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Simulation Robot for the Expression of the Emotion Extracted from SMS Message

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Abstract – A simulation robot was developed that can express the emotional element extracted from mobile SMS(Short Message service) sentence. The emotional element was extracted based on the emotion classification system which was developed based on the characteristics of Korean emotional language. As human emotion is expressed by the countenance, the voice, the gesture and so on, the simulation robot was developed to be able to represent countenance, sound, and gesture to express emotion extracted from SMS. In this study the structure of robot hardware and the expression method of various kinds of emotions effectively, by the countenance, the voice and the gesture, are suggested.

Keywords**:** Robot simulator, Emotion simulation, Emotion expression, Arduino.

1. Introduction

Recently, various kinds of humane robots are developed which express emotions. Usually, for the robotic expression of emotion, countenance, voice, and gesture are used, as human emotion is expressed by them. Facial movement are used for the expression as shown Park et al(2009), Sosnowski et al(2006) and Usui et al (2008).

The developed robot can represent countenance, sound and gesture to express emotion extracted from SMS. Emotion classification system by Choi et al (2013) was used for the emotion extraction and expression of the extracted emotion. In this paper, the structure of the simulation robot hardware is suggested and the method is also suggested to express various kinds of emotion by the countenance, the voice, and the gesture synthetically.

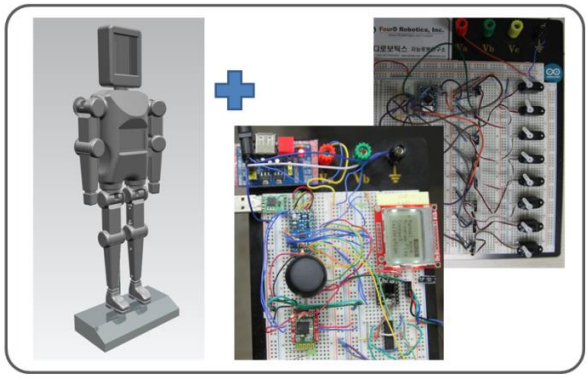


Fig. 1. Emotion simulation robot.

2 . Structure of the Emotion Simulation Robot

Human emotions can be expressed by countenance, voice, and gesture. The robot is able to simulate those expressions. The height of the simulator robot was 300mm and the robot simulator was composed of 12 DOF for a gesture. A LCD was emplaced on the robot head for a facial expression

2. 1. Facial Expression

For a facial expression, various kinds of method are used such as low resolution expression using LED, multi degree of freedom face with the real facial muscle structure and so on. In this study, the image of face and short video file was used to express emotion

In order to effectively display an image by using a small LCD or OLED, an appropriate resolution and process should be applied because of the system delay time. In this study, considering such points, 1.8 inch color TFT LCD was used for the display.

Various kinds of face images were stored as bmp files in the SD card. The simulator controller reads and displays the appropriate file to express the extracted emotion as a facial expression. The resolution of the image file was 128X160

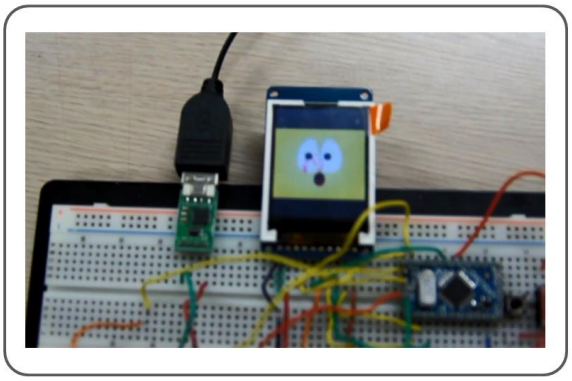


Fig. 2. A face image file examples.

2. 2. Voice Expression

Audio files were recorded by voice actors depending on the scenario based on the emotion classification system. According to the extracted emotion, appropriate audio file is played by the audio player. Voice data can be varied even on a emotion, so we built a reasonable database that can be applied in most normal cases.

ISD 4003 chip was used for Speech Audio circuit which is compatible to the control system based on Arduino board.

Audio files were also stored in the SD card as a compressed mp3 file format such as Fig. 3.

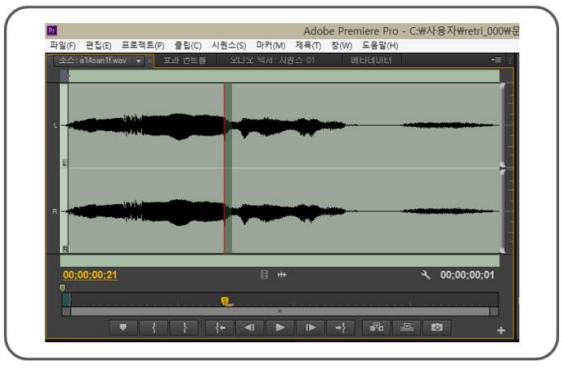


Fig. 3. Korean voice file examples.

2. 3. Body Expression

In order to simulate the emotion behavior, 12 DOF humanoid was developed.

For the joint control, small sized servo motor was used which was controlled by of ATmega328 Microcontroller Arduino board (Arduino Nano).

To control 12 motors, efficient protocol, shown in Fig. 4, was made and used for fast and accurate control of the angle of each motor.

* Single motor control protocol

STX	CMD CODE	DATA LEN	DATA[]		ETX
			POSITION [1byte]	Tula selection [1byte]	
>	20	02	0 ~ A	1 ~ 8	C/R
>	20	02	F[STOP]	1 ~ 8	C/R
<	20	00	-	-	C/R

Type : >2002A8\r [Host → Driver]
<2000\r [Driver → Host]

* Multi motor control protocol

STX	CMD CODE	DATA LEN	DATA[]	ETX
			POSITION [8byte]	
>	30	08	XX XX XX XX	C/R
>	30	01	F[STOP]	C/R
<	30	00	-	C/R

Type : >3008000088AA\r [Host → Driver]
<3000\r [Driver → Host]

Fig. 4. Body motion protocol for motor control.

12 DOF humanoid robot body, such as Fig. 5., was designed, manufactured and assembled

NX 8 (Simens), three dimensional program, was used for the design of humanoid body and parts appropriate for the emotion expression based on the concept design sketch.

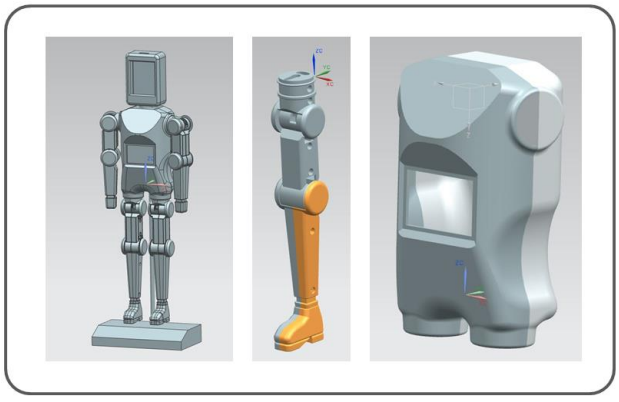


Fig. 5. 3 Dimensions CAD design by NX 8.

Fifty five parts were designed for humanoid. And for the manufacturing by NC machine, G-Code file was drawn up using Power-MILL pro 9.0 (Delcam plc).

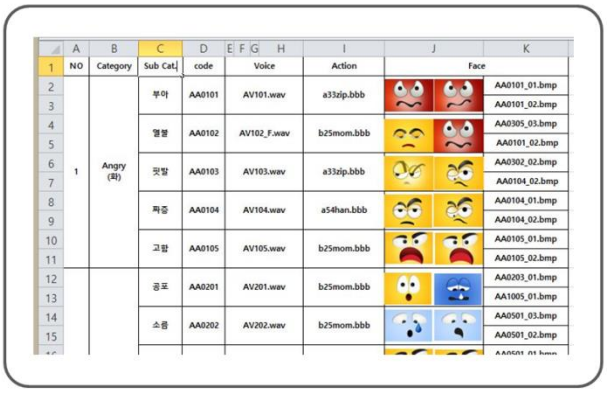
NC Machine DAVID 3025 and MACH 3 (Artsoft) were used for the processing robot parts using G-Code program

3. Building a Database for the Emotion Expression

A database was built and used for the expression of the emotion extracted from SMS message through the face display, voice and gesture of the robot simulator

The data Base is composed of image data for facial expression, voice data for audio expression, and motion command data for robot gesture. Each data was built on the basis of the emotion classification system and user attributes, sex and age

The emotion classification system consists of 3 phases, main category, middle category and detail category, for the more natural expression. The main category is classified into 8 emotions such as anger, fear, hate, love, sadness, joy, shame and tension



NO	Category	Sub Cat	code	Voice	Action	Face
1	Angry (화)	투아	AA0101	AV101.wav	a33zip.bbb	AA0101_01.bmp AA0101_02.bmp
		열불	AA0102	AV102_F.wav	b25mom.bbb	AA0305_03.bmp AA0101_02.bmp
		끗발	AA0103	AV103.wav	a33zip.bbb	AA0302_02.bmp AA0104_02.bmp
		짜증	AA0104	AV104.wav	a54han.bbb	AA0104_01.bmp AA0104_02.bmp
		고함	AA0105	AV105.wav	b25mom.bbb	AA0105_01.bmp AA0105_02.bmp
		공포	AA0201	AV201.wav	b25mom.bbb	AA0203_01.bmp AA1005_01.bmp
		소름	AA0202	AV202.wav	b25mom.bbb	AA0501_03.bmp AA0501_02.bmp

Fig. 6. Emotion DB example.

4. Conclusion

It is not easy for the robot to express emotion appropriate to the extracted emotion.

In this study, a humanoid type emotion simulator was suggested. The simulator suggested in this study can be effectively used for finding out proper expression for a emotion. The expression can be compiled easily in a DB according to the emotion classification system. Countenance, voice and gesture data can be compiled using developed robot simulator. In particular, for the construction of the motion data base, proper motor speed and behavior patterns are formed easily.

Acknowledgements

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