POWER QUALITY, CONTINUITY AND LOAD MONITORING OVER IOT

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Abstract:

This paper deals with term Power Quality and its reference to terms Voltage and Current Quality, Continuity of supply. For long time the main concern of consumers of electricity was the continuity of the supply, i.e. the reliability. Nowadays consumers want not only reliability, but quality too. Power quality is determined by ability of customer equipment to perform properly. The reason to explain the current interest in power quality is growing economic impacts on the network operators (i.e. the utilities) and their customers. The devices and equipment being applied in industrial and commercial facilities are more sensitive to power quality disturbances than equipment applied in the past. The whole system is as sensitive as the most sensitive equipment. Malfunction of equipment or misoperation of an important process can affect production continuity resulting in material damages. PIC Microcontroller is used as controller; current sensor and voltage sensor are used to monitor the power supply. The details of parameters are updated in the thingspeak through IoT module connected to the controller. Any disturbance can be identified easily and necessary measures can be taken immediately to avoid further loss.

Keywords:

PIC Microcontroller, current and voltage sensor (CT, PT), Esp8266 Wi-Fi module, Relay, Load, LCD display, Thingspeak

1. INTRODUCTION:

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

This work namely "power quality, continuity and load monitoring over IoT" using PIC16F73 Microcontroller is an exclusive module which is used to monitor the parameter such as current, temperature, voltage remotely using Wi-Fi module by using smart phone. The Wi-Fi module is provides the communication mechanism between the user and the microcontroller system by means of text messages. If the parameters data exceeds thresholds value or fault occur in circuit then system send the alert message to the user over Wi-Fi and motor will stop automatically. The status of the parameters are display on LCD.

2. LITERATURE SURVEY:

1.S. H. Laskar, Mohibullah. [2] carried out a comprehensive assessment on different problems concerned with power quality as experienced by consumers in different countries. PQ costs summery are presented. Consequently Poor PQ caused large financial impacts on a country's economy. Therefore additional initiatives are projected from the apprehensive parties and regulating organization to take remedial measures for maintaining better power quality from utility and at end users. Also provides insight on worldwide economical fatalities due to poor PQ. The commercial risk created by PQ problems is a genuine. For future power system, Smart grid is the most important vision.

2. IoT based power consumption monitoring and controlling system. In this paper, a model is designed which aims to control and monitor power consumption of a particular area or sector. The designed model monitors the power consumption of the end users and cut off the power supply when it exceeds the set limit. The device sends the power consumption data to the supplier's blynk server using Internet of Things (IoT) technology. The designed model can be placed before the transmission of the load in each house of that

particular area. It consists a meter that generates a continuous unit pulse which can communicate with network through an Internet gateway WI-FI

3. Implementation:

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Fig: 1Block Diagram of power quality, continuity and Load Monitoring over IOT

The main controlling device is a Microcontroller. Voltage and current sensor module, Relay, LCD display and Wi-Fi module are interfaced to pic16f873 Microcontroller. The microcontroller is continuously read the data from current and voltage sensors and upload this values into the thingspeak cloud along with date and time so user check this values from anywhere in the world. The Microcontroller is loaded with intelligent program written using Embedded 'C' language.

4. Related Work:

The brief introduction of different modules used in this paper is discussed below:

4.1. PIC microcontroller:

The PIC16F73 CMOS FLASH-based 8-bit microcontroller. It features 200 ns instruction execution, self-programming, an ICD, 2 Comparators, 8 channels of 8-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

Table: 1 system Parameters

RAM	192
Memory Type	Flash
Program Memory K Bytes	7
I/O Pins	22
Pin count	28
Max. CPU Speed MHz	20
Timers :	2 - 8-bit & 1 - 16-bit
Temperature Range	-40 to 125

4.2. Relay:

Fig : 2 Relay circuit

Relay is an electromagnetic switch. . It consists of a coil of wire surrounding a soft iron core, an iron yoke, which provides a low reluctance path for magnetic flux, a movable iron armature, and a set, or sets, of contacts; two in the relay pictured. The armature is hinged to the yoke and mechanically linked to a moving contact or contacts. When an electric current is passed through the coil, the resulting magnetic field attracts the armature and the consequent movement of the movable contact or contacts either makes or breaks a connection with a fixed contact.

4.3. LCD display:

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals .Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it.

Fig : 3 LCD display

In this paper we are using 16*2 LCD module to display the current, voltage values on LCD module.

4.4 ESP8266 WI-FI MODULE:

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware.

Features:
- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

4.5 Current Sensor:

This paper uses CT (current transformer) as a current sensor. In this CT, relay through load are connected in series for measuring the generated voltage by using potential divider which is interfaced to the PIC microcontroller. Then the microcontroller monitor the voltage load values on LCD display.

4.6 Thingspeak:

ThingSpeak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plugins and apps for collaborating with web services, social network and other APIs. We will consider each of these features in detail below.

The core element of ThingSpeak is a 'ThingSpeak Channel'. A channel stores the data that we send to ThingSpeak and comprises of the below elements:

- 8 fields for storing data of any type - These can be used to store the data from a sensor or from an embedded device.
- 3 location fields - Can be used to store the latitude, longitude and the elevation. These are very useful for tracking a moving device.
- 1 status field - A short message to describe the data stored in the channel.

To use ThingSpeak, we need to sign up and create a channel. Once we have a channel, we can send the data, allow ThingSpeak to process it and also retrieve the same. Let us start exploring ThingSpeak by signing up and setting up a channel.

5. CONCLUSION:

The proposed system presented is that sensor data could also be indicative of equipment performance regarding efficiency and Power Quality standards.

Fig: 4 voltage, load monitoring on thingspeak cloud

Fig: 5 voltage, load monitoring on LCD display

With the current Internet of Things prototype, the user will be able to detect not only most Power Quality steady-state disturbances but events such as voltage and current, while also monitoring the energy consumption.

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