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A Survey on Technological Advances in Agriculture

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Abstract: Since over 12000 years agriculture has been a backbone of our country. In the start it was mainly man-power and the farmers had to face not much problems. But this road hasn't always been smooth. The problems have not only been increasing in intensity but also finding a solution for it hasn't been easy. Depletion of resources, rapid population growth, birth of new diseases, changes in climate, and other factors contribute to food shortages from time to time, impoverishing the poor Indian farmers. In this 21st century, ICT has revolutionized every aspect of life, including agriculture, which gave rise to E-farming. It was started with the aim to provide food security, but over the years it has taken a great turn. In the coming years, agriculture will use advanced technologies like robots, temperature and humidity sensors, aerial photography, and GPS. These equipment will allow farming to be more profitable, more efficient, safe, as well as environmentally friendly. So with the help of this paper, we intend to study all the technological advancements in agriculture over the years.
Keywords: E-farming, Technology , ICT , Agriculture, Weather Forecast

I. INTRODUCTION

Farming has been the prime occupation in India since ages and around 59% of the population of India derive their livelihood from agriculture. India is the largest producer of milk, pulses and jute in the world. It is also ranked second in the production of rice, wheat, sugarcane, nuts, vegetables, fruits, and cotton. India accounts for 25% of the total production and 27% of the total consumption and is one of the top 20 countries for exporting food products. Although ICAR claimed that the demand for foodgrains will rise up to 345 million tons by 2030, its contribution to the GDP has been decreasing recently (pre-covid).

Statistics [1] say that each day, 28 people dependent on agriculture give their lives away. The two main reasons for this are, failure of crops and debt burden, along with some climatic conditions like water scarcity, flash floods, change in the nutritional status of the soil and other effects of global warming. If we consider the data lent by NCRB [2], it states that out of 3000 victims in 2015, there were 2474 victims who had loans which they were unable to pay back, from the local banks. And these statistics helped create a correlation between the facts. For these indebted farmers, the input cost also creates a huge impact. Fertilizers, pesticides, and also seeds needed for cultivation, can sometimes be a real burden for them. But these input costs are not only of the basic raw materials. In this 21st century, where machines reduce a huge man-load,using agricultural equipment and machinery like tractors, submersible pumps not only adds to the already high costs but also makes it less feasible. Even though the government has declared various policies for their betterment, which can not only curb their debts but also find a way for them to acquire these expensive machinery, this information fails to reach the farmers, thus forcing them to choose the easier way and run from their problems.

One of the driving factors is not being able to get full value for their hard work. Although farmers spend a lot of money on produce all year round, there is no profit for them during the harvest. This happens due to the existence of a middleman, who takes the commission which is meant for the farmers. To get their produce to the market and gain a profit on it, farmers often contact such middlemen who fool them and take away a lot of profit.

With the climatic conditions changing rapidly in the past centuries, the farmers also face quite a few other challenges which never existed ages before. And due to this, farmers cannot depend entirely on the old techniques. They ought to incorporate the new methodologies to increase their productivity.

With global warming on rise, there are a lot of factors which cannot be controlled by the farmers and if they aren't handled properly, they can face a huge failure in their production.

As per the food and agriculture organization of the United Nations, India has gained a self-sufficiency in agricultural production, but it still is a home for around 25% of the world's hungry people and there are over 190 million undernourished people in our country [3]. The main reason for this bargain is the lack of technology and awareness in farming. In this 21st century, technology has created a major impact in each domain and agriculture is one of them.

And that is where E-farming comes into the picture. E-farming is a way by which farmers can face the above mentioned challenges in a better way and find a solution to cope up with the technological advances in each field.

As the covid pandemic hit this world in 2020, the near cessation of economic activities was expected but the agricultural sector proved it wrong. Even though there was a complete lockdown all around the world, the gross value added (GVA) by agriculture was 3.4% in the first quarter itself [4]. This would have been next to impossible without E-farming and a lot of technological advances. So with the help of this paper we aim to study these advances over the years and how it intends to benefit a nation driven by agriculture.

II. ADVANCES BEFORE THE BIRTH OF E-FARMING

In the past 50 years, a lot of improvements were made in the process of agriculture and in no time, technology became an important part of agriculture. Starting with the Green Revolution in 1960, India achieved self-sufficiency in food production by using modern methods like better quality of seeds, proper irrigation and advanced fertilizers and pesticides. Farmers no longer need to use the same old technique that uses water, fertilizer and pesticides in the whole field. Instead, they can use the small amounts needed and directly apply on specific areas, or treat each plant differently.

They also started using the tractor, followed by new farming and harvesting equipment, irrigation and air seeding technologies. As a result of this development of machinery, there is an increase in scale, speed and productivity of farm machinery, resulting in better land cultivation.

Seeds, irrigation, and fertilizer have also improved significantly, helping farmers to increase yields. The major benefits of this include increased crop productivity. Decreased use of fertilizers, seeds and water which not only helps in saving the resources but also helps in curbing the input cost. There is also less runoff of chemicals in local water supplies. And there is worker safety, since machines do the crucial work.

Around 60% of the global population has access to the internet. And with the help of this, it is possible to not only facilitate better communication but also ensure the delivery of services and information to people who previously lacked access. Thus the Information and communication technologies(ICT) have created a major revolution in each domain, including agriculture. The use of ICT in agriculture, which is often termed as E-agriculture, has created a huge impact in agricultural and rural development by inculcating innovative ways which improve the existing information and communication processes. It has particularly revolutionized smallholder agriculture in several agrarian economies and has helped address several challenges associated with the traditional form of agriculture. There has been an historical development of agricultural technologies which started with human labor and then the use of tractors, followed by wireless sensors and robotics.

III. E-FARMING

Although ICT activities have helped in bridging the gap between the rural world and technology for a long time, the Agricultural Community (also called "e-agriculture") came into being after the World Conference on Information in 2003 and 2005. When we talk about the rural areas, the major problem they face is lack of awareness and technology, but along with this resides many other problems, with many aspects of information exchange and the inefficiency of information content, as well as a lack of human resources, institutional capacity, and sensitivity and the different needs of different groups. The main purpose of this was not only to guide institutions and individuals concerned with agriculture and rural development but also to share the necessary information, learn from them, and to carry out the necessary improvement for rural development, rural livelihoods, and agricultural agriculture and food security and security. Though E-agriculture was started in 2007, it gained a huge momentum in the Covid pandemic in 2020. With few clicks , farmers can reach out to a global network of farmers, agronomists, businesses, and other service providers to keep abreast of the latest cropping techniques.

A. Advantages

1) The new machines reduce the time and effort of the farmers.
2) They increase the price and demand of the products.
3) Use of new technology improves the fertility of the soil.
4) Less amount of chemicals are used which further reduces pollution.
5) Use of modern technology reduces impact on the environment, as they are eco friendly.

B. Disadvantages

1) The farmers don't have in-depth knowledge about the modern machines, due to which they can't use them properly.
2) The overall cost of upkeep of these modern machines is extremely high.
3) Overuse of technology may have an adverse effect on the environment.
4) Excessive use of chemicals can reduce the fertility of the soil
5) Modern technology has excessive electronics, which makes it unreliable.

IV. LITERATURE SURVEY

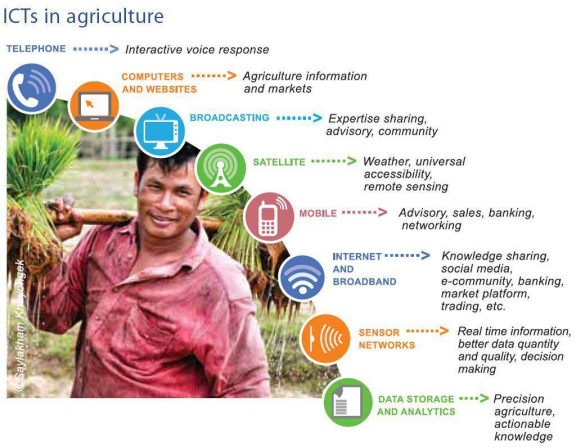
1) L. Pradhan, B. B. Mohapatra-"E-agriculture: A Golden Opportunity for Indian Farmers"[9]. In this paper, with the help of ICT , information on price distribution of commodities can be provided and this inturn helps farmers and the traders to make decisions regarding the agricultural outputs. Information provided when combined with budget data can help the farmers to decide the crops that can be produced in the next season. Also having information about market prices through ICT , farmers can move their produce to the market where they can get better prices. Farmers , researchers , scientists and administrators can be united by establishing "Agriculture on-line " through information and idea exchange**.** Traditional technologies such as radio , television and newspaper are preferred over the Internet by the farmers . Barely 12 percent of the farmers are using the Internet for making farming related decisions . Because of which , Doordarshan and All India Radio are being enforced for telecasting 30 minutes of agricultural programmes , 5 to 6 days per week. Also farmer's feedback is being collected regularly.

2) Bibhu Santosh Behera, T.K. Das, K. J Jishnu, R.A.Behera,.A.C.Behera, S.Jena -"E-Governance Mediated Agriculture for Sustainable Life in India" [10]. In this paper, with the help of E-Agriculture , farmers can be empowered with relevant and up-to-date information about different crop varieties . Farming risks regarding information on weather , production and cultivation techniques , seeds, fertilizers , plant nutrients and water usage can be reduced. Encouraging knowledge sharing among farmers for increasing agricultural productivity and boosting the growth in rural areas. Information Technology can assist an Indian farmer to obtain important information regarding agricultural inputs, production technologies for crops , agricultural processing, support provided by the market , agricultural finance and management of farm and agricultural business. Appropriate and location specific technologies through IT can provide efficient advice to the farmers.Through IT not only agricultural development will take place but also there will be an expansion in the agricultural research and education system .

3) Sumitha Thankachan, Dr. S.Kirubakaran, "E- Agriculture Information Management System" [11].Here, with the help of E-Agriculture , farmers can get the desired information at any instant of time from any part of the world and they can also get the help from experts viewing their problem immediately without moving anywhere. Illiteracy among farmers in reading messages is also another factor that pertains to the usage of technology in agriculture, to overcome this it is necessary to create awareness of learning the state language Mobile phone costs should be lowered to enable the majority of farmers to have access to the current information about agribusiness within the state or country.

V. E- FARMING IN INDIA

As per the world bank collection of development indicators, as of 2018 over 60% of land is used for agriculture, due to which there is a huge diversity in soil. The current active practices used for agriculture can either be the basic primitive techniques or the modernized techniques. Due to this, a lot of problems are faced by the Indian farmers to increase their productivity. Even though there are researches on latest agricultural techniques that are related to developing new variant crops,cultivation process and also modern techniques of pesticide usage the per head income of farmers is one-fifth of that of an average Indian.There also exists a huge information gap between the research done and the information reached to the farmers. All around the world, the role of ICT in agriculture i.e. E-farming ranges from prediction of climatic measurements to delivering all the necessary information about research, marketing and distribution of the agricultural products.



In India, the National Agriculture policy suggests the use of Information Technology for achieving rapid development in India, with the main aim of creating awareness amongst the rural population. Some of its initiatives include the creation of Kisan Call Centers, a number of projects such as the Bhoomi project, the GyanDoot project, the e-Choupal project, the e-Saga project and many more. Along with this, it was kept in mind that around 12% of farmers are able to make full use of these technologies. So the government started to use Doordarshan and All India Radio are being enforced for telecasting 30 minutes of agricultural programmes , 5 to 6 days per week . Farmers feedback is being collected regularly through the Audience Research Units and implementation of schemes are guided and monitored at the respective levels.

The Ministry of Agriculture launched the initiative of Kisan Call Centers(KCC) [12] with the main objective to answer farmer's queries through the telephone in their own dialect. These queries are answered by Farm Tele Advisors (FTA's) or high level experts on a 1-1 call basis or conferencing mode. Each KCC agent is assigned an id and password by which they can login [13] to the Kisan Knowledge Management System (KKMS) by which it is assured that correct and prompt responses are given and the calls are also recorded for further use.

With the help of The Bhoomi project we understand how we can use any ICT project for data processing as well as production and access of information, which is supported by the right of information**.** This computer-generated world record assists farmers in obtaining Rights, Tenancy and Cultivation (RTCs) certificates. In addition, the Bhoomi project also provides internet connectivity to various courts to use the land records website to resolve disputes over land ownership and cultivation.

The Gyandoot project started within the Dhar district of Madhya Pradesh, overlaying six hundred districts and 26 Soochanalaya which are centers of information at the village level. This provider includes providing records on agricultural products, public sale costs, copies of international facts, online software registration, rural public sale websites and extra. The local auction project permits farmers and citizens to marketplace and sell land, agricultural machinery, gear and different long lasting gadgets. with a view to provide facts, a small amount of consumer expenses are charged through the statistics centers.

The e-Choupal venture now covers nine counties and a few 36,000 villages, empowering an estimated 3.5 million human beings. Those e-Choupal facilities carry actual-time records and custom designed information to enhance the farmer's selection-making capability, therefore higher concentration on farm manufacturing and market wishes, achieving better first-rate, productiveness and progressed charges. It additionally facilitates farmers to get high pleasant agricultural inputs at low fee.

The eSagu challenge, a campaign via the Indian Institute of facts generation, in Hyderabad, provides plant-based total recommendation from urban specialists in the rural regions of Andhra Pradesh, the use of digital generation. In this application, the consultant collects all the statistics about vegetation within the place and sends it to a consultant group in Hyderabad for the usage of a storage tool. experts then examine the plant gadget and suggest answers, which can be downloaded from nearby knowledge facilities.

VI. FUTURE SCOPE

The development in the past was purely mechanical, in the form of powerful and efficient machinery, and genetics, in the form of highly productive seeds and fertilizers. Now more and more digital tools are needed to bring the next generation of production. Some are already in place to help farmers use resources efficiently and effectively, while the most advanced ones are still being developed. These new technologies can improve decision-making, allow for better risk and diversity management in order to improve productivity and economic development.

As they are bred in livestock, they can improve the well-being of livestock, dealing with growing concerns about animal welfare. If modern agriculture is widely used in the near future, millions of farmers will be able to benefit from access to real-time farm information. Farmers do not have to spend a lot of time obtaining farmers' data and will be able to access disaster warnings and weather information in the event of a disaster. It is difficult to predict the future of technology in agriculture but there are many promising trends and pilot projects. In future agriculture will no longer depend on the use of water, fertilizer, and pesticides alike in all fields. Instead, farmers will use the minimum required amounts and direct the most specific areas. Studies also suggest that farms and agricultural activities will have to be conducted in a very different way, mainly due to advances in technologies such as sensors, metals, machinery and information technology. Future agriculture will use sophisticated technologies like robots, temperature and humidity sensors, aerial photography, and GPS technology. These advanced equipment as well as accurate agriculture and robotic systems will allow farms to be more profitable, efficient, safe, and environmentally friendly.

VII. OUR SYSTEM

Our System hopes to tackle a few of the challenges in the agromarket by getting more and more farmers familiar with online e-farming web portals. Helping farmers get agro products at cheaper rates and educating them about efficient,effective and eco friendly farming is what we aim for. In this system, farmers can purchase seeds and necessary fertilizers of best quality at cheaper price rates. Apart from farming , keeping the track of weather is also important . Thus the system will help the farmer in giving weather forecasts for almost a week, this can help them plan their future activities as per the weather conditions.

Renting farm equipment proves to be an advantage for the farmers , as the farmers can harvest the crops on time without facing the huge cost spent on farming equipment or the machinery. Farmers can avail this facility of equipment leasing i.e renting farm equipment through the system. Using a user-friendly interface we would help the farmers to get these materials at their doorstep.The farmers would also be made aware of the various schemes put forward by the government.

For giving farm related knowledge , a functionality called Training is incorporated in the system. Farmers can gain more knowledge through the videos uploaded by the Agricultural Experts. Agricultural Experts will be a part of the system and their role is to provide necessary information and knowledge to the farmers. Farmers can also connect with them through video conferencing present in the system. Though the farmers can use technology at its best, it is not feasible to assume that everyone is familiar with the English language, so we will add the multilingual feature too. With the help of the system farmers can also record their harvest inputs into the Harvest (Tracker) Recorder. Farmers will hence get respective farm related alerts pertaining to the data recorded into the Harvest (Tracker) Recorder .

In today's date there are quite a number of E-farming systems available on the internet. They do prove to be useful but there isn't a single computerized system where not only can the farmers rent the necessary equipment, but also buy essential products needed for harvest, as well as get all the necessary information related to farming in any language they want.

REFERENCE	PROPOSED SYSTEM	OUR SYSTEM
[5]	A portal which acts as an online auction system with the main aim of eradicating the middleman . This is a beneficial application to the Indian farmers . It helps them to earn value for their hard work. It also provides a secure way for the transactions .	Here the system moreover focuses on a system wherein the farmer can buy seeds and fertilizers at reasonable rates . Farm equipment leasing is implemented in such a way where the farmers can rent farm equipment for a specific period.
[6]	It proposes a system consisting of the elements such as buy/sell interface , feedback , weather forecasting and government schemes. It also consists of a chatbox between the farmers and sellers.	Apart from the buy/rent interface , Weather forecasting is also incorporated into the system . Timely SMS would be sent to the users by the system. Information related to Government Schemes will be also displayed by the system .

[7]	A system to advise the farmers in all the aspects, the current market rate of different products , the total sale and profit earned from sold products and approach to the new farming techniques through E-learning . It also focuses on compensations and government schemes for farmers.	Agriculture experts / consultants are also a part of the system. Farmers can interact with them through video conferencing . These agriculture experts will also help farmers by constantly posting Farm related information/knowledge.
[8]	A web based portal wherein the Farmers can view the details about the crops , get details about weather reports , alert messages through SMS regarding the details about the weather conditions and get particular loan information from the financial bank by clicking on the link for financial websites.	Farmers can record their harvest input in the systems . Thus the system acts as a harvest recorder for the farmers . Also alerts related to the data in the records will be broadcasted to the respective farmers timely.

VIII. CONCLUSION

With the help of this paper, we did a survey of existing systems and proposed systems. This survey was aimed to list down and understand numerous functionalities proposed for the farmers and thus understand how our site can prove to be beneficial for them. Understanding the role of technology in agriculture was also necessary. Information Communication Technology can assist an Indian farmer to obtain important information regarding agricultural inputs, production technologies for crop , agricultural processing, support provided by the market , agricultural finance and management of farm and agricultural business , which would not only result in an increased produce, but also help in boosting the economy of our country and thus give farmers a true value for their hard work. Thus we aim to build a system that not only solves the above mentioned issues, but also bridges the gap between technology and the rural population of India.

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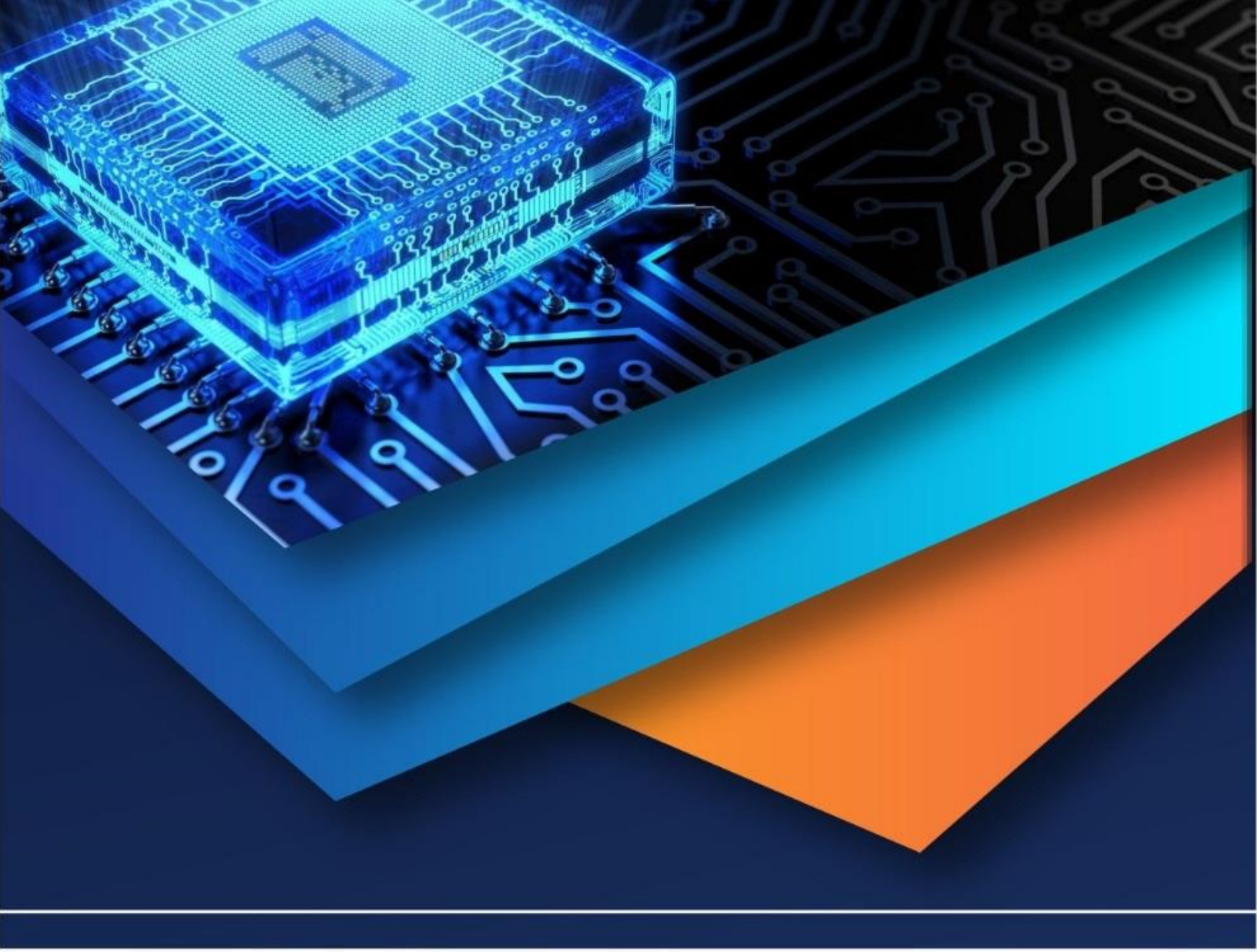

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