

Device load monitoring for programmable meter for energy audit

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Abstract - The design and working of a cost and energy efficient power meter that monitors the usage of electrical energy consumed by any appliance or machine at any given time are described in this paper. The usage of electrical energy consumed by any appliance or machine at any given time can be monitored by the power meter, providing the precise knowledge of the consumption of each device that will let us identify the devices that increase the cost of our electricity bill. The consumption of the load of a particular device is evaluated by the circuit designed. The evaluation is instantaneous as this is real-time monitoring, and the readings can be monitored by the user at any given time.

Keyword: Device monitoring, Real-time data, Energy Audit

I. INTRODUCTION

The main goal of an energy audit is to identify ways to reduce working costs or power usage per unit of product production. A "benchmark" (reference point) for energy management within the commercial operation is given by energy audits and also serve as the foundation for creating plans for more efficient energy use at a later time within the employer. To properly comprehend and evaluate how electricity might be used within different consumers or businesses, a high level of reports can be produced. Nowadays, all of our actions are totally or partially dependent on the use of energy. Industrial and general growth of every country depends on electricity, which is a desired kind of energy because it can be generated centrally in huge amounts and carried cheaply across long distances. The energy crisis is a broad and complex issue that is of real concern in the present day situation. Its reality is not perceived by most people unless the price of electricity or gas rises. As the demand rises and limited natural resources used to power industry are diminishing, the cost of electricity will also be significantly increased. The situation of this crisis is caused by overconsumption of electric power. Due to rapid industrialization, the demand for electric power in the world is ever-increasing. To meet the demand, it is the responsibility of every individual to reduce utilization. Energy audit and management is the technique that can be practiced to reduce electric consumption.

The costs of manufacturing electronic devices have been reduced due to advancements in technology. With this advancement, an energy meter can be designed per circuit instead of per whole house. Through this implementation,

we can have a better perception of the energy being utilized by each household electronic appliance.

II. LITERATURE REVIEW

Both D.C. Mahipalla and Prof. Pravin Balbudhe discuss the importance of energy audits for identifying potential energy savings in both residential and industrial applications. Mahipalla focuses on the development of software that allows for real-time and remote monitoring, data analysis, and identification of system difficulties, as well as load management strategies such as load shifting and power factor correction. Balbudhe's project utilizes IoT and Arduino technology to develop a remote energy parameter monitoring system for industrial applications, allowing for analysis and optimization of energy consumption. Both articles demonstrate the importance of implementing advanced technology in energy audits to increase efficiency and reduce energy consumption.

III. WORKING

This project has been created to calculate the energy, energy supply consumption of loads in units, cost consumption, and incurred cost over the use in rupees based on the number of hours that load is used. The result is provided simultaneously, allowing the auditor to save time wasted in the energy audit. The project itself is made up of an instant energy auditing system using AT89S52 Microprocessor. The input data, including energy tariffs and the number of hours spent by the units in the system by the user, are based on the data. An energy meter that gives 3200 impulses/kwh is connected through an optocoupler to the microcontroller 8051. Then, after the data is processed by the microcontroller, the information is displayed on the LCD display. Four buttons, i.e., up, down, normal, and reset buttons, are present to feed data into the microprocessor to input the values and the tariff rates.

IV. CALCULATIONS

The current sensor will give the value of current (I) in Amps. As the voltage provided is a fixed 230v supply, the power can be calculated as follows

$$P (\text{Watts}) = V (\text{volts}) * I (\text{Amps})$$

Here, P = Power in Watts,

V = Voltage in Volts,

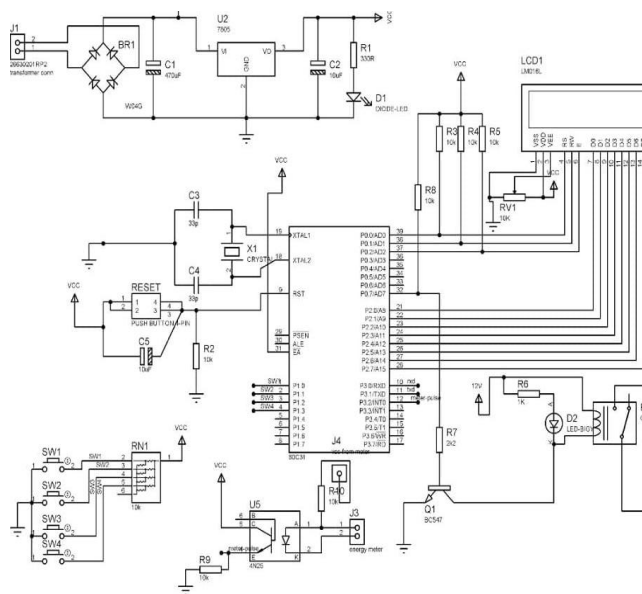
I = Current in Amps.

The power thus obtained is calculated into energy consumed as follows

$$E = P/1000 \text{ kWh}$$

The further calculations were not made as the unit value of electricity and the cost per unit value differ for different electricity boards, but the number of units consumed can be calculated from the obtained energy value.

V. BLOCK DIAGRAM

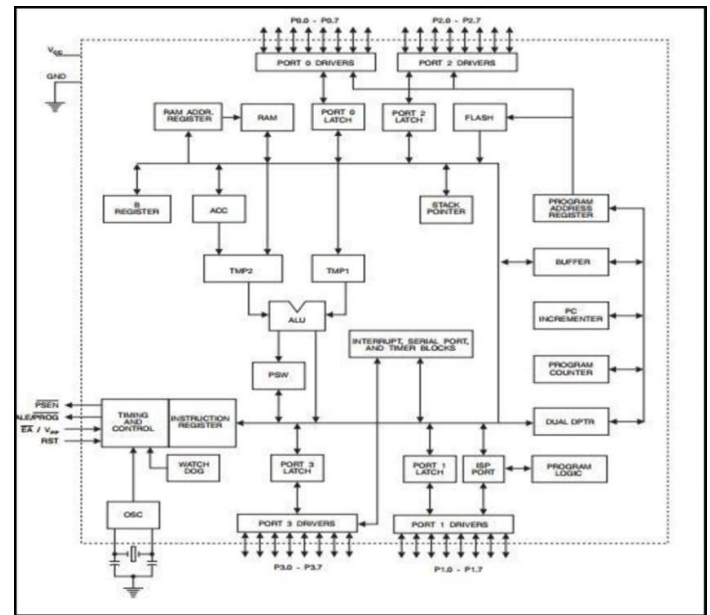


VI. COMPONENTS

1. ELECTRIC METER

Charge units, which are usually a kilowatt hour, are used to measure electric meters. The charge cycles and the energy used during the cycle are established by regular readings of electrical meters. In settings where energy savings are sometimes desired, demand and maximum power consumption during downtime can be measured by meters. In some areas, a reduction in consumption is encouraged by high electricity prices at certain times of the day. Additionally, unnecessary equipment can be turned off by meters in some places when transmitted. An electronic mechanical meter of watt hour input is the most common type of electric meter. The change of aluminum disc that is rotated at a speed equal to the power is calculated by the electronic input meter. The amount of change in this way is proportional to the energy consumption. It uses a small amount of power, usually around 2 watts. Magnetic flux proportional directly to voltage is developed by one coil arranged in such a manner, and the other produces magnetic flux at the current rate. The coil of voltage field is delayed by 90 degrees using the lagging of coil.

2. MICROCONTROLLER AT89S52



Less power is consumed by it and it has 8-bit memory which can be programmed. The memory of the system can rest within the system or via a standard memory system that is not set down because of the presence of one chip. AT89S52 is a strong and impactful microcontroller that offers an easy-to-use solution for an embedded control application by integrating an 8-bit convergent controlled processing unit with an organized in-system monolithic chip. Two standard features offered by AT89S52 are 8k Flash bytes, 256 bytes of RAM, 32 I/O, a watchdog timer, 2 data pointers, three 16-bit timers/counters, a six-dimensional weird six-vector, a full serial duplex port, an on-chip oscillator, and a clock circuit. Moreover, AT89S52 operates at a frequency of zero and supports two energy-saving modes and the inbuilt ability to perform logic operations. It has flash memory. Many ports are stopped for further functioning, such as eliminating RAM content, serial port, and other chips and pins programs when needed, in IDLE mode.

3. LCD

The example of the Parallel Port does not use the Bi Side feature found in the new ports, which makes it effective for almost all Parallel Ports. However, the use of Portus Mode as an alternate port in parallel connection to the 16 Character x 2 Line Module is not indicated. These modules are easy to work on and have the necessary runs on board, but their use is random.

Various functions of the LCD include:

- Being very compact and light.
- Having low power consumption.
- Its geometry cannot be denied.

- Having little or no flicker, depending on the backlight technology.
- Not being affected by the new screen.
- Having no difficulties during repairing and servicing.
- Being able to be made in almost any size or shape.
- Having no decision limit theory.

VII. CONCLUSION

By successfully implementing this kind of real-time hardware projects and providing the end user with necessary information about the consumption of energy by household appliances, a great reduction in electricity bills can be achieved. The usage of open software and open hardware technology will help the circuit to be modified by future developers with future technology, resulting in the development of a better device.

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