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IOT BASED DESIGN OF ELECTRIC SUBSTATION TEMPERATURE MONITORING SYSTEM

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ABSTRACT *:* To maintain the reliability in grid operation it is important to monitor real time transformer health. We know the importance of transformers in electricity distribution and transmission. They are the main components and constitute the large portion of capital investment of the circulation network. Continuous transformer wellbeing checking frameworks help to supplant the hardware before disappointment and coherence of the force won't be upset.
To the IOT stages continuously. It empowers the network administrator to characterize the presentation of the unit. It additionally gives significant data about transformer wellbeing. IOT Based Transformer Monitoring System will permit the utilities to ideally run the transformer and save this gear in activity for a more extended period.
At first electric force is created by utilizing electric generators, for example, atomic force generators, nuclear energy generators and water driven force generators and afterward communicated through transmission frameworks utilizing high voltage. Power departs from the generator and enters into a transmission substation, where huge transformers convert the generator's voltage to extremely high voltages (155kV to 765 kV) for long-distance (up to about 300 miles) transmission. Then, the voltage level is reduced using transformers and power is transferred to customers through electric power distribution systems.

***Index Terms* :**Field-programmable gate arrays, Internet of Things (IoT), Industrial Internet of Things (IIoT), Remote Monitoring, Real-time systems, Smart grids.

I. INTRODUCTION

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer, electric power may flow through several substations at different voltage levels. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

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The distance between the generators and load may be regarding hundreds of miles hence the amount of enormous power exchange over long distances has turned out as a result of the lack of quality of the electric power. During the earlier development stages, the issues on quality of power were not every now and again detailed. Requesting the nature of force being conveyed to the client side has raised the alert because of the expansion sought after for power in the client side. An enormous measure of energy is lost during the transportation of the overall force which prompts the reduction in the idea of power got at the substation.

Work on the nature of force with an alternate arrangement, it is important to be comfortable with what kind of requirement has happened. Furthermore, in case there is any deficiency in the insurance, checking, and control of a force framework. The framework may become unsteady.

Subsequently it fundamental an observing framework that can naturally recognize, screen, and group the current requirements on electrical lines. Today power actually encounters control power outages and blackouts on account of the nonappearance of mechanized examination and poor deceivability of the utility over the grid. WSN will give the service provide the needed view by collecting information from the different sub-systems of the grid.

A sensor node will decide information or to slightly delay this notification whether to notify the sink about this information immediately.

II. LITERATURE REVIEW

The IoT changed the human life when compared to past decade. IoT has been foreshowed as one of the key development to be realized throughout the internet technologies. IoT converged from the wireless technologies, micro-electromechanical systems, micro services and the internet. IoT is automation and embedded system which comprised of electronics, networks, software and sensors that enables objects to exchange data in order to control objects remotely. WSN is a collection of specific transducers integrated with communication mechanism for remote monitoring and recording the data at distributed locations. The common monitoring attributes are temperature, humidity, pressure, wind direction and speed, sound, voltage and so on. WSN allow connecting the objects to the internet using a gateway which acts as interface for WSN and internet. To enable the integration of WNS in the IoT, there are two relevant protocols to be added such as the IPv6 over Low power Wireless Personal Area Networks (6LoWPAN) protocol and Machine to Machine communications (M2M) protocols. Steven Lanziseral proposed an energy-efficient solution which uses a Communicating Power Supplies (CPS) for facilitating the energy information transfer and controls the information between the devices and building management system.Qinran constructed a hardware system which has Smart Home Energy Management System (SHEMS) that includes applications like communication, sensing and a machine-learning algorithm. It reduces the total electricity bills for users without any human intervention. Dae-Man Han initiated smart home interfaces and device that allows interoperability among Zigbee devices manufactured by various electrical equipment vendors. Zigbee is used for data transferring about the power and energy of home appliances. Jinsoo Han offered a photovoltaic system management to improve home energy using PLC. It consists of PLC modem, Renewable Energy Gateway (REG) and smart devices. The amount of DC power

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generated by PV modules is transmitted to the grid-connected inverter through PLC modems with REG. The received data is stored and processed by REG. The smart applications allow the user to view the status of the entire PV system and facilitate the clients to reduce the failures and fix them easily.

III. Block Diagram of System

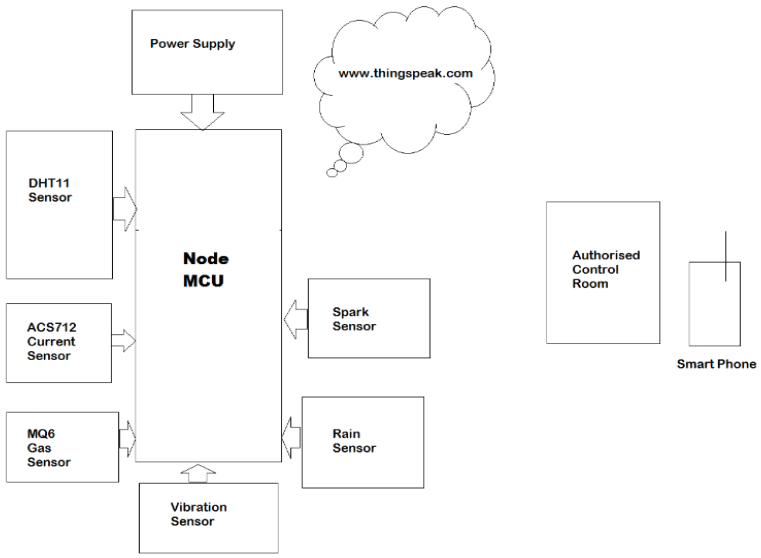

Fig 3: Block Diagram

3.1 BLOCK DIAGRAM DESCRIPTION

An electricity substation may have transformers to convert voltages between two end points and voltage correction devices like capacitors, reactors. These three elements are to be carefully monitored for avoiding faults to maintain uninterrupted transmission of power.
Flame fire sensor, oil level sensor, voltage sensor and temperature sensor are integrated with transformer for sensing the various parameters like oil level, voltage, temperature and fire. Flame fire sensor, voltage sensor and temperature sensor are integrated with capacitor and reactor for sensing the parameters like voltage, temperature and fire. All the sensors integrated to three units (transformer unit, capacitor unit, reactor unit) are interfaced with Node MCU to receive and process the substation parameters. From the micro-controller the data is forwarded to the cluster-based [data aggregation sink which is cloud storage as scenario. Then the values are transferred to the predefined web application via wireless communication and it would be accessible remotely from any location. In addition to this, the concerned authority can be notified by the status of each substation via SMS using GSM. The location status of each substation is extracted via GPS and it is also notified along with parameter values. The values of the parameters are displayed in the LCD's at the each substation.

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IV. COMPONANTS USE

1) DHT11–Temperature and Humidity Sensor

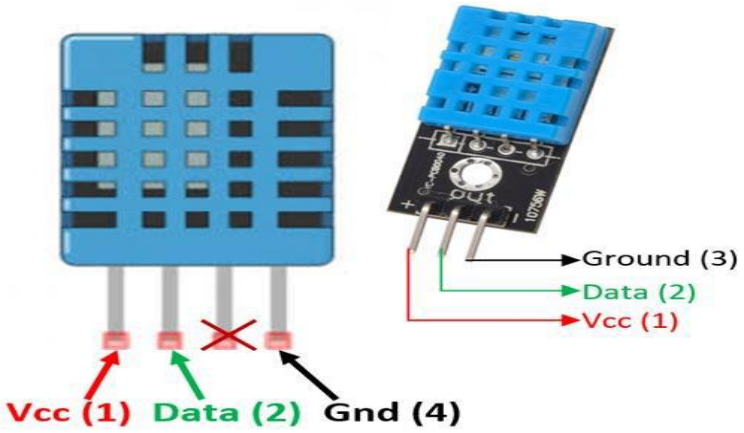

Fig -DHT11–Temperature and Humidity Sensor

The DHT11 Sensor is factory calibrated and outputs serial data and hence it is highly easy to set it up. The connection diagram for this sensor is shown below As you can see the data pin is connected to an I/O pin of the MCU and a 5K pull-up resistor is used. This data pin outputs the value of both temperature and humidity as serial data. If you are trying to interface DHT11 with Arduino then there are ready-made libraries for it which will give you a quick start.

2) ACS712 Linear Current Sensor IC

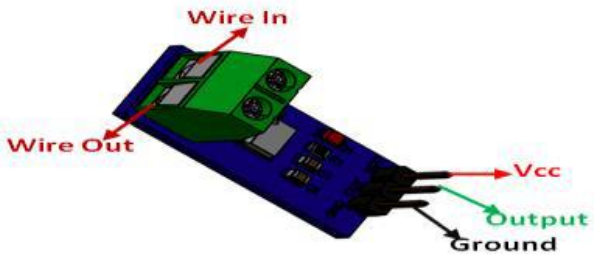

Fig- ACS712 Linear Current Sensor IC

The device consists of a precise, low-offset, linear Hall sensor circuit with a copper conduction path located near the surface of the die. Applied The Allegro ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switched-mode power supplies, and overcurrent fault protection. The device is not intended for automotive

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applications. For the automotive grade version, see ACS714. Current flowing through this copper conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer.

3) MQ-6 Gas Sensor

Fig -MQ-6 gas sensor

The MQ-6 Gas sensor can detect or measure gases like LPG and butane. The MQ-6 sensor module comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.
So if you are looking for a sensor to detect or measure gasses like LPG, or methane with or without a microcontroller then this sensor might be the right choice for you.

4)Vibration Sensor

Fig -vibration sensor

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This Vibration Sensor Module consists of an SW-420 Vibration Sensor, resistors, capacitor, potentiometer, comparator LM393 IC, Power, and status LED in an integrated circuit. It is useful for a variety of shocks triggering, theft alarm, smart car, an earthquake alarm, motorcycle alarm,
LM393 Comparator IC is used as a voltage comparator in this vibration sensor module. Pin 2 of LM393 is connected to Preset (10KΩ Pot) while pin 3 is connected to vibration sensor. The comparator IC will compare the threshold voltage set using the preset (pin2) and the Vibration Sensor pin (pin3).
Preset (Trimmer pot):-Using the onboard preset, you can adjust the threshold (sensitivity) of the digital output.
SW-420 Vibration Switch:-Vibration switch recognizes the amplitude of the vibration to which it is exposed. The switch response can be electrical contact closure or contact opening. The electrical contact may be either an electromechanical relay or a solid-state devic

V. WHAT IS IOT?

Fig -Internet of Things

The term “IoT” stands for the internet of things, can be defined as the interconnection between the individually identifiable embedded computing apparatus in the accessible internet infrastructure. The ‘IoT’ connects various devices and transportations with a help of internet as well as electronic sensors.
Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights. Cheap cloud computing power and increased device connectivity is enabling this trend.
IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home auto.
 At a high level, many IoT systems can be described using the diagram below:

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On the left, we have the smart devices (the “things” in IoT) that live at the edge of the network. These devices collect data and include things like wearable devices, wireless temperatures sensors, heart rate monitors, and hydraulic pressure sensors, and machines on the factory floor.
In the middle, we have the cloud where data from many sources is aggregated and analyzed in real time, often by an IoT analytics platform designed for this purpose.
The right side of the diagram depicts the algorithm development associated with the IoT application. Here an engineer or data scientist tries to gain insight into the collected data by performing historical analysis on the data. In this case, the data is pulled from the IoT platform into a desktop software environment to enable the engineer or scientist to prototype algorithms that may eventually execute in the cloud or on the smart device itself.

VI. SOFTWARE USED

What is Thing speak?
According to its developers, "Thing Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates"
Thing Speak was originally launched by abridge in 2010 as a service in support of IoT applications.
Thing Speak has integrated support from the numerical computing software MATLAB from Math Works, allowing Thing Speak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Math works.
Thing Speak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. Thing Speak provides instant visualizations of data posted by your devices to Thing Speak. With the ability to execute MATLAB code in Thing Speak you can perform online analysis and processing of the data as it comes in. Thing Speak is often used for prototyping and proof of concept IoT systems that require analytics.

Fig -Thing speak software

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VII. CONCLUSION

On completion of our project “we can improve the quality of power transferred and provide uninterred “IOT Based Design of Electrical Substation Temperature Monitoring System” upted power supply. Additionally, ongoing checking of various boundaries is done which can guarantee wellbeing to the substation and its hardware. Moreover, using a lot of impelled IC's with the help of creating advancement, the endeavor has been viably executed. Thusly, the endeavor has been successfully formed and attempted. The planned framework gives simple control of far off substation. It enables two-way interchanges. The substation can speak with the service organization to show, with what sort of fault, a substation has been related. The exact location of the substation can also be determined by sending location coordinates of the substation .finally the experimental output verified

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