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Smart Trekking Bag

Tanveer S Siddiqui[1], Aamir I Patel[2], Adnan A Shaikh[4], Yasar S Shaikh[3], Harshal Ahire[5]
[1, 2, 3, 4]*Students,* [5]*Assistant Professor, Department of Mechanical Engineering. Theem College of Engineering, Boisar 401501*

Abstract: ***In Today's world If you are a hiking enthusiast, or a military person chances are you are despise carrying around a heavy traditional backpack on your adventures. Backpacks can be uncomfortable after a period of time and cause excessive sweating as well. So we need to find some other ways and a solution for this .A bag is called smart when it provide lots of features that helps a trekker during his journey. It is important that a trekker feels comfortable and relax while trekking. So basically in an ordinary smart trekking bag consist limited features like only charging ports are given, The bag which we are creating consist of a GPS tracker, Solar panels, Power bank, and heating element .This features enhance the trekking effect by its features like GPS tracking as it will help to trace the location of tracker in case of missing .In this bag a solar panel or solar disk which will charge the battery inside the bag and also charge the power bank and that battery can be used to charge cell phones. A very important feature which we will provide in this bag is a heating element or heating pad .This heating pad is used to provide warmth to the trekkers' .For example if the trekking location is in somewhere on mountains or is in cold place so in that case warmness is necessary for the trekkers. So this heating pad will relief the back pain of the trekkers and provide warmth to them. This heating will provide at the back side of the backpack and to relief back pain and neck pain. There are many other smart bag available in the market but none of these provide heating element and also this bag is waterproof and dustproof and easily washable.***

Keywords: Smart backpacks, GPS Module, Solar Disk, Power Bank, Trekking.

I. INTRODUCTION

In the last couple of decades, people who spend more time outdoors have been blessed with major enhancements in the technology of equipment they use. Would you believe that everything has become almost seven times lighter than what it used to be before? Let us look at all the equipment that is being used currently, which would not have been possible without the various technological advancement. Those are the days when a trekker have to carry lots of equipment and heavy items for trekking, which results in their physical health like aching muscles, sore shoulders etc. As the physical health of a trekker is concern there should be a system which reduce the aching of body and provide warmth to the person for the comfort of the trekkers. Gone are the days when one needed to carry multiple maps on paper . Today, a GPS enables recording of all milestones on the way. One can even download the entire map of an area on a smartphone before venturing out. Using Google Maps offline functionality, one can track distances covered easily through a smartphone, as well.

Solar power refers to the energy created when solar radiation is converted into heat (thermal processes) or electricity (electric processes). Solar energy describes several energy creation techniques that use the sun's radiation. It has been used in traditional construction for centuries though in developed countries interest has fluctuated with the price of fossil fuel. The traditional use of solar energy as passive heating has influenced the design of homes and public buildings in many parts of the world: the most efficient dwellings historically have been designed, in the northern latitudes, with large windows facing south and small windows in the walls oriented toward the north. This simple building technique has for centuries reduced the need for other sources of energy to generate heat. Trekking is an outdoor recreational activity of hiking or walking for more than a day. It can be a short or an extended journey, and may or may not involve camping outdoors. In Nepal, trekking is the most widespread activity for tourists, obviously due to its privilege of being home to the Himalayas.

II. LITERATURE REVIEW

Some reviews regarding project topic studied as follows

Ehsanul Kabir et al.(2017) [1] The development of novel solar power technologies is considered to be one of many key solutions toward fulfilling a worldwide increasing demand for energy. Rapid growth within the field of solar technologies is nonetheless facing various technical barriers, such as low solar cell efficiencies, low performing balance-of systems (BOS), economic hindrances (e.g., high upfront costs and a lack of financing mechanisms), and institutional obstacles (e.g., inadequate infrastructure and a shortage of skilled manpower). The merits and demerits of solar energy technologies are both discussed in this article. A

number of technical problems affecting renewable energy research are also highlighted, along with beneficial interactions between regulation policy frameworks and their future prospects. In order to help open novel routes with regard to solar energy research and practices, a future roadmap for the field of solar research is discussed.

Bjornar Sandnes, et al,(2007) [2] Flexing a metallic disk triggers the crystallization of the super cooled sodium acetate solution contained in commercial heat pads. Many mechanisms have been proposed to explain the apparent nucleation of crystalline material. In this paper a simple experiment is described that demonstrates that nucleation is triggered by preserving seed 5 crystals clamped between opposing metal surfaces. An explanation for the retention of the crystalline particles is the elevated melting point caused by very high local pressures. A series of thermo physical properties of the sodium acetate solution is also measured, including the available enthalpy upon crystallization of the super cooled substance, and liquid and solid phase specific heat capacities.

Qiang Xiei's, et al.(2010) [3] refers to a solar collector which may receive and direct solar radiation onto a photovoltaic (or, solar) cell. A concentrating solar collector may also convert the received solar radiation into a concentrated radiation beam prior to directing the radiation onto the solar cell. In some aspects, determination of the target tracker position in the second coordinate system includes subtracting 360° from an azimuth angle in the first coordinate system if the azimuth angle in the first coordinate system is between +180° and +360°, wherein the azimuth angle in the second coordinate system is determined to be equal to the azimuth angle in the first coordinate system if the azimuth angle in the first coordinate system is between 0 and +180°.

Myung_su_Kim et al (2019) [4] Thermal contact conductance (TCC) plays an important role in thermal management, which can strongly affect heat dissipation. Therefore, accurate measurement and understanding of TCC are essential for the design of scientific instruments operating at low temperatures. Cryogenic applications using a cryocooler can be significantly affected by TCC because there are many metal interfaces for heat transfer. Therefore, this must be considered during the optimization of thermal design of instruments. The steady state method is applied in this study for measuring the TCC. An electrical heater made of nichrome wire is located in the middle of the metal specimen, and the generated heat flows through the interface across the specimen. The temperature drop across the specimen is measured, from which the TCC is calculated using heat flux. The effects of operating temperature and contact pressure on the surface form and TCC are quantitatively investigated.

Ali_Asghar_Rastegari et al.(2019) [5]. The ability of renewable energy sources to supply global energy needs if not completely then to a significant degree has been amply demonstrated. What needs to happen now in order to make large-scale implementation possible? Special consideration is given to chances of commercialization of biofuels that provides a reasonable assessment of various techno-economical aspects of pilot-scale future energy production. The future for renewable energy examines each of the major renewable energy technologies. It provides a qualitative evaluation of achievements to date, which proposes for each chapter of this book detailed, realistic goals for a strong and coherent research, development and demonstration (R&D) policy, and maps out a path to a stronger market and more widespread deployment of renewable energy sources. The future for renewable energy will be regarded as a critical and authoritative source for strategic planning of renewable energy development worldwide. The current status and future directions of the biological processes for the production of energy by a biofuel provides a unique perspective to the industry about the scientific problems and their possible solutions in making a bioprocess work for the commercial production of commodity bioproducts. The commercial production of some of these commodity bioproducts in the near future will have a far-reaching effect in realizing our goal of sustainable conversion of these renewable resources and realizing the concept of the biorefinery. Discusses the processing of renewable resources, such as plant biomass, for mass production of commodity chemicals and liquid fuels to meet our ever-increasing demands. Encourages sustainable green technologies for the utilization of renewable resources offers timely solutions to help address the energy problem as non-renewable fossil oil will soon be unavailable

Matej_Žnidarec et al (2019) [6]. Performance of 5 photovoltaic (PV) modules made of different technologies (monocrystalline silicon, polycrystalline silicon, amorphous silicon, copper indium selenide and heterojunction with intrinsic layer) is evaluated according to the short-term capacity evaluation method described in IEC TS 61724-2 standard. Measurements for the analysis are obtained from the data acquisition system developed by the Laboratory for Renewable Energy Sources at the Faculty of Electrical Engineering, Computer Science and Information Technology (FERIT) Osijek which is described in the paper. Results of the performance analysis according to the IEC TS 61724-2 standard indicate that the copper indium selenide PV module Solar Frontier SF150-S has the greatest performance, therefore it is the most suitable PV module for the micro-location of Osijek, Croatia with European humid continental climate. The lowest performance of all studied PV modules is achieved by polycrystalline silicon PV module Bisol BMU 250. Empirical analysis of the relations of various electrical and meteorological parameters is performed and dependencies are evaluated. In the last section, mathematical models of PV module efficiency in relation to the module temperature are derived based on empirical analysis of measurements..

Prabir_Kanti_Basu, et al (2018) [7]. A high efficiency (>18%) industrial large area crystalline silicon wafer solar cell fabrication process generally requires industrial equipment with large footprint, high capital and running costs. Stricter processing window, continuous monitoring and automated functioning are the reasons for it. However, for any conventional laboratory (lab) it is always difficult to manage these requirements with limited available lab space or insufficient fund and other related resources. In this work, we report a novel way to fabricate high efficiency full area aluminium back surface field monocrystalline silicon wafer solar cells in our lab using low-cost processing with small-footprint fabrication tools for 6 inch pseudo-square industrial wafers. The novelty of our work includes optimization of every fabrication process step, e.g., texturization, emitter diffusion, emitter passivation and anti-reflection coating deposition, edge-isolation, screen printing and co-firing individually. These modifications include tuning of processing tools and processes, utility changes and inclusion of additional process steps. Beaker-based chemical processes, manual diffusion furnace, introduction of low temperature oxidation, low temperature silicon nitride deposition processes, plasma-edge isolation tool, single manual screen printer, single oven drying of metal pastes and co-firing using rapid thermal processing tools were used at our lab. For our cells, actual and active area efficiencies of 18.5 and 19% (measured under AM1.5G 1 Sun condition), respectively, were achieved.

III. RESEARCH METHODOLOGY

A. Components of Smart Trekking Bag

1) Solar Disk

Fig. Solar Disk

Solar Disk is shown in fig. This solar disk absorb sunlight as a source of energy to generate electricity. Photovoltaic module use light energy (photons) from the sun to generate electricity through the photovoltaic effect.

2) Power Bank

Fig. Power Bank

A Power Bank is portable charger designed to recharge your electronic devices when you're on the move. Ranging in size from slim, pocket-sized devices up to large higher capacity Power Bank they can be used to charge smartphones, tablets etc.

3) Heating Element (Nichrome wire)

Fig .Heating element (Nichrome wire)

Nichrome (NiCr, nickel-chrome, chrome-nickel etc.) is any of various alloys of nickel, chromium, and often iron (and possibly other elements). The most common usage is as resistance wire, Almost any conductive wire can be used for heating, but most metals conduct electricity with great efficiency, requiring them to be formed into very thin and delicate wires in order to create enough resistance to generate heat. When heated in air, most metals then oxidize quickly, become brittle, and break. Nichrome wire, however, when heated to red-hot temperatures, develops an outer layer of chromium oxide, which is thermodynamically stable in air, is mostly impervious to oxygen, and protects the heating element from further oxidation.

4) Trekking Bag

Fig. Trekking Bag

A trekking backpack is one of the most important gear when it comes to trekking in the Himalayas. It will be an essential gear which must be carried by you for hours when you go hiking in the mountains. The comfort, capacity, size, and durability are some of the factors which must be kept in mind before you buy one. You should invest a fair bit of money and research on the one that suits you best before getting a trekking backpack for yourself.

5) Piezoelectric chip

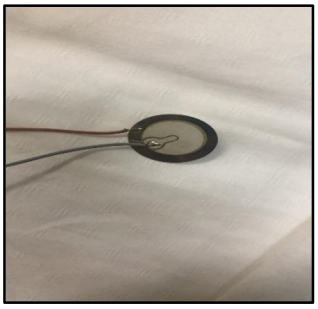


Fig. Piezoelectric Chip

A piezoelectric crystal is placed between two metal plates. At this point the material is in perfect balance and does not conduct an electric current. Mechanical pressure is then applied to the material by the metal plates, which forces the electric charges within the crystal out of balance.

6) Step up Transformer

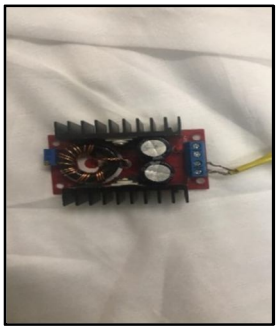


Fig. Step up Transformer

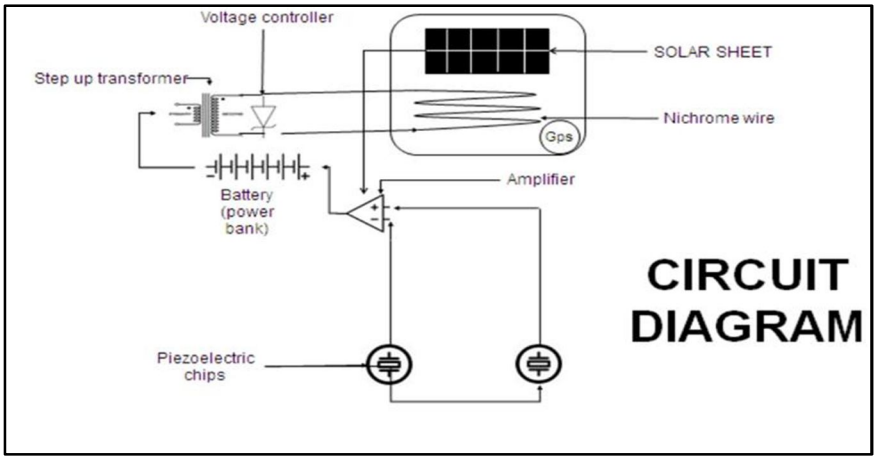
A step-up transformer is a transformer that increases the voltage from the primary coil to the secondary coil while managing the same power at the rated frequency in both coils. It converts low voltage & high current from the primary side to the high voltage & low current on the secondary side of the transformer.

7) GPS Module

Fig. GPS Module

GPS receivers are generally used in smartphones, fleet management system, military etc. for tracking or finding location. Global Positioning System (GPS) is a satellite based system that uses satellites and ground stations to measure and compute its position on Earth.

IV. CIRCUIT DIAGRAM



The connection of the components are as per shown in above figure. This circuit consist of eight solar panels, Step up transformer, Nichrome wire, GPS, Piezoelectric chips, and a Power Bank. The connection is made according to circuit shown above.

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A. Prototype of the Design

The prototype of our design consist of a trekking bag of standard size. The circuit work is installed inside the bag and the solar panels are arranged on the top side of the bag the connection is made according to the circuit and shown in below figure. But in the diagram, some connection is not visible

Fig. Prototype of design

We attached the eight solar panels on the top side of the bag, and its connections and power bank is inside the bag. The heating pad (Nichrome wire) is attached at the back side of the bag to remove back pain and neck stiffness during trekking.

Fig. Attached solar panels

Fig. Heating pad (Nichrome wire)

Here we design a bag to be used for trekking a bag is consist of heating element which work on power bank i.e 5V 2A OR 5V 1A. Also the main power source to charge the power bank. In total there will be 8 panels on the front part of the bag so that, it can absorb maximum heat and sunlight, 8 panels are made in pair of two connected parallel and all four pair are connected in series to get more power to charge the battery.

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V. ANALYSIS AND RESULT

A. Analysis

In our project, we have used eight solar panels. These solar panels is used to charge the Power Bank inside the bag. And also the Piezoelectric chip is also used to charge the power bank in low light condition. There are 15 piezoelectric chips are used of brass ceramic chip of 20grams each and 27mm diameter .the voltage generation further maximized b step up transformer.

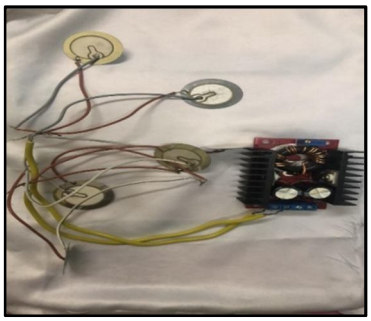

Fig. Piezoelectric chips with Step up Transformer

The piezoelectric chip is mounted on shoe soles to generate pressure force and it will convert into electrical energy by piezoelectric effect.

Fig. Piezoelectric chips on Shoe sole

Brass ceramic material is used in this piezoelectric chips they are very sensitive in response it has a microsecond response time (without load) which is even shorter than a blink in time. This type of piezoelectric chip can deliver a displacement from 0.7 to 3.6µm maximum.

B. Result

In order to determine the amount of electricity generated due to solar panels, we counted the number of solar panels required. After counting a solar panels we have to calculate the capacity of each solar panels so we found that each solar panels has a capacity of 6V 0.2 AMP so eight solar panels can generate electricity upto 1.6 ampere. Similarly piezoelectric can generate voltage which is further magnifies the voltage by step up transformer.

Diameter Of Solar Disk= 80mm

Disk Capacity= 6-V 0. 2 –AMP

Power Bank Capacity= 12000 Mah

No Of Disk = 8 UNITS

8 units of solar disk can generate upto 2 ampere. In direct sunlight it will work with 95 percent efficiency so that 1.5ampere can be generated.

And in normal sunlight it will work with 47 percent efficiency so that 0.94 ampere can be generated.

As we know, In our prototype

Number of Piezoelectric chip = 14 units

Chip capacity single unit = 2mW

And provide enough energy to charge a 40mAh button cell battery in one hour.

14 units can generate 28mW

Piezoelectric chip will take twenty one hour to full charge a 10000mAh power bank.

VI. CONCLUSION

While working on this project we got to learn about solar and different modules we used. We learned how to make a thing prioritizing human comfort. We studied those concept theoretically and then tried to implement it practically. However it is quite a challenges we have to go through lots of trial and error methods during wiring and soldering. There are wide range of equipment we could use but depending upon are design best modules we chose is the Disc type PV module and nichrome wires because of its quality and properties and because of its compatibility. So we have successfully completed the ‘Smart Trekking Bag’ as for generating electricity and provide warmth to the trekker and wide range of application. As for this project are ,the basic aim of the project was to generate electricity from solar panels and piezoelectric chips to compensate the energy because many location of trekking there is shortage of energy. This method should used to generate electricity and to reduce deaths and misplace during trekking.

VII. FUTURE SCOPE

This smart bag is a complete package which can give pain relief and protection in cold regions. In today’s world, people are adopting trekking as their hobby and passion also to come in contact with the nature. So, in future their will be more crowd who wants to go trekking and for that purpose this smart bag can be an ideal trekking bag for trekkers. As it produces power by walking on piezo chips and also from solar sheet. Another main application of this bag is, it can be used for military purpose in snowy areas because of the heating element and GPS navigation system.

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Full Name and Surname	Siddiqui Tanveer Shaban
Title	Mr.
Organisation	Theem College of Engineering
Address	Roon no.2, Mukadam chawl, Maqbool Compound, Pathanwadi Malad (East)
Postal code	400097
City	Mumbai
Country	India
Telephone	9619618592
E-mail	Tanveer78252@gmail.com
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Authors	Tanveer S Siddiqui , Aamir I Patel, Adnan A Shaikh, Yasar S Shaikh, Harshal Ahire.

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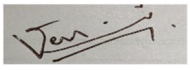

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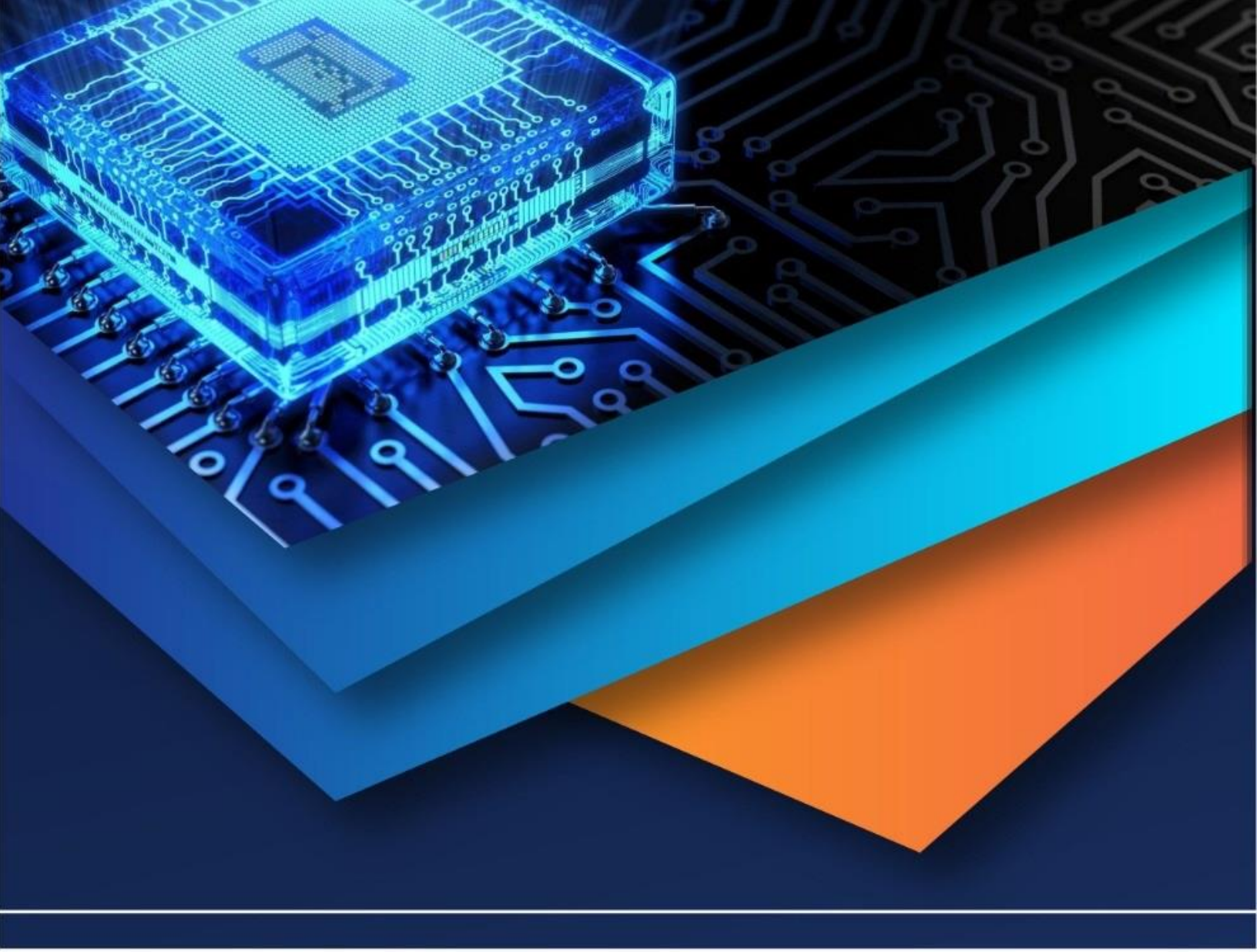

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