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Studying the Impact of Emotional Tactile Icons on Mobile Communication

Rıza Ilhan [1*], Mustafa Alper Karatepe [2]

[1] Istanbul Aydin University, Engineering Faculty, Mechanical Engineering Department, 34295, Istanbul, Turkey

Abstract

With the increasing factors of stress in workplaces, migration for work opportunities, and loss of communication with family members or friends, people tend to isolate themselves, and due to the loneliness of the individual, negative factors tend to harm their own lives as well as their loved ones. In this study, an application is designed to stimulate human touch when pressed on specific points on their mobile device, therefore making physical contact with their loved one away from them. The application is designed as a nine-button array. When a button is pressed, a specific emotional effect is transferred to the other side using nine servo motors, creating patterns of vibration. The servo motors integrated into the mobile phone's back side, which could be easily held and handled. The effectiveness of the developed system was tested through a subjective evaluation. As a result, not only subject can distinguish emotional icons, but also can transfer their emotional thoughts to tactile icons.

Keywords: Haptic, Social Touch, Human-Machine interaction

1. Introduction

With the increasing factors of stress in workplaces, migration for work opportunities, and loss of communication with family members or friends, people tend to isolate themselves, and due to the loneliness of the individual negative factors tend to harm their own lives as well as their loved ones. It is studied that %33 of the world's population feels alone and has nothing with them materially as well as emotionally [1]. This problem is lowered by communicative devices such as computers and smartphones, but still, there are many cases of miscommunication and isolation. Due to these psychological factors, an application idea has been designed thanks to the advancement of virtual reality and haptic systems. With that information creating an application that uses haptic mimicry technology for social interaction when people communicate on their smartphones is devised.

A. What is Haptics

Haptic technology is a tactile feedback mechanism that sends touch, vibration, and motion responses using applied forces on the mechanism itself. The technology sends these signals via a virtual area that is able to control devices and applications that are around its vicinity using a mobile or remote device that is coded within the system. This allowed many corporations to use remotely controllable devices and advanced the virtual reality gears in research centers and in the gaming industry. Haptic technology facilitates the investigation of how the human sense of touch works by allowing the creation of controlled haptic virtual objects and made research on cutaneous, kinesthetic sensory systems [2]. The haptic devices use tactile feedback to apply pressure to their specific target to make the device turn on and do their task without the user being in the vicinity of the targeted device and instead of that a remote connection does the work in a controllable state.

B. Social Interaction Theory

Social interaction is a communication type that is examined in an area where two or more individuals are making verbal or visual cues to interact with one another. Examples of social touch can be given as handshakes in a social gathering with colleagues and bosses, hugs and kisses to family members for comfort and support, or patting a friend's shoulder for congratulating. Social touch is essential for our well-being as individuals, and for making good communication within the society [3].

C. Haptic Touch

Haptic touch is a new branch of haptic technology that mimics human social interactions and visualizes those mimicries the pressures and movements in virtual reality in order to manipulate the user of the device on if the person that is touching them is real or not. This type of interaction can be done either by a real person, in order to match their own responses with the haptic responses for the realism factor or by making a virtual person, and making a test area using a VR headset or other mechanisms to gather information from the subject and/or subjects with the illusionary person they are making communication with, in order to check the development of the technology. [4]

2. Methodology

The developed system was built using 18 servo motors and 2 Android-powered mobile phones that were using Bluetooth 2.0. Nine servo motor for each telephone were placed in to a casing and was stick in to the back side of the mobile phones using double side tape. Servo motors was covered with an elastic band. They were powered using pca9685 servo motor drivers. Two Bluetooth HC-05 and HC-06 modules were employed for communication. Two Arduino Uno board on each phone were used to control the servo motors and establish communication between two phones. Arduino board and its components placed in to a 3D printed casing and was stick to the phone. Nine tactile emotional such as love, anger, happy, Fear, etc. icons were developed in MIT App Inventor program. The developed system and its component are seen in Figure 1.

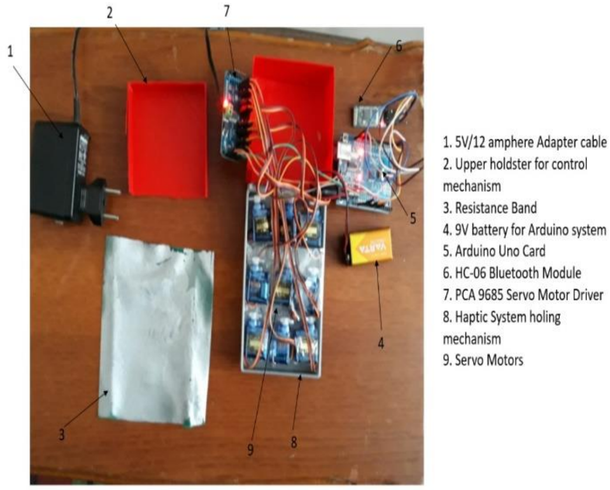

Figure 1 Shows mobile phone and the developed system components.

A. MIT App Inventor Application

The system consists of nine buttons, each linked to a servo motor that generates haptic pressure feedback on paired test phones. This feedback alerts users to button presses from the other side, with each button representing a specific human emotion as stated above.

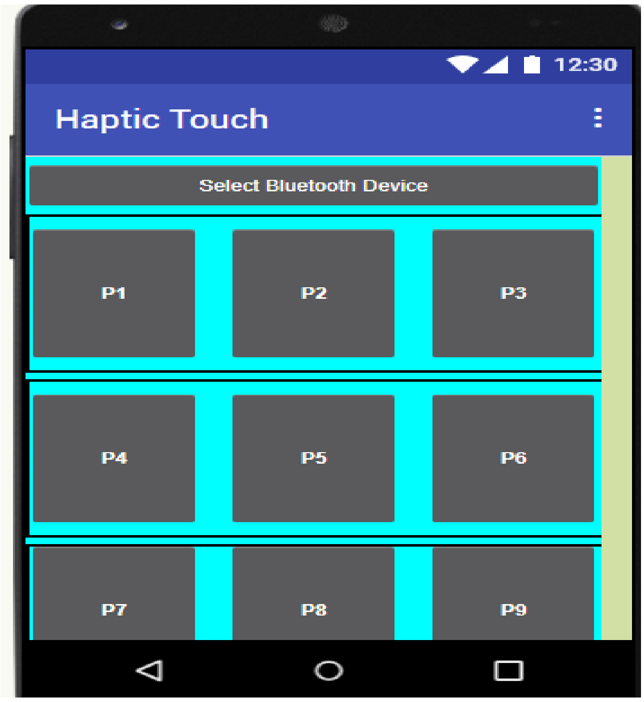

Figure 2 Displays the application's design in MIT App Inventor, featuring buttons numbered 1 to 9. Each button corresponds to a different emotion, allowing users (both transmitter and receiver) to exchange emotional signals, enhancing communication through tactile feedback.

Figure 3 Shows front side and backside configuration of the developed system.

3. Experimental evaluation

A. Experiment Overview

The experiment will take place in a controlled test room with two chairs positioned back-to-back, approximately 5-7 cm apart. Two participants will hold test phones in their dominant hands and follow a scripted telephone conversation while using the coded application. The study was supervised to ensure accuracy and provide guidance. Eight participants (four males and four females, aged 30-70) took part in the experiment. Initially, they followed a structured script with two response-type questions. Afterward, the conversation became more spontaneous, guided by the participants' emotions.

Following the tests, participants completed a 10-question survey to provide feedback on their experience. After completing the questionnaire, the experiment concluded, and participants received a predetermined reward for their time and participation.

B. Experiment Process

Subjects were given a script numbered from 1 to 9 randomly as is seen in figure 4. According to the established scenario they were required to input a diver’s emotion when coming to the empty line in the scenario. The other side were asked to note which icon has been pushed. The testers were randomly chosen customers of a given workplace and were not aware of the test.

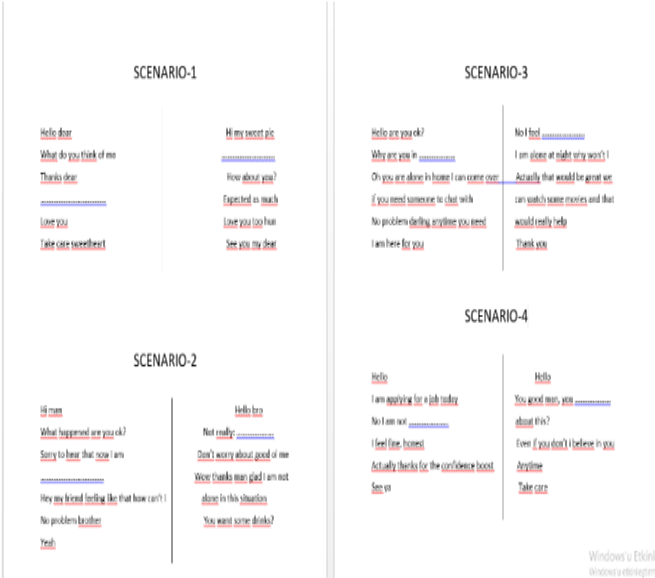

Figure 4 Some sample scenarios prepared for the experiment. In the empty sections people were asked to input an emotional icon and in the other side subject we required to recognize and note it.

Figure 5 The photo was taken when Scenario 4 was taking place. On the left, Tester 7, and on the right side, Tester 5 is taking commands while looking at the script in his hand and is focused on the application.

C. Experiment Results:

The results indicate that ease of use and time management are the strongest aspects of the application. Notably, despite differences in test phone models, no technical issues arose, ensuring that user feedback was based solely on personal experience rather than hardware compatibility. Accuracy received mixed feedback, primarily due to scenarios 3 and 4 not being successfully observed, leading to varied participant opinions on the system's reliability.

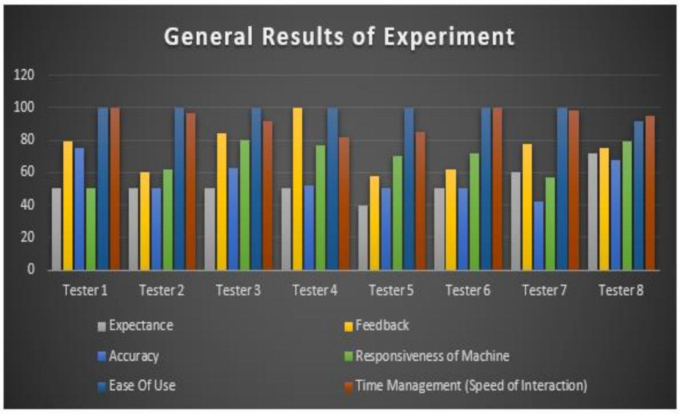

Figure 6 Shows average score received by each user evaluating the developed system from expectance, Accuracy, Ease of Use, Feedback, Responsiveness of Machine and, time management.

D. Error Correction

During the experiment, testers reported that the emotions "FEAR" and "INSECURE" did not respond properly, requiring system inspection. Upon closer examination, Button 3 was found to be functioning correctly, but its servo motor spinner was getting stuck near the edge of the filament sheath. This issue was resolved by shortening the spinner. The second issue was simpler to fix—on the smaller test phone, the servo motor's spinner had detached. After reattaching it, functionality was restored. Notably, the fourth command on the larger phone worked without issue, suggesting either user error or an unidentified obstacle.

4. Conclusion

With the experiments completed and results analyzed, it is evident that the program functions as intended. Setting aside the appearance of the mechanism, the main areas for improvement are accuracy and realism. The system successfully translates input commands into physical stimuli, aligning with the original concept. However, testers 3, 5, and 7 noted that the sensations felt more like generic electromechanical signals rather than a direct application-driven response. Despite these concerns, the majority of the experiment was successful. The project holds promise for future innovation, enhancing emotional and physical connectivity through technology, and bridging distances between people in meaningful ways.

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