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A Design and Simulation of Speech Signal Uniqueness Test Circuit

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ABSTRACT: This dissertation is intended to design and simulate 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 Simulation 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 and Time 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 circuit which 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 circuit will work efficiently in checking identical signals as long as the frequency is within the audible range of frequencies. This circuit 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

Taking logarithm of 3.1 above

$\log_e s_r = \log_e \frac{f(x)}{w(x)}$……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.4

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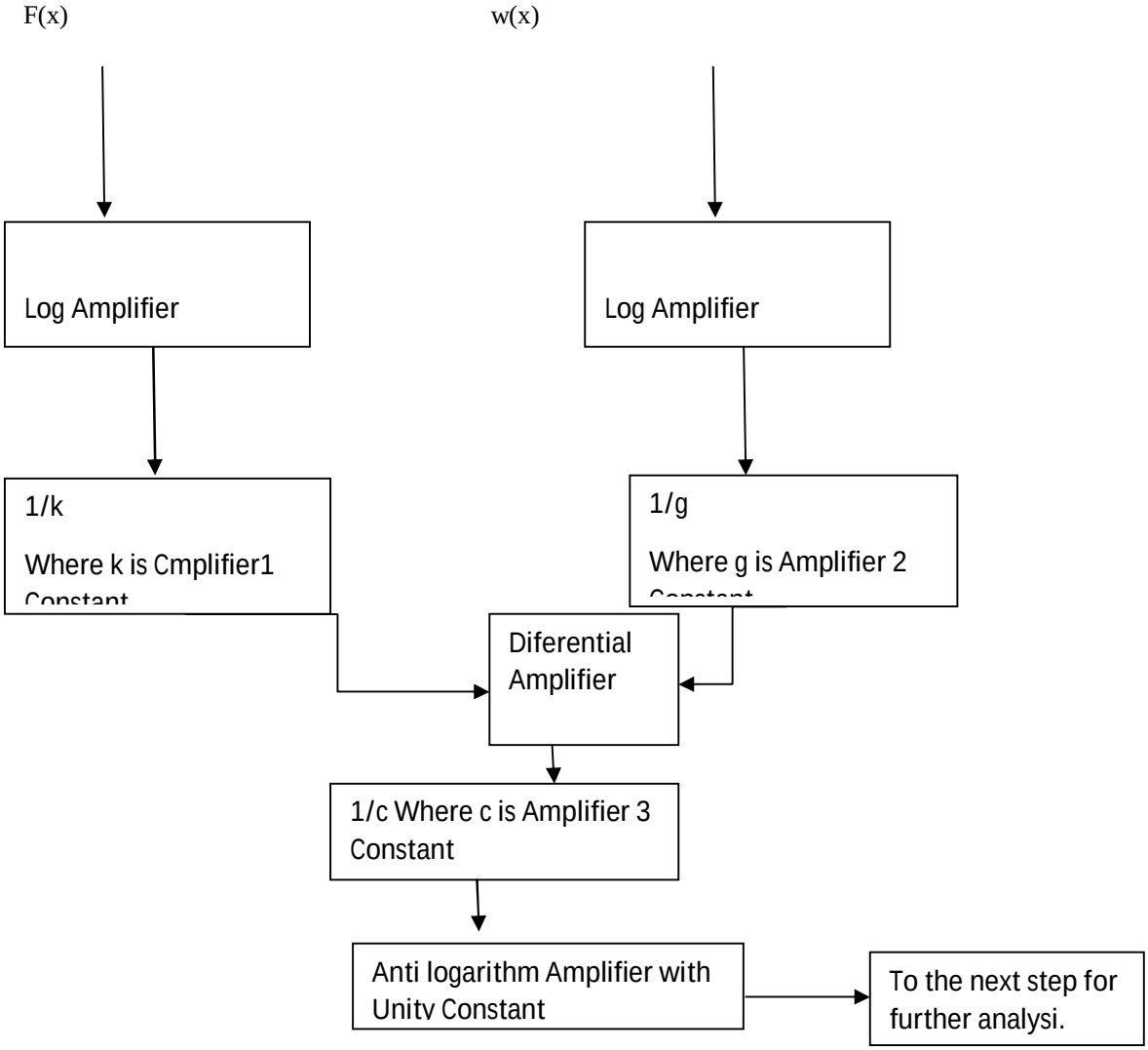

Fig 1: Signal Processing Unit

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

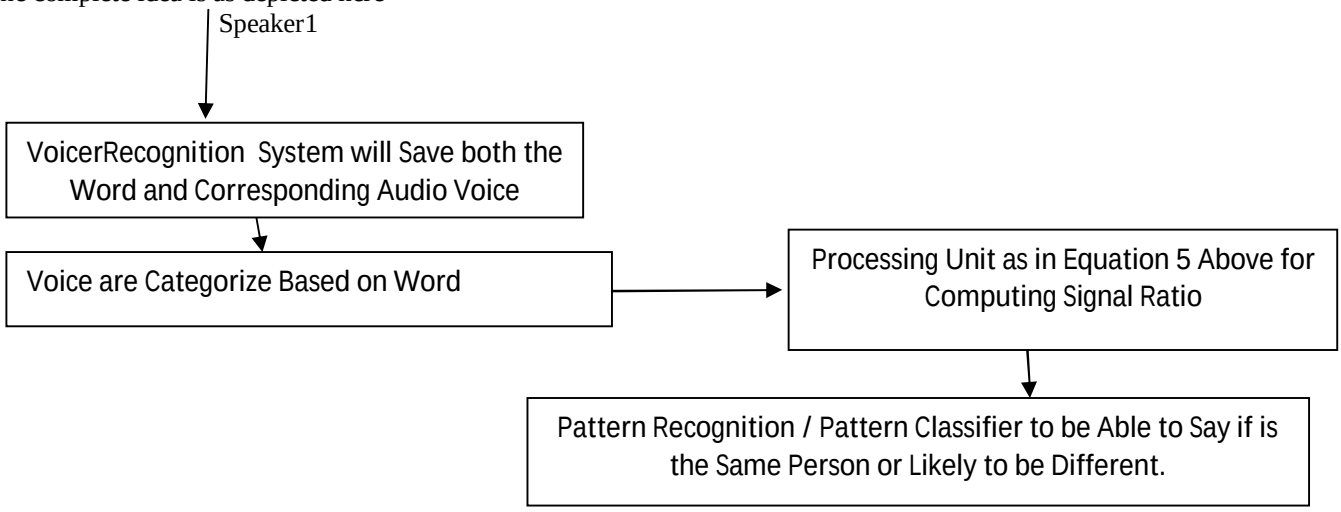

Fig 2: Checking for Unique Character

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 4.1 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

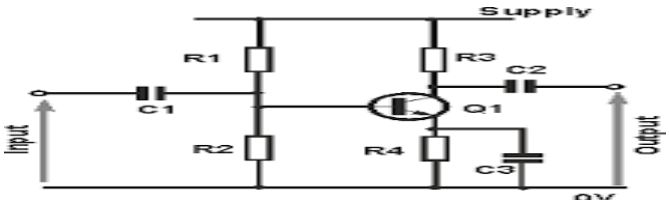

Fig 3: Transistor Amplifier Standard Circuit

$V_{CC} = V_{R1} + V_{R2}$ ……..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

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$I_C = \beta I_b$ eq.17
$I_E = I_b + I_C$ eq.18
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 $\beta = 150$
$I_{RI} = I_{R2} + I_b$ eq.19
$R_1 = 1.72\ R_2$ eq.20
$V_{R2} = 4.4 = I_{R2} * R_2$ eq.21
$V_{R1} = 7.6 = I_{RI} * R_1$ eq.22
$I_{RI} = 0.000026 + I_{R2}$ eq.23
$7.6 = 0.000026\ R_1 + I_{R2}\ R_1$ eq.24
From equation 3.21
$I_{R2} = 4.4/R_2$ eq.25
$7.6R_2 = 0.000026\ R_1\ R_2 + 4.4R_1$ eq.26
And $R_2 = 2k\Omega$ And $R_1 = 3.5k\Omega$ And $R_4 = 6/0.00044 = 13.6k\Omega$
Since $I_E = 0.004026A$ to leave emitter voltage at 3 volt $R_3 = 4.2\ k\Omega$
$I_{R2} = 4.4/R_2\ 4.4/2000$
$= 0.0022A$ (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, $C_3 = \frac{1}{20*4200}$
$= 11.9\mu F$ at minimal condition
And hence the amplifier will be implemented on both side of pre differential amplifier stage.

B. INTERFACING DIFFERENTIAL AMPLIFIER WITH ANTILOG UNIT:

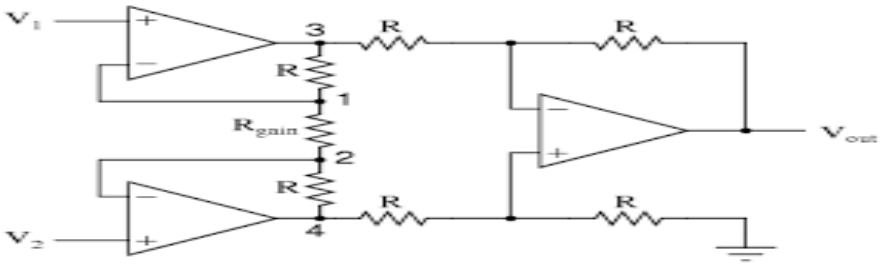

Fig 4: Differential Amplifier

$R_g$control the gain of differential amplifier, gain, A_V is given by
$A_V = (1 + \frac{2R}{R_{gain}})$ eq.27
For choosing gain of 2
$R_{gain} = 2R$ eq.28
For $R_{gain} = 10k\Omega$ therefore,
$R = 5k\Omega$.

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VI. SIMULATION

Simulation is very important, with the help of simulation I will be able to understand the circuit will or will not work, because with the help of simulation for every input condition, computer will show me the output.

In this dissertation I was given an option either to demonstrate my work using simulation or by constructing a device. I decided to go with construction option despite the fact construction is more difficult compare to the simulation, the device was already constructed but I have to present this simulation to have assurance that what I did is 100% right. To say using simulator everything will work perfectly without the need of any synchronizer, in simulation no matter how the situation is everything will start at the same time. But simulation really work to show you an insight of what you are doing. Since the world standard demand for simulation I have to show it.
The complete design is for signal cancellation, so I decided to simulate the central unit to have an insight of whether the cancellation is successful or I am just wasting my time.

By using PROTEUS 8 PROFESSIONAL for audio input 1 and 2 the result of simulation is as below:

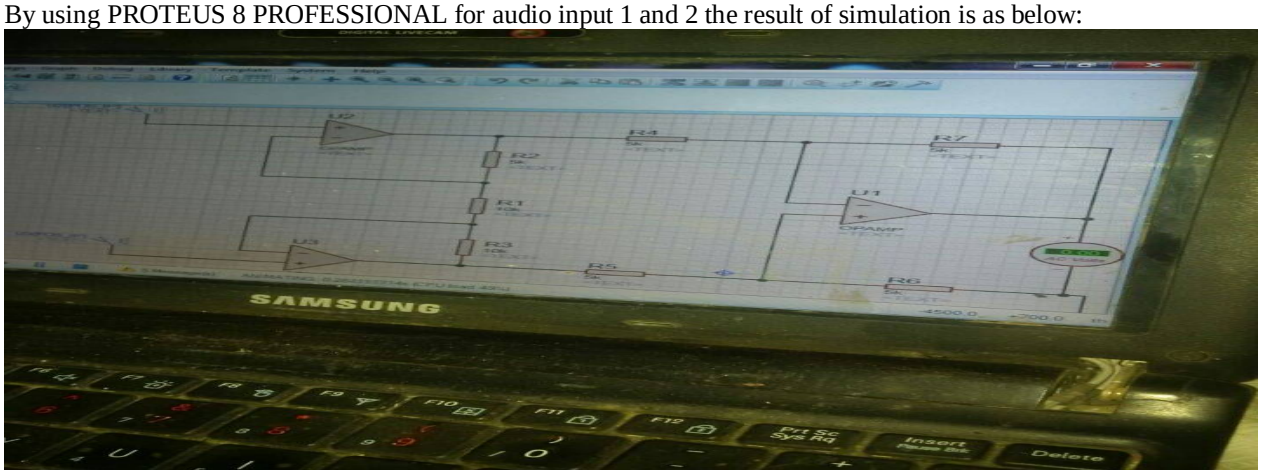

Fig 5: Simulation with same audio input.

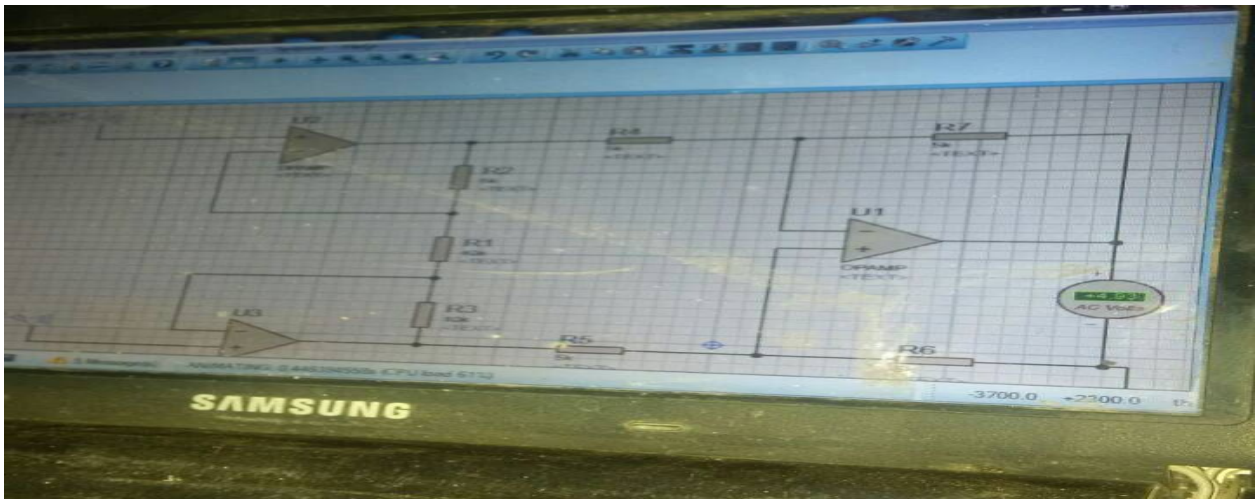

Fig 6 Simulation with different audio input

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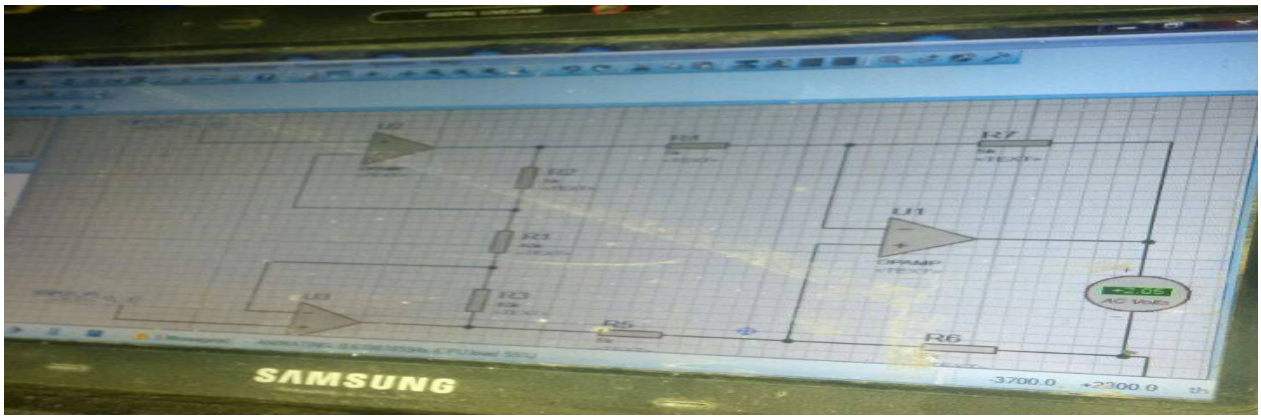

Fig 7: Second simulation with two different audio signal

Discussion of Result of Simulation:

Fig 3.6 shows that for the same input cancellation was successful as no any signal obtained the output meter read 0.00 For Fig 3.7 and 3.8 it shows active signal and the meter read +4.93 signal and + 2.05 respectively which shows alternating output are present and so everything is okay.

VI. 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 circuit the result emerged at the output is sufficient enough to say whether the two signals were identical or not, this electronic circuit 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.

The focus of the current research was to see if we can be able to identify identical voice signals and in term of audio or voice I can confidently said it covers all the audible frequency i.e from 20Hz to 20kHz, and the hardware device was successfully designed and tested with audio signals, 1 from computer and the second signal was from mobile phone, it worked accurately as can be seen from the video taking in advance communication Lab.

Subsequent research on this field are expected to come as follows:

1. Design a software that will make one of the input to be fixed on targeted voice and the other input will be allow to check within a given set of audio signals, to check for identical voice be online or from saved data (voice)
2. And in a recent future there is need to design a synchronizer i.e a timing unit to equipped my constructed work with, because in case of checking online data with the fixed data there is possibility that the two data will not be properly timed and in such cases even identical data may not be seen as identical.
3. By completing the above mission, I am just saying sorry to any terror or criminal that has allowed his voice available with securities.

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