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EDITORIAL

The current issue with a variety of papers strives to present the realistic picture of society. With studies related to AI and agribusiness practices, Chinese and Indian agriculture; AI and pattern analysis; cloud computing and security; ecological movements; free and compulsory education act; this issue renders its novel way to add to the knowledge.

To add to the vast source of knowledge, Khushboo, Dubey, and Mehta explores the role of AI in agribusiness practices; Weirong focusses on the development and challenges of Chinese and Indian agriculture; Uwizeye Samuel studies artificial intelligence home automation system with pattern analysis and cloud computing and security; Mondal studies ecological movements; whereas Debashis and Sakyasuddha conducts study of the right of children to free and compulsory education act.

I am sure this issue will serve as an eye opener for the authorities and help them envisage a better way towards quality education free of chaos and terror for the HEIs and the teachers.

Regards,

Avdhesh Jha
Chief Editor,
Voice of Research

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EXPLORING THE ROLE OF AI IN REVOLUTIONIZING AGRIBUSINESS PRACTICES

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Abstract

The agricultural sector is experiencing a significant transformation due to the rapid advancement of Artificial Intelligence (AI). This paper investigates the groundbreaking impact of AI on agribusiness by examining its practical applications throughout the agricultural supply chain. The study focuses on three main objectives: evaluating AI's role in enhancing precision farming methods, which improves resource allocation efficiency and crop yields; assessing AI's utilization in predictive analytics to facilitate improved decision-making for planting schedules, resource management, and market forecasting; and identifying the primary obstacles to AI adoption in agribusiness, such as inadequate technological infrastructure, high implementation expenses, and a lack of skilled personnel. By harnessing AI-driven insights, agribusinesses can boost efficiency, sustainability, and profitability, fostering a more resilient agricultural ecosystem. Key areas of AI implementation encompass precision farming, automated machinery, predictive analytics, supply chain optimization, and market analysis. The research findings highlight AI's potential to revolutionize farming practices through process automation and the provision of actionable insights, ultimately contributing to a more robust and productive agribusiness environment.

Keywords: *Artificial Intelligence, Agribusiness, Precision farming, AI applications, Sustainable agriculture*

Artificial Intelligence (AI) has become a transformative force in sustainable agriculture, revolutionizing the agribusiness sector. The integration of AI technologies into farming practices marks a significant step towards addressing global issues such as climate change, food insecurity, and resource depletion. AI applications in agriculture span a wide range, including predictive analytics, precision farming methods, and autonomous operations, all contributing to increased agricultural productivity while minimizing environmental impact (Sakapaji, 2023; Bhagat et al., 2022; Adewusi, 2024; Akintuyi, 2024).

AI plays a crucial role in advancing sustainable agriculture by enabling data-driven decision-making processes. This allows farmers to optimize resource utilization, improve crop management strategies, and enhance soil health. For instance, AI can significantly reduce pesticide usage through targeted application based on real-time data, thereby safeguarding biodiversity and ecosystem health (Sakapaji, 2023; Akintuyi, 2024; Victoire, 2023). Moreover, AI-driven innovations like smart irrigation systems and climate-controlled greenhouses contribute to water and energy conservation, which are vital for sustainable farming practices (Bhagat et al., 2022; Adewusi, 2024; Senoo, 2024). AI's ability to process vast amounts of

data also supports climate monitoring and adaptation strategies, ensuring agricultural practices remain resilient in the face of changing environmental conditions (Zidan, 2024; Alazzai, 2024).

The influence of AI on sustainable agriculture goes beyond merely boosting productivity. It fosters a more equitable agricultural landscape by providing smallholder farmers access to advanced technologies that were previously out of reach. This democratization of technology has the potential to enhance livelihoods and food security in vulnerable communities (Akintuyi, 2024; Akintuyi, 2024). Furthermore, the integration of AI with the Internet of Things (IoT) creates a synergistic effect that enhances monitoring and control systems in agricultural operations, further promoting sustainability (Senoo, 2024; Naman, 2024). As a result, AI not only addresses immediate agricultural challenges but also contributes to long-term sustainability goals, aligning with global initiatives such as the United Nations Sustainable Development Goals (SDGs) ("Using AI to Improve Sustainable Agricultural Practices: A Literature Review and Research Agenda", 2023; Akintuyi, 2024).

AI is becoming an essential component of modern agribusiness, transforming traditional practices into data-driven and highly efficient systems. This research aims to explore the various applications of AI across the agricultural value chain and examine the challenges associated with its implementation. By analyzing key areas such as precision farming, automated machinery, predictive analytics, and supply chain management, the paper provides a comprehensive understanding of how AI can enhance sustainability and profitability in agribusiness. The objectives include to analyze the role of AI in improving precision farming techniques; to examine the use of AI in predictive analytics for better decision-making and to identify the key challenges to AI adoption in agribusiness.

The Agricultural Sector's AI Revolution

The agricultural industry is being revolutionized by Artificial Intelligence (AI), which is optimizing processes, improving resource utilization, and enhancing decision-making across the entire agricultural value chain. AI applications are diverse, ranging from cutting-edge farming methods and smart irrigation to supply chain improvements and equipment automation. As indicated in table 1, AI strengthens the agricultural input sector by providing data-driven insights for effective resource distribution. In the production phase, it automates tasks and predicts optimal planting and harvesting times. AI also enhances product quality, reduces waste, and refines supply chains in the processing-manufacturing sector, ultimately benefiting end consumers.

AI is transforming process management in agribusiness, from resource optimization to task automation. Table 2 demonstrates how AI applications in food and agriculture contribute to pest detection, crop quality enhancement, and overall farming efficiency through data-informed insights. Table 3 showcases specific AI tools, such as India's AI Sowing App, which optimizes planting times and fertilizer usage, leading to a 30% increase in yield. In the United States,

Harvest CROO Robotics reduces environmental impact by decreasing CO2 emissions by 96% through autonomous harvesting. Additionally, platforms like Plantix and Crop In provide farmers worldwide with AI-powered solutions for pest management, disease identification, and farm operations, improving both yield and crop quality. These AI advancements highlight the growing significance of technology in transforming agribusiness by enhancing productivity and sustainability throughout the agricultural supply chain. AI is becoming increasingly integrated into agribusiness, particularly in precision farming, automated machinery, predictive analytics, supply chain optimization, and market analysis. This synthesis will explore these applications, supported by relevant research.

Table 1 - Components of agribusiness

Main Components	Role & Definition
Agricultural input sector	Gives farmers access to the equipment, chemicals, feed, seed, credit, and other resources they require to operate. Improves productivity of production sector
The production sector	A series of operations that produce a final good that is sold at retail.
Processing-manufacturing sector	Set of commercial operations to process agricultural products and deliver retail food products to consumers. Insurance to production sector to decrease waste and provide customer with value.

Source: Rahman (2021)

Precision farming: AI is instrumental in precision farming, especially for crop monitoring and soil analysis. Machine learning and remote sensing technologies enhance data-driven irrigation and fertilization strategies, optimizing resource use. For example, integrating surrogate models and multi-objective algorithms has been shown to improve agricultural management by selecting optimal irrigation and fertilizer applications tailored to local conditions, maximizing yield while minimizing resource consumption (Du et al., 2023). Furthermore, AI-powered systems can analyze soil moisture and crop health data to inform irrigation schedules, leading to significant water conservation and improved crop yields (Garcia et al., 2023; Zhao, 2023).

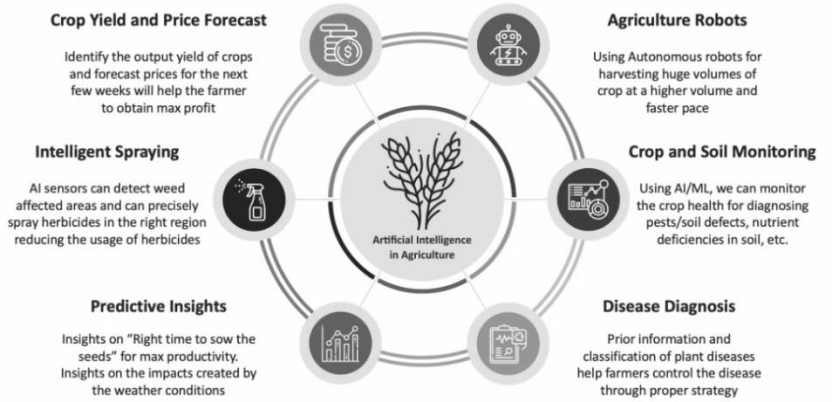

Figure 1 - Artificial Intelligence in Agriculture (Source: Grandhi, S. P. 2022)

The figure 1**,** illustrates various applications of AI technology aimed at optimizing agricultural practices. Central to the diagram, it highlights how AI can enhance crop yield and profitability through several key areas: forecasting crop yields and market prices, employing intelligent spraying techniques that target weeds while minimizing herbicide use, and providing predictive insights for optimal planting times based on weather conditions. It also showcases the role of autonomous agriculture robots in streamlining harvesting processes, monitoring crop health and soil conditions using AI-driven diagnostics, and identifying plant diseases to implement effective management strategies. Collectively, these applications demonstrate the transformative potential of AI in improving agricultural efficiency and sustainability.

Automated machinery: The implementation of robotics in field operations is another key AI application in agribusiness. Autonomous tractors and harvesters are being developed to boost efficiency and reduce labor costs. These machines utilize AI algorithms for field navigation, crop identification, and task execution such as planting and harvesting with minimal human intervention. This automation not only increases productivity but also enables more precise input application, which is crucial for sustainable farming practices (Kumar, 2023).

Predictive analytics: Predictive analytics is vital for crop yield forecasting and risk assessment in agriculture. AI models can analyze historical weather data and current climatic conditions to predict future crop yields and assess risks associated with adverse weather events. For example, machine learning techniques have been employed to develop models that forecast crop yields based on climate big data, which can help farmers make informed decisions regarding planting and resource allocation (Alibabaei et al., 2021). Furthermore, AI can enhance weather prediction accuracy, enabling farmers to better prepare for potential climate impacts on their crops (H., 2024).

Supply chain optimization: AI is transforming supply chain management in agribusiness by streamlining logistics and improving inventory and demand management. AI algorithms can analyze market trends and consumer behavior to optimize the supply chain, ensuring that products are delivered efficiently and in a timely manner. This optimization not only reduces waste but also enhances profitability for farmers and distributors alike (Cravero et al., 2022). The ability to predict demand accurately allows for better planning and resource allocation, which is crucial in the perishable goods sector (Kumar, 2023).

Market analysis: AI-driven market analysis tools are becoming increasingly sophisticated, enabling stakeholders to understand market trends and consumer behavior more effectively. These tools utilize big data analytics to forecast prices and inform decision-making processes. By analyzing vast amounts of data from various sources, including social media and market reports, AI can identify patterns that inform pricing strategies and marketing efforts (Cravero et al., 2022). This capability is essential for farmers and agribusinesses looking to remain competitive in a rapidly changing market landscape.

Table 2 - Different areas where AI is implemented

Areas	Use of AI applications	Companies that integrate	References
Web Search	AI collects users' searches and uses them to determine what this user can search for in future—designed to get the best possible outcome for each inquiry. This involves providing the most relevant search results and the best user experience on the site, both in content and overall quality.	Google Microsoft	(Kaput, 2022)
E-commerce	AI collects personalized interests and gives suggestions and recommendations to customers based on their previous experience.	Amazon	(Manole, 2022)
Machine Translation	Text-based or spoken language translation software employs artificial intelligence to provide and improve translations.	Google Translate	(Strach, 2022)
Manufacturing	AI robots utilize machine learning algorithms to automate repetitive and decision-making tasks in manufacturing facilities. As these algorithms are self-learning, they continue to improve in dealing with their assigned processes. AI robots do not need breaks and are less susceptible to making errors than humans.	Toyota Amazon Intel	(Gray, 2022)
Food and farming	AI systems are beneficial in raising and improving the overall accuracy and quality of the crop. AI technology aids in the detection of pests, plant diseases, and undernutrition in farms. Artificial intelligence (AI) sensors can recognize and target weeds before determining which herbicide to apply in the region.	Merlin Robot Milker Rosphere Harvest Automation Orange Harvester	(Revanth, 2019; Dolezal, 2021)
Public administration and services	AI delivers warnings of natural disasters and enables effective planning and impact reduction by using a wide range of data and pattern recognition.	Ororatech Global navigation satellite system	(Albayrak & Kuglitsch, 2022)

Table 3 - AI applications adopted in agribusiness

AI applications	How it works	Country	Results
AI Sowing app	Determines when to plant seeds, prepare the soil, and apply fertilizer.	India	30% increased yield
Harvest CROO Robotics	Live Harvester pick monitoring Farm-to-industry comparative analytics Harvester scheduling & control Gathering information on individual plants for performance & auditing Autonomous inspection (pack/process/reject) Direct control over the Harvester.	USA	Reducing waste and minimizing the impact on the environment. Reduces CO2 emission by 96% vs traditional manual picking
Price forecasting	The algorithm gathers information from satellites such as crops sowing area, production, yield, and weather to forecast the date of grain arrival in the market and their volume, which would impact their pricing. Karnataka,	India	Protects farmers from high inflation and price crash
Plantix	A database of 100,000 photos of sick plants is used by AI-powered image recognition to identify over 60 diseases. Farmers upload pictures of the infected plant, and the app will diagnose the disease.	Around the world. Focus in India	Pest control Yield increase

Crop In	Farmers submit complex information in an app, such as pictures of crops, information about planting and many more. This data is combined with other information in the application, and the algorithm produces recommendations for sales, risk management and storage.	India	Improve yield and quality

Source: Sadunishvili (2024)

Challenges in AI Adoption for Agribusiness

The integration of artificial intelligence (AI) in agriculture encounters several major obstacles that impede its capacity to revolutionize farming methods. These hurdles include gaps in technological infrastructure, financial constraints for implementation, and a dearth of skilled personnel and expertise. Each of these elements plays a crucial part in determining the viability and success of incorporating AI into agricultural practices.

Gaps in technological infrastructure: A primary challenge in embracing AI technologies in agriculture is the insufficient technological foundation. Numerous regions, particularly in developing nations, lack the essential digital and physical infrastructure to support sophisticated AI applications. For example, the incorporation of AI in farming requires robust systems for data collection, such as sensors and drones, which are often unavailable in rural areas (-, 2024). The lack of reliable internet connectivity further compounds this problem, restricting farmers' ability to effectively utilize AI tools (Mishra et al., 2023). The dependence on data-driven technologies in precision agriculture necessitates not only the availability of technology but also the ethical handling of data, which is frequently lacking in underdeveloped areas (Adewusi, 2024). As a result, without substantial investments in technological infrastructure, the potential advantages of AI in agriculture cannot be fully exploited.

Financial barriers to AI implementation: Expense remains a significant obstacle to the widespread adoption of AI in farming. The initial capital required for AI technologies, including hardware, software, and training, can be prohibitively expensive for many farmers, especially smallholders (Witt et al., 2021). Research indicates that the costs associated with precision agriculture technologies can discourage farmers from adopting these innovations, as they often necessitate additional application and management expenses (Koutsos & Μενεξές, 2019). Moreover, the economic feasibility of implementing AI solutions is frequently questioned, particularly in regions where profit margins are already slim (Shockley et al., 2019). For instance, while autonomous machinery can boost productivity, the upfront costs can be a significant deterrent for farmers who are risk-averse or lack access to financing (Shockley et al., 2019). Therefore, addressing these financial barriers is crucial for promoting broader adoption of AI technologies in agriculture.

Shortages in skilled labor and expertise: The scarcity of skilled labor and expertise in AI technologies presents another formidable challenge in agriculture. The successful implementation of AI solutions demands not only technical knowledge but also an understanding of farming practices (Kumar et al., 2023). However,

many regions face a considerable gap in the availability of trained personnel who can operate and maintain AI systems (Jia, 2023). This shortage is particularly evident in areas where traditional farming methods prevail, and there is resistance to adopting new technologies (Witt et al., 2021). Furthermore, as highlighted by Kumar et al., the integration of advanced robotics and AI in agriculture requires a workforce that is not only proficient in technology but also knowledgeable about sustainable farming practices (Kumar et al., 2023). The lack of educational programs focused on AI in agriculture further exacerbates this issue, creating a cycle where the demand for skilled labor outpaces supply, thereby hindering the adoption of innovative agricultural technologies (Fu, 2024).

Impact of AI on Sustainable Agribusiness Practices

The incorporation of Artificial Intelligence (AI) into sustainable agribusiness practices has become a game-changing development, especially in optimizing resources, strengthening agricultural supply chain resilience, and lessening environmental impact. This review examines these aspects, drawing from recent academic literature.

Resource optimization and waste reduction: AI technologies play a crucial role in improving resource management in agriculture by enabling precise monitoring and control of inputs like water, fertilizers, and pesticides. For example, AI-powered predictive analytics allow for the tailored application of resources based on specific crop requirements, thus reducing waste and increasing yields. This is particularly evident in precision farming, where AI systems analyze extensive datasets to guide farmers on best crop management practices, resulting in decreased water consumption and lower greenhouse gas emissions (Sakapaji, 2023; Linaza et al., 2021). Moreover, AI applications in food waste management show promise in boosting resource efficiency. By utilizing machine learning algorithms, agribusinesses can anticipate food spoilage and streamline supply chains to redistribute surplus food, contributing to a circular economy (Onyeaka, 2023).

Enhancing resilience in agricultural supply chains: The robustness of agricultural supply chains is vital in addressing global challenges such as climate change and pandemics. AI is instrumental in bolstering this resilience by enhancing demand forecasting and supply chain responsiveness. For instance, the synergy between AI and the Internet of Things (IoT) enables real-time data collection and analysis, which can predict disruptions and optimize logistics. Research has demonstrated that AI can enhance supply chain agility, allowing firms to swiftly adapt to fluctuating market conditions and consumer demands (Sullivan & Wamba, 2022; Modgil et al., 2021). This adaptability is crucial for maintaining stability and performance in agricultural sectors, particularly during crises.

Reducing environmental footprint: AI's impact on minimizing the environmental footprint of agribusiness is multifaceted. Through optimizing resource utilization and minimizing waste, AI technologies directly contribute to reduced carbon emissions. For example, AI applications in energy management within agricultural operations can lead to significant reductions in energy consumption and

associated emissions ("Incorporation of artificial intelligence toward carbon footprint management in hotels to create sustainable, green hotel: Mini review", 2024). Furthermore, AI's capacity to improve crop yields without expanding agricultural land is essential for preserving biodiversity and ecosystems (Sakapaji, 2023). The integration of AI in waste management systems also promotes environmental sustainability by enhancing sorting and recycling processes, thereby decreasing landfill contributions and fostering a more sustainable waste management framework (Sharma & Vaid, 2021; Nwokediegwu, 2024).

Conclusion and Future Directions

It highlights the profound impact of AI on agribusiness, demonstrating its ability to revolutionize several key areas within the agricultural value chain. AI applications, ranging from precision farming and automated machinery to predictive analytics and supply chain optimization, have significantly enhanced efficiency, sustainability, and profitability in the sector. By leveraging AI-driven insights, agribusinesses can make more informed decisions, reduce waste, and optimize resource use. However, despite these advancements, several challenges persist, such as *Technological infrastructure gaps:* Limited access to advanced technology, particularly in rural areas, hampers AI adoption; *High implementation costs:* The initial investment required for AI systems remains a barrier, especially for small-scale farmers; and *Skilled labor shortage:* A lack of trained personnel to manage and implement AI solutions is a significant constraint.

Future Directions

Looking ahead, AI has the potential to further transform agribusiness through *Advanced AI-integrated technologies*: The continued convergence of AI with robotics, IoT, and other emerging technologies will drive precision and efficiency in farming operations; *Scaling AI for smallholder farmers:* Developing affordable, accessible AI solutions will be crucial for promoting inclusive growth across the agricultural sector; *Investment in infrastructure and training:* Increasing investments in technological infrastructure and capacity-building initiatives will ensure that more farmers can adopt and benefit from AI tools; and *Collaborative efforts:* Greater collaboration between governments, technology providers, and the farming community is necessary to address policy challenges and create an enabling environment for AI adoption.

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CHINESE AND INDIAN AGRICULTURE: DEVELOPMENT AND CHALLENGES

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Abstract

Agriculture is a very large topic, touching directly or indirectly on many sectors of societies. Since ancient times to the present, agriculture has been the foundation of people's survival. The development of social production first started in agriculture. In other words, not only in developed countries but also in developing countries agriculture is the foundation of the national economy and thus is the basis for economic development. China and India are two of largest developing countries in the world. The development of agriculture is vital to both countries. Because of the large population in China and India, agriculture is particularly important for the two countries. In this essay, the focus will firstly be on both China and India's general situation of agriculture. In addition, the present situation of agriculture including cropping systems, agricultural infrastructure and agricultural education will be discussed. In the context of those fields, two regions are selected as case studies; southwest China and West Bengal in India to specifically analyse each region's agricultural development. Finally, from discussing the rural economy in China and India, some insights into current Chinese and Indian agricultural challenges are provided.

Keywords: *agriculture, india, china, Yunnan, west Bengal*

China is located in Eastern Asia on the Pacific West Coast. It has a land area of 9.6 million square kilometers. Although China has diverse types of land resources, mountains are much more common than plains. Mountains and plateaus cover nearly 66 percent of all land area, while only about 34 percent of land consists of plains. Furthermore, there have a big proportion of semi-arid and arid regions compared with the other humid regions. In China farming is the most significant agricultural production sector; the main crops are rice, corn and wheat. There are also cash crops, such as cotton and peanuts (Peel, 1991). India is located in the South Asian subcontinent and has a land area of about 2.97 million square kilometers. Approximately 80 percent of the population depends on agriculture for their livelihoods. India has abundant land resources and has the most arable land of any country in Asia. The per capita arable land in India is at least twice that of China (Aggarwal, 2006). Through the above introduction, it is evident that although there have some similarities concerns the general situation of agriculture in these two countries such as the fact that both are in Asia and have large population, there are still appreciable differences between them.

Background

By understanding the general situation of agriculture in China and India it is relatively easy to analysis the current situation of agricultural development in both countries comprehensively. There is considerable evidence to suggest that the level of agricultural techniques reflects a country's level of agricultural development. In China, agriculture has entered a new stage of development in the

21st century. First, the adjustment and optimization in agricultural production and rural economic structures have been improved. Second, the agricultural growth pattern has changed from an extensive mode to an intensive mode. Furthermore, in rural areas, governments established the agricultural technology extension system, in order to promote the implementation of new agricultural techniques. For instance, by 2000, in national farming, livestock and management's systems there were a total of 215,000 extension services agencies. Meanwhile, governments provided technical training as well. For example, the extension service agencies impart agricultural knowledge to farmers through television broadcast and have established places to provide scientific and technological advice (Peel, 1991). However, there still have some problems in Chinese agriculture, notably the slow of transformation in agricultural techniques and the low levels of industrialization.

Current Scenario

The current situation in India is different. Since the last decade of the 20th century Indian economic growth accelerated. However, the overall growth figures disguised an imbalanced development between different sectors. For instance, from 2005 to 2006 the annual GDP growth rate of India was 8.4 percent. However, agriculture grew by only 3.9 percent. Another factor limiting agricultural development and the improvement of farmers' income is lack of modern infrastructure. Because of the lack of infrastructure such as roads and markets, many agricultural sectors' developments are limited. The rate of agricultural products which are processed only 2 percent, which is under the international level. In addition, there is a large number of poor and unemployed population of farmers. This situation may lead to urban slums. It is estimated that urban slums' population more than 70 million in India. Moreover, there has been a lot of urban drift. In response Indian governments have already carried out some new policies related to agriculture. For example, governments have adopted various policies to develop export of agricultural products, such as establishing the Special Administrative Region of agricultural exports and attracting foreign investment in some agricultural sectors (Aggarwal, 2006).

Comparative Study

The previous paragraph has outlined the current situation of agriculture in China and India, it is necessary to analyse the specific situations in detail in order to provide insights into current challenges. The reason why two regions have been selected is that both regions are major agricultural provinces. Furthermore, both regions have similar physical geography. For example, compared with other regions in these two countries, Yunnan Province and West Bengal are almost in a same latitude area and these two regions' average annual precipitations exceed 1000mm. In comparing Yunnan Province and West Bengal's agriculture, three main aspects are discussed below.

Firstly, in the aspect of cropping systems, it is evident that the terrain conditions and climate change may influence the cropping system to some extent. In other

words, cropping systems are subject to environmental constrains. There are a great number of high mountains in the southwest of China and Yunnan Province belongs to Yunnan-Guizhou Plateau. Because of the mountainous land, much of the cultivated land is on mountains. The temperatures on the Yunnan-Guizhou Plateau are usually lower than many other regions of China because of its high altitude. So the two crops of rice a year cannot be grown on this plateau. The main crops in Yunnan Province are rice, wheat and maize. However, the rice paddies is quite different from normal paddies because this kind of rice has to be grown in the mountains, where irrigation is more difficult (Xu, 1991). However, the cropping system in West Bengal is not the same.

Although the north of West Bengal is mountainous area, the south consists of alluvial flatland. West Bengal has a tropical climate which means that in the plain's area winter is usually short. The type of landform and climate makes a big difference to cropping systems. In contrast to Yunnan Province, the landform and climate of West Bengal allows multiple cropping to take place. Multiple cropping is defined as different crops grown on the same land. For example, the common form is that to plant a summer crop such as potato in the rice field after the rice harvest, then to leave the field fallow in winter, and to plant a spring crop such as maize in the spring. This kind of cropping system leads to higher productivity and promotes the development of intensive cultivation (Rudra, 1983).

Secondly, in the aspect of agricultural infrastructure, the weakness of the agriculture in Yunnan Province is that it is far away from the sea and the inconvenience of transportation. Although in Yunnan Province highways are common, most of them meander through the mountains, so it is not easy for farmers to cultivate their land and they have to keep to the existing farmland instead of opening up new land which is far away from their houses. (Xu, 1991).

West Bengal has a similar situation in agricultural infrastructure to that of Yunnan Province. Admittedly, West Bengal has its own geographical advantage which benefits agricultural development. However, the infrastructure in India is lagging behind and this is also a major aspect restricting the development of agriculture. For example, even now there are no roads to go to some rural areas in India. People who are living in those areas cannot transport food to outside and this constrained the rural agricultural promotion. Now the Indian government is aware of this point and advocates local governments to make plans for building rural link roads (Rudra, 1983).

Last but not least, in the aspect of agricultural education, although in Yunnan Province the history of higher education in agriculture is quite short, nowadays the local governments have realized the importance of agriculture and begun to establish more agricultural colleges and institutions. For example, in 1985, only Yunnan Agricultural University existed as an agricultural institution of higher learning (Peel, 1991: 238). However, the situation changed a lot in recent years. Now there are many secondary schools specializing in agriculture. Furthermore, there are also some middle schools which include agriculture in their curriculum. In rural

areas, agricultural training is also provided for people. Since living standards of farmers have developed, their interest in agricultural training has also increased.
It is evident that West Bengal has paid more attention to agricultural education. In the middle of the 20th century, the 'Green Revolution' began in India and had a profound effect in agriculture. Since then successive Indian governments established the agricultural science and technology promotion network from central to local areas. West Bengal was also influenced by this agricultural revolution. In West Bengal local governments have already established an online agricultural education system for farmers. Farmers can easily access the latest agricultural information through computer shops and markets. In addition Indian Tobacco Company carried out a plan to combine market information regarding tobacco in West Bengal to that of the whole world (Mukherji, 1997). Moreover, according to Rudra (1983: 7) more than half of the agricultural families as labor families in West Bengal. The situation in Yunnan Province is almost the same, there are approximately 60 percent of the agricultural families as labor families.

Development

In addition, by comparing the agriculture in those two regions it is available to outline the development of rural economy in two countries. In China, agriculture has always been regarded as an important part of the national economy. As Yao states (1991: 179) " For the past 30 years agricultural policy has been drafted in accordance with the principle that 'agriculture is the basis of the national economy and grain is the basis of that basis' ." Agriculture promotes rural economic development. In India low incomes of rural farmers are due to the lack of economic opportunities. Not only in India but also In China many people in rural areas still are unable to pay for many things. Though with the development of agriculture the rural economy has increased and there have been a number of programs which have been put into practice by the local and national governments to address the problems of poverty in rural areas, the situation still needs to be improved. The rural economy is inextricably intertwined with the national economy, so governments in these two countries should continue to pay close attention to it.

Challenges

The key challenges for both countries can be divided into two parts; domestic and international. To discuss the domestic part first, although both countries have made great progress in agricultural development in recent years, agricultural productivity remains low and the development of the rural economy had lagged behind that of national economy. In other words, the agricultural productivity still does not meet the demand for food and this will continue to constrain economic development. For instance, in Yunnan Province, farmers' low incomes and rural societies' poor development led to low agricultural productivity, because people regard agriculture as a weaker industry. In 2002, the rural population accounted for 80.5 percent of general population in Yunnan Province. However, agricultural value added as a percentage of GDP is only 20% (Li, 2010). Furthermore, market

development is another significant challenge for both countries. Since two countries do not have an improved market system compared with other western countries. Moreover, because of the agricultural infrastructure, it is problematic for farmers to take crops to markets for sale. This will lead to an imbalance market development between urban and rural areas. The international challenge is that although globalization has influenced all the aspects of the economy, including agriculture, the trend of globalization will be a threat to many countries around the world, especially those which do not have a modernized system and are not well prepared to deal with challenges (Xu, 1991).

Conclusion

To conclude, agriculture is an important sector to developing countries. Judging from the two countries' economic development from past to present, agriculture has a vital role in the national economy. The promoting speed of agriculture determines the increasing speed of national economy. This is a significant feature in both countries' development. Both China and India should try to change the traditional agricultural conception and improve their own agricultural systems. In addition, both countries need to explore international market and carry out effective policies according to domestic situation.

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ARTIFICIAL INTELLIGENCE HOME AUTOMATION SYSTEM WITH PATTERN ANALYSIS

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Abstract

Recent days, automation is playing significant role using computers (android phone) in human daily life, particularly, handicapped and senior citizens. Currently people to interact with home appliances need to be direct contact with them, which means that to take action on them such as switch on and off light (Bulb), switch on and off television, etc. This interaction requires enough time in one way or another, waste their money on unknown home appliances that is switched on and they need to be at home to carry out this kind of job. As we know, technology has come to easy many jobs for this current generation. Many things can be done without involving yourself manually. This has also spread to the home appliances control. Instead of operating home appliances using your hands, you can operate it remotely wherever you are. Appliances automation allows users to manage different appliances such as light (Bulb), PC, TV, charging electrical and electronics devices and so on. It can also give privilege to the home in charge to controls temperature variation and take action according to sensed temperature data. It has been observed that the internet services in all part of country especially in rural area are not as much better as required. Hence, GSM SIM900A based android application is developed named Home Appliances Automation system using Arduino. The developed system is decomposed into two separate entities: Hardware is designed and developed using Arduino UNO with other required electronics components that is programmed using embedded C language, and software that provides freedom to user to control and access the electronic appliances and the security system without internet. The overall objectives of this project is to design and implement Home Appliances Automation system with GSM from SMS sent by android application by using Arduino Uno to control automatically home appliances anytime, anywhere by using Smartphone. I recommend also all public institution and private institution to use Home Appliances Automation system instead of using manual system in case they are going to control home appliances for good, security, quick and smart control.

Keywords: *Arduino Uno, Artificial Intelligence, SMS/GSM-SIM900A, Home Automation System, Microprocessor and Pattern Analysis*.

The phrase "*Internet of Things*" describes a collection of actual "things" that are outfitted with sensors, software, and other technologies and linked to a network of other hardware and systems via the internet. These gadgets include everything from standard domestic items to state-of-the-art industrial machinery.

One of the most important 21st-century technologies to recently emerge is the Internet of Things. Today, the capacity to connect everyday objects to the internet via embedded devices, such as home appliances, vehicles, thermostats, and baby monitors, enables seamless communication between people, processes, and things.

Low-cost computers, the cloud, big data, analytics, and mobile technologies enable sharing and collecting data by physical things with the least amount of human interaction. Digital systems can record, monitor, and modify every

interaction between connected things in today's highly connected environment. The physical and digital worlds connect and work together. A remote control is an electrical device that is used to wirelessly and remotely operate another device. It is also referred to as a clicker or remote. Consumer gadgets such as televisions, digital video/versatile players, and other appliances can all be controlled by a remote control.

Now that we have remote controls for all of our modern electronics, life is much easier. Have you considered installing a Home Appliances Automation system that would allow remote control operation of your electrical appliances and tube lights? Of course, yes! But are there more affordable options? We have found a solution if the response is "No." We have created a new system known as the Home Appliances Automation system using the Global System for Mobile (GSM). The user of this system will be able to control any electronic device without even having to pay for a remote control thanks to how cost-effective it is. With an integrated computer and additional features not typically found in phones, such as an operating system, web browsing, and the capacity to run software applications, this project makes it possible for users to control all of their electronic devices using a cellular phone (Smartphone). Having time is valuable. Everybody wants to save time, and it's not difficult to do. To assist people, save time, new technologies are being developed daily. We are happy to present the "*Home Appliances Automation system*," a brand-new system that makes use of the Global System for Mobile. The machinery and electrical appliances in your home can be managed using this technique and your mobile phone.

Literature Review

Projects associated: Home Automation system using Bluetooth: Bluetooth Based Home Automation Project using Android Phone was worth to notice on it while developing the project. This project was used to control and switch device on and off in a small diameter as Bluetooth don't have the range as Wi-Fi and GSM have technology which can control appliances in longer distance than Bluetooth technology Automation is also involved in building management system in which lights, temperature, security devices and other appliances are controlled through a high degree of computer involvement. In this report, all the devices, which are used in building management system, are control by a single controller using a wireless network. Client module and host controller are used to communicate with each other through a wireless device such as Bluetooth enabled the mobile phone. In this report, an android-based smart phone is used. This project was used in short range of distance and has numerous disadvantages: Bluetooth is used in this Home Appliances Automation system, which has a rage 10 to 20 meters so the control cannot be achieved from outside this range; Application is connected after disconnect of the Bluetooth; When the new users want to connect the first download application software then the code and configuration must be done. (Lab, 2016).

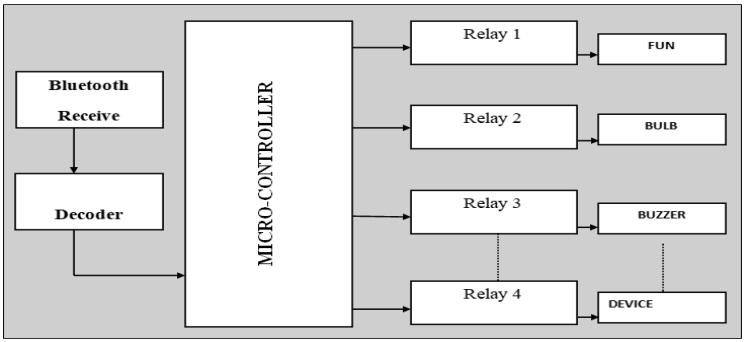

Figure 1 - Block diagram of Bluetooth based Home Automation.

Algorithm of Home Automation system using Bluetooth: STEP 1: Start; STEP 2: Connect Bluetooth; STEP 3: Send Request to The Micro Controller; If the request matched to the criteria from C++ script (arduino programmed instructions); Give command to the relay to turn OFF or ON the connected appliances; If the request isn't matched to the criteria from C++ script (arduino Programmed instructions); Back to step 3; STEP 4: Stop

GSM based home devices control system: GSM based home devices control system is another interested project we noticed on and we learned a lot about it while we were developing Home Appliances Automation system. The basic concepts of this project is to turn on or turn off home devices like fans, lights etc. through mobile phone. So SMS is used for this purpose. SMS communicates information between two devices. GSM module is kind of mobile phone. It has built in subscriber's identity module i.e. SIM. GSM module is connected with microcontroller. GSM module interfacing with microcontroller is not difficult task. Control devices are also connected with microcontroller. (Microcontrollers, 2015)

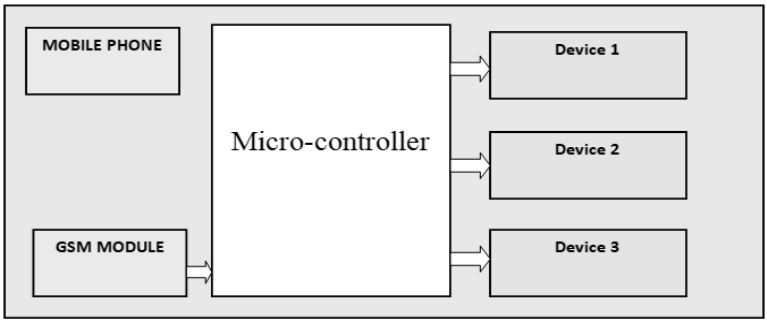

Figure 2 - Block diagram of GSM based home devices control system

Algorithm of GSM based home devices control system: STEP 1: Start; STEP 2: Open The Android App; STEP 3: Give The Request Via Android App Buttons;

STEP 4: Send Request To The Micro Controller; If the request matched to the criteria from C++ script (arduino programmed instructions); Turn OFF or ON the connected appliances; If the request isn't matched to the criteria from C++ script (Arduino Programmed instructions); back to step 3; STEP 5: Micro Controller Send Feedback to The User in The Form of SMS (GSM); STEP 6: Stop

Introduction to AT command: AT commands are instructions used to control a modem. AT is the abbreviation of Attention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones.

Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

Note that the starting "AT" is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. For example, D is the actual AT command 8 name in ATD and +CMGS is the actual AT command name in AT+CMGS. However, some books and web sites use them interchangeably as the name of an AT command.

Note that mobile phone manufacturers usually do not implement all AT commands, command parameters and parameter values in their mobile phones. Also, the behavior of the implemented AT commands may be different from that defined in the standard.

In general, GSM/GPRS modems designed for wireless applications have better support of AT commands than ordinary mobile phones.

In addition, some AT commands require the support of mobile network operators. For example, SMS over GPRS can be enabled on some GPRS mobile phones and GPRS modems with the +CGSMS command (command name in text: Select Service for MO SMS Messages).

But if the mobile network operator does not support the transmission of SMS over GPRS, you cannot use this feature.

Basic Commands and Extended Commands: There are two types of AT commands: basic commands and extended commands.

Basic commands are AT commands that do not start with "+". For example, D (Dial), A (Answer), H (Hook control) and O (Return to online data state) are basic commands. Extended commands are AT commands that start with "+". All GSM AT commands are extended commands.

For example, +CMGS (Send SMS message), +CMSS (Send SMS message from storage), +CMGL (List SMS messages) and +CMGR (Read SMS messages) are extended commands. (SMS Tutorial: Introduction to AT Commands, Basic Commands and Extended Commands).

Used languages and technologies

Arduino Microcontroller: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone, children, hobbyists, artists, programmers can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50.

Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers.
The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

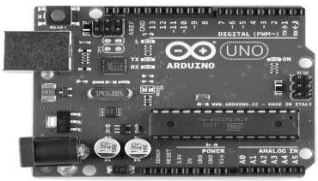

Figure 3 - FArduino Uno microcontroller

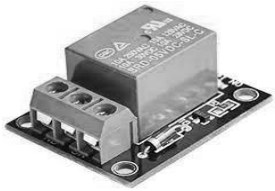

Figure 4 - Relay

Relays are the switches which aim at closing and opening the circuits electronically as well as electromechanically. It controls the opening and closing of the circuit contacts of an electronic circuit. When the relay contact is open (NO), the relay isn't energizing with the open contact. However, if it is closed (NC), the relay isn't energize given the closed contact. However, when energy (electricity or charge) is supplied, the states are prone to change.
Relays are normally used in the control panels, manufacturing and building automation to control the power along with switching the smaller current values in a control circuit. However, the supply of amplifying effect can help control the large amperes and voltages because if low voltage is applied to the relay coil, a large voltage can be switched by the contacts.
If preventive relays are being used, it can detect over current, overload, undercurrent, and reverse current to ensure the protection of electronic equipment. Last but not the least; it is used to heat the elements, switch on audible alarms, switch the starting coils, and pilots the lights.

Global System for Mobile (GSM) module

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell

Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

GSM Architecture

A Mobile Station: It is the mobile phone, which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.

Base Station Subsystem: It acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station that contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the Base Station Controller, which controls the Base Transceiver station and acts as an interface between the mobile station and mobile switching center.

Network Subsystem: It provides the basic network connection to the mobile stations.

The basic part of the Network Subsystem is the Mobile Service Switching Centre, which provides access to different networks like ISDN, PSTN etc. It also consists of the *Home Location Register* (HLR) and the *Visitor Location Register* (VLR), which provides the call routing, and roaming capabilities of GSM. It also contains the Equipment Identity Register that maintains an account of all the mobile equipment's wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity.

Features of GSM Module: Improved spectrum efficiency; International roaming; Compatibility with integrated services digital network (ISDN); Support for new services; SIM phonebook management; Fixed dialing number (FDN); Real time clock with alarm management; High-quality speech; Uses encryption to make phone calls more secure Short message service (SMS)

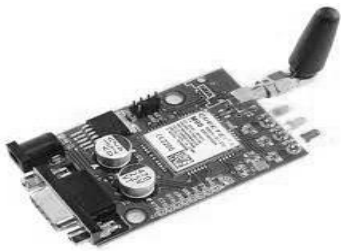

Figure 5 - GSM module

Project Methodology

The last technique I utilized to gather information for my thesis was observation. I looked through the electronic library for documents, used information search engines, and visited many electronics websites. With this method, you look at how things are currently done and, depending on the circumstance, develop a solution. Relays, a smartphone, a Global System for Mobile Communication (GSM) mobile communication modem, and an Arduino Uno microcontroller will all be used in this investigation.

System Analysis and Design

This project's main goal is to plan and implement A Home Appliances Automation system. A number of works have been finished in order to achieve this. The approach for the research attempt is shown in this portion of the project. It describes the research methods used to compile all the data, look at the problems with the current system, and evaluate the suggested replacement system.

A review of the present system: The system should concentrate on assisting the user in preventing unwanted access utilizing manually operated equipment, as well as monitoring all of the appliances placed throughout the house.

Issue with the present system: People today need to interact physically with household appliances in order to interact with them. This calls for them to take activities, such as turning on and off lights, televisions, or other electronic devices, on them. They invest their time and money on unidentified home equipment that are on and demand their presence at home in order to be manually completed.

Analysis of the new system: As is widely known, technology has made many things simpler for the modern day. You don't need to perform many tasks manually. This directly impacts how home appliance control functions. Without using your hands, you may operate home appliances remotely from anywhere.

System Requirements: The technique presented in offers three ways to operate the house: speech, the Internet, and the GSM network. Real-time monitoring is a crucial component of marketable Home Appliances Automation systems. The user may get a prompt alert when the devices' condition changes. Typically, user commands are sent from a PC to a server.

Before sending user commands to the appropriate units, the server processes them. This might facilitate controlling the machinery. GSM is utilized as a communication tool to aid in connection establishment in locations where suitable internet coverage might not be available. The server and GSM modem communicate using AT commands. The mobile interface was designed using J2ME. The system can be managed by SMS. The system uses a PIC16F887 microcontroller to manage home appliances. The appliances are controlled through GSM. In this method, SMS is utilized. GSM has gained popularity due to its superior availability, security, and coverage. SMS codes are the main method of controlling home appliances. The delivery of AT commands, which control the home appliances, is made possible through the GSM network. Additionally, the device sends and receives SMS messages from the user.

This technique may, however, result in additional SMS charges. The user cannot operate the device via a user interface (UI). This method's limitation is that it cannot program the devices.

Due to SMS's dependency on the networks, delivery delays are also possible. It is the user's responsibility to monitor the device's status because the system provides none. The AT (attention) directives and SMS were combined by this system.

Its primary control panel is a smartphone. The household appliances are controlled by a system based on the GSM network via SMS, as seen in the image below. An Arduino board serves as the appliance interface controller. Specific peripheral drivers and relays are used to implement this interface. Phones serve as the user interface. The system uses "App Inventor," a visual programming tool, to develop the user interface and other technologies to distribute the app.

The application generates SMS messages and sends them to the Arduino's GSM modem based on user commands. This enables the user to control the household appliances. Similar to SMS, the technology has price and dependability problems. Additionally, the interface is preprogrammed and cannot be adjusted to the devices.

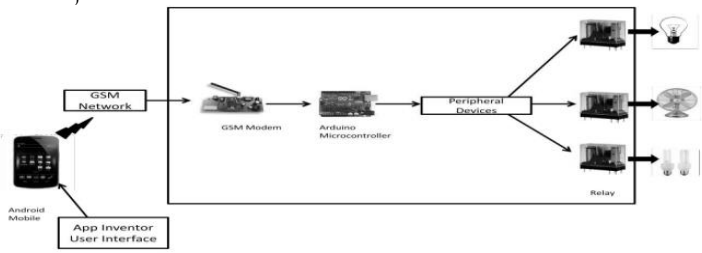

Figure 6 - GSM based Home Appliances Automation system

The projected voice control technology will enable the elderly and disabled to remotely control appliances. The main form of communication is GSM. Using a mobile device, the speech commands are recorded and converted to text. This is sent as an SMS message to another phone through the GSM network. This other phone uses Bluetooth to transmit the text commands to the Bluetooth module. A microcontroller from the PIC16F877A series is connected to this module.

This controller reads the commands and does the required actions. The load is kept apart from the control circuitry by using a separate mechanism to control electrical circuits. The system also offers feedback to let the user know how the command has worked.

Due of its voice command feature, everyone can use this system. However, because SMS is used, it is unreliable. The necessity of two phones one in the user's possession and another in the close proximity of the controller can incur significant expenditures. A system uses an AVR microprocessor and the GSM network. This approach also depends on SMS. User inputs are used to enter commands.

Data Collection Technique; Documentation Technique; I used search engines to locate documents and other electronic libraries in addition to browsing the actual contents in the electronic library for my research assignment.

Observation Technique

Observation was the final technique we used to collect data for our project proposal. These methods comprise evaluating how things are currently done and coming up with a remedy based on the circumstance.

Algorithm of the new system: STEP 1: Start; STEP 2: open the android app; STEP 3: Give the request via android app buttons; STEP 4: Send request to GSM; STEP 5: If Request received well by GSM; Send the action to Microcontroller (Arduino); STEP 6: If is not received well by GSM (Not interrupted); Back to STEP 4; STEP 7: GSM Send request to the micro controller; If the request matched to the criteria from C++ script (Arduino programmed instructions); Order relay to turn OFF or ON the connected appliances; Send feedback to the Mobile User; STEP 8: Stop

Result and Discussions System Implementation

Outcomes: I reached a lot of theoretical and practical conclusions after putting my study project into practice. Theoretical outcomes: My circuit is powered by an AC source. The entire component connected to the Arduino must get 5V of DC power; this power can come from the computer or the AC to DC converter on the Arduino. We also know that five volts, or 5V, are the difference between zero and five volts. 5V and above. A digital circuit recognizes the 5V as bits, and it has been determined that 5V equals 1024 bits.

Following analysis of the literature, each component used in our project conceptually defines its purpose and result, as shown in the table below:

Table 1 - List of components, its application and its theoretical desired result

No	Components	Purpose of component	Result in project
1	Relay	To switch AC home appliances	Changing the status of appliances
2	Microcontroller	Heart of the project	To detect action, require and order component selected to perform that action
3	GSM	To send and receive SMS	GSM allows you to receive notifications on your phone.
4	Mobile phone	To send and receive SMS	To send command and to receive notification of performed action

Practical Results: As we have discussed above the practical result that we obtain after implementing, we did many test to make sure that what we expect to do are done, by referring to the theoretical result we had, we have seen that in the following table:

Table 2 - List of command used to control home appliances

No	Commands	Functions	Response from android mobile phone
1	INDOOR ON	Turn on living room lamp	LIVING ROOM LAMP IS TURNED ON
2	INDOOR OFF	Turn off living room lamp	LIVING ROOM LAMP IS TURNED OFF
3	OUTDOOR ON	Turn on outside lamp	OUTSIDE LAMP IS TURNED ON
4	OUTDOOR OFF	Turn off lamp	OUTSIDE LAMP IS TURNED OFF
5	TV ON	turn on television	TV IS TURNED ON
6	TV OFF	Turn on television	TV IS TURNED ON
7	PC ON	Turn on pc	PC IS TURNED ON
8	PC OFF	Turn off pc	PC IS TURNED OFF

Description of the project

Figure 7 - Main

Figure 8 - App info

Figure 9 - History

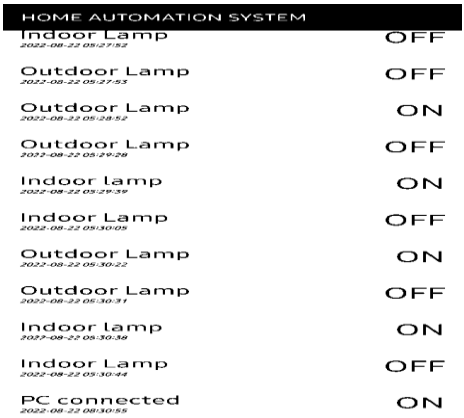

Figure 10 - Feedback

Discussion

This section, where I explain how the work's theoretical and practical findings came to be, is the most important part of my work.

After looking at them, I realized that my product is offering a solution to the problem I wanted to address. By sending a command to the SIM installed in the GSM module using an Android mobile phone, a homeowner can remotely control appliances in my circuit system.

The microcontroller is then automatically interrupted and given instructions to tell the relay to change the status of the appliances, turning them ON or OFF, based on the feedback received from the home appliance.

A GSM SIM card will be given to the registered Android phone as of the time of this writing.

Conclusion

Design and implementation of the Home Appliances Automation system has been implemented successfully. The purpose of the project is to use mobile phone inbuilt SMS facility and GSM Modem for automation of Home Appliances. Home Appliances Automation system application program is tested on various Android mobile phones that are quite satisfactory and responses received from the community in general are encouraging. I can also conclude that the objectives of this research project have been successfully met and they are as follows: Constructed Home Appliances Automation system controlled by an android mobile phone application, To remote and control home appliances anywhere anytime, To allow the people to switch ON/OFF home appliances from single device without movements especially disabled and elderly people, To help project user to save energy, improve safety and effective usage of electrical equipment and appliances, To provide smart life for project user by

giving peace of mind and avoiding the stress where he/she forgot to turn ON/OFF home appliances

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CLOUD COMPUTING AND SECURITY: THE SECURITY MECHANISM AND PILLARS OF ERPS ON CLOUD TECHNOLOGY

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Abstract

Cloud computing is one of the latest technologies that has been employed by many organizations. The technology presents the cheaper means of data management through a secure cloud system. The majority of organizations have opted for cloud computing technology since it is a reliable means of managing organizational information. However, many critics have complained about the security feature of the cloud systems since third-party companies handle them. Research shows that the sophisticated technology provided by cloud has shown some vulnerabilities hence not trustworthy. Research indicates that many organizations fail to report the cybercrimes associated with cloud system due to reputation damage and embarrassments associated. This paper will address the cloud computing security, taking the case study of ERP systems on the use of secure cloud systems.

Keywords: *Cloud computing, security, ERP, Server, data privacy, cryptographic, VMware*

Cloud computing is a technology that involves hosting applications, information, and other organization services on the servers and accessing the software via the internet connection. Under this technology, the organizations can pay for the services they require to a company hosting for them. To access the resource and computing power from cloud space, services must be paid for depending on the usage pattern (Al-Mashari & Zairi, 2000). The institutions are the rule of the game that is; they include primary constraints like laws, and practice, relaxed restrictions like conventions and behaviors are controlled. This research will seek to discuss the issues related to the application of ERP's security and privacy at the cloud systems. Secondly, it will consider if there are any security mechanisms and pillars that can be established to facilitate trustworthiness and confidentiality of data stored on the cloud servers.

Cloud computing is one of the latest technologies that are likely to drive many organizations to greater heights. The concept of cloud computing has been widely accepted by regular internet users. However, some severe organizations have a great concern over the security features of these systems.

Companies are moving to the implementation of cloud technologies to perform critical functions at least cost. At the same time, these companies are faced with a challenge on how to protect the data and all users' information stored on the cloud systems. Security, confidentiality, and privacy are the first concerns when it comes to cloud servers, as compared to the cost of operation (Al-Mashari & Zairi, 2000). For companies, lack of technologies and resources to manage third-party security in the cloud servers can result in low cots safety. Cloud computing users consequently are facing various security related risks.

The cloud systems have both technical and institutional challenges. The legal regimes relating to cloud safety management are developing slowly as compared

to the rate of technology expansion. The safety issues like privacy, information ownership, and privacy currently are not covered adequately in the current legal systems. Some researchers are arguing that the organization is supposed to be legally responsible for customer's data rather than the third-party company (Al-Mashari & Zairi, 2000). Another issue raised is the lack of respect on how some third-party companies handle client's information. Criticisms also are facing cloud providers because they do not investigate their clients, who are the organizations whether they have secure systems before processing their data.

Businesses and many other clients have expressed their concern on the issue of data security. They have become more cautious about the use of cloud services to store their highly valued and sensitive data. Due to weak security strategies implemented, cloud systems remain the riskiest approach to manage information (Al-Mashari & Zairi, 2000). According to the report done by the International Data Corporation in 2008, safety was the most significant obstacle to the embracing of cloud computing technology. Additionally, the organizations are worried about any hidden charges associated with the lawsuits and security breaches of data privacy.

General Analysis and Problem of Statement

Security issue with cloud computing technology is the new puzzle for many organizations today. The whole idea of implementing cloud services is to reduce the cost involved in managing all resources and software at the organization level. With the virtualized environment, the user can access information from any location and at any time of the day (Al-Mashari & Zairi, 2000). These services are known as Software as a Service (SaaS). Enterprise resource planning is a type of software that unites all the operations of the organization through a single interface. It changes all the organizational processes while managing all data effectively.

Probabilities of a fruitful execution of an ERP in an association are less. Likewise, it takes a generous measure of labor, cost, and exertion to convey and keep up the ERP. A whole ERP application being re-appropriated is a moderately new thought and has been under dialog much of the time for its points of interest and some inert disservices (ECONOMIST, 2009). In today's world with such monetary circumstances, it suits authoritative for an association to lessen its working expenses while expanding mostly productivity with a similar measure of assets and to satisfy client's requests (Al-Mashari & Zairi, 2000). This is the dwelling a cloud and anchored based ERP can indeed encourage a company, nevertheless some remarkably relevant inconveniences that must be defeated to make this a more feasible choice to a "best of breed" or an off-the-shelf ERP arrangement, complete.

The barriers to the implementation of cloud computing technology depends on the data of the organization. If the organization is handling substantial data sets, it will be useful to manage it through the cloud service. However, many other situation can call for the use of cloud technology. These factors can be the saving of operation cots, fault tolerance, on-demand service, data flexibility, and

compliance data formats, on-demand service and information reliance (ECONOMIST. (2009). There are four diverse types of cloud services that an organization can opt to use dependent on the company requirements. The four categories include public cloud, accessed by any subscriber, secondly is the private cloud, obtained by a specific controlled group, the third one is the community cloud, which is shared among the organizations members and the last one, is the hybrid cloud, which is any combination of the above types (Al-Mashari & Zairi, 2000).

Objectives of the Study

The general objectives and specific objectives are addressed in this study. The general aim is to illustrate and identify various cons and pros that will result in an organization that utilized cloud computing or a cloud-based ERP system and the possible security risks associated. The objectives of this study are: to investigate the current cloud systems framework; to analyze if the cloud systems are associated with any security vulnerability; and to evaluate any possible disadvantages of adopting cloud computing technologies in an organization.

Literature Review

ERP systems are the current software used in many businesses for storage of information and computing purposes. An ERP system manages and integrates all business processes into one entity to facilitate activities of the company through a simple software. Most organizations view the ERP-integrated system as a means of standardizing the organizational operations and provides seamless access to information in the business. ERPs stores and manages information at an appropriate format while stretching past business boundaries (ECONOMIST, 2009). Since this system touches all parts of the organization, it is a critical tool to facilitate organizational performance.

One key challenge with the adoption of ERP is the flexibility of the business to welcome the new integrations into data processing systems. The flexibility involved denotes to the degree to which the ERP software can be configured to meet the requirements of the business. In other words, some managers find the ERP system difficult to use when integrating projects (ECONOMIST, 2009). The online delivery has been a long-term dream for software salespersons and suppliers. There are several areas for future research about ERP systems and the cloud computing technologies. Instead of licensing software like the ERP system, it is cheap and convenient to adopt the system form the cloud service provider who created the software.

A cloud is a type of disseminated computer system with a gathering of interconnected virtual computers. These computers are unified through a single server to allocate resources upon request. Most of the applications developed on cloud systems are determined by the services demanded by the physical location provider. The benefits of cloud-based systems are that they offer flexibility, reliability, agility, and interoperability. Cloud computing presents easy scalability and flexibility of resources and dismantling of funds and clients require during

the peak workloads (ISACA, 2009). The use of cloud system offers a pay-per-use basis with a fixed cost and reduced risk.

Cloud-based ERP systems have a slighter time measure for configuring and deploying the software. The effects the agility of the system and the business and reduces the costs involved with time delays (ECONOMIST, 2009). This system allows the organization to benefit from a competitive edge. Through this system, organizational data is accessed globally form any location; this also facilitates virtual working.

Besides the aspect of data security, the adoption of cloud systems has some regulations and legal procedures. When moving submissions to the cloud, the organization can opt to trace the resources anywhere on the planet concerning the laws applicable (Kim, 2009). For instance, some cryptographic strategies may not be applied in some other countries due to restrictions present (ISACA, 2009). Cloud services have decreased the expense of substance stockpiling and conveyance. However, they can be hard to use for non-designers, as each administration is best used using remarkable web benefits, and have their very own one of kind idiosyncrasies (Kim, 2009). A client could likewise get frightful amazement on the off chance that they have not comprehended what they will be charged for (Kim, 2009). Merchant secure is another issue that an association may need to confront if they need to relocate towards another specialist organization.

Research Methodologies and Theoretical Frameworks

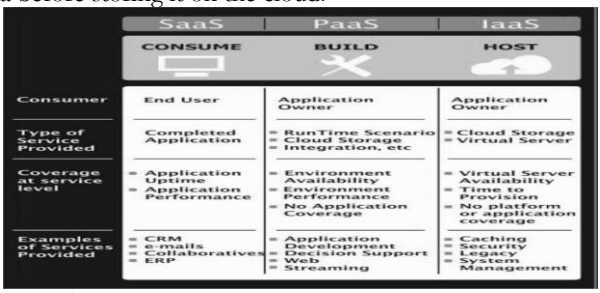
This research was focused on finding a solution to the problem of cloud-based ERP systems. Formulating a research topic is very significant in any study. To evaluate the pros and cons of ERP systems, which are cloud-based, and its security impact, the background of the topic was first assessed.

Qualitative research contributed to the investigation of how cloud-based systems are vulnerable to security issues. Qualitative approaches are based on the non-numerical data by providing means of behavior assessment in quantitative data (Bryman & Bell, 2003). It seeks to evaluate a concept and the meaning of a phenomenon. Personal methods depends on the conviction that the people are on-screen characters who play a functioning job in reacting to circumstances and the acknowledgment that the reaction depends on the specific importance (ECONOMIST, 2009). The comprehension of this importance is characterized and reclassified through cooperation, with affectability to situations and the connection between health, activity and the result (Bryman & Bell, 2003). Subjective examination considers better contrasts to be uncovered which will enable the analyst to explore his case thoroughly. As indicated by research, the attributes of this methodology as empowering the scientist to examine marvels in their standard settings, while endeavoring to decipher these wonders as far as the implications individuals convey to them.

Cloud's Newness and Unique Vulnerabilities

The cloud's new uniqueness and newness in the organizations come with particular problems. With more popularity on this technology, new bugs,

security issues and vulnerability with virtual technologies are experienced. Cloud systems, however, are not familiar with many IT security companies. Lack of strategies to offer security at the cloud (ISACA, 2009). Experts are arguing that such vulnerabilities can provide a dangerous effect to the company implementing the technology (Boykin, 2001). The cloud can be challenging forensically in case there is the data breach. For instance, some public cloud systems can store information differently depending on the regulations regarding data privacy, data loss and privacy issues. Some companies may opt to encrypt data before storing it on the cloud.



Cloud computing Layers according to Gartner, 2009.

Results of the Study

Cloud computing is the latest technology that has proved to be the best for many organizations. Some of the popular cloud service providers include Google, Amazon, Microsoft, IBM, and VMware in conjunction with other third-party companies (Boykin, 2001). The interpretation of the results from this research was based on third-party auditors, technology awareness, virtual network providers, cloud-based systems and access controls to the cloud information (Boykin, 2001). To secure the data stored on the cloud-based ERPs, the organization should look for means of encrypting information when retrieving it from the cloud systems. Secondly, there should be legal strategies governing third-party organizations that offer cloud services.

The model introduced in this paper likewise has suggestions for administration practice and open arrangement. Most cloud providers‟ administrations accompany no affirmation or guarantee of a given level of security and protection (Dubey & Wagle, 2007). Cloud suppliers need strategies and practices identified with protection and security. Nor is that their separate issue. Cloud suppliers have likewise exhibited a propensity to lessen their obligation by proposing contracts with the administration gave "as seems to be" with no guarantee (Boykin, 2001). View of inadequacy or resistance of cloud suppliers may consequently go about as a detour to organizations‟ cloud reception choices. In such manner, the above examination demonstrates that security and protection estimates intended to decrease apparent hazard and straight forwardness and clear correspondence procedures would make an upper hand for cloud suppliers (Boykin, 2001).

The novelty and uniqueness of the cloud frequently imply that customers would not comprehend what to request in speculation choices. A comprehension of model would likewise enable associations to take mechanical, conduct and perceptual/attitudinal measures (Al-Mashari & Zairi, 2000). The clients of the cloud are working on the supposition that cloud suppliers consider protection and security issues important. Nevertheless, against the background of the institutional settings, this likely could be an advantage however perhaps false suspicion.

Conclusion

Cloud computing is one of the modern technology that is useful in many organizations. Cloud computing works on the basis that it provides information in a quick and accessible means within the shortest time possible and form any geographical location. However, the issue of security and data privacy at the cloud-based ERP systems have paused a challenge to many organizations when it comes to adopting this technology. Distributed computing is a multi-occupant advantage partaking stage, which allows varied specialist governments to convey software design as administrations and convey equipment as administrations in a practical way. Anyway, alongside these points of interest, putting away a lot of information including fundamental data on the cloud propels profoundly gifted programmers, hence making a major imperative to business information proprietors (Boykin, 2001). Consequently, there is a requirement for the security columns and secretly instrument to be considered and actualized as one of the best arrangement of the urgent issues. Additionally, it should be recognizing Cloud Computing innovation with the goal that Legitimate and also ill-conceived associations and substances can be guaranteed to do not accessing information on the cloud through illicit, unprecedented, and semi lawful means (Boykin, 2001). The fears to implement cloud-based ERP systems can be eradicated with the implementation of an authentication pillar to provide secure online services.

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ECOLOGICAL MOVEMENTS: A THESIS

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Abstract

Ecological movements are one of the new social movements that have gradually taken a prime position in the professional field. It is growing as a relatively new phenomenon in the expanse of social movements and cross-cultural actions that are going through the entire civil society. Why is it called a new phenomenon in the domain of the latest social movements? Because the ecological actions are the result of counter effects to the post-industrial cultural worlds in the second portion of the last century through which natural capital is retaining its pace. Why it is called a cross-cultural issue that it seems that every society has to pay importance to it in different forms? It is assumed that our blue planet is falling into doom and the natural capital is losing its integrity by tremendous exertions for mere material benefits and the earthly leisure of greedy humans. Resulting in the way many an ecological movement will have to pose an important stature in the professional world. At this juncture, we have to understand how an ecological movement raises some environmental questions that point out the dark sides of material developments and how to overcome the bane of human exertions for the earthly benefits that are eroding our blue planet. The fact observation and thought exchange methods have been used for furnishing the article.

Keywords: *Ecological Movements, New Social Movements, World Conglomerations, Natural Capital, Material Developments.*

Human antiquity is the history of conquest over nature. A conscious being revolts against nature and endures themselves in geological worlds[1]. From a negligible species to the bigger one, everybody is struggling to live which leads them to a secure position on the Earth. Humans also too. They are constantly trying to rebel in contradiction to the creation and making room for existence. Humans had refrained from forming a settled livelihood in the age of major glacial epoch[2], but they were trying to fight against the ice age on Earth around twelve thousand years ago. And had succeeded. The new humans were made up in the age of Holocene[3], since then they have framed a settled livelihood primarily on the bank of the river. Humans have noticed that gathering is the instrument through which they can get leisure and leisure opens up another aspect of livelihood which is the right to self-determination through which humans get individual belongings. Gatherings bring the concept of private properties. The private possessions created a situation where the clash of interests prevailed. The clash of interests created the civilization and a civilization tried to dominate others. At the same time, humans want to secure peace and security because they are rational beings. Rationality gives them a conjugal life that shapes society. As the unit of social forms, they follow the social rules at the same time they want to secure earthly benefits. They do play dual roles for earthly benefits: as the unit of social

conglomerations and as the agent of geological worlds. And they have started the Anthropocene[4], which means the age of humans.

Ecological Movements: A Critical Analysis

Ecological movement is called one of the new social movements that are a recent phenomenon that has been practiced professionally since more or less the last fifty or sixty-odd years when the post-industrial social cultures have reached saturating and satisfying points. The last century has witnessed two great wars that were spread over the world for the occupancy of unquantified material possessions. The proximity of economic belongings and earthly leisure brings the clash of interests among the substantial aspirants that made the war-like situation in Europe. Resulting in the way of counter-revolution has been framed against the immeasurable gatherings by the greedy classes and exploiter communities. They have exploited the colonial subjects that have needed a greater magnitude for maximum attention in the professional fields. The colonial subjects want to restore the humanist approach to the world conglomeration. Because they feel, the exploitation in every aspect of human life by the colonial masters to the colonial multitude made into a cultural phenomenon that was subservient to the masters. It was the primary testimony of a tremendous attack on humanity that created a moral ulcer in the social fabric. At the same time, nature has suffered the maximum for arbitrary material exertions for wealth accumulation that has followed by those nations who were free from the bane of the colony along with colonial masters.

We have categorized here the new social movements into three major groups: the humanist movements, animal-friend actions, and nature-restoration operations. The humanist movements will open up the socio-political-economic environments where the human conglomeration gets the opportunity to meet every aspect of livelihood. The animal-friend actions will manifest the proximity of humans and other species that will create an ecofriendly environment resulting in the possible conjugal life between humans and animals. The nature-restoration operations present the juxtaposition between humans and the inert matters that are conceivable. From this, we have taken the last one which is nature-restoration operations also known as the ecological movements[5]. Because where humans and nature conjointly engage and make a different trajectory to go with the correlated issues. Primarily humans have played as the unit of the geological world where they maintained conjugal relations with nature. Humans have used the raw materials from nature for their material accomplishments but basically, they have sustained nature for their interests since the rise of civilization. Over time, they breach the affinity of kinship with nature that has lost the balance in conjugal rapport resulting in the way nature bounces back hard to the humans, and vengeance by the inert matters taking place in many a form. Against this backdrop, the counter-revolutions were taking place in the professional domain against the policy-generating measures about eroding nature for earthly leisure and enormous wealth accumulations by the sizable number of acquisitive

societies. The ecological movements are raising some questions as regards why the conjugal affinity between humans and nature broke down and how to restore it. If we do not maintain our conjugal relation with sub-humans and inert matters then humans will necessarily extinct from the bigger panorama of the blue planet.

Ecological Movements: The Thematic and The Problematic

Why the ecological movements are significant? Ecological movements are significant because they prepare room for nature's good resulting in the way human's future will be secure. If we do not secure the good of our blue planet then human extinctions are possible. This issue has to many a consonantal application that has been manifesting its magnitude in the professional and populist fields. The consonantal appliances of the issue have been divided into not-diverse rather two interrelated subjects: a) thematic, and b) problematic that is fully articulated and comprehensive in a manner through which we shall dispose of it. The thematic is the epistemological and ethical issue that makes a framework discussion by different elements. It has been considered by the statement, "The basic principles of an ideological system are expressed in terms of both epistemology (assumptions about the way knowledge is structured) and ethics (assumptions about what is morally correct). These principles may well seem natural or "common sense" to a person who believes in them."[6] On the other hand, the term problematic refers to the modality of propositions that are "to be recovered by a 'symptomatic reading' of the relevant body of texts."[7]

A problem is composed of various concrete statements that make a possibility to think about a particular issue that gives explicit reflections of a theme. It may be designed according to Philip Holden's words, who states, "A series of concrete statements about actions which should be taken based on the theme."[8] The ecological movements have challenged the people who want to make wealth by hook or crook on the contrary they make a statement that the ecological resentment is anti-developmental and it refrains the human exertion for material accomplishments. This issue is to be called problematic. On the other hand, all of those have importance to developmental activities as a theme. Here lies the significance of the ecological movements and it has manifested two theses that procure the different aspects of this resentment.

Ecological Movements: A Thesis

The Proximity of the Human and Natural-Capital Brands the World Good.

The ecological movements want to restore natural capital for the benefit of humans and other species. It tries to establish the role of humans as the geological agent in natural differentiations. Many a time the natural differentiations do oblivion and make a binary among humans and sub-humans as the unit of natural capital. Ecological resentments have to pursue the sustained differentiation in the natural capital that may open up a new means of relationships in the conjugal life of humans and nature that shall make our present good and future well-off. Interdependent relationships between humans, sub-humans, other living creatures, and inert matters follow some basic principles and every segment of

the natural capital follows the rules whichever does apply to them. Here we have mentioned an inimitable example that will follow in this fashion: Allan Weisman wishes to practice a thought experiment, he assumes: "Suppose that the worst has happened. Human extinction is a fait accompli…. picture a world from which we all suddenly vanished. Tomorrow. Unlikely perhaps, but for the sake of argument, not impossible…. How would the rest of nature respond if it were suddenly relieved of the relentless pressures, we heap on it and our fellow organisms?"[9] and he also say that if it happened not so practically but rather hypothetically, "Is it possible that, instead of having a huge biological sigh of relief, the world without us would miss us?"[10]

Alan Wiesman is not cognizant of the whole figure of the realm of species. For argument, if suddenly humans disappear, then other species will fall into critical conditions. To us, it has two primary reasons: a) if the sudden extinction of humans befalls, then human accomplishments have back and forth to nature, and it would be perilous to all. Subsequently, in no way, it would reduce the relentless pressure on them, then, on the other hand, it will expose many a destructive way; b) if hypothetically, the most conscious beings called humans, suddenly disappear then a big gap in nature will be fabricated resulting in the way of ecological balance will doom. At this juncture, we understand as regards why the proximity of humans and nature is inevitable.

Humans have conjugal relations with natural capital. Here we may clarify what is natural capital.[11] The natural capital is the conglomeration of different things that are composed of conscious beings, other living creatures, and inert matters. Natural capital is the group of key elements from which humans extract the necessary means and transform them into happenings that make our life is prospering. A prosperous life secures peace and fraternity that arguably establishes freedom for mankind. It to be said that the two things: humans and natural capital are complemented each other. As conscious beings, humans have been bestowed with the ample capacity to understand other living creatures and inert matters.

We have to care about the understanding of nature but in practice, the avaricious peoples are eroding it religiously resulting in the way of natural calamities and other devastating events occurring in regular or irregular intervals. The ecological movements eagerly desire to make a resistance against the tendencies and activities to exhaust natural capital. The resentment of mankind in the name of restoring natural capital against villainy activities shares and includes the particular geo-psychological actions that will prevail in the present and recent future. What are geo-psychological actions? It is a serious thing that has to be practiced made of the inclusive tendencies of humans. Historically an ecological movement has to be tried to manifest the geo-psychological actions in the world conglomeration that will secure us, we assume.

The agitation about the restoration of nature secures the tendencies of natural capital, on the other hand, those who are in the anti-restoration movement of

nature blame the resentment against the eroding world and label them as anti-developmental and anti-human accomplishments. They do not understand if nature goes to the destructive condition, then nature will bounce back in the form of natural tragedies. The entire humanity will suffer from the villainy activities of the self-centric grasping peoples and human exertion does not yield good results. For this very cause, the ecological movements do not merely practice physical resentments rather they try to manifest the notion of basic principles to follow by the natural capital whichever is appropriate to them. This notion will maintain harmony in nature, we assume.

The ecological movements rely upon the diverse features of non-living matters and living beings in the geological realm that explicitly manifest the complexities of natural worlds. The anger against the anti-nature efforts categorically reveals that every human exertion for earthly benefits and activities to material accomplishments is to be cautious because the complex-ridden geological realm is highly responsive and sensitive. Many a time their response to the human exertion for wealth accumulation reveals the opposite results and yields a negative state of mind that has an evil impact on the conjoint relations of natural capital.

The sensitivities of the sub-humans and the non-living matters do influence humans and other creatures in nature. So, an ecological movement has the sole duty to take care of it and organizes a strong resentment for sustaining sensitivities and responsive features of the natural capital. The leaders of the ecological movements primarily think of a particular notion that is composed of a mindset through which it can hold continuity of the proximity of humans and nature and those who want to breach the relations then shall face tremendous resistance. The interdependent affinity in natural capital is the fundamental concern of the ecological actions and the sustaining relations in geological worlds shall make a prosperous life but the breach of the proximity of humans and natural worlds will reveal the opposite results.

Concluding Words

Ecological movements are one of the new social movements that have emerged as the tendency of counter activities against the anti-natural capital in the professional fields and social activists. The human exertion for material development and earthly happenings is making a particular cultural affinity that culture is maintaining excluding policies of those humans who want to retain nature. The counter-discourses of the ecological movements in contradiction of the post-industrialist and anti-natural capital have conjointly manifested by two theses which are branding and practicing affectionate tendencies in the professional worlds. The magnitude of the ecological movements is evolving and the nature friend activists are trying to find a way of counter-attacking the situation against the eroding natural capital practice. Because the sizable numbers of greedy people are corroding natural capital and destroyed our blue planet in the name of inducting earthly belongings during the last five centuries. Nature is retorting and retaliating through many an event and the ecological actions are

trying to cope with the anti-nature activities, retain nature, and practice the instrument of Sustainable management for justifiable developmental efforts and hope that will yield a good result for mankind. The thesis of the ecological movements has indicated a way out for nature's friend propensities in the arena of the new social movements: a) the first thesis focused on the conjugal relations in the natural capital that has manifested the proximity of humans, sub-humans, and inert matters is essential for livelihood to all and b) the Sustainable management is the idea and the practicing instrument that is necessarily using for durable happenings. If we follow the propensities of nature friend actions then our life will be prosperous.

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Natural capital is the natural environment and the biodiversity contained within that is necessary for the provision of the ecosystem goods and services "essential to basic human needs such as survival, climate regulation, habitat for other species, water supply, food, fiber, fuel, recreation, cultural amenities, and the raw materials required for all economic production" in https://www.sciencedirect.com/topics/earth-and-planetary-sciences/natural-capital, accessed at 11:11 PM on 17.05.2021.

A CONJOINT STUDY OF THE RIGHT OF CHILDREN TO FREE AND COMPULSORY EDUCATION ACT, 2009 AND STUDENTS WITH DISABILITY

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Abstract

The disabled population of the land are on equal footing with their so-called 'able' counterparts, both in the statutory and constitutional plateau, so far as the Indian legal system is concerned. But in reality, the disabled population is one of the marginalized communities of the land, in terms of inter alia education, job opportunity etc. which is in sharp contradiction with the constitutional mandate along with the statutory one. The concept of inclusive education somewhere goes in vain because the issue of participation restriction is mostly in oblivion. The issues concerning disabled persons of the land revolve mostly around the conferring of rights by constitutional or statutory means, but these rights, which are so conferred cannot be materialized without proper education and the biggest impediment in the way towards education is participation restriction of the disabled students. Concepts like 'Learning Poverty', 'Human Capital Index (HCI)' etc. evolved to assess the proficiency of learners and can be used as indicators of the participation of disabled students in the education system. Hence, closer scrutiny of the RIGHT OF CHILDREN TO FREE AND COMPULSORY EDUCATION ACT, 2009 is required.

Keywords: *Disability, Human Capital Index (HCI), Human Capital Country Brief, Impediment to Education, Right to education*

The term education as it is understood now, was probably used for the first time in the early 1500's.[1] As per the Cambridge Dictionary the term 'Education' means the process of teaching or learning in a school or college or the knowledge that one gets from this.[2] As per Collins Dictionary, the term 'Education' is an uncountable noun, which means 'Education of a particular kind involves teaching the public about a particular issue'.[3] On the other hand, the Encyclopedia Britannica gives a more rigid and orthodox definition of the term 'Education' as it denotes education as a discipline which is 'concerned with methods of teaching and learning in schools or school-like environments as opposed to various non-formal and informal means of socialization'.[4] This particular definition is both

[1] OXFORD ENGLISH DICTIONARY,
<https://www.oed.com/dictionary/education_n?tl=true> (accessed on October 18, 2024).
[2] CAMBRIDGE DICTIONARY,
<https://dictionary.cambridge.org/dictionary/english/ education> (accessed on October 18, 2024).
[3] COLLINS DICTIONARY,
<https://www.collinsdictionary.com/dictionary/english/education> (accessed on October 18, 2024).
[4] ENCYCLOPEDIA BRITANNICA,
< https://www.britannica.com/topic/education> (accessed on October 18, 2024)

orthodox and vague as this definition loosely attends to the question and issue of the non-institutionalized education aspect of both children's education and higher education and it is more prominent so far as the education of disabled students is concerned and this is true for all levels of education. Though, on the other hand, this particular definition highlights another aspect that, education in the modern world must be imparted in an institutionalized manner (though without prejudice to the requirement of adult education, night school etc.; though these aspects of education have little connection with the education of children in general and also with that of higher education) to extract maximum benefit from imparting education, from the perspective of knowledge enhancement, overall development of children, socialization etc. But the most important aspect may be the employment opportunity which is created and enhanced by getting institutionalized education, which is vehemently clear as, according to the World Bank, for every extra hour of schooling, there will be a 9% increase in hourly earnings.[5] Thus, institutionalized education can play a pivotal role in creating and enhancing employment opportunities, which is a highly crucial aspect in a developing country like India. The World Bank also recognized this aspect and as per the World Development Report (WDR) 2018,[6] the developing countries achieved remarkable success in getting children to schools, so that the benefit of institutionalized education can be provided even to the most marginalized section of the society. Thus, this highlights the requirement for the development of human resources by making significant investments in education without any discrimination whatsoever.[7].

Learning Poverty

The World Bank and the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics jointly created and evolved the concept of Learning Poverty, which means the inability of children by the age of 10 to read and understand a simple text.[8]

This concept on the other hand also helped to create the Human Capital Index (HCI) of the world at large[9] and also country-specific HCI.[10] Moreover, the

[5] THE WORLD BANK, *Education Overview*, <https://www.worldbank.org/en/topic/education/overview#1> (accessed on October 18, 2024).
[6] THE WORLD BANK, *World Development Report 2018*, <https://www.worldbank.org/en/publication/wdr2018> (accessed on October 18, 2024).
[7] THE WORLD BANK, *Education Overview,* <https://www.worldbank.org/en/topic/education/overview#2> (accessed on October 18, 2024).
[8] THE WORLD BANK, *Ending Learning Poverty*, <https://www.worldbank.org/en/topic/education/brief/ending-learning-poverty> (accessed on October 18, 2024).
[9] THE WORLD BANK, *Human Capital,* <https://www.worldbank.org/en/publication/human-capital#About> (accessed on October 18, 2024).
[10] THE WORLD BANK*, Insights from Disaggregating the Human Capital Index,* <https://www.worldbank.org/en/publication/human-capital/brief/insights-from-disaggregating-the-human-capital-index> (accessed on October 18, 2024).

concept of Learning Poverty as a part of HCI also helped in the creation of 'Socioeconomically-disaggregated Human Capital Index (SES-HCI).[11]

As both the concept of HCI[12] and SES-HCI[13] include in its fold, inter alia the capacity of learning and acquisition of skill as prime factors, the World Bank and UNESCO developed a few paradigms to minimize and in the long run to eradicate learning poverty across the globe,[14] which can be summarized into three broad heads, viz. - i) Literacy Policy Package- Focused on reading proficiency at primary school level.[15]; ii) Renewed Education Approach- Focused on rejuvenating the entire education system, which also includes the domain of higher education.[16]; iii) Learning assessment Platform- This is to eliminate the assessment measuring gap.[17]

Human Capital Country Brief of 2023- India

As per the HCI-Country Brief and Data[18] of the World Bank, the HCI in India is slightly better than the average of the South Asia Region and Lower Middle-Income Countries,[19] as if one child in India able to enjoy complete education and full health will be 49% more productive in comparison to those who did not get these benefits, which is in the former two cases 48% respectively.[20]

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[11] THE WORLD BANK, *Insights from Disaggregating the Human Capital Index,* <https://www.worldbank.org/en/publication/human-capital/brief/insights-from-disaggregating-the-human-capital-index> (accessed on October 18, 2024).

[12] THE WORLD BANK, *Human Capital*, <https://www.worldbank.org/en/publication/human-capital#About> (accessed on October 18, 2024).

[13] THE WORLD BANK, *Insights from Disaggregating the Human Capital Index,* <https://www.worldbank.org/en/publication/human-capital/brief/insights-from-disaggregating-the-human-capital-index> (accessed on October 18, 2024).

[14] THE WORLD BANK, *Learning Assessment Platform (LEAP),* <https://www.worldbank.org/en/topic/education/brief/learning-assessment-platformleap#:~:targetText=To%20move%20forward%20the%20learning,learning%20more%20efficiently%20and%20effectively> (accessed on October 18, 2024).

[15] THE WORLD BANK, *Literacy Makes Sense,* <https://www.worldbank.org/en/who-we-are/news/campaigns/2019/literacy-makes-sense > (accessed on October 18, 2024).

[16] THE WORLD BANK, *Learning Assessment Platform (LEAP),* <https://www.worldbank.org/en/topic/education/brief/learning-assessment-platformleap#:~:targetText=To%20move%20forward%20the%20learning,learning%20more%20efficiently%20and%20effectively> (accessed on October 18, 2024).

[17] THE WORLD BANK, *Learning Assessment Platform (LEAP),* <https://www.worldbank.org/en/topic/education/brief/learning-assessment-platformleap#:~:targetText=To%20move%20forward%20the%20learning,learning%20more%20efficiently%20and%20effectively> (accessed on October 18, 2024).

[18] THE WORLD BANK, *Human Capital*, <https://www.worldbank.org/en/publication/human-capital#Briefs> (accessed on October 18, 2024).

[19] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on October 15, 2024).

[20] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on October 15, 2024).

Apart from these basic statistics, this report[21] also highlight a few components and elements of HCI which can be summarized as follows: i) Expected years of school- If started at the age of 4, up to 11.1 years of school by the age of 18.[22]; ii) Primary school completion rate- 97%.[23]; iii) Net school enrollment in lower secondary level- 87%.[24]; iv) Youth literacy rate- Between the age of 15-24, it is 95%.[25]

On the other hand, this particular report[26] also indicate that, the unemployment rate among the adults of the age of 25 years and above is 5%,[27] which is similar to the average regional level.[28] This indicates both the success of the institutionalized education system of India on one hand and on the other depicts the possibility of improvement.

Right To Education Under the Auspice of Indian Constitution

Art.21 of the Indian Constitution[29] paved the way for Art.21A,[30] which is subsequently added to the Indian Constitution via the 86th Amendment in 2002,[31] which provides for the right to education as Fundamental Right[32] for the children between the age group of 6 to 14 years.[33]

Though, in the original constitution, the right to education of children was not expressly provided and mentioned in the Fundamental Right[34] segment, the apex court of the land in the case of *Unni Krishnan, J.P. and others. v. State of A.P. and*

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[21] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on 15 October 2024).

[22] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on 15 October 2024).

[23] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on 15 October 2024).

[24] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on 15 October 2024).

[25], THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA,* <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on 15 October 2024).

[26] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on October 15, 2024).

[27] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on October 15, 2024).

[28] THE WORLD BANK, *HUMAN CAPITAL COUNTRY BRIEF-INDIA*, <https://thedocs.worldbank.org/en/doc/64e578cbeaa522631f08f0cafba8960e-0140062023/related/HCI-AM23-IND.pdf> (accessed on October 15, 2024).

[29] *Art. 21, The Constitution of India, 1950*.

[30] *Art. 21A, The Constitution of India, 1950*.

[31] *Art. 21A, The Constitution of India, 1950*.

[32] *Part- III, The Constitution of India, 1950*.

[33] *Art. 21A, The Constitution of India, 1950*.

[34] *Part- III, The Constitution of India, 1950*.

others[35] observed that, the concept of 'Implied Fundamental Right' is true in the case of the Indian Constitution also and every Fundamental Right need not be expressly provided in the bare provision but notwithstanding that, the judiciary can expand the scope of an existing provision of the Indian Constitution (Fundamental Right part is not an exception[36]) to safeguard a right and this is what happened with Art.21 as the judiciary expanded and extended the scope of Art.21 in several cases.[37]

The basic concept of the right to education though now enshrined in the Constitution of India,[38] the elements of this particular right can be traced in the Directive Principles of State Policy chapter of the Constitution of India,[39] specifically inter alia in Art.39, 41, 46, 47[40] and most specifically in Art.45.[41] Art.45 was amended in the same 86th Amendment, 2002,[42] which incorporates Art.21A[43] and after this amendment, Art.45[44] now cast a directive principle to provide early childhood care and education for the children below the age of 6[45] as the age group of 6 to 14, which was erstwhile mentioned in Art.45 now transformed into a Fundamental Right, thanks to Art.21A.[46]

Right of Children to Free and Compulsory Education Act, 2009[47]

The preamble of this enactment clearly states that, this Act[48] is there to provide free and compulsory education to children between 6 to 14 years, which is clearly in consonance with the scheme as laid down in *Unni Krishnan, J.P. and others. v. State of A.P. and others* [49] verdict vis-à-vis Art.21A of the Constitution of India.[50]

In order to grasp the scheme of this enactment, a few definitions must be taken into cognizance- i) Child- Sec. 2(c) [51]- Here, child means and include both male and female children between the age of 6 to 14 years; ii) Child belonging to disadvantaged group- Sec. 2(d) [52]- This provision singles out the children of disadvantaged groups, which shall be again categorized into 3 broad heads viz. -

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[35] *Unni Krishnan, J.P. and others. v. State of A.P. and others*, AIR 1993 SC 2178.
[36] *Part- III, The Constitution of India, 1950.*
[37] M P JAIN, *INDIAN CONSTITUTIONAL LAW,* (first published 1962, 8th edn, Justice Jasti Chelameswar & Justice Dama Seshadri Naidu 2019) 1284.
[38] *Art. 21A, The Constitution of India, 1950.*
[39] *Part-IV, The Constitution of India, 1950.*
[40] *Part-IV, The Constitution of India, 1950.*
[41] *Part-IV, The Constitution of India, 1950.*
[42] *Art. 45, The Constitution of India, 1950.*
[43] *Part- III, The Constitution of India, 1950.*
[44] *Art. 45, The Constitution of India, 1950.*
[45] *Art. 45, The Constitution of India, 1950.*
[46] *Part- III, The Constitution of India, 1950.*
[47] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[48] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[49] *Unni Krishnan, J.P. and others. v. State of A.P. and others*, AIR 1993 SC 2178.
[50] *Part- III, The Constitution of India, 1950.*
[51] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[52] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*

a) Child with disability, b) Child belonging to Scheduled Caste, the Scheduled Tribe, the socially and educationally backward class, c) Child belonging to other disadvantaged groups, where disadvantage is connected with social, economic, linguistic, geographical, gender etc; iii) Child belonging to weaker section- Sec. 2(e)[53]- This particular category is connected with economic disadvantage, which can in its fold contain a child with disabilities, if that particular child belongs to the economically weaker strata, whereas the criteria of economic weakness for the purpose of this Act[54] will be specified by way of notification by the appropriate government; iv) Child with disability- Sec.2 (ee) [55]- Surprisingly this definition was not part of the original enactment, but was subsequently added in 2012.[56]

This is an inclusive definition, which contains in its fold, children belonging to any of these heads- a) a child, who comes under the definition 'Disability' as it is provided under Sec. 2(i) of the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995; b) a child, who comes under the definition of disability as enshrined in Sec2(j) of the National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999; c) child comes under the category of 'severe disability' as provided under Sec.2(o) of the National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999.

Surprisingly again, this particular definition does not carry in its fold the definition of 'person with disability',[57] 'person with benchmark disability',[58] 'person with disability having high support needs'[59] provided under the Rights of Persons with Disabilities Act, 2016,[60] which is a major drawback as, if these definitions are provided under this impugned Act[61] along with separate and category-specific guidelines and legal schemes for the children belonging to these sub-categories or sub-classified groups of disability definition (which is essentially classified on the basis of degree of disability in one hand and consequential degree of care corresponding with such degree of disability on the other), the effective implementation of Art.21A[62] and the Right of Children to Free and Compulsory Education Act, 2009[63] can be achieved. v) Elementary education- Sec.2 (f)[64] **-** It means the education from 1st to 8th class. Hence, elementary education as

[53] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[54] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[55] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[56] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[57] *The Rights of Persons with Disabilities Act, 2016 (Act 49 of 2016).*
[58] *The Rights of Persons with Disabilities Act, 2016 (Act 49 of 2016).*
[59] *The Rights of Persons with Disabilities Act, 2016 (Act 49 of 2016).*
[60] *The Rights of Persons with Disabilities Act, 2016 (Act 49 of 2016).*
[61] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[62] *Part- III, The Constitution of India, 1950.*
[63] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[64] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*

envisaged in this Act, must be provided to disabled children as well, as this will comply with the mandate of Art.21A.[65]

Thus, from the close scrutiny of the definitions under this Act,[66] it is evidently clear that, this Act[67] provides a comprehensive scheme but notwithstanding that, practically only Sec.3 of this Act[68] provide express mechanisms for disabled students. Apart from this, a few other elements of this Act[69] can be considered to ascertain the benefits provided by this Act[70] to disable students, though it is also true that, the demarcation of this kind cannot be executed in a water-tight chamber manner, as all the provisions of this Act[71] is ipso facto applicable to disabled students, but this demarcated cognizance is needed, on the other hand, to ascertain the impact of this Act[72] on the disability-specific needs of students with disability and on the other stakeholders of the education of disabled students.

Right of child to free and compulsory education- Sec.3[73] - Sec.3 (1) and (2) provides that, every child between the ages of 6 to 14 is entitled to free elementary education. Sec.3(3)[74] is the only express provision regarding disabled students, which provides that, children with a disability under this Act[75] are entitled to the same right to elementary education with their normal counterparts and also provides that, a child with 'multiple disability' and 'severe disability' as provided in Sec.2(h) and 2(o) of the National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disabilities Act, 1999 respectively has the option for home-based education.

Thus, this particular provision only puts a disabled child on par with other students (with one option for home-based education) but does not address the issue of disable specific requirements.

Duties of appropriate government- Sec. 8[76]- It cast several obligations on the appropriate government and these are to ensure the right to education, which are inter alia- i) provide free and compulsory education; ii) ensure neighbourhood school availability to every child; iii) to ensure non-discrimination of disabled students (termed as 'child belonging to disadvantaged group' which include disable); iv) provide infrastructure to realize right to education; v) provide training facility to teachers etc.

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[65] *Part- III, The Constitution of India, 1950.*
[66] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[67] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[68] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[69] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[70] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[71] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[72] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[73] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[74] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[75] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[76] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*

Thus, this provision cast three most important obligations to address the issues of disabled students viz. - i) non-discrimination, ii) accessibility, iii) training of teachers who are the most important stakeholders in disable education.
More or less the same kind of obligation is also cast on local authorities.[77]
School's responsibility- Sec.12[78]- Sec. 12(1) (c) provides that, the specified category schools and unaided schools shall admit disadvantage group children, which include disable and economically weak children, up to the extent of at least 25% of its class strength in class-1.

Conclusion

Thus, the evolution of this enactment from the perspective of disabled students can safely follow the concept of 'claim' as envisaged by Hohfeld and used by Prof. Honore, which means what a person is entitled to demand, which is quintessentially different from what a person is permitted to do and on the basis of this line of argument, claim co-relative to positive duty can be divided into two heads viz. 1) claim against individual and 2) claim against state,[79] and as far as the right to education under Art.21[80] and Art21A[81] of the Indian Constitution on one hand and disabled students on the other is concerned, it must be treated in a single fold and hence, the statutory framework must be moulded in such a manner so that it fully complies (in word and essence) with the mandate of the Grundnorm. Thus, the approach towards this statute must be jurisprudential in nature, which clearly leads to the fact that, the statute[82] shall contain express provision for disabled students in general and particular provision for different kinds of disability, as the nature and degree of care and support heavily differ so far as different kinds of disability are concerned and this very requirement must be addressed in the statute itself which is connected with education i.e. The Right Of Children to Free and Compulsory Education Act, 2009,[83] which at present is noticeably absent in this particular statute and the concept of 'claim' as mentioned above, will be futile unless a skirl can be created with the ground reality of disabled students and their corresponding needs and the statutory framework. Hence, it can be safely assumed that, the incorporation of disabled-specific infrastructure and care requirements will metamorphose the lacuna present in the RIGHT OF CHILDREN TO FREE AND COMPULSORY EDUCATION ACT, 2009[84] into an advantage and will make this statute a disable-friendly and disabled student-oriented one which in turn will materialize the 'claim' of disabled students regarding access to education, which is a major issue and one of the greatest

[77] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[78] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[79] RWM Dias, *Jurisprudence* (5th edn, 2017) 68
[80] *Part- III, The Constitution of India, 1950.*
[81] *Part- III, The Constitution of India, 1950.*
[82] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[83] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*
[84] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*

impediments to the inclusion of disabled students in the mainstream education system of the land. This disable-specific statuary incorporation will also facilitate the most cherished goal which is inclusive education and will dilute up to a great extent the participation restriction issue but it shall also be kept in mind that, without proper orientation of the stakeholders in the school education system, any amount of statuary alternation, notwithstanding how great such statutory changes is in the direction of incorporation of disable students, will go in vein and hence, alongside the legal changes in the direction of infrastructure improvement and disable specific care requirements, the orientation of stakeholders, which include disable students also, must be incorporated within the statutory framework to materialize and to extract the most benefit of this trailblazing statute[85] in the Indian legal regime.

A pertinent issue may arise that, on the basis of what line of argument, the concepts of Learning Poverty and Human Capital Country Brief can be used to assess the soundness and the relevance of the RIGHT OF CHILDREN TO FREE AND COMPULSORY EDUCATION ACT, 2009 for the purpose and from the perspective of disabled students. The issue is more complex and multidimensional as, the RIGHT OF CHILDREN TO FREE AND COMPULSORY EDUCATION ACT, 2009 do not contain any disable specific statutory mandate and moreover the Rights of Persons with Disabilities Act, 2016 is the nodal law, which shall be considered while discussing the educational rights of disable students and the conjoint reading of these two statues invariably leads to the conclusion that, though they operate in their respective arenas, they share some overlapping issues and the conscious blending of the 2016 Act may possibly increase the effectiveness of the 2009 Act and this assimilation of 2016 Act with that of the educational rights requirement as enshrined in the 2009 Act, will materialize the rights of disable students regarding education and moreover in a multidisciplinary manner, the parameters like Human Capital Country Brief can lead and illuminate the path of the integration of these two statues and apart from statutory framework, such parameters can optimize the policy so much so that, the djellaba of status in the grassroots level can be minimized and the by this recalibration, the constitutional and statutory mandates can be implemented in a coruscate manner.

[85] *The Right of Children to Free and Compulsory Education Act, 2009 (Act 35 of 2009).*

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