

Effective Touch Screen Based User Interface

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Abstract— User interface (UI) interface user to the machine, so that the user can control the machine. The machine gives feedback as soon as the user selects the function on the UI. In this paper different types of UI are compared. Touch screen based user interface is the best. Also different types of touch screen technology are compared. UI is designed and developed. The factors important for the UI are explained.

Keywords—User Interface (UI), Touch screen

I. INTRODUCTION

User interface exists everywhere e.g. washing machine which we use on the top surface there are various buttons that is nothing but a UI. You can stop the machine or turn ON just by the selecting proper button on the UI. User interface comes in very handy where user can't actually go e.g. chemical industry.

User interface should be easy to understand, speedy in operation. Just for understanding a UI no special training should be required. If we considered our smart phone UI they are easy to understand even a small baby play with it and understand.

In this paper different types of UI are explained and compared. Also why touch screen is best it is explained further. Different touch screen technologies are compared and why capacitive touch screen is preferred is explained. Also UI is designed and developed also few parameters like threshold, response time and crosstalk are explained in the paper

II. TYPES OF USER INTERFACE

The user interface or UI is nothing but helps the user to control the machine. The UI are classified as follows

1. Buttontype
2. GUI type
3. Touchtype

The touch screen based UI are preferred because they are compact in size, speedy in operation and just by the symbol or the label you can understand the operation. Comparison of the UI is given as follows

	Button Type	GUI Type	Touch Type
Components	Push button, sliders, rotating knobs	Windows, icons, menu, joystick	Touch
Size	It requires maximum physical area, it requires more human effort	GUI is compact in size physically but requires more memory	Compact in size
Power	Power utilization is maximum	Power utilization is maximum	Less power is utilized

Table 1 Comparison of different types of UI

III. TOUCH SCREEN TECHNOLOGY

Touch screen technology is classified as follows

1. Resistive touch screentechnology
2. SAW touch screentechnology
3. Infrared touch screentechnology
4. Capacitive touch screentechnology

From this touch screen technology infrared and capacitive is famous. Capacitive touch screen is commonly used. Infrared technology is costlier than that of the capacitive touch screen technology, so most probably capacitive is preferred. Capacitive touch screen technology is further classified as

1. Projected Capacitive touchscreen
2. Surface Capacitive touchscreen

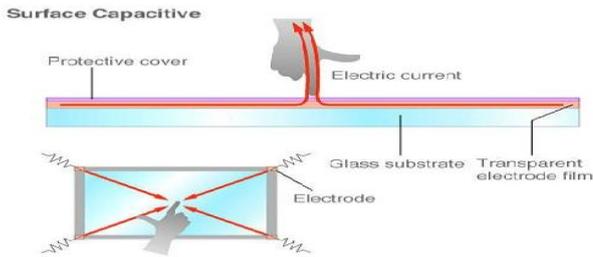


Fig.1 Surface capacitive touch screen technology[5]

These two capacitive technology are similar just touch de- tection is different. In surface capacitive touch screen on the surface of touch screen electrode is passed from the four cor- ners of the touch screen whenever user touch screen comes in contact with the touch screen it cuts the electrode, which changes the capacitance, thus the touch controller recognize thetouch.

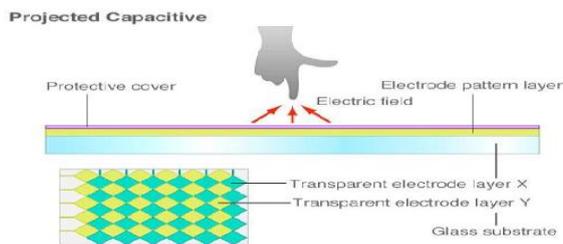


Fig. 2 Projected capacitive touch screen technology[5]

But in projected capacitive touch screen technology the X and Y electrode forms the electrode matrix. Where X and Y electrode meets at that point touch detection is done. As shown in the above figure the X and Y lines forms the elec- trode matrix. Whenever the user comes in contact with this point the touch is detected as it results in change in capacit- ance which is sensed by the touchcontroller.[5]

IV. IMPLEMENTATION

1. Hardware

V. The Fig 3. shows the block diagram of the UI. As you can see the touch keys gives input to the touch controller. The touch controller then check the whether the touch key operation is related to

main controller or touch controller can perform it e.g. lock function, to lock a UI touch control performs thatoperation.

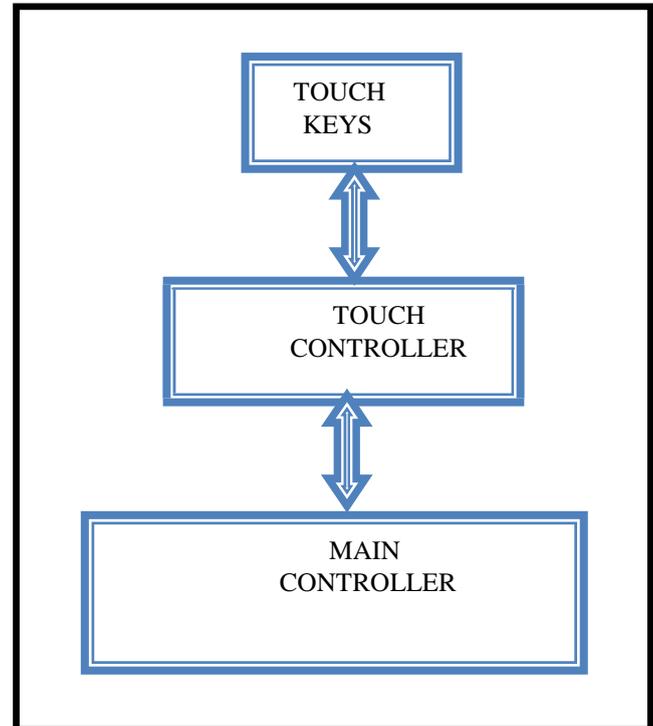


Fig 3. Block diagram of hardware



Fig. 3 UI Fascia[6]

The above figure shows the final UI fascia. According to the fascia touch keys and LED allocation is done on the PCB. It is important because user will come to know what functions is selected and the description about the keys is enough to let the user undersatnd about the function so proper allocation of keys isessential.

1. Software

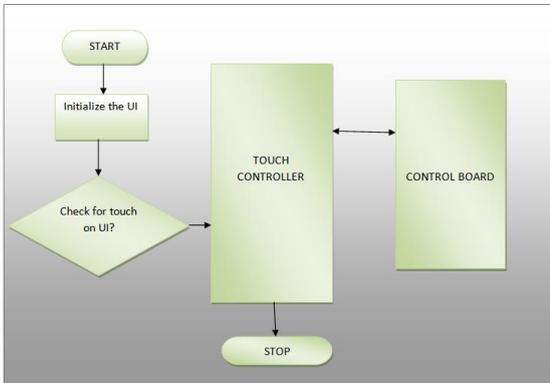


Fig.4 Flow Chart

The above figure is the flow chart for the software. In the flow chart when user touches any touch key. Touch controller will identify the operation is related to touch controller or main microcontroller. The main microcontroller is on the control board.

2. Touch Tuning Parameters

For a touch tuning of UI we are considering three parameters

1. Threshold setting
2. Responsetime
3. Crosstalk

The detail explanation about these parameters is as follows

1. Threshold setting

Threshold value is the ideal value above which, the touch key is detected. Threshold is basically the value where touch is detected, touch detection is done above or equal to this value. Threshold is different for different touch keys. Threshold value determines the touch when human finger had touched the UI. So with the help of threshold the touch detection is done only with the help of human finger.

2. Responsetime

Response time is nothing but the time required by the machine to provide output for the selection from user on the UI. The response time should be as minimum as possible. It should be in milliseconds. User should not wait for longer time duration just to get the feedback from the system for the command the user has selected. Nowadays the user should get

the output from the machine in the flick of seconds. No waiting for re- sponse.

3. Crosstalk

The crosstalk is nothing but interference. When key1 is pressed with it other keys like key2 or key3 also get activated. The activation of other keys other than the key touch is crosstalk. Crosstalk leads to false activation of keys. Crosstalk will make the behavior of the UI random.

IV. RESULTS

A. Threshold

The relation between touch and threshold value is given in the below graph. For No touch detection min and max value should be less than threshold value, which indicates that touch is not sensed when other than human finger comes in contact with the touch keys. The touch detection min and max average value indicates that in between this range human finger touch is detected. Other than this range touch should not be considered.

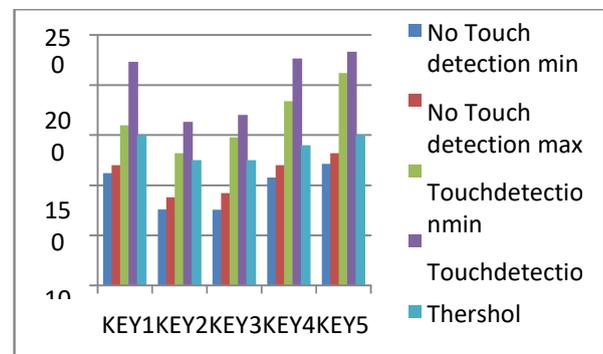


Fig.6 Touch Vs Threshold

B. Responsetime



Fig.7 Response time for key whose operation is related to main controller

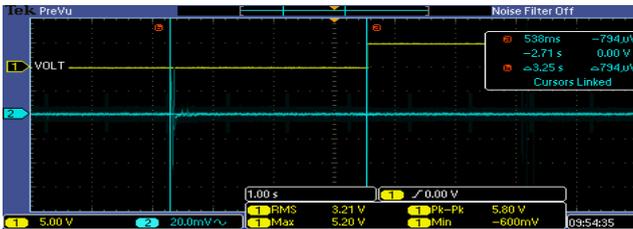


Fig. 8 Response time for the operation/function related to touch controller

C. Crosstalk

In the below figures the crosstalk was observed. When touch key 1 was pressed there is no crosstalk i.e. no other touch key is activated.

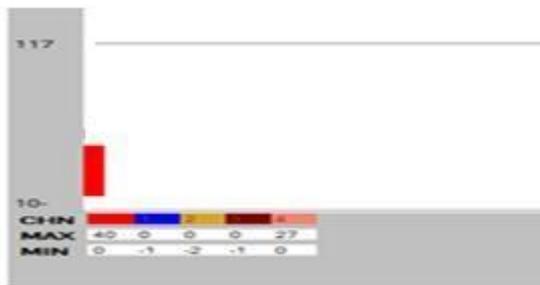


Fig. 9 Cross talk for touch key1

In the figure below the 5th touch key is pressed. When it is pressed, crosstalk is there as 4th key is also showing some value, but that value is below threshold so that value is not considered.

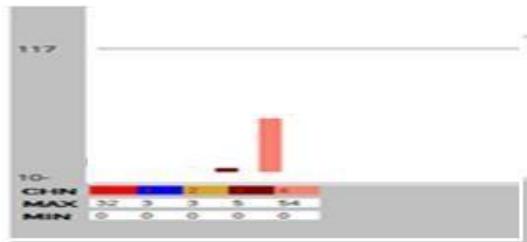


Fig.10 Cross talk for touch key5

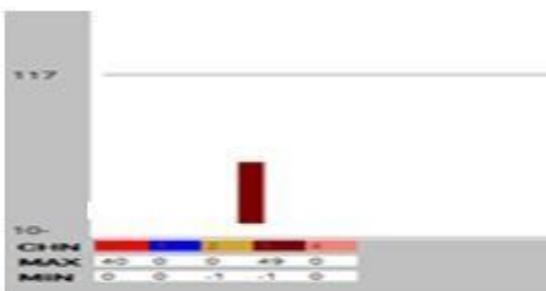


Fig.11 Cross talk for touch key4

In the above figure, when 4th touch key is pressed and there is no crosstalk.

V. CONCLUSION

When a UI is developed the parameters are important factors. While designing of a UI these factors are the major requirements. If these parameters are fulfilled then only the user interface for any machine is helpful. If the response time is huge then that user interface is definitely not preferred. As now user demands faster response, user should not wait for the feedback it should be done in flick of seconds. Crosstalk is also not allowed as it leads to false indication of touch keys which will provide false feedback from the machine. Threshold setting is important because only human finger touch should be detected; otherwise it will lead false detection which is not preferred.

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