iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 9 **Issue:** V **Month of publication:** May 2021

**DOI:** https://doi.org/10.22214/ijraset.2021.34170

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue V May 2021- Available at www.ijraset.com*

# Development of Water Quality Index for Urban Water Body

Sumanth C. R[1], Yashas. S[2], Varshith. K. S[3], Shreyas Y[4], Spoorthy S. S[5]
[1, 2, 3, 4]*Undergraduate Students, Dayananda Sagar College of Engineering, Bengaluru- 560078, Karnataka, India.*
[5]*Assistant Professor in Civil Engineering, Dayananda Sagar College of Engineering, Bengaluru-560078, Karnataka, India.*

***Abstract:*** ***The nature of water assets in metropolitan regions has gone through debasement because of the release of homegrown and modern wastewaters and urbanization among different components. Notwithstanding the lawful instruments that mean to protect water bodies, different components ought to be carried out, like observing organizations and revealing outcomes. Another test is the understanding of the outcomes that may uphold dynamic on the moves that should be made to safeguard water quality. In the current examination lake water boundaries will be broke down and water quality record will produced for the chose lake.We have selected 2 lakes in Banglore that is Yadiyur lake and Yelchenahalli lake. Yediyur Lake is one of the oldest manmade lake in the Bengaluru city that spreads over 20 acres, Yediyur Lake sits at the edge of Basavanagudi. Yediyur lake is exists from the days of Hoysala kings -- that's about 1,400 years ago. Yelachenahalli Lake is one among the oldest manmade lake in the Bengaluru city that spreads over 6.32 acres, lake sits is located on the south part of Bengaluru city. This lake is existed for at least about 100 years. We have chosen ARITHMETIC INDEX method to calculate WQI value. We have taken 2 sample station from each lake and with an interval of 15 days in the month of April to May of 4 sample collections in this months. By analyzing these 2 lakes by doing 11 parameters that is pH, Turbidity, Hardness, Electronic conductivity, Chloride, DO, BOD, COD, TDS, Nitrate, and MPN test. We got to know that the WQI value for Yadiyur lake is 196.013 which is not suitable for Drinking purpose and the WQI value of Yelchenahalli lake is 123.982 which is not suitable for drinking purpose.***
***Keywords: Ground water, Surface, water quality, water quality index.***

## I. INTRODUCTION

Water quality is a significant benefactor addressing all parts of environments and human prosperity. The environment administrations of water from waterways and lakes are straightforwardly or by implication add to both human government assistance and amphibian biological system. The strength of the sea-going environment is controlled by the water quality boundary which incorporates the physical, compound, and organic attributes. Water Quality Record is a solitary number which can be determined effectively and utilized for generally speaking depiction of the nature of water bodies. To record the information which demonstrate the soundness of water assets and for estimating and evaluating water quality.

All the water sources, for example, Waterways, Streams, Lakes and so forth, are getting contaminated step by step. A few waters are getting dirtied at the actual sources. These contaminated waters cause numerous extreme issues to individuals, creatures and climate. It might prompt eutrophication, exhaustion of disintegrated Oxygen content in water, demise of fishes and different creatures, changes in water quality boundaries, physicochemical changes and so forth, These progressions in water force financial misfortunes additionally by scale development, utilization of more water, necessity of pre-treatment and so on,

### *A. Water Quality Appraisal*

Parameters and allowable levels, wellsprings of water contamination.

The Scope Of The Work Are As Follows

*1)* Collection of water tests in Southeastern piece of Yadiyur Lake and its connected information.
*2)* Collection of water tests in Northwestern piece of Yelchenahalli Lake and its connected information.
*3)* Analysis of water quality for different boundaries was led with modern instruments and Standard working strategies.
*4)* Data accumulation
*5)* Graphical portrayal of information
*6)* Interpretation of results

### *B. Objectives*

*1)* To analyze physical, chemical and biological characteristic of yadiyur lake and yelchenahalli lake water.
*2)* To develop Water Quality Index (WQI) for water body.

## II. LITERATURE REVIEW

Adriano A. Bordalo, et al: 2006. "A Water Quality Index Applied to an International Shared River Basin: The Case of the Douro River" In This analysis reinforces the requirement to include the prevailing bi-lateral agreements between European country and European nation and to determine a broad international study covering the whole watershed to judge land uses, classify and amount purpose and diffuse sources of contamination, calculate current water uses and outline potential water resource use. And to uphold current international bilateral agreements and to adopt the Water Quality Guideline with a read to enhancing the number and quality of water that the downstream country collects from the common watershed, especially as a result of 2 million folks use water from the last watercourse as their sole supply of beverage.

Hulya Boyacioglu: January 01 2007. "Development of a water quality index based on a European classification scheme" It offers an easy illustration of elaborate and complicated variables dominant the overall surface water quality meant for drinking consumption. The findings showed that, by suggests that of AN index, the quality of the water quality activity is less complicated than comparison the parameter price calculated by experimentation with current steering. Supported ascertained knowledge on water quality, the implementation of the new index was incontestable at a sampler at the Tahtali Reservoir in Turkey.

Karbassi, A. R, et al: May 25 2011. "Development of Water Quality Index (WQI) for Gorganrood River" Based on the comments and experiences of the many consultants acquainted & well advised of relevant water body conditions, the conclusions are updated and manipulated. Applying the approach of AHP restricts the utilization of NSF to a specific gain in water quality for a particular scenario. During this respect, in relevance the abstraction characteristics, the sensitivity of the analysis is also adjusted and updated. In different words, the utilization of the AHP approach compass the utilization of the NSF to a specific water quality project below specific circumstances.

Babaei Semiromi.F, et al: September 05 2011. "Water quality index development using fuzzy logic: A case study of the Karoon River of Iran" This analysis concerned the creation of the Fuzzy water quality index, a contemporary index. It provides a transparent illustration of the careful and complicated factors (physical, biological and chemical) regulation the quality of surface water for drinking use. Six water quality parameters, together with DO, turbidity, pH, TDS, nitrate, and unclean coli sort, were thought-about to be necessary FWQI predictor parameters for evaluating the standard of surface water provides, supported knowledgeable opinions and national expertise. The implementation of the new index was incontestible at the Karoon watercourse sampler in Persia on the premise of determined information on water quality.

P.J. Sajil Kumar, et al: May 12 2012. "Development of Water Quality Index (WQI) model for the groundwater in Tirupur district, South India" In the Tiruppur district, the water quality analysis found that the groundwater in several areas is declining. Each surface water Associate in Nursingd groundwater showed an enrichment of substance concentration within the flow direction throughout the post-monsoon season. Water altogether seasons seems base-forming in nature. So as to strengthen the present groundwater chemistry, the study recommends the installation of bound water storage services, like rain harvest & artificial recharge. To safeguard this important resource, contamination sources like artifact waste & inseminated emissions should be managed.

Shweta Tyagi, et al: August 07 2013. "Water Quality Assessment in Terms of Water Quality Index" It will be assumed that the aim of WQI is to produce one price to a source's water quality in conjunction with the next range of parameters in an exceedingly straightforward expression, leading to simple understanding of watching information on water quality. Moreover, this can be a trial to guage the numerous indexes utilized in the measure of water quality. No index has been widely accepted till now, amid all the experimental works and diverse indexes getting used internationally, and there's still a search for a lot of helpful and universal water quality index, so water authorities, customers and water managers in numerous countries uses and follow it with very little adjustment.

H. Rubio Arias, et al: Nov 2013. "Development of a Water Quality Index (WQI) of a man-made Aquatic scheme in Mexico" throughout the time of year, a lot of the parameters multiplied. As per Mexican and foreign standards, the variables of turbidity and TH were below the allowable limits. Wonderful water quality for spring, tight quality for fall and winter and caliber for summer is decided by the measured WQI. Our findings indicate that the water of this scheme will safely be used for ecological functions furthermore as for fishing, cultivation and farm animal production with none issues. It's powerfully suggested to continue water sampling and to use further variables to use alternative methodologies just like the WQI.

Surjeet Singh, et al: Gregorian calendar month twenty nine, 2015. "Development of associate degree Overall Water Quality Index (OWQI) for Surface Water in Indian Context" The Water Quality Index (OWQI) is meant to produce a basic instrument for determinant the standard of the provision of drink from surface water provides. By considering sixteen criteria covering physical, chemical and biological aspects of water, the OWQI is outlined on the idea of national and international standards.

For 3 separate sampling sites, the applying of OWQI is illustrated and also the water state is written on the idea of the computed table. This OWQI may be a simplified approach of assessing water quality that is incredibly helpful for decision-makers, planners and field engineers to confirm the great health of surface water provides. It's conjointly doable to use the suggested index as a choice support mechanism for water internal control. It is conjointly doable to use the suggested index as a choice support mechanism for water internal control.

Gopal Krishan, et al: January 2016. "Water quality index of groundwater in Haridwar district, Uttarakhand" so as to work out the suitableness of groundwater for drinking functions in Haridwar district, Uttarakhand, WQI was computed supported seven separate quality parameters. The findings indicate that ninety five % of groundwater samples qualified within the 'nice to outstanding' class and five % of groundwater samples needed treatment. This analysis concludes that thirty eight groundwater samples may be thought-about as a drinking norm which the remaining a pair of groundwater samples obtained from Libraheri and Laksar don't seem to be applicable for drinking as a result of the lower WQI worth, i.e. WQI = 75. In Haridwar district, Uttarakhand, continuous observation of groundwater is required as a result of any potential future pollution thanks to rising manufacture and agricultural activities within the district.

Sajal Singh, et al: Apr eighteen 2016. "Water quality index development for groundwater quality assessment of larger noida sub-basin, uttar Pradesh" the standard of groundwater is additionally necessary to the atmosphere, thus it's necessary to keep up its sensible quality the least bit times so as to not endanger the welfare of the user. In theory, 3 main operations square measure influenced by groundwater provides. The primary of these practices is that the improper use in agricultural areas of fertilizers and pesticides. In open un-engineered lowland, the operation of solid waste disposal is one in every of the explanations inflicting groundwater contamination thanks to lack of pollution management measures like water proof sheet, leachate treatment tank, testing wells, etc.

Rajiv Das Kangabam, et al: June twenty six 2017. "Development of a water quality index (WQI) for the Loktak Lake in India" Water quality may be a vital contribution to any or all aspects of ecology and human well-being, and a crucial instrument for assessing the speed of human impoverishment, income, and education. Water ecological advantages from rivers and lakes contribute directly or indirectly to human well-being and to the marine scheme. As most water bodies round the world square measure the supply of water provides, for human use for domestic use, the increase in contamination of water provides like lakes and rivers may be a major concern for the world state of affairs. As most water bodies round the world square measure the supply of water provides, for human use for domestic use, the increase in contamination of water provides like lakes and rivers may be a major concern for the world state of affairs.

## III. STUDY AREA

Yediyur Lake is one of the oldest manmade lake in the Bengaluru city that spreads over 20 acres, Yediyur Lake sits at the edge of Basavanagudi. Yediyur lake is exists from the days of Hoysala kings -- that's about 1,400 years ago. It's one of the last standing lakes in the city and is popular with the locals. It is situated at 12°0'93" N and 77°0'57" E at an altitude 901 m above MSL with a catchment area 1.23sq.km. It is 1.5km long and 1.25 km wide. The capacity of storage of the Lake is 3.752 M ft3.

Yediyur Lake is a hotbed for birds. You can turn your binocular to the trees to catch a glimpse of these winged beauties. Storm water was getting stored in the lake; aquatic plants and animals performed as live treatment plant. The Lake behaved as a Historic lake of the city. Bio-accumulation of organic wastes was not present.

Lake served as an extremely necessary ecological zone of Bengaluru. Due to the absent of industrial discharge and sewage discharge, Yediyur lake has not been highly polluted and hence the current project work is concerned only on the South-East region of the Yediyur Lake.

2 sample stations are selected based on the physicochemical importance of the point and the samples are analyzed for physicochemical properties and microbial parameters. Yelachenahalli Lake is one among the oldest manmade lake in the Bengaluru city that spreads over 6.32 acres, lake sits is located on the south part of Bengaluru city. This lake is existed for at least about 100 years. It is situated at12°0'90" N Northing and 77°0'56" E Easting at an altitude 891 m above MSL with a catchment area 0.32sq.km. It is 1.2km long and 0.65km wide.

This lake has diverse Flora and Fauna. Storm water is also been stored in the lake which helps aquatic plants and animals. Hence the current project work is concerned only on the North-West region of the lake. 2 sample stations are selected based on the physicochemical importance of the point and the samples are analyzed for physicochemical properties and microbial parameters.

Fig 3.1: Yediyur Lake, Bengaluru

Fig 3.2: Yediyur Lake (Southeast region), Bengaluru


Fig 3.3: Two Sampling Locations in Yediyur Lake (South East Region), Bengaluru

Fig 3.4: Yelachenahalli Lake, Bengaluru

Fig 3.5: Yelachenahalli Lake (Northwest region), Bengaluru

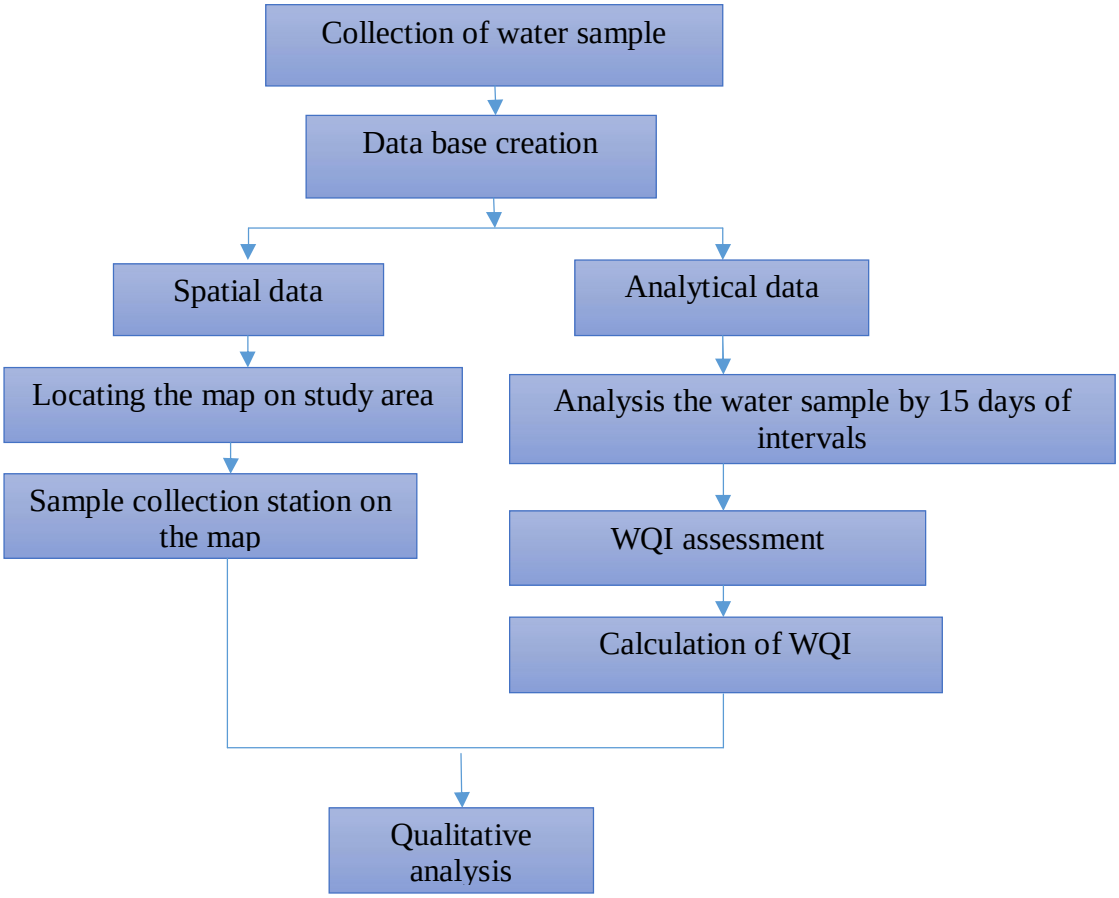

Fig 3.6: Two Sampling Locations in Yelachenahalli Lake (North West Region), Bengaluru

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue V May 2021- Available at www.ijraset.com*

Table 3.1: Details of Sampling Locations.

| Sl. No | Sampling Station | Sample location | Latitude | Longitude |
|---|---|---|---|---|
| 1 | Sample 1 | Yadiyur lake | 12.932992 N | 77.577334 E |
| 2 | Sample 2 | | 12.933113 N | 77.577265 E |
| 3 | Sample 3 | Yelchenahalli lake | 12.900443 N | 77.565406 E |
| 4 | Sample 4 | | 12.900457 N | 77.565261 E |

## IV. METHODOLOGY




Surface water tests for lab examinations were gathered from two unique locales from 2 distinct lakes, chosen which covered the Southeast territory and another from Northwest space of the lake during Walk 2021 to May 2021 dependent on 15 days stretch.

The examples of water were gathered haphazardly in Polyethylene jars (1 Liter limit) were loaded up with the lake water. The inspecting areas are appeared in the Fig. The examples were gathered from a profundity of cm beneath the water surface.

Every one of the examples gathered were promptly conveyed to the logical research facility for investigations. Gathered examples were investigated around the same time of the example assortment.

The investigations of the water tests for physicochemical boundaries like Temperature, Turbidity, Shading, Scent, pH, Electrical Conductivity, Complete Broke up Solids, DO, Body, COD, Nitrate, Chloride, Absolute hardness and MPN were done by the standard methodology.

The WQI strategy is a useful asset that empowers simple correspondence of the nature of water to the public particularly the arrangement producers. Water quality list is a significant instrument for checking the nature of water, if it is good for drinking. In this investigation, the WQI, which is determined utilizing the weighted math record technique.

*A. Collecting the Lake Water Samples*

1) The water samples were collected using 1 Liter polythene cans from March 2021 to May 2021 for the analyses and study the behavior of different physicochemical and biological parameters.
2) Water samples were collected at each site by random sampling.
3) The polythene cans were rinsed by the lake water at the sampling stations for at least 3 times.
4) After rinsing, submerge the can below the water level and allow it to fill completely to the top.
5) Screw the lid on tightly to prevent leakage.
6) Refrigerate the sample until you are ready to send it to the laboratory.
7) It was confirmed that there are no floating materials collected into the can.
8) The cans were later labelled with the labelling stickers consisting the details of samples collected such as each container was clearly marked with the name and date of sampling.
9) The cans were then placed in the ice box and transported to the laboratory.
10) In laboratory, the sample cans were stored in cold room i.e., refrigerator until the analyses to preserve the sample water characteristics.

Lter, analyses were carried out according to the standard procedures

*B. Formula to Calculate WQI*

$$WQI = \frac{\sum_{i=1}^{n} q_i w_i}{\sum_{i=1}^{n} w_i} \quad (1)$$

where

$q_i$=quality rating (sub index) of $i^{th}$ water quality parameter

$w_i$= unit weight of $i^{th}$ water quality parameter; $\sum_{i=1}^{n} w_i = 1$

Also, $q_i$ , which relates the value of the parameter in polluted water to the standard permissible value is obtained as follows:

$$q_i = 100\left(\frac{v_i - v_{io}}{s_i - v_{io}}\right) \quad (2)$$

where

$v_i$= estimated value of the $i^{th}$ parameter

$v_{io}$= ideal value of the $i^{th}$ parameter

$s_i$= standard permissible value of the ith parameter

In most cases, $v_{io}$=0 except for pH and DO

For pH, $v_{io}$=7; For DO, $v_{io}$=14.6mg/l

The unit weight ($w_i$), which is inversely proportional to the values of the recommended standards is obtained as:

$$w_i = \frac{K}{s_i} \quad (3)$$

Where $k = \frac{1}{\sum_{i=1}^{n} \frac{1}{s_i}}$

## V. RESULTS

Based on the result of all all parameters of physicochemical parameters and biological parameters, we got the average WQI value of both the lakes are listed below

*A.* The average WQI value for Yadiyur lake water is 196.013
*B.* The average WQI value for Yelchenahalli lake water is 123.982

Table 5.1: Calculating WQI Using Excel sheet

| yadiyur | Parameters | BIS standards(Sn) | 1/Sn | Sum of 1/Sn | K=1/(s 1/Sn) | W=K/Sn |
|---|---|---|---|---|---|---|
| | Ph value | 8 | 0.125 | 0.640556 | 1.561144 | 0.195143 |
| | Turbidity | 5 | 0.2 | 0.640556 | 1.561144 | 0.312229 |
| | hardness | 100 | 0.01 | 0.640556 | 1.561144 | 0.015611 |
| | e.c | 50 | 0.02 | 0.640556 | 1.561144 | 0.031223 |
| | chloride | 250 | 0.004 | 0.640556 | 1.561144 | 0.006245 |
| | DO | 5 | 0.2 | 0.640556 | 1.561144 | 0.312229 |
| | BOD | 30 | 0.033333333 | 0.640556 | 1.561144 | 0.052038 |
| | COD | 250 | 0.004 | 0.640556 | 1.561144 | 0.006245 |
| | TDS | 500 | 0.002 | 0.640556 | 1.561144 | 0.003122 |
| | nitrate | 45 | 0.022222222 | 0.640556 | 1.561144 | 0.034692 |
| | MPN | 50 | 0.02 | 0.640556 | 1.561144 | 0.031223 |
| total | | | 0.640555556 | | | 0.999999 |

| Vo | Vn | Vn/Sn | Vn/Sn *100=Qn | WnQN |
|---|---|---|---|---|
| 7 | 9.53 | 2.53 | 253 | 49.37117 |
| 0 | 20.75 | 4.15 | 415 | 129.5749 |
| 0 | 176 | 1.76 | 176 | 2.747613 |
| 0 | 0.27825 | 0.005565 | 0.5565 | 0.017376 |
| 0 | 47.64 | 0.19056 | 19.056 | 0.118997 |
| 14 | 11.63 | 0.2633 | 26.33 | 8.220983 |
| 0 | 22 | 0.733333 | 73.33333 | 3.816129 |
| 0 | 23 | 0.092 | 9.2 | 0.05745 |
| 0 | 180.8625 | 0.361725 | 36.1725 | 0.112941 |
| 0 | 0.022 | 0.000489 | 0.048889 | 0.001696 |
| 0 | 31.6 | 0.632 | 63.2 | 1.973286 |
| | | | | 196.013 |

## VI. CONCLUSIONS

After the investigation of different lists of water quality, it very well may be reasoned that the objective of WQI is to offer a solitary benefit to a source's water quality, alongside decreasing a more prominent number of boundaries into a straightforward articulation, bringing about simple comprehension of checking information on water quality. As we address the advantages and bad marks of both the WQI Public Disinfection Base and the WQI of Oregon, which are valuable for following, surveying and impacting reads for different areas of water bodies. These files utilize distinctive physicochemical and organic boundaries and have been created because of innovative work endeavors. Disregarding every one of the endeavors and particular lists examined are being utilized, Up until now, no measurement has been generally embraced and there is now a chase for a more helpful and widespread record of water quality, so that water specialists, shoppers and water supervisors are arranged at different areas. With little change, it tends to be utilized and acknowledged. Water quality is one of the most important factors in a healthy ecosystem. Clean water supports a diversity of plants and wildlife. Though it may seem unrelated at first, our actions on land affect the quality of our water. Hence we have taken two lakes of yadiyur lake and yelchenahalli lake we come to know that the average WQI value of two lakes are listed below

*1)* The average WQI value of Yadiyur lake is 196.013
*2)* Hence Yadiyur lake water is not suitable for drinking purpose
*3)* The average WQI value of Yelchenahalli lake is 123.982
*4)* Hence Yelchenahalli lake water is not suitable for drinking purpose

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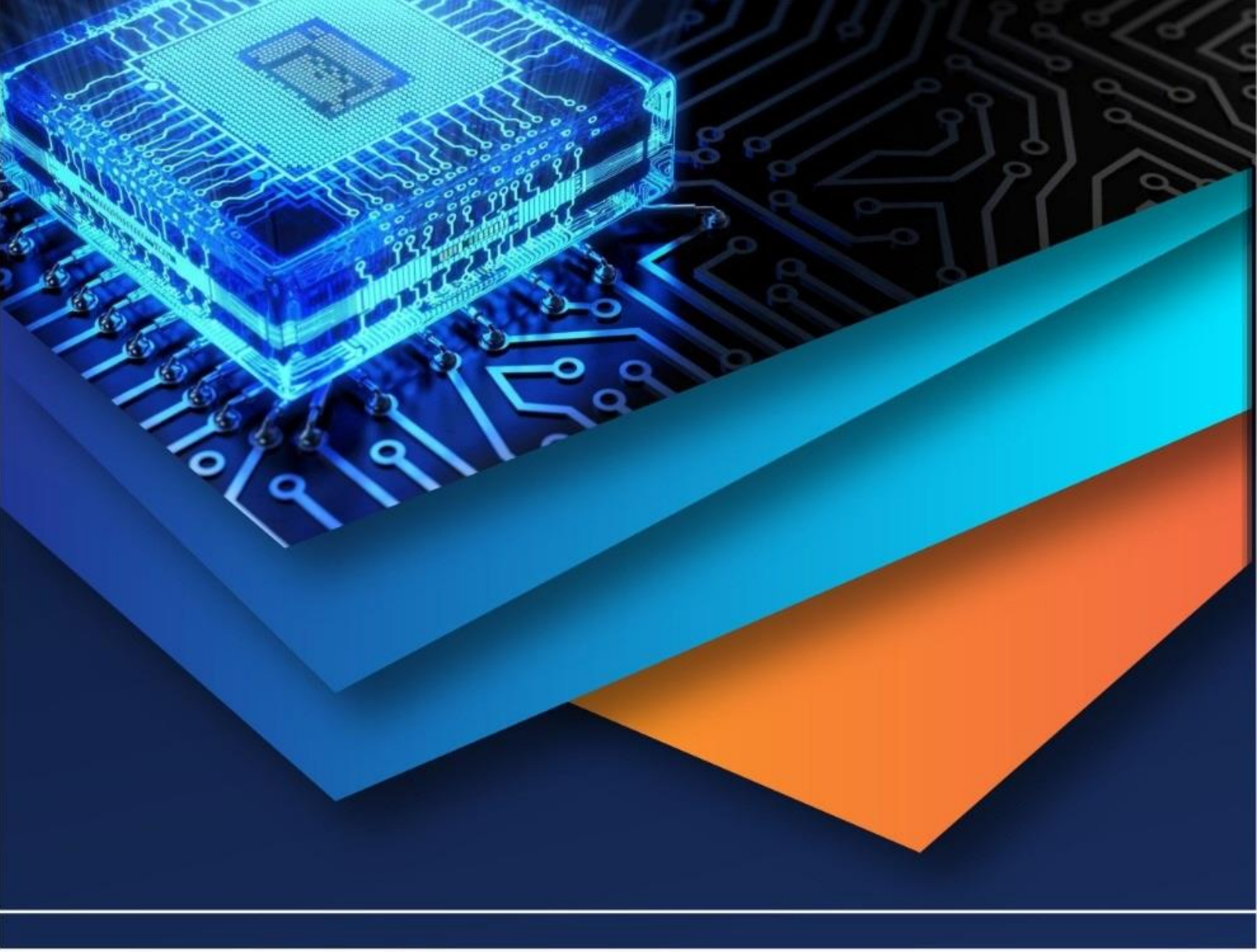

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