Flex Watch: One Handed Continuous Smartwatch Input

Shruti Umesh Mestry[1] Latika Kesarinath Vartak[2] Aarti Vaman Wadekar[3] Sonali Bodekar[4]
[1,2,3]Student [4]Assistant Professor
[1,2,3,4]Department of Computer Science & Engineering
[1,2,3,4]Usha Mittal Institute of Technology Maharashtra, India

Abstract— Flex Watch: an interaction technique that uses continuous movements of fingers for one-handed operation on smartwatches When observing the collective range-of-motions of the wrist along each of its axes of movement, the hand can be viewed as a natural joystick. There is a smartwatch which is available in the market with proximity sensors but, disadvantage of that smartwatch is, we can't use proximity sensors in high temperatures. To validate the use of Flex Watch in different application scenarios, we implemented a Hand Glove with smartwatch having flex sensors in it. The sensors detect the wrists joystick-like motion by sensing the degree of exion/extension and ulnar/radial deviation of the wrist motion as well as motion of fingers. Smartwatches which are available in the market that we have to interact with both hands, this paper introducing the new input style that is the Fingers as a joystick by which we can interact with that smartwatches using one hand.

Key words: Hand Gestures, Hand Glove, Flex Sensor, One Handed Interaction

I. INTRODUCTION

While interacting with the normal watch we have to use both hands for gesturing. However, this simple task is challenging when user's hands are occupy holding objects or with other tasks. To allow same side operation (SSH) on smartwatches, however these have input operations such as micro-interactions, for assigning commands to finger portures, tilting the wrist, but they may quickly loose visual contact with display as we tilt the hand.

In this paper, we have proposed to use the finger as an always-available joystick to interact with smartwatch using one handed gestures.

Wearing the watch. The smartwatch which is available in the market is using proximity sensors and piezo sensors to interact with that smartwatch however, we can't use proximity sensors in high temperature.so that is the big disadvantage of that smartwatch.so in Flex Watch we used flex sensors which uses carbon on a strip of plastic which act like a variable resistor, we can change the resistance by bending the flex sensor.

Every finger has its own bending capacity and every finger has different capacity. With the help of these we have used flex sensors according to the bending of fingers. And we packaged it with the help of glove. And because of this we can use one hand to interact with that watch.

II. LITERATURE REVIEW

In this section, we present the existing literature to enable one handed interaction with smartwatch. Here is some existing work who explained one handed interaction.

A. Arduino based Smart Watch

We first studied how to make the simple smartwatch using Arduino.

B. Wrist Whirl

One-handed Continuous Smartwatch Input using Wrist Gestures-In this paper they explained how they developed prototype using piezo sensor and proximity sensor to interact with smartwatch using one hand gestures.

C. Wrist Player

A smartwatch gesture controller for smart TVs- This paper explained how to interact with TV using smartwatch with the help of hand gestures.

D. Finger Identification & Hand Gesture Recognition

Techniques for Natural User Interface- This paper proposed the finger identification method.

E. Tomo

Wearable, Low-Cost, Electrical Impedance Tomography for Hand Gesture Recognition-It uses the Electrical Impedance Technology (EIT).

III. DESIGN

The generic principle is that the smart watch interaction should be simple and easy to use, which translates to the following design principles:

1) Minimum number of menus on screen.
2) Total number of steps required to execute the apps function should be less than steps required on smartphone.
3) Visually appealing. The user interface should be simple to use and visually appealing.

A. Software Required

In this paper we have used Arduino IDE software.

1) Arduino IDE

This is the open source software which is widely used for the Arduino coding. It can be runs on Windows OS X, Linux. It is java-based processing system. This software can be used with any Arduino board.

B. Hardware Required

Following hardware components are required for this paper:

1) Arduino Mega
2) 3.2' TFT display
3) Flex sensor
4) iPod or Headphones
5) Voltage Comparator Module
6) Relay Module
7) RTC module:
8) MP3 Player Module
9) Gloves

1) Arduino Mega

The Arduino Mega 2560 is actually a microcontroller board. It has 54 digital input/output pins and 16 analog inputs pins, also it has 4 UARTs (hardware serial ports) and a 16 MHz crystal oscillator.

a) TFT Display

This display has the 480320-pixel resolution. Also, it has SD card adaptor in which we can easily insert SD card having various images, music etc. It can be worked on 3.3V and 5V logic levels. The connection of Arduino mega with TFT display is easy, all we have to do is to mount the TFT display directly on Arduino Mega, and then we can load the sketch. In this paper we have used the 3.2 TFT display, there are various displays available in the market we can use any one of them.

2) Flex Sensor

A flex sensor uses carbon on a strip of plastic to act like a variable resistor. We can get resistance by flexing/bending the Flex sensor. The more we bend, higher the resistance we can get.

3) IPod or Headphones

The iPod Mini is a digital audio player which is used in our smartwatch. Using iPod, we can increase or decrease the volume. The iPod Mini supported MP3. We have used iPod only for the testing of music then we can use Headphones to listen songs.

4) Voltage Comparator Module

Using Method: by reference voltage adjusting potentiometer to generate reference voltage, and compare voltage generated by sensor and divide resistor with reference voltage, achieving high/low level comparison result output.

5) Relay Module

Relay module generally contains 4 channels from which we have used only three. For swiping the next song, increase the volume and decrease the volume.

6) RTC module

This module is used for displaying the current time. Relay module maintains Hours, Minutes, Seconds. Also, it can maintain Months, weeks and days of weeks. This module widely used in Arduino projects as well as Clock and calendar projects.

7) MP3 Player Module

MP3 Player module Plays MP3 music stored MicroSD card. It has five switches for basic user control: play/stop, forward, reverse, volume up and down. Also, the Mini USB port is provided for charging in-built rechargeable battery.

8) Gloves

In our project we used Gloves to attach the Flex sensor.

IV. APPLICATIONS

We implemented two Applications.

1) Game
2) Music player

A. Game Implementation

The first application that we have implemented is the replica of famous flappy bird game which can be play using one hand gestures. For playing the game we used one Flex sensor for upward and downward directions.one flex sensor for both upward and downward because it can get resistance when it bends, so if we are using bending of flex sensor for upward direction then, by default it can be used for downward direction also.

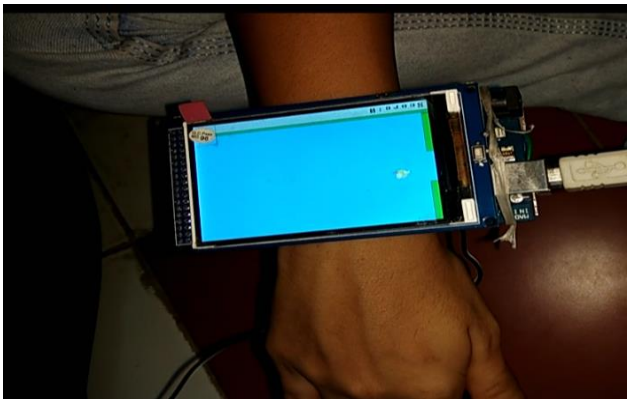

Fig. 1: Game Implementation

B. Music Player

From MP3 music player module, we have used three switches, for swiping the next song, increase the volume and decrease the volume. User can use Fingers extension to swap the next song or for increase/decrease the volume. Also, we can perform reverse the playlist and pause the song using remaining switches.

V. ALGORITHM

A. Clock

1) Pinch Detection
2) Start The watch
3) Pinch Detection
4) Close the watch

B. Game

1) Pinch Detection
2) Start the watch
3) First Gesture
4) Start the Game
5) Play the game with upward and downward gestures
6) Pinch Detection
7) Close the watch

C. Music Player

1) Pinch Detection
2) Start the watch (or we can switch to music player directly from the game also using gesture)
3) Second gesture
4) Play the songs on music player
5) For playing next song use the finger gestures
6) Also for pause the song use another finger gesture
7) To replay the song use finger gesture.
8) Pinch detection
9) Close the song.

VI. FLOW CHART

Here is the Flowchart of our project. The music system is not displayed on TFT display instead we can listen music even if we are playing the game. And to reverse, swap next song, for increase and decrease the volume, pause the song we have to just use the finger gestures to interact with the Flex Watch.

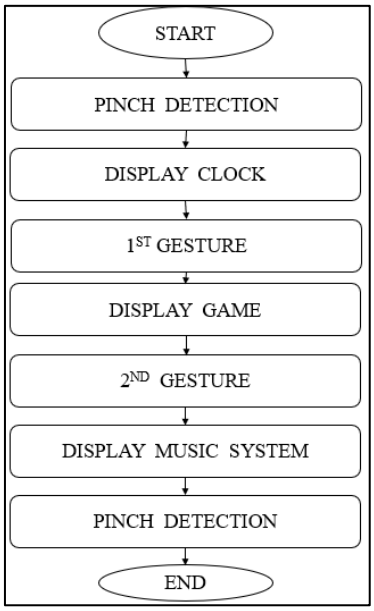

Fig. 2: Flow Chart

VII. CONNECTION DIAGRAM

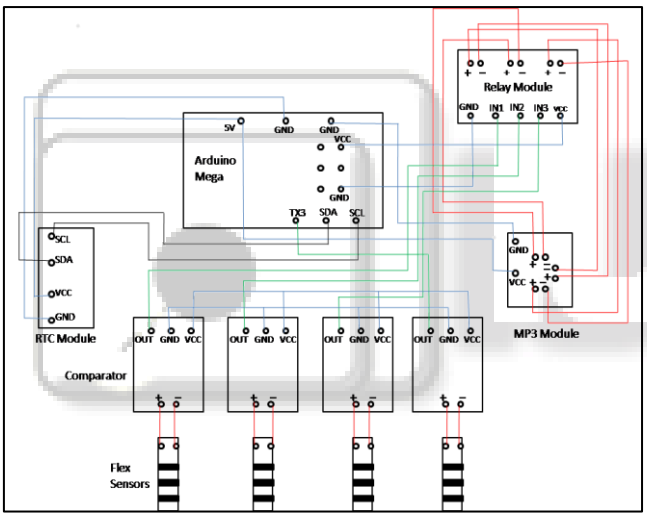

Fig 3. Connection Diagram

VIII. RESULT

A. *Result of our Project*

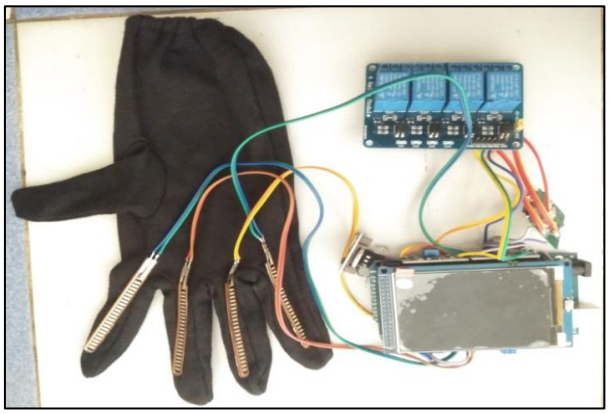

Fig. 3: Result

IX. CONCLUSION

In this paper, we have proposed a prototype using Flex sensor that uses the continuous movements of fingers. For one handed interaction on smart watches, we have used flex sensors and for implementing the gestures and to fix these sensors we have used gloves. Because of this, user don't have to use both hands for interaction with smartwatches. We believe that our work serves as important groundwork for exploring one handed interaction techniques on smart watches.

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