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AUTOMATED ADVANCE DISTRIBTUION SYSTEM

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Abstract:-*Electric power distribution system plays vital role to delivery the electricity to consumers as per their requirement. But as the population of India is increasing rapidly it directly or indirectly affects the distribution of power to the consumers. Therefore, research and development activities worldwide are being carried out to automated the electric power. In the era of Artificial Intelligence (AI) and data science, this paper consist of automated advance distribution system(AADS) is going to take over the tradition / recent distribution system and improves the efficiency and reliability of power distribution to the required consumers.*

Keywords:-Automated Advance Distribution System(AADS), DMS, Artificial Intelligence (AI) and data science, sensors, communication system, SCADA, smart grid etc.

I. INTRODUCTION

The automated advance distribution system in electrical engineering is a smart grid technology that uses advanced communication and control systems to optimize the distribution of electricity.

It helps in improving the reliability, efficiency, and flexibility of the power distribution network. This system uses sensors, real-time data, and automated controls to monitor and manage the flow of electricity, detect faults, and restore power quickly in case of outages. It also enables better integration of renewable energy sources and supports the implementation of demand response programs. The purpose of automated distribution system in electrical engineering is to efficiently manage the flow of electricity from power generation sources to consumers. It involves the use of advanced technologies and automation to monitor and control various components of the distribution system, such as transformers, switchgear, and distribution lines. The scope of an automated distribution system includes improving reliability, reducing downtime, optimizing energy usage and enabling remote monitoring and control of the distribution network. It plays crucial role in ensuring a reliable and efficient supply of electricity to consumers.

II. LITERATURE REVIEW

Since 1991, when the North eastern and Eastern grids interconnected and here the first distribution system formed. The distribution of electrical power is critical aspect of the electricity supply chain. It involves the delivery of electricity from the transmission system to end users such as residential, commercial, and industrial consumers. The traditional distribution system in electrical engineering typically involves a radial network configuration where power flows from single source or substation to various load centers. This system is characterized by manual operation and control, with limited automation and remote monitoring capabilities. In traditional setup, distribution feeders are often designed with limited flexibility to accommodate changes in demand patterns or integrate renewable energy sources seamlessly. Moreover, traditional distribution systems are more susceptible to power outages and faults due to their limited ability to isolate and reconfigure circuits automatically. Maintenance and fault identification in traditional systems often rely on manual inspections and periodic testing, which can lead to longer downtime and service disruptions for consumers. Therefore, the review of previous research studies to minimize the problems creating by the tradition distribution system the researchers had implemented automated advance distribution systems which shows pros towards the old distribution systems.

“The Current Research on Distribution Automation System”, this paper also introduces about the implementation of the automated advance distribution system to overcome all such situations which are faced by traditional distribution system.

Automation advance distribution system(AADS) offer several benefits. Firstly, they improve the overall efficiency of power distribution, reducing energy losses and optimizing the utilization of resources. Additionally, it also provide better control and monitoring capabilities, allowing for real-time data analysis and more effective management of the distribution network. On the behalf of pros, there are cons which may cause system failures in automated distribution systems includes data loss or security breaches, software bugs or glitches, hardware malfunctions, power surges or fluctuations, communication errors, and inadequate maintenance. But

there some strategies to prevent system failures such as regular maintenance, redundancy and backup systems, and robust testing and quality assurance, monitoring and remote diagnostics and staff training and education by implementing these strategies , the risk of system failures in automated distribution system can be significantly reduced, leading to improved efficiency and reliability.
Finally, the distribution automation is the inevitable trend of distribution system and will be gradually developing in the direction of smart distribution grid.

III. ANALYSIS OF AADS

The key components and functionalities of an advance automated distribution system are, Supervisory Control and Data Acquisition (SCADA), Distribution Automation(DA), Communication infrastructure, Advance Metering Infrastructre(AMI), Distribution Management System(DMS), Demand Response(DR), Renewable Energy Integration.

Its an evolving field that aims to improve the efficiency, reliability, and sustainability of electricity distribution. Evolution of the potential impact on electrical grid of advanced automated distribution system is reliability and efficiency is significant. By incorporating advanced technologies and automation, the system can enhance the overall performance and operation of the grid. Here are some ways it can make a positive impact:

- SCADA systems allows for faster fault identification and restoration of power, minimizing the impact on consumers.
- With real-time monitoring and control, operators can make informed decisions to optimize the distribution network, resulting in more energy efficient delivery.
- The integration of advanced metering infrastructure leads to more effective grid management and improved energy utilization.
- The system can better accommodate the intermittent nature of renewable generation and ensure grid stability.
- The proactive maintenance approach helps prevent equipment failures and extends the lifespan of grid infrastructure.

Further, the main aspect is in cost effectiveness and return on investment of implementing such systems. When it comes to analyzing of cost and return investment of automated advance distribution systems in electrical engineering it depends upon certain factor such as initial cost of implementation is depended upon the power to be distributed among the consumers. However, by reducing losses and wastage of energy they utilize and improve the energy which results in lower operational costs overtime. In terms of return investment, the profits of installations of automated advanced distribution systems can increase the productivity of utilization of energy and consumer satisfaction. Improved service quality and reduced downtime can lead to higher consumer retention rates and attract the new maximum demand consumers, thereby generating additional revenue which is profitable to the system. Overall there might be high initial cost for installation of such system but the automated advance distribution system gives long-term benefits and feds positive return investment.

IV. CASE STUDIES

This section of the paper consist of comparisons between the tradition distribution systems and automated advance distribution systems. In tradition distribution systems manual operations and human intervention are more common. This can lead to downtime and slower restoration of power.

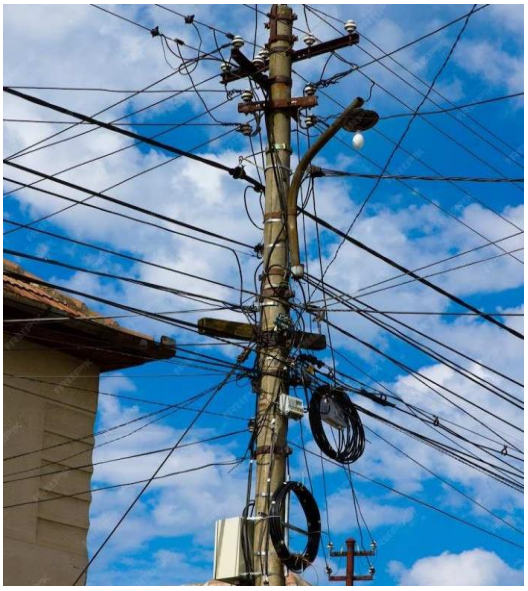

Fig-1: shows the traditional distribution system

Fig-2: shows AADS

Fig-3: shows DMS & OMS

Fig-4: shows the application of AADS

Some of the few challenges had been faced for the implementation of automated advance distribution system. One of the main challenge is the initial investment required for the infrastructure and equipment needed for these systems. Another challenge is the complexity of integrating these systems in to the existing electrical system. It must hold synchronization with the existing equipments in the electrical infrastructure. Next, the most weigthiness for the automation system is the cyber security that is another main consideration. With the rapid growth of automation and connectivity, there is need to protect these systems from potential cyber threats and ensure the security of critical infrastructure.

Lastly, the transition from traditional systems to automated advance distribution systems may require careful planning and phasing to minimize distortion and ensure smooth transition.

On the other hand, automated distribution system uses Information Technology(IT), Operational Technology(OT), sensors, communication networks, and smart devices to monitor and control the distribution of electricity. Here are the some real life based examples on the automated advanced distribution systems. In India, automated distribution systems has been implemented in some cities includes:-

1. Mumbai: This city includes the use of smart meters, remote monitoring and control systems.
2. Delhi: This city includes the major components such as DMS,AIM,SM etc.
3. Bengaluru: This city has same features as Mumbai and Delhi has owned.

V. CHALLENGES AND FUTURE PROPECTS

It clearly states that before implementing such systems we had to face several obstacles and challenges for automatic advance distribution system(AADS) in future. Some of the challenges are enlisted below:

1.Cost: The initial investment cost is required for the automated distribution system which includes the infrastructure, installation of communication networks, sensors, AIM, DMS etc.

2.Compatibility: Implementing the automated distribution system by merging the existing infrastructure is difficult and challenging.

3.Data Management: Not easy to handle all the data of sensors and communication networks which can be so complicated to manage and analysis.

4.Cyber security: Software data can have the risk of cyber threats and attacks also increases. The hackers may also jam the connectivity between the distribution and transmission.

5.Workforce Training: To operate all the data and system we need to hire well trained software developer and software analyzer.

The future prospects of automated advanced distribution systems in the field are quite promising. Such systems have the potential to revolutionize the way electricity is distributed and managed. Further, this system gives potential to improve efficiency, reliability and sustainability paving the way for more intelligent and resilient electrical grid.

VI. CONCLUSION

This paper ends with the conclusion that the benefits of automated advance distribution system in electrical field how it can cover up all the problems raised by the traditional distribution system. It enhances the efficiency, reliability productivity of utility, and also provides quality and reliable supply to consumers. Later part of the paper we have also discussed about the challenges faced by distribution system which are necessary to modify and develop in communication technology and with the use of integration of various IT and OT modules would facilitate the utilities to be smart and proactive and would increase the satisfaction level of the consumers in future.

VII. REFFERNCES

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Transmission and Distribution of Electrical Power- By J.B.Gupta
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