SKINPUT TECHNOLOGY: USING HUMAN SKIN AS TOUCH SCREEN

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ABSTRACT - *This paper provides an empirical review on the skinput technology- an emerging facility for regulating mobile gadgets. Skin as an information technique, starting up an unique and predominantly uncharted interaction space. Skinput technology is based on bio-acoustic sensing which permits the skin to be used as a touch-screen input surface for the acoustic transmission. We will explore the attributes of disparate skin-specific input modalities and inspect the diverse variety of gestures that are implemented on skin. Skinput serves as an approach to separate the input from electronic devices with the intention of making devices more compact and smaller, without simultaneously diminishing the surface area on which the input can be executed. This authorizes the body to be annexed as an input surface without the need for the skin to be invasively instrumented with sensors, tracking markers or other items. This prototype model adopts a wireless approach like Bluetooth, to transmit the signals as a command to the different electronic devices like smart phones, tablets. ipods, etc which are connected to it.*

Key Words: Skinput technology, Bio-Acoustic sensing, Sixth-sense device, Pico Projector

1. INTRODUCTION

In the 21st century the demand of mobile device is escalating rapidly with every passing day due to conveniences like portability, manoeuvrability and resilience, and most importantly the small size due to which we can tote it anywhere with great ease but miniaturizing devices has simultaneously diminished their interactive surface area and consequently abates their purpose and performance. This has led to diminutive screens, congested keyboards, and tiny jog wheels which foist strictures that reduce usability and restrict us from recognizing the extensive potentiality of mobile computing. As computing becomes more mobile there is an accelerating requirement to establish more advanced and progressive input tools and techniques. Even with the advancement of touch technology everywhere yet entering and editing texts, selecting different graphics entities, performing drag and drop, navigation in devices, zooming in and out and so on are still challenging. One real struggle in handling small screens is the interactive surface area. Recent smartphones have enough clarity that we can detect tiny objects even as presbyopia set in. We cannot simply make buttons and screens larger and add surface area without losing the primary advantage of small size and mobility- it is a physical constraint which has trapped us in a device size paradox. One promising approach to mitigate this is to appropriate the Human body as an input device that is freely accessible by hands (e.g., arms, upper legs, torso). We can use our skin, the largest organ of our body as an input surface. However, skin is fundamentally diverse from traditional, off-body touch surfaces. The pliable nature of skin not only allows touching, but also pulling, shearing, squeezing, and twisting. Skin is proficient of sensing different stages of contact force, which permits pressing. More over the fingernails on skin can also result in scratching which is another form of touch, or the hand can encase any other body part resulting in grabbing. Further convolute gestures, e.g. rubbing or shaking, can be implemented by using these elemental input modalities. This boosts the input space for on-skin interactions and also provides more diverse forms of interaction. Moreover, interaction on skin has a powerful personal and sentimental connection, facilitating a more emotional way of interaction. Human body generates a distinct frequency of vibrations when tapped on varied body parts. With the help of this unique property of the human body, this technology uses different locations as disparate functions of frequencies by analysing mechanical vibrations that propagate through the body and are captured by the sensor array. Besides, proprioception (perception or awareness of the position and movement of the body) allows us to meticulously interact with our bodies in an eyes-free manner. For example, we can readily snap each of our fingers, touch the tip of our nose or any body part, clap our hands together or make any particular gesture without visual assistance. Few external input devices can defend this accurate, eyes-free input characteristic and also produce such a large interaction area. This in turn gave rise to a new way of accessing technology- the "SKINPUT TECHNOLOGY" which is to a great extent remains unexplored.

2. PRINCIPLE

Skinput works upon bioacoustics technology. There is an armband in which a menu, a keyboard for the transfer of commands or any other application is embedded. This armband has to be worn by the user. An acoustic detector is also embedded in this band whose function is to detect the acoustic signals which are generated whenever the user taps on his skin. The amplitude of these signals depends on the surface of the finger taps. These signals have some losses also as many of them are reflected back from the skin as sound waves. Here, the main medium of reflection is bones, where the rest of them is taken by the armband. A software is needed which senses different locations of the touch based on bone density, tissues and other artificial work on the skin of the individual like tattoos or else.

2.1 Sixth Sense Device

Skinput provides a sixth sense technology i.e. mobile, easily available input system for the sake of convenience to the user as with the help of this technology, we can ensure that no extra devices are needed to be carried through, as the input system will always work as soon as the user is wearing that armband. Although, this functionality makes the technology a bit expensive but as per the researches, soon we can have some cost-effective devices proposed for us.

2.2What Skinput Technology?

Skinput Technology was originally introduced by Microsoft Corporation at their first public presentation in Microsoft Techfest in 2010 where the precursor was demonstrated live at the event. The technology was flourished by Chris Harrison, Desney Tan, and Dan Morris, at Microsoft Research's Computational User Experiences Group.

The term skinput is the consolidation of the phrases skin and input that signifies the performance of the technology-input through skin. Skinput, a technology that conveniences the human body for acoustic transmission. In other words skinput can be regarded as an input technology that adopts bio-acoustic sensing to localize finger taps on the skin. We determine the locale of finger tap on the skin by inspecting mechanical vibrations that transmit through the body. It is a new skin-based interface that recognizes the skin as touch screens by perceiving distinct ultra-low-frequency sounds that are produced when tapping disparate parts of skin. It is also acknowledged as bio-acoustic sensing or bio-acoustic transmission. This pathway serves as an on-body finger input arrangement which is constantly accessible, naturally portative and nominally intrusive. When enhanced with a pico-projector, an entirely interactive graphical interface can be executed instantly on the body. Skinput commits a unique meaning to the phase "touch typing".

3. WORKING

As the biological signals are used for the computer inputs, Skinput is similar to this technology as it proposes imposing properties of natural acoustic conduction of the human body as an input system. The whole working of our Skinput technology depends on the Bio-acoustics technology which we will see in detail.

3.1 Bio-Acoustics

The human skin produces different forms of audible or to be more specific, acoustic energy whenever the fingers are tapped on the skin. Among these, some energy is radiated or lost in the environment as sound waves as this energy is not captured by the Skinput armband system. Now, among the leftover energy of these taken signals, the most unhesitatingly visible are the transverse waves which are formed due to the deracination of the finger over the skin. If proper required view screens are used, the outward repulsion of these waves from the point of interaction is observed which we can shoot this with the high-speed cameras. These repulsions show some variations on the tapping behaviour on the skin and compliance of the soft regions of the skin as it creates the transverse waves of comparatively higher amplitude with respect to those of bony areas like the wrist which usually do not have enough compliance. These are the variations which results in the transverse waves of higher amplitude. As we have seen about the energy propagation on the skin, let's see how the rest energy which is transmitted inwards, inside the body. These are the waves which travel longitudinally through the soft tissues of the skin which excites the bones. Since the bones are comparatively more rigid than that of soft tissues but whenever the bone moves or rotates, it reacts to the mechanical excitation which then excites the soft tissues also which then results in the formation of the now longitudinal waves coming out of the skin as a resulting wave. These two different kinds of waves propagating inwards and outwards as root and resulting waves carry the energies of different frequencies which propagate at different distances. Thoroughly looking to this phenomenon, high frequency waves propagate more through the bone than that of soft tissues and the distance covered by the energy conducted by bones is larger than that of soft tissues.

3.2 System Components:

Hardware Componentsbasicallyinclude Vibration Sensor, Bluetooth Module and ARM7 Microcontroller.Whereas in **Software Components,** we can use any basic compiler for the simulation. For example, we can have Eclipse IDE which is widely used in the Java programming.

3.3Pico-projector

This is another hardware augmented in the armband to provide a Graphical user interface to this technology, which enhances the experience to the user. Pico-projector is basically the device which works as a display screen of any device on human skin. The user can interface anything in its menu depending on his need i.e. if he wants to keep it simple, then as per requirement, he can have the functions on his band, but if he wants multifunctionality in it, then he can have so many other functions also in its menu which varies as per the taps of fingers on the skin. This proves to be the link of the user with the technology.

Pico-Projector

4. ADVANTAGES

a)There will be no interaction with the gadget. This system does not require the users to carry or pick up a device

b)The body is portable and constantly accessible anywhere at any point of time and fingers are a natural input equipment. This in turn also saves space.

c)The projected interface provides a much larger display than the mobile phone's screen.

d) Arm can be brought closer to the face or vice versa to see the display close up.

e)Colour contrast can be regulated by dimming the light so that a better display will be provided if the skin and text are too similar in colour during daylight.

f)The skinput technology can eventually be used without a visual screen. As the laws of proprioception states humans can interact with specific body parts without looking at them. After the user learns where the locations are on the skin. They will no longer have to look down which in turn will prove to be ideal for people with little or no eyesight.

g)We don't need to worry about the keypad. People with large fingers get into trouble in navigating tiny buttons and keyboards on mobiles. Larger buttons dwindle the risk of pressing the wrong button.

h)Technology also provides more interactive gaming experience.

i)There is no need to look down while driving to operate the cellular device, thus reducing the chance of road accidents.

j)Blue light exposure from computer screens, smartphones and other digital devices damages light-sensitive cells in the retina. This technology reduces the exposure of blue-rays on your eyes.

k)Low sustenance charge and Less Energy Consumption.

5. DRAWBACKS IN SKINPUT:

a) Users cannot cover their hands with full sleeves, as it won't function on fabrics.

b) People with obesity cannot operate this. If the user has more than a 30% BMI, then the accuracy will be degraded to 80%.

c) The arm band is considerably heavy and it may also seem to slip off on wearing too long.

d) The visibility of the projection of buttons on the skin will be diminished if the user has a tattoo on their body.

e) Not enough research has been conducted to assess the possible skin diseases or types of cancer one may endure from prolonged use of this technology.

f) It is not affordable by the common mass.

g) Individuals with disabilities such as amputated arms cannot use this product.

6. APPLICATIONS:

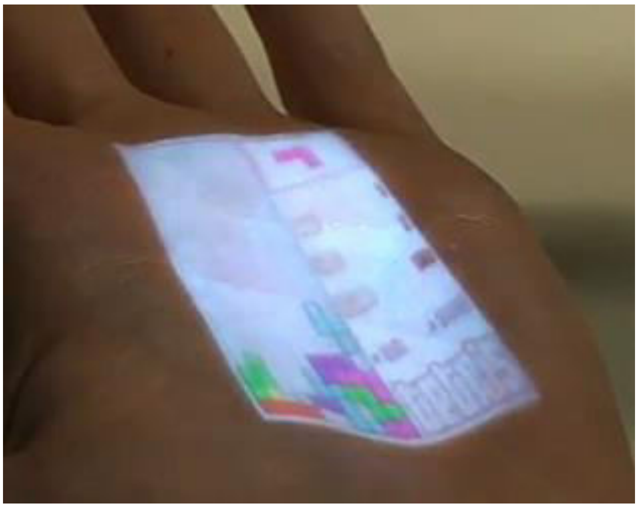
a)Controlling Music Player Applications using Skinput- We can increase or decrease the volume of tune playing and also change the track of the music players such as I-pods which only requires 4 or 5 buttons to operate without touching them.

b)Making phone calls- We can turn our arm into a cellular device. It is possible to make a phone call by just typing the numbers that flash on our forearm. Infact we can text messages by tapping in certain places on our arms.

c)Using fingers as a Control Pad for gaming- Through Skinput we can play games with just the motion of our hands. Without joysticks or touch screens we can play games easily which will introduce a totally new epoch of gaming.

d)Implementation in Educational System- With the help of this technology we can use calculators on our skin or simply browse through the web.

e)An aid to the paralyzed people- This feature provides a projected graphical interface on the skin so that the person who is paralyzed or physically changed can easily make a call, send messages, play games or even control the music player applications.



The user plays Tetris on the palm of his hand

FUTURE SCOPE:

We can assemble a new advanced system that will incorporate several additional sensors, especially electrical sensors to sense the muscle activity associated with finger movement and inertial sensors such as accelerometers and gyroscopes in order to appraise the real-world practicality of Skinput.The size and electrical complexityof our armband can be considerably curtailed. The hardware components of the armband can be efficiently stimulated in software, which in turn

can supplant the relatively hefty piezoelectric sensors with micro-fabricated accelerometers. Research is carried out for smaller wrist watch sized sensor armbands.
The Multi-Sensor armband will be wireless allowing us to explore a wide variety of user preference. More external devices should be incorporated with the system thereby enhancing the accuracy level to a greater extent and providing more robustness to false positives.

CONCLUSION:
The main motto of this technology is to turn the human body into an always available input. For this, we have proposed a wearable arm-band with inbuilt vibration sensor for detecting the vibrations from the finger taps on the hand and forearm. We have described the Bio-acoustics technology based arm-band in order to localise the finger-taps and sensing it with vibration sensors and processing it further. This technology is tested well to perform even when the body is in motion.

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