Rich Tactile Output as Notification on Mobile Devices

Abstract

For mobile phones, notification is of great interests as many functionalities of a phone are triggered externally and require the attention of the user. Audio notification is the most commonly-used form of notification; however it is not suitable in many contexts as it may disturb others or be inaudible due to environmental noise. Tactile output is used as a mean of discreet notification and offers a basic alternative to audio output. Vibration stimulus is an unobtrusive way to find out about incoming calls, messages, or reminders without disturbing others. Here, we assess the potential of rich tactile notifications on mobile phones. Many mobile phone users use vibration output for various types of notification on their phone. Currently, tactile output in phones is limited to one single actuator that can potentially present patterns based on different vibration intensities over time. To explore the possible design space, we conducted experiments with up to 6 actuators included in a prototype phone.

Prototype

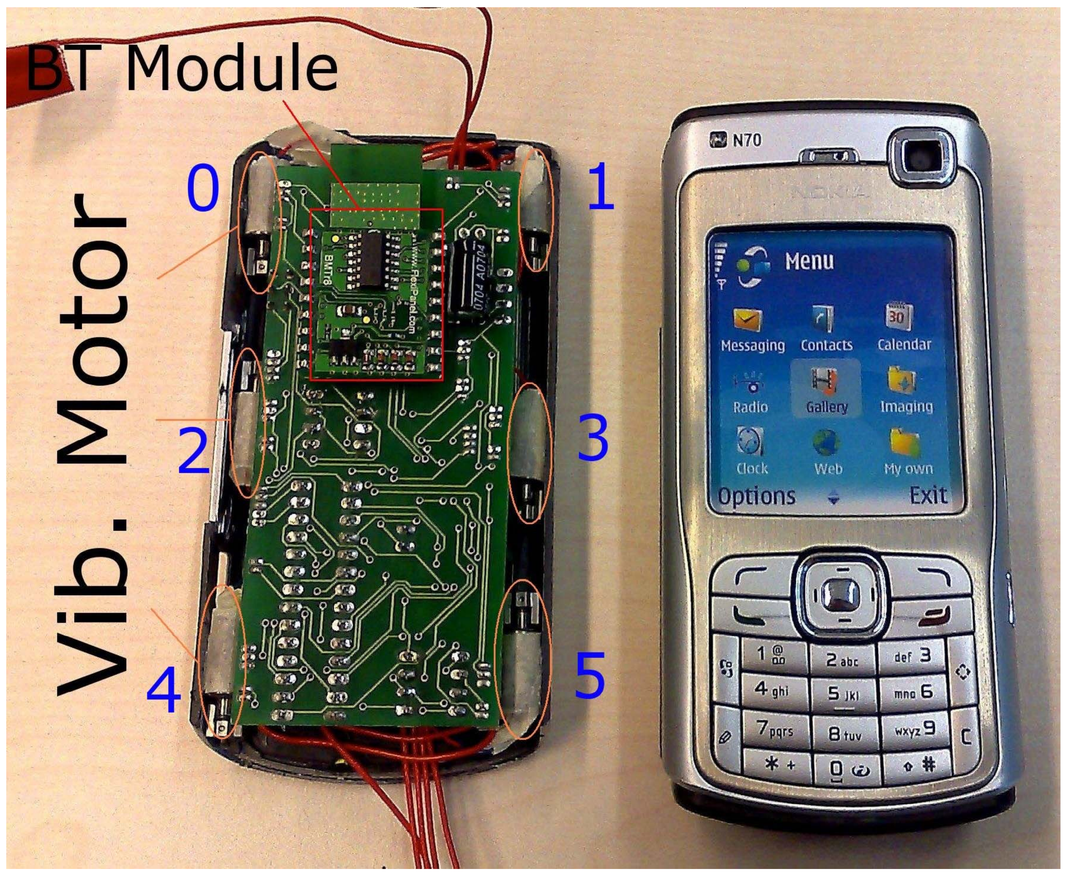
- PCB board
  - **1** microcontroller
  - **6** vibration motors
  - **1** Bluetooth module

•Motors are controlled **remotely**

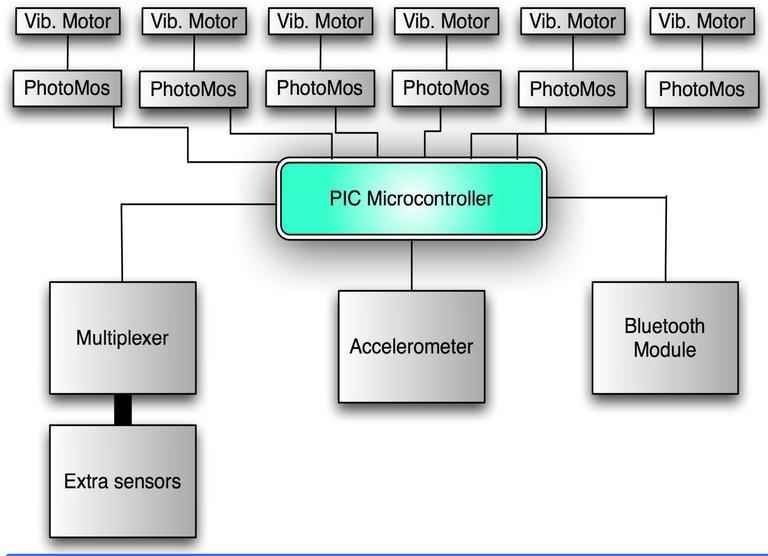
•Embedded in a **dummy** N-70 Nokia

•Same **dimension** as the original phone

• **No** phone functionality



Architecture



User Study

Locating Individual Actuators

•The experiment showed that users could **discriminate** between left and right (a), as well as top and bottom(b), with a recognition rate of **75%** on average. We had similar detection rate for actuators in the four corners with an average rate of **73%**(c).

•However, the recognition rate for the **actuators in the middle** of the device (as a group or individually) was significantly **lower**.

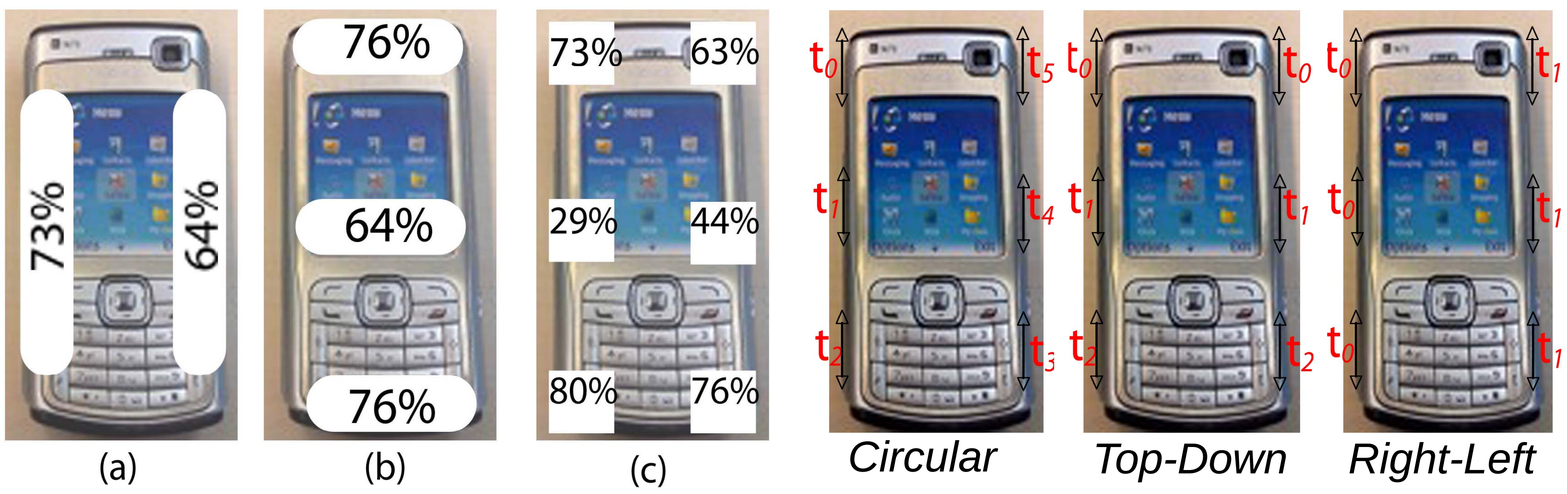
Discriminating Between Vibration Patterns

•Three patterns were defined: ***Circular***, ***Top-Down***, ***Right-left***.

•The patterns differed in the number of motor/s which were turned on in each moment.

•**Random** patterns were defined to assess the user.

•Initial results reveal that users were able to **correctly identify each pattern** with up to **80%** accuracy.



Conclusion

✓Rich tactile output creates new options for providing information to the user.

✓It is preferable to place actuators in the corners of the device as have highest recognition rate.
(based on the current motors' configuration)

✓Distinguishing between different patterns are feasible for the users

✓Results motivate further research on the use of multi-tactile patterns as new opportunities to personalize phones and providing information.

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