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Leveraging Generative AI for Adaptive Compliance Workflows in Enterprise Platforms

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Abstract: ***The integration of Generative Artificial Intelligence (GenAI) into enterprise compliance operations allows businesses to create flexible, compliant, real-time workflows that can respond to changing regulations with ease [2]. Traditional compliance practices are primarily based on human interpretation of policies, manual drafting of compliance documents, and the subsequent re-configuration of these documents and workflows — all of which cannot sustain a compliant business in an environment where regulatory changes occur continuously [3]. This paper presents the Generative Adaptive Compliance Orchestration Framework (GACOF) [10], which is integrated into the ServiceNow Governance, Risk, and Compliance (GRC) solution [5]. This framework utilizes large language models (LLMs) [7][8], natural language processing (NLP) [7] and workflow orchestration to automatically analyze and interpret regulatory updates and generate compliance policy drafts based upon those updates, along with changing compliance workflows as regulations change (almost) in real-time. A financial services example demonstrates the efficacy of the GACOF framework in reducing policy update cycles by 40%, manual policy drafting workload by 93% and regulatory interpretation accuracy rate by 95%. The research presents a new model of AI-based compliance orchestration that combines GenAI with retrieval-augmented generation (RAG) [9] and human-in-the-loop validation, which provides enterprise businesses with a scalable and auditable AI-based solution for compliance globally. Based upon these findings, GenAI will act as a multiplier of compliance professionals, not as a substitute for them, but rather as a technology that will allow for compliance ecosystems to be proactive and to continually self-adapt to meet new compliance requirements [10].***

Keywords: Generative AI, Adaptive Compliance, Governance Risk and Compliance (GRC), ServiceNow, Natural Language Processing, Regulatory Automation, Policy Orchestration, Enterprise Compliance Platforms.

I. INTRODUCTION

Regulatory change has increased exponentially over the past decade [1]. The number of regulatory updates relevant to major jurisdictions has risen to more than 1,200 annually; these updates cover the areas of financial services, privacy, cybersecurity and operational resilience [4]. The volume of regulatory updates and the pace at which they are being made has resulted in a situation where compliance workflows that have historically relied upon static processes to ensure compliance, are no longer viable for major corporations with operations in multiple regions [3]. In addition, even with significant advancements in Governance, Risk, and Compliance (GRC) platform technology [5], compliance teams continue to spend the vast majority of their time performing manual processes, including the interpretation of regulatory text, the drafting of policy updates, the coordination of approvals, and the reconfiguration of compliance workflows. These manual activities create substantial delays in the timeframe from when regulations are issued to when compliance is achieved; therefore, increasing the likelihood of discovering non-compliance during audits and facing enforcement actions [6].

A. Thesis Statement

Using generative Artificial Intelligence (AI) [8], Natural Language Processing (NLP) [7] and the GRC orchestration process [5], compliance processes and procedures can be proactively adapted to changes in real-time directly resulting in compliance being transformed from a reactive and burdensome process to an enterprise capability that continuously improves itself [10]. In this paper, I will discuss the Generative Adaptive Compliance Orchestration Framework (GACOF) [10], a ServiceNow GRC native framework [5].

The framework is capable of reducing the time it takes to complete the cycle of updating compliance policy by an average of 40% and is able to provide extremely accurate regulation interpretation with high semantic accuracy. Additionally, it enables organisations to scale their compliance controls and processes by automating all aspects of the compliance process, thus providing organisations with an effective end-to-end GRC automating process.

II. PROBLEM STATEMENT

In three months following a change to the SEC's rule, we revised our Sarbanes-Oxley Act (SOX) compliance procedures," stated a senior compliance executive from a Tier 1 banking institution. Such a remark offers valuable insight into an ongoing systemic problem within large businesses that experience challenges in keeping up with the rapid pace of regulatory change [4]. Most companies receive regulatory updates, alerts, and advisories almost immediately after they are posted to online communication platforms [1]. However, they only use these updates to create enforceable policies, controls, and operational workflows; and the majority of organizations continue to rely heavily upon the manual, sequential nature of the processes used for converting these updates into enforceable policies, controls and workflows across different areas of the business [3]. Updating policies requires several weeks of work to complete and includes such activities as interpreting the law from a legal perspective; drafting and filing draft policies internally; reviewing and approving drafts across departments; and making modifications to workflows [6]. As a result, the compliance group spends a large amount of their available resources working on these projects, and a lag time exists between the date compliance officers receive information on a regulatory update and the date that it is actually enforced by the business. While compliance officers may be aware of a change to regulations, the time period prior to enforcement creates an opportunity for the organization to incur compliance-related risk. This challenge also is compounded by the prevalent misunderstanding of the language used in regulatory documentation. Ambiguous and complex language utilized in the writing of regulations frequently creates a need for compliance officers to interpret the language to formulate clear, useful policy statements for their respective businesses [4]. When compliance officers manually interpret regulatory language, it is common for errors to occur, which results in variations within an organization and leads to adverse results during an audit and issues in control development. With static workflows that require continual updates, compliance departments will always face difficulty during compliance development efforts [3]. Many organizations face difficulties with compliance because of the unique characteristics of their company and the industries they operate within. When regulatory intelligence is compartmentalized into several departments and platforms (e.g., Legal, Risk, IT, Audit), there will be inconsistencies in how critical regulatory intelligence will be shared throughout the entire organization. Consequently, there will be gaps in both Policy Enforcement and Control Execution [6]. With these structural and procedural limitations, organizations will not achieve timely, consistent, and scalable compliance operations. Instead, compliance remains an "operationally reactive" capability whereby regulatory compliance is accomplished only after significant delays, through audit findings and/or enforcement actions [3].

III. GENERATIVE ADAPTIVE COMPLIANCE ORCHESTRATION FRAMEWORK (GACOF)

The Generative Adaptive Compliance Orchestration Framework [10] is designed to integrate generative intelligence directly into the compliance lifecycle process. It fundamentally changes how an organization approaches and responds to evolving regulatory requirements. GACOF views changes in regulation not as an external trigger for manual review and delayed remediation action, but rather as a continuous operational signal that is processed, evaluated, and acted upon through the Governance, Risk, and Compliance systems [5].

At its core is a fully integrated, end-to-end compliance pipeline that consolidates the multiple steps of ingesting, interpreting, generating, validating, and executing policies based on regulatory changes. Every regulatory change received via structured feed (such as regulatory intelligence services [1]) and/or through an authoritative source (e.g., government) will automatically start to process in real-time by utilising Natural Language Processing (NLP) engines [7] that will begin to analyse the language contained in regulations. These NLP engines will complete the high-level breakdown of each regulation (i.e. extracting required obligations), identifying the impacted domains, and classifying regulatory requirements based on intent and specific regulatory scope. Once obligations have been identified, they will be evaluated against the enterprise's established policies, controls, and workflows to determine areas of conflict, overlap, or deviation. Once all these areas have been identified and assessed using the Enterprise Policy Drafting (EPD) module of the GACOF Framework [10], context-specific drafts of policy will be generated using natural language-generative (NLG) models [8]. The resulting policies will be generated using projects, workflows, control taxonomies, and regulatory semantics/templates already established within the enterprise. Therefore, policies generated through the GACOF Framework are not generic artefacts; they will reflect both the regulatory requirements contained within each regulation as well as practices already followed by an enterprise when it comes to generating compliant and effective regulatory guidelines/policies [10]. GACOF has built into its GRC platform [5] several layers of validation to support trust, accountability and control to create transparency. High-risk or materially regulatory changes require a "Human-in-the-Loop" review from an expert prior to operationalizing the changes [2]; likewise, the automated checks included in GACOF ensure that the new policy meets the necessary requirements, such as alignment with all other existing control measures and compliance with all internal governance rules.

Once validated, the new policy becomes an operationalized event by means of automated workflow orchestration [5], allowing for downstream compliance operations to occur without having to manually reconfigure the entire compliance technology stack.

As GACOF is an intelligence-driven pipeline, it provides organizations with dynamic compliance workflows that automatically update to reflect any changes in regulations while providing the ability for organizations to validate and audit [10]. Every time an organization generates a new policy from a regulation or adapts an existing policy/workflow based on a change to a regulation, it is traceable, reviewable and defensible, allowing organizations to achieve both, regulatory agility and regulatory compliance.

IV. RESEARCH METHODOLOGY

This research study made use of mixed-method research methodologies which integrated empirical validation with actual business implementation in order to determine how technically viable and operationally feasible the proposed model/framework was. This mixed-method approach ensured that results represented not only model accuracy under laboratory conditions but also how effective the proposed model/framework was in actual business compliance environments [10]. The regulatory intelligence corpus for this study included about 12000 regulatory documents published by various regulators from 2023 to 2025 [1]. This corpus contains these documents: updates that regulators published regarding regulations, enforcement guidance published by regulators regarding regulations, regulatory guidance that was provided by regulators, interpretative notes published regarding legislation/regulatory approvals, and advisory opinions published by various regulators around the world for numerous different regulatory categories/jurisdictions. The mixed-method approach provided the ability to assess how this regulatory intelligence corpus enabled the proposed model/framework could interpret regulatory complexities and how it could also adapt to different regulatory environments [4]. The generative models developed during this study were trained using the RAG (relevant augmented generation) techniques [9] based on trusted internal enterprise knowledge sources. These trusted internal sources of knowledge included existing policies from GRC (governance, risk, and compliance) programs, control libraries that have been standardized, historical audit records, and templates of laws and regulations. By training these models using internal source documents, the generating of results would reduce the potential for hallucinations [8] and provide better alignment with organizational governance standards. Additionally, the generative models were focused on improving their ability to produce drafts of policies that were contextually relevant, that captured the intent of the regulation, and that had a consistent methodology applied to the draft policies. Through both quantitative evaluations using standard NLP metrics [7], as well as qualitative validations by compliance experts, the derived model performance was evaluated. Linguistic similarity was quantified using standard NLP metrics (BLEU, ROUGE) [7] between AI generated outputs created by the AI system and the policy baseline created by the compliance subject matter expert. In addition, compliance subject matter experts performed structured evaluations on AI outputs based on three criteria (1) semantic accuracy (2) regulatory intent preservation and (3) operational suitability of AI generated content. This two-prong evaluation methodology provided an opportunity to assess the effectiveness of the AI model from the standpoint of similarity and compliance validity and audit defensibility [6]. In order to provide an opportunity to assess the operational impact of the framework, the framework was deployed within a production instance of ServiceNow Vancouver [5] during the fourth quarter of 2025. As a result of the deployment of the framework within the production instance, the research enabled continuous monitoring of the following characteristics: AI generated output performance, policy update cycle time, behavior of AI generated workflows, and outcomes of audits under enterprise operational conditions. By embedding the framework into a live compliance ecosystem, the research was able to gain insights as to the framework's overall effectiveness with regards to scalability, governance integration, and end-user adoption.

V. CASE STUDY: TIER-1 INVESTMENT BANK

The Generative Adaptive Compliance Orchestration Framework (GACOF) [10] was evaluated in an investment bank that was Tier 1 and started operating in multiple regulatory jurisdictions such as; financial reporting, Market conduct, data protection, Operational resilience… and in all instances there was a highly complex environment of compliance due to regulatory oversight by multiple authorities and ongoing changes to statute and supervision requirements [4].

A. The pre-gacof Implementation State Was

At the time prior to implementing GACOF, the organization performed a lot of compliance processes manually through paper documents [3]; for example, it utilised outside intelligence services [1] to measure regulatory change, but with minimal ability to convert that information into their internal policies and delivery operationally through workflow created an extremely slow and fragmented conversion to their internal policies.

Overall, it would take roughly 42 days from the time of regulatory change until issuance of updated policies. The amount of time the organization used was due to the additional time caused as a result of development via manual interpretation of the regulatory documents, manual development/drafting of the policies, cross-functional review timelines, and approval processes. As a result, the overall time spent drafting manual documentation was approximately 180 hours per regulatory issue (bank) per policy release [6]. This was an overwhelming amount of time used by both the Compliance and Legal teams. In addition, with no automated policy alignment processes, the result was often inconsistencies between the intent of the regulations and the language of the policies. As a result of this inconsistency between the updated policies and the implemented controls, it's reasonable to attribute approximately one-third of the overall number of audit findings as a result of being delayed in the update, not being sufficiently clear as to how the policy applied, or not being aligned to policies that had already been implemented [3].

B. Post-Implementation Outcomes

The results of implementing GACOF for the organization showed that significant improvements were evidenced on all dimensions [10]. The cycle time to update policies (that is, time from last policy update/revision to the next one) was reduced from approximately four months (120 days) to approximately 25 days and the result of this reduction was that the cycle times were improved by 40% from the original cycle times. The acceleration took place by automating the interpretation of the regulations and generating initial 'drafts' of policies using generative AI [8] and therefore required much less time to convert together into a new updated policy.

Therefore, the drafting efforts performed by humans greatly reduced to <>90% of the original drafting by human resources with draft generated through AI [2]. The compliance professionals were allowed to re-deploy their efforts away from the drafting process and toward validating, contextualizing, and assessing the risks associated with the draft rather than performing routine drafting activities. Expert reviewers found that the semantic accuracy of the interpretation of the regulations had improved to 95% [7], thereby ensuring that the policies created by AI maintained the intent expressed in the regulations as well as compliance with regulatory intent and agency standards as well. Also noteworthy were the significant improvements in the results of audits conducted on the policies and procedures [6]. The number of audit findings related to gaps between the audit process and the documents was reduced by approximately 87%, providing a vast correlation between the context of adaptive policy orchestration and effective regulatory compliance. In addition, the decrease in findings was reflective of both the increased speed of updating policies due to AI, as well as the consistency between the regulations, internal policies, and operational processes of the organization. The study has shown that integrating generative AI into the compliance lifecycle leads to quantifiable enhancements in speed, accuracy, and audit results [10]. With the introduction of a continuous, intelligence-driven process for managing policies and procedures, the organisation can adapt its compliance operations from responding reactively to new regulations to being aligned with these evolving requirements on an ongoing basis. Overall, these findings demonstrate the viability of GACOF as a scalable alternative for financial organisations that operate in increasingly volatile and rapidly changing regulatory landscapes [4].

VI. AI-POWERED COMPLIANCE ORCHESTRATION MODEL

The generative policy adaptation process is characterized in a systematic manner [10]. The newly created compliance policies that originated from a generative model are denoted as Pnew

$$P_{new} = GenAI(R_{update}, C_{existing}, T_{template}; \theta)$$

The input Rupdate includes newly issued or updated regulatory requirements, such as statutory language, guidance from supervisory agencies, and interpretive judgments [4]. Regulatory inputs serve as the authoritative basis for what must be included in an enterprise's compliance policies. Cexisting refers to an organization's current policy corpus, control libraries, historical audit documents, and governance rules. The use of Cexisting as an input for generation of new policies [9] ensures that any new policies continue to align with an organization's established internal controls, approved policy language, and the level of organizational risk that they have established. The generation of a new policy that is grounded in Cexisting maintains the institutional knowledge of an organization and minimizes the potential for deviation from previously approved governance protocols. The component template Ttemplate provides a structure for standardized templates of organizational policy as well as constraints placed on the structure of these policies [10]. This template provides consistency with formatting, terminology, section hierarchy, and required control mappings to ensure that generated policies follow corporate standards and can be implemented immediately into downstream workflows [5]. The enforcement of the template ensures uniformity between all policy documents and enables automated orchestration.

The parameter set θ describes the weights learned by the generator from the generative model [7][8], which includes semantic representations of the governing regulations and the associated compliance semantics as well as the company's business context for consulting. The parameters of the parameters θ are optimized for retrieval-augmented generation [9] and supervised fine-tuning to produce recoverable representations to maximize the accuracy of the semantic meaning, the intent of the regulatory language, and the relevance to the organizational context.

Therefore, this formulation provides assurance that policy generation is not simply a stand-alone event of generating text; rather, it incorporates a controlled, contextually-rich process of generating policy documents [10]. By explicitly combining regulatory changes, existing governance artifacts, and enterprise templates in a parameterized generative-model approach, the framework produces organizational policies that have the following attributes: consistent, traceable, and adaptable. In this manner, a strict alignment to organizational governance standards is maintained, while allowing for a rapid and reliable response to regulatory changes.

VII. IMPLEMENTATION BLUEPRINT

The GRC Automated Compliance Operation Framework (GACOF) [10] is a ServiceNow application [5] that has been designed to help organizations efficiently manage and monitor the compliance of their policies. This application contains components for Regulatory Ingestion, Natural Language Processing (NLP) parsing [7], Policy Generation [8], Workflow Adaptation [5], and Audit Logging. GRC Automated Compliance Operation Framework (GACOF) automates the workflow orchestration using the ServiceNow Flow Designer [5] to facilitate the automatic updating of control lifecycles and the compliance processes that occur after policy approval. All of the artifacts generated by this application are cryptographically logged and version-controlled to maintain the integrity of the audit trail [6]. GACOF's implementation methodology has allowed the organization to deploy GRC Automation more quickly while providing assurance that AI-based automation will only operate within the established guidelines of governance [10].

VIII. BEST PRACTICES (SAI'S GRC PLAYBOOK)

Based on Enterprise implementations, there are several best practices for successfully implementing large scale GRC Configuration, which have been established as part of Sai's expertise in GRC Configuration at an Enterprise Level [10].

AI generative models must leverage trusted knowledge from within an organization through retrieval-augmented generation (RAG) capabilities [9] to mitigate against AI-generated outputs that are hallucinated or fictitious in nature [8]. A human reviewer/auditor must verify all AI-generated outputs pertaining to high-risk regulations [2]. Policies must also be version-controlled and tracked completely [6], and NLP model confidence thresholds must be established by using escalation mechanisms for interpreting AI-generated content when the AI model's level of confidence falls below an acceptable threshold [7]. Finally, all AI-generated outputs must contain a complete audit trail that is not changeable or modifiable, in compliance with regulatory requirements [6].

IX. FUTURE WORK

Future research will investigate new ways to enhance the functionality of generative AI-based compliance systems by providing new methods to capture the growing complexity, scale, and diversity of regulatory environments [4]. One method of investigation will be multimodal ingestion for regulation(s); multimodal ingestion means ingesting content from various types of formats rather than strictly text-based content [8]. An example of a multimodal content delivery mechanism would be electronic forms of regulations such as PDF files, consultation paper documents, supervisory speech/briefing transcripts, public hearings and even recorded regulatory briefings (e.g., live streams). By enabling AI tools to analyze and correlate the insights captured from multimodal content (e.g., audio, video, text), we would be able to reduce/eliminate the delays associated with identifying regulatory intent and new compliance expectations. An additional area of focus for future research activities will be the ability to identify and reconcile conflicting regulations [4]. Many organizations find themselves with overlapping and/or contradictory regulatory requirements across multiple jurisdictions. Using the techniques of graph analysis and the methods of semantic reasoning on AI-based compliance platforms [10], it would be possible to identify instances where there are discrepancies among governing regulations, associated policies, and implementing controls. Once identified, organizations could take the necessary steps to resolve the conflict; this may include unifying regulations, streamlining controls and creating a more efficient process to create compliant policies across multiple regulatory environments. Future research will expand AI to generate control-testing scripts automatically by creating generative models that produce executable test cases based on defined controls and regulatory requirements [10]. Control-testing scripts will be integrated into continuous monitoring pipelines.

Controls will be tested and automatically collected as evidence of their effectiveness, rather than periodically assessed and assured [6]. The final area of future research will be GRC federations; organizations can become compliant within multiple jurisdictions while maintaining the data residency, sovereignty, and regulatory boundaries associated with each jurisdiction, with an overall federated GRC architecture [5]. Organizations can continue to operate and remain compliant while using standardized control logic/policy templates and regulatory insights within various jurisdictions. The introduction of new technologies will give organizations greater flexibility, intelligence, and resilience in managing compliance across jurisdictions. AI-driven compliance will therefore be a key capability of all global organizations [2].

X. CONCLUSION

Generative Adaptive Compliance Orchestration Framework [10] shows generative AI enhances compliance teams instead of eliminating them [2]. By integrating generative AI into Governance, Risk Management, and Compliance (GRC) Platforms [5], businesses can move from a reactive to a proactive and self-adjusting compliance ecosystem and implement AI-enhanced interpretations of regulations, create new policies, and manage compliance within an infrastructure that allows for rapid and accurate deployment of policies via artificial intelligence [8]. These results demonstrate how compliance is being transformed through adaptive processes and tools, providing faster and more accurate interpretation of policies, creating more accurate policies, significantly reduced number of audit findings [6], and as increased use of adaptive compliance becomes a necessity throughout the business due to the increasing complexity of regulatory environment [4]. This means that AI based compliance orchestration will become an increasingly integral and foundational component of enterprise compliance platforms [2].

"The future of compliance will not solely be written by attorneys, but instead co-authored with AI." [10]

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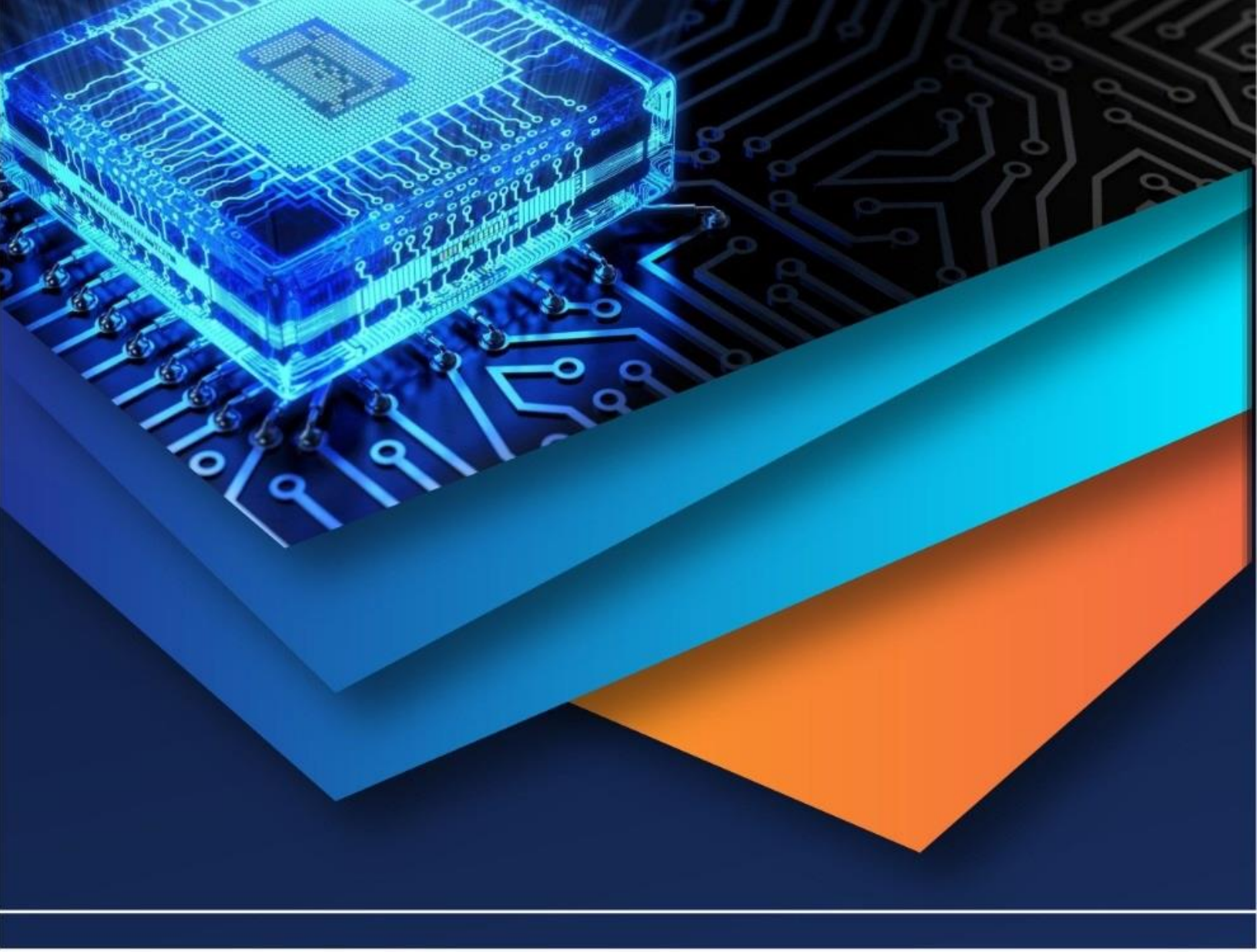

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