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A Design and Construction of Speech Signal Uniqueness Test Device

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ABSTRACT: This dissertation is intended to design and construct electronics computational circuit which help in checking uniqueness property of voice/ audio signal to help communication engineers consider human speech as a unique biometric character which can be used for people identification in internet security and also in searching people online from calls they made or voice chat. The design was successfully completed and result obtained from the constructed device shows that human voice can be considered as a unique biometric character. It can be used as a weapon against Criminals, Militant and Extreme groups to get access to their current information like phone number, IP addresses, location and other useful information. In this dissertation saved offline data were used to verify we can check for identical voice. This device work based on the targeted voice andTime required to search for a person online was not taken in to consideration. What I believe is "if the entire world i.e. about 7 billion will make a call at the same time, electronics has sufficient switching time to search for just one person within acceptable time limit"

KEYWORDS: Security, Speech Uniqueness, Voice uniqueness, Voice Recognition, Pattern Recognition,

I. INTRODUCTION

In-security is one of the world biggest problem affecting both under developed, developing and developed nations everywhere on this planet, which promoted the topic "war against terrorist" as one of the major agendas in all united nation conferences related to problem affecting the world. Searching criminals, militants and other anti-government groups by security personnel, using their phone numbers, IP addresses is not sufficient enough to efficiently trace them and moreover, phone numbers, IP addresses are things that can be permanently changed.

This is an electronic device which serve as an equipment use for checking identical audio signal, it was designed to be operated within audible range of frequency (20Hz to 20 kHz). Regardless of the nature of signal, this device will work efficiently in checking identical signals as long as the frequency is within the audible range of frequencies.This device was equipped with two inputs to make it suit for checking any targeted voice, so that the voice to be checked will be fixed at one input while the other input is available for checking all the available audio signals. This device has one input that can give a serial output which can be directly interfaced with any "analog to digital converter" there is no restriction in choosing which of the input is to be connected to signal to be check and which of the input is to be connected to set of available voices, it depend on user to decide on how to make use of the inputs.

II. RELATED WORK

In [1] they just focus on biometric identification, they treated how biometric can be use to categorize individuals and their work was successful. In [2] they focus on limitation of biometric and they clearly come up with condition of selecting biometric for a particular application. [3] Dealt with speaker recognition enhancement and he uses Block Level, Relative and Temporal Information of Subband Energies. [4] dealt with biometric authentication he was also

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successful. [5] Come up with the idea of Personal Identification in Networked Society, and and he used the idea of biometric where users were identified.

III. THEORETICAL BACKGROUND

A. BIOMETRIC

Introduction: Biometrics refers to metrics related to human characteristics. Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance, and is unique to each and every individual like finger print, iris, voice, face etc.

Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioral characteristics. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, voice, face, palm veins, face recognition, DNA, palm print, hand geometry, iris recognition, retina and o dour/scent. Behavioral characteristics are related to the pattern of behavior of a person, including but not limited to typing rhythm, gait, etc.

IV. ANALYSIS

A. INTRODUCTION

This chapter deals with design and analysis of a main unit which will enable communication engineers to consider human speech as one of the biometric character which can be used as a weapons against criminals, terrorist etc. For several years engineers and scientists are trying to represent human speech with a mathematical function to be able to implement in computer for further analysis.

B. Signal Analysis Consider a function f(x) as a function that represent human speech to pronounce a particular word, and also let the second function be w(y) , which represent a second function to pronounce second word be the same or different person involve. The ratio of the two signals involve is given below:

Signal ratio, $s_r = \frac{f(x)}{w(x)}$…….. eq. 1

$\log_e s_r = \log_e \frac{f(x)}{w(x)}$……. eq. 2

$\log_e s_r = \log_e f(x) - \log_e w(x)$……..…..……. eq. 3

S_r = anti-log ($\log_e f(x) - \log_e w(x)$)……..….. eq.

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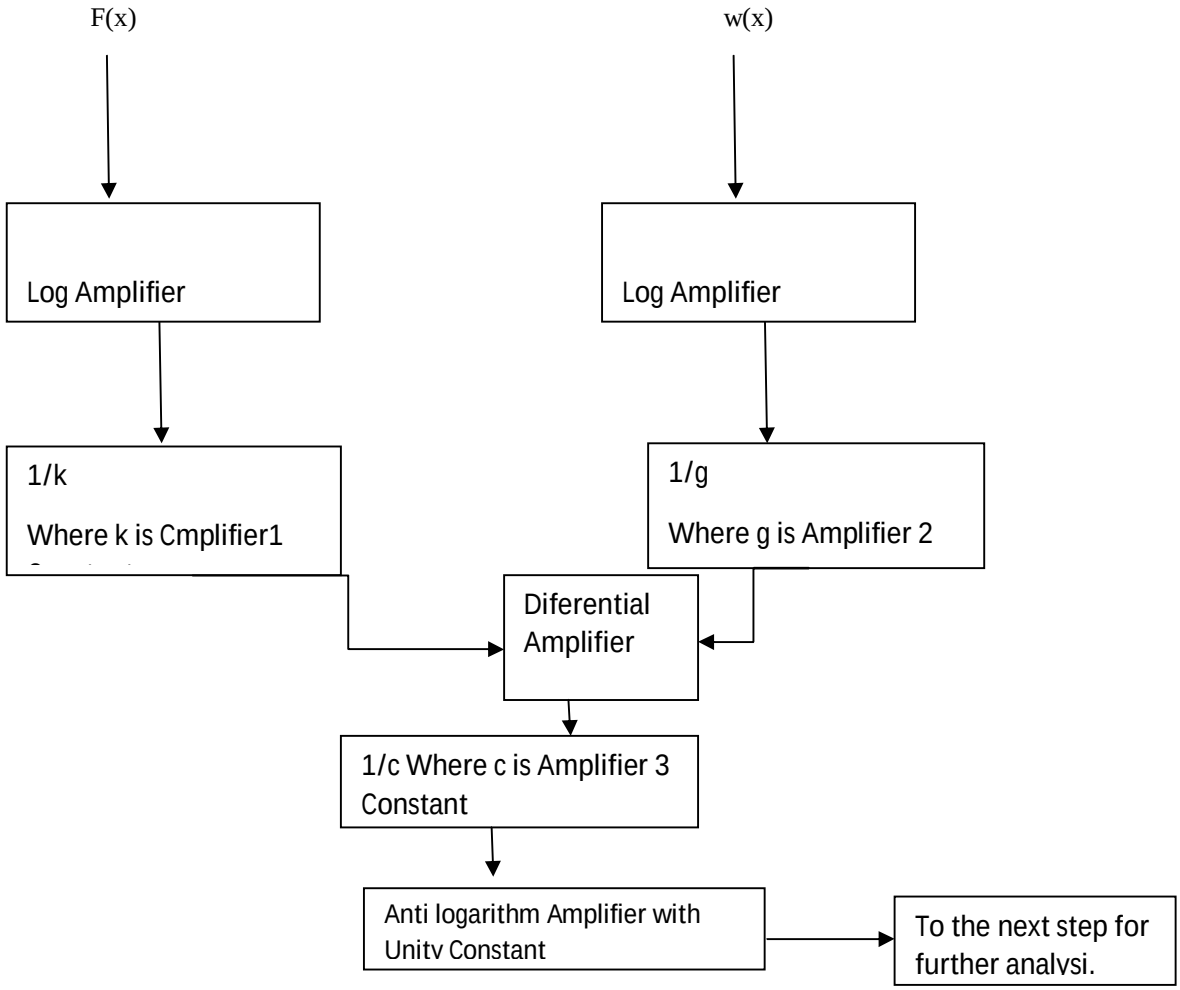

Fig 1: Signal Processing Unit

If y= f(x), then, $\frac{dy}{dx}$ = zero ..... eq. 5

$\frac{d\,s_r}{dt} = d/dt(\text{anti-log}\,(\log_e f(x) - \log_e w(x)))$..... eq. 6

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The complete idea is as depicted here

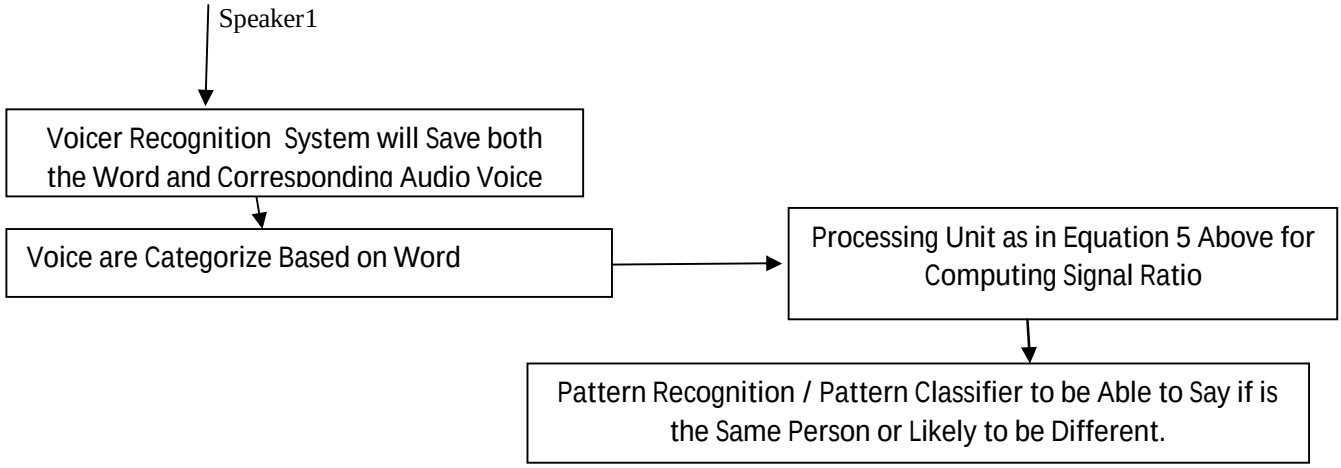

Fig 2: Checking for Unique Character

V. ELECTRONICS CIRCUIT DESIGN

A. *LOG AMPLIFIER*

$V = v_y \log \frac{V_{in}}{V_x}$…….. eq. 7

The output of log amplifier is normally of the form of equation 4.1 above i.e $v_{out} = v_y \log \frac{V_{in}}{V_x}$

By recalling equation of straight line curve i.e

y= mx +c…….. eq. 8

and re express eq. 7 above as follows

$v_{out} = v_y \log_e v_{in} - v_y \log_e v_x$…….. eq. 9

$v_{out1} = v_y \log_e f(x) - v_y \log_e v_x$…….. eq.10

$v_{out2} = v_y \log_e w(x) - v_y \log_e v_x$…….. eq. 11

$v_{out} = v_{out1} - v_{out2} = v_y \log_e \frac{f(x)}{w(x)}$ as required…….. eq.12

A. *TRANSISTOR BIASING AND AMPLIFICATION DESIGN*

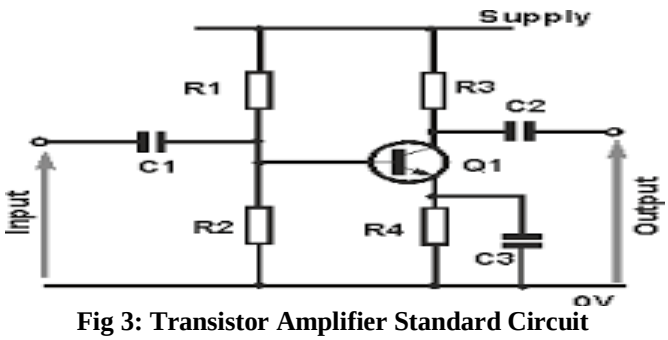

Fig 3: Transistor Amplifier Standard Circuit

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$V_{CC} = V_{R1} + V_{R2}$ ……..eq. 13

$V_{R1} = \frac{R_1}{R_1+R_2} \times V_{CC}$ …….. eq. 14

$V_{R2} = V_{CC} - V_{R1}$…….. eq. 15

V_{R1} = 12-4.4= 7.6 volt
$I_C = \beta I_b$ where β is given by $\beta = I_c/I_b$ collector current is always set from I_b
$V_{BE} + I_E * R_4 = V_{R2}$ ……..…….. eq. 16

$I_E = I_b + I_C$ ……..eq.17

By accepting I_c to be 4 mA since it is within the allowable range therefore,
$I_B = I_C / \beta$= 0.004/150= 0.000026A at β = 150
$I_{RI} = I_{R2} + I_b$……...eq. 18

$R_1 = 1.72\ R_2$ …… eq. 19

V_{R2}= 4.4 = $I_{R2} * R_2$ ……..……... eq. 20

V_{R1} =7.6 = $I_{RI} * R_1$ …….. eq. 21

I_{RI} = 0.000026 + I_{R2}……..... eq. 22

7.6 = 0.000026 $R_1 + I_{R2} R_1$……..,…….….. eq.23

From equation 3.21
I_{R2} =4.4/R_2…….…. eq. 24

7.6R_2=0.000026 R_1 R_2 + 4.4R_1 ……..……...eq. 25

And R_2 = 2kΩ And R_1 = 3.5kΩ And R_4= 6/0.00044 =13.6kΩ
Since I_E = 0.004026A to leave emitter voltage at 3 voltR_3= 4.2 kΩ
I_{R2} =4.4/R_2 4.4/2000
=0.0022A (which is within the acceptable range)
And from equation 4.23
I_{R1}= 0.000026 + I_{R2}
0.000026+0.0022
=0.00217A which is also within the acceptable range.
$V_{CE} = V_{CC} - V_C - V_E$
=12-3-3.722
5.3 Volt which is also acceptable value
C_1 and C_2 are coupling capacitors and hence I have selected standard value of 10μ farad for just blocking d.c or as filter capacitors.
And minimum audible frequency =20Hz
Therefore, $C_3 = \frac{1}{20*4200}$
= 11.9μF at minimal condition
And hence the amplifier will be implemented on both side of pre differential amplifier stage.

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B. INTERFACING DIFFERENTIAL AMPLIFIER WITH ANTILOG UNIT:

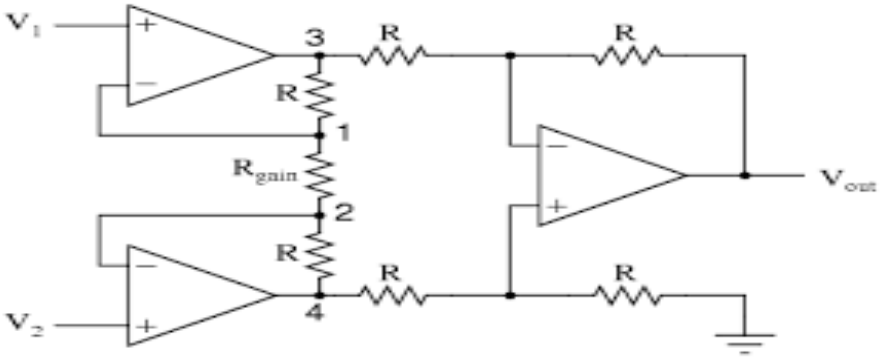

Fig 4.4: Differential Amplifier

R_g control the gain of differential amplifier, gain, A_V is given by

$A_V = (1 + \frac{2R}{R_{gain}})$ …… eq.26

For choosing gain of 2

$R_{gain} = 2R$ …… eq. 27

For R_{gain} = 10kΩ therefore,

R = 5kΩ.

VI. RESULT AND ANALYSIS OF RESULT

A. FIRST INPUT SIGNAL WAVE FORM

The first input signal used to verify how this circuit work come from computer and the nature of the signal is as seen below is an audio signal with nature as shown below but it true nature will be better understood by playing the video attached to this project report. It has an unsteady frequency which can hardly be computed manually but it ranges from 20Hz to 20kHz which is the range of audible frequency. This waveform is the photograph taking from advance communication laboratory as the output of CRO as can be better understood by playing the video CD attached to this report.

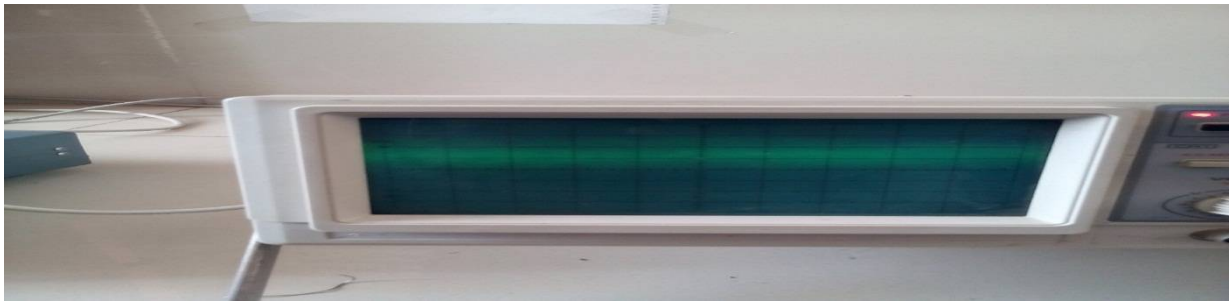

Fig 5.1Wave form of Signal one from Computer as Taken From CRO

B. SECOND INPUT USED IN ADVANCE COMMUNICATION LAB

Below is the nature of second signal used to test the workability of my constructed circuit it frequency cannot be stated but I can only say it ranges from 20Hz to 20kHz as it is an audio signal. What make speaker to work is based on the law which stated that movement of diaphragm produces sound in direct proportional to the variation of the frequency of supply voltage, it will be better understood by playing the attached video taking in advance

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communication LAB. Is a great mistake to state the frequency of any audio signal as the variation of frequency is the characteristic of all audio signals. The waveform is as shown below but can be clearly understood from the attached video

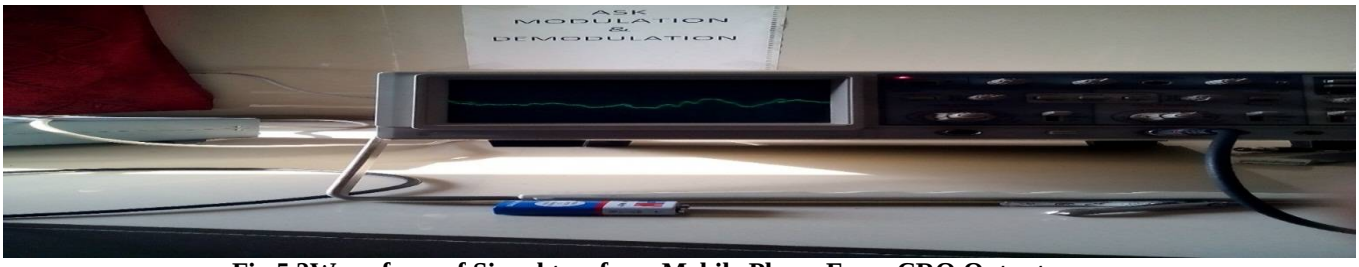

Fig 5.2Wave form of Signal two from Mobile Phone From CRO Output

C. CONNECTING SIGNAL 1 TO FIRST INPUT AND SIGNAL TWO TO THE SECOND INPUT

Input 1 of the constructed circuit was connected to signal 1 as seen above in figure 3.2 and input 2 of the constructed work was also connected to signal two as also seen above in fig 3.3 and the output probes were connected to the oscilloscope as can be clearly seen from the video CD attached to this report. The output signal from my constructed work as snapped from oscilloscope output is as seen below fig 4.3 below

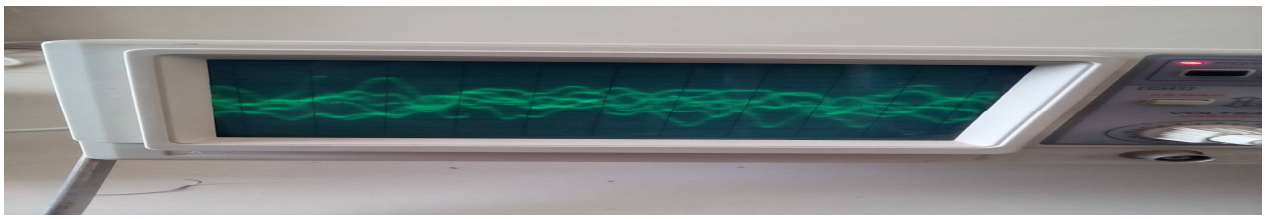

Fig 5.3Wave form of OutputSignal of the Circuit when Signal one and two were Compared Taken From CRO

Discussion of Result: Signal one and two are two different signals, when connected to the circuit the output of the circuit is as seen above snapped from the CRO output and it is of audio in nature but it will be better understood if you played the attached CD plate. Fig 4.4 is the waveform obtained when signal one is compare to signal two.

D. SIGNAL 1 IS CONNECTED TO BOTH TWO INPUTS

Signal one as seen in figure 4.1 is connected to both inputs of the circuit and the output obtained is as seen below but it will be better understood by watching the video of connection and output waveform from the CD attached to this project report. Fig 4.4 as seen below

Fig 5.4 : Wave form of Output When Signal 1 from Computer is Compared with Identical Signal

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From the time division as can be seen from the attached video the time scale is at 5 micosecond / division and as seen the period of the signal is just 5µs

T = 5µs

And frequency, F = 1/(T) =1/(5µs) = 200kHz which is outside audible range of frequency as I already in the video. Audible range of frequency ranges strictly from 20Hz to 20kHz. Therefore I consider it as just noise and moreover, even if it is within the audible range it will not be audio in nature as constant frequency can never make diaphragm to vibrate and frequency variation is what causes existence of voice but within audible range.

Discussion of Result: Signal one is compare to identical signal one and the output of the circuit is as seen above and it is of constant nature in frequency domain as can be viewed from the attached CD, and the frequency is 200kHz which is outside the audible range

E. SIGNAL 2 IS CONNECTED TO BOTH INPUT

The result is the same as 4.4 above

F. GENERAL DISCUSSION OF RESULT

figure 4.1 is the waveform of signal one and figure 4.2 is the waveform of second signal. When signal one is connected to input 1 and signal two is connected to input two the output as snapped from the oscilloscope is as seen in figure 4.3 which is of audio in nature (not steady frequency and within the audible range), the result of figure 4.3 signifies the two signals were not identical that is why the audible behavior of the signal was not cancel.

Figure 5.4 is a condition when signal one was used to cancel audible behavior of identical signal from computer and the cancellation was successful as the output obtained is not of audio in nature(steady frequency and outside the audible range) it will be clearly understood by playing the attached CD plate as attached to this seminar report.

Figure 4.5 is a condition when signal one was used to cancel audible behavior of identical signal from computer and the cancellation was successful as the output obtained is not of audio in nature(steady frequency and outside the audible range) it will be clearly understood by playing the attached CD plate as attached to this seminar report.

VII. CONCLUSION AND FUTURE SCOPE

This research has been successfully completed and result obtained shows that identical or similar speech signal can be checked and using this constructed device the result emerged at the output is sufficient enough to say whether the two signals were identical or not, this constructed electronic device is sufficiently enough to tell the relationships between the two signal connected to it input. Based on this, human voice can be used for internet security and also as a weapon against Criminals, Militants, Extreme groups, Avengers etc. to search for their voices online from active calls, saved calls, chat voice and to come-up with their phone number, location(country and city including the cell/communication tower from where he originated/termination his call) even if they changed their phone numbers. To search for a person online or from saved calls you don't need to know his/her phone number, but the most important thing is you ended up with all his details including his phone number. In recent future I am expecting design of synchronizer and software for making one of the input variable.

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BIOGRAPHY

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