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# Real Time Data-Logger and Cloud based Data Management System

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***Abstract*: This paper presents data acquisition system for temperature, pressure, humidity in real time process dynamics. The user can monitor energy consumption through a webpage. Wi-Fi unit functions by sending data of the load acquired by IOT operations to the cloud which can be accessed through the webpage of the system. This proposed system utilizes an Arduino microcontroller, the data generated by IOT operations is sent to the cloud via internet. The generated data unit is fetched from the cloud and displayed on the analytical webpage through internet, which becomes convenient for analyses and hence it provides detailed of the energy usage statistic to the authorized user.**

***Keywords*: Arduino Microcontroller, Data acquisition, Cloud, Data Logger, ESP 8266 Wi-Fi module, IoT.**

## 1. Introduction

The Internet of things (IOT) concept enables us to connect the normal day to day devices with each other through the internet. The devices those are connected through IOT concept can be analyzed remotely. The IOT concept has provided the basic infrastructure and opportunities to form a connection between the physical world and computer based systems. This emerging concept has been gaining importance with more and more wireless devices whose demand is increasing rapidly in the market. The ESP8266 Wi-Fi module used in the system provides the connectivity with the internet in the system [1]. A data logger is used to collect and record the readings from sensors. These type sensors can be deployed in an environment for the measurement of temperature, pressure, humidity, and/or in any industrial process. These sensors developed are mostly used for industrial applications such as process control and monitoring. A real-time data acquisition software which keeps track of live datasets, that has to be developed, this would allow users to submit and fetch data reports through website or smart phone, enabled digitization of production data [4].

The proposed system is designed on an Arduino microcontroller [2]. It can be structurally differentiated into three parts viz., controller (NODE-MCU), Detector (NODE-MCU) and a Wi-Fi unit. Controller has sensors (Temperature, Humidity, Pressure) attached to it, serving as client- which sends achieved-data to (via internet) the Detector that serves as a server. This Server delivers the dataset received from the client to cloud. Data is extracted and logged at regular intervals (1 second to 120 seconds) from the system. Data retrieval in non-invasive and does not intrude in the running system. Data is uploaded to a Cloud, where all calculations are done to compute the Energy Flow and Energy loss in various locations and processes. This Energy Flow, Losses, and Value are shown on a web based dashboard to all authorized users, who track the daily variations in Energy usage. Based on process pre-defined limits, notifications are given to relevant users as alerts. The most important role is played by the Wi-Fi unit to send the information from the sensors over the Internet that can be viewed by the user at real time. The Arduino controller is programmed on the Arduino software IDE (Integrated Development Environment) which is a pre-requisite to operate on the Arduino board. Its code is derivative of the C language [3].

## 2. Literature survey

"Landi, C.; Dipt. di Ing. dell"Inf., Seconda Univ. di Napoli, Aversa, Italy; Merola, P. ; Ianniello, G", "ARM-based management system using smart meter and Web server",2011. [1]. In this paper they have proposed a low cost real-time ARM-based energy management system. It is conceived as part of a distributed system which measures the main power system quantities and give the possibility to manage the whole power plant. An integrated Web Server that allows to collect the statistics of power consumptions, power quality and is able to interface devices for load displacement. This device has been characterized by easy access to the information and the combination of a smart meter also data communication capability allows local and remote access. The solution proposed by the AMR system aims to optimize the energy consumption and allows remote monitoring and control of end-user equipment using energy consumption reduction strategies based on up-to-date information accessible through the power line.

"Garrab, A.; Bouallegue, A.; Ben Abdallah", "A new AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication", 2012 [2]. In this paper they described such as the growing demand of energy, the capacity limitations of energy management, one-way communication, the need of an interoperability of the different standards, the security of the communication and the greenhouse gas emissions, leads to emerge a new infrastructure

grid: Smart Grid. Smart Meters are one of the proposed solutions for the Smart Grid. In this paper, an AMR solution which provides enhanced end-to-end application. It is based on an energy meter with low-power microcontroller MSP430FE423A and the Power Line Communication standards. The aim of this work is to realize a real time pricing thanks to the proposed communication infrastructure. This solution is with great interest in economical and low carbon society point of view.

Vicente R. Tomas, Marta Pla-Castells, Juan Jose Martinez, Javier Martinez, "Forecasting Adverse Weather Situations in the Road Network", IEEE Transactions on Intelligent Transportation Systems, vol.17, NO, 8 August 2016 [3]. This paper presents a survey reviewing the state-of-the art of Cloud sensor monitoring platforms and data gathering techniques. this weather station is design in such a way that it will measure different atmospheric conditions as well as forecast the weather information like temperature, humidity, thunderstorm, atmospheric pressure, rainfall, current day, date and time. Weather forecasting is an application of science and technology which collects the quantitative data of current state of atmospheric weather and predict the future state by analyzing the past and present conditions.

Abu Asaduzzaman and Kishore K. Chidella "A Smart Data Logger for Enhancing Data Communication in Wi-Fi Based Mobile Systems." IEEE Southeast Con 2015, April 9 - 12, 2015 [4]. This paper elaborates that accurate data acquisition is important for any computing system. Many systems require high-speed connections and digital recording. Signals that are hard to characterize and analyze with a real-time display are evaluated in terms of high frequencies, large dynamic range, and gradual changes. The proposed data logger stores data if there is any system failure such as no or inadequate transmission signal. Also, the proposed data logger stores current data when the system sends any previously stored data by using time request mode. As a result, data loss is drastically reduced due to the addition of the proposed data logger. In addition, the system saves power due to the use of fragmentation and Request to Send (RTS) threshold methods.

"Ivan Stoianov and Lama Nachman", "PIPENET: A Wireless Sensor Network for Pipeline Monitoring" IPSN'07, April 25-27, 2007, Cambridge, Massachusetts, U.S.A. [5]

In this paper, we discuss how wireless sensor networks (WSNs) can increase the spatial and temporal resolution of operational data from pipeline infrastructures and thus address the challenge of near real-time monitoring and eventually control. We focus on the use of WSNs for monitoring large diameter bulk-water transmission pipelines. It described the PipeNet system that the developed system for detecting and localizing leaks and failures in water transmission pipelines. PipeNet provides a number of noteworthy properties, including: automated detection of leaks and bursts in water transmission pipelines; near-real time operation with few false alarms; applicability to a range of pipe materials; inexpensive to produce, install, and maintain; high-frequency data collection; the ability to differentiate between sensor and system faults and a flexible, reusable data-flow based programming environment.

J. He, R. A. Norwood, M. Fallahi, and N. Peyghambarian, "Solar-Powered Ad-Hoc Wireless Sensor Network for Border Surveillance," SPIE Defense, Security, and Sensing, 2012 [6].

This paper presents a research reviewing Wireless Sensor Network (WSN) that has been emerging in the last decade as a powerful tool for connecting physical and digital world. WSN has been used in many applications such habitat monitoring, building monitoring, smart grid and pipeline monitoring. In addition, this paper has also elaborated that the researchers have been experimenting with WSN in many mission-critical applications such as military applications. Two of the promising application spans are the border surveillance and intrusion detection applications. The main advantage of using WSN in such applications is the high spatial and temporal data resolution results from deploying hundreds of low cost sensor nodes along borders. The potential benefits of using WSN in border surveillance are huge; however, up to our knowledge very few attempts of solving many critical issues about this application could be found in the literature.

## 3. Block details

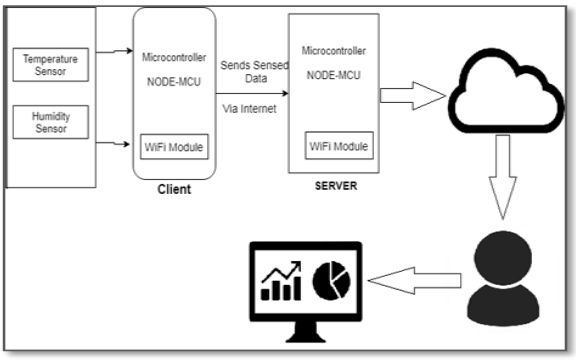


Fig. 1. Block diagram of the system

## 4. Hardware implementation

### *A. ESP 8266 Wi-Fi module (Node MCU)*

The ESP 8266 Wi-Fi module is a low cost component with which manufacturers are making wirelessly networkable microcontroller module. Node-MCU is an open source LUA based firmware which is a powerful and fast programming language built for performing sort of applications, Also it is developed for ESP8266 Wi-Fi chip . ESP 8266 Wi-Fi module is a system-on-a-chip with capabilities for 2.4GHz range. It employs a 32 bit RISC CPU running at 80 MHz . It is based on the TCP/IP (Transfer control protocol) [5]. It is the most important component in the system as it performs the IOT operation. It has 64 kb boot ROM, 64 kb instruction RAM, 96 kb data RAM. Wi-Fi unit performs IOT operation by sending data (Archived through attached sensors) to webpage which can be accessed through IP address.

Fig. 2. ESP 8266 Wi-Fi module (Node MCU)

The TX, RX pins are connected to the 7 and 8 pins of the Arduino microcontroller.

*B. DHT22 temperature & humidity sensor*

DHT22 is a digital sensor consisting of a thermistor (temperature measurement) and a capacitive sensor for determining the humidity [5]. Figure 3. DHT22 temperature & humidity sensor. The voltage supply must be between 3.3V and 6V (recommended 5V).

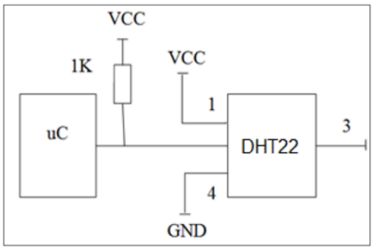


Fig. 3. DHT22 temperature & humidity sensor

This sensor has a 4-pin:

- Pin 1 is a power pin
- Pin 2 is data
- Pin 3 is a NULL pine
- Pin 4 is a ground pine.

## 5. Web page

The proposed system can be used to display energy usage reading for analytics. User from any part of the world would be able to access the information with proper credentials. This webpage is made for analytical view of the archived data (gathered from sensors attached to NODE MCU), this webpage fetches the data from the cloud (Serving as Database). A graphical representation of data makes the analyses easier and even more convenient for the users to keep track of the real time values. The acquired datasets are the real time values achieved after every 30 secs (as per Arduino coding).

## 6. Conclusion

Energy Monitoring using IOT is an innovative application of internet of things developed to control home appliances and also used in many industries for keeping track of the energy usage remotely over the cloud from anywhere in the world. In the proposed project various sensors are used to sense the current, temperature, pressure that is to be displayed on the user's dashboard via internet using IoT operations. The output archived are the graphical representations of the real time values of the system achieved by fetching data (gathered from sensors through Wi-Fi) from the cloud. The graphical representation of real time data is achieved through webpage request ((after every 30seconds)) which displays the data from the cloud serving as its database.


Fig. 4. Monitoring graph

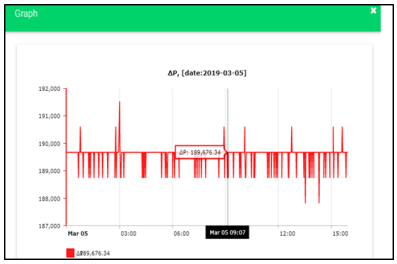


Fig. 5. Real- time analytical graph

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