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A Study and Analysis of Bot Project Performance Using Time Impact Analysis

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Abstract--Inadequate or weak preparatory work before starting construction of any structure may cause serious problems during the construction period. For example, projects without sufficient detailed drawings or construction schedules and a disorganized building site can create many problems in the management and completion of the construction works. Consequently, the cost of construction increases digressively, the construction duration of the project extends and the quality of construction is affected adversely. This study dwells on the importance of construction schedules in achieving the aim of producing good quality construction work within the specified duration.

Monitoring continuously the interactive relation concerning delays in construction schedules and contractor demands is a complicated process. Here the simplest and basic approach is that, both for owner and contractor, time is money and for this reason construction schedule delays should be analyzed and corrective measures should be taken in a timely manner. The main purpose of this study is to investigate the causes of construction schedule delays and the methods of schedule delay analyses. The "Time Impact Analysis Method" (TIA) was applied to the case study project using MSP software in order to determine the construction schedule delays; to measure the impacts of these delays on the project completion duration; and to allocate responsibility amongst the project participants for preventing delay claims.

I. INTRODUCTION

A. General

Planning and control of resources within the framework of a project is the main target of construction management. Construction management procedures guide managers about how the resources can be best used during construction process and aims for the timely and efficient application of the resources in construction projects. Many issues shall be carefully thought in order to conduct a project successful. Construction site activities are only the second part of the whole construction process. The first part is comprised of all kinds of office work. The planning, designing, estimating, negotiating, purchasing, scheduling, controlling, accounting, etc. shall be done carefully in the office before the work starts on the site to accomplish the objective of a quality project within budget and on schedule. Construction delays are widespread in most projects around the world. Some delays may happen in the preconstruction phase which is defined as the period beginning from the initial conception of the project to the signing of the contract between the owner and the contractor; however some of them may happen in the construction phase that is the period when actual construction is under way. Project schedules are consistently dynamic and uncertain. Several controllable and uncontrollable factors can adversely affect the project schedule and cause delays.

B. Objective

The objectives of the work done with Study Analysis of Road Project Performance Using Tia (Time Impact Analysis) were.
To study and understand project scheduling.
To determine the major types & causes of construction delays.
To study the types of schedule delay analysis techniques.

C. Scope

The scope of the work done with Study Analysis of Road Project Performance Using Tia (Time Impact Analysis) was.
The focus of the work is to do a detailed study about the performance of project and analyzing it by using the management software tool MSP.
The study is to monitor the project performance by analyzing the delays and to give suggestions for improving productivity.

II. LITERATURE REVIEW

A. General

The main purpose of literature review is to give an idea about the work conducted world over in the field of study. In this brief review of literature about the delay and model is repotted and discussed. Literature regarding other delay measure is also reported.

B. Literature

Aibinu A.A et al (2002) describes the construction delay has become endemic in Nigeria. It is imperative to create awareness of the extent to which delays can adversely affect project delivery. Delay had significant effect on completion cost and time of 61 building projects studied. Client-related delay is significant in Nigeria. Acceleration of site activities coupled with improved clients' project management procedure and inclusion appropriate contingency allowance in pre contract estimate should assuage the adverse effect of construction delays.

Takim, Akintoye et al (2003) describes that in the manufacturing and construction industries, performance measurement is used as a systematic way of judging project performance by evaluating the inputs, outputs and the final project outcomes. Previous studies have revealed that performance measurements can be measured in terms of financial and non-financial measures, or the combination of both. When measurements are being implemented, contractors, consultants and the management team's performances are blamed as the major reasons for the failure of a particular project. Based on this review and synthesis, the paper proposes the use of an 'amalgamated- model' of measurement project phases as a framework for measuring construction project performance.

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III. METHODOLOGY

A. Flow Chart of Methodology

The flowchart of the methodology adapted for studying in the time impact analysis show in the figure 3.1 below.

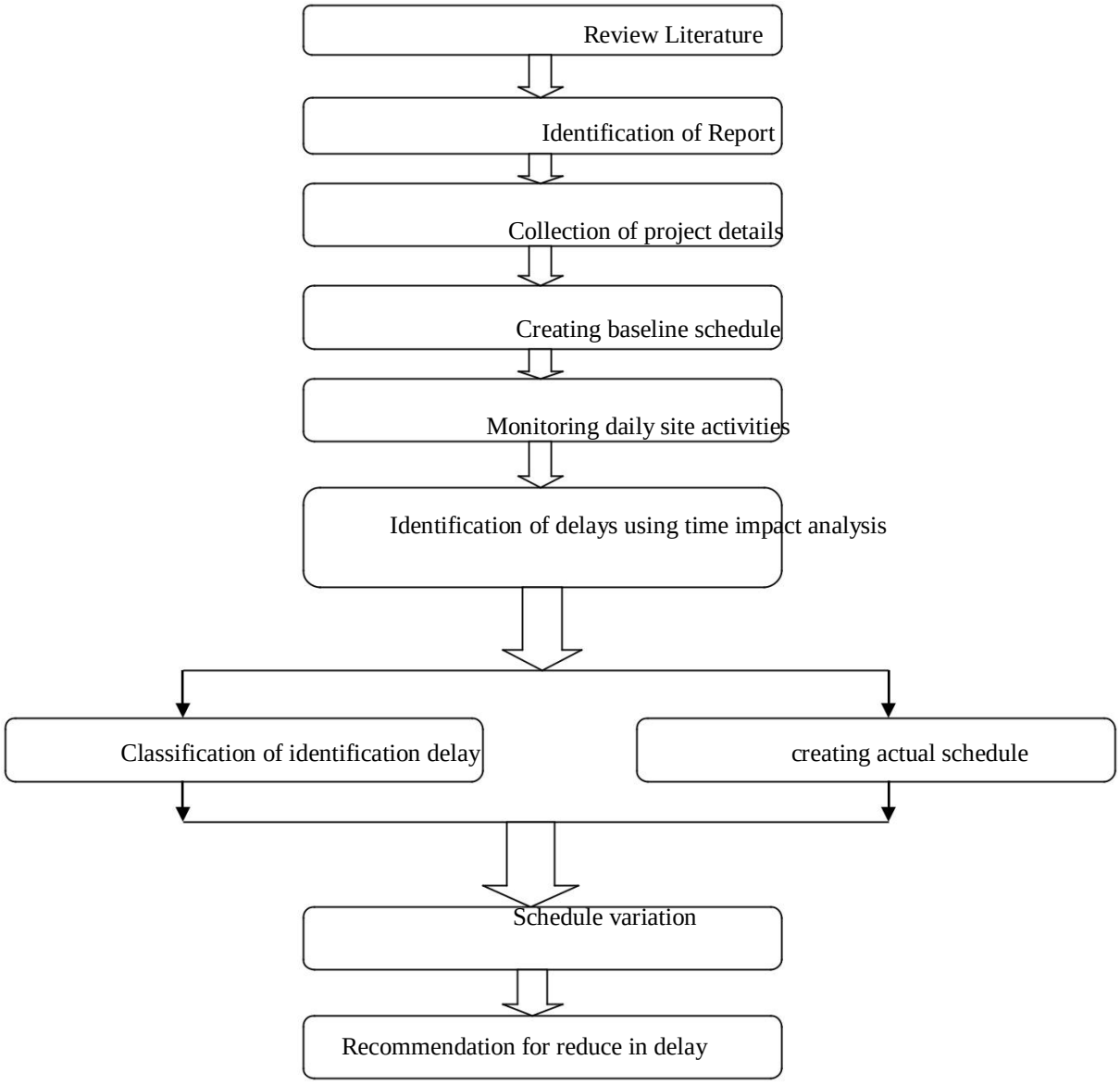

Fig 3.1 Flow chart of the methodology

B. Steps Involved

The above said methodology is for developing a delay analysis model in Construction companies. The detailed methodology can be explained as follows:

1) Identification Project: Identification project is any process of preparing and collecting data, for example, as part of a process improvement or similar project. The purpose of material collection is to obtain information to keep on record, to make decisions about important issues, or to pass information on to others.

2) Collection Of Project Details: The project details are collected from the company. The date for the execution of each process is also collected from the company. The data may be collected using a questionnaire or with the brainstorming.

3) Creating Baseline Schedule: Planning is a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks.

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The scheduling work takes place in four phases.
Planning
Scheduling
Monitoring
Controlling
The schedules can be done in weekly basis. A good scheduling requires ongoing preparation as activities draw closer to execution.

IV. TYPES OF CONSTRUCTION DELAYS & DELAY ANALYSIS TECHNIQUES

A. Types of Construction Delays
There are three types of construction delays.

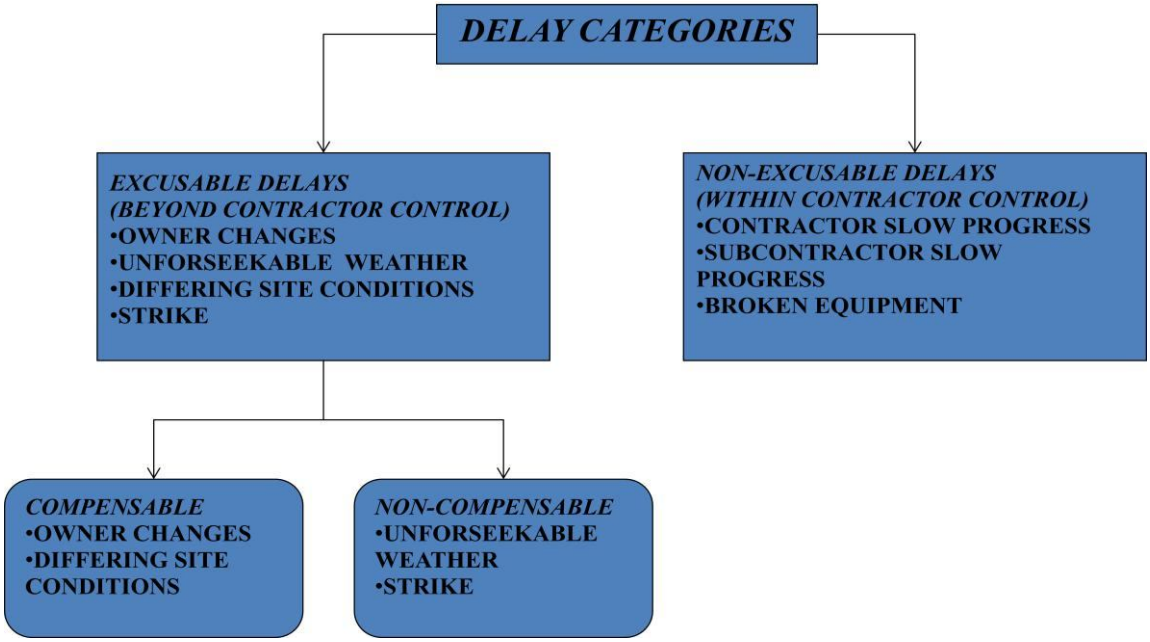

Fig 4.1: Delay categories

1) Excusable Delays: Excusable delays are those not attributable to the contractor's actions or inactions, and typically include unforeseen events. These events are beyond the contractor's control and are without fault or negligence on his/her part. Excusable delays, when founded, entitle the contractor to a time extension if the completion date is affected. This type of delay can also have an impact on non-critical activities which need a more detailed analysis to determine whether additional time extension is warranted, or if the reduction of float time can be justified. Excusable delays can be further classified into excusable with compensation and excusable without compensation.
2) Non-Excusable Delays: Non-excusable delays are delays which result from the contractors' or subcontractors' actions or inactions. These delays might be the results of underestimates of productivity, improper project planning and scheduling, poor site management and supervision, wrong construction methods, equipment breakdowns, unreliable subcontractors or suppliers. Consequently, this type of delay presents no entitlement to a time extension or delay damages for the contractor if the delay can be proved to have affected the whole project. The client, however, could be entitled to liquidate damages. An example of a non Excusable delay would be when a contractor fails to provide sufficient manpower to complete the job on time.
3) Concurrent Delays: Concurrent delays refer to delay situations when two or more delays occur at the same time or overlap to some degree either of which, had the delays occurred alone, would have affected the ultimate completion date. Normally concurrent delays which involve any two or more excusable delays result in a time extension. When excusable with compensation and non-excusable delays are concurrent, a time extension can be issued or the delay can be apportioned between the owner and the contractor.

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B. Schedule Delay Factors

The factors that affect the scheduling process are being listed below.
Consultant Related Delay Factors (CRF1)
Contractor Related Delay Factors (CRF2)
Design Related Delay Factors(DRF)
Equipment Related Delay Factors(EF1)
External Related Delay Factors(EF2)
Labor Related Delay Factors(LRF)
Material Related Delay Factors(MRF)
Owner Related Delay Factors(ORF)
Project Related Delay Factors(PRF)

V. PROJECT DETAILS

A. Site Details

The site detail of the roadway project is listed below.

- Name of The Project : NAM Expressway Ltd (Narketpally – Addanki Medarametla)
- Client : Andhra Pradesh Road Development Corporation
- EPC Contractor : Ramky Infrastructures Ltd
- Construction Period : 30 Months
- Concession Period : 24 Years
- Total Length of Project Road : 212 Kms
- Type of Project : BOT(Build Operate Transfer)
- Type of Up gradation Lanes : Strengthening & Widening To 4 In Service Lanes In Urban & Semi Urban Sections.
- Estimated Project Cost : Rs. 1196.84 Crores

B. Technical Data

The technical data details of the roadway project are listed below

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- Start Chain age : Km 0+000
- End Chain age : Km 212+500
- Total Length of Project Road : 212.500 Km

Type of up gradation : Strengthening & Widening of 2 lanes to 4 Lanes

- Pavement overlay Composition (over Existing Road)

  (a) Dense Bituminous Macadam (DBM) = 50 - 75 mm

  (b) Bituminous Concrete (BC) = 40 mm

- Pavement Composition (New Construction)

  (a) Sub grade (with 10% CBR) = 500 mm

  (b) Granular Sub Base (GSB) = 200 mm

  (c) Wet Mix Macadam (WMM) = 250 mm

VI. DATA COLLECTION

A. Daily Progress Report

The Summary of hourly- and daily-conditions and events at a worksite on every workday, prepared for the offsite project administrators. An essential document in construction projects, it records the number of workers/employees and work equipment at the construction site, exact time the work began and ended, job progress, weather, accidents (if any), etc. On no-work days it reports "No Work Today," and serves as an evidence in case of disputes.

B. MS Project Schedule

In the world of project management, project schedules can be characterized by their level of sophistication, by their intended usage, or by the nature of their content:

In terms of sophistication, project schedules range from the simplest (activity listing, timetable), to the more comprehensive (bar charts which converge action with time), to the most complex (network-based schedules, such as CPM, where activities are causally linked).

Project schedules can also be characterized by their intended uses. Early-phase schedules (more commonly called *plans*) can be helpful in forging a project execution strategy. Examples of strategic plans include feasibility plans, optimization plan, and consensus plans. Project schedules enjoy their greatest use as tools of communication, coordination, and collaboration. In all cases,

project schedules (including precursor plans) are tools of the project manager, intended to optimize their efforts to effectively manage the project.

The third categorization of project schedules relates to content of the presentation of the schedule. This content is conveyed using adjectives placed before the word "schedule". Examples are "bar chart schedule", "milestone schedule", "submittal schedules", "design schedules", "outage schedules"

C. Anticipated Financial Progress As Per Boq In Percentage

Anticipated financial progress is the expected financial run of a project/entity in a period of time. It is a predicted value which may vary depending on certain uncalculated risks. A project is feasible and profitable only if it's anticipated financial progress percentage is in positive numbers. It is not advisable to continue the project if its anticipated financial progress is very low or in negative numbers.

D. Daily Activity Report

The Summary submitted by each responsible persons in site to provide certain details to the management about project activities and performance over a given period .It records the number of workers/employees and work equipment at the construction site, exact time the work began and ended, job progress, accidents (if any), etc.

VII. ANALYSIS AND RESULTS

Impacts of construction schedule delays on the duration of the case study project were analyzed by the help of Time Impact Analysis method. The results of application of the selected method and the discussions are given in this section under respective headings, presented with tables.

A. Determination of Delays

In application of the TIA method, the accuracy of records which were used in the delay analysis was very important. To provide reliability of schedule delay analysis, inaccurate and unreliable records should not be used during the analysis process. Project changes, changing site conditions, official correspondences between project participants, time extension requests of the contractor were approved under the control of parties. Therefore, these records did not require any reliability control. In this study, only approved records were collected and analyzed, such as the Daily Project Report, MSP Schedule, etc., After these steps, it was noticed that there had been many problems during the whole construction process inevitably resulting in delays in the as-planned schedule. The results of this delay analysis are presented in the following sections

1) Delay In Lcc In Bituminous Works: In this project, the LCC in bituminous works which is affected due to paver fault resulting in the delay in the activity. According to the schedule the activity should have been finished on 25.11.12 and this activity was finished in 02.01.13 resulting in delay of 37 days.

2) Delay In Laying Of Pipes: The laying of NP 4 pipes is due to rain. The dewatering process took some time so the pipe laying process difficult and it has been delayed from 10.12.12 to 08.01.13 Resulting in delay of 28 days.

B. Summary Of Allocation of Liability To Parties And Delay Types

S. NO	DELAYED ACTIVITY	CAUSES OF DELAY	TYPE OF DELAY FACTORS	LIABLE PARTY	DELAY ID CODE	TYPE OF DELAY	ACTION TO BE TAKEN
1	LCC in bituminous works	Equipment failure	Delay due to equipment	contractor	EF2	Non excusable Non compensate	Periodic maintenance of equipment's

						bled	
2	Pipes of pipes in culverts	unforbled weather conditions(rain)	Unanticipated events	External factor	EF1	Excusable Non Compensable	Cannot be avoided, shall be adjusted in the Schedule
3	Back filling	unforeseeable weather conditions(rain)	Unanticipated events	External factor	EF1	Excusable Non Compensable	Cannot be avoided, shall be adjusted in the schedule
4	Reinforced/ pre stressed cement concrete in super structure	Delay in approval of drawings	Delay due to consultant	Consultant	CF2	Excusable Compensable	Design shall be finalized & checked before starting the project.
5	Constructing crash	Poor Workmans	Delay due to	Contractor	CF1	Non excusable Non	Well trained labors shall be recruited

	barrier	hip	contractor			compensable	
6	Making reinforcement	procurement of materials	Delay due to consultant	Consultant	CF2	Excusable Compensable	Materials shall be procured on time
7	Stone pitching	unforeseeable weather conditions(rain)	Unanticipated events	External factor	EF1	Excusable Non Compensable	Cannot be avoided, shall be adjusted in the schedule
8	Constructing bed flooring	Poor Workmanship	Delay due to contractor	Contractor	CF1	Non excusable Non-compensable	Well trained labors shall be recruited
9	Laying RCC for box / slab culverts in superstructure M25 Grade	Poor Workmanship	Delay due to contractor	Contractor	CF1	Non excusable Non-compensable	Well trained labors shall be recruited
10	Providing and fixing bearings	procurement of materials	Delay due to consultant	Consultant	CF2	Excusable Compensable	Materials shall be procured on time

VIII. CONCLUSION

The major problems for contractors and owners, can be caused by Construction schedule delays, which results in costly disputes, controversial issues and adverse relationships between all the project participants. It point out, the most important causes of delays are shortage of resources, financial difficulties and organizational deficiencies of the company, delays in design work, large quantities, of extra work and frequent change orders. Here in this project the baseline schedule is taken into account and from that delays are rectified. The scheduling is updated by using the Daily Progress report & Daily Activity reports and the baseline schedule is compared with the ongoing schedule and the results are found.

In the case of the project the following delay events can be listed as follows

Delay in laying of LCC in bituminous works

Delay in laying of pipes of pipes in culverts

Delay in back filling

Delay in Reinforced/pre stressed cement concrete in super structure

Delay in constructing crash barrier

Delay in Providing and fixing bearings

Delay in painting in sub structures.

The reason for selecting the Time Impact Analysis (TIA) method was that it can display the progress of construction works step by step with the help of MSP® software.

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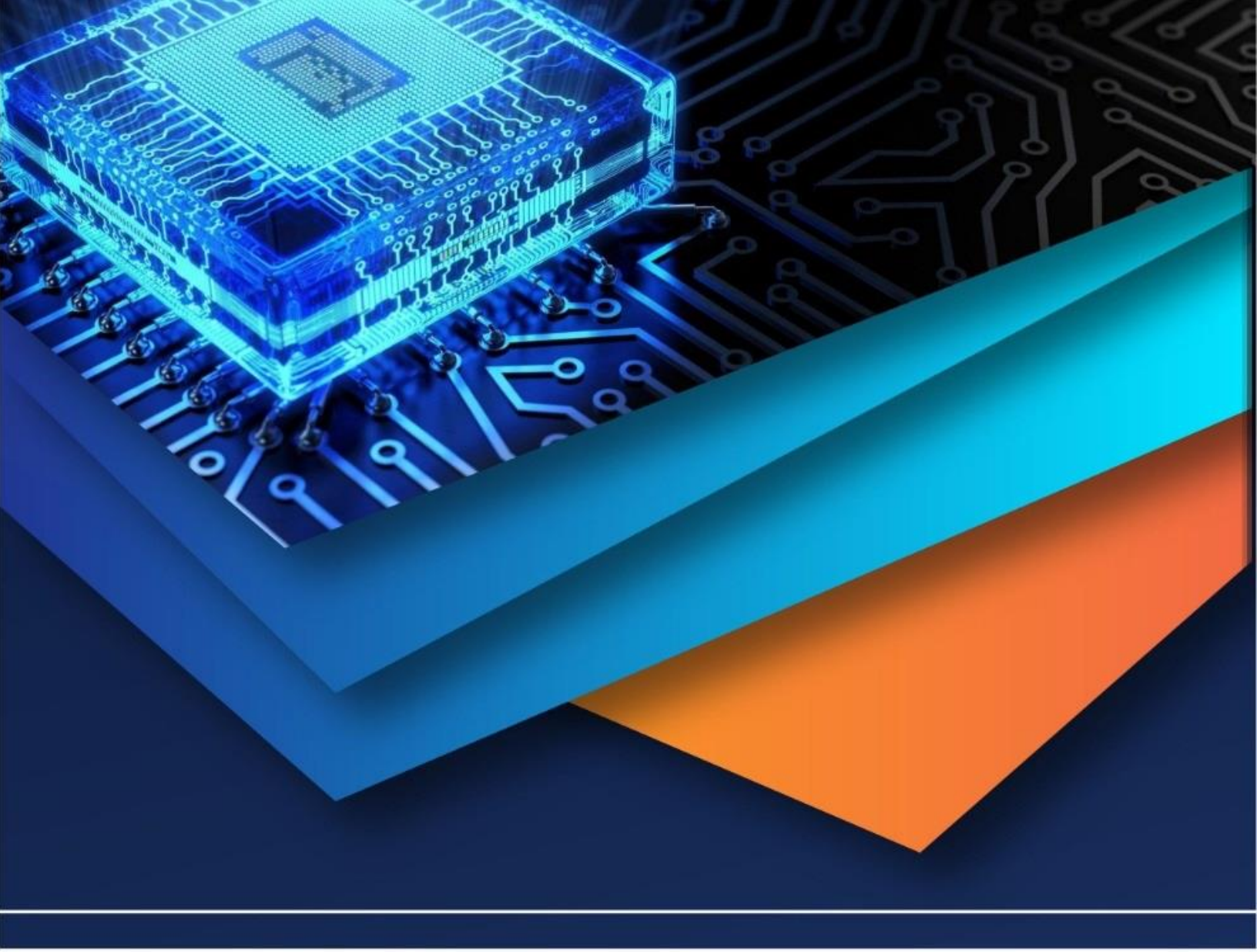

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