INTERNATIONAL JOURNAL OF ENGINEERING MANAGEMENT SCIENCE
journal homepage: www.ijems.online/index.php/ijems/index

REVIEW PAPER ON DYNAMIC PHASE ADJUSTMENT IN RESPONSE TO LOAD VARIATIONS

Umankant Ingale[1], Aman Bhoyar[2], Prajwal Acharya [3], Lokesh Bhagdkar [4], Prof. Rahul Dekate[5]
[1,2,3,4] Dept. of Electrical Engineering, SCET College, Nagpur
[5]Asst. Professor, Dept. of Electrical Engineering, SCET College, Nagpur

How to Cite the Article: Umakant Ingale et. al.,(2023). Review Paper On Dynamic Phase Adjustment In Response To Load Variations. *International Journal of Engineering Management Science , 3(2), 36-43.*

Keyword
Arduino, Microcontroller, IR sensor, voltage sensor, Relay, Distribution Transformer Pole.

Abstract
Electrical Power transfer by using transmission lines, large cargo centers. These lines are exposed to faults as a result of lightning, short circuits, defective outfits, missed operations, mortal crimes, load, and aging. To avoid this situation, we need the exact position of the fault. This problem is handled by a set of resistors representing string length in KMs, and fault creation is made by a set of switches at every known KM to cross-check the delicacy of the same. The only way to solve this problem is to come up with a medium that can detect the fault in the electricity transmission line automatically and insinuate the authorities with a specific position. Through this design, you'll develop a device that uses detectors to smell incoming and gregarious values and detect anomalies. And, the system will be integrated with the IoT medium to insinuate the responsible people in real time with the position information; specialized losses occur naturally and are caused by power dispersion in transmission lines, mills, and other power system factors. Specialized losses in transmission and distribution are reckoned with information about total cargo and the total energy bill. While technology is raising pitches, we should also note the addition of immoral conditioning. The phase power cut is the main issue in home or assiduity, so our design aims to shift the cargo to another phase if one phase is disconnected. Also, if the cargo increases, the phase is shifted.

INTRODUCTION

It's known that when a fault occurs in overhead transmission line system also immediate changes in voltage and current at the point of fault induce high frequency (John, B., Khobragade, N., & Bhambulkar, A. V. ,2022). Electromagnetic impulses called travelling surge which propagate along the transmission line in both directions down from the fault point. The electric power structure is largely end infuriated against numerous forms of natural and spiffy physical events. Which can distrustfully affect the overall performance and stability of the grid? The fault impedance being low (Sahare, Mohadikar, Sharma, Bhambulkar, & Yerpude, 2019). The fault current is fairly high, during the fault (Rahul Mishra et al.,2013). The power inflow is diverted towards the fault and force to the neighboring zone is affected Voltage come unstable. It's important to descry the fault as early as possible that's why a tackle is being made using microcontroller to make its process briskly. The transmission line captain resistance and inductance distributed slightly along the length ofthe line. Travelling surge fault position styles are generally more suitable for operation long lines (Kajal et al., 2023). Power transmission lines employ at 50- HZ are further than 80- km long are considered to have the parcels of voltage and current surge that travel on the line have the parcels of voltage and current surge that

travel on the line with finite speed of propagation (Bhambulkar & Titarmare, 2021). Traveling surge styles for transmission line fault position have been reported since a long time. Following developments employ high speed digital recording technology by using the traveling surge transients created by the fault (Jadhav & Bhirud, 2015). Presently, the electric power structure is more vulnerable against numerous forms of natural and vicious physical events which are directly affect the stability of grid (Bhambulkar & Titarmare, 2022). There will be some parameter which is affected (Ambudare et al., 2023). With this, there's an approaching need to equip the age-old transmission line structure with a high- performance data communication network that supports unborn functional conditions like real in the time record and control necessary for smart grid integration. Due to this fashion the real time monitoring is necessary (Tijare et al., 2020). Numerous electric power transmission companies have primarily depended on circuit pointers to descry the defective sections of their transmission lines (Nayak, C.B. ,2021). There are still challenges in relating the exact position of these faults. Although fault index technology has handed a flexible means to detect endless faults, the specialized crew and command brigades still has to physically patrol and check the bias for large duration to descry defective sections of their transmission lines. Most of these loads consume further reactive power and therefore increases confluent losses and reduces active power inflow capability of the system. In this paper, a STATCOM grounded regulator for a three- phase system feeding single phase loads is presented (Gaurkhede et al., 2023). The objects of the regulator in the system is to compensate the inductive loads to gain nearly concinnity power factor, balance the source currents by cancelling the effect of unstable loads and to filter out the cargo harmonious currents in order to form a sinusoidal force current (Baghele et al., 2023); (Bhambulkar, A.V. ,2011). A simulation model of the system is developed in MATLAB SIMULINK and tested with direct and non-linear loads under balanced and unstable conditions (Nayak, C.B. ,2022). This research provides an economical substructure to design a real time data transmission network. To observe the status of the power system in real time, sensors are put in various components in the power network. These sensors are able to taking fine grained measurements of a variety of physical or electrical parameters and generate a lot of information (Patil, R. N., & Bhambulkar, A. V.,2020). Sending this information to the control center in a cost efficient and appropriate time is a critical challenge to be addressed in order to build an intelligent smart grid (Bhambulkar, A., V., Gaur, H., & Singh, A. K. ,2021). To ensure this the project uses the relay as a sensor switch for the transmission line and if one phase is cut off the respective relay will off and so the controller gets the notification and load is shift to another phase using relay network (Bhambulkar et al., 2023). Similarly, the current sensor uses to check the load power and if increases above the required limit then again load is shift to another phase. Fault as early as possible that is why a kit is being made using microcontroller to make its process faster (Ganorkar R. A. et al. ,2014).

LITERATURE SURVEY

Su Chen, GCza Jobs ‘‘Series and Shunt Active Power Conditioners for Compensating Distribution System Faults’’, Vol. 142, No. 1, Jan. 1955.The growing concerns regarding electric power quality and availability have led to the investigation of solutions to eliminate or mitigate the problems created on critical loads by faults in distribution systems. Series and shunt active power conditioners have been proposed and used for this purpose. This paper discusses and compares the potential of D- STATCOMs and DVRs to provide these functions. It introduces a compensator rating factor which defines the ability of the compensator to support the load voltage in the presence of single and three phase faults. The algorithms required to carry out voltage support are derived and alternatives discussed, including the use of sequence components and direct voltage regulation.

Anu P, Divya R, Dr. Manjula G Nair ‘‘STATCOM Based Controller for a Three Phase System Feeding Single Phase Loads’’ Most of these loads consume more reactive power and thus increases feeder losses and reduces active power flow capability of the system. In this paper, a STATCOM based controller for a three-phase system feeding single phase loads is presented. The objectives of the controller in the system is to compensate the inductive loads to obtain nearly unity power factor, balance the source currents by cancelling the effect of unbalanced loads and to filter out the load harmonic currents in order to form a sinusoidal supply current. A simulation model of the system is developed in MATLAB SIMULINK and tested with linear and non-linear loads under balanced and unbalanced conditions.

L.S. Ezema, B.U. Peter, O.O. Harris ‘‘Design of Automatic Change over Switch with Generator Control Mechanism’’ Power supply in Nigeria and most developing countries of the world is anything but stable. This has adverse effects on the consumers of the electricity and the equipments that are operated from the mains sources of electricity supply in these parts of the world. In this paper, we provide an automatic switching

mechanism that transfers the consumer loads to a power source from a generator in the case of power failure in the mains supply. It automatically detects when power has been restored to the mains supply and returns the loads to this source while turning off the power from the generator set. This mechanism has been tested and we recorded a great result. It thus holds an important key in the provision of a continuous power supply through a near seamless switching between the mains supply and an alternative standby source like the generator set (Uikey et al., 2023).

Ahmed, M.S., Mohammed, A.S., Agusiobo, O.B. ‘‘Single Phase Automatic Change-Over Switch” Phase selector is a mechanism used in alternating or switching between power phases with respect to the availability of power on any of the phases. Over the decades, there has been frequent phase failure in the power phases resulting to manual switching of the fuse from one phase to the other. However, this paper focuses on the design of a phase selector using automatic switching mechanism. This during its operation transfers the consumer’s loads to the available power source in the case of power failure in the power supply from the national grid and automatically detects when power is restored to the failed phase and returns the loads to this source. In the course of this design, several tests were carried out such as the continuity test of contactor and relay coils to ascertain low resistance, continuity test on the contacts of the materials used to ensure free flow of current, conductivity of the wires and the whole system was also simulated using the Proteus electronics software (Pothi et al., 2023)

BLOCK DAIGRAM

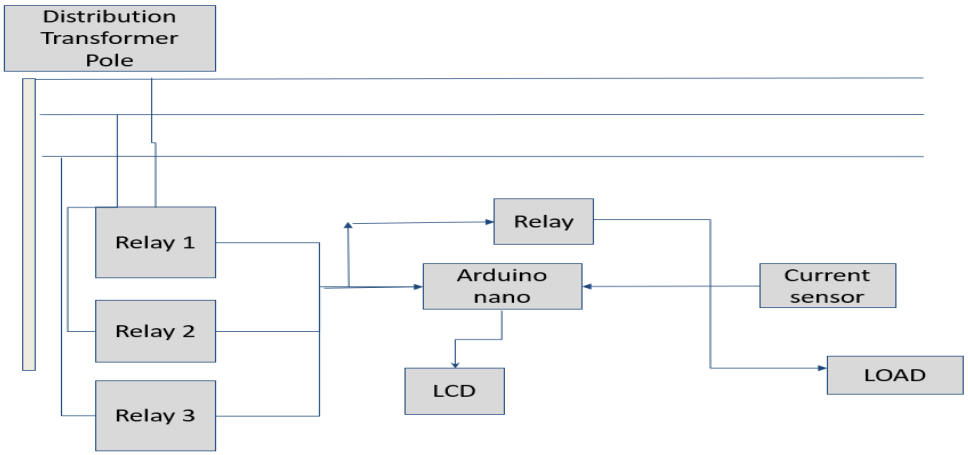


Fig.1 Dynamic Phase Adjustment in Response to Load Variations

The main objectives of this research are as follows:
1. To select automatically a voltage that is present in power line.
2. To avoid stress and inconvenience in manually selecting of phase voltage.
3. To build a system that can be able to choose any voltage that appears to be of high potential among other voltage.

The provided discusses a system that uses an Arduino Nano controller as its central processor to monitor and control a three-phase electrical setup. Here's a brief explanation:

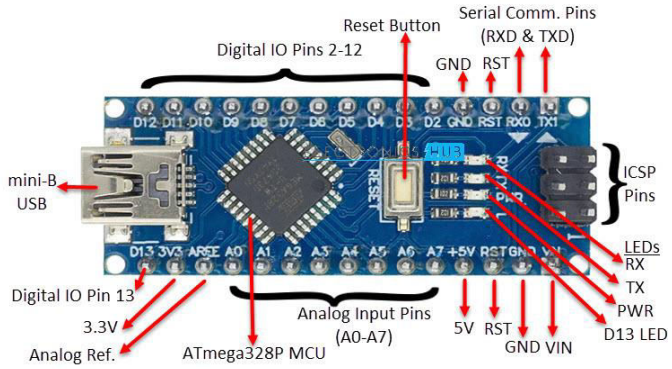
Central Processor: The Arduino Nano controller serves as the central processing unit for the system. It is responsible for controlling and monitoring the entire setup.
Three-Phase Transformer: The system involves three transformers, each converting 230 volts AC to 9 volts AC. These transformers are likely used to power the connected loads or equipment.
Relays: Relays are used in the system for various purposes. Three relays are used as sensors for each phase, which means they monitor the status of each phase. Additionally, two more relays are used for load switching.

Phase Monitoring: The three relays that serve as sensors monitor the status of each phase. If anyone phase goes off or experiences a fault, the respective relay sends a signal to the Arduino Nano.
Load Relay: When a phase is detected as being off, the system uses the load relay to trigger a response. For example, it may shift the load to other phases to maintain power continuity to critical equipment or systems.
LCD Display: An LCD screen is integrated into the system, and it is used to display messages or information. When a phase goes offline or when load shifting occurs, the Arduino can display relevant messages on this screen.Current Sensor: Current sensors are connected in series with the loads. These sensors measure the current passing through the load. If the current exceeds a certain threshold, indicating an overload or fault, the Arduino can trigger the relay to shift the load to another phase or take corrective action.
In summary, the system uses an Arduino Nano controller to monitor a three-phase electrical setup. It checks the status of each phase, uses relays to control load switching, and can trigger responses in case of phase failures or abnormal currents. The status and messages related to these events are displayed on an LCD screen, providing real-time information and control over the system. Road injuries are the leading cause of death around the world for children and young adults aged 12- 30 years. Approximately 1.35 million people die each year as a result of road traffic crashes.

A. Distribution Transformer Pole

Pole-mounted transformers are power distribution transformers that are mounted on a power pole (wood or concrete) and usually horizontal to overhead cables. Pole mounted transformers are common breadbox transformers used for converting distribution voltage to a 240 volt power source used by homes and small businesses (Wairagade et al., 2023).
Pole mounted power transformers are used in many rural areas. These transformers range from 25 kVA to 100 kVA and convert 11,000 to 33,000 volts to 433 volts low. Pole mounted transformers are reasonably small in size and mass. We can easily install on single-pole structures and larger units on two-pole structures, approximately 5 meters from the ground. This makes transformers inaccessible, reduces the risk of injury to animals and humans, and minimizes vandalism (Kokkawar et al., 2023)

B. Arduino Nano



After Arduino UNO, the most popular board in the Arduino line-up is probably the Arduino Nano. Both UNO and Nano are based on ATmega328P Microcontroller but Nano is significantly smaller in size compared to UNO. Despite the size, Arduino Nano packs in more or less the same features as UNO. If you compare UNO and Nano, then Nano lacks the DC Power Jack and contains a mini-B type USB connector. Other than that Nano is very similar to UNO in terms of functionality. The Nano board is designed in such a way that the pins are breadboard friendly so that you can easily mount it on one for your DIY projects. Overall, the Arduino Nano is a very good alternative to the mighty Arduino UNO and is available at a lower price. Personally speaking, I suggest Arduino Nano over UNO as it is cheaper, breadboard friendly, small in size and has couple of more pins (digital and analog IO) than UNO

METHODOLOGY

The methodology for implementing the system described in the provided content involves several steps to design, build, and operate the three-phase electrical monitoring and control system. Here's a general methodology for this project

Project Planning: Define the project objectives and requirements, such as the desired response to phase failures, load shifting criteria, and acceptable current thresholds. Create a project plan, including a timeline, budget, and resource allocation (Bhambulkar, A. V., & Patil, R. N., 2020).

Components and Hardware Selection: Choose appropriate components, including the Arduino Nano controller, three transformers, relays, LCD screen, current sensors, and other necessary hardware. Ensure compatibility and adequate specifications for the selected components (Bhambulkar et al., 2021).

Circuit Design: Design the electrical circuits, including the connections for the three transformers, relays, current sensors, and LCD display. Ensure proper electrical connections to safely interface the hardware components with the Arduino Nano.

Arduino Programming: Develop the software code for the Arduino Nano to perform the following tasks: Monitor the status of each phase using the relay sensors.

Detect phase failures or abnormal currents through the current sensors. Control load switching relays based on predefined criteria. Display messages on the LCD screen. Implement any other required functionality.

Prototype Assembly: Build a physical prototype of the system, including mounting the components on a suitable platform. Ensure that all connections are correctly wired according to the circuit design.

Testing and Calibration: Test the system under various load conditions to verify its functionality. Calibrate the current sensors and relays to respond appropriately to phase failures and current overloads.

Integration and Monitoring: Integrate the system into the actual three-phase electrical setup where it will be deployed. Continuously monitor the system's operation to ensure it responds correctly to phase variations and current anomalies.

Documentation: Create detailed documentation, including schematics, code explanations, and user manuals for maintenance and troubleshooting.

Safety Measures: Implement safety measures to protect against electrical hazards, such as short circuits, and ensure the system complies with relevant safety standards.

Deployment and Maintenance: Deploy the system in the target environment where it will be used for real-time monitoring and control. Establish a maintenance plan for regular system checks and updates as needed.

User Training: Train the operators and users of the system on its functionalities and how to respond to alarms and messages displayed on the LCD screen.
Scaling: If required, design the system for scalability to accommodate more phases or loads in the future.
The methodology outlined above provides a systematic approach to designing, building, and operating the three-phase electrical monitoring and control system. It ensures that the system meets its objectives, operates safely, and can be effectively maintained over time.

CONCLUSION

In this paper, we are implementing the system described in the provided content, which involves several steps to design, build, and operate the three-phase electrical monitoring and control system. The phase power cut is the main issue in homes or industries, so our project aims to shift the load to another phase if one phase is disconnected. Also, if the load increases, the phase is shifted.

REFERENCES

1. Ahmed, M.S., Mohammed, A.S., Agusiobo, O.B, ‘‘Single Phase Automatic Change-Over Switch, AU J.T. 10(1): 68-74)’’.
2. Ambudare, Rajurkar, Ganvir, Gaurkhede, Pothi, & Titarmare. (2023). OPTIMIZATION OF SOLAR POWER FOR ON-GRID PV SYSTEM BY IMPLEMENTING SUPER CAPACITORS. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 562–565. https://doi.org/10.56726/IRJMETS32922
3. Anu P,Divya R, Dr. Manjula G Nair, ‘‘STATCOM Based Controller for a Three Phase System Feeding Single Phase Loads’’ 2015 IEEE International Conference
4. Baghele, Padole, Dongare, Titarmare, Gaurkhede &Dekate.(2023). UNDERGROUND TUNNEL CABLE MONITORING–AN OVERVIEW. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 669–672.
5. Bhambulkar, & Titarmare. (2021). Innovations at the Intersection of Civil and Electrical Engineering for Sustainable Food Processing. INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES, 10(4), 577–586. https://ijfans.org/uploads/paper/d21694cab4e6819e98c90f5e1159e5bb.pdf
6. Bhambulkar, & Titarmare. (2022). Energy-Efficient Building Design for Food Manufacturing: An Interdisciplinary Review. INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES, 11(10), 3009–3017. https://ijfans.org/uploads/paper/90e241759613309dc0827cbb78c94909.pdf
7. bhambulkar, A. V., & Patil, R., N., (2020). A New Dynamic Mathematical Modeling Approach of Zero Waste Management System. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 11(3), 1732-1740.
8. Bhambulkar, A., V., Gaur, H., & Singh, A. K. (2021). Experimental Analysis: Cable Stayed Bridge. Ilkogretim Online, 20(2), 1942-1947.
9. Bhambulkar, A., V., Gaur, H., & Singh, A. K. (2021). Overview An Cantilever Bridge. Ilkogretim Online, 20(3), 2643-2646.
10. Bhambulkar, A.V. (2011). Municipal Solid Waste Collection Routes Optimized with ARC GIS Network Analyst. International Journal Of Advanced Engineering Sciences And Technologies, 11(1): 202-207.
11. Dr. Ashtashil Vrushketu Bhambulkar, Niru Khobragade, Dr. Renu A. Tiwari , Ruchi Chandrakar, & Anish Kumar Bhunia .(2023). DEPLETION OF GREENHOUSE EMISSION THROUGH THE TRANSLATION OF ADOPT-A- HIGHWAY MODEL: A SUSTAINABLE APPROACH. European Chemical Bulletin,12(1), 1-18. Retrieved from https://www.eurchembull.com/fulltext/246-1674559389.pdf?1676012263.
12. Erika Twining, “Grid Current Regulation of a Three Phase Voltage Source Inverter With an LCL Input Filter,” Transaction On Power Electronic, Vol .18, No .3 May 2003. Mariusz Malinowski and Jasinski.

13. Ganorkar RA, Rode PI, Bhambhulkar AV, Godse PA, Chavan SL. Development of water reclamation package for wastewater from a typical railway station. Int J Innov Technol Res. 2014;2(2):841–846 http://ijitr.com/index.php/ojs/article/view/288/pdf.
14. Gaurkhede, Bhusari, Shirbhate, Thool, Pothi & Titarmare.(2023). IOT BASED INDUCTION MOTOR SPEED CONTROL AND MONITORING SYSTEM International Research Journal of Modernization in Engineering Technology and Science, 5(1), 515–519.
15. Gua-Kiang Hung, Chih- chang Chang, "Automatic Phase Shift Method for Islanding Detection of Grid–Connected Photovoltaic Inverters," IEEE Transaction on Energy conversion, Vol.18. No.1, March 2003.
16. Jadhav, & Bhirud. (2015). An analysis of causes and effects of change orders on construction projects in Pune. . *International Journal of Engineering Research and General Science*, *3*(6).
17. John, B., Khobragade, N., & Bhambulkar, A. V. (2022). SAP'S STRATEGY FOR DIGITAL TRANSFORMATION IN INDUSTRY 4.0. European Journal of Molecular & Clinical Medicine, 9(08), 2022.
18. Kajal, Sephali Sinha, Swayamprabha Pati, Sanyogita Shahi, Medicinal Value of Chiraita: A Review, European Chemical Bulletin, Volume 12, Special Issue 1(Part B), 2023, ISSN No. 2063-5346.
19. Khunte, M. N. K. AN EXPERIMENTAL STUDY ON PROCESSING, CHARACTERIZATION AND MODEL ANALYSIS OF RANDOMLY ORIENTED SHORT BANANA & GLASS FIBER REINFORCED HYBRID POLYMER COMPOSITES., International Journal of Mechanical Engineering ,Vol. 6 No. 3 December, 2021.
20. Khunte, M. N. K., & Mishra, M. R. AN EXPERIMENTAL WORK ON EPOXY, BANANA FIBER&E GLASS FIBER COMPOSITES., International Journal of Mechanical Engineering ,Vol. 7 No. 3 March, 2022.
21. Khunte, N. K. ISSN 2063-5346 BIODIESEL PRODUCTION FROM NON-EDIBLE OILS: A COMPARATIVE STUDY OF JATROPHA AND KARANJA OILS., Eur. Chem. Bull. 2023,12(Special Issue 1), 306-311.
22. Kokkawar, Motghar, Randaye, Polke, Titarmare, & Yende. (2023). A REVIEW ON INTERNET-BASED INTELLIGENT AGRICULTURAL IRRIGATION SYSTEM. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 673–679. https://doi.org/10.56726/IRJMETS32875
23. L.S. Ezema, B.U. Peter, O.O. Harris, ''Design Of Automatic Change Over Switch With Generator Control Mechanism'', ISSN: 2223-9944 Vol. 3, No. 3, November 2012
24. Mishra, R. CRITICAL ANALYSIS OF THERMO-PHYSICAL PARAMETERS AND MODELING OF HYBRID ENERGY.
25. Mishra, R., & Dewangan, V. (2013). Optimization of Component of Excavator Bucket. International Journal of Scientific Research Engineering & Technology (IJSRET), 2, 076-078.
26. Nayak, C. B. (2021). Experimental and numerical investigation on compressive and flexural behavior of structural steel tubular beams strengthened with AFRP composites. Journal of King Saud University – Engineering Sciences, 33(2), 88-94.
27. Nayak, C.B. (2022). Experimental and numerical study on reinforced concrete deep beam in shear with crimped steel fiber. Journal of Innovative Infrastructure Solutions, 7(41), 1-14.
28. Patil, R. N., & Bhambulkar, A. V. (2020). A Modern Aspect on Defluoridation of Water: Adsorption. Design Engineering, 1169-1186.
29. Pothi, Titarmare, Yende, Umbderkar, Wakodiar, & Gadpayle. (2023). DESIGN AND IMPLEMENTATION OF A MICROCONTROLLER BASED AUTOMATIC CHANGEOVER SWITCH. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 498–502. https://www.irjmets.com/uploadedfiles/paper//issue_1_january_2023/32878/final/fin_irjmets1673673314.pdf
30. Sahare, Mohadikar, Sharma, Bhambulkar, & Yerpude. (2019). A Review Technique in Structure Audit. *International Journal of Management, Technology and Engineering*, *IX*(III), 5512–5514. Retrieved from https://www.ijamtes.org/VOL-9-ISSUE-03-2019-6/
31. Steven M. Hietpas, Mark Naden,"Automatic Voltage regulator using an AC Voltage-Voltage Converter," IEEE Transaction on Industrial Application, Vol 36,no 1, January-February 2000.

32. Su Chen, GCza Jobs, ‘‘Series and Shunt Active Power Conditioners for Compensating Distribution System Faults’’, Vol. 142, No. 1, Jan. 1955.
33. Tijare , Mr. Supare, Shripad, Kolhekar , Sonkusare , & Bhambulkar. (2020). COMPARITIVE ANALYSIS ON VARIOU PROPERTIES OF PERVIOUS CONCRETE WITH CONVENTIONAL CONCRETE. *Journal of Emerging Technologies and Innovative Research*, *7*(5), 144–147. Retrieved from https://www.jetir.org/papers/JETIREA06030.pdf
34. Uikey, Rangari, Kewate, Polke, Titarmare, & Yende. (2023). A REVIEW ON INTELLIGENT AGRICULTURAL SEED AND FERTILIZER SPREADER ROBOT WITH IOT. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 471–476. https://doi.org/10.56726/IRJMETS32868
35. Wairagade, Meshram, Maraskole, Titarmare, Gaurkhede & Dekate. (2023). REVIEW PAPER ON AUTOMATIC CABLE CUTTING MACHINE. International Research Journal of Modernization in Engineering Technology and Science, 5(1), 485–487.