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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Energy Audit Using Programmable Meters

Venkatesh Nikam, Vikalp Dwivedi, Vivek Kumar, Prof.R.S. DESAI

Department of Electrical Engineering, Bharati Vidyapeeth (Deemed to be University) College of Engineering,  
Pune, India

**ABSTRACT:** An energy audit is a power consumption survey of the amount of units consumed by a particular device and the cost incurred over it to determine if the device is economical use in domestic or industrial sectors. Since electricity cost per unit has increased a lot these days, energy audits for devices have gained importance.

In some nations, the energy audit system is in a deplorable state, and in some areas, public utility consumers complain of the high electricity tariff rates, while in other areas, electricity bills are issued at the end of the month without the Distribution company carrying out a comprehensive energy audit.

According to ISO50002, “An energy audit is a systematic analysis of energy used and energy consumption within a defined energy scope.” An energy audit is like an energy assessment.

Therefore, to carry out an effective energy audit, there is the need for a device capable of monitoring the load consumption and is not prone to the mistakes which are traceable to manual input.

## I. INTRODUCTION

It is basically a Device Load Monitor designed in order to calculate the energy consumption of a load in units and the cost incurred over the use in rupees in accordance to the number of hours that the load is to be used. The result is provided instantly allowing user to save time wasted in energy audits.

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Our project consists of an instant energy auditing system using 8051 microcontroller that is able to calculate the consumed units and cost incurred by device use over given time. The input data including energy tariff and the number of hour's device is to be used is fed by user into the system. Based on this data the system instantly displays the cost and units consumed within no

## II. WORKING

Our project consists of an instant energy auditing system using 8051 microcontroller that is able to calculate the consumed units and cost incurred by device use over given time. The input data including energy tariff and the number of hours device is to be used is fed by user into the system. Based on this data the system instantly displays the cost and units consumed within no time.

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The voltage, current, power and energy readings are displayed on the LCD, with their respective S.I units. Based on the tariff rate used in the code, a user can determine how much it will cost to run at a particular load rating for a specified time.

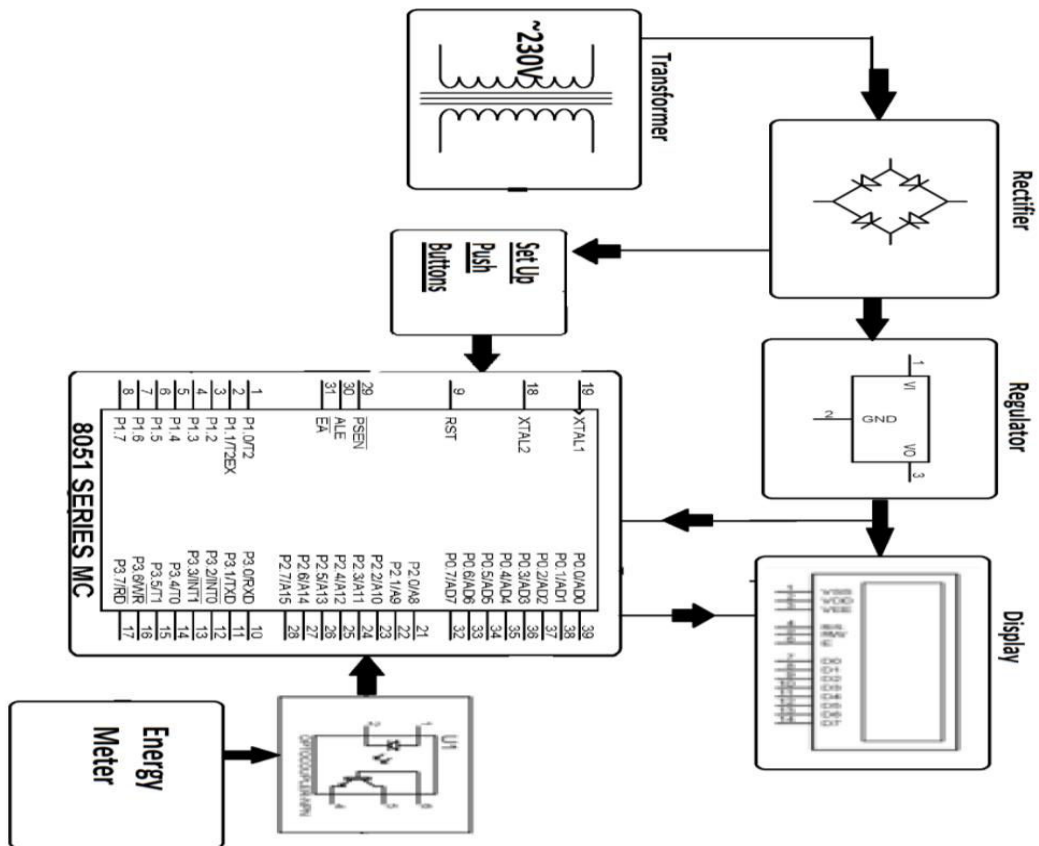
The time duration is inputted by the user, using the keypad, and then the cost is displayed on the LCD (Liquid Crystal Display).



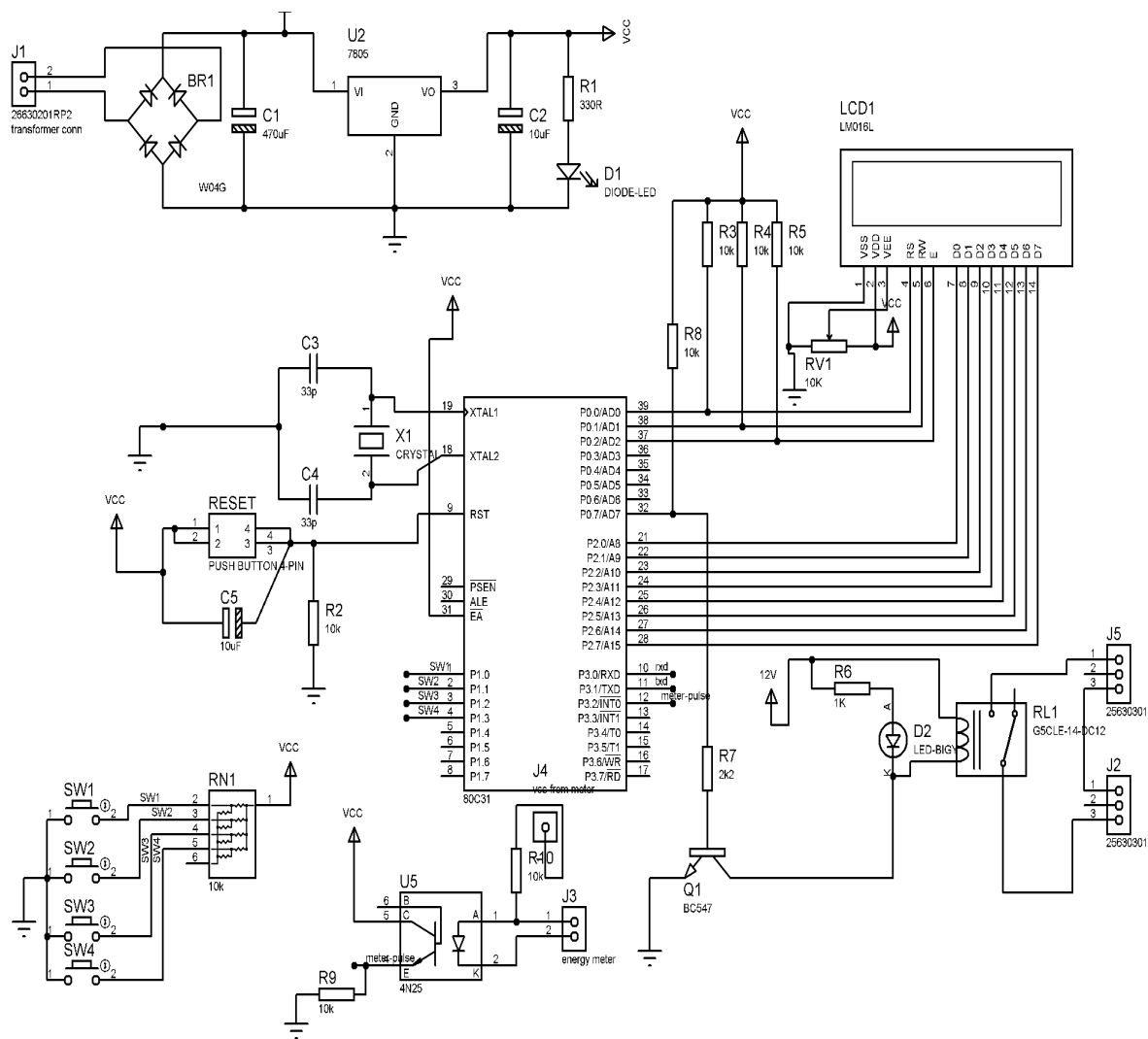
**HARDWARE REQUIRED**

- Crystal Oscillator
- Resistors
- Capacitors
- Transistors
- Cables and Connectors
- Diodes
- PCB and Breadboards
- LED
- Transformer/Adapter
- Push Buttons
- Switch
- IC
- IC Sockets
- Energy meter

**BLOCK DIAGRAM**



**SCHEMATIC DIAGRAM**



**III. DESCRIPTION**

**POWER SUPPLY**

The circuit uses standard power supply comprising of a step-down transformer from 230V to 12V and 4 diodes forming a bridge rectifier that delivers pulsating dc which is then filtered by an electrolytic capacitor of about 470µF to 1000µF.

The filtered dc being unregulated, IC LM7805 is used to get 5V DC constant at its pin no 3 irrespective of input DC varying from 7V to 15V. The input dc shall be varying in the event of input ac at 230volts section varies from 160V to 270V in the ratio of the transformer primary voltage V1 to secondary voltage V2 governed by the formula  $V1/V2=N1/N2$ . As  $N1/N2$  i.e. no. of turns in the primary to the no. of turns in the secondary remains unchanged V2 is directly proportional to V1. Thus if the transformer delivers 12V at 220V input it will give 8.72V at 160V. Similarly at

270V it will give 14.72V. Thus the dc voltage at the input of the regulator changes from about 8V to 15V because of A.C voltage variation from 160V to 270V the regulator output will remain constant at 5V.

## STANDARD CONNECTIONS TO 8051 SERIES MICRO CONTROLLER

ATMEL series of 8051 family of micro controllers need certain standard connections. The actual number of the Microcontroller could be “89C51”, “89C52”, “89S51”, “89S52”, and as regards to 20 pin configuration a number of “89C2051”. The 4 set of I/O ports are used based on the project requirement. Every microcontroller requires a timing reference for its internal program execution therefore an oscillator needs to be functional with a desired frequency to obtain the timing reference as  $t = 1/f$ .

A crystal ranging from 2 to 20 MHz is required to be used at its pin number 18 and 19 for the internal oscillator. It may be noted here the crystal is not to be understood as crystal oscillator. It is just a crystal, while connected to the appropriate pin of the microcontroller it results in oscillator function inside the microcontroller. Typically, 11.0592 MHz crystal is used in general for most of the circuits using 8051 series microcontroller. Two small value ceramic capacitors of 33pF each is used as a standard connection for the crystal as shown in the circuit diagram.

## IV. RESET

Pin no 9 is provided with an reset arrangement by a combination of an electrolytic capacitor and a resistor forming RC time constant. At the time of switch on, the capacitor gets charged, and it behaves as a full short circuit from the positive to the pin number 9. After the capacitor gets fully charged the current stops flowing and pin number 9 goes low which is pulled down by a 10k resistor to the ground. This arrangement of reset at pin 9 going high initially and then to logic 0 i.e., low helps the program execution to start from the beginning. In absence of this the program execution could have taken place arbitrarily anywhere from the program cycle. A pushbutton switch is connected across the capacitor so that at any given time as desired it can be pressed such that it discharges the capacitor and while released the capacitor starts charging again and then pin number 9 goes to high and then back to low, to enable the program execution from the beginning. This operation of high to low of the reset pin takes place in fraction of a second as decided by the time constant R and C.

For example: A 10 $\mu$ F capacitor and a 10k $\Omega$  resistor would render a 100ms time to pin number 9 from logic high to low, thereafter the pin number 9 remains low.

### External Access(EA):

Pin no 31 of 40 pin 8051 microcontroller termed as EA<sup>-</sup> is required to be connected to 5V for accessing the program from the on-chip program memory. If it is connected to ground then the controller accesses the program from external memory. However, as we are using the internal memory it is always connected to +5V.

## OPTOCOUPLER

Opto coupler is a 6 pin IC. It is a combination of 1 LED and a transistor. Pin 6 of transistor is not generally used and when light falls on the Base-Emitter junction then it switches and pin 5 goes to zero.

If input of the diode is zero and other end of diode is GND then the output is one.

When logic zero is given as input then the light doesn't fall on transistor so it doesn't conduct which gives logic zero as output.

## V. CONCLUSION

The system is designed in order to calculate the energy consumption of a load in units and the cost incurred over the use in rupees in accordance to the number of hours that the load is to be used. The result is provided instantly allowing user to save time wasted in energy audits. An energy audit is a power consumption survey of the amount of units consumed by a particular device and the cost incurred over it to determine if the device is economical use in domestic or industrial sectors. Since electricity cost per unit has increased a lot these days, energy audits for devices have gained importance. Our project consists of an instant energy auditing system using 8051 microcontroller that is able to calculate the



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#### **REFERENCES**

1. Design and Construction of a Load Monitoring Programmable Energy Meter for Effective Energy Audit paper submitted by Joseph O. Olowoleni, Cladius O. A. Awosope, Anthony U. Adoghe, C. A. Okeke, and Francis E. Idachaba at the Proceedings of the World Congress on Engineering and Computer Science 2018 Vol I WCECS 2018, October 23-25, 2018, San Francisco, USA.
2. Energy audit, ". [ (n.d.)]. Retrieved from [https://en.wikipedia.org/wiki/Energy\\_audit](https://en.wikipedia.org/wiki/Energy_audit).
3. Lipari, G., capua, C., Lugara, M., & Morello, R. (2014). A SMART ENERGY METER FOR POWER GRIDS. INSTRUMENTATION AND MEASUREMENT TECHNOLOGY CONFERENCE. Montevideo, Uruguay: IEEE
4. [www.atmel.com](http://www.atmel.com)
5. [www.beyondlogic.org](http://www.beyondlogic.org)
6. [www.wikipedia.org](http://www.wikipedia.org)
7. [www.howstuffworks.com](http://www.howstuffworks.com)
8. [www.alldatasheets.com](http://www.alldatasheets.com)



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