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SKINPUT - AN EVOLVING SENSING TECHNOLOGY

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Abstract - *Skinput, a technology that uses a Bio-acoustic sensing that localizes finger taps on the skin. Device provides a Direct Manipulation and Graphical User Interface on the body when it is augmented with Pico-Projector. It listens to vibrations on the body and responds to various hand gestures. The signals generated by the movement and taps are collected using a Novel Array Sensors worn as Armband. Device Provides a Finger Input system that is always available and portable. Technology suffers from limitations*

that are Armband is currently bulky and it's dysfunctional for the road. Unless a person already uses a Bluetooth device they have to reach for their cell phone to take that call. This paper focuses on the study, advantages and limitations of skinput sensing technology.

***Key Words*: Skinput, Bio-acoustic, Array Sensors ,Armband, Pico-projector.**

1. INTRODUCTION

Technologies are not just creating machines, or devices what we are really doing is designing experiences, crafting our relationship with devices and with each other. We are shaping the culture and the way we live. In this era everyone expects computing all the time, all the place as we go about everyday life.

Pretty amazing transformation has been made in world of computing. Challenges has moved from making computers smaller, faster and cheaper to making computer more accessible, more of time and place, to more people and to do more Interesting thing. There is bottleneck in the interface as we continue to shrink these devices so do we shrink the ability to hold these devices, ability to see screens, and ability to interact with them. Challenge is of creating rich and Natural ways of interaction with our devices and people around us and computing environment. One of the helpful and supporting approach to this challenge is Skinput technology.

"Skinput" refers to a new input technology that essentially makes use of human body as an input device. It is also known as bio-acoustic sensing or bio-acoustic transmission. Skinput technology is introduced by Microsoft Company. Basically it turns the body into touching interface.

With the help of this interface users are facilitated to use their hands and arms as a touch screen.

Skinput is able to locate and resolve finger taps on the skin using a novel sensor array that is worn as an armband and with the help of Pico-projector; our skin can operate as an interactive canvas supporting both the input and graphical output.

2. WORKING OF SKINPUT

Skin is used as an input to Skinput technology. The keyboard or other graphical representation is projected on user's palm with the help of pico-projector implemented in armband. The sounds emitting from taps on different locations are figured out to perform action accordingly. The audio signals captured by sensors are converted into digital signals. These signals are transferred via Bluetooth to device that is connected with armband .Software is used to match sound frequencies to specific locations of skin and corresponding action is performed. This is done within seconds.

2.1 Bio acoustics

It is the study of sound waves inside living body. The energy is radiated when taps are made.

The taps on any location of the arm or tapping of fingers produces a unique acoustic which is transferred by transverse waves through the skin and some energy is transmitted inward which goes through the bones with the help of longitudinal waves resulting in vibration and sensors work according to it. And machine learning programs could learn about this and identify the action.

2.2 Armband Prototype

Figures 2 and 3, as featured, armband are incorporated with two arrays each having five sensing elements that response to a particular frequency range. The reason of using two sensor packages is to give prime focus on the arm for input. When the band is placed on the upper arm (above the elbow), it is able to collect the acoustic information from the fleshy bicep area along with the firmer area on the underside of the arm, with better acoustic coupling to the Humerus that is located between the shoulder and elbow joint. When the sensor is placed on the forearm, one array package is located

near the Radius that is from the lateral side of the elbow up to the thumb side of the wrist, and the other near the Ulna, which runs parallel to Radius on the medial side of the arm close to the body.

The vibrations are transmitted by the body upon tapping and the sensing elements detect those vibrations. The acoustic data varies according to the location of tapping. Each tapped surface produces slightly different acoustic information which helps in differentiating input location. The upper and lower sensor package frequencies can be tuned as per the requirements.

Fig -1: Prototype armband (Outside View) [5]

Fig -2: A bio-acoustic sensing array in an armband. (Inside View)[5]

2.3 Bluetooth

The armband is connected with device with the help of Bluetooth technology. It is used in Skinput technology to transmit the information from the armband to the device, so that the device functions accordingly.

2.4 Pico – Projector

A pico projector is a small hardware device used in Skinput technology. It is attached with an armband so as to give the Graphical user interface to the user. It is employed as an Output device that shows menu or whatever functionality user wants to use according to the tap. It is the most essential part of the technology as it provides the interactivity of technology with the user.

3. SKINPUT IN COMMUNICATION

With the help of machine learning techniques and bio acoustics sensors used in Skinput, it is possible for people to use their body parts like forearms, fingers etc as touch pads and control the device. Since the content is projected on the skin, it becomes easy to use any kind of communicating applications on the skin. Also typing becomes easy on the bigger surfaces of skin or palm. It can be used for gaming too.

3.1 SKINPUT AS A TOUCHSCREEN INTERFACE

In Skinput technology, skin is used as a medium to control various computing operations. On every touch and every part, many things are controlled with the help of sensors that are placed on the arm.

Sensors are able to distinguish between each touch on the body so that desired tasks are accomplished.

Skinput is a method that allows the body to be appropriated for finger input using a novel, non-invasive, wearable bio-acoustic sensor.[1]

For tracking the taps on arm by the user, a series of sensors are used. Previously interfaces used motion-tracking to determine the taps. Skinput uses a modern and novel technique: It listens to the vibrations in our body. Different kinds of vibrations are created when tapping is done on different parts of the arm. It depends upon the amount, shape of bones or tendons and muscle in that specific area.

With the help of armband, Skinput track those vibrations and recognize where the user tapped.

The armband is a prototype. When coupled with a small projector, it can populate a menu interface and tapping on different areas of the arm and hand, provides scrolling through menus and select options.

Fig -3: Skin as a touch screen interface [5]

3.1 SOUND AS AN INPUT TO DEVICE

When the user taps on different areas of the arm while wearing an armband which has an acoustic sensor attached that is able to generate unique and different sounds according to the area's bone density, joints or soft tissues and other factors. The armband has small projector which displays the content on the surface area and when the user taps on different areas of the arm while wearing an armband which has an acoustic sensor attached that is able to pick the unique and different sounds which are generated according to the area's bone density, joints or soft tissues and other factors.

These signals are analyzed by the software used in Skinput that determines which button or function is being called by the user.

The information is then transferred to the device with the help of Bluetooth technology.

So, for example, if the user tapped on music player, then the command would go on device and music player would turn on.

It is been claimed by Harrison that accuracies ranges from 81.5 to 96.8% and enough buttons are provided for controlling many devices. [2]

4. ADVANTAGES OF TECHNOLOGY

Our skin becomes the touch screen. There's no need in interacting with the gadget directly. More accuracy than we have ever had with a mouse. Removes trouble in navigating tiny buttons and keyboards on mobile phones. Complete and portable system. Projected interface appears much larger as compared to a device's screen. No issue of small fonts or small screen which becomes barriers for many with poor eyesight. Through Skinput we can play games with just the movement of our hands. This will introduce a totally new era of gaming.

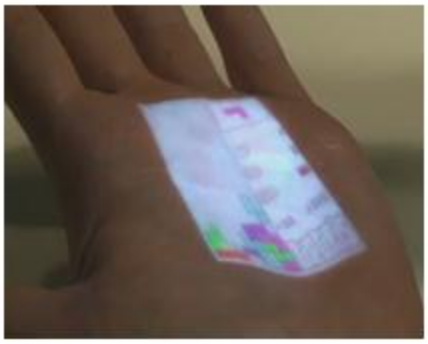

Fig -4: Playing Tetris: Using Skinput[6]

5. LIMITATIONS OF THE TECHNOLOGY

The accuracy of Skinput depends upon the BMI (Body Mass Index) of a person. That is, if a person has 30% or above BMI then up to 80% accuracy is reduced. The other limitation of this technology is its size. Wearing such a big band around the arms to enjoy the technology is not preferable for whole day and especially for senior citizens, it would create inconvenience for them. Incoming calls needs to be answered by your phone, as this technology lacks this feature. More research needs to be conducted on the mentioned product to test the probability of possible diseases one can get by using this product. If the skin surface is not clear or has tattoos, then visibility of projected content could reduce. It is a risk using this on the road as it may become a reason for deviation of individual's attention. Adapting to this product would take time and not everybody could use it.

6. FUTURE ENHANCEMENTS IN THE TECHNOLOGY

The size of the armband needs to be decreased, so that it would become easy to use and carry, and suitable for all ages. Total phone calling features must be implemented. Testing skinput such that it doesn't harms the skin of the user. It is not a commercial product yet, so it may become one for commercial use. In future, it may be used along with home appliances too such as Air conditions, TV sets etc.

7. CONCLUSION

Less interaction with device directly once connected with Skinput technology. Usage of skin as an input is a better idea and system performs well for a series of gestures. It is tested to perform well even when body is in motion. Performance, pricing, device compatibility and other factors still need to be fleshed out. The technology is evolving by time, and we could hope much better version of Skinput in near future. No clue yet for the technology's market launch. It is a very interesting technology. But it solely depends on Microsoft for making it a commercial reality and we hope for it soon.

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