I.4. Team/collaborative and interdisciplinary research is encouraged.

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A19

ISTEC 2019
Book of ABSTRACTS

Conference Theme
"Innovative Science, Technology, and Engineering Researches Through Academe-Industry Confluence for Sustainable Future"

May 27-30, 2019
Henann Hotel, Panglao, Bohol, Philippines

A 1.6

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Programme Overview

May 27, 2019

12:00 nn - 5:00 pm	Registration Billeting of the Participants
6:00 pm – 8:00 pm	Opening Ceremonies & Conference Banquet
	Welcome Message **Hon. LEONILA P. MONTERO** Mayor, Panglao (First District) Province of Bohol
	Message of Support **Hon. EDGAR M. CHATTO** Governor, Province of Bohol
	Dr. REGUCIVILLA A. POBAR University President, Bohol Island State University
	Opening Remarks **Dr. EMANUEL C. DE GUZMAN** University President Polytechnic University of the Philippines
	Presentation of the Delegates/Participants **Dr. ANNA RUBY P. GAPASIN** VP for Research, Extension and Development Polytechnic University of the Philippines
	Conference Banquet and Socials Welcome Dinner

May 28, 2019

8:00 am – 8:30 am	Registration
8:30 am – 8:40 am	Ecumenical Prayer and National Anthem
8:40 am – 9:00 am	Welcome Remarks **Dr. EMANUEL C. DE GUZMAN** University President Polytechnic University of the Philippines
	Messages **Hon. NORALYN J. BAJA** Assistant Secretary Department of Foreign Affairs United Nations International Organizations

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	Atty. LILY FREIDA M. MILLA, CESO IV Director, International Affairs Staff Commission on Higher Education
9:00 am – 9:05 am	Introduction of Keynote Speaker Dr. MANUEL M. MUHI VP for Academic Affairs, PUP
9:05 am – 9:55 am	Keynote Address Hon. ROWENA CRISTINA L. GUEVARRA Undersecretary for Research & Development, Department of Science and Technology
9:55 am – 10:00 am	Awarding of Certificate of Appreciation to the Keynote Speaker PUP and BISU Officials
10:00 am – 10:15 am	Opening of Exhibit PUP and BISU Officials with Guests
10:15 am – 10:30 am	Health Break
10:30 am – 11:00 am	Plenary Session 1 Dr. NOEL A. SAGUIL Department of Biology, University of Utah
11:00 am – 11:30 am	Plenary Session 2 BORJA GARCIA DE SOTO, PhD, PE New York University, Abu Dhabi
11:30 am – 12:00 nn	Plenary Session 3 Dir. JOSE B. PATALINJUG III Department of Science and Technology National Capital Region
12:00 nn – 12:20 pm	Open Forum Dean JOCELYN RIVERA-LUTAP Polytechnic University of the Philippines
	Awarding of Certificate of Appreciation to the Plenary Speakers PUP and BISU Officials
12:20 pm – 1:00 pm	Lunch
1:00 pm – 2:40 pm	Parallel Sessions A
2:40 pm – 3:00 pm	Health Break
3:00 pm – 4:40 pm	Parallel Sessions B
	May 29, 2019
7:00 am – 8:15 am	Registration

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	Recap of Day 2
8:15 am – 8:30 am	Plenary Session 4
8:30 am – 9:00 am	**Prof. FERDINAND OSWALD** University of Auckland, New Zealand
9:00 am – 9:30 am	Plenary Session 5 **Dr. ANGEL ANNE YANAGIHARA** Department of Tropical Medicine John A. Burns School of Medicine University of Hawaii At Manoa
9:30 am – 10:00 am	Plenary Session 6 **Dr. FRANCIS ALDRINE UY** Dean at School of Civil, Environmental and Geological Engineering Mapua Institute of Technology
10: 00 am – 10:20 am	Open Forum **Dean JOCELYN RIVERA-LUTAP** Polytechnic University of the Philippines
	Awarding of Certificate of Appreciation to the Plenary Speakers **PUP and BISU Officials**
10:20 am – 10:30 am	Health Break
10:30 am – 12:20 pm	Parallel Sessions C
12:20 pm – 1:00 pm	Lunch
1:00 pm – 2:40 pm	Parallel Sessions D
2:40 pm – 3:00 pm	Health Break
3:00 pm – 5:00 pm	Closing Ceremonies
	Conference Synthesis **Dean GISELA MAE ALBANO** Polytechnic University of the Philippines
	Awarding • Partner Institutions • Best Paper • Best Oral Presenter **PUP and BISU Officials**
	Closing Remarks **Prof. ALBERTO C. GUILLO** Executive Vice President, PUP
	May 30, 2019
8:00 am 11:00 am	Cultural Tour (Optional) Check out from hotel

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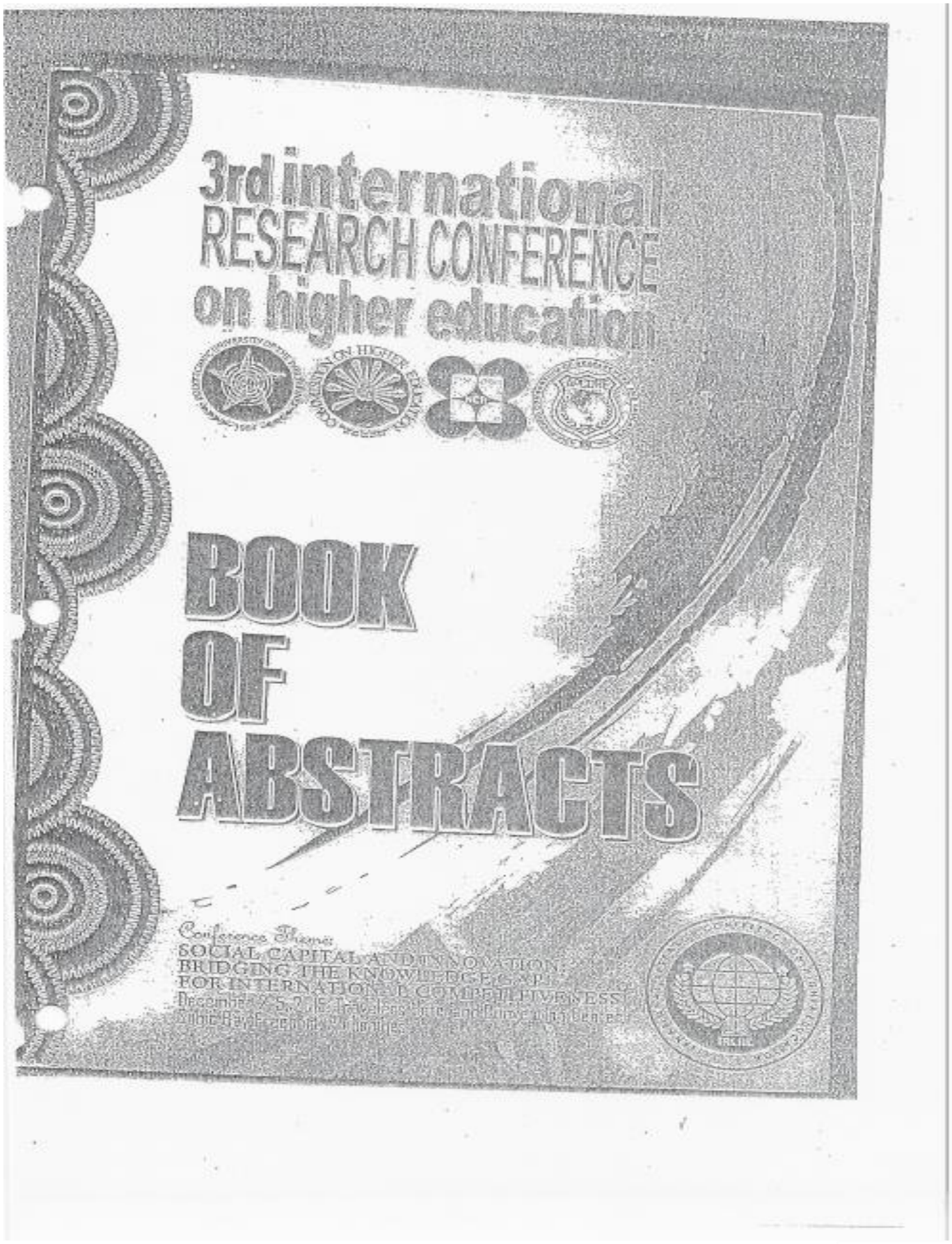

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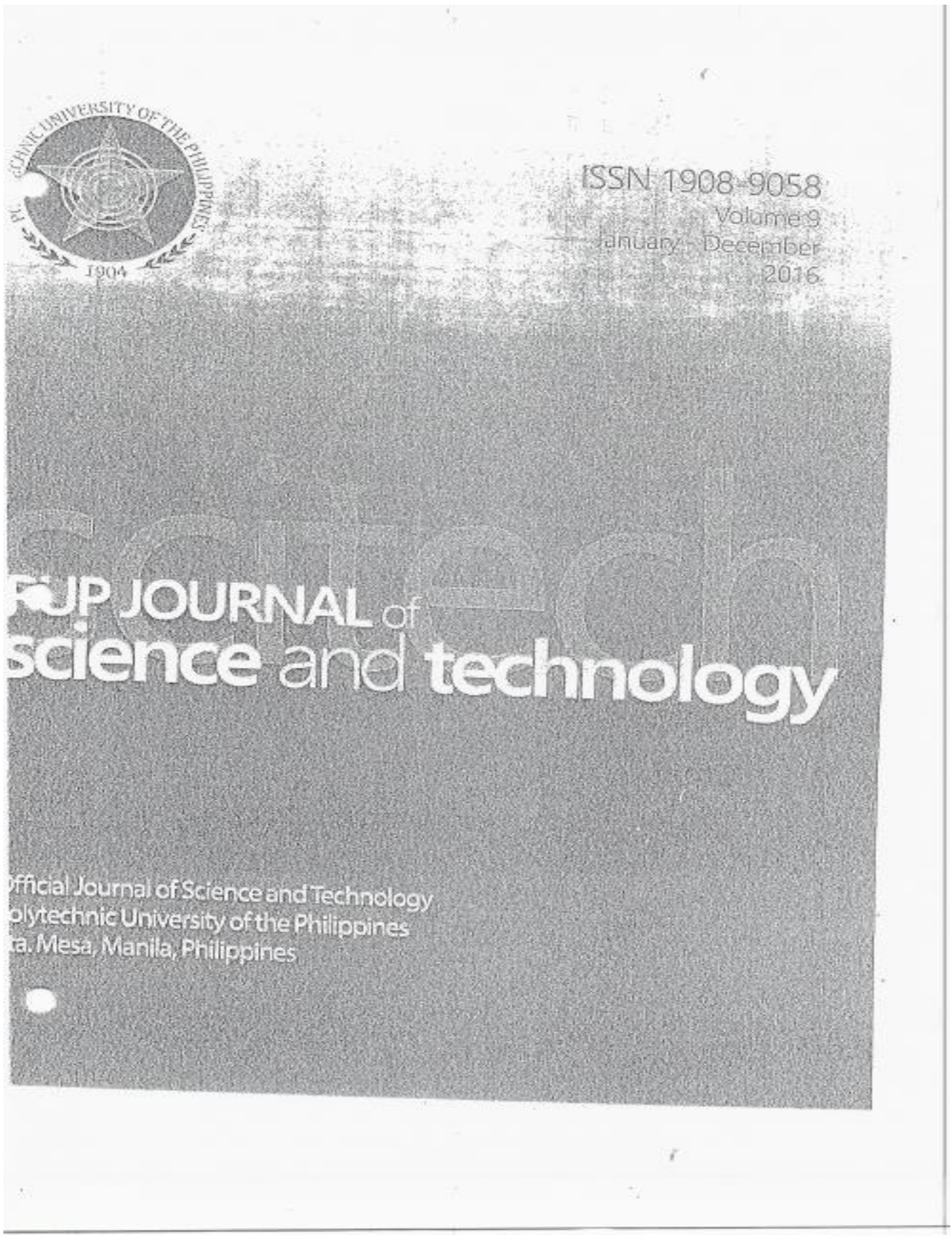

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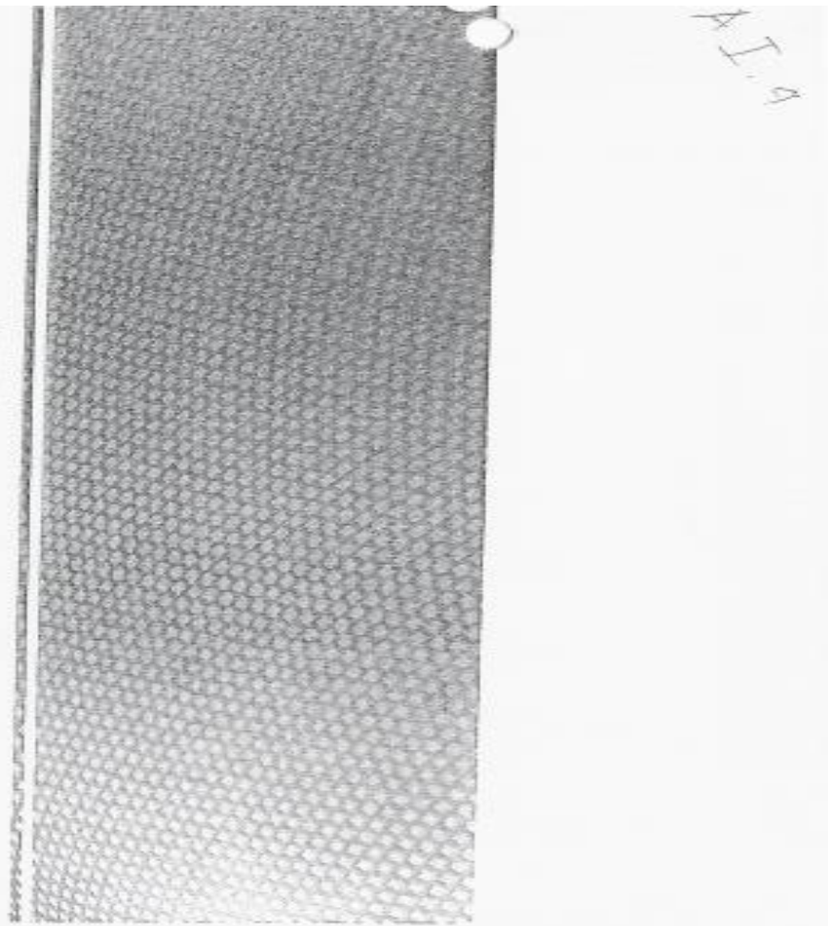
ISSN 1908-9058 Volume 9

January to December 2016

AESTHETICS TEAM

Shell Eco Marathon 2020



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Republic of the Philippines
POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
Office of the President

2019-12734

PUPCTS No. 2019621890
PUP - Central Records Section
April 22, 2019
Received by: Roberto S. Palillo
APR 26 2019
3:35

SPECIAL ORDER
No. 1320, s. 2019

Conformably with the letter of the Officer-In-Charge, Office of the Deputy Executive Director, Commission on Higher Education (CHED), and in the interest of the service, *the herein-named official, faculty member and students, College of Engineering,* this University, are hereby authorized to attend on official time the **Shell Eco Marathon Asia** at the *Kuala Lumpur, Malaysia* on *April 29, 2019*:

1. FLOR, JOSEPH AGUSTIN
2. LAGAZO, MARVIN A.
3. ESTILLES, ROJET C.
4. JARDINERO, ALLEN RAY C.
5. AWA, JEFFERSON
6. RAMOS, ANGELIKA
7. MAGHAZEHI, ABBAS AGHA ALI
8. BONIOL, REINIER O.
9. CLEMENTE, KELLY ANDREI
10. GOLPEO, JOSELINDA M.
11. ANDRES, GINNO L.

Pursuant to the provisions of Section 64 of P.D. No. 1445, **DR. REMEDIOS G. ADO**, *Dean and Special Disbursing Officer, College of Engineering,* this University, is hereby authorized to hold a cash advance of **ONE HUNDRED FIFTY THOUSAND PESOS ONLY (P150,000.00)**, to defray other expenses to be incurred in connection with the aforementioned activity, chargeable against Student Development Fund.

It is understood that *Dr. Ado* shall be guided by existing accounting and auditing rules and regulations and that no cash shall be paid out of the afore-stated cash advance except in fulfillment of the purpose for which it was granted.

They are required to submit their certificate of attendance and a report on the proceedings to the Human Resource Management Department in thirty (30) working days from the completion of the said activity.

CONTROLLED COPY

EMANUEL C. DE GUZMAN, PhD
President

Copy furnished/Signed by: 4-26-19
Date

Office of the President
Executive Vice-President
Vice-President for Academic Affairs
Vice-President for Administration
Vice-President for Finance 4/27
Vice-President for Student Affairs and Services
Vice-President for Research, Extension and Development
Vice-President for Branches and Campuses
COA Auditor 4/29/19
Director, Internal Audit Office
Director, Accounting Department 4/27/19
Director, Fund Management Office
Director, Budget Services 4/24/19
Director, Human Resource Management Department
Dean, College of Engineering
Chief, Payroll Section 4/24/19
Acting Chief, Records Section/201 files 4/24/19
The Participants

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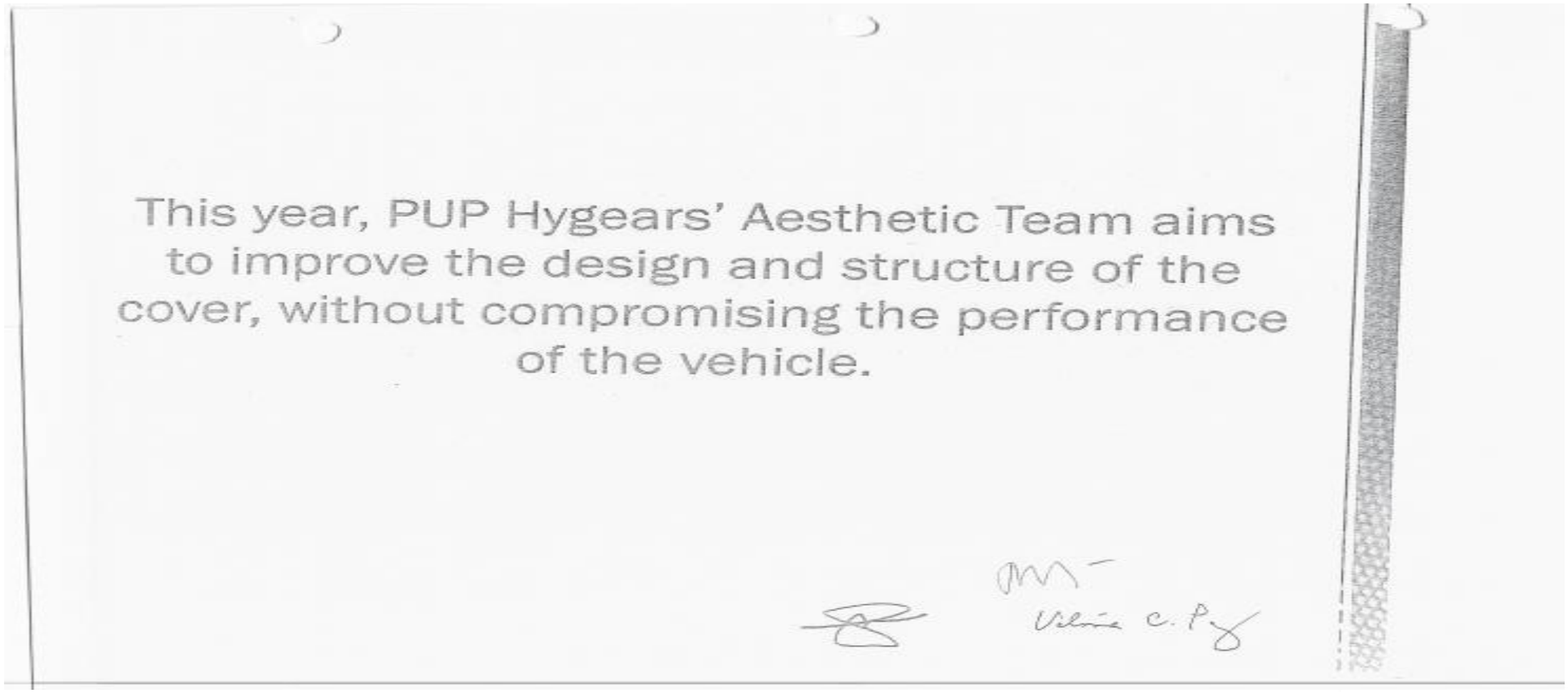

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To create the vehicle's cover, the team will use carbon fiber as sandwich panels with Nomex honeycomb core. Both materials will meet the required strength and weight needed for the vehicle.

Other properties include:

Carbon Fiber

- High in stiffness
- High in tensile strength
- Has a low weight to strength ratio
- Is high in chemical resistance
- Is temperature tolerant to excessive heat
- Has low thermal expansion

Honeycomb structure

- Low density
- Solid stability
- Mechanical strength
- Fire resistant

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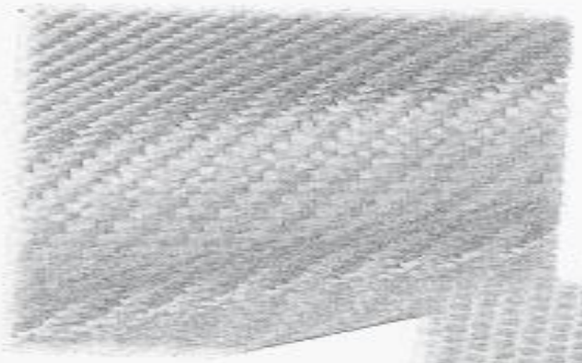
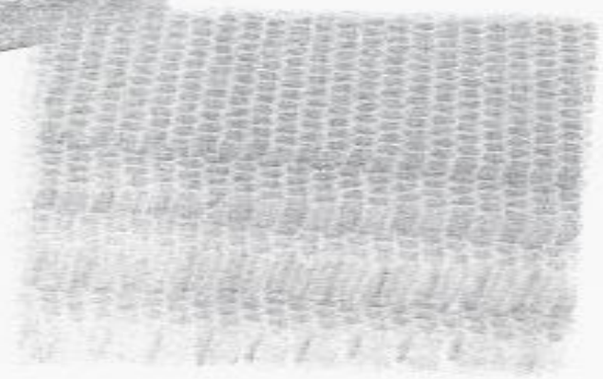
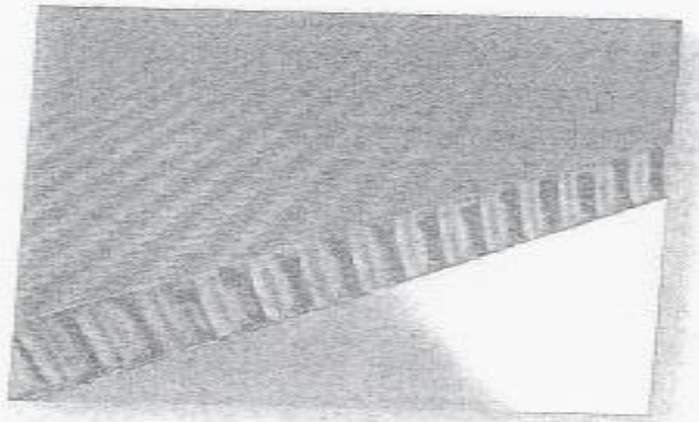
With the use of two component mixture of epoxy resin as the bonding agent, high amount of heat will not be needed during the curing process.



CARBON FIBER



HONEYBOMB STRUCTURE



CARBON FIBER HONEYCOMB CORE PANEL

Vilma C. Paz

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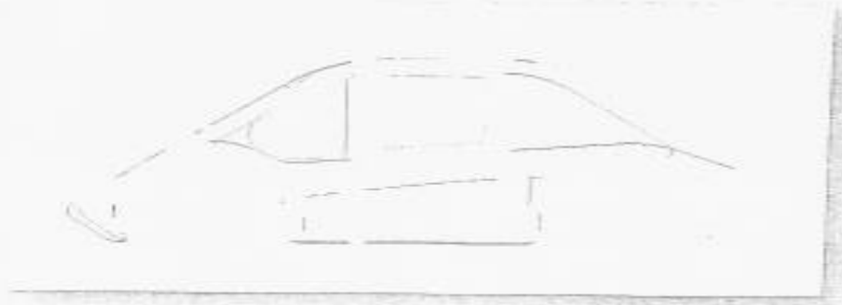
The illustrations shown indicate where the layers of honeycomb structure will be placed during the process.

This will also serve as the minor framing for the cover and will ensure the strength and rigidity of the whole vehicle.



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Other parts of the procedure includes:

- Divisions for the door, window and lights.
- Fixing hinges, handles, and other hardwares.
- Attachment of pre-cut polycarbonate to selected areas for windows.
- Finishes through paints and others.

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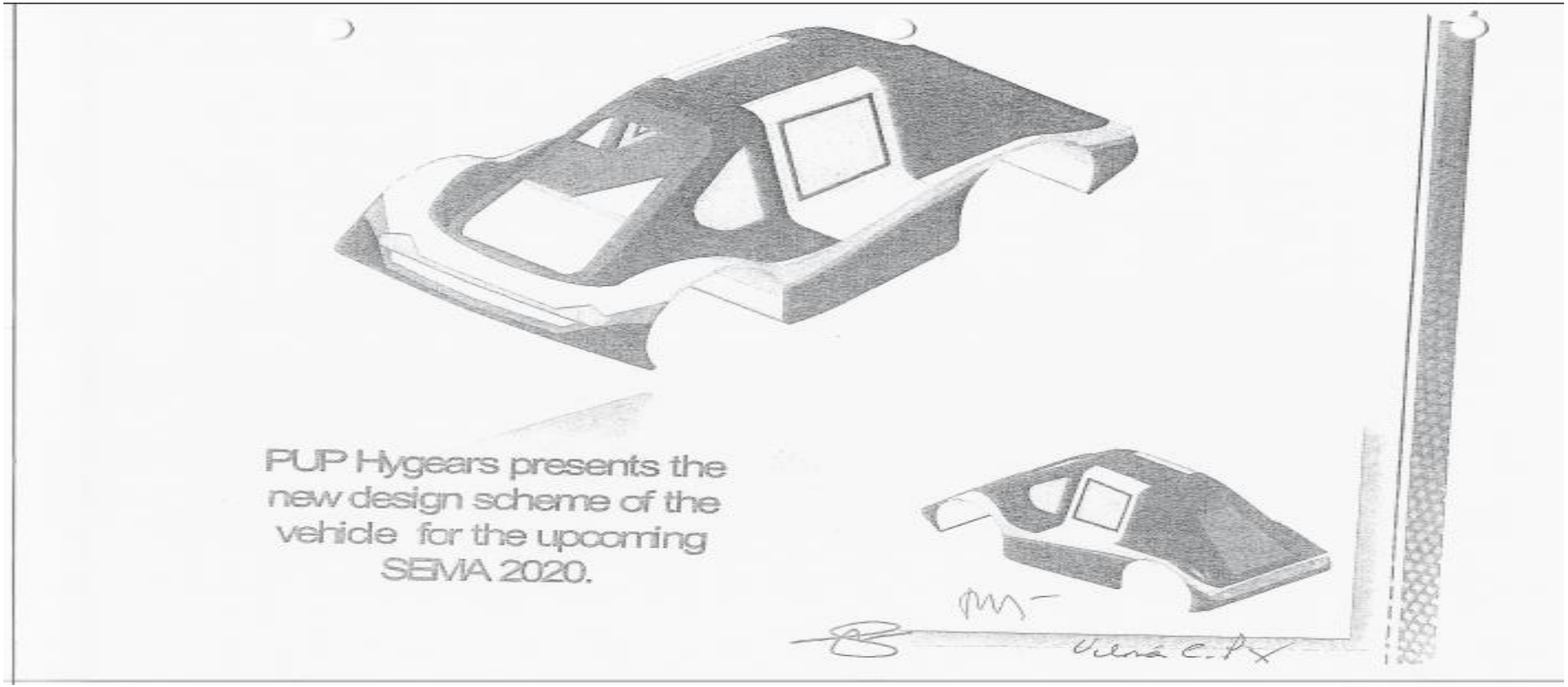

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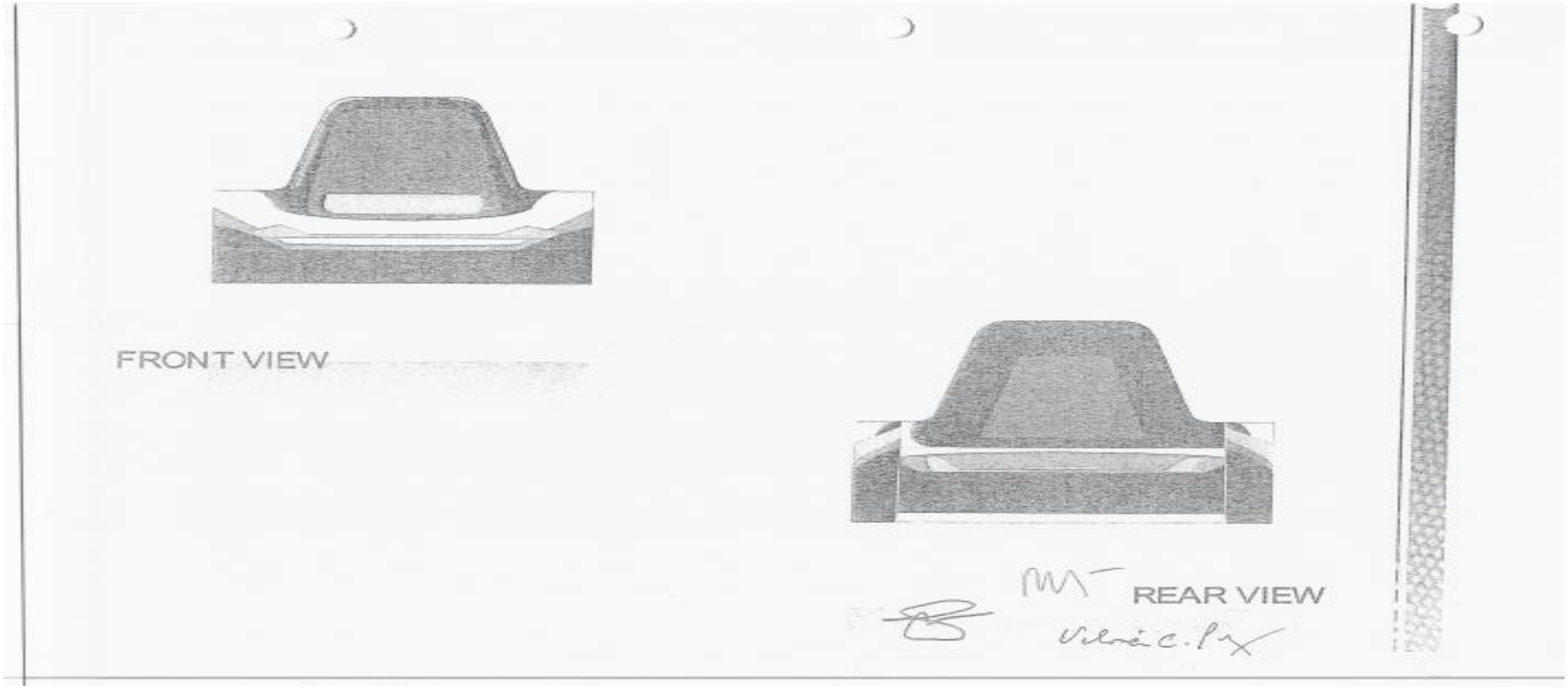

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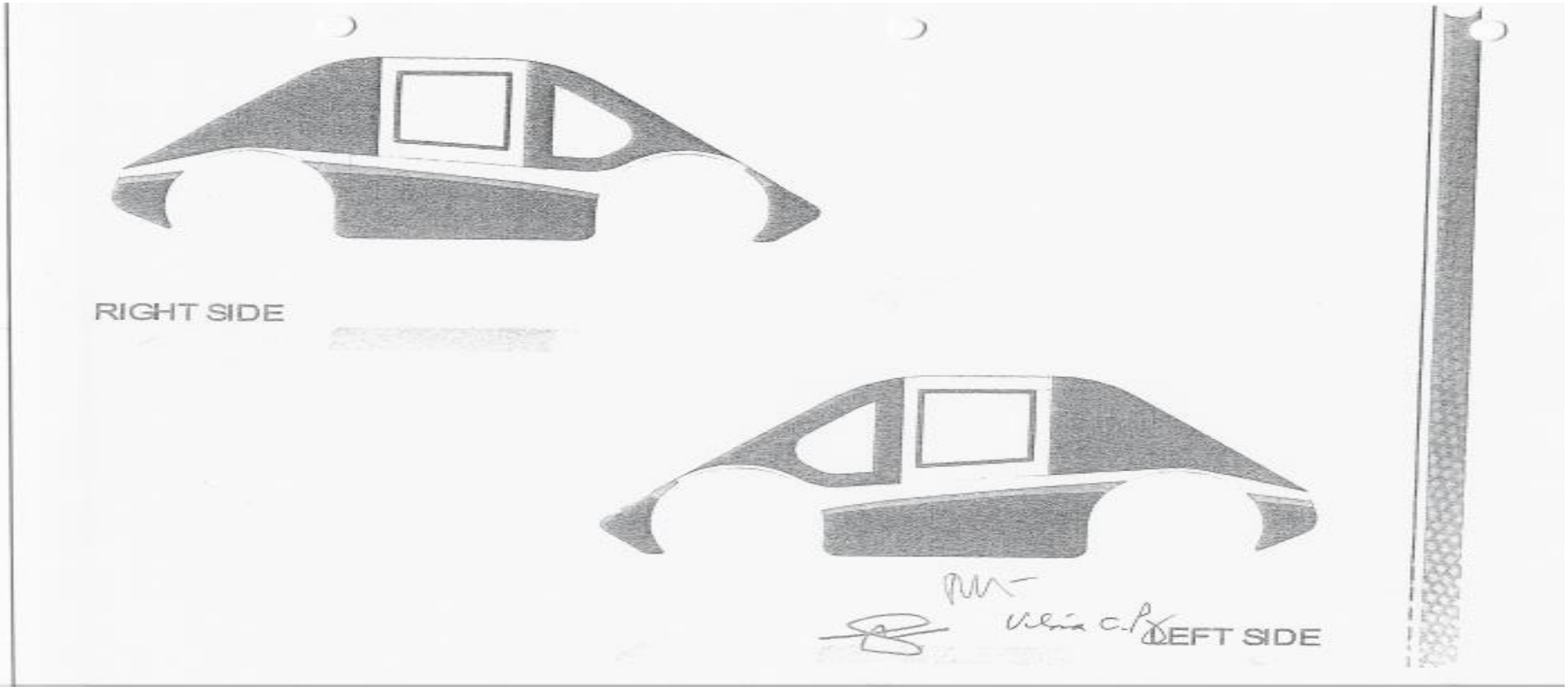

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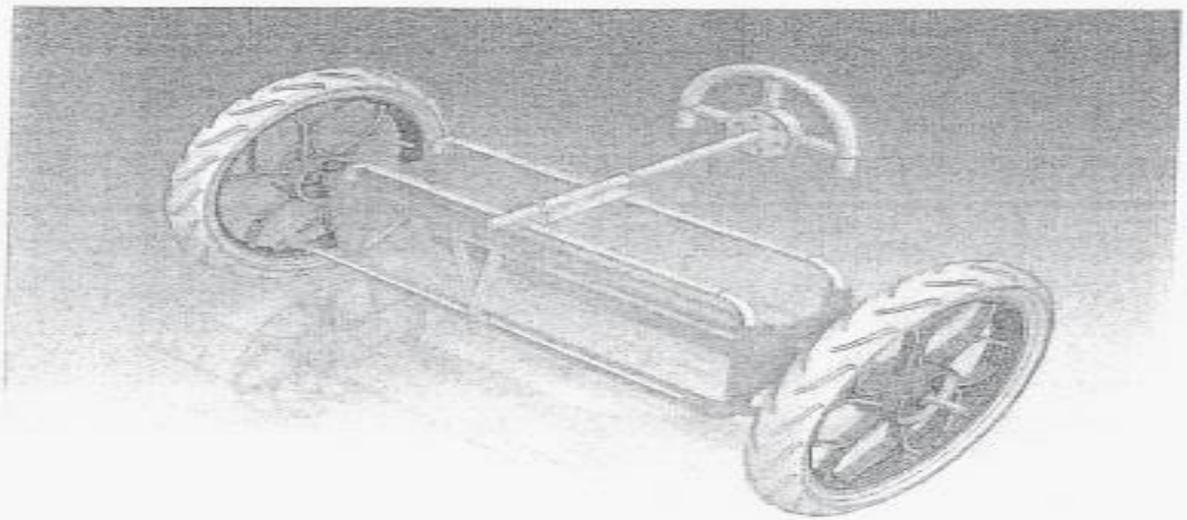
Front Assembly



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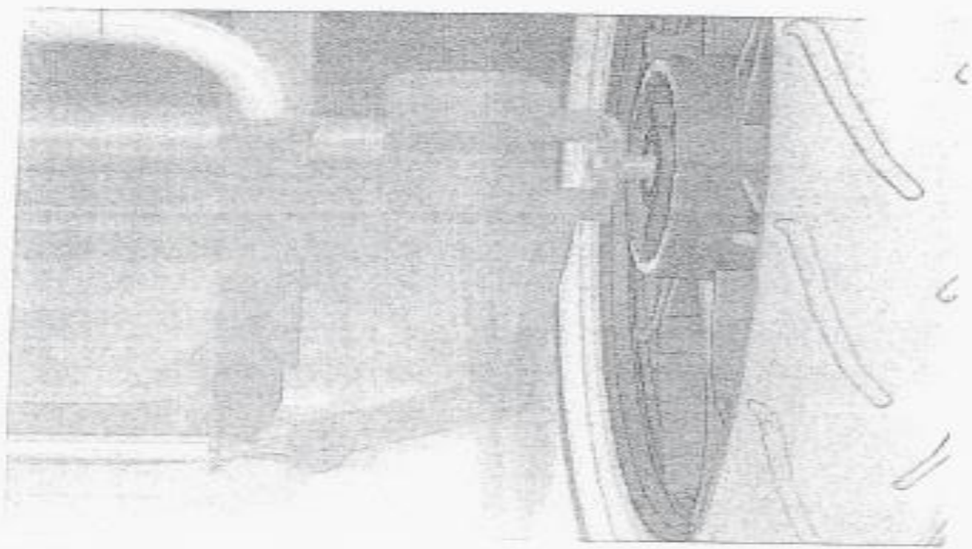
Strut and Spindle



- The spindle is designed base on a go kart spindle that can withstand a weight of 300kg.
- The spindle has an axial thrust bearing included for smooth turn when steering.

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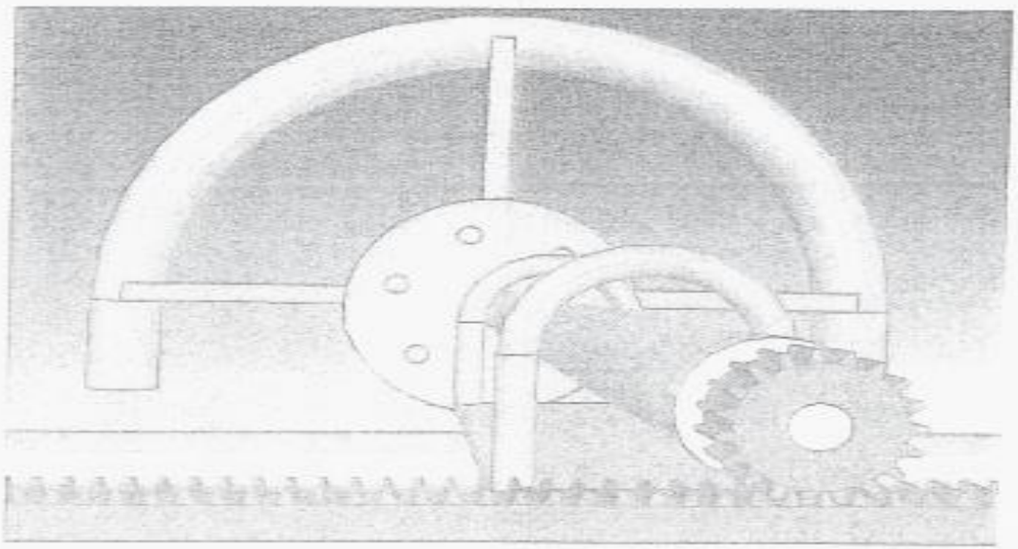
Steering Assembly



Considering the wheel alignment, the rack and pinion mechanism is the best choice to attain the proper toe in of the front wheels.

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Steering Assembly

The steering assembly is connected by a thread bar and heim joint enclosed in an aluminum tube to avoid the bending of thread bar.

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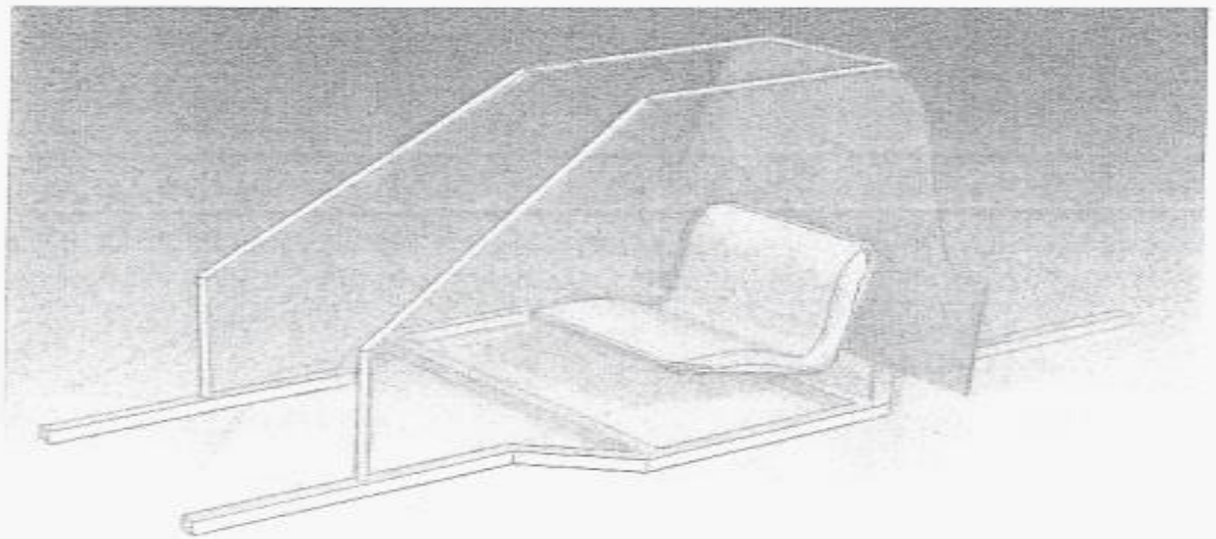
Middle Assembly



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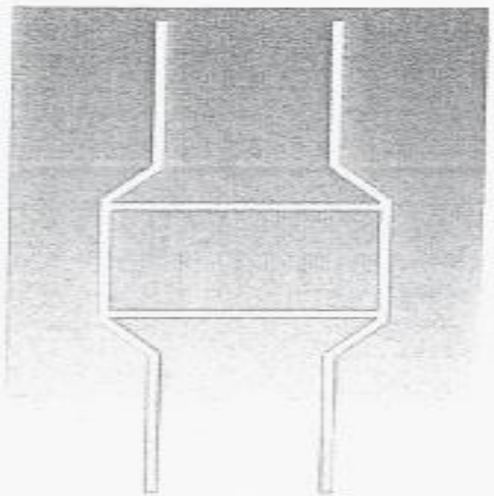
Center Chassis



Made of 1" aluminum square tube
for minimal bending displacement.

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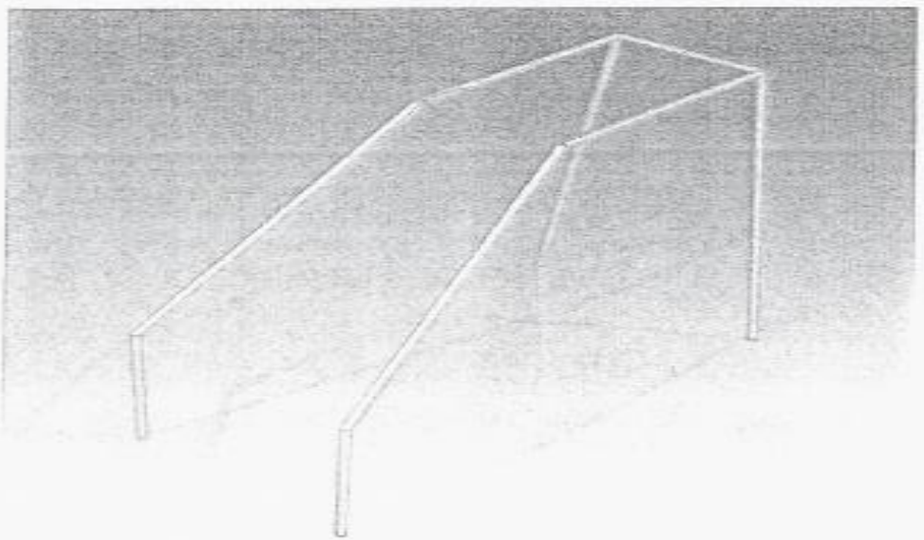
Bulkhead and Roll Cage



Made of ¾ Ø aluminum tube for lightweight material without sacrificing the strength.

Serves as an additional safety features of the car.

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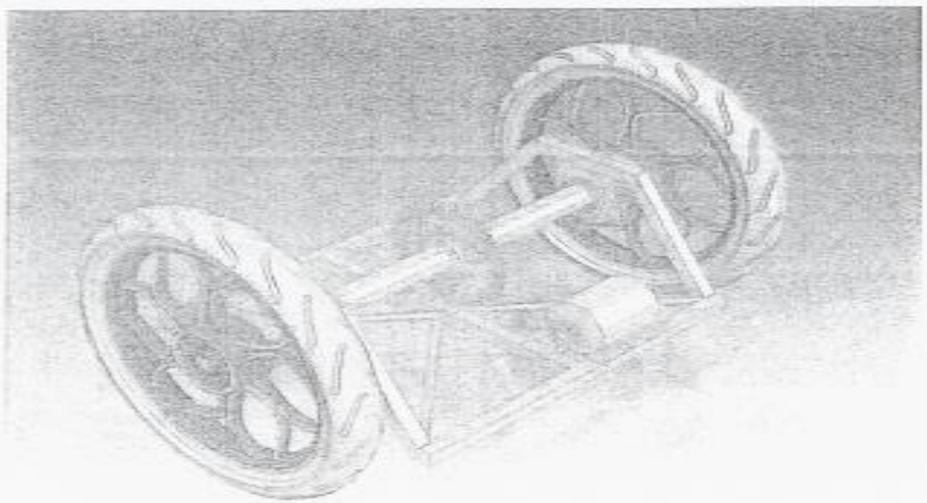
Single Motor Drive



Single Motor Drive uses high torque sprocket chain combination. We designed our own differential shaft without any gears and by using only the combination of ratchet bearing and ceramic roller bearings which can withstand high torque application.

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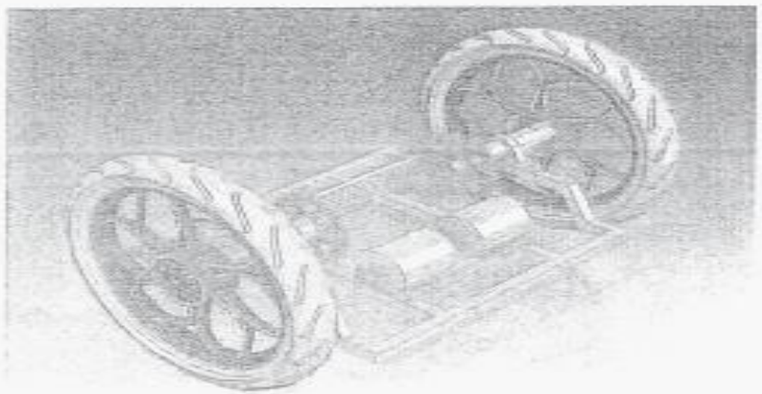
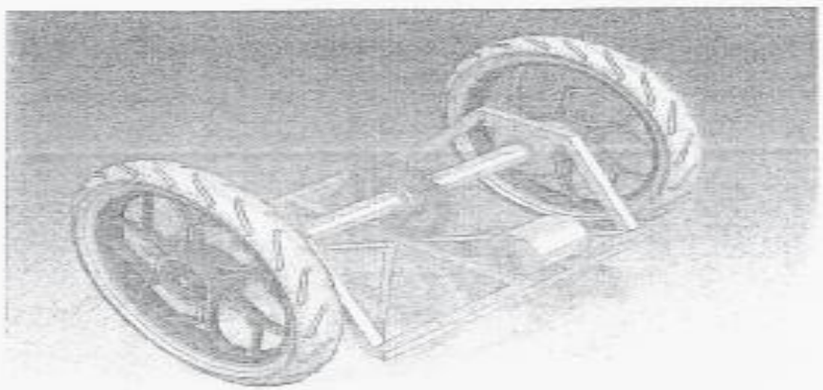
Rear Assembly



Dual Motor



Single Motor

Dual Motor Drive and Single Motor Drive are the two main choices depending on the what application of transmission is needed for the race.

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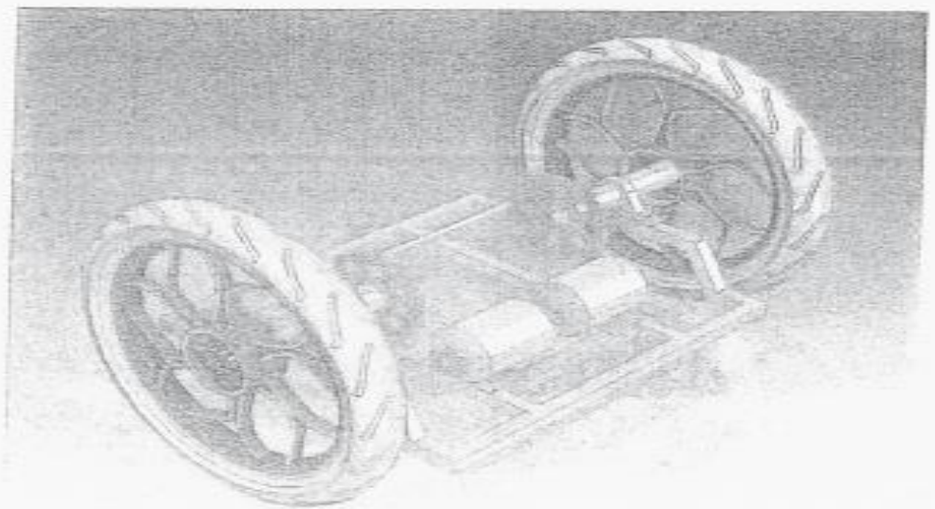
Dual Motor Drive



Consist of two drive shafts each sides of the assembly. By using electric differential we reduced the losses gained when turning the vehicle. Also the sprocket chain combination is perfectly designed for high torque applied by each motors.

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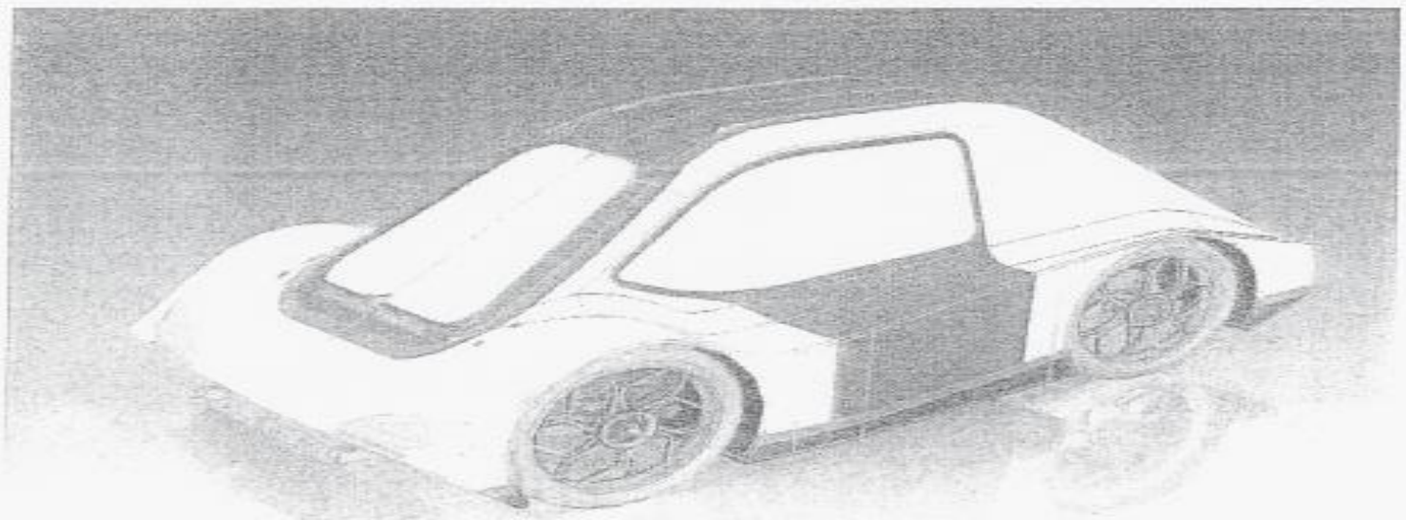
Shell Eco Marathon 2020



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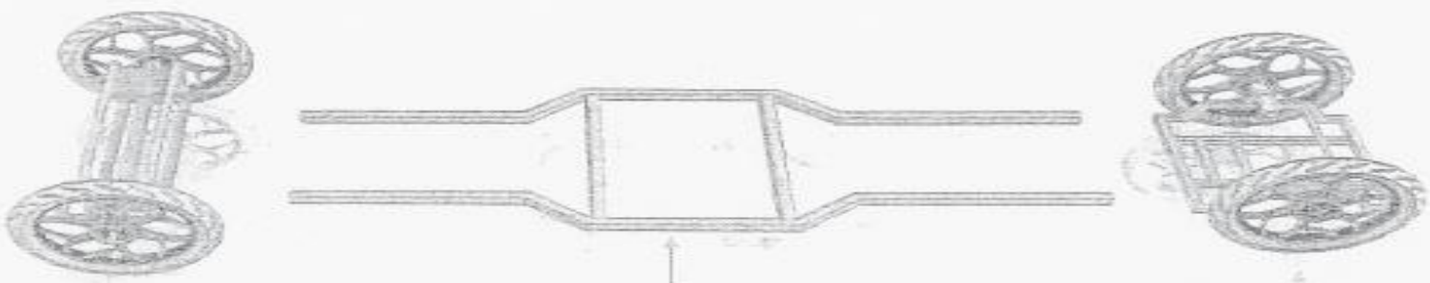
The main goal of mechanical team is to reduce the losses coming from the mechanical parts especially when it comes to alignment. We divided the car into three main assemblies:



Front Assembly Middle Assembly Rear Assembly

(The full assembly is joint by 8 12mm bolts from front to rear to secure its strength.)

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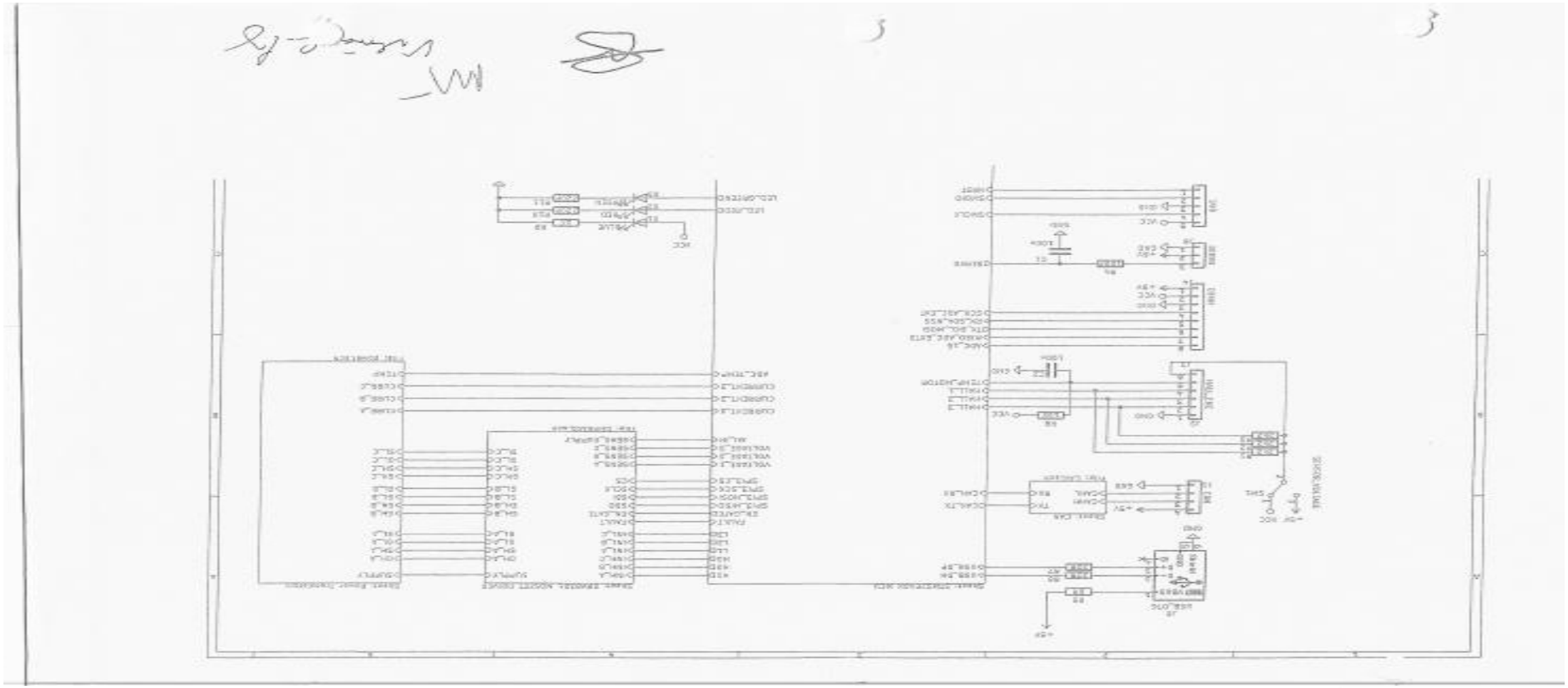

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Faculty Research Publication

Name of the Faculty/Personnel	Title of Research/Article	Name of Book/Journal	Date Started	Date Completed	Editors/ Referees (Name and Profession)	Vol./Issue/ Place/Date of Publication/C opyright No.	Level of Publication		
							International	National	Local
De La Cruz, Arvin R. Tenerife, Pedrito Jr. M.	Design and Development of Banana Fiber Decorticator with Wringer	International Journal of Recent Technology and Engineering	2018	2019		Vol.-8, Issue-1S4	√		
De La Cruz, Arvin R.	Optical Character Reader of a Braille Unicode System for the Blind	International Journal of Recent Technology and Engineering	2018	2019		Vol.-8, Issue-1S4	√		
De La Cruz, Arvin R. Tenerife, Pedrito Jr. M.	Image-Based Microalgae Cell Identifier and Counter	International Conference on Innovative Research in Science, Technology and Management Conference Proceedings	2017	2018		Vol.-6, ISSN 2244-5668		√	
Ado, Remedios G. Mahaguay, Rolito L.	Development of e-Bag Wireless Charger for Gadgets	International Conference on Innovative Research in Science, Technology and Management Conference Proceedings	2017	2018	Dr. Teena Bagga	ISBN 978-81-934246-4-3	√		
De La Cruz, Arvin R. Tenerife, Pedrito Jr. M.	Design and Development of a Hybrid Photobioreactor for Biomass Production of Spirulina Platensis Species	International Conference on Innovative Research in Science, Technology and Management	2017	2018	Dr. Teena Bagga	ISBN 978-81-934246-4-3	√		
Tenerife, Pedrito Jr. M. Tubola, Orland D.	The Development of a Hybrid Renewable Energy-Powered Light Bouy System Harnessing Sea Energy Potentials	Ascendens Asia Journal of Multidisciplinary Research Conference Proceedings	2014	2015	Dr. Carmencita L. Castolo	Vol. 2, No. 3 ISSN 2529-7902	√		

Ado, Remedios G.	"Mobile Emergency Response Application Using Geolocation for Makati Command Center"	International Journal of Computer and Communication Engineering	2013	2014		Vol. 3, No. 4, July 2014 ISSN 2010-3743	√		

Prepared by:

Pedrito M. Tenerife Jr.

Scopus

Document details

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International Journal of Recent Technology and Engineering
Volume 8, Issue 1 Special Issue 4, June 2019, Pages 82-84

Design and development of banana fiber decorticator with wringer (Article)

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Abstract

The demand for fiber as raw materials to make various products is increasing. It can be extracted from the seed, leaves, fruits and stem of a plant. Banana is one of the leading fruits grown in the Philippines. It provides food and a source of industrial raw materials. Aside from the fruit, banana blossom and its trunk pith that can be eaten, natural fiber can be extracted in the trunk (pseudo-stem) that is usually thrown as waste after the harvest season. The study aims to develop a machine that can extract fiber in a pseudo-stem which can be used in handicrafts, ropes, clothing and other products. A prototype was designed, developed and was tested for banana trunk fiber extraction. During the extraction process, the stem which is 45.72 cm in length and 1 cm thickness is fed manually in the prototype machine. Fiber is extracted from the pseudo-stem using a decortication process where a roller with scratched surface is compressed into a stationary bar that will crushed and scraped the trunk. During the decortication process the banana stem is also undergoing the wringing process wherein the fiber loses its water content. The extracted fiber is already dried and can be used in making domestic products. However, to have a good quality fiber, after the process, it should be washed and dried. Results indicated that the recovery rate of the banana fiber has increase by 2-3% in an average of 35.5 cm pseudo-stem. The device has a great potential and should be used for the growing fiber industry in the country. © BEIESP.

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Design and Development of Banana Fiber Decorticator with Wringer

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Abstract*— The demand for fiber as raw materials to make various products is increasing. It can be extracted from the seed, leaves, fruits and stem of a plant. Banana is one of the leading fruits grown in the Philippines. It provides food and a source of industrial raw materials. Aside from the fruit, banana blossom and its trunk pith that can be eaten, natural fiber can be extracted in the trunk (pseudo-stem) that is usually thrown as waste after the harvest season. The study aims to develop a machine that can extract fiber in a pseudo-stem which can be used in handicrafts, ropes, clothing and other products. A prototype was designed, developed and was tested for banana trunk fiber extraction. During the extraction process, the stem which is 45.72 cm in length and 1 cm thickness is fed manually in the prototype machine. Fiber is extracted from the pseudo-stem using a decortication process where a roller with scratched surface is compressed into a stationary bar that will crushed and scraped the trunk. During the decortication process the banana stem is also undergoing the wringing process wherein the fiber loses its water content. The extracted fiber is already dried and can be used in making domestic products. However, to have a good quality fiber, after the process, it should be washed and dried. Results indicated that the recovery rate of the banana fiber has increase by 2-3% in an average of 35.5 cm pseudo-stem. The device has a great potential and should be used for the growing fiber industry in the country.

***Index Terms*— bast fiber, decortication process , pseudo stem, wringing process**

I. INTRODUCTION

The demands for the use of natural fibers to produce clothes, carpets and other handicraft products have grown tremendously. Various plants are used as a source material for fiber to meet the demands. It is extracted from fruits, stem, and leaves of various plants. In the Philippines, a natural source of fiber is coconut, water hyacinth, pineapple, abaca. A lot of attention has been given to these plants. However, banana (*Musa sapientum*) which resembles and closely related to abaca (*Musa textilis*) is also a good source of fiber.

Philippines is one of the largest producers of banana in the world. Also, banana is the fourth largest commodity that is being produced in the Philippines next to paddy rice, coconuts and native pig meat. With the large scale of banana that is being harvested means that there a lot of banana stems that can be used to produce banana fiber and help local banana farmers for their livelihood.

II. BANANA FIBER CHARACTERISTICS AND PRODUCTS

Physical Properties

Banana fiber has good modulus of elasticity, tensile strength, and stiffness [8].

Other characteristics includes [2]:

- Appearance of banana fiber is like that of bamboo fiber and ramie fiber, but its fineness and spinnability is better than the two.
- The chemical composition of banana fiber is cellulose, hemicellulose, and lignin.
- It is highly strong fiber.
- It has smaller elongation.
- It has somewhat shiny appearance depending upon the extraction & spinning process.
- It is light weight.
- It has strong moisture absorption quality. It absorbs as well as releases moisture very fast.
- It is bio- degradable and has no negative effect on environment and thus can be categorized as eco-friendly fiber.
- Its average fineness is 2400Nm.
- It can be spun through almost all the methods of spinning including ring spinning, open-end spinning, bast fiber spinning, and semi-worsted spinning among others.

Chemical Composition

The chemical composition of banana fiber is cellulose (50-60%), hemicelluloses (2530%), pectin (3-5%), lignin (12-18%), water soluble materials (2-3%), fat and wax (35%) and ash (1-1.5%) [7].

Products

Because of it being biodegradable, banana fiber is use in different products like yarn, fabric, apparel, paper and paper made products, handicrafts and industrial purposes [9].

As stated by Mr. Romeo O. Bordeos Jr. global competitiveness of the Philippine natural fibers depend on the accuracy of classification and grading of fibers produced [1].

III. PROTOTYPE DEVELOMENT

The prototype uses the concept of auto feed system. It consists of keypad, LCD display, rollers, containers,

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emergency stop and conveyor. Keypad was the component used to control the whole system. The numbers in the keypad corresponds to the following tasks: (1) Automatic, (2) Manual, (3) Motor (On), (4) Motor (Off), (5) Conveyor (On), (6) Conveyor (Off). Banana pseudo stem is fed into the prototype. The roller, serves as decorticator and wringer at the same time, was used in stripping the medium. It undergoes adjustments depending on the size of the medium to be fed. The decorticated banana pseudo stem will then fell onto the conveyor. Excess water of decorticated banana pseudo stem that falls in the water container is monitored by a water level sensor. The conveyor brings the decorticated pseudo stem into the output container. All components are connected to a micro-controller unit. The Liquid Crystal Display (LCD) is used for the monitoring the current stage of the process.

Block Diagram

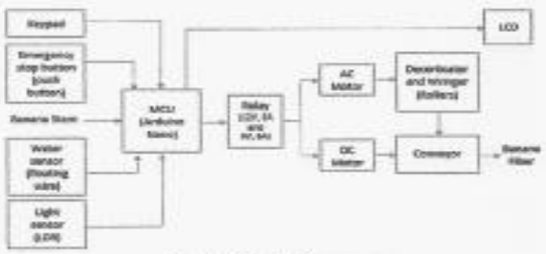

Fig. 1 Block Diagram

Fig. 1 shows how the prototype components are connected. The machine is controlled by a microcontroller Arduino Nano. It has an option whether automatic or manual (user operated). Once a banana stem is placed into the machine and the photoresistor (LDR) sensed it his will turn on the whole machine. The decorticator and wringer are powered by an AC motor to extract the banana fiber. The extracted fiber will go onto a conveyor belt and transferred on a bucket. The extracted water from the stem goes in a container monitored by a sensor. Warning and status of the system is displayed on the LCD. An emergency stop button is included to turn off the whole system once needed. The banana fiber extracted will be dried under the sun.

IV. EXTRACTION MACHINE

Major components of machine are roller, motor, conveyor, and the display. Fig 2a and 2b shows the actual machine.

Fig 2a Decorticating and conveyor

Fig 2b Display

V. TEST RESULTS AND DISCUSSION

For initial testing of the prototype, the proponents used a constant motor speed, and length and thickness of the stem to determine the exact distance of the two rollers needed to achieve the highest fiber recovery range.

Table I. Initial Testing

Length of the stem	Thickness of the stem	Motor Speed	Distance of two rollers	Fiber recovery rate
45.72 cm	1 cm	2800 rpm	8 mm	No fiber recovered.
45.72 cm	1 cm	2800 rpm	7.62 mm	0.01% - 0.05%
45.72 cm	1 cm	2800 rpm	7.112 mm	0.1% - 0.3%

After the initial testing, it was observed that it can decorticate and wring but there was a problem with the motor because it stops in the middle of the process. The motor that was used doesn't have enough torque to drive the rollers continuously. The solution is to add another motor to increase the torque.

Table II. Final Testing

Length of the stem	Thickness of the stem	Motor Speed	Distance of two rollers	Recovery rate

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35.5 cm	1 cm	2800 rpm (2)	7.0 mm	Fiber recovered. 0.4% - 0.5%
35.5 cm	1 cm	2800 rpm (2)	6.5 mm	Fiber recovered. 0.6% - 0.7%
35.5 cm	1 cm	2800 rpm (2)	5.2 mm	Fiber recovered. 0.8% - 1.0%.
35.5 cm	1 cm	2800 rpm (2)	4.0 mm	Fiber recovered. 0.1.5% - 2.5%

The final test results show that the roller should be 4mm apart from each other and 2 motors are needed to extract the fibers from the stem.

VI. CONCLUSION

The developed Banana Fiber Decorticator with Wringer is efficient. By giving attention to the motor speed and the distance of the roller there is an increase in the production rate of the banana fiber. The application of the conveyor and feeder reduces the time and effort of the user.

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Optical character reader of a braille unicode system for the blind (Article)

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Abstract

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--This study aspires to innovate braille system by applying the fast coping technological advancement of the world to it. Braille is a code – a system of dots that represents the letters of the alphabet and that visually impaired individuals can use to read independently. As Braille Technology is fast growing, more and more people with visual impairment cannot afford to bought one. Thus, the proponents created a prototype, a portable and a lot cheaper braille device that will help individuals and institutions for their reading challenges. The proponents created a braille display that comes up with a scanner that will scan physical text documents then process it to become an output as a braille cell. It also comes up with a text-to-speech conversion which will become an option for the involved person on what will he or she chooses as an output. This is made possible by Optical Character Recognition (OCR) technology that the proponents used in Raspberry Pi. The OCR is responsible for the image processing that will convert the image captured into a text file. The text file will then be processed again to send signal to the servo motor that is responsible for pushing the braille cells needed. The device also includes motor guide for correct scanning of the physical text documents. The device will perform the task quickly that will surely help visually impaired individuals to easily read reading materials. This system is conducted to provide another solution on problems about reading for blind and visually impaired individuals and to provide cheaper device for them. It will contribute not only to the community involved but also in the technological industry in the Philippines. ©BEIESP.

Author keywords

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Optical Character Reader of a Braille Unicode System for the Blind

Arvin R. De La Cruz, Reginald D. Legaspi, Zildjian L. Mergilla, Marc Oliver P. Otawa

ABSTRACT— This study aspires to innovate braille system by applying the fast coping technological advancement of the world to it. Braille is a code – a system of dots that represents the letters of the alphabet and that visually impaired individuals can use to read independently. As Braille Technology is fast growing, more and more people with visual impairment cannot afford to bought one. Thus, the proponents created a prototype, a portable and a lot cheaper braille device that will help individuals and institutions for their reading challenges. The proponents created a braille display that comes up with a scanner that will scan physical text documents then process it to become an output as a braille cell. It also comes up with a text-to-speech conversion which will become an option for the involved person on what will he or she chooses as an output. This is made possible by Optical Character Recognition (OCR) technology that the proponents used in Raspberry Pi. The OCR is responsible for the image processing that will convert the image captured into a text file. The text file will then be processed again to send signal to the servo motor that is responsible for pushing the braille cells needed. The device also includes motor guide for correct scanning of the physical text documents. The device will perform the task quickly that will surely help visually impaired individuals to easily read reading materials. This system is conducted to provide another solution on problems about reading for blind and visually impaired individuals and to provide cheaper device for them. It will contribute not only to the community involved but also in the technological industry in the Philippines.

Index Terms— braille, optical character recognition, raspberry pi, Braille, Unicode System, Optical Character Reader.

I. INTRODUCTION

Reading is always a challenge for the blind and the visually impaired where they only rely on special books and items that are limited in terms of availability and effectiveness. The blind and visually impaired does not only struggle to read books, articles, or any published materials, physically written papers and signage are just few of those that have little to no use for the blind and visually impaired to use. Their touch is the most important factor for them to read and interact with their surroundings which is why people started to invent electronic devices and applications which communicate with computers and phones in order to provide and help them in using computers and phones, although it is a solution for them to communicate it is only for digital or non-physical means only, this means they are left behind when it comes to physically written, printed or displayed words. Refreshable braille displays are currently available on the market this day. These displays are mostly used in computers to output a text, which means it is only limited to display computerized text. The braille system uses six dots to represent a certain character. Therefore, there will be two (the possible states of the dots, on/off) raise to the power of six (the number of dots) combinations which is equivalent to 64. Therefore, a braille system with 6 dots is capable of displaying 64 different characters. Optical Character Recognition is a technology that is widely used nowadays in various fields. Optical Character Recognition, or OCR, is a technology that enables you to convert different types of documents, such as scanned paper documents, PDF files or images captured by a digital camera into editable and searchable data.

The proponents would like to use this technology to develop a system that will be able to recognize texts from the outside world, and project those texts using a braille display. Blind and visually impaired individual needs to have a proper education just like us. But in our current society, they are rapidly left behind by the rapid growth of education system. Admit it or not, people with disability, especially blind individual can't cope on a normal education system that we have today. It is not because of their thinking capability, it is because it's hard for them to use and apply materials that students use on schools, especially in reading. Maybe there are some who can overcome that obstacle with the help of available Braille devices in the market but, there are many also who are left behind. So the big question is was it enough given that there are many children who are in need of a device that will help them to study? As a solution to that, the proponents want to develop an Optical Character Reader of a Braille Unicode System for the Blind to help them easily read printed materials that will become the first step in making their study patterns easy. It will also serve as the first step in the development of technology in the field of Braille devices and hopefully, the time will come that there are no more visually impaired individual that will be left behind in this society where disability is a disease and education is most important.

II. METHODOLOGY

A. Method of Research

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Figure 1 Research Paradigm of the Project proposal

To improve human conditions of visually impaired persons, the proponents used applied and developmental research. As an applied and developmental research study, it focuses to solve practical problems that will improve human conditions rather than to acquire knowledge. It focuses on analysis and solving social and real-life problems and generally conducted on a large-scale basis. It uses some part of the research communities' accumulated theories, knowledge, and methods. It is used to find solutions to everyday problems, and develop innovative technologies, rather than to acquire knowledge for knowledge's sake. Once an applied research has identified a workable solution to a specific problem the focus shifts to development of a specific product that involves refining the solution to produce a substance that will be effective, safe and appealing and can be manufactured in a timely and cost-effective way.

B. Data Gathering Procedure

Permission to conduct the research will be secured by the proponents from the administrator of the ATRIEV where questionnaires will be distributed to the chosen sample of the institution. The questionnaire will be scored, tallied and tabulated. The proponents and instructors of the institution will guide the persons involved for answering the given questionnaires.

III. RESULTS AND DISCUSSION

a. Functionality testing for Optical Character Recognition

Functionality Testing	First Testing	Second Testing	Third Testing	Fourth Testing
• OCR using Raspberry Pi and Pi Cam	Approximate image to text conversion accuracy is 30%	Approximate image to text conversion accuracy is 50%	Approximate image to text conversion accuracy is 60%	Approximate image to text conversion accuracy is 75%
	Fifth Testing	Sixth Testing	Seventh Testing	Final Testing
	Approximate converted image accuracy is 75%	Approximate image to text conversion accuracy is 78%	Approximate image to text conversion accuracy is 85%	Approximate image to text conversion accuracy is 90%

Table 1 shows the functionality of the OCR with a total of 8 testing done. The results are approximately computed based on the factors that are used during the testing period.

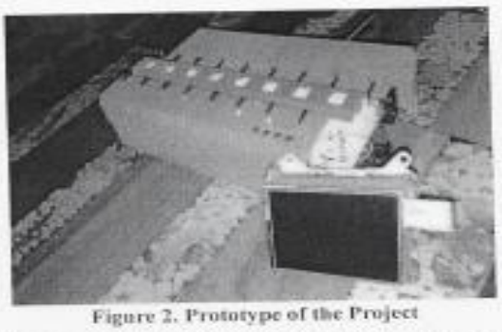

Figure 2. Prototype of the Project

Figure 2 shows the prototype of the project that showcases the braille system and the OCR and Camera that will store all the scanned documents. The device uses an 8 megapixels Raspberry Pi Cam that is installed to the Raspberry Pi, this makes it possible for the user to scan physical texts from documents or printed materials, then it will be processed by the Raspberry Pi. The scanned image undergoes Optical Character Recognition whereas the output is a text file containing all the converted data from the image. The Raspberry Pi then reads this text file and converts it to Braille ASCII, this text file is also read by the Raspberry Pi as an output for the text-to-speech

The Raspberry Pi checks the position of every cell of the braille by reading data from the rotary encoders which are attached to the servo motors on each cell, this position is used to determine the rotation needed for the servo motors to rotate to the correct position. The Raspberry Pi will send signals to the PWM Servo driver to rotate the servo motors for the desired angle. A wheel with magnets lined on its outside wall is driven by these servo motors along with the rotary angle sensors, these magnets attract and repel the pistons that serves as the individual dots. A rumble motor then vibrates to provide a haptic feedback to as the user navigates through the device.

As a feedback and error checking the rotary angle sensors are read again to ensure that the correct position is obtained, the rotary angle sensors are connected to a multiplexer that is then connected to the Raspberry Pi.

b. Weighted Mean (WM) and Verbal Interpretation (VI) of Students, Staffs, and IT Practitioner for Optical Character Reader of a Braille Unicode System for the Blind in terms of Accuracy

Accuracy	Students		Staffs		IT Practitioners		Overall	
	WM	VI	WM	VI	WM	VI	WM	
Correct characters are displayed	3.50	G	3.70	G	4.20	G	3.80	G
Converted text is complete	3.80	G	3.50	G	4.20	G	3.77	G
Words/Words are easy to understand	4.20	G	4.10	G	4.60	G	4.30	G
Overall Mean	3.77	G	3.77	G	3.80	G	3.84	G

Legend: Good(G)

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Table 2 shows the respondents result of the assessment. It shows the results of the developed device based on its functionality. Accuracy table shows the evaluation of the "Correct characters are displayed" with the WM of 3.50 for Students which is Good, a WM of 3.70 for the Staffs which is Good and WM of 4.20 for IT Practitioners which is Good too. "Converted text is complete" has a 3.60 WM for students and 3.50 WM for the Staffs and 4.20 WM for IT Practitioners which are both Good. "Words/Words are easy to understand has both 4.20 WM for the Students, 4.10 for Staffs, and 4.50 for IT Practitioners which indicates Good verbal interpretation. This implies that the developed device meets the functionality specification and requirements of the respondents in terms of different criteria made to be said that the device is functional.

c. Weighted Mean (WM) and Verbal Interpretation (VI) of Students and Staffs of ATRIEV, and IT Practitioner for Optical Character Reader of a Braille Unicode System for the Blind in terms of Efficiency

Efficiency	Students		Staffs		IT Practitioners		Overall	
	WM	VI	WM	VI	WM	VI	WM	
How long the device will last on a daily usage	3.50	G	4.00	G	4.10	G	4.00	G
Characters that the device can output at a time	3.80	G	3.80	G	3.80	G	3.80	G
Overall Mean	3.65	G	3.90	G	3.95	G	3.90	G

Legend: Good(G)

Table 3 shows the evaluation of the respondents which are Students and Staffs on Optical Character Reader of a Braille Unicode System for the Blind on the criteria of the Efficiency. It is evaluated using two (2) criteria to assess if the device can efficiently be used by the users specifically the life span of the device and the output rate of it. Efficiency evaluation table shows in terms of how long the device will last on daily basis usage, achieve a 3.90 WM with a VI of Good and 4.00 WM with a VI of Good for the staffs and a WM of 4.10 for IT Practitioners which indicates Good interpretation. Measuring the characters that the device can output at a time produced a WM of 3.80 for both Students and Staffs and IT Practitioners that indicates a Good interpretation.

This implies that students, staffs and the IT Practitioners agreed that the developed device is appropriate to use, effective and efficient based on their needs in their everyday routine and activities.

d. Weighted Mean (WM) and Verbal Interpretation (VI) of Students and Staffs of ATRIEV, and IT Practitioner for Optical Character Reader of a Braille Unicode System for the Blind in terms of Portability

Portability	Students		Staffs		IT Practitioners		Overall	
	WM	VI	WM	VI	WM	VI	WM	
Weight of the device	3.90	G	3.70	G	4.10	G	3.90	F
Overall size of the device	4.60	G	3.30	F	3.70	G	4.10	G
Overall Mean	4.25	G	3.50	G	3.90	G	3.70	G

Legend: Good(G), Fair(F)

Table 4 shows the evaluation of the respondents to Optical Character Reader of a Braille Unicode System for the Blind on the criteria of portability. Portability table shows that the device meets the needs for portability as the weight of the device scores a 3.90 WM that has a Verbal Interpretation of Good for students, a WM of 3.70 that indicates Good interpretation for the staffs and a WM of 3.10 with an interpretation of Fair for the IT Practitioners. The overall size of the device produced a WM of 4.60 which is Very Good, 3.30 which is Fair and 3.70 WM which is Good for staffs, and IT practitioners respectively. Although the results are not that high the overall WM reach a Good interpretation with a WM of 3.70 so we can conclude that the device portability was met.

f. Weighted Mean (WM) and Verbal Interpretation (VI) of Students and Staffs of ATRIEV, and IT Practitioner for Optical Character Reader of a Braille Unicode System for the Blind in terms of Cost-Effectiveness

Cost-Effectiveness	Students		Staffs		IT Practitioners		Overall	
	WM	VI	WM	VI	WM	VI	WM	
Components Cost	4.50	VG	4.70	VG	4.60	VG	4.60	VG
Housing Cost	4.60	VG	4.80	VG	4.40	VG	4.60	VG
Overall Mean	4.55	VG	4.82	VG	4.50	VG	4.60	VG

Legend: Very Good(VG)

Table 5 shows the evaluation of the respondents to Optical Character Reader of a Braille Unicode System for the Blind on the criteria of portability. Cost-effectiveness table shows that the components cost got a WM of 4.50 and a verbal interpretation of Very Good for students, a WM of 4.70 which is Very Good for staffs, and a WM of 4.60 which indicates a Very Good interpretation for IT practitioners. This implies that both the students, staffs and the IT practitioners agreed that the developed device is a cost-effective one. This is very important now that as technology arises, its price also gets bigger.

g. Overall Weighted Mean (WM) and Verbal Interpretation (VI) evaluation for Optical Character Reader of a Braille Unicode System for the Blind

Variables	Students		Staffs		IT Practitioners		Overall	
	WM	VI	WM	VI	WM	VI	WM	
Accuracy	3.77	G	3.77	G	3.90	G	3.80	G
Efficiency	3.85	G	3.95	G	3.95	G	3.90	G
Portability	4.25	G	3.50	G	3.70	G	3.90	G
Cost-Effectiveness	4.55	VG	4.80	VG	4.50	VG	4.60	VG
Overall Mean	4.10	G	4.00	G	4.01	G	4.03	G

Legend: Good(G), Very Good(VG)

Table 6 shows that the overall based on the four variables got a WM of 4.10 and a verbal interpretation of Good for students, a WM of 4.00 which is Good for staffs, and a WM of 4.03 which indicates a Good interpretation for IT practitioners. This implies that all the type of respondents agreed that the developed device is effective in term of the variables mentioned.

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b. ANOVA

To determine the difference among the evaluation of Students, Staffs and IT Practitioners of ATRIEVs' assessment of the Optical Character Reader of a Braille Unicode System for the Blind, the analysis of variance or ANOVA is applied. The results of the application of the test statistics will be presented, and discussed below:

Table 7 Summary of Evaluation of the Respondents

Variables	Source of Variation	Sum of Squares	df	Mean Square	F	P	Decision
Accuracy	Between Groups	0.252	2	0.126	3.338	0.052	Accepted
	Within Groups	1.013	27	0.038			
	Total	1.265	29	0.164			
Efficiency	Between Groups	0.030	2	0.015	7.5	0.038	Rejected
	Within Groups	0.041	27	0.002			
	Total	0.071	29	0.017			
Portability	Between Groups	0.350	2	0.175	6.481	0.005	Rejected
	Within Groups	0.725	27	0.027			
	Total	1.075	29	0.202			
Cost-Effectiveness	Between Groups	0.120	2	0.060	30	0.000	Rejected
	Within Groups	0.040	27	0.002			
	Total	0.160	29	0.061			

Table 7 shows that the difference in the evaluation in term of accuracy, efficiency, portability and cost-effective of the Optical Character Reader of a Braille Unicode System for the Blind

1. Accuracy

Table 7 shows that there is no difference in the evaluation of the Students, Staffs, and IT Practitioners in Optical Character Reader of a Braille Unicode System for the Blind between groups and within groups using one-way ANOVA. The computed value of P = 0.052 which is greater than the 0.05 level of significance accepts the null hypothesis. The result of the non-rejection of the null hypothesis indicates the equality of evaluation among the three groups of respondents which further proves that the Optical Character Reader of a Braille Unicode System for the Blind meets the specification and requirements of the respondents in terms of Accuracy

2. Efficiency

Table 7 shows that there is a difference in the evaluation of the Students, Staffs, and IT Practitioners in Optical Character Reader of a Braille Unicode System for the Blind between groups and within groups using one-way ANOVA. The computed value of P = 0.026 which is less than the 0.05 level of significance accepts the null hypothesis. The result of the rejection of the null hypothesis indicates the differences of evaluation among the three groups in terms of efficiency since the users are not knowledgeable in terms of technical operation of the device except the IT Practitioners.

3. Portability

Table 7 shows that there is a difference in the evaluation of the Students, Staffs, and IT Practitioners in Optical Character Reader of a Braille Unicode System for the Blind between groups and within groups using one-way ANOVA. The computed value of P = 0.005 which is greater than the 0.05 level of significance accepts the null hypothesis.

The result of the non-rejection of the null hypothesis indicates the equality of evaluation among the three groups of respondents which further proves that the Optical Character Reader of a Braille Unicode System for the Blind meets the specification and requirements of the respondents in terms of Portability.

4. Cost-effectiveness

Table 7 shows that there is a difference in the evaluation of the Students, Staffs, and IT Practitioners in Optical Character Reader of a Braille Unicode System for the Blind between groups and within groups using one-way ANOVA. The computed value of P = 0 which is less than the 0.05 level of significance accepts the null hypothesis. The result of the rejection of the null hypothesis indicates the differences of evaluation among the three groups of respondents which tells that there is a difference in terms of knowledge or experience in cost among the groups of respondents.

IV. CONCLUSIONS

On the account of the foregoing significant findings the following conclusions were made:

1. The stages undertaken in the development of the Optical Character Reader of a Braille Unicode System for the Blind sign the SDLC followed the system engineering procedure with the steps of Defining Requirements to itemize the specification and needs of target client, Iteration of Integration and Testing for the development, coding, designing, and prototyping until customer satisfaction then Deployment to the client and Maintenance. Those steps will help to provide the highest satisfaction of the users.
2. The result of the assessment of Students, Staffs, and IT Practitioners to the accuracy, efficiency, portability, and cost of the Optical Character Reader of a Braille Unicode System for the Blind is Good therefore recommended for implementation.
3. There is a significant difference in the assessment of the Students, Staffs, and IT Practitioners on the Braille Unicode System using Optical Character Reader for the Blind in terms of efficiency, portability and cost-effectiveness while there is no significant difference in terms of accuracy.
4. Based on the problem encountered during the development of the device, the researchers need to consider all the components by making sure that the criteria that need to meet will satisfy the requirements of the device.
5. The problem encountered was solved by adding functionality similar to the functions the beneficiary uses which they recommended as a solution to the problem.

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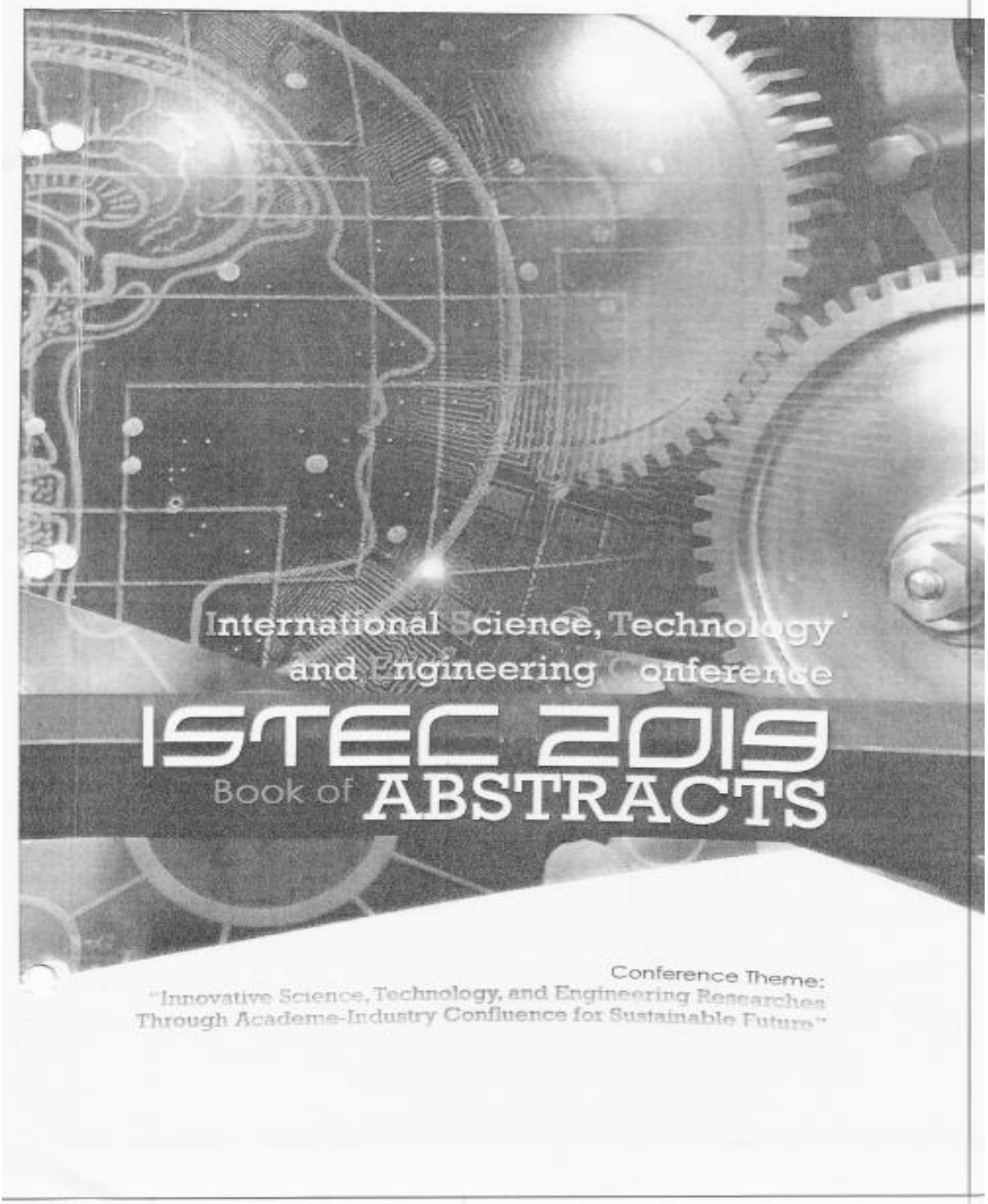
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