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Principal Components Analysis

Impact of Silicon Film Thickness

Highlights

Enhancement of Face Recognition

Properties of Advanced Bio Materials

Discovering Thoughts, Inventing Future

VOLUME 23 ISSUE 2 VERSION 1.0

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Electrical and Electronics Engineering

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Investigation the Impact of Silicon Film Thickness on FDSOI and PDSOI MOSFET Characteristics

By Towhid Adnan Chowdhury
Ahsanullah University of Science & Technology

Abstract- The performance of chip is degraded because of the short-channel effect (SCE) as the metal oxide semiconductor field effect transistor (MOSFET) size scales down. Silicon on insulator (SOI) technology helps to reduce the short channel effects and permits a good solution to the miniaturization. The electrical characteristics of fully depleted SOI (FDSOI) and partially depleted SOI (PDSOI) n-channel MOSFET (N-MOSFET) are investigated as silicon film thickness is varied in this paper. Both transistors are compared in terms of electrical parameters which are the threshold voltage, subthreshold slope, on-state current, leakage current and drain induced barrier lowering (DIBL). Silvaco TCAD tools are used for simulating both PDSOI and FDSOI MOSFETs. FDSOI MOSFET is superior to PDSOI MOSFET based on found simulation results.

Keywords: silicon on insulator, subthreshold slope, leakage current, threshold voltage, drain induced barrier lowering.

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Towhid Adnan Chowdhury

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Keywords: silicon on insulator, subthreshold slope, leakage current, threshold voltage, drain induced barrier lowering.

I. Introduction

Today devices of minimized area, reduction in power and increased performance have a great demand in the industry of microelectronics. The feasible technique of semiconductor industry to enhance productivity and performances is scaling of device [1]. The size of MOSFET has continually been scaled down [2]. The submicron technologies have created electrical operational challenges such as threshold voltage (Vth), sub threshold slope and leakage current due to the shrinking of the devices dimensions in MOSFET. The industry is facing difficulty to fulfill the Moore's Law using bulk devices which cause threshold voltage to decrease and leakage current to increase as length of channel decreases because of short channel effect (SCE). Silicon on Insulator (SOI) is considered as a potential alternative over conventional bulk MOSFET due to decreased silicon geometries and simple fabrication process. Radiation hardness, improved switching speeds, reduced leakage currents, better isolation, eliminization of latch up and decrease in the short channel effects are some of the advantages of the SOI devices [3]. It has the intrinsic benefit of reduced source and drain areas and reduction of junction capacitance which makes these devices a potential candidate for low power and voltage applications [4-6]. SOI has several benefits over other technological solution such as no latch up, lower threshold voltage and better sub threshold slope [7-8]. There are two types of SOI, which are partially depleted (PD) and fully depleted (FD) depending on the thickness of the silicon film on the insulator. Usually, the thickness of silicon film is between 100nm to 500 nm for PD SOI device. For fully-depleted SOI devices, the thickness of silicon film is about less than 100nm. Due to removal of the floating body effect, FDSOI provides better short channel behaviour compared to the PDSOI. Hui et al. investigated impact of silicon film thickness on leakage current and threshold voltage in PDSOI and FDSOI [9]. This paper presents investigation between partially depleted and fully depleted SOI devices in terms of electrical parameters which are threshold voltage, subthreshold slope, on-state current, leakage current and drain induced barrier lowering. TCAD Silvaco software was used for simulation study of SOI devices. Simulation results revealed that the electrical characteristics such as threshold voltage, subthreshold slope and leakage current of fully depleted SOI outperformed than that of partially depleted SOI devices. There is difference in turn on voltage in fully depleted SOI (FDSOI) MOSFET. The threshold voltage is stable in partially depleted SOI (PDSOI) device due to thicker silicon film layer.

II. Methodology

To study the electrical parameters on SOI MOSFET a schematic cross-sectional view of the SOI MOSFET, shown in figure 1, is simulated using Silvaco TCAD device simulator. The channel doping concentration is kept at 1×10^{17} cm^{-3}. The source/drain region doping concentration is kept at 1×10^{20} cm^{-3}. Gate length of the device is 1 μm. Gate oxide (SiO_2) thickness and buried oxide thickness are 18 nm and 0.4 μm respectively. The total device length including drain, channel and source is 3 μm. Shockley-Read-Hall recombination, field-dependent mobility model and

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impact ionization model from Selberherr [10] was used for the simulation. Newton methods is used as numeric methods for simulation.

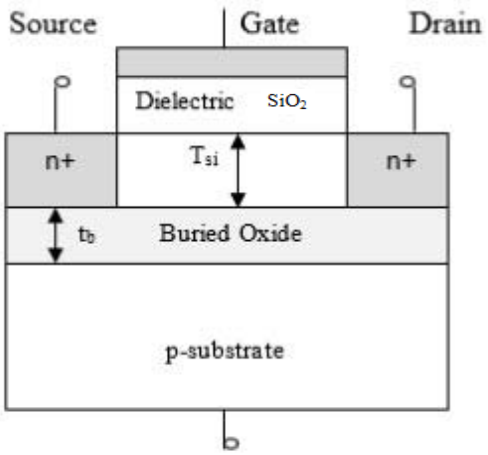

Figure 1: Schematic view of SOI MOSFET

III. Results and Discussion

The n-channel PDSOI and FDSOI MOSFET has been investigated in terms of electrical parameters by simulation results obtained using Silvaco TCAD simulation software. Atlas syntax is used to create SOI structures and TonyPlot is used to display simulation results.

The impact of silicon film thickness on SOI MOSFET's electrical parameters are shown in table 1. FDSOI MOSFET has thickness of silicon film below 0.1 μm while for PDSOI it is greater than 0.15 μm for the simulated structure [11].

Table 1: The impact of silicon film thickness on electrical parameters of SOI n MOSFET

Silicon Film Thickness(μm)	Threshold Voltage,Vth(V)	Subthreshold slope(mV/dec)	On-state current,I_{on}(μA)	Leakage current,I_{off}(pA)	DIBL(mV/V)
0.07	0.3206	65.45	81.89	12.42	74.84
0.09	0.4686	67.15	68.12	0.415723	113.34
0.11	0.6081	86.75	55.56	0.301249	166.66
0.13	0.6731	94.5	46.16	0.241121	178.18
0.15	0.6846	95.92	42.69	0.194797	180.73
0.20	0.6869	96.26	41.53	0.288933	179.56
0.25	0.6863	96.27	41.27	0.347851	177.83
0.30	0.6902	96.74	40.35	0.284068	175.69

The gate to source voltage needed to turn on the MOSFET is defined as threshold voltage, V_{th} [8]. Smaller threshold voltage satisfies high performance of device with technology scaling [12]. The threshold voltage for PDSOI is above 0.68 V and for FDSOI below 0.47 V as extracted from simulation results and also shown in figure 2. So the turn on voltage of PDSOI is larger than FDSOI from the results. This is the reason for FDSOI devices consuming less power and gaining higher speed.

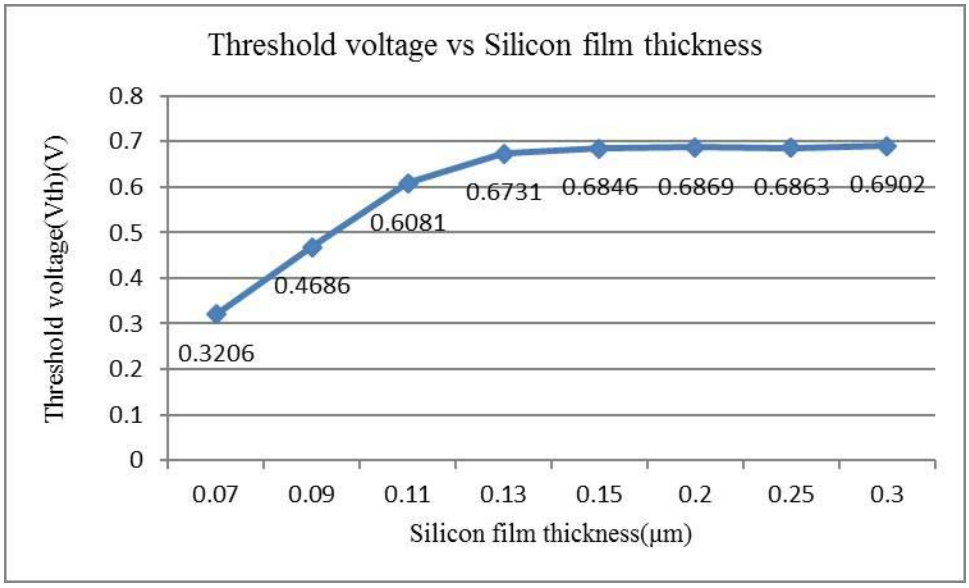

Figure 2: Threshold voltage versus silicon film thickness

A steeper subthreshold slope helps MOSFET to gain fast switching [13]. As silicon film thickness decreases, the steeper subthreshold slope becomes as from figure 3 which strongly increases the device speed. Comparison of subthreshold slope between FDSOI and PDSOI n-MOSFET is shown in figure 4.

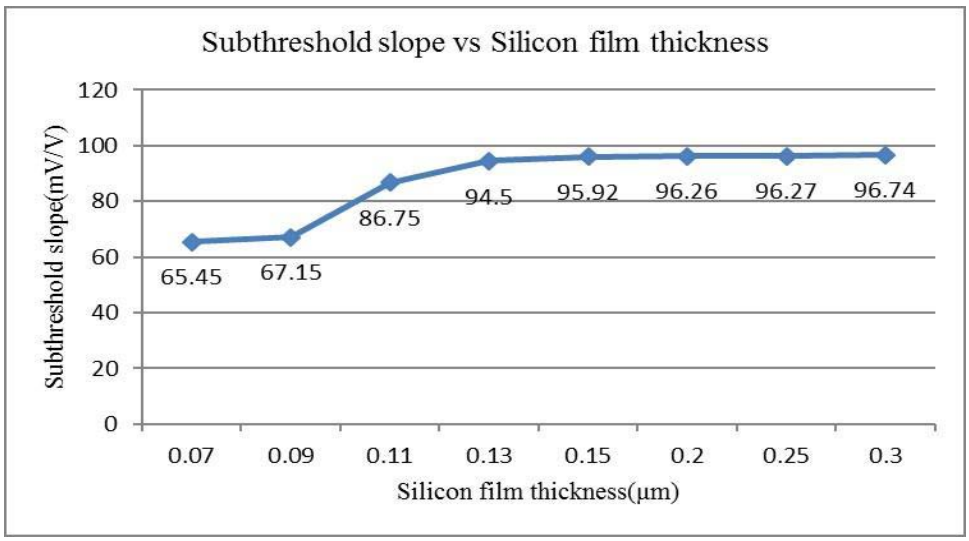

Figure 3: Subthreshold slope versus silicon film thickness

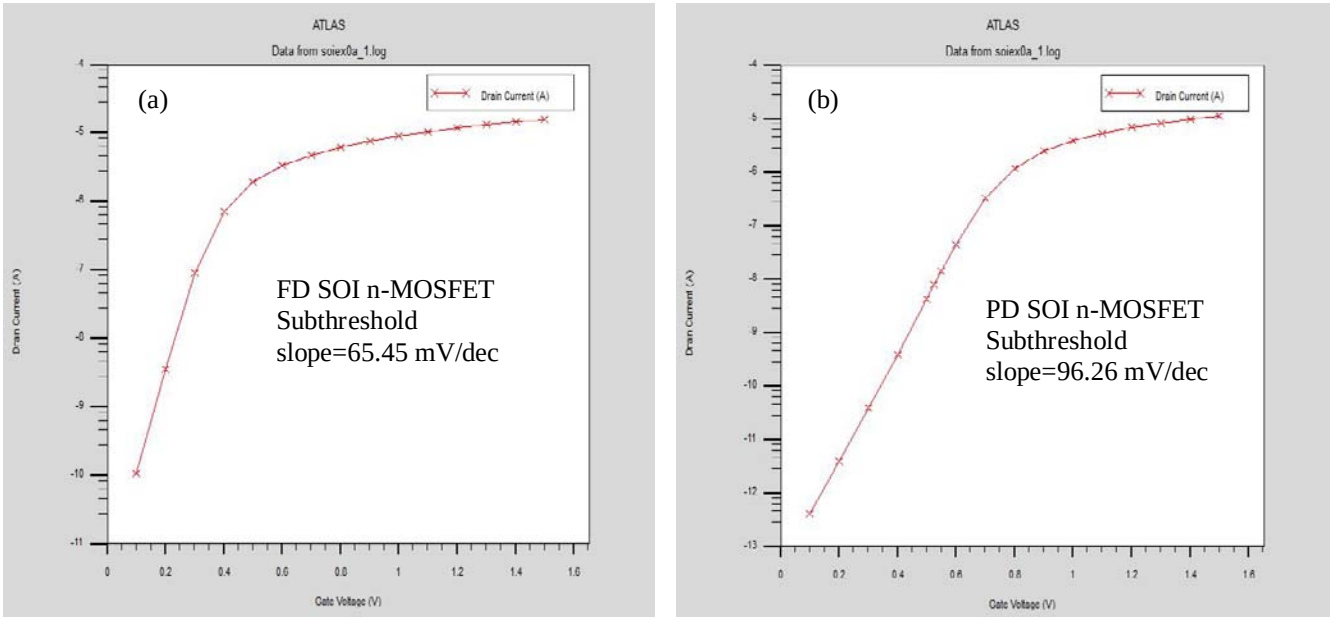

Figure 4: Comparison of subthreshold slope between (a) FDSOI and (b) PDSOI n-MOSFET

A high on-state current(I_{on}) is needed to increase the driving force of the device. From figure 5, it can be said that the on-state current is greater when thickness of silicon film is reduced.

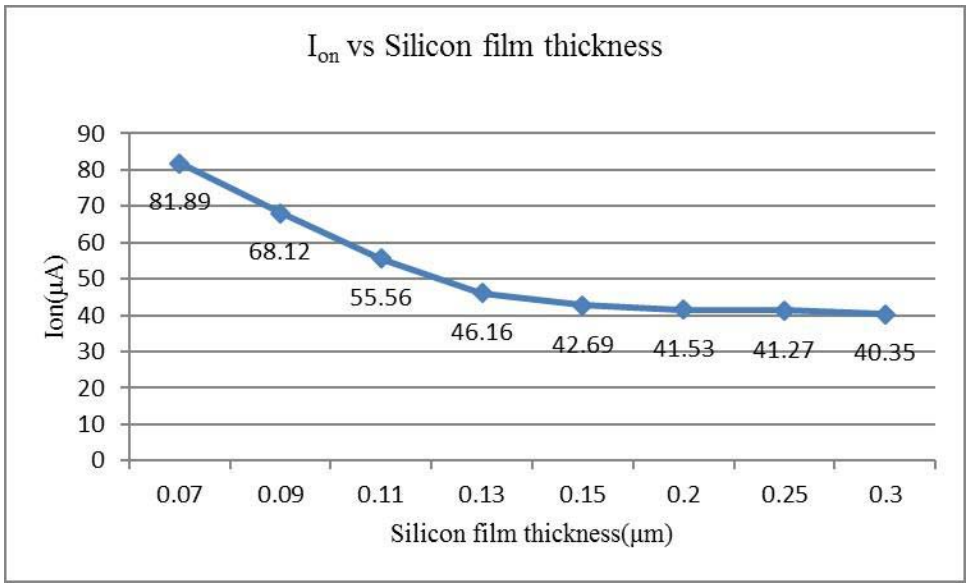

Figure 5: On-state current versus silicon film thickness

As threshold voltage is increased, the leakage current(I_{off}) is decreased [14]. It can be decided that in PDSOI the leakage current is lesser but the variation is insignificant as shown in figure 6. Static power dissipation is created by leakage current when the device is not powered [15]. Static power dissipation will be small if leakage current is smaller. Thus, from the simulation results the static power dissipation of PDSOI will be smaller compared to FDSOI.

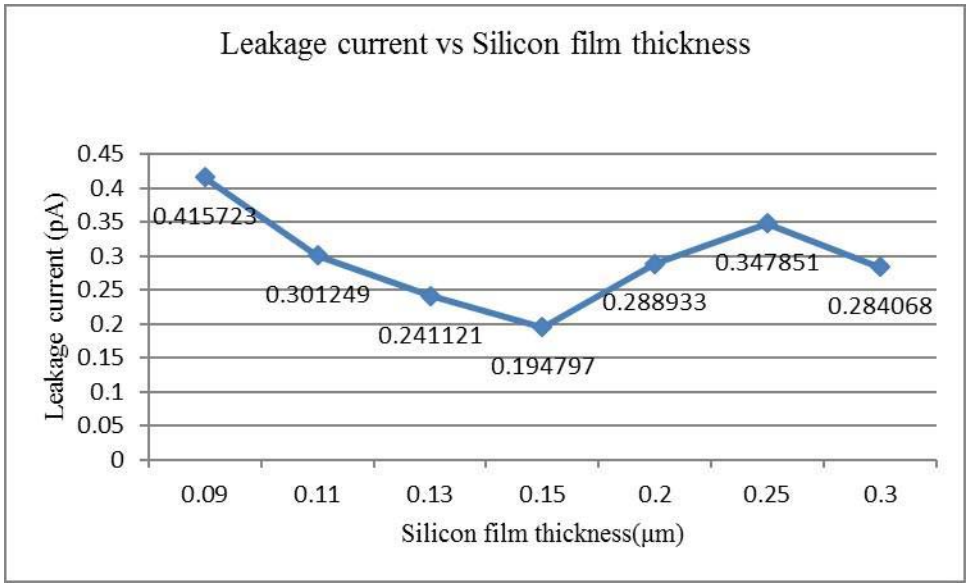

Figure 6: Leakage current versus silicon film thickness

Drain induced barrier lowering (DIBL) is an indication for short channel effects. Devices with smaller channel lengths and large bias on drain are vulnerable to DIBL effect. As thickness of silicon film increases from 0.07 μm upto 0.15 μm, the DIBL value increases from 74.84 mV/V to 180.83 mV/V as shown in figure 7 which degrades short channel effects. As silicon film thickness increases from 0.15 μm to 0.3 μm DIBL value improves slightly. But it does not reach the same improved DIBL value compared with silicon film thicknesses between 0.07 μm to 0.1 μm. Therefore SOI with silicon film thickness of 0.07 μm has the best DIBL parameter value which makes it less sensitive to short channel effects. Therefore, the impact of drain voltage on the device threshold voltage reduces.

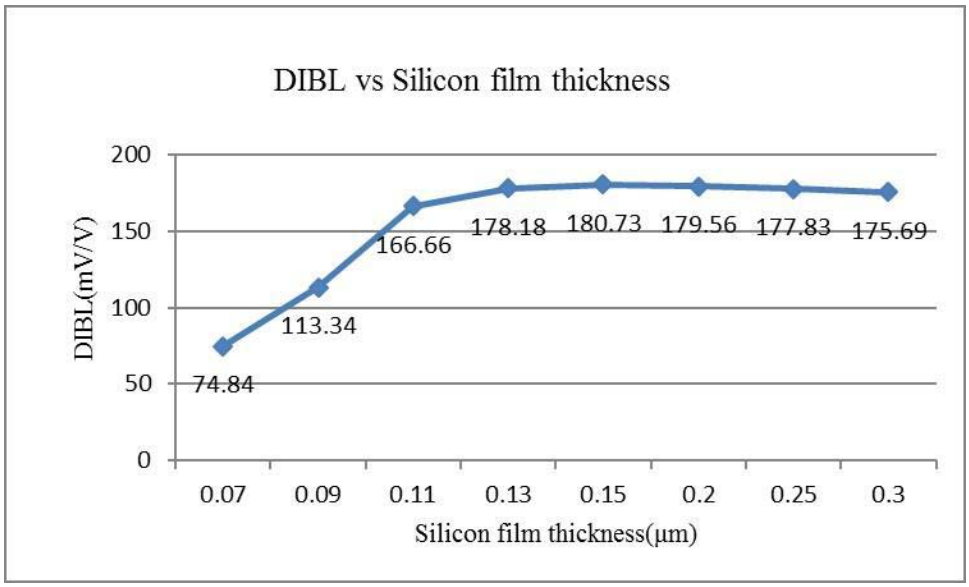

Figure 7: DIBL versus silicon film thickness

IV. Conclusion

PDSOI and FDSOI has been compared in terms of electrical characteristics using Silvaco T-CAD Simulator. It is concluded that with increase of thickness of silicon film, the threshold voltage and subthreshold slope increased on SOI MOSFET which allows a smaller operating voltages and a higher switching speed for FDSOI. PDSOI can ensure a low static power dissipation as leakage current is small. But the leakage currents are in pA (10^{-12}) range for both SOIs. The DIBL parameter value shows that FDSOI is less sensitive to short channel effects. Based on the results obtained, FDSOI MOSFET displays superior performance compared to PDSOI MOSFET because of its lesser threshold voltage, steeper subthreshold slope, high on-state current and improved DIBL value in the device.

Conflict of Interest

The author declares that there is no conflict of interest.

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Spintronics and Optical Properties of Advanced Bio Materials

By Dr. Alla Srivani, Gurram Vasanth & Dr. GVS Subbaroy Sharma
East European University

Abstract- Spintronics is an interactive combination of electronics and magnetics that has grown in popularity in the twenty-first century as nanotechnology has advanced. Spintronics is a new type of electronics that employs mutual control of magnetic and other physical signals, such as electrical and optical signals. Spin current has recently received a lot of attention as a basic idea in spintronics. Understanding spin current entails deciphering the mechanisms underlying the mutual control of diverse physical signals, which should lead to future advances in spintronics. The notion of spin current and its historical context are discussed first in this chapter, followed by a discussion of innovative materials for spintronics. Much attention is also dedicated to the physical phenomena that result from the coupling of spins.

Keywords: *spintronics, optical properties, advanced bio materials.*

GJRE-F Classification: *DDC Code: 620.5 LCC Code: T174.7*

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Spintronics and Optical Properties of Advanced Bio Materials

Dr. Alla Srivani [α], Gurram Vasanth [σ] & Dr. GVS Subbaroy Sharma [ρ]

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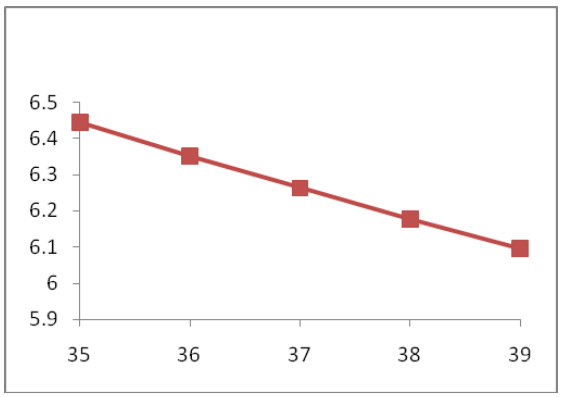
Keywords: spintronics, optical properties, advanced bio materials.

I. Introduction

Optical techniques are becoming increasingly important in medical diagnosis and treatment, there is an urgent need to develop and refine materials platforms for bio-photonic applications.

To enable therapeutically useful bio-photonic devices for transferring in vitro optical techniques into in situ and in vivo application, it is especially necessary to design biocompatible and biodegradable materials with appropriate optical, mechanical, chemical, and biological properties. This technological trend is driving the development of natural and synthetic polymeric biomaterials to replace brittle, non degradable silica glass-based optical materials.

We offer an overview of breakthroughs in polymeric optical material development, optical device design and fabrication techniques, and the associated applications to imaging, sensing, and phototherapy in this study.



II. Methodology & Results

Sl. No.	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	35	6.446
2	36	6.352
3	37	6.263
4	38	6.177
5	39	6.095

Sl. No.	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	30	6.979
2	31	6.862
3	32	6.751
4	33	6.644
5	34	6.543

Author α: Ph.D, D.Sc., Indian Institute of Science (IISC)-INUP & VVIT, East European University, Mallareddy Engineering College (MREC-A). e-mail: vaniraghava2751982@gmail.com
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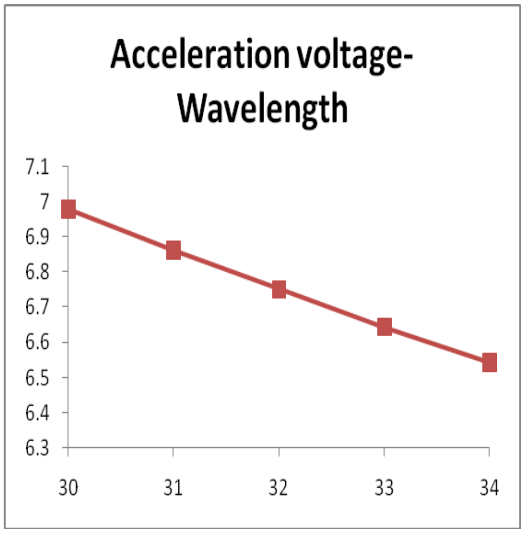

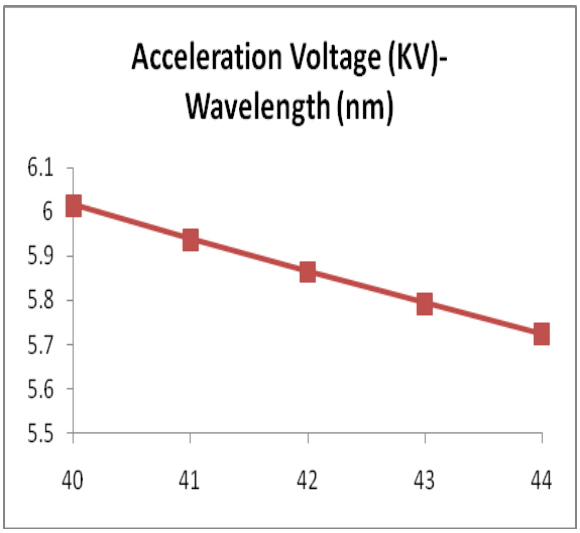

Sl. No.	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	40	6.015
2	41	5.938
3	42	5.865
4	43	5.793
5	44	5.724

Optical materials are required to fabricate optical elements such as waveguides for bio-Photonic.

Photonics applications must have specified optical, mechanical, chemical, and biological qualities. The degree of transparency and the refractive index, as well as their Photonics applications must have specified optical, mechanical properties. Current synthetic biodegradable optical waveguide materials have restricted processability and designability, resulting in low-efficiency in vivo light delivery and limited functionality. A versatile material platform that can meet the diverse needs of optical (tunable refractive indices, low optical loss), mechanical (tunable mechanical flexibility for tissue compliance), and biological (biocompatibility, biodegradability, and bioactivity) functions is urgently needed. A citrate-based biomaterial platform has been investigated to overcome this issue. Citrate-based biomaterials are a class of polymers made by reacting citric acid with various diols and/or amino acids in a ne-pot poly condensation reaction. Flexible chemical and design properties have enabled citrate-based biomaterials with tunable degradation rates (from a few days to over one year), adjustable mechanical strengths (tens applications such as optical imaging, optical sensing, and light activated infrared (IR) spectral areas have Materials for bio- The degree of transparency and the refractive index, as well as their spectral dependence, are frequently the most significant qualities to consider when selecting an optical material. High-transparency materials have chemical, and biological qualities. Ultraviolet (UV), visible, and Optical materials are materials that have the capability of controlling altering.

III. Conclusion

Biomaterials are a broad category of natural and synthetic materials that can be used alone or in combination. It is, by definition, a chemical that has been created to interact with biological systems, primarily for medical and clinical purposes. The Increased understanding of biological systems and their interfaces with materials is opening up new avenues for the use of biomaterials, which have a diverse set of uses and requirements.

Millions of patients throughout the world have profited from biomaterials' technological advancement. Nonetheless, even as life expectancy rises, organ failure and catastrophic damage continue to crowd hospitals and degrade quality of life. Advances in disease understanding and tissue regeneration, together with increasing accessibility of modern technologies, have given unprecedented prospects for the use of biomaterials. Materials may now be swiftly generated and selecte.

This collection showcases biomaterials research that has been published in Advanced Materials technologies, with an emphasis on targeted drug delivery vehicles, high-throughput material synthesis, minimally invasive biodegradable shape-memory materials, and the development of techniques to promote tissue regeneration through the introduction of instructional. http://orcid.org/0000-0002-5091-3663.

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11. Dr. Alla Srivani et.al, Determination of Wavelength and Peak position in Advanced Materials, International Advanced Research Journal in Science, Engineering and Technology-IARJSET, 2394-1588.

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Design of Embedded System for Recycling Machine of PET

By Nicolás Vargas Alice

Abstract- This article presents the design and implementation of a device able to generate printer filament from bottles to use on 3d printers. Also, it explains technical concepts as 3D printing and recycling plastics and describes other parts of the developed device.

Keywords: *plastic recycling; 3D printing; PET.*

GJRE-F Classification: *LCC Code: TJ223.P76*

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Design of Embedded System for Recycling Machine of PET

Diseño de Sistema Embebido Para Máquina de Reciclaje de PET

Nicolás Vargas Alice

Resumen- En este artículo se presenta el diseño e implementación de un equipo capaz de generar filament plástico apto para uso en impresoras 3D a partir de botellas descartables de plástico PET. Se buscó desarrollar un dispositivo de fácil implementación, económico y que sea simple de controlar con el fin de ser utilizado en centros educativos por personas sin una amplia experiencia previa. Además, se aporta información referida a la impresión 3D y al reciclaje de plásticos.

Palabras clave: reciclaje de plásticos; impresión 3D; PET.

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I. Introducción

A continuación se enumeran los temas que involucran este diseño y los aspectos que dieron inicio al proyecto.

a) *Impresion 3D*

La impresión 3D es una tecnología de fabricación por adición donde un objeto tridimensional es creado mediante la superposición de capas sucesivas de material. Esta tecnología encuentra uso en campos tales como joyería, calzado, diseño industrial, arquitectura, ingeniería y construcción, industria aeroespacial, industrias médicas, educación, sistemas de información geográfica, ingeniería civil entre otros.

En la actualidad existen tres formas masivamente utilizadas para imprimir en 3D: modelado por deposición fundida (FDM) (Fig. 1), estereolitografía (SLA) y procesamiento digital de luz (DLP) [1]. Aunque todos los tipos utilizan el proceso aditivo, existen diferencias en la forma de construir el objeto.

b) *Reciclaje de plástico*

El tereftalato de polietileno, generalmente conocido como PET, es un polímero plástico que proviene de un proceso de polimerización de ácido tereftálico y monoetilenglicol. Su principal uso es la fabricación de botellas y envases y una característica importante de mencionar es que no es un material biodegradable [2].

De acuerdo con el último reporte de la OCDE (Organización para la Cooperación y el Desarrollo Económicos) [3], el mundo produce el doble de residuos plásticos que hace dos décadas [4].

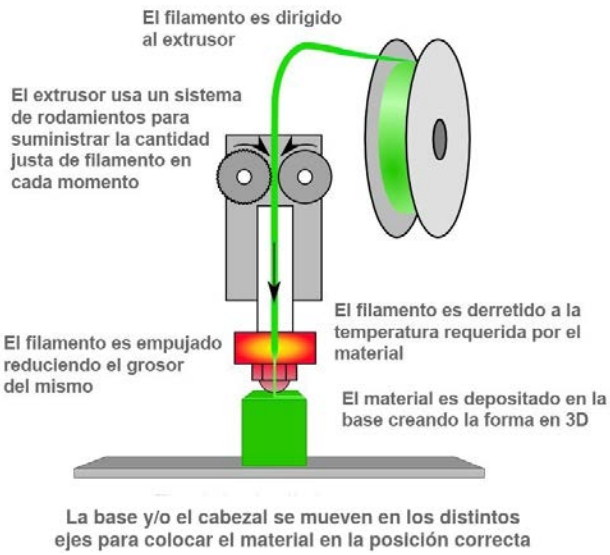

Fig. 1: Proceso de construcción 3D por deposición fundida

La producción mundial de plástico a partir su reciclado se ha cuadruplicado, pasando de 6,8 millones de toneladas (Mtn) en el año 2000 a 29,1 Mtn en el año 2019, pero aún representa sólo el 6% del volumen de la producción total de plástico [5].

II. Motivación y Objetivos

En reuniones con directores y docentes de distintas instituciones educativas de nivel primario y secundario de todo el país, se expresaron las ventajas que trae el desarrollo 3D en la educación. Sin embargo, varios integrantes manifiestan la falta de material de fabricación para utilizar las impresoras 3D ya instaladas.

Al mismo tiempo que se plantea esta problemática, en las escuelas existen campañas de concientización sobre la ecología y el cuidado del medio ambiente. Mediante un desarrollo innovador, se encontró una forma de generar la materia prima faltante que permita el uso de estos equipos, la cual al mismo

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tiempo revaloriza la recolección de botellas plasticas y el reciclaje.

A partir de los indicadores sobre la cantidad de botellas plásticas desechadas en el pais [6] y las problematicas en las instituciones educativas que se comentaron anteriormente, el objetivo principal propuesto fue el desarrollo del sistema de control de una máquina recicladora de botellas plásticas tipo PET. Este sistema debe ser capaz de controlar la transformación del plástico reciclado en filamento para uso en impresoras 3D del tipo FDM. Como objetivo complementario se buscó trabajar con elementos tanto electrónicos como mecánicos que pudieran hallarse sin dificulad en el mercado local. Al mismo tiempo el desarrollo de un sistema fácil de implementar permitiría que el dispositivo pueda ser replicado por personas sin amplios conocimientos técnicos.

III. Diseño e Implementación

A continuación se enumeran los elementos que componen esta implementación y los criterios de diseño utilizados.

a) Kit de desarrollo STM32F1C8T6

La placa de control principal del equipo fue el kit de desarrollo STM32F103 (Fig. 2). La selección de este kit se debe a su buena relación precio/calidad, la posibilidad de adquirirlo en el mercado local y sus adecuadas características técnicas. Esta elección se complementa con la intención del desarrollador del proyecto en interiorizarse en su uso.

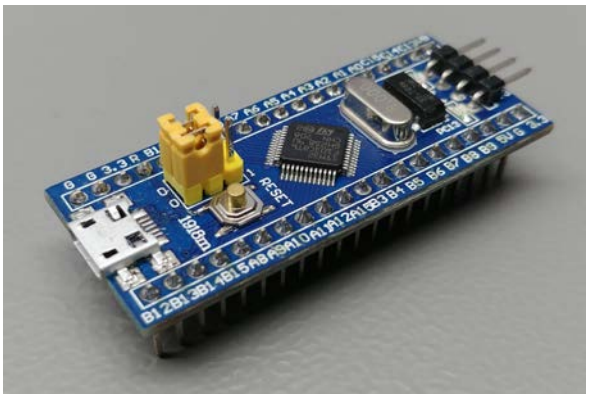

Fig. 2: Kit de desarrollo STM32F103

Entre sus especificaciones se encuentra: un procesador ARM 32-bit Cortex-M3, 64 Kbytes de memoria Flash, 20 Kbytes de SRAM, interrupciones en todos los puertos, 2 conversores A/D de 12-bit, entre otras. La placa es la encargada de comunicar los distintos módulos del proyecto (Fig. 3).

b) Interfaz de usuario

Este modulo le permite al usuario ejecutar las siguientes acciones:

- Visualizar datos de funcionamiento.
- Activar y desactivar módulos.
- Configurar parámetros de cada módulo.
- Navegar por el menú de configuración.

Para la visualización de los parámetros del equipo se optó por una pantalla LCD2004 (Fig. 4), un expansor de puertos PCF8574 (Fig. 5) y un encoder rotativo de 20 posiciones KY-040 (Fig. 6).

El encoder rotativo se usa para navegar por las distintas pantallas del programa que se muestran en el display LCD. El evento de presión del encoder se utiliza para ejecutar la acción seleccionada o acceder al submenú correspondiente, mientras que el evento de rotación cambia la posición del cursor en la pantalla actual.

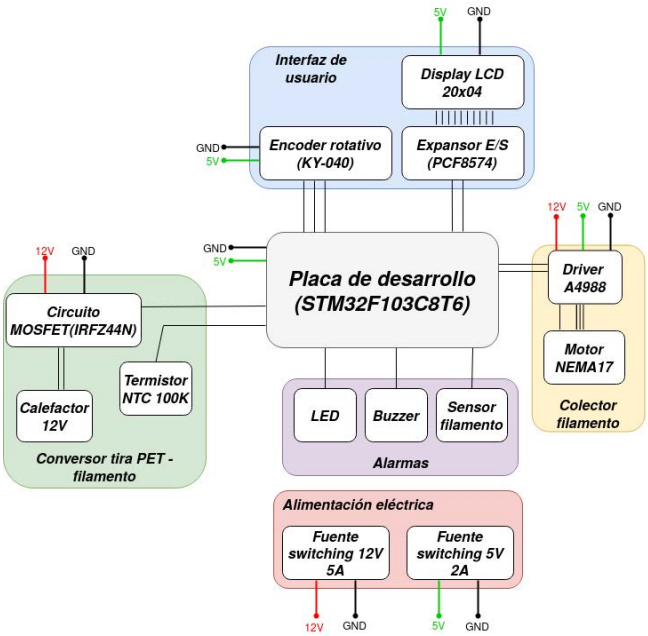

Fig. 3: Bloques que integran el equipo

Fig. 4: Display LCD2004

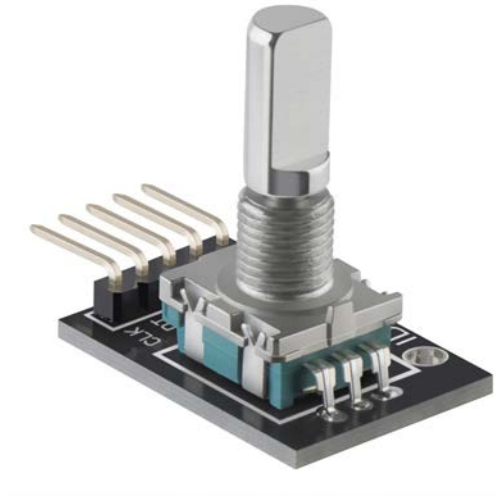

Fig. 5: Encoder rotativo KY-040

Fig. 6: Expansor E/S PCF8574

c) Etapa generadora de filamento

Esta etapa se encarga de transformar la franja de plástico PET en filamento a partir del calentamiento del material y del cambio de su forma. Para lograr esto, se implementó un mecanismo similar al que se encuentra en el extrusor de una impresora 3D, el cual consiste en atravesar filamento plástico por un material caliente a una temperatura que lo derrita o lo ablande. La etapa está compuesta por:

- Una resistencia calentadora de 12 V / 40 W (Fig. 7).
- Un termistor NTC 100 k b3950 (Fig. 8).
- Un módulo MOSFET IRFZ44N.

Fig. 7: Resistencia calentadora junto a bloque de aluminio que funde el plastico PET

Fig. 8: Termistor NTC 100k comunmente utilizado en impresoras 3D

El control de la temperatura de trabajo se realiza desde la placa de desarrollo mediante el sensado de temperatura con el termistor y la activación de la resistencia calentadora a través del módulo MOSFET.

d) Etapa colectora de filamento

La colecta de filamento es la forma de acumular el producto resultante del proyecto para que quede en condiciones de utilizarlo directamente en una impresora 3D. En esta etapa se utilizaron los siguientes elementos:

- Un motor paso a paso SC42STH47-1504-01AF (Fig. 9).
- Un driver A4988 (Fig. 10).
- Piezas mecánicas varias (soportes, poleas, etc.).

El driver es el elemento intermediario entre el motor y la placa de control con el que se maneja:

- Velocidad de giro.
- Reset.
- Dirección de rotación.

Si se modifica la señal que llega al pin de velocidad del driver, se modifica la velocidad de giro del motor. Además de las características mencionadas, el driver maneja la alimentación eléctrica del motor.

Fig. 9: Motor paso a paso tipo NEMA17

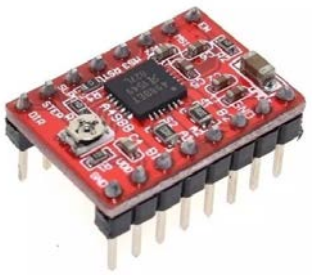

Fig. 10: Driver A4988

e) Control principal del flujo de programa

Durante el funcionamiento del dispositivo se ejecutan dos tareas principales:

- Mantener la temperatura de extrusión en el valor configurado.
- Mantener el movimiento contínuo del colector de filamento en caso de estar activado.

Debido a esto, la función *main( )* se divide en:

- Sensar la temperatura de trabajo cada 1 segundo.
- Monitorear si el usuario interactuó con la interfaz para cambiar algún parámetro.

f) Control de temperatura de trabajo

El usuario debe configurar la temperatura de trabajo para el bloque extrusor de filamento, que moldea la franja de PET que recibe. A nivel firmware, para elevar la temperatura se debe activar el puerto GPIO asociado al calentador, mientras que en caso de enfriar el bloque se lo desactiva.

El cálculo de la temperatura medida se realiza con una *look-up table* que relaciona la medición del ADC con el valor de temperatura actual. Es interesante destacar que este método es el mismo que utilizan las impresoras 3D [7]. Para la generación de la tabla se utiliza un *script* [8] obtenido del proyecto *RepRap* [9] basado en el lenguaje *Python* [10], donde se cargan los datos relacionados al modelo de termistor, al valor de la resistencia que forma el divisor resistivo, la cantidad de valores que se desee incorporar en la tabla y la tensión máxima tolerada por el conversor ADC.

Luego del cálculo de temperatura se verifica el valor obtenido contra la temperatura configurada y se hace la corrección de ser necesaria. El control que se realiza es de tipo *ON/OFF* ya que pruebas con un control PID arrojaron resultados muy inestables.

g) Control de velocidad de motor

El control de velocidad de giro del motor incluido en el colector de filamento se realiza a partir de un timer del microcontrolador, el cual activa una interrupción por desborde. Al ocurrir este evento, dentro de la función *callback* se ejecutan las siguientes acciones:

- Se verifica si el usuario modificó la velocidad de giro del motor.
- Se cambia de estado el GPIO asociado al pin *velocidad*.

El usuario puede seleccionar tres valores distintos de velocidad de recolección: 100 mm/min, 200 mm/min o 300 mm/min.

h) Diseño del montaje mecánico

El montaje del equipo se realizó sobre un gabinete de madera de 480 mm x 200 mm x 200 mm (Fig. 11), el cual fue acondicionado en su interior para alojar las partes electrónicas y fuentes de alimentación. En el exterior, se instalaron las partes asociadas a la interfaz de usuario, al extrusor de filamento, al sensor de filamento y al colector de filamento (Fig. 12).

IV. Resultados

Luego del ensamble del equipo, se desarrollaron una serie de pruebas funcionales que incluían la verificación del correcto funcionamiento de las distintas partes del equipo, el analisis del filamento desarrollado y la comparación de este resultado con el rendimiento de otros filamentos plasticos comunmente utilizados en el área de la impresión 3D [11].

Se obtuvieron resultados satisfactorios al ejecutar las pruebas de funcionamiento sobre la navegación sobre el menú del equipo, sobre la estabilidad de la temperatura de trabajo una vez alcanzada y sobre la velocidad de filamento por parte de la etapa colectora.

El proceso de transformación del plástico PET permitió cuantificar el filamento producido según el volumen de las botellas comúnmente usadas como envases de bebidas en el mercado local. Para el conteo del filamento generado por botella, se procesaron: cinco botellas de 500 ml, cinco botellas de 1,5 l, cinco botellas de 2 l y cinco botellas 2,25 l.

Fig. 11: Montaje final del equipo

Fig. 12: Montaje de interfaz de usuario, etapa extrusora y etapa colectora de filamento

A partir del promedio, los resultados fueron los siguientes:

- 4 m de filamento a partir de una botella de 500 ml
- 9 m de filamento a partir de una botella de 1,5 l
- 10 m de filamento a partir de una botella de 2 l
- 12 m de filamento a partir de una botella de 2,25 l

Todos los filamentos resultados presentan un diámetro de 1,75 mm. A partir de los resultados obtenidos y teniendo presente que en promedio las bobinas comerciales presentan 320 m de filamento plástico, se requieren las siguientes cantidades de botellas para lograr esa longitud:

- 80 botellas de 500 ml
- 36 botellas de 1,5 l
- 32 botellas de 2 l
- 27 botellas de 2,25 l

Además se realizaron pruebas de impresión 3D, las cuales permitieron analizar y comparar piezas mecánicas producidas con el filamento producido y filamentos comerciales [12]. Las piezas resultantes (Fig. 13 y Fig. 14) tienen dimensiones de entre 1,5 cm y 2 cm. La impresora 3D utilizada fue Replikat M5 Extendida, configurada con los siguientes parámetros:

- Altura de capa: 0,4 mm
- Diámetro de boquilla: 0,4 mm
- Velocidad: 30 mm/s
- Temperatura de extrusión: 245°C
- Temperatura de cama: 80°C

Fig. 13: Muestras de pequeñas piezas impresas con filamento PET reciclado

Fig. 14: Muestras de pequeñas piezas impresas con filamento PET reciclado

Respecto a la comparación con otros materiales no reciclados comúnmente utilizados en el área como PLA *(polylactic acid)* y ABS *(Acrylonitrile Butadiene Styrene)*, se realizó la impresión de un cubo de 10 mm x 10 mm x 10 mm con ambos materiales y con filamento producido desde botellas PET (Fig. 15). La prueba se realizó sobre una impresora 3D *Trimaker Nebula*. Para el momento de la impresión con PET, se configuró el equipo con los siguientes parámetros:

- Altura de capa: 0,3 mm
- Diámetro de boquilla: 0,4 mm
- Velocidad: 20 mm/s
- Temperatura de extrusión: 250°C
- Temperatura de cama: 90°C

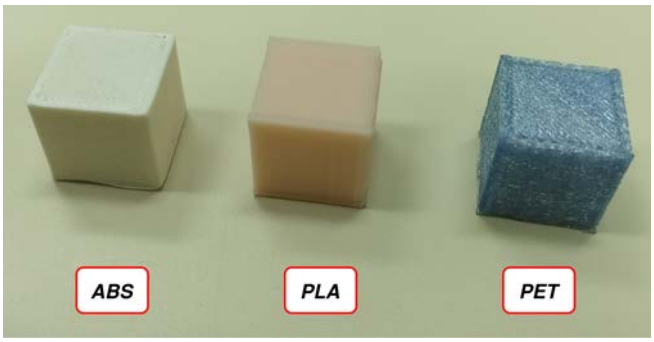

Fig. 15: Comparativa de piezas impresas en ABS, PLA y PET reciclado

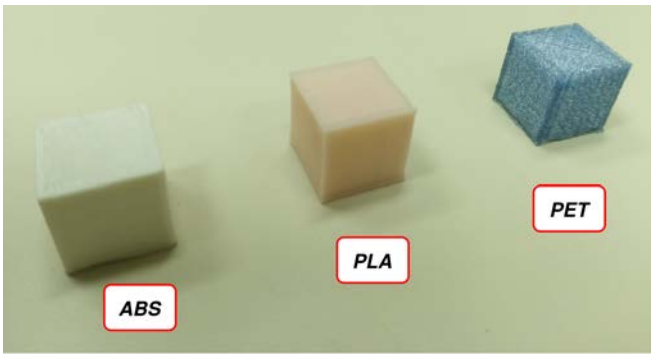

Fig. 16: Comparativa de piezas impresas en ABS, PLA y PET reciclado

Los resultados muestran considerables diferencias respecto a la terminación de las piezas impresas en ABS y PLA respecto a la pieza impresa en PET. Si bien la geometría de las piezas impresas no requiere un nivel de detalles exigente, en la práctica puede considerarse que el PET es un material noble para trabajar con piezas donde se requiera un elevado nivel de resistencia mecánica por sobre un gran nivel de detalles en la terminación de la pieza [13].

Otro aspecto no menor para hacer referencia es la continuidad del filamento producido a partir del filamento de dos botellas plásticas distintas. En la práctica, no se logró la continuidad de dos franjas PET previo al proceso de termoformación, al cruzar la franja de PET por el pico caliente. Esto ocurrió debido a que en las zonas donde se produce la unión de ambas franjas de PET, la termoformación se volvía más compleja al encontrarse más material a procesar. Esto generó que no puedan realizarse pruebas sobre impresiones de dimensionar más grandes que las descriptas anteriormente.

V. Conclusiones

El presente trabajo surgió de la necesidad de generar un mecanismo para articular el reciclaje de plásticos y la innovación tecnológica del diseño 3D en las instituciones educativas. Se logró diseñar e implementar un prototipo de un equipo que transforma el plástico PET de botellas descartables en filamento para uso en impresoras 3D.

En cuanto al cumplimiento de los objetivos, el prototipo permite efectivamente procesar el plástico de botellas PET para transformarlo en filamento apto para uso en impresoras 3D. Además, la interfaz de usuario permite el control de los distintos módulos del proyecto de forma fácil y clara. En cuanto a los objetivos no alcanzados, no se logró el almacenamiento de los metros de filamento generados. Al consultar, el cliente manifestó que esa característica no era de real importancia en el resultado final, con lo cual, fue descartado con su debido aval.

VI. Trabajo Futuro

Con el objetivo de producir más filamento reduciendo los tiempos requeridos, se pueden identificar las siguientes oportunidades de mejora y ampliación:

- Agregar una segunda etapa extrusora y de recolección de filamento.
- Ampliar la interfaz de usuario para el manejo de los agregados comentados en el ítem anterior.
- Desarrollar un módulo de soldadura para unir dos filamentos creados y lograr una extensión mayor de la lograda en la actualidad.
- Desarrollar un control de temperatura mediante control PID con un sistema de autotune de parámetros, como ejecutan en la actualidad las impresoras 3D.

VII. Agradecimientos

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Performance Enhancement of Face Recognition Algorithms based on Principal Components Analysis

By Ahmed Elbala Ahmed, Khalil. B. Ahmed. A & Banaga Hassan Mohammed

Sinnar University

Abstract- In this paper many face recognition algorithms and codes were studied and tested, and it was concluded that they still face the challenge of not providing optimal accuracy and precision, especially in the case of images that have some distortions such as those resulting from poor illumination, different angles of taking the image and different facial expressions or wear hats, masks or glasses. Although recognition technologies using iris and fingerprint are more accurate, face recognition technology is the most common and widely utilized since it is simple to apply and execute, in addition it can be used directly anywhere and does not require any physical input from user. The results show that the best performance of face recognition depends on the number of principal components (PCs), the percentage of face recognition increases in the ranges of 10%, 40%, 50%, 80%, 90% and 100% when the PCs increase in order of 1, 3, 5, 7, 11 and 15, respectively.

Keywords: *face recognition, PCA, image processing.*

GJRE-F Classification: *LCC Code: QA76.9.N37*

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Ahmed Elbala Ahmed [α], Khalil. B. Ahmed. A [σ] & Banaga Hassan Mohammed [ρ]

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Keywords: face recognition, PCA, image processing.

I. Introduction

Face recognition systems (FRS) is a biometric identification mechanism, like other methods such as (fingerprint, voice recognition, iris recognition and handwritten recognition), is shown to be more important both theoretically and practically [1,2]. Face is a complex multidimensional structure and needs good computing techniques for recognition. To find out exact identity of any person, face recognition is very essential technology. Can recognize a number of faces learned throughout our lifespan and identify that faces at a glance even though that persons became old in age. There may be variations in faces due to aging and distractions like beard, glasses or change of hairstyles [3,4,5,6]. Face detection from a single image or sequence of image is a challenging task, because of the variance in size, orientation, color, expression, occlusion, and luminance of image, to build a fully automated system that extracts information from images of human faces, it is essential to develop efficient algorithms to detect human faces. The primary objective of facial discovery algorithms is to determine whether there is any face in the picture or not. Recently, a lot of the studies work in facial recognition and facial detection has been suggested to make it more progressive and accurate, but it is revolutionizing in this area when a real-time facial detector, able to discover faces in real-time accurately [7].

II. Proposed System

The proposed system of this paper were based on the tries to recognize the input image by matching it with existing images (data base), by selecting the stage of image acquisition (Acquired), extracting the face image from the total image (Detection), aligning stage and image standardization (adjusting the angle of the face By camera angle) (Alignment), extraction of important features of the image (Extract), The stage of matching between the desired image and the image store (Matching) and The stage of issuing the report is closer to the image or no report (Report), this steps illustrated in figure 1.

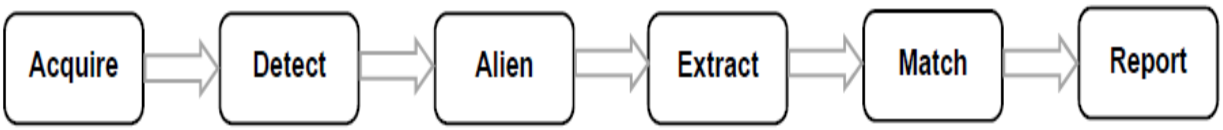

Figure 1: Stages algorithm

Systems and techniques of FRS are a subset of an area related to information security. Information security is concerned with the assurance of confidence, integrity, and availability of information in all forms. Some many tools and techniques can support the management of information security; however, one of the important issues is the need to authenticate a person correctly. Traditionally the use of passwords and a Personal Identification Number (PIN) has been employed to identify an individual. Still, the disadvantages of such methods are that someone else

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may use the PIN for unauthorized access or the PIN may be easily forgotten. Many agencies are now motivated to improve security data systems based on body or behavioral characteristics, often called biometrics. Biometric approaches aim to identify an individual by his unique physical characteristics and biological traits. Given these problems, the development of biometrics approaches such as face recognition, fingerprint, and voice recognition proves to be a superior solution for identifying individuals over that of PIN codes. Using of biometric techniques not only uniquely identifies an individual, but also minimizes the risk of someone else using the unauthorized identity.

III. Methodology

Our work aims to improve the performance enhancement of the face recognition algorithm using PCA by increasing the number of PCs including one dimensional value for face recognition. Experiments were carried out using MATLAB. The investigation was used to adjust the best number of images for each individual to be used in the training set, that gives the highest percentage of recognition. the highest matching ratio was made by multiples of images in the training set for each person. In this experiment, the number of PCs in the test database was increased by ten images per person in the training database as provided by the experiment. We change the PCs, trying to decide the best matching. PCA flow chart for feature extraction process can be seen in figure (2).

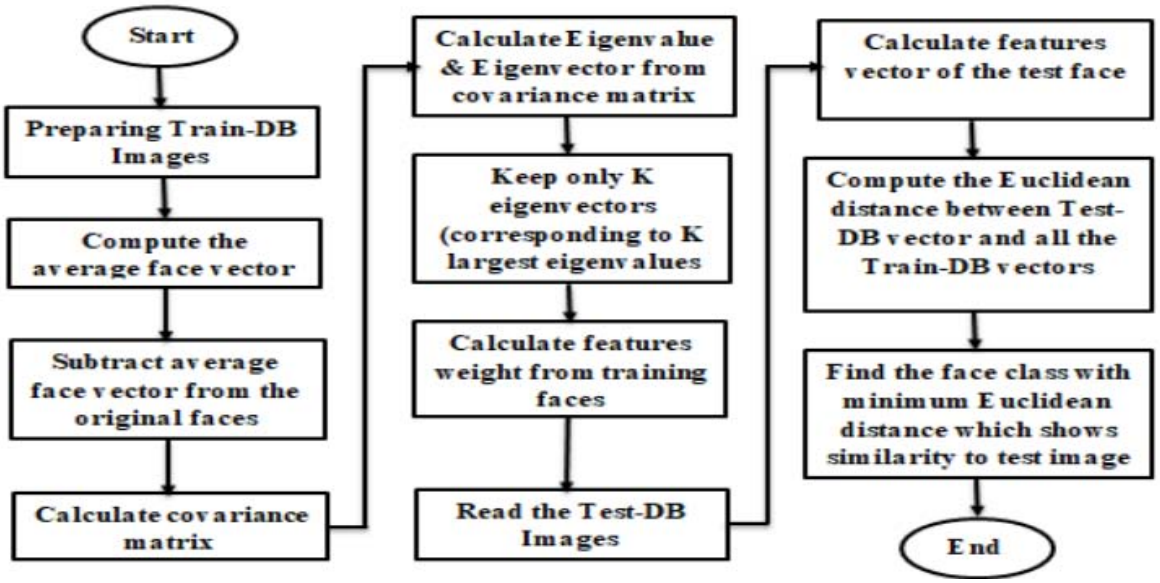

Figure 2: Flow Chart of PCA

IV. Results

Six tests are considered for different Principal Components. In each test, different faces were matching depending on the PCs. as shown in figures and table below.

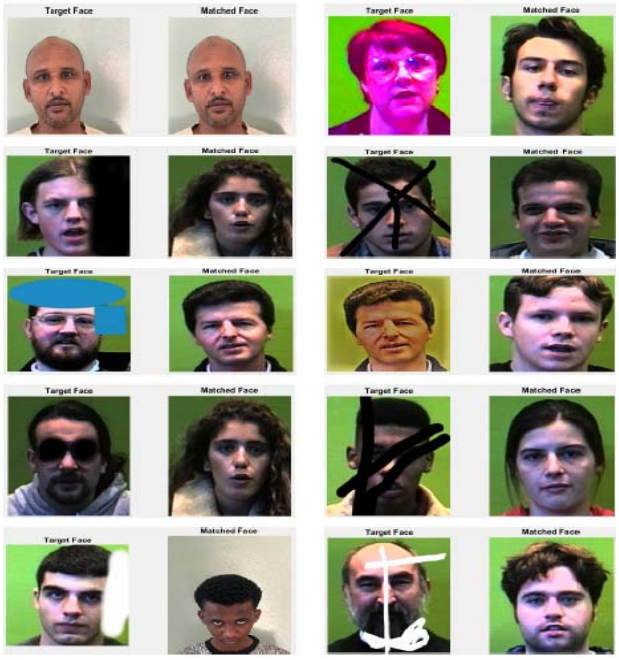

Figure 3: PCs = 1

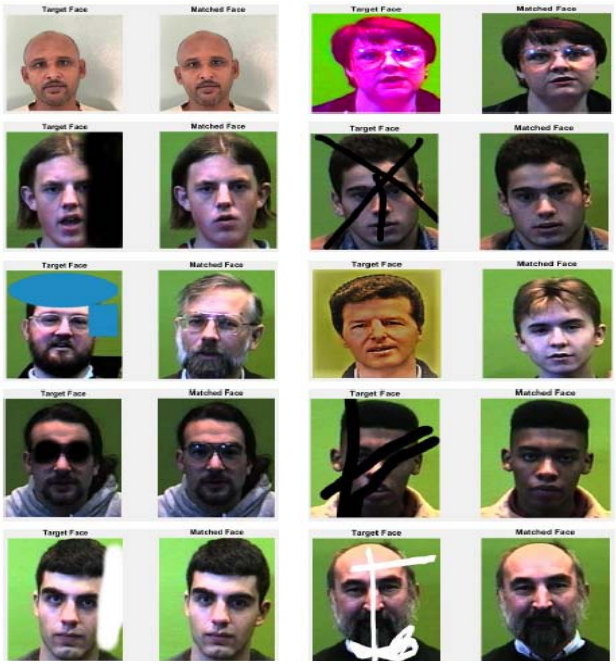

Figure 4: PCs = 7

Figure 5: PCs = 11

Figure 6: PCs = 15

Table 1: Accuracy of PCA

#	Number of PCs	Number of Matching Face	Recognition Ratio (%)
1	1	1	10
2	3	4	40
3	5	5	50
4	7	8	80
5	11	9	90
6	15	10	100

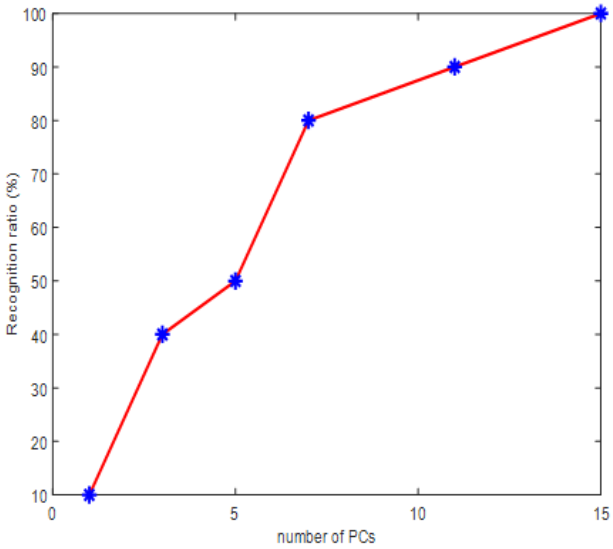

Figure 7: Recognition ratio versus number of PCs

V. Discussion

Increasing the number of images for each person in the training set were get best recognition rate, by comparing the results of the experiments, the enhanced algorithm gives high recognition ratio when the PCs were increased.

VI. Conclusion

This paper discusses how to augment the PCA feature with the selected optimization method by increasing the PCs to improve the accuracy of face recognition models. Enhancement is one of the most useful tools that can be used in image processing and, in particular, in areas such as object matching. This paper aims to optimize the face recognition using the PCA algorithm, by increasing the PCs and number of images in the training set. Our enhanced algorithm reduces the participated eigenvectors in the algorithm to reduce the computation time. Increasing the number of images for each person in the training set to get the best recognition rate causes a long computational time, which increased exponentially with the database size. By comparing the results of the experiments the improved algorithm gives a reduction of the recognition ratio when the PCs is smaller, while the enhanced algorithm shows noticeable improvement and gives considerable increase of the recognition ratio when increasing the PCs. Future work will focus on success and increasing the face recognition rate for huge databases. To improve the results, the algorithms for face recognition could be upgraded to detect multiple faces in the same image. We will try to develop a system using a video camera that will work with real-time face recognition.

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3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of research engineering then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.

- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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