Project Planning Report

on

"Voltage, Current, Power Consumption monitoring and ON/OFF Control: A IOT Based Project"

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Certificate

This is to certify that **Mr Gajanan Deshpande** From **MIT Polytechnic,Pune** having enrollment number **1901480184** has completed Project Planning Report having title **Voltage, Current, Power Consumption monitoring and ON/OFF Control: A IOT Based Project** in a group consisting of **3** candidates under the guidance of Guide name **Prof. Shilpa Shitole**

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Diploma in Computer Engineering

Abstract

Electricity is a basic human necessity that is extensively employed for home, industrial, and agricultural purposes. In this way, energy waste leads nations to lose revenue. Solutions based on technology, such as The Internet of Things (IOT) connects the physical and digital worlds, This IOT application ,In this scenario, manages and/or analyze energy consumption..

Furthermore, the advancement of micro and Nano-electronics has made it possible to the creation of connectivity modules like the XBEE that enables the rapid deployment of a wireless sensor network effectively, using the least amount of energy possible employed for responsibilities of monitoring and control.

By developing a hardware and software solution, the given prototype takes advantage of the previously indicated features. It uses a scalable and modular platform with XBEE technology and a developed protocol for data exchange between the modules that make up the system to allow remote monitoring of electricity consumption in a home.

The prototype's accuracy is shown when compared to readings acquired with a regular electric bill, according to the conclusions.

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1. Rationale:

1.1. Motivation:

People now are dealing with an increase in their power bills. They lack their own mechanism for monitoring current and voltage usage. As a result, we're building a system that will allow consumers to track their consumption and volume at home. Keep track of the number of persons who have entered the building.

1.2. Background of Project:

Since a home contains a variety of equipment, each of which uses a different amount of energy. With the help of IOT, this model focuses on voltage consumption and analyses current usage. The model aids in identifying and graphically presenting the amount of energy used by each object.

Second, the model is a combination of hardware and software; the software warns the user when voltage fluctuation occurs. The software component displays the consumption and acts as the project's front end, while the hardware component is in charge of voltage monitoring and resistance.

1.3. Scope and Need:

In this regard, in the sector of energy, the method for measuring power usage in houses and industries is inefficient and imprecise. First and foremost, human resources are used to visit each site monthly and record the readings of the electrical meters. The acquired data is then analyzed to determine the user's usage bill. This procedure takes a long time, is time-consuming, and is vulnerable to human error and meter manipulation.

The prototype given in this study is built on Internet of Things (IOT) technology as an alternate approach. It's an intelligent meter that uses XBEE wireless technology to provide remote monitoring via a web application that shows information on voltage and current usage in a house in a modular manner. The results are saved in a cloud-based database. The use of an intelligent meter would allow resource optimization by automating reading procedures and reducing the need for employees to execute kWh unit readings. Its usage would save energy and contribute to the reduction of pollution

1.4. Introduction of Project:

This literature review presents a conceptual framework that creates questions to guide the purpose of this study. It involves review of a number of publications and referred academic journals organized under central themes. This will lead to reduction in energy consumption in buildings – most especially commercial buildings such as factories, hospitals, hotels, office complexes, shopping malls etc. by 30 – 40% (ARUP, 2016).

This research investigates the importance of building management systems (BMS), its processes, workflows, current trends, available technologies, and the future of BMS utilization. Specific areas to determine which factors may predict successful adoption, integration and deployment in commercial buildings was also reviewed. In this era, where energy management is the concern of everyone, buildings are being constructed in a manner to provide maximum comfort and ease to the people with minimum energy utilization.

This is only possible with the help of controlling devices that are to be installed in a building during construction. This control can be of any type, from simple switching on and off of lights, to water motor control and many more. Therefore the main idea of designing this system is to automate these building operations in the most resourceful manner (Swarnalatha, 2011). Besides controlling, security factor has also been kept as a concern with password protection. Cameras, fire alarms systems, main gate security and main gate barrier automation has been put at priority in this systems (BMS). Another feature which is required in a multiple story building is elevator, which can also be found in building systems.

Building Management System (BMS), otherwise known as Building Automation System (BAS), is a computer-based control system installed in buildings that controls and monitors building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire and security systems. BMS consists of software and hardware; the software program, usually configured in a hierarchical manner, can be proprietary, using such protocols as C-Bus, Profibus, and so on. Vendors are also producing BMS that integrates the use of internet and open standards such as Device Net, SOAP, XML, BAC net, Lon Works and Modbus. It analyses specific necessities of a particular building by controlling the associated plant installed in it and helps save energy (Daintree Neworks, 2009).

Devices installed outside the buildings are connected with panels which can be switch on or off over different sets of instructions. The working of BMS is totally based on the input in form of information by the devices such as sensors. Once the information is collected it can be processed with the help of controller that will further instruct the system to perform a specific task. In BMS technology, switching on and off of the plant can be controlled in the same manner. Plant can be set to a respective temperature in order to provide heating and cooling with respect to the temperature outside the building. BMS serves as a tool for potential increase in economics and energy efficiency, and thus, must be clearly defined and understood before its implementation in both private and commercial buildings, especially in the later where it seems to provide enormous cost savings due to minimized energy consumption it yields when installed in a building. The evolution, benefits, limitations, efficiency, application and adoption of BMS are reviewed.

2. Literature Survey

IEEE Xplore, 01 March 2018- IOT based Electrical Energy Consumption Monitoring System Prototype [1]

Energy monitoring system becomes an important subject to provide information of electricity usage for the users. Moreover, with rapid development in information technology, especially IOT, it is possible to establish better energy monitoring system by providing real-time consumption data. In this paper, IOT based Electrical Energy Consumption Monitoring System Prototype for G4 Building Universities Negeri Malang is developed. Real-time measurement of the energy consumption utilizes current and voltage sensors for each wiring phase of the building electrical panel. For the IOT system, data is processed and displayed in Web-based system using Public Subscribe method. This prototype is implemented during work-hours and achieving 95.5% accuracy based on the electrical data of the G4 Building.

IEEE Xplore, 06 December 2018: - An IOT-based Remote Monitoring System for Electrical Power Consumption via Web-Application [2]

Electricity is a fundamental need of the human being that is commonly used for domestic, industrial and agricultural purposes. In this sense, the waste of energy generates millionaire losses for the countries. The presented prototype takes advantage of the previously mentioned advantages by developing a hardware and software solution. It allows remote monitoring of electricity consumption in a home through a scalable and modular platform using XBEE technology and a customized protocol for data communication between the four modules that make up the system. Results are presented that demonstrate the accuracy of the prototype compared to the readings obtained with a conventional electricity meter.

. IEEE Xplore, 10 November 2020: Internet of Things (IOT) based Energy Tracking and Bill Estimation System [3]

—Electricity is the most requisite energy in modern times. IOT based energy tracking and bill estimation system discussed in this paper has an objective to build awareness among household and industrial consumers about their usage of this energy. It does so by displaying real-time estimated electricity consumption by each load connected to it and realtime estimated bill of total consumption on a monitor unit. The novel approach used in the proposed system is the integration of a cloud-hosted database and control unit. The hosted database in Google Firebase enabled the simple design of this system, which is without the use of any electric energy measurement chip or current and voltage sensor, and it also gets logged with the final estimated bill of each month. To save energy when unused, users can operate the control unit to transmit switching instructions for loads. The proposed system also uses Node MCU, 4-channel relay module, and Blynk android application

3. Problem Definition

As part of the challenge, the participants have to build an IOT device that converts a conventional building into a Smart Building, which can automate the lights in a room based on the occupants. The Smart Building System using IOT should satisfy the following criteria:

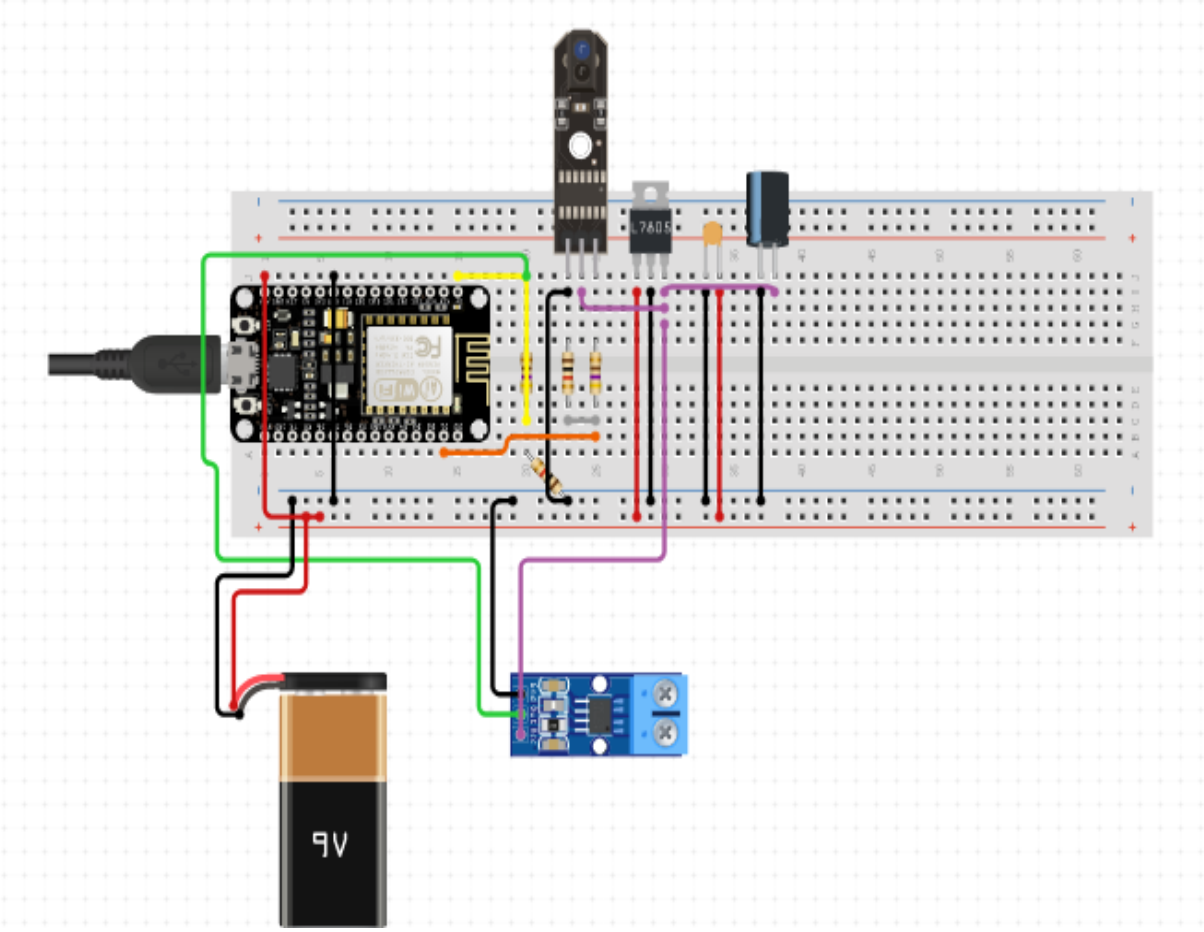
- The Smart Building System using IOT should be completely autonomous and be driven by Arduino Uno, an open-source hardware and software platform
- The Smart Building System using IOT should count the number of person entered in building
- The Smart Building System using IOT should also monitor current and voltage

3.1. Proposed Methodology

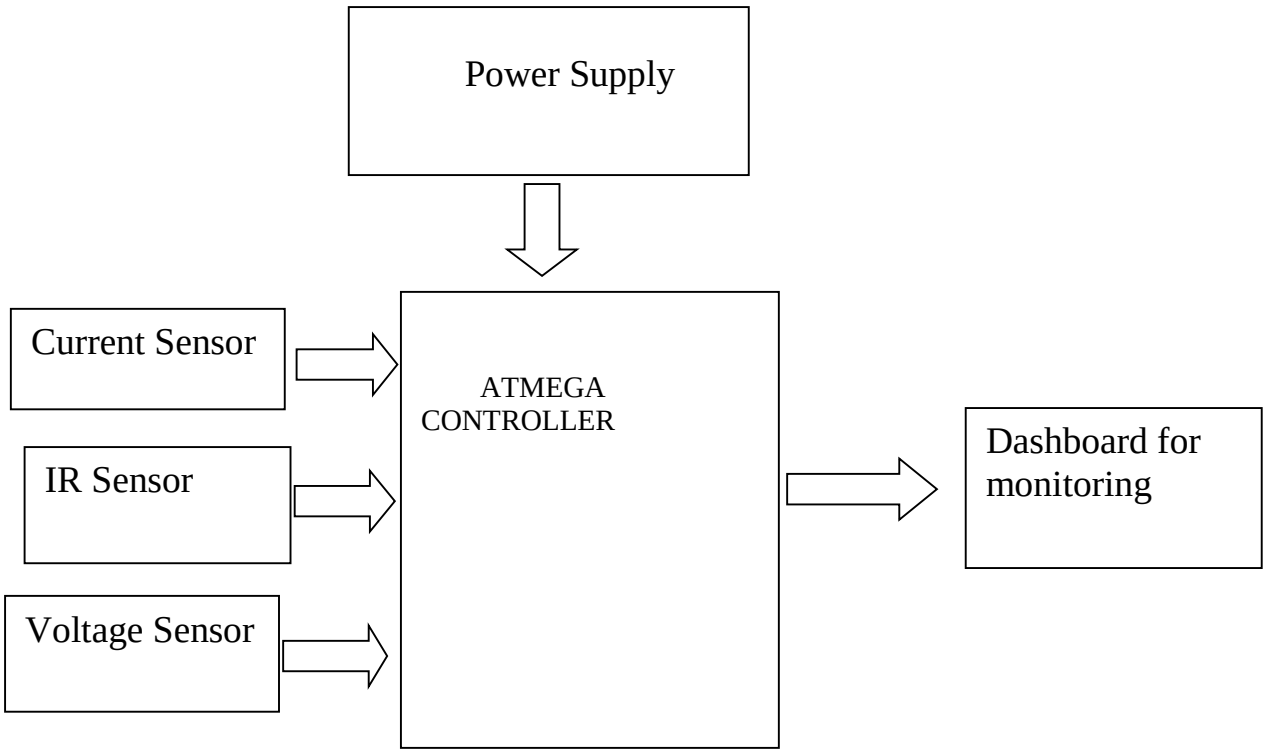
The step-by-step methodology to be followed for Voltage and Current consumption model:

- Research and analyses on various old, voltage and current monitoring techniques.
- Based upon above analysis a Model is developed using XBEE.
- Results achieved after the Completion of Model and are to compared with the earlier Electric Bill.

3.2. Circuit Diagram

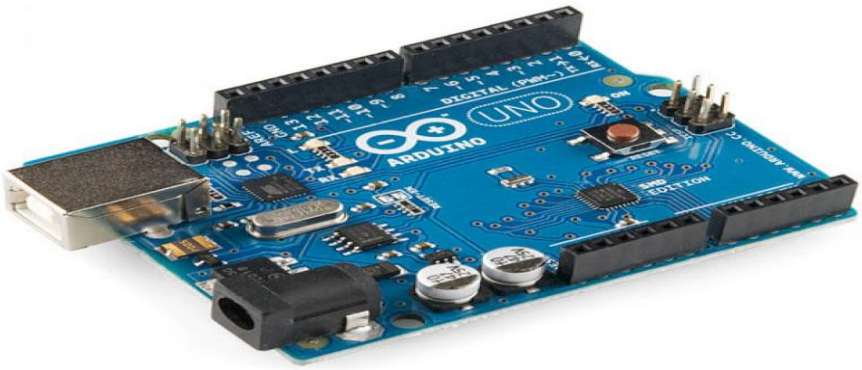


3.3. Block Diagram



3.4. Description of the Block Diagram and Hardware Specifications –

- ATMEGA CONTROLLER



This is the Heart and the Brain of the Project as it accepts the Input from the Sensors and takes the action according to the Code entered in Embedded C Language. Programming Software used for it is Arduino IDE

Microcontroller	ATmega38P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0-A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40mA
DC Current on 3.3V Pin	50mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2kB
EEPROM	1kB

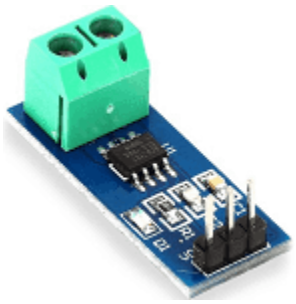
- **Voltage Sensor-**

The Voltage Sensor is a **simple module** that can used with Arduino (or any other microcontroller with input tolerance of 5V) to measure external voltages that are greater than its maximum acceptable value i.e. 5V in case of Arduino. Following is the image of the Voltage Sensor Module used in this project.

In our Project, the Voltage Sensor constantly monitors the Line Voltage of the Battery and sends the Data to the Dashboard.

- **Current Sensor-**

This sensor **operates at 5V** and produces an Analog voltage output proportional to the measured current. ... The output of this current sensor is analogy, so to read it, we can directly measure the output voltage using voltmeter or measure it by using a microcontroller like Arduino through Analog Read pin or ADC pin.In our Project, the Current sensor will constantly monitor the Current

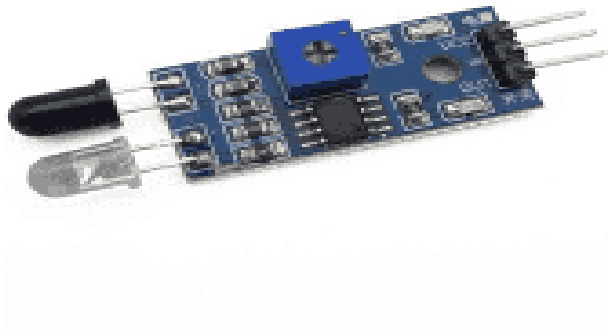


- **IR Sensor-**

The connections for the IR sensor with the Arduino are as follows: Connect the negative wire on the IR sensor to GND on the Arduino. Connect the middle of

The IR sensor which is the VCC to 5V on the Arduino. Connect the signal pin on the IR sensor to pin 8 on the Arduino.

In our Project, the Proximity sensor will constantly monitor the presence of people



- **Hardware and software requirement**

Hardware:

Atmega controller

Voltage sensor

Current sensor

IR sensor

Power supply

Software:

ARDUINO IDE:

The **Arduino Integrated Development Environment (IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards

Blink:

A typical program used by beginners, akin to Hello, World!, is "blink", which **repeatedly blinks the on-board LED integrated into the Arduino board**. This program uses the functions pin Mode() , digital Write() and delay() , which are provided by the internal libraries included in the IDE environment

3.5. ADVANTAGES

- Ease of Operations
- Immediate Assistance can be provided
- Simple and efficient
- Compact Design

3.6. DISADVANTAGES

- Slightly expensive
- Should be kept in a metal case
- Can give false output sometimes due to various conditions
- Overheating can damage the IC

3.7. APPLICATIONS

- Home Automation
- Office Automation
- Building Management System
- Factory Automation

3.8. Action Plan:

Work Task	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Requirement Gathering												
Backend coding												
Documentation												
Frontend/Interface design												
Implementation												
System Testing												
Deployment												

3.9. Conclusion

The conclusion of this project is that we can use Atmega Controller to control the System without Human Interference. Voltage sensor is monitor voltage, current sensor is monitor current and IR sensor keep track on count people entered in building

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