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Advancement in Stretcher and Wheelchair – A Review

Raveena J. Ramteke[1], Aishwarya R. Dhurwey[2], Harshit B. Borkar[3], Adarsh J. Rai[4], Ankit Malviya[5], Ajay A. Mate[6], Mohammad Aftab Sheikh[7], Vikrant. P. Katekar[8]
[1,2,3,4,5,6,7,8]*Department of Mechanical Engineering*
S. B. Jain Institute of Technology, Management and Research, Nagpur, 441501, Maharashtra, India

***Abstract:** In a present day scenario, it is a very serious issue for handlingof patients in critical as well as normal conditions. Both hospital staff and patients have to face problems like stresses which are produced in the body. Mobility aids are used to transfer the patient from one place to another. Most commonly used mobility aids are wheelchair and stretcher. But these devices also hold various problems due to the reason that they are not much modified. Understanding all these issues regarding mobility aids and introducing a better design will be a great help to medical field. This paper reviews the various areas of development about mobility aids for the comfort of both patient and hospital staff.*
Keywords-Mobility aids, stretcher, wheelchair, vibrations

I. INTRODUCTION

A. Stretcher

As we know that in almost all the hospitals, stretcher is available for transfer of patient from one place to another. It is an essential part of medical first aid system. A basic structure of stretcher (Fig 1) consists of bed, tube frames, handle for adjusting height, and brake system and castor wheels.
The different types of stretcher are:

1) Cot stretcher
2) Litter stretcher
3) Gurney Stretcher
4) Bed stretcher
5) Cart stretcher
6) Bariatric stretcher

This review paper proposes model of various types of advanced stretchers.

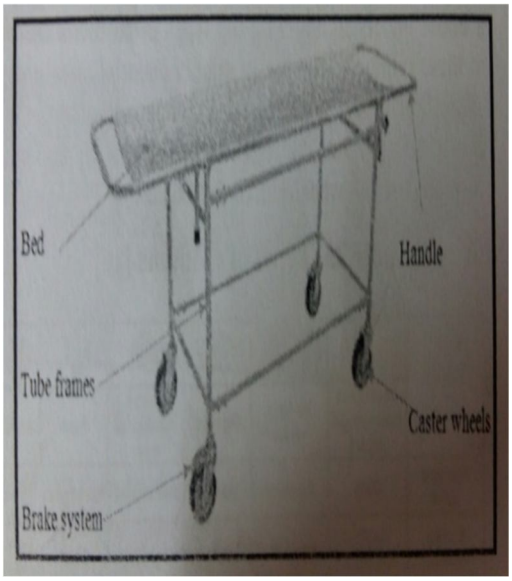

Fig. 1 Basic structure of stretcher

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B. Wheelchair

This device is mainly used for patients having physical injury or disability. The main components of wheelchair (Fig. 2) are: a seat andback rest, handle, brake system, front small castor wheels and rear large wheels.

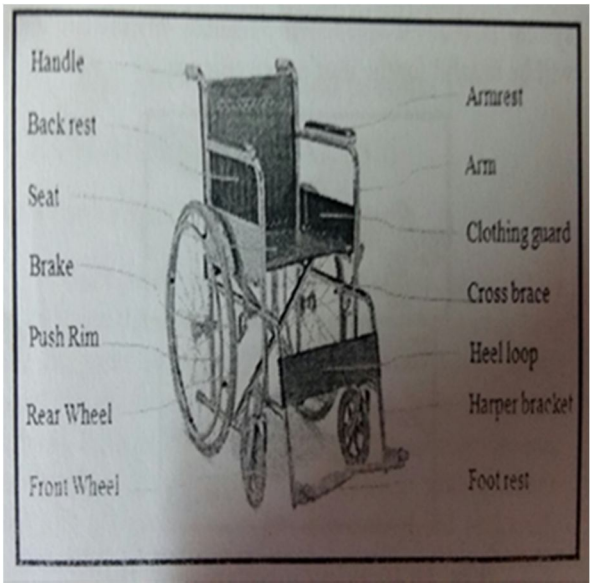

Fig. 2 Basic structure of wheelchair

II. LITERATURE REVIEW

A. S N Waghmare, N A Sawant, S D Dhumal, P G Patil, and N T Kedar [1]

These authors proposed a model of compact stretcher with shock absorbers. With the use of shock absorbers in stretcher as shown in fig.3, the vibrations generated in rough travelling are reduced. Helical spring shock absorbers are mainly used, as there is provision to the hospital staff to take stretcher anywhere. Because in case of hydraulic shock absorber, it is confined to hospital use only. Shock absorbers are used only on one side of stretcher where head of patient rests. Patients feel more comfortable on such type of stretcher rather than traditional one.

Fig. 3 Initial overview of compact stretcher with use of shock absorber

B. Lt Col Satendra Katoch [2]

Satendra Katoch introduced modern stretchers in Armed Forces for improving casualty evacuation in field with special reference to casualty evacuation in mountains.

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1) *Stretchers scan for use in mountains*

a) *Rescue Stretcher-(*Fig. 4) It weighs 4 kg and has lifting capacity of 200kg.

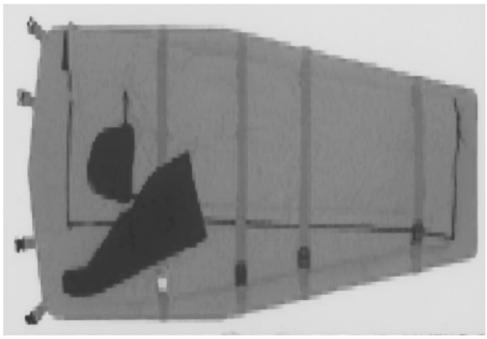

Fig. 4 Rescue Stretcher

b) I*nflatable Stretcher-This stretcher is foldable with lifting capacity of 100kg.(Fig.5)*

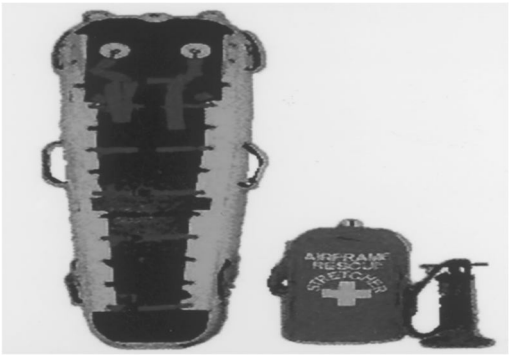

Fig.5 Inflatable Stretcher

c) *Heli-Lift Stretcher*-It is generally used at higher altitudes and it also provides maximum protection(Fig.6). It can be rolled up for carrying and has lifting capacity of 300kg.

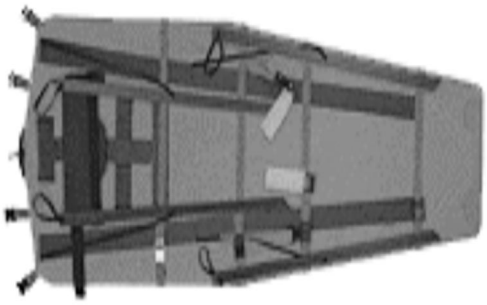

Fig. 6 Heli-Lift Stretcher

d) *Basket Stretcher*- It is more effective on snow and mainly used for spinal injuries. It is made up of fibreglass or aluminium with a lifting capacity of 268kg.(Fig.7)

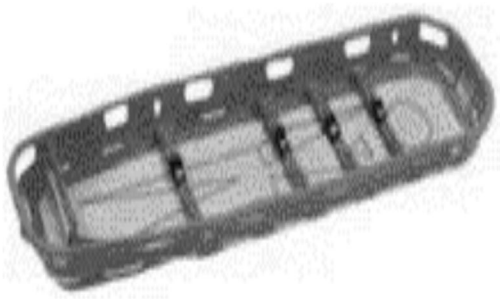

Fig. 7 Basket Stretcher

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e) *Spine Board*- It is also used for spinal injuries.(Fig. 8)

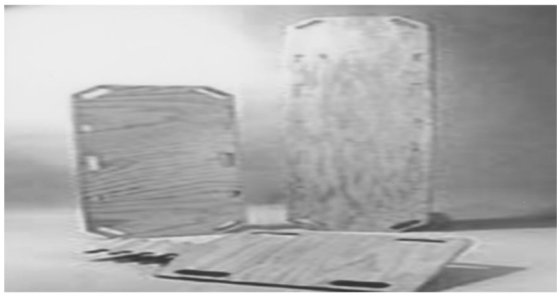

Fig. 8 Spine Board

f) *Para guard Stretcher*- It is also a foldable stretcher made up of aluminium and vinyl folding which fully encloses patient. It can be used for helicopter rescue missions and has lifting capacity of 150kg.(Fig. 9)

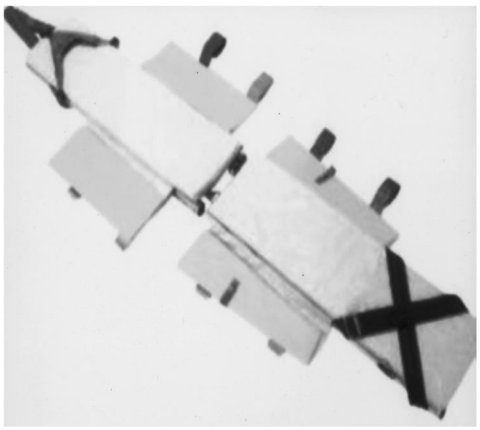

Fig. 9 Para guard Stretcher

g) *Neil Robertson Stretcher*-It is required for specificmissions and is made up of flexible protective case made of semi rigid canvas.(Fig. 10)

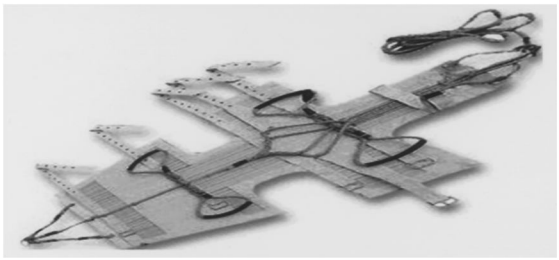

Fig. 10 Neil Robertson Stretcher

h) *Spine Aid Stretcher*- It is made up of aluminium and it is strong and light weight. It can be X-rayed.(Fig.11)

Fig. 11 Spine Aid Stretcher

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i) *Ferno-Washington Orthoscoop*- Stretcher- It is specificallyused for suspected spinal injuries and has lifting capacity of 156kg.(Fig.12)

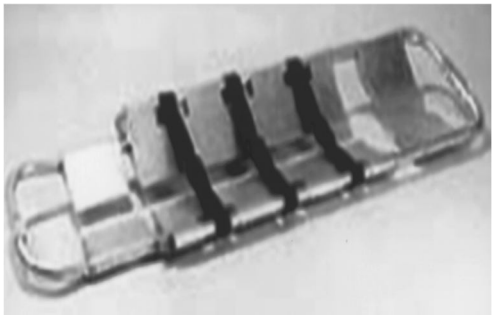

Fig. 12 Ferno-Washington Orthoscoop Stretcher

j) *Emergency / folding stretcher*- It is used in emergency situations. It is light, sturdy and has a single fold.(Fig. 13)

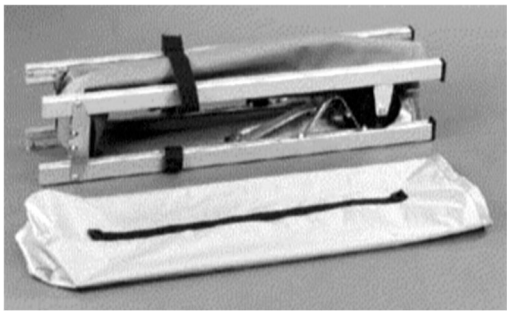

Fig. 13 Emergency / folding stretcher

k) *Stretchers scan for use in helicopters*

i) *Indigenous Stretchers*- It is cost effective and commercially viable. IT is suitable for transport of spinal injury, limb fractures and other injuries. It has lifting capacity of 100kg.(Fig. 14)

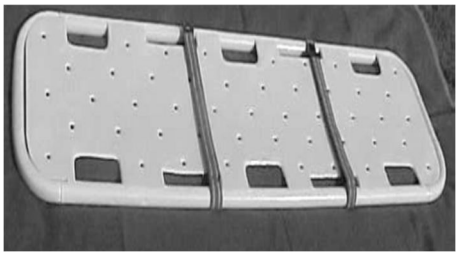

Fig. 14 Indigenous stretcher

With the advancement of technology, these modern stretchers should be used rather than conventional one for better handling of patient.

C. Padmanabhan M, Rahoof T E, Vipin Raj V M, Vivek Krishnan K [3]

Their paper shows a framework of wheelchair convertible stretcher. It eliminates shifting of patients from stretcher to wheelchair and vice-versa. They have also provided pressure support to avoid ulcer formation. It also exposes body to fresh air so that perspiration on skin evaporates better. The pneumatic cylinders are used in the framework for conversion of device from one form to another (Fig. 15). The operating principle is quite simple and also pneumatic cylinders are non-hazardous. Here the spending is reduced as it is a two in one mobility aid with good comfort for patient handling.

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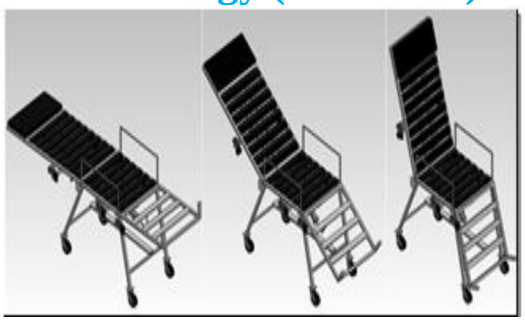

Fig. 15Stretcher-Chair conversion

D. Jyothish K Sunny, Thomas Paul, Kiran P Karunakaran, Vipul Roy, Bibin Varkey [4]

As there is a need of wheelchair cum stretcher in hospitals, these authors developed such system mainly for paralysed patients. The positions are achieved by a lead screw connected with hinge joint (Fig.16). Hydraulic jack is provided for adjusting height of chair. Waste lid is there to eliminate human waste. Brake lever stops the wheel chair movement. Thus, they manufactured wheelchair cum stretcher to eliminate the separate use of both by keeping focus on cost factor and utility (Fig. 17).

Fig. 16 Wheel chair position

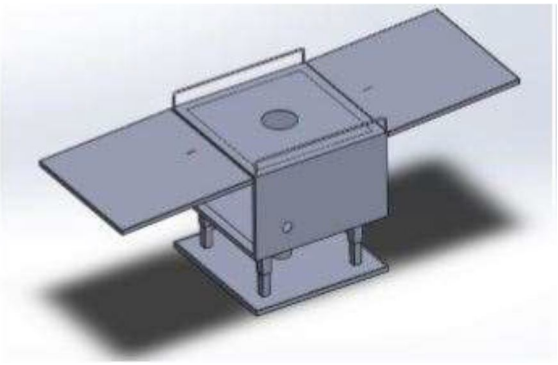

Fig. 17 Stretcher position

E. Dr.M.S. Rohokale, Bakul Shinde [5]

Dr.M.S. Rohokale and Bakul Shinde proposed a user friendly stretcher which has provisions like document holder, oxygen cylinder and rotatable handles. They used scissor mechanism in the stretcher for height adjustment (Fig. 18). Horizontal roller mechanism is also introduced in which idler rollers are used for transfer of patient from stretcher to bed. Electric driven pulley or rotatable handle can be used for operation of belt drive (Fig. 19). Manual handling of patient is thus eliminated. We have to handle patient only once i.e. to transfer from accident spot to stretcher trolley.

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Scissor Mechanismhinged at one end and Roller at the other end

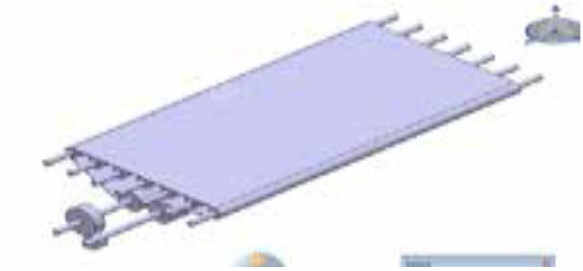

Fig. 19 Horizontal Transferring Mechanism

F. Arvind T Wadgure, Dr.R.D. Askhedkar, V.N. Mujbaile [6]

They proposed a design of modified mattresses for patient handling. A mattress is designedby using a layer of foam and aluminium square tube. It maintains straightness of mattress and do not form sagging shape. The mattresses are affordable for all type of hospitals and are effective for patient handling.

G. Talha Ahmad [7]

Talha Ahmad designed the stretcher for EMS (Emergency Medical Services). He carried out fish bone analysis and collected data for the reason of patient discomfort. It is due to manual handling, transporting vehicle problem and design of stretcher. So a modified stretcher is proposed specially for EMS which is light, strong and compact. Four supports are also provided i.e. neck support, lower back support, knees support and ankle support (Fig. 20). After development of stretcher, Effectiveness of the device is checked by trials and confirmed that patient is more comfortable in this stretcher. The pain felt by patient is reduced as compared to other proposed models.

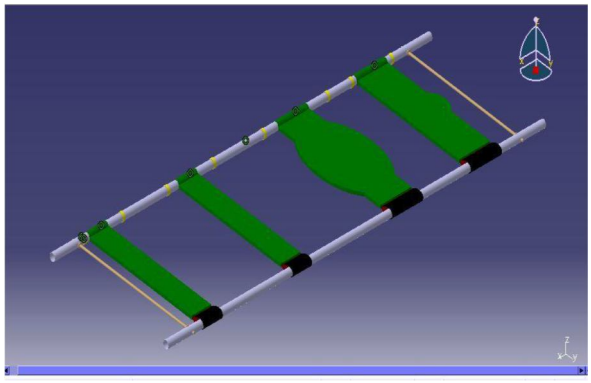

Fig. 20Final design of stretcher

H. Ninad M. Borkar, Saurabh A. Apte, Tejas Deshmukh, Sampada M. Apte [8]

Mechanically operated wheelchair convertible stretcher is developed by these investigators. They used simple mechanical linkages with seat back recliner mechanism to achieve required motion (Fig. 21). The main priorities were to reduce cost, save

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space,eliminate the steps of shifting patient and to work reliably under different operating conditions. Study showed that 50% space is saved by using this concept rather than using stretcher and wheelchair separately. The design is thus an efficient mobility aid for medical field (Fig. 22).

Fig. 21 Mechanical linkage

Fig. 22 Wheelchair convertible stretcher

III. CONCLUSION

The study carried out in the review shows the development of stretcher and wheelchair with the advancement in technology. Various modifications in these devices provided more comfort and better handling of patient. Also the hospital staffs have to face fewer problems with this advancement. Thus it has provided a helping hand to the medical field.

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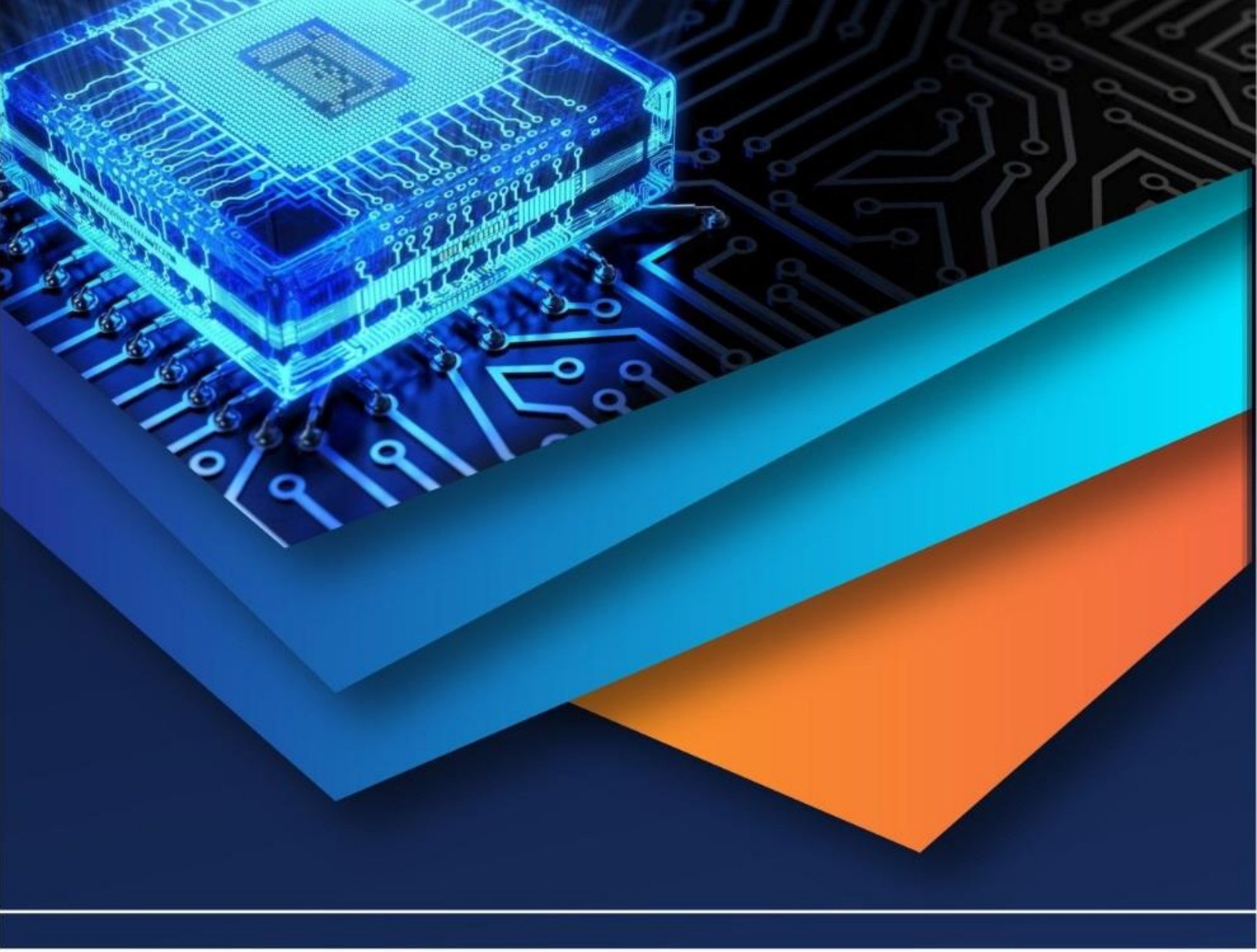

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