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IMPLEMENTATION OF ONLINE SIGNATURE VERIFICATION USING ADVANCE RISC PROCESSOR

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Abstract

In this paper we have discussed on the implementation of the online signature verifier using the advanced RISC processor. The circuit is wired around the Atmel's AVR microcontroller .We also developed the algorithm based on slop calculation method. In that the signatures are generated & stored in the permanent memory in the form of look up table. During the runtime, the signatures are again generated in real time and are compared to the stored, expected signatures. If disagreement occurs, the occurrence of an error is detected & reported.

Keywords— Signature, RISC,AVR, slop calculation, Registration array ,Online array

INTRODUCTION

Signature is socially accepted authentication method & is widely used as proof of identity in our daily life. Depending on the format of input information, automatic signature verification can be classified into two categories

a) Online signature verification

b) Offline signature verification

FEATURES

In this algorithm, we take advantage of the online registration data to recover writing trajectory of an offline input signature & make verification decision based on the recovered trajectory.

BLOCK DIAGRAM OF THE SYSTEM

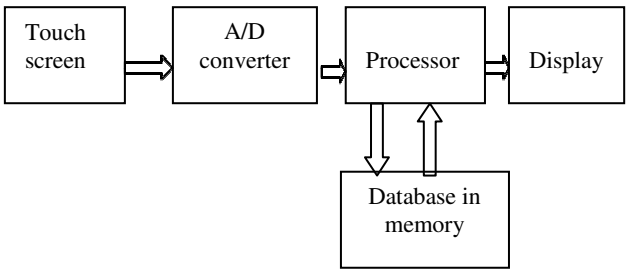


Figure1: block diagram of online signature verifier

In this system touch screen is used as input device. It is used to sense the signatures which are in the form of analog signals. These signals are converted into digital signal by using analog to digital converter. After processing, Microcontroller unit stored the data (digital form of signature) in the memory & the corresponding message i.e. ―signature registered‖ will be displayed on the LCD display. Digital forms of signatures are stored in the form of array.

When same signature comes on the touch screen, the same process will be repeated. Microcontroller unit will verify the signature with the database signatures & if the signature matches with corresponding signature of database, the message ―signature correct‖ will be displayed on the display. If the signature not matches with the database, the message ―signature incorrect‖ will be displayed on the display.

CIRCUIT DIAGRAM OF THE SIGNATURE VERIFIER

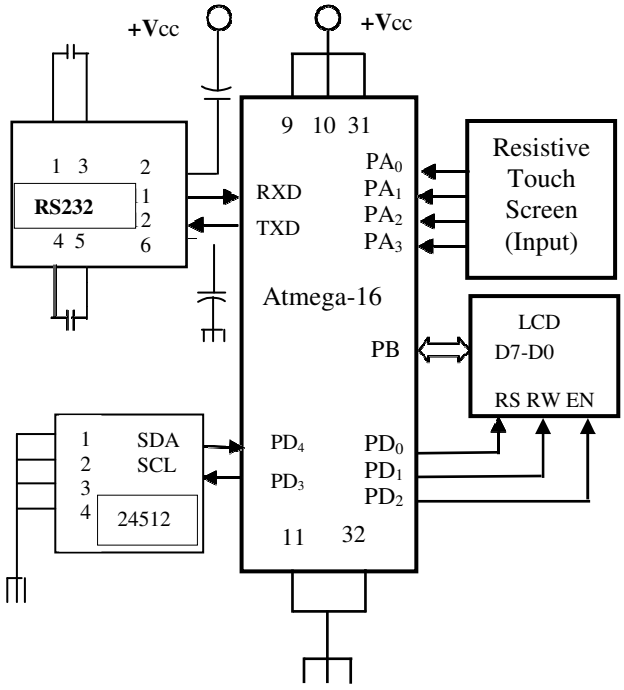


Figure 2: Circuit diagram of signature verifier

Above circuit diagram of signature verifier is wired around Atmel's AVR Atmega16. Resistive type touch screen is used as an input device. Resistive touch screen are so named because they are basically resistive voltage dividers. The four wires of the touch screen namely x+, x-, y+ , y- are connected with the port A pins . LCD 16×2 display is used as output device ,the data lines D_7-D_0 of LCD are connected with the port B, control signals RS,R/W,EN are connected with the PD_0,PD_1,PD_2 pins of the AVR microcontroller respectively. For storing additional database the additional memory, serial EEPROM (IC 24C512) is connected. The I2C protocol is used to perform the data transfer between the AVR microcontroller & serial EEPROM. The AVR microcontroller communicates with the other processor like PC through serial port using RS232 converter. Program can be burn in the microcontroller via serial port.

FLOWCHART

The system will work in two modes namely registration mode & verification mode. In registration mode the algorithm will store the signature in the EEPROM in the form of array. The array present in EEPROM is called as the registration array. For the n no. of signatures the n no. of arrays are required In the verification mode algorithm will store the signature in RAM in the form of array. The array present in RAM is called as online array.

Data Base Management

The output of the A/D converter is a binary data of the analog signature. By using algorithm, Slopes of the consecutive coordinates of the signature is calculated, then each slope is converted into the sample .Each sample consists of 8 bit data .for given signature, 100 samples are generated. So the look up table of 100 samples is created in the EEPROM memory for the one given signature .Data base is required for comparing two signature samples. The number of memory locations required for storing the different encoded signatures.

Flowchart of signature registration

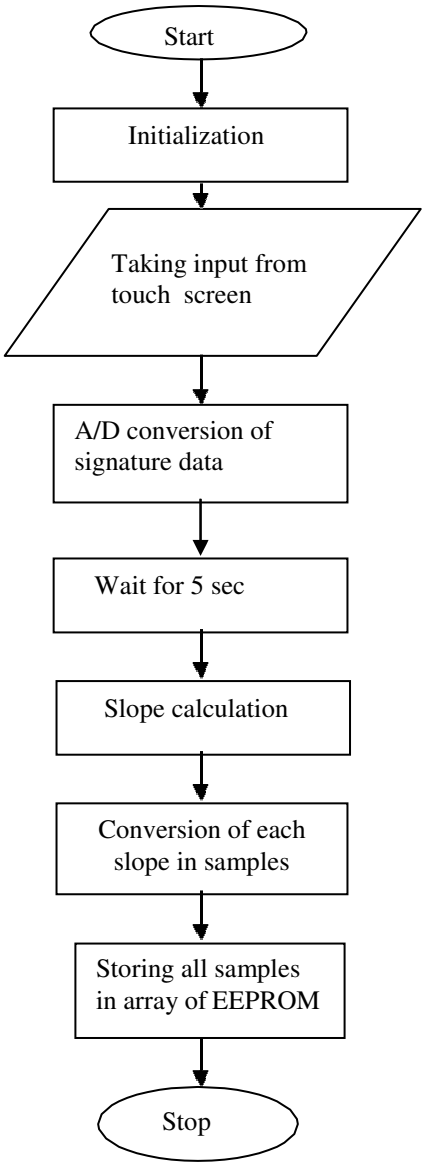


Figure 3: Flowchart of signature registration

FLOWCHART OF SIGNATURE SENSING & VERIFICATION

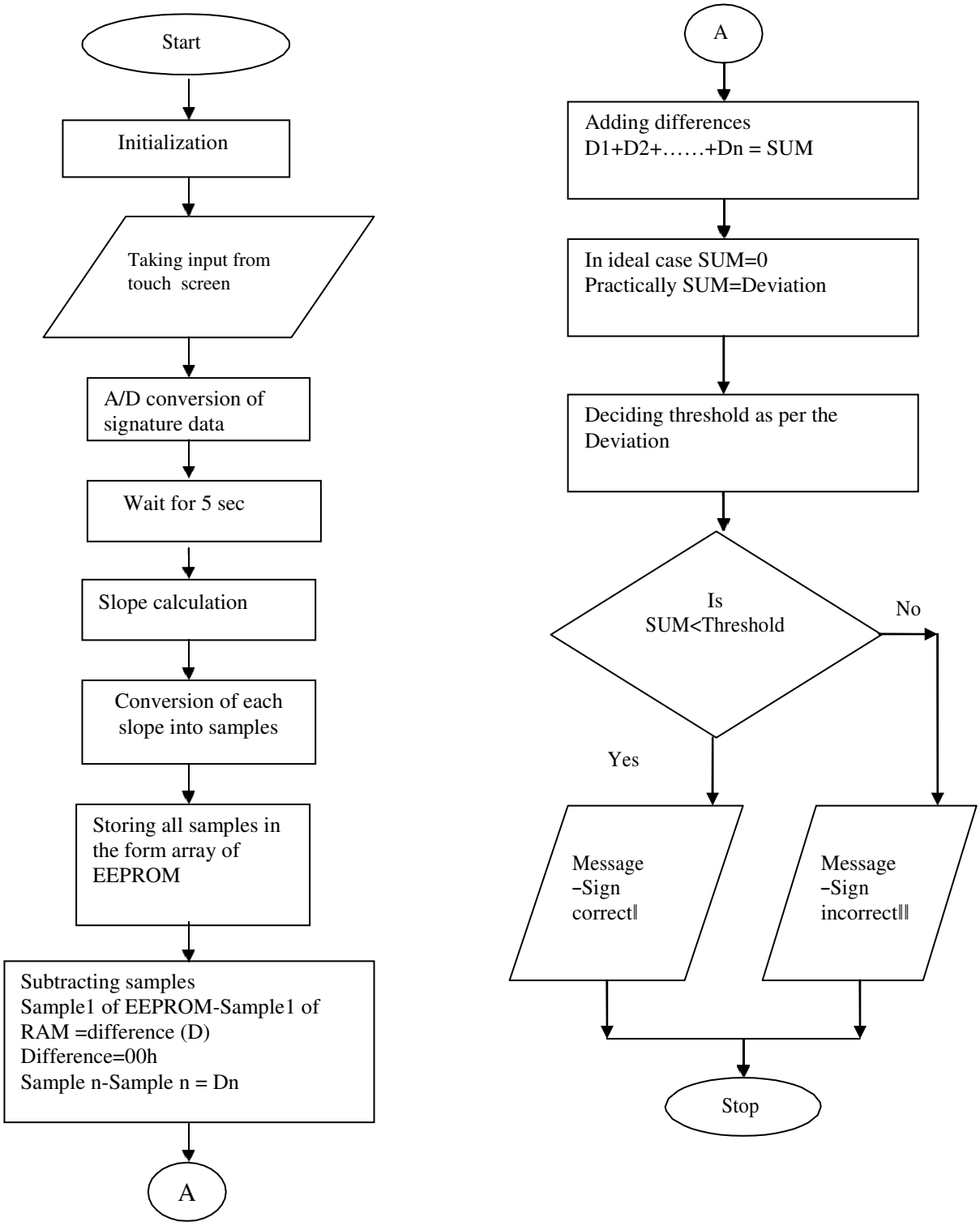


Figure 4: Flowchart of signature sensing & verification

DATA PROCESSING

The processing unit will check the signature with the database signature (sample codes) by using algorithm. The algorithm will perform the percentage match with the reference (i.e. given coded samples of signature).Depends on the percentage match or error, system will decide whether it is correct or not & the corresponding message will be display on the output device.

ALGORITHM

Algorithm of the system based on the slope calculation method

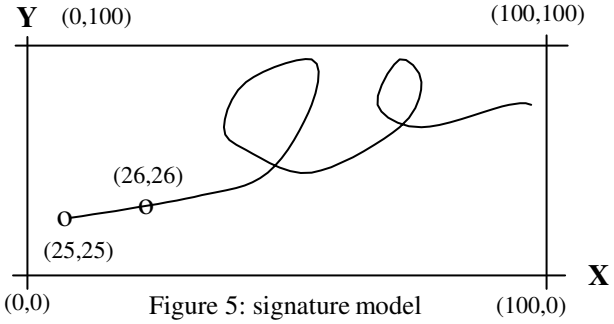


Figure 5: signature model

Representation of signature

In the very first stage the algorithm will find the coordinates of the origin (starting point i.e. Xo,Yo).With reference to the origin algorithm will find the other coordinates of the signature i.e.(X_1,Y_1),(X_2,Y_2), (X_3,Y_3)…….. . (X_n, Y_n).
In the second stage the algorithm will calculate the slopes of the consecutive coordinates by using the standard formula

$$\text{Slope} = \frac{(Y_1 - Y_0)}{(X_1 - X_0)}$$

Lets assume

Origin = $(X_0, Y_0) = (25, 25)$ &
$(X_1, Y_1) = (26, 26)$

The slope will be

Slope = (26-25) / (26-25)
=1

Like that the other slopes are calculated. One sample is generated for one slope

Technique used in algorithm for signature registration

Presuming signature time 5 sec for each signature. For each signature, there are 100 samples generated. The size of each sample is 8 bit.

Sample rate calculated by

$$\frac{\text{Time required for signature}}{\text{Total no. of samples}}$$

$$= \frac{5 \text{ sec}}{100} = 50 \text{ m sec}$$

All the samples of signature are stored in EEPROM in the form of look up table (array). It is called as registration array. In this project 5 arrays are created for 5 different signatures namely Sign1, Sign2, Sign3, Sign4, and Sign5

Sign 1 Array	Sign 2 Array	Sign 3 Array	Sign 4 Array	Sign 5 Array
Sample1	Sample1	Sample1	Sample1	Sample1
Sample2	Sample2	Sample2	Sample2	Sample2
Sample3	Sample3	Sample3	Sample3	Sample3
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
Sample 100	Sample 100	Sample 100	Sample 100	Sample 100

Table 1: Arrays present in EEPROM database

Technique used for signature sensing & verification

For online verification of signatures, again 100 samples created for each signature. At this stage the temporary look up table is created for storing all the samples in RAM memory in the form of array, it is called as online array.

In this technique, initially sample1 (8 bit) of online array is subtracted from sample 1 of registration array. Then we get difference between two samples.

Like that all the samples of online array are subtracted from the corresponding samples of registration array. Ultimately we get all the differences

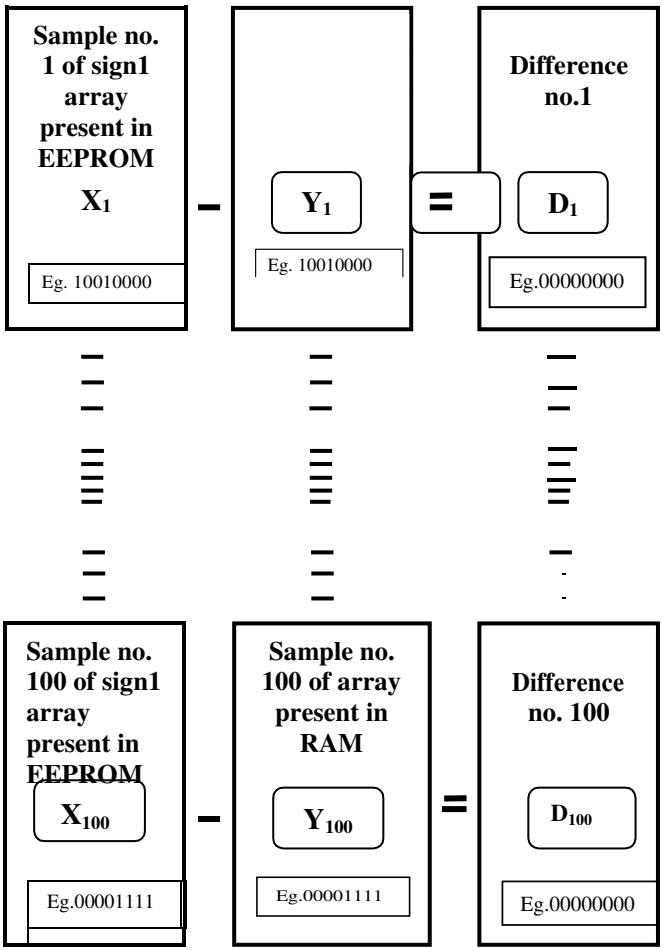


Figure 6 : Subtracting samples from arrays & obtaining differences

Finally added all the differences & summation is stored in the variable named –SUM‖. If all differences are zero, the content of variable SUM is zero.

In ideal case the differences should be zero. The content of variable SUM will be zero. We conclude that the sample matches with their corresponding samples.

But practically the differences are non zero. We got some deviation. Hence the content of variable –sum‖ is non zero value. At this stage the threshold is fixed .if the sum is less than the threshold, we conclude that the current signature matches with the database signature & displayed the message

–correct sign‖. If the deviation more than threshold, signature not matches with the database signature. Then we displayed the message –incorrect sign‖

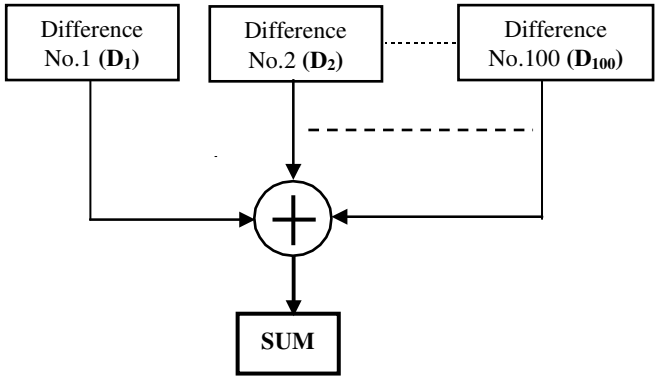
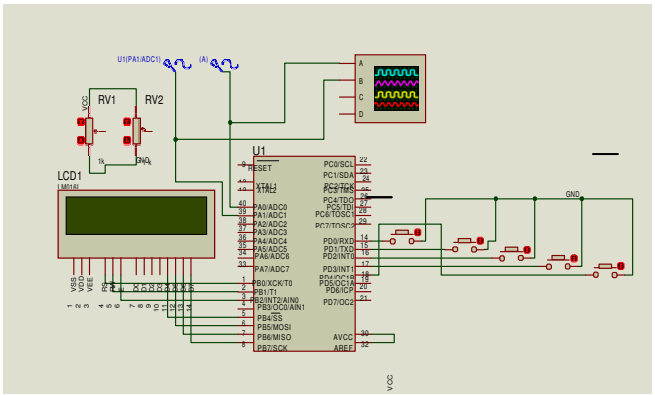


Figure 6: Summations of all differences

Ideally SUM=0, But practically SUM≠0
If SUM≤ Threshold, then result= correct sign
If SUM> Threshold, then result= incorrect sign

Experimental study

The experimental study of the signature verifier has done on the simulator named ‗Proteus'. In which 5 switches are connected for registration of the 5 different signatures. Also we have designed & fabricate the prototype of the signature verifier.



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