Study of IoT Based Power Failure Monitoring and Analysis System

[1]Mohammed Jamshed,

[1]Student,
Electrical and Electronics Engineering,
Amity University, Noida, India

[2]Karan Harit,

[2]Student,
Electrical and Electronics Engineering
Amity University, Noida, India

[3]Bharat Bhatnagar

[3]Student,
Electrical and Electronics Engineering
Amity University, Noida, India

Abstract : Transformers are an essential element of electrical components that is utilized all over the world . The duty of keeping track of the condition is now a fierce one. Because any disruption to the structural features would lead to a significant loss . As a result, it is vital to maintain a check on a frequent basis. The major goal of this paper is to use advanced technologies to collect metadata on equipment condition through the web. We will keep an eye on the voltage of the equipment. This information will be transferred over wi-fi through the web. The viewer will be contacted including an alarm signal if there is a power outage utilizing esp32 units. It also has a unique feature of detecting phase failure. The indicator would illuminate on the control kit if any segment becomes defective. Such variables will be shown on the screen .Such approach allows us to monitor the equipment's condition on a continuous basis and take the appropriate steps to ensure that it is properly maintained.

IndexTerms - **Arduino, Internet of Things, Power Failure monitoring system.**

I. INTRODUCTION

A phasing failure happens whenever one of the 3 phases is disrupted. A broken breaker, heating stress, damaged cable, deteriorated connection, or equipment problem are common causes of' single phasing.' It is indeed a sophisticated technology that detects outages. There still are three stages. When any of the phases detects a problem, it sends a text signal to the appropriate authorities. The ESP32 module is linked to this IoT system, and the connection is linked for configuring purposes. When the phases are separated, the system displays an outage on the LCD, along with the terminal voltage, and then sounds an alarm. Then it informs the authorized service of the detached stage by sending a signal. When restoring electricity towards the step method, an alarm sounds & data about the phase's operation would be sent to the authoritative user's contact details. As a result, the proper agency is immediately contacted, and they can act swiftly to resolve the issue.The Iot is bringing the lines between the physical together to make society across us intelligent and much more adaptive. Any physical thing that can be linked to the internet and operate or convey data can be converted into an Electronic gateway.

II. LITERATURE REVIEW

Utility companies are massive and intricate systems. Electric utilities like this include a supplemental form of electricity that is critical for satisfying a person's requirements, improving the quality of life, and boosting advancement [1] [2]. Such devices are linked to give monetary opportunities, enhanced dependability, and work and organization, trying to make it the most essential regional and world architecture, with huge environmental and economical and homeland security consequences if they fail [1]. The basic aspects of a power source are scattered power producing devices & applications, which are frequently made up of several equipment such as overhead lines, switchgears, controllers, and converters. Production, transfer, and consumption are the three divisions that make up a power network. As per [5,] the supply chain is a critical component of the whole electric utility strategy, serving as the linked report among mass transmission networks and consumers, with supply chain failures accounting for 80 percent of user energy power interruption. The requirement for a stable energy source has risen as civilization has become more urbanized and computerized. Catastrophic events, also known as energy breakdowns, disrupt urbanization and digitalisation, due to reduced welfare, poor economic expansion, and lower organizational productivity [3] [4]. Brownouts can be characterized by increased air, falling items, falling rocks, physical touch by wildlife, thunderstorms, blizzards, dielectric contaminants, mishaps, surges, poor insulation, and safety loss [4]. The goal like most energy energy suppliers is to guarantee that outages result in less lost revenues, lost work, and user discomfort. The Distributed system includes a distributed machine for electricity fault location to ensure minimal stoppage expenditures outages [4] [6].

The mechanization of the brownout managerial network is necessary for spotting an outage and pinpointing its origin in order to restore power quickly. It is critical to maintain the electrical system secure when a defect has been detected by determining the geolocation of the blackout. In [4] Among key measurable gains of computerized power surge detecting systems are stated being the lowered number of users affected as well as the customer behavior durations of disturbance. Outages are common in the

electrical business, necessitating an efficient and contemporary approach to power outage and troubleshooting. One such research aims to create an energy breakdown detection and administration paradigm. An outage Object detection is done by the researcher of any location without the requirement for actual visits. Tactile items are used to perceive and gather data from remote locations in actual environments, and then relay the information to the server location because the electronics industry has progressed so ingrained in all parts of life, the stability of the energy generation system is more important than ever. Development on its use detects different factors such as base and circuit tests, roadways, and device planned maintenance is also being done. Researcher in [11] proposing an internet lamp post regulation and issue detection. These employ a Wi-Fi module to broadcast malfunctioning light alarm signals here to online, allowing data to be collected at any location worldwide. The Arduino microcontroller is used to sense and operate the GSM module, which sends an alarm Text message to a cell phone. An energy resistor monitors be it light or dark, turns on even off the lamps, & indicates where illumination is broken. The research in [12] proposes and develops an iot based experimental approach that relies to prevent grain stealing at nutrition reserve authority depots. PIR sensors detect movement and transmit meaningful data. They came to the conclusion that if this technique is used, fraud will decrease and food administration at depots will enhance. In their design, meanwhile, there has been no mechanism for finding solar storage. A benchmark analysis of the problems raised in inventory of replacements was undertaken in [13], and it was determined that the toughest problem was owing to manual resource management, which resulted in erroneous inventory recording and component fraudulent activity. They suggest a browser inventory control based on cloud design and qr technologies to address this problem. The server and interface elements of the concept programme were constructed, and customers were established and controlled by the sysadmin. To capture the barcodes upon those objects, a scanner is included. It collects information about the captured image, which is subsequently recorded to the system. The constructed prototype outperformed the conventional and document methods in favor of speed, efficiency, and reliability. Furthermore, the survey did not create a way for it to be notified when replacements are stolen, whether via software program or a Text to a cell device.

A concept centered on wireless sensors networking, computing, and IoT is presented in [14] to assist the quick response, and fact checking from all of its supply depots. It experienced issues including such mechanical as becoming, inadequate connection to faraway facilities, failure to monitor goods in need, robbery, rotting of merchandise owing to the absence of pollution management, according to background research. The microprocessor, moisture levels cameras, activity devices, Geolocation tracker, communication devices, and Area network connectivity were all included in the suggested sample. Users also managed to use the web applications to analyze climate, precipitation, geolocation, and mobility using all these sensors. They came to the conclusion that contemporary storage, which relies on sensors, detailed food storage, monitoring, and visibility of procedures, resulted in free food selling and improved sustainability of natural resources. Furthermore, the study focused on delivering notifications through Enabled devices, as it has a range of around 100 meters, and did not investigate how Gsm could be utilized in the same way. The GPS module is used by the researchers in [15] to identify and control uplink line issues. The device may send a text message to the operator, and the versatility can place current limitations on the service. The energy, amplitude, and impedance are sensed by the microprocessor. By matching the flow measured with the predefined threshold, Embedded systems can identify power system restrictions. Whenever the predefined threshold is exceeded, the microchip gives a notification to the server, which triggers an Instant warning via the Cell phone. Adjusting the input power threshold from just a cell device is now feasible thanks to interconnection. The investigators, from the other hand, won't investigate how cloud applications may aid in the maintenance of power distribution characteristics or the delivery of notifications including the site of the defect.

III. OBJECTIVE

According to the research framework of planned and executed developments, there's still a big opportunity to be explored from application of monitoring and computing technologies in electrical networks and certain other industries. It should also be acknowledged that there were no tests or developments that used virtualization as well as sensor technology in multiple power outages control and implementation, allowing alarm signal, placement, condition, intensity, and quantification documentation being sent to both cellphones but rather cloud solutions for capacity and destination tenacity on destination graphs. In [16] [17] On power transmission damage detection, authors think of a Cellular system. Their output, amperage, and rate are all sensed by a processor. This information is then transferred to a cell device and displayed on a workstation by serial connection. The experts, on the other hand, do not investigate the utilization of cloud infrastructure through Wifi, nor do they investigate the advantages of using geographical mapping to locate the reported defects. [18] [19] suggest using GSM tools to track substation characteristics such as voltage and current (overcharge, power quality issues, and overheating) and transmit this data to the operator's cell phone for more intervention.

The modification in quality of the characteristics is sent to the carriers by Text messages using GSM technology, so administrators could text message to examine the substation's statistics. The electrical values are sensed using an Embedded system. The authors, on the other hand, do not investigate the usage of cloud technologies, WLAN, or the advantages of using position information to locate the reported defects. To detect circuit characteristics such as critical load, pressure, and load conditions, the authors in [20] employ a combination GSM, Texting, and processor solution. In [21], the study develops even farther by utilizing the attachment of the microprocessor to a machine, allowing for converter state management. Speculative plan is a detailed method defined as the problem-solving stage of study in which the researcher concentrates on the report's area while anticipating challenges at a later time [22].

In addition, study master plan specifying the methods as a sort of study that is used to provide a broad picture or an outline by examining the views, practices, ideas, and sentiments of a select sample of people [23]. Usage scenarios depict how users engage through its context by depicting the actions done by the information system and thus the actions of the platform. [24].The Arduino is a microcontroller device open - sourced microcontroller device that consists of a circuitry and program known as the Arduino IDE which is utilized to create and transfer computer algorithms to the connected device [25]. Arduino have analog and digital pins that may be configured as serial communication signals using the Arduino Software [26].

IV. RESEARCH METHODOLOGY

This review presents an overview of the study methodology as well as an overview of such data collection techniques. The proposed work began with a primary survey, the results of which were utilized to create an outage monitoring methodology and a concept dependent on it. The observational, interpretive, and hydraulic slide program development inquiry approaches were used in this study. Experimental plan is a detailed method defined as the problem-solving period of study in which the researcher concentrates on the report's scope while anticipating challenges at a later time. The difficulties encountered by the supplier and indeed the energy customers in notifying and mitigating outages were investigated using qualitative and observational studies.

A sample for monitoring and communicating power dissipation was developed using an iterative waterfall systems integration academic practice. Data sets and selection: The material for this inquiry was gathered by both internal and external sources. Systematic review materials on the issue, including manuals, key periodicals, papers, published technical articles, and documentations, were used as secondary resources. And from the other end, main data comprised questioning surveys with the power network operator and power customers. Workers from Different points in the process which serve as in Help Desk service team, Problem Co-coordinators, and power clients in the area were the report's target demographic. People who utilize power call center staff, and fault monitors were chosen in this study. These information gathering tools included both open-ended and closed-ended queries. The researcher planned to gather and analyze answers as a result of this. The experts were chosen using a Convenient sampling Sample technique, since the goal was to find people who were familiar with present brownout reports images. Nonetheless, a stratified cluster survey strategy was used to pick power users, with regional communities being chosen. Later afterwards, survey design was used, wherein residences were chosen for survey form. The size of the sample was determined using the stratified sampling approach, which maintains a curvature of relative relations among populations and matching data points with a confidence interval. The number of participants was assessed to be 383. Data Collection . The data for Sociologists was used to enter and evaluate quantifiable data gathered from participants. Statistics were used in quantification, which was presented in columns and data sets. However, a stratified random sampling process was used to choose the power users, with province communities being chosen by simple sample choice. After that, survey design was used to pick houses for distribution of the questionnaires. The survey research method was determined using a sample selection approach, which is based on a graph of correlation variables among demographic and sample .

V. POWER FAILURE MONITORING SYSTEM

5.1 Power failure sensing functionality

The brownout detector feature is enabled via a volt detector wherein the voltage is recently resigned over 230V AC to 12 V AC, rectified, and utilized as a Microcontroller entry of roughly 2V DC. Whenever the provision is lost, a Arduino's 2V DC input would become 0, as well as the encapsulated programme in the Embedded system and Atmega microcomputer needs to send an Instant notification to a predetermined phone through using able to connect ESP-32 over wireless router, containing information about the condition of the source first from 3 phases or the power surge placement. Simultaneously, a program on the cloud host is executed via an instruction U Target server to analyze the blackout Import the information and position of the power interruption into the database server for retention and presentation on the virtualized environment. Three voltage transformers scale down the ac Mains voltage value from the R,Y,B phases to 12V Ac voltage in the voltage sensor module. A bridge rectifier converts alternating current to direct current and a voltage splitter guarantees that the Microcontroller panel's analog signal ports get about 2V DC. The volt measurements out from the device are transformed to a range between 0 and 1023 by the analogue signal pins, which will then be reconverted to volt levels for showing on the Display and network infrastructure. When any of the 3 phases loses power, the outcome The integrated programme in the Microcontroller senses the interruption of power and transmits alerts to the server and a predetermined phone when the power feed to the Microcontroller is lost. The Microcontroller may communicate the volt difference between the 3 phases to the cloud infrastructure via an integrated software calculation. The public cloud also shows the date and time of the alert messages. The primary wire harness is shown in Figure 7. Aside from the voltage sensor circuit, the main board circuit is powered by an LM7805 regulator that keeps the 5 Volt input value constant. There's also an energy management circuitry that manages the device's charge, as well as a Display screen.

5.2 Arduino microcontroller board

The Microcontroller functionality software device that consists of a circuitry and application known as the IDE , that is utilized to create and publish computer code to an arduino hardware. Arduino boards have digital audio pins that may be configured to send or receive signals using the Arduino IDE .
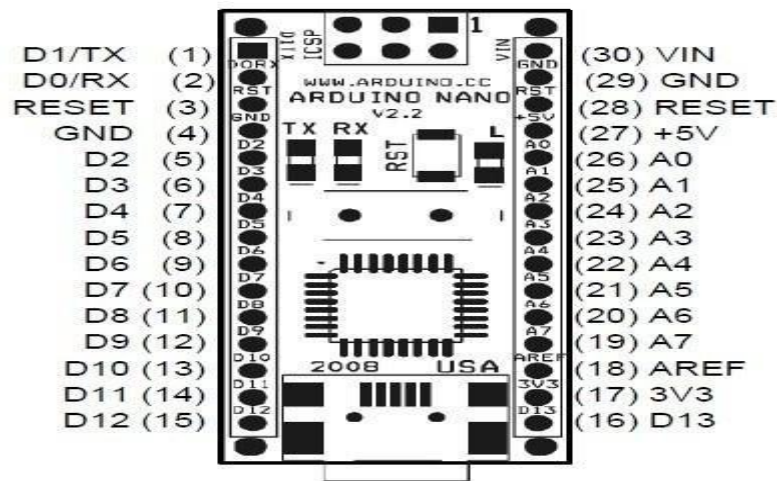
5.3 Prototype Testing

The model was developed and tested in a laboratory setting by linking it to a 3- phase power source as well as a cell for standby, as illustrated in Fig. 10. A browser – based client on a desktop utilized to interface to the virtual machine, and a cellphone was utilized to receive notifications from the device. The status of the 3 phases were effectively shown on the LCD, network infrastructure, and an alarm message was delivered to the smartphone when the electricity was turned on. The amount of time required to display the three phase voltage readings from both the local Digital display and the community cloud was tested and found. Simultaneously, a Message confirming the condition of the 3 phase sent to a predetermined cell number. After that, the phone's red phase power was severed. The red phase dc supply and condition were simply moved and shown on the regional Display, network infrastructure, and cellphone, with the transfer taking only seconds. This was done for other stages as well, with comparable outcomes each time. After all of the components were removed, a zero reference voltage for all of them was transmitted to the regional Screen, virtual machines, and smartphone as aspect condition. The gadget was able to operate upon that cell after the different stages were unplugged. The 3 phase power was subsequently reconnected, and reports were properly relayed here to locally Lcd, network infrastructure, and predetermined cell phone number once more. Aside from volt readings, the position of the power outage was effectively shown on the virtualized environment and on a phone. When compared to the real location of
the lab setting, the position was likewise judged to be right. The cloud platform also displayed the date and duration of the power outage. The start time, finish time, and period of the blackout presented on the virtualized environment were confirmed to be16 true when compared to a GPS-synchronized timestamp. To see if the voltage readings reported on the Screen are correct.
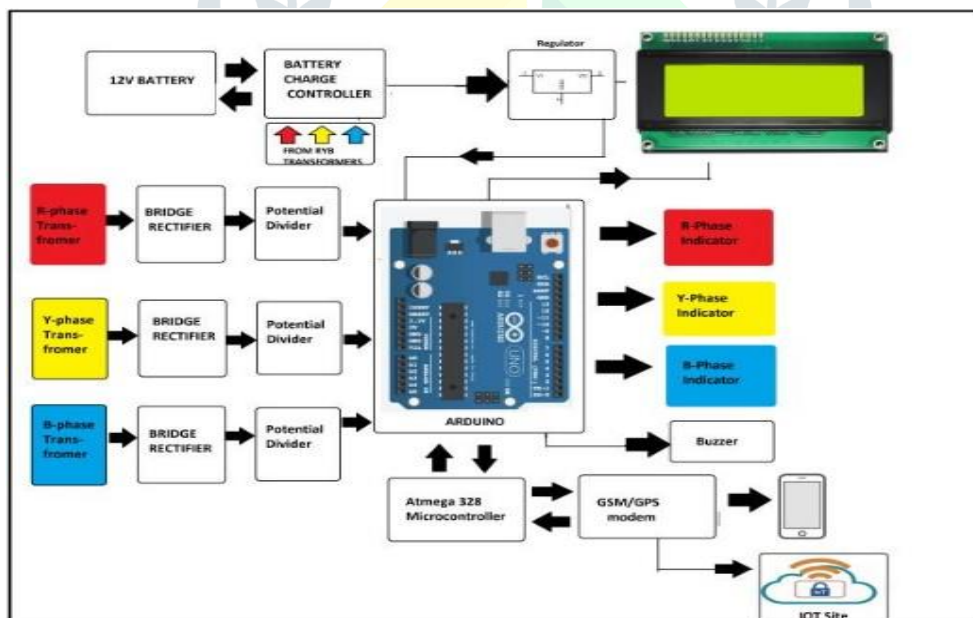
VI. CONCLUSION

Power surge notifications are transmitted to the cell-phone and internet service in a couple of seconds in the conceptual framework and sample, which is far better than allowing the client to report the incident. When implemented, this technology would enhance reaction times to outages and shorten system outages by automatically reporting power outages to utility staff through the web and cell phone. Improve reaction times to power outage notifications and shorten system outages by automatically reporting power outages to utility staff through the cloud and mobile phone. Ensure that the service operator uses the internet to manage the reduced output network and keep a record of power outages. Reduce pressure on customer service to relieve customers of the stress of notifying power outages. Allow field staff to obtain power cut data via the virtualized environment. According to the findings, managing the brownout review system is desired, and hence this technology must be completely established to reap its extravalue.

REFERENCES

[1] Sachan, "Microcontroller Based Substation Monitoring and Control System with GSM Modem," International Journal of Electrical and Electronics Engineering, vol. 1, no. 6, pp. 13-21, 2012.

[2] E. Christie, A. Ademola and A. Olayinka, "The Daunting Challenges of the Nigerian Electricity Supply industry," International Journal of Energy Technologies and Policy, vol. 5, no. 9, pp. 25-32, 2015.

[3] H. Tao, L. Simona, A. P. Anca and E. Abouzar, "Analysis of Chain of Events in Major Historic Power Outages," Advances IN Electrical and Computer Engineering, pp. 63-70, August 2014.

[4] M. Mohammed, A. Sheriff and J. Kluss, "Review of Fault Types, Impacts, and Management Solutions in Smart Grid Systems," International Journal of Smart Grid and Renewable Energy, vol. 10, no. 4, pp. 98-117, 2019.

[5] H. M, R. S, W. S, J. M, A. Ghani and B. Z, "Development of a novel fault management in distribution system using distribution automation system in conjunction with GSM communication," International Journal of Smart Grid and Clean Energy, vol. 2, no. 3, pp. 329-335, 2013.

[6] K. S. Osmo, S. Amir, L. Matti and F.-F. Mahmud, "Optimal Distribution Network Automation Considering Earth Fault Events," IEEE Transactions on Smart Grid, vol. 6, no. 2, pp. 1010-1018, March 2015.

[7] ZESCO, "Our business - Transmission," ZESCO, Lusaka, 2015.

[8] Ministry of energy and Water Development, "Power System Development Master Plan for Zambia," Ministry of energy and Water Development, Lusaka, 2010.

[9] H. M. Zulu, "ZESCO Customer Base Hits one million," ZESCO, Lusaka, 2019.

[10] B. A. Thomas and D. Carl-Johan, "Power outages and economic growth in Africa," International journal of energy economics, vol. 38, pp. 19-23, 2013.

[11] T. Gowdhaman and D. Surendran, "Automatic Street Light Control andFault Detection System with Cloud Storage," International Journal of Scientific & Engineering Research, vol. 8, no. 5, pp. 1-5, 2017.

[12] S. Chihana, J. Phiri and D. Kunda, "An IoT based Warehouse Intrusion Detection (E-Perimeter) and Grain Tracking Model for Food Reserve Agency," International Journal of Advanced Computer Science and Applications, vol. 9, no. 9, pp. 213-223, 2018.

[13] T. Muyumba and J. Phiri, "A Web based Inventory Control System using Cloud Architecture and Barcode Technology for Zambia Air Force," International Journal of Advanced Computer Science and Applications, vol. 8, no. 11, pp. 132-142, 2017.

[14] C. Mulima and P. Jackson, "A Remote Sensor Network using Android Things and Cloud Computing for the Food Reserve Agency in Zambia," International Journal of Advanced Computer Science and Applications, vol. 8, no. 11, pp. 411-418, 2017.

[15] K. Okokpujie, E. Amuta, R. Okonigene and J. Samuel, "Monitoring and fault detection system for power transmission using GSM technology," in International Conference of Wireless Networks, 2017.

[16] S. Sujatha M and K. M. Vijay, "On-line monitoring and analysis of faults in transmission and distribution lines using GSM technique," Journal of Theoretical and Applied Information Technology, vol. 33, no. 2, pp. 258-265, 2011.

[17] R. P. Vikramsingh, J. Shivani, D. Anand, S. Arti and C. Kapil, "Automatic Fault Detection in Transmission Lines using GSM Technology," International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, vol. 6, no. 4, pp. 90-95, 2018.

[18] D. Vihar, D. Avee, S. Rishi and J. Arjun, "Implementation of Remote Monitoring of Substation Equipment Using GSM," International Journal of Advanced Research in Electrical,Electronics and Instrumentation Engineering, vol. 5, no. 6, pp. 5565-5571, 2016.

[19] D. Krupal, P. Jenish, S. Yasin, M. Anas and P. Krishn, "Substation Monitoring and Control Using Microcontroller & GSM," International Research Journal of Engineering and Technology, vol. 4, no. 4, pp. 398- 403, 2017.

[20] A. Hassan, "Monitoring and Controlling of Distribution Transformer Using GSM Module (AVR Microcontroller Based)," International Journal of Advanced Research in Science and Engineering, vol. 6, no. 8, pp. 1645-1653, 2017.

[21] P. Sandeep, B. Ashish, B. Nitishsingh, K. Neelam and U. Prag, "Web based substation monitoring and protection and control," International Journal of Application or Innovation in Engineering & Management, no. Special Issue for National Conference On Recent Advances in Technology and Management, pp. 1-7, 2013.

[22] A. Gerald, A. R. Catherine and M. S. Scott, "Topic sensitivity and research design: effects on internet survey respondents' motives," Asia Pacific Journal of Marketing and Logistics, vol. 26, no. 1, pp. 147 – 161, 2014.

[23] C. Joseph and K. S. Russell, Research Methods in Education, Thousand Oaks, CA: SAGE Publications, 2011.

[24] D. Alan, H. W. Barbara and R. Roberta, System Analysis and Design, USA: John Wiley & Sons, Inc, 2012.

[25] S. Monk, 30 Arduino Projects for the evil genius, McGraw-Hill Companies, Inc publisher, 2010.

[26] B. Massimo, Getting Started With Arduino, California: O'Reilly MediaInc , 2011.