game accessibility is a growing interest that can be reexamined by other researchers as well. Meisenberger et al. reported on the accessibility and interface requirements necessary for each type of disability [3]. Porter et al. interviewed game developers and game players with disabilities for a survey on game accessibility. The survey results shed a light on issues that occurred while playing games as well as game industry issues related to cost [4]. Zahand presented accessibility requirements for game developers from the standpoint of business values and game design [5].

In this paper, we have developed an action RPG (role-playing game) that players with healthy vision, and those who are visually impaired, can play together. In addition, we created a tool that allows the visually impaired to easily create fields on their own.

II. MATERIALS AND METHODS

A. Audible Mapper: A Map Creation Tool

Audible Mapper is a field creation tool with accessibility for the fully blind. The screen reader provides audio information on cursor locations, allowing the user to design 2D fields by
typing on a keyboard. This tool conveys the position of the cursor on the screen and two-dimensional fields are drafted through keyboard operations. The conditions under which a totally blind person drafts a map using this map editor is described in Figure 1. First, the map is surrounded on four sides by a wall (Figure 1 (Left)); then the walls are arranged according to the image of the map to be drawn (Figure 1 (Center)); and finally objects, such as treasures, are positioned (Figure 1 (Right)). For the developer to know the cursor location at each point in time, the editor plays different sounds based on the cursor location. The horizontal direction of the cursor is expressed by asymmetry in the sound pressure; thus, the developer can find the lateral coordinate on the screen through sound image localization. Different sound pressures indicate the vertical direction of the cursor, allowing the developer to find the vertical coordinate on the screen. The developer can move the cursor over the map to get an entire picture of the screen with the sound effects. Regarding the changes in sound pressure when the cursor positions change, the lateral differences in the sound pressure are set at 2 dB and above. The vertical differences are set at 1 db and above. The editor also generates sound effects for each of the tiles that the developer places.

B. ShadowRine: An Action RPG

Fig.2 shows overview of our developed game. This game is an action RPG game for those with regular vision as well as those with visual impairments to play on their own. The game is played in the Windows operating system and is programmed to command DirectX for multimedia processing.

Game players with normal vision can play ShadowRine just like a regular action RPG by visually following what occurs on screen. The visually impaired, on the other hand, can play the game by receiving information through auditory and tactile information. Just like the Audible Mapper, lateral differences in sound pressure express the horizontal coordinates, and changes in sound pressure represent the vertical coordinates, enabling the gamer to acquire screen information.

III. CONCLUSION

We developed both the Audible Mapper as a game development tool and action RPG, ShadowRine. This game allows gamers with visual impairments and those with normal vision to play together. We plan to further our research in ways for the visually impaired and those with normal vision to game together.

ACKNOWLEDGEMENTS

This work was partially supported by JSPS KAKENHI Grant Numbers 26285210, 15K04540, 15K01015 and 15K16394.

REFERENCES