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# Design of Touch-screen by Human Skin for Appliances

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**ABSTRACT**: The present paper highlights the utilization of human skin for changing state of device from present state to other state. It is introducing that human skin can be used as input device.

The main purpose of this research is to introduce a human skin as input device for bio-medical instruments. Because while accessing a bio-medical instruments during operation in operation theatre, doctors need to sterilize all required instruments, which is more time consuming and costlier. If we used this technique for doctors while operation, then they don't need to sterilize all required instruments.

The human skin input device mainly divided into three major sections, one is sensor board which is detecting the tapping on body, second is Microcontroller board used for processing on input which is received from sensor board and third is wireless communication board which is essential for communication between input device and other devices which is going to access.

**KEYWORDS:** Skin-based instruments, mini-sense 100, arm controller, embedded system

## I. INTRODUCTION

The emerging stream of research on human skin surface as input device. Now days accessing device by remotely is more popular. In bio medical field also this remote input technology has been introduced by wireless protocols e.g. Bluetooth, ZigBee, RFID. But there is no unique input device to access all required devices during surgery in operation theatre. The lack of this there is needed to sterilize all equipments with wasting time as well as money also.

Doctors are always sterilizing their hands before entering into operation theatre, after sterilization they can't touch any un-sterilize instruments or body till surgery end. This device will help them to access all equipments by their own skin surface.

There is so many approaches have been introduced and designed in earlier days, WUW is one of from them, its wearable gestural interface. Which is including camera with projector, it is colour-marked-based vision tracking system [1]. But its accuracy is difficult to maintain. Glove based input system also is there as input device [2] but are unbearable and turbulent to tactile sensation. Another good approach is speech input [3] but it's less precise in uncertain acoustic environment and it is also be subjected to privacy issues in shared environments. " Smart fabrics " systems introduced by Post E.R. and Orth [4] which embed sensors and conductors in fabric, because of this it becomes more complex and expensive as in required to implement on each cloth. However, there is one surface area which can be use to implement a new input device which is always travelling with us: Human Skin.

When any person is tapping on its body surface area, there is some different ripples are travelling through that body surface area. But this ripples are having different frequency as per the different tapping location on human body part [5][6]. Waves which are produced by tapping on body is acoustic energy, in this some energy is transferred into air as sound waves and remaining energy travels on body surface area in the form of transverse wave and longitudinal wave. These waves are visible to human eyes as displacement of body surface area. The amplitude of these waves is corresponding to the tapping force, area covered by tapping and soft tissues on that body location. Longitudinal waves are travelling inward direction as well as outward direction of the body surface area. These waves are propagating through soft tissues, trying to excite bone which is having less elasticity than the soft tissues.

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These waves are produce very low frequency approximately in the range of 45 Hz to 25Hz or below than this. To accumulate the information after tapping we need more accurate sensor. The existing sensors which includes microphone coupled with stethoscope accelerometer and piezo contact microphones. The drawback of these existing sensors is giving flat response over the entire range of frequencies. Because of this flat response curve increase to receive irrelevant frequencies and it is responsible for high signal-to-noise ratio. To succeed in dealing with this, we moved towards highly tuned vibration sensor name as minisense100 (Fig.1). It is low cost cantilever type vibration sensor loaded with a mass for high sensitivity at low frequencies. Coming with horizontal and vertical mounting options as well as reduced height version. Sensors pins are easy to install and solder. The active sensor area is shielded for improvising RFI/EMI rejection. It has good linearity and dynamic range (Fig. 2) [7]. Mass can be changed to capture different frequency response and sensitivity selection.


Fig. 1

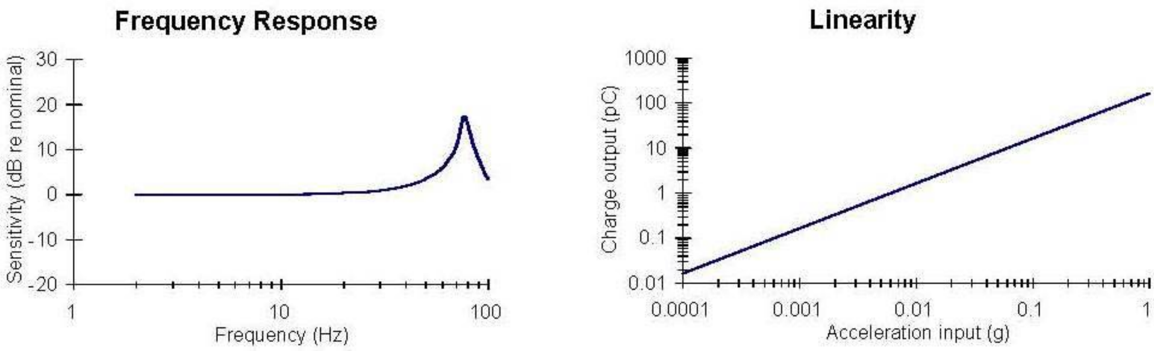


Fig. 2

## II.FUNCTIONAL BLOCKS

This system includes major three blocks (fig. 3), first is vibration sensor which is sensing a wave from human skin after tapping at particular location. The frequency of wave is different at different body surface area. This block consists of mainly one minisense100 vibration sensor and low frequency signal amplifier (fig. 4). Amplifier amplifies a signal at particular voltage range and forward to microcontroller block. Produced analogue output after vibrations are forward to microcontroller. After converting the analogue output into digital, it should get store in microcontroller. Look-up vector Table classifies the data and select particular category. So this classification gives idea about, on which location the tapping is done. Now as shown in diagram the microcontroller is connected with the different devices using wireless communication module.

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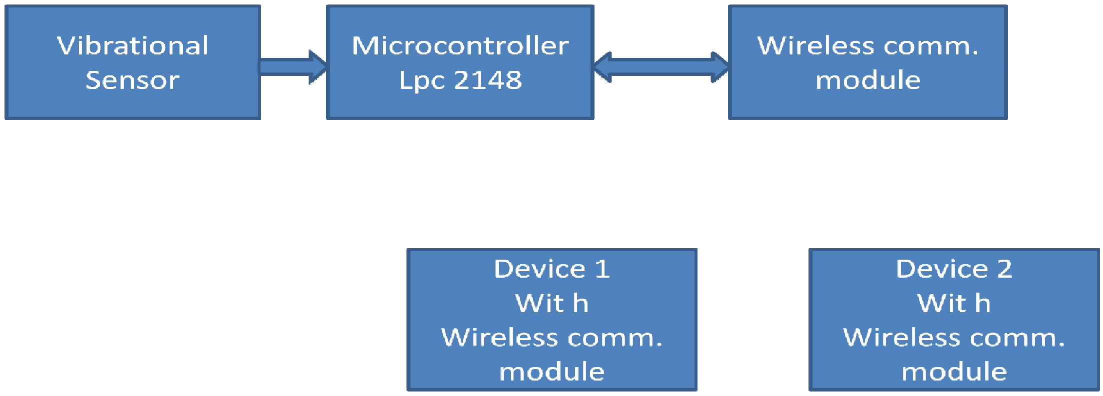


Fig. 3

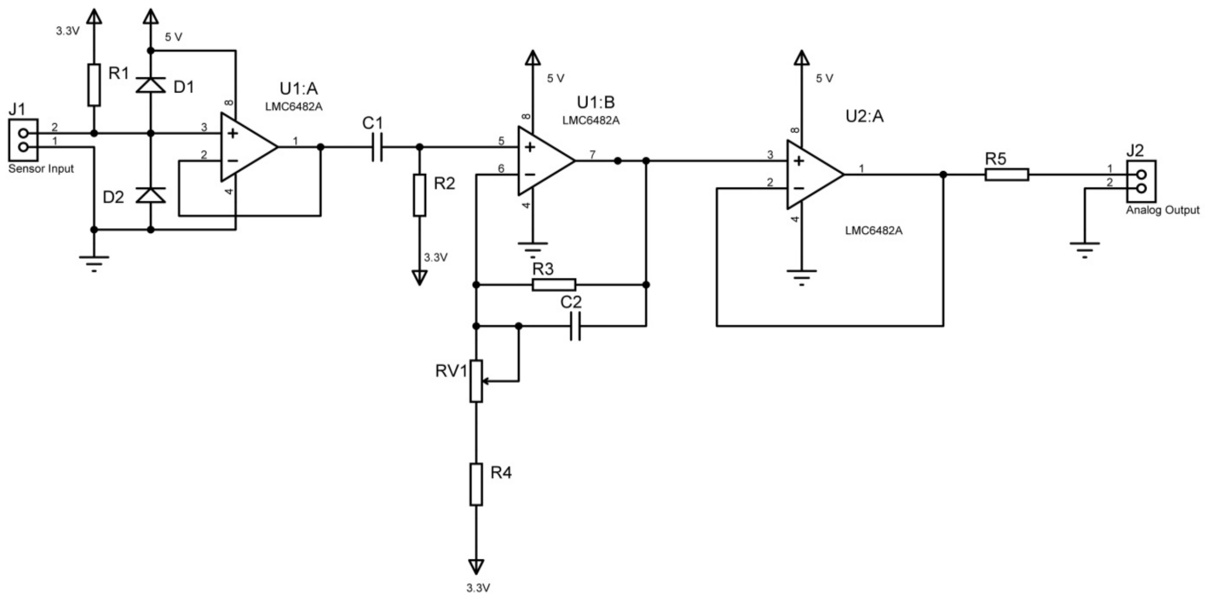


Fig. 4

## III. WORKING

Acoustics is nothing but interdisciplinary science; it is the study of all mechanical waves in gases, liquids, and solids. When a finger taps the skin, several distinct forms of acoustic energy are produced [5].

These waves are sensed with vibration sensor: minisense100. The MiniSense100 acts as a cantilever-beam accelerometer. If beam is mounted horizontally, acceleration in the vertical plane creates bending in the beam, due to the inertia of the mass at the tip of the beam. Strain in the beam creates a piezoelectric response, which may be detected as a charge or voltage output across the electrodes of the sensor. Sensor behaves electrically as an “active” capacitor. Sensitivity of sensor follows cosine law. The sensors were naturally not sensitive to forces parallel to the skin. Thus, the skin stretch induced by many routine movements prone to be attenuated. However, the sensors are highly responsive for capturing transverse surface waves. When person tap on each location, the sensors will produce different output. Process of whole system is shown in fig.5.

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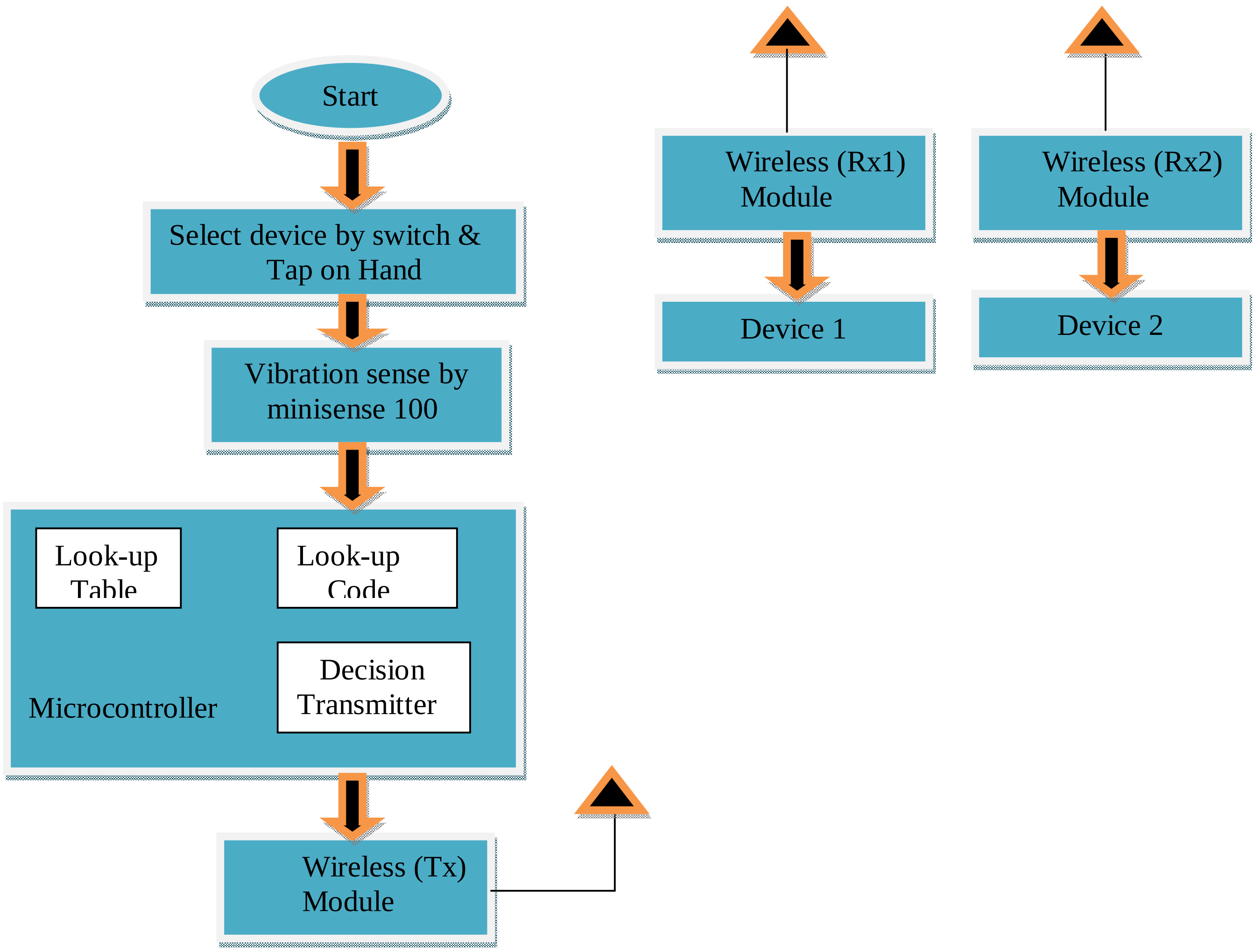


Fig. 5

## IV. EXPERIMENTAL RESULT

The hardware part is consisting of ARM7 processor with interfacing of minisense 100 sensor. Minisense100 is connected with amplifier to give amplified signal to processor for detecting an exact tapped location on body. There is different tapping location has been checked on human body, Fig. 6 shows percentage accuracy at different body location. A Fig. 7 shows the pressure impact signal on human body with different pressure applied by user on particular location output of sensor is varies with respect to tapping pressure on that particular location.

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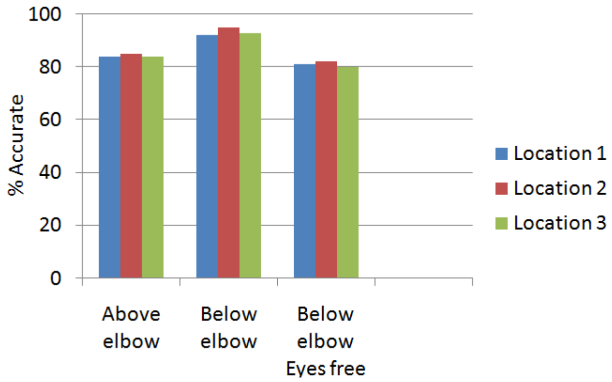


Fig. 6

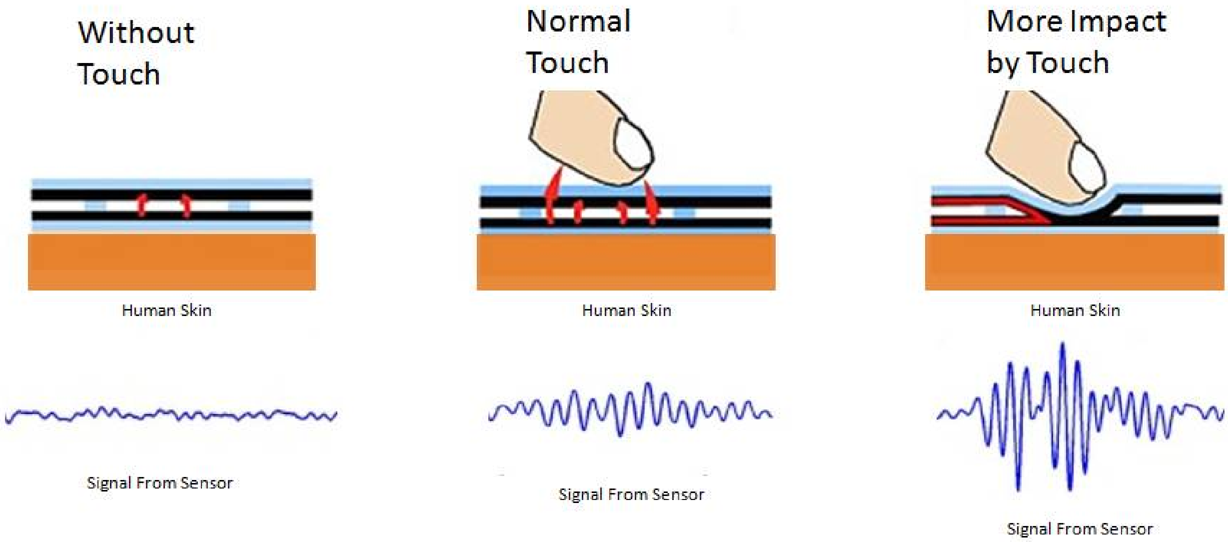


Fig. 7

## V. FUTURE IMPLEMENTATION

In this paper, three different tap locations have introduced. So person can access three different operations for different devices. He can select initially device by (device select switch) which he wants to operate and perform operation by tapping in particular location. Tapping location can be extend more i.e. we can increase more operation. Also connect video projector with microcontroller. It will show button GUI on human body. This will improve system performance and user can access device easily because of it.

## VI. CONCLUSION

In this paper we presented technology of touch screen by human skin as input device with wireless modules. The person who wants to use this device, he has to tie a sensor on exact location of a body part to sense waves after tapping on particular location. This technology can be used in many applications with many devices by operating select device switch on microcontroller. So this technology can used human skin part as an input device to many application devices.

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