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Smart MSEB Substation Monitor Using Node MCU

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ABSTRACT:

A clever substation control machine is a complicated device that utilizes modern era at the side of sensors, node mcu, communication networks, and clever algorithms to reveal, control and optimize the operation of strength substations. A substation is a important aspect of the electricity grid that transforms high voltage electricity from power vegetation into decrease voltage strength that may be allotted to homes and corporations. A smart substation management machine can enhance the reliability, efficiency, and protection of the electricity grid.

Keywords— node mcu , substation, sensor, buzzer, relay.

Introduction

The MSEB Substation IoT machine is designed to monitor and control electric parameters which includes contemporary, voltage, and relay reputation in a substation placing. It makes use of an ESP32 Node MCU to interface with sensors and manage structures. The information is sent to the Blynk cloud platform, which allows for a ways flung tracking and manage of the device through a cell app or internet interface. The machine additionally consists of to control relay-based operations and combine safety skills, which includes a buzzer for alerting.

Substations can be owned and operated with the aid of an electrical utility, or may be owned through way of a big commercial or industrial client. Generally, substations are unattended, counting on SCADA for remote supervision and control. The word substation comes from the instances earlier than the distribution system have grow to be a grid. As applicable era stations became large, smaller producing flowers had been converted to distribution stations, receiving their power supply from a bigger plant in choice to using their very personal turbines. The first substations have been linked to excellent one energy station, in which the generators were housed, and had been subsidiaries of that electricity station. A smart substation tracking tool, like the ones being performed thru MSEB (Maharashtra State Electricity Distribution Company), makes use of advanced technologies to expose and control substation operations, improving reliability, performance, and protection.

With the appearance of microprocessor era, virtual protection and manipulate gadgets have become extra practical. New clever electronic devices (IEDs) can collect and document records on many one-of-a-kind parameters of a machine, manner them based totally totally on complex desirable judgment in a fraction of a 2nd and make decisions on regular conditions to deliver control commands to switches and breakers to smooth the fault. In addition to their advanced processing functionality, modern-day substation gadgets also can hold facts of their internal storage for a high-quality period and transfer this records to one/3-party programs for further test and assessment. IEDs can now send information to a nearby or a long way off consumer via one-of-a-kind types of verbal exchange. This offers operators greater flexibility on how and while to approach the information to provide a quick recovery time from an interruption in the substation. With greater information remotely to be had, new supervisory systems have been evolved to facilitate the project of a machine administrator within the manage center. A Supervisory Control and Data Acquisition (SCADA) tool can accumulate records from numerous IEDs in an electrical machine through superb strategies of conversation after which manipulate and screen them the usage of various visualizing era – even automating the supervision assignment based mostly on predefined parameters and algorithms. With greater information remotely available, new supervisory systems were evolved to facilitate the challenge of a device administrator inside the manage center. A Supervisory Control and Data Acquisition (SCADA) tool can collect statistics from diverse IEDs in an electrical machine via extraordinary strategies of conversation after which control and monitor them using numerous visualizing generation – even automating the supervision mission based totally totally on predefined parameters and algorithms.

Literature survey

"A clever home strength control system the use of IoT and large records analytics method", 2017, Al-Ali AR, Zualkernan IA, Rashid M, Gupta R, Alikarar

Described:

Increasing cost and demand of electricity has led many corporations to discover clever ways for monitoring, controlling and saving energy. A smart Energy Management System (EMS) can make a contribution in the direction of slicing the fees while still meeting electricity demand. The emerging technologies of Internet of Things (IoT) and Big Data may be applied to higher manage electricity intake in residential, business, and commercial sectors. This paper presents an Energy Management System (EMS) for smart houses. In this gadget, every domestic device is interfaced with a information acquisition module this is an IoT object with a completely unique IP cope with ensuing in a massive mesh wi-fi network of gadgets. The information acquisition System on Chip (SoC) module collects strength consumption statistics from every device of every smart home and transmits the data to a centralized server for similarly processing and analysis. This data from all residential areas accumulates inside the software's server as Big Data. The proposed EMS makes use of off-the-shelf Business Intelligence (BI) and Big Data analytics software program applications to higher control strength intake and to satisfy customer call for. Since aircon contributes to 60% of energy consumption in Arab Gulf countries, HVAC (Heating, Ventilation and Air Conditioning) Units were taken as a case have a look at to validate the proposed device. A prototype become built and tested inside the lab to mimic small residential location HVAC System.

"GSM enabled smart strength meter and automation of home home equipment",2017, Das HS, Saikia LC

Described:

Electricity is the heart of these days's world and now because of digitalization it became key factor to be taken care, that allows you to decorate the way of residing of humans and monetary improvement of our u . S .. For the beyond many years, there may be a loss of technological development for the fundamental shape of energy grid which involves lack of knowledge in power usage and also tedious billing system through a committed worker want to take out the bill from meter and offers to the precise purchaser area with the aid of place, similarly to errors like extra billing amount notifications from the power manufacturing board even payments are paid by way of the patron, are pretty common. In a few regions cameras also used to take the reading however it isn't so user friendly. All the above mentioned issues can be solved via the use of Internet of Things based totally energy control device which continues music of client hundreds to be able to correct billing, attention about the electricity consumption and a way to save the wastage of power by using a few threshold values on the way to flip off the desired load via relay as according to the requirement. This paper especially makes a speciality of energy control system which utilizes Internet of Things (IoT) so as to enhance the strength management degrees and clever billing system with the help of smart meters and clever grids.

"Smart grid technologies: communication technologies and requirements",2011, Gungor VC, Sahin D, Kocak T, Ergut S, Buccella C, Cecati C, Hancke.

Described:

For one hundred years, there was no alternate in the primary shape of the electric strength grid. Experiences have shown that the hierarchical, centrally managed grid of the 20th Century is ill suited to the wishes of the 21st Century. To address the demanding situations of the present strength grid, the brand new idea of smart grid has emerged. The clever grid may be considered as a present day electric energy grid infrastructure for more desirable efficiency and reliability via automatic control, high energy converters, current communications infrastructure, sensing and metering technology, and modern electricity management strategies based at the optimization of demand, energy and community availability, and so on. While cutting-edge energy structures are based totally on a stable statistics and communique infrastructure, the new smart grid wishes a one-of-a-kind and lots more complicated one, as its dimension is a great deal larger. This paper addresses vital issues on clever grid technology ordinarily in phrases of statistics and conversation era (ICT) problems and possibilities. The predominant objective of this paper is to provide a modern examine the modern state of the artwork in smart grid communications as well as to talk about the nevertheless-open research problems on this area.

"Design of computerized meter analyzing based on Node MCU",2012, Corral P, Coronado B, de Castro Lima AC, Ludwig. Described:

The conventional strength meter, which we use in our households to measure electricity consumption, is an offline tool, so it needs to be monitored manually. As the us of a's populace will increase, it's miles becoming maximum hard to take the reading of power meter from each domestic. As variety of houses will increase, it can be viable but it takes lot of manpower. The clients are unaware of strength usage, which ends up in large bills. Electricity robbery is not unusual in some rural regions which ends up in both operational and financial loss. To avoid these troubles, our Prepaid Energy Meter performs a key role. This proposed venture makes customers happy due to the fact they could monitor their usage through the internet. In this proposed version, an automated device by means of Node MCU and Arduino is carried out. SMS is despatched to recharge the meter. Since IoT is getting used, it could monitor the status of the power thru the Internet. The recharge can also be carried out thru the Internet. If there may be an inadequate balance, then the electricity deliver connection is actually disconnected from the house. The computerized alerts are also sent in the shape of

messages to the give up consumer's cellular cellphone according to the stability gift in the device. With this inspiration labor requirements, energy theft, and billing errors are decreased.

"WSN based totally strength monitoring in smart grids",2011, Yerra RVP, Bharathi AK, Rajalakshmi P, Desai UB.

Described:

In order to improve the performance and safety of the grid, monitoring and automating the machine became mandatory. In Indian grids, the road parameters are not monitored constantly which ends up in situations inclusive of blackouts, overloading of the electricity machine elements, such situations can be prevented through well timed tracking the parameters and taking important moves to prevent the destiny intolerable situations on the road. This paper proposes an architecture for monitoring smart grid the use of wi-fi sensor community (WSN) generation. A miniature clever grid prototype and sensing module is designed and carried out to gather the line parameters like contemporary, voltage and frequency. Using WSN era, the accumulated parameters are communicated to a valuable tracking unit at periodic intervals.

Methodology.

- **System Analysis & Requirements:** Identify the monitoring needs (e.G., voltage, modern, temperature) and goals (actual-time facts, fault detection, predictive protection) through using consulting with MSEB engineers.
- **System Architecture Design:** Plan the machine components (sensors, RTUs, SCADA, communique protocols), and combine predictive protection the usage of AI/ML.
- **Hardware & Software Selection:** Choose dependable sensors, RTUs, and verbal exchange devices. Develop or configure SCADA software and cell/net interfaces for real-time monitoring.
- **System Integration:** Integrate all components for seamless statistics collection, transmission, and analysis.
- **Testing & Validation:** Conduct useful, performance, and redundancy assessments to make sure reliability and accuracy, along with AI-primarily based totally predictive maintenance validation.
- **Pilot Deployment:** Implement the tool in a restrained form of substations, collect remarks, and educate operators. Full-Scale Deployment: Roll out the device to all substations, making sure whole integration and scalability.
- **Continuous Monitoring & Optimization:** Monitor gadget overall overall performance, replace predictive algorithms, and optimize primarily based mostly on comments. Post-Deployment Support & Training: Provide ongoing assist and education to operators and make certain system updates and upgrades.

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