Defense Attack: Gesture Recognition Smart Watch

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Abstract— Gesture based interaction is gaining attention in consumer electronics market. It is compelling user interaction modality for enabling truly on the go interactions. The keyboard and touch screen interactions require attention. People can use gesture to perform these kind of actions. This paper presents the design of the wrist watch interface that enables gesture interactions during any kind of emergency situations. The mechanism used in gesture watch is push to gesture mechanism where the user need to perform a gesture. If the victim is in danger of any physical attack, specific gestures are used to activate the watch by which the GPS location can be shared to necessary person by dropping a message on respective person's phone. By implementing this work time can be saved in helping the victim and the suspect can be easily caught.

Keyword - *Gesture, Push to Gesture, GART, GPS, Smart Watch*

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1. INTRODUCTION

Mobile gesture interaction is a logical next step for future investigation. It is gaining attention in consumer electronics market(e.g., Nintendo Wii[2]) as a viable mode of interaction to control devices in a more natural and initiative way. In a mobile interaction users are often on-the-go interacting with the mobile devices as they navigate the physical environment. When mobile , users need to split their visual attention between their device and the environment to ensure accurate hand-eye coordination while avoiding obstacles in their path. However, interacting with a mobile device while in motion raises concern for safety. While developing our first wrist watch user interface (UI) for mobile gesture interaction, the gesture watch, we observed the similar problems. The gesture watch captured in air hand gesture through wrist mounted IR sensors and sent the gesture patterns to recognizer. With the gesture watch users could control electronic devices while on-the-go.

In this paper, we present the use of proximity sensors with a vibration motor pressed against the user's wrist. When the proximity sensor detects a hand above it the corresponding motor buzzes. We designed a new push-to gesture mechanism for gesture recognition. The mechanism follows two design principles of direct manipulation: representation of object of interest in this case, the tactile representation of hand movement in relation to device) and reversible operations.

2. FEATURES:

A. The proposed system consists of a device that will feature sensors to monitor the user’s movement.

B. On performing a particular gesture, the recognizer cracks the gesture pattern and the GPS location is sent to the assigned person.

C .We hypothesized that tactile feedback and the new push to gesture will assist eyes free mobile gesture interaction when the user's vision is limited.

D. This watch ensures the safety of the person by simply performing a gesture in spite of having to press a button.

3. MOTIVATION:

What happens when you are in a danger of being attacked and need a quick pick-me-up? Safety of people matters a lot, whether at home, outside the home or working place. As we all know, the safety of women is a great concern all over the world. Keeping this problem in mind, we proposed an idea that will allow the users to help themselves in a demanding situation. Our wrist watch interface allows the user to send their GPS location to the respective person just by performing a particular gesture. This watch will help the user in a helpless and indefensible situations where the user is not in the condition to operate the device.

4. RELATED WORK

As a design principle, direct manipulation has shaped physical UIs . For example ,a text label that changes color in a GUI visually represents the object of interest and enables reversible actions as suggested by direct manipulation. By using capacitive sensing with physical keys, we have created a keyboard which would display what action a given button would perform when a user touched the button but had not yet pressed it. In this manner, users could easily interact with the physical buttons and retreat from an action before committing it.

Touch and sensor-based interaction in mobile and wearable computing often raise new concerns on motor performance. Even expert suffer performance difficulties when using touch based soft keyboards due to the lack of force feedback. This difficulty can be reduced by providing an auditory feedback. To reduce visual distraction in mobile interactions, researchers have explored the benefit of using touch. Users can perceive touch patterns on the wrist while visually distracted , receive tactile directional cues on the torso while driving , and navigate the environment helped by navigational cues on the waist .

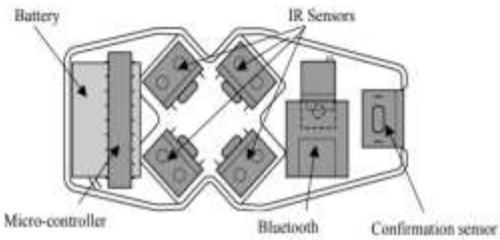
Researchers tested the importance of device placement in mobile computing. They observed significantly faster interaction time on wrist-worn mobile devices than devices stored in pockets , suggesting that wrist-worn devices may require less motor distraction than devices placed elsewhere.

5. APPARATUS AND CONFIGURATION

The Gesture Watch performs gesture recognition using the Gesture and Activity Recognition toolkit (GART), which utilizes hidden Markov models (HMM). GART links the patterns of hand gesture to corresponding commands that can be sent to electronic devices. After performing the corresponding gesture, the GPS (Global Positioning System) location of the user is sent to the definite contacts of the user.

5.1 WRIST WATCH INTERFACE AND GART:

The gesture watch consists of two parts[4], the sensors in a wristwatch UI and a tactile display[6] which are fastened by an elastic strap and worn on the dorsal and volar sides of the wrist (Figure 1). Since, in the previous similar experiments performed, it was observed that user faces difficulty in localizing vibrators on the dorsal side of the wrist. So in order to reduce the difficulty, the tactile display was located on the volar side of the wrist, where high perception frequency is shown.



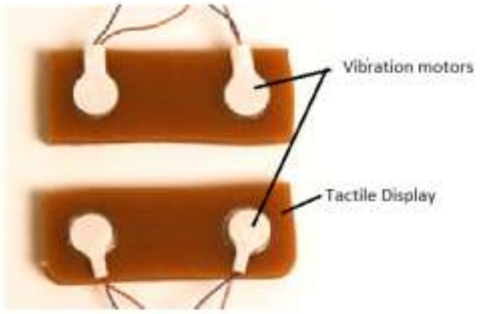


Fig - 1: Wrist watch interface

Four SHARP GP2Y0D340K IR proximity sensors are used to capture the hand gestures made by the user. Four vibrating motors are arranged in a square with 30 mm center-to-center distances. A rubber housing ensures constant center-to-center distance between the motors. longer center-to-center distances enables easier perception. [1]Unlike the cardinal layout of the gesture watch, sensors are arranged in orthogonal layout (Figure 2) to assist easier perception of tactile feedback. The microcontroller synchronizes sensors and motors by turning on and off vibration motors based on the sensors' input. Users can mentally synchronize the in-air hand gesture with on-body tactile feedback. Power is supplied by a 3.7 lithium ion battery. [7]A stable 3.3V power supply is supplied by a power regulator. Sometimes false triggering is caused by the hand. To avoid this front sensor is tilted by 20 degrees. Sensor data is received by a remote computer through bluetooth and the gestures are processed. The visual training of

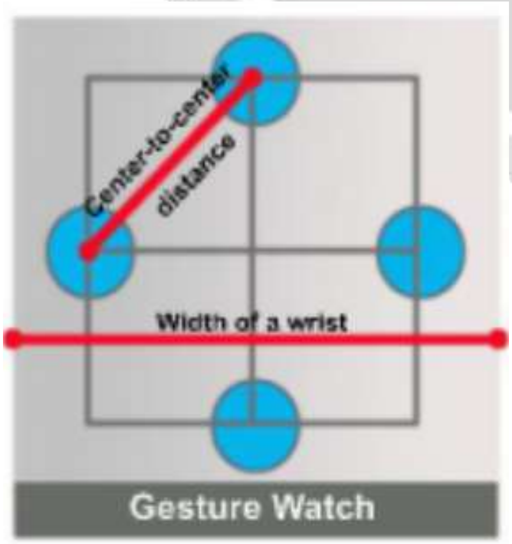


Figure 2. Sensor layout comparison

new gestures are assisted by GART interface which is implemented in java. It even recognizes the trained gestures.

5.2 PUSH-TO-GESTURE RECOGNITION:

The data from the sensors are captured and passed to the ATmega 168 microcontroller. A microcontroller is a small computer on a single integrated circuit. The storage function of microcontroller supports our new push to gesture by storing the sensor data turning the motors on and off and waits for user confirmation rather than sending it immediately to GART (Figure 3). Within the timeout period the user can make decision to confirm or abort the gesture. The microcontroller will send the data to GART only when the user confirms gesture within the timeout period. Gesture recognition smart watch enables reversible user operations as it waits for user confirmation.

The push to gesture requires a pair of wrist tilting gestures for segmenting the gesture but the timeout period enables automatic segmentation of gesture by taking advantage of

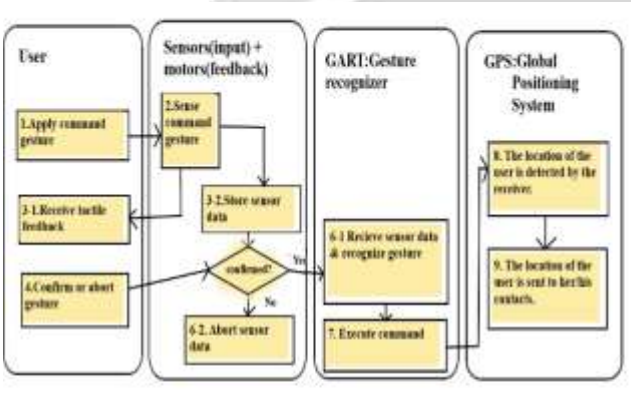


Fig - 3: Flow diagram

'idle period'. We performed a simple experiment called Alpha test to find out the appropriate length of timeout period. The alpha test was performed with six participants where each participant was asked to perform 5 gestures 6 times(5 gestures * 6 times= 30 trails). Participants listened to voice commands and performed the gestures with new push to gesture. The time lapse between the last data input from the motion sensor and the front sensor activation is measured. The results calculated from 180 points showed that maximum time between hand gesture and confirmation was 1.6 seconds. Thus, we decided to set the timeout period for two seconds.

5.3 GLOBAL POSITIONING SYSTEM:

[8]GPS provides geographic location and time information to a GPS receiver. The gesture watch consists of a wi-fi module that helps the GPS module to determine the user's location. GPS[3] uses the information about location and timing that satellites send from space. These information sent by the satellites are received by the GPS receiver. The GPS sensor is paired with the user's phone and gets the location data through tethered connection. Once the location is identified, it is shared with the contacts of the user thus, ensuring their safety.

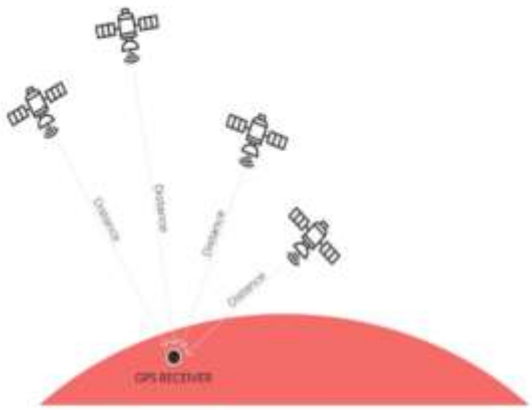


Fig - 4: Global Positioning System

6. STUDY DESIGN OVERVIEW:

To investigate the possible benefits of tactile feedback with respect to visual attention in mobile gesture interaction we took reference from an experiment which was conducted in Georgia Institute of Technology. In this experiment performance accuracy and performance time were measured.

7. EXPERIMENT:

The experiment[5] was conducted with the help of sixteen participants. The mean width and circumference of their wrists were 56.26 mm and 165.81 mm, respectively. The participants chosen were right handed except one. 37.5% of participants wore a wristwatch daily. During the experiment, accuracy and performance time (4 gestures x 6 times x 4 conditions x 16 participants = 1536 trials) were measured and the subjective feedback was recorded.

7.1 TASK AND PROCEDURE:

The experiment employed a within subject design in a balanced order. All participants had four conditions that were composed of 24 trials (4 gestures x 6 times). The 2x2 conditions of this experiment was determined by the presence or absence of tactile feedback (with tactile feedback = T, without tactile feedback = nT) and visual restriction (full vision, limited vision) .

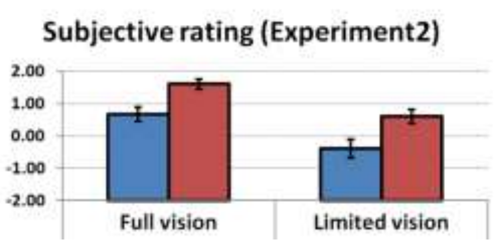


Fig - 5: Subjective rating

7.2 RESULT:1

The mean accuracy that was recorded during the training session was 93.97% (Figure 6). In this experiment performance accuracy and performance time was measured. The performance time was divided into two parts: gesture time and confirmation time. The time between the first and last sensor data captured is called gesture time. The time between the last sensor data and the confirmation or rejection of the event is confirmation time. The effect of tactile feedback on accuracy was not significant regardless of the visual restriction and vice versa. When examining the accuracy the gesture type affected the accuracy in some conditions. The effect of tactile feedback was observed different in full and limited vision conditions.

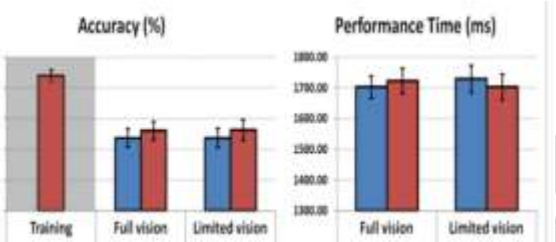


Fig - 6: Accuracy and Time

It was observed that during the limited vision conditions tactile feedback enabled faster performance time with statistical significance (Figure 5). Thus the tactile feedback was more beneficial when the user's visual access to the interface was limited.

8. DISCUSSION AND FUTURE WORK:

By the experiment we found slower performance for the limited vision situation only in the no tactile feedback condition. This suggests that the tactile feedback provides support when the user's visual attention is limited in mobile interactions. Thus the tactile feedback can compensate for limited visual attention in the gesture interaction. This result indicates that tactile feedback can successfully assist mobile gesture interaction when the user's visual attention for the interface is limited while the user is under attack or is in an emergency situation.

During the experiment we observed three limitations that were caused by the test setting, hardware, and gesture design. We also found that the sensor range needed to be shortened. We found the false triggering of the motion sensor was subjected to body posture (pulling the forearm too close to the body) which was less consistent. The IR sensors accidentally captured data from the forearm the false data was considered as hand gestures and started the clock to count the time-out period. This problem can be resolved by the shorter detection range of sensors. The proper detection range should be explored in future work.

The wrist watch sends the location of the user to their respective contacts. In future work, instead of sending the location of the user to all of their contacts, the user's location can be sent to the nearest police station. This would ensure faster and better safety of the user. Any person in the danger of getting attacked will then be rescued more easily by having their location sent to the police station of the nearest locality.

9. CONCLUSION:

Our new method which uses push to gesture enables faster and more accurate gesture interaction with less effort as in this case, the user commits a command gesture after performing it unlike holding a trigger posture while performing a command gesture. Our method also helps the user by getting their GPS location sent to her/his contacts when in need. During the experiment, similar difficulties were observed in a limited visual access condition with tactile feedback and a full visual access condition without tactile feedback. Thus, we conclude that the new gesture recognition technology can be proven helpful for people in danger of getting physically attacked.

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