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Battery Level Indicator-A Novel Approach

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Abstract: ***This paper aims to design a simple and cheap Battery level indicator.The background information of circuit, operations and uses of the indicator. Basic elements required to construct Battery-Level Indicator as well as the design criteria for the constructed indicator. This paper will present a circuit that lets us know the battery level of a device from the number of LED glowing and display on LCD. The Battery-Level Indicator circuit is successfully constructed. This indicator is capable to indicate the status of battery. The performance and limitations of this indicator are discussed in the project report.***

I. INTRODUCTION

Battery level indicator will let us know the states of battery of a device just by glowing the number of LED's. For example four LED's are glowing means battery capacity is 40%. You can use this circuit with your inverter or with your car battery; it will give you indication about your battery status. So before your battery dies you can recharge it. Advantage of this circuit is it does not require power supply; it will take power supply from the battery of the device itself. This simple circuit is based on single IC LM3914 with few more discrete components. LM3914 is a monolithic integrated circuit which senses the analog voltage and derives 10 LED's providing a linear analog display.In this paper, we will show how to design a simple Battery Level Indicator Circuit using easily available components. Battery level indicator indicates the status of the battery just by glowing LED's. For example six LED's are glowing means battery capacity 60% remains. This article will explain how to design battery level indicator. We can use this circuit to check car battery or inverter. So by using this circuit, we can increase the lifetime of battery.

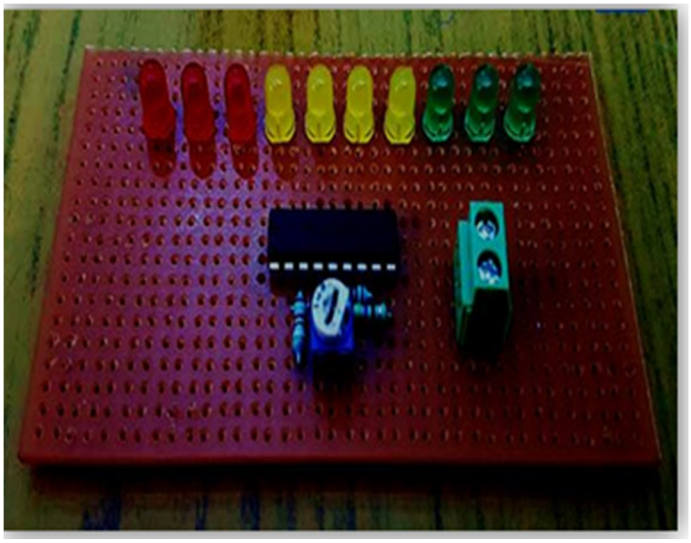


Fig 1:Battery Level Indicator

II. WORKING PRINCIPLE

With a little modification we can use this circuit to measure other voltage ranges also. For this remove the resistor R2 and connect upper voltage level to the input. Now vary the resistance of Pot RV1 till the D10 LED glows. Now remove upper voltage level at the input and connect lower voltage level. Connect a high value variable resistor in the place of resistor R2 and vary it till the D1 LED glows. Now disconnect the pot, measure the resistance across it and connect resistor of same value in place of R2. Now the circuit is ready to monitor other voltage ranges.

The circuit is most suitable for indicating 12V battery level. In this circuit each led indicates 10 percent battery level. We can extend this circuit to 100 steps by cascading lm3914 IC's.

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III. COMPONENTS REQUIRED

1) LM3914 IC
2) LEDs -10 (Red – 3, Yellow – 4, Green – 3
3) SPST Switch
4) Resistors – 18KΩ, 4.7KΩ, 56KΩ
5) Potentiometer – 10KΩ
6) 12V Battery (to test)
7) Connecting wires
8) Bread board

IV. CIRCUIT DIAGRAM

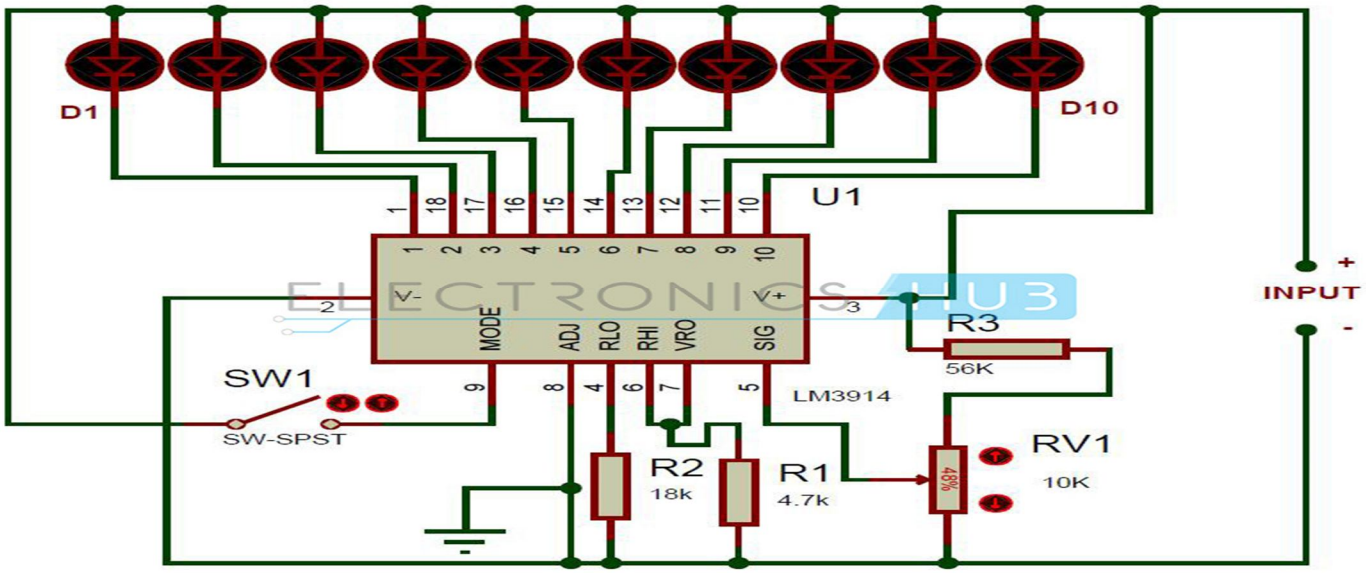
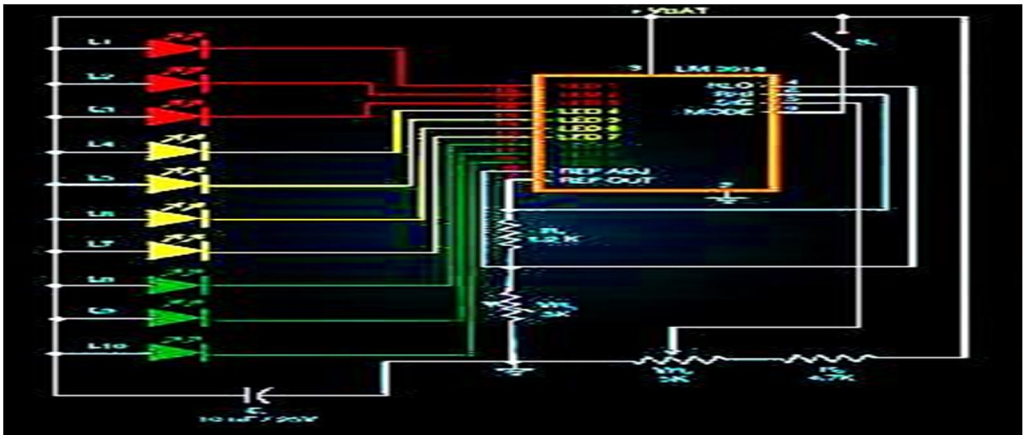


Fig 2: Battery Level Indicator Circuit Diagram

V. CIRCUIT DESIGNING

In this circuit LEDs (D1-D10) displays the capacity of the battery in either dot mode or display mode. This mode is selected by the external switch sw1 which is connected to 9th pin of IC. 6th and 7th pins of IC are connected to the ground through a resistor. This resistor controls the brightness of LEDs. Here resistor R3 and POT RV1 forms potential divider circuit. Here pot RV1 is used for calibration. There is no need of any external power supply to this circuit. The circuit is designed to monitor 10V- 5V DC.

The circuit will work even if the battery voltage is 3V. The operating voltage of this IC is 3v - 25v DC. Lm3914 drives LEDs, and vacuum fluorescents. The IC contains adjustable reference and accurate 10-steps divider. This IC can also acts as sequencer.



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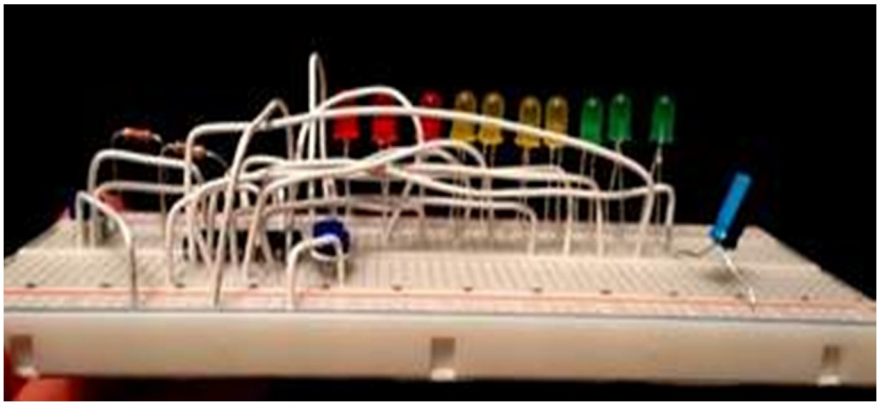


Fig 3: Circuit using LM3914 IC

VI. HOW TO OPERATE

1) Connect battery to be tested to the input of the circuit.
2) Now adjust the pot RV1 so that LED D1 just starts glowing.
3) Now increase the input Dc voltage slowly and observe the LEDs.
4) First led will glow for 1.2V and second LED is for 2.4 V and so on.

VII. RESULT

Below table shows the status of LED's with input voltage level-

1.2V	10	D1 – ON
2.4V	20	D1, D2 – ON
3.6V	30	D1, D2, D3 – ON
4.8V	40	D1, D2, D3, D4 – ON
6.0V	50	D1, D2, D3, D4, D5 - ON
7.2V	60	D1, D2, D3, D4, D5, D6 - ON
8.4V	70	D1, D2, D3, D4, D5, D6, D7 - ON
9.6V	80	D1, D2, D3, D4, D5, D6, D7, D8 - ON
10.8V	90	D1, D2, D3, D4, D5, D6, D7, D8, D9 - ON
12V	100	ALL LEDs - ON

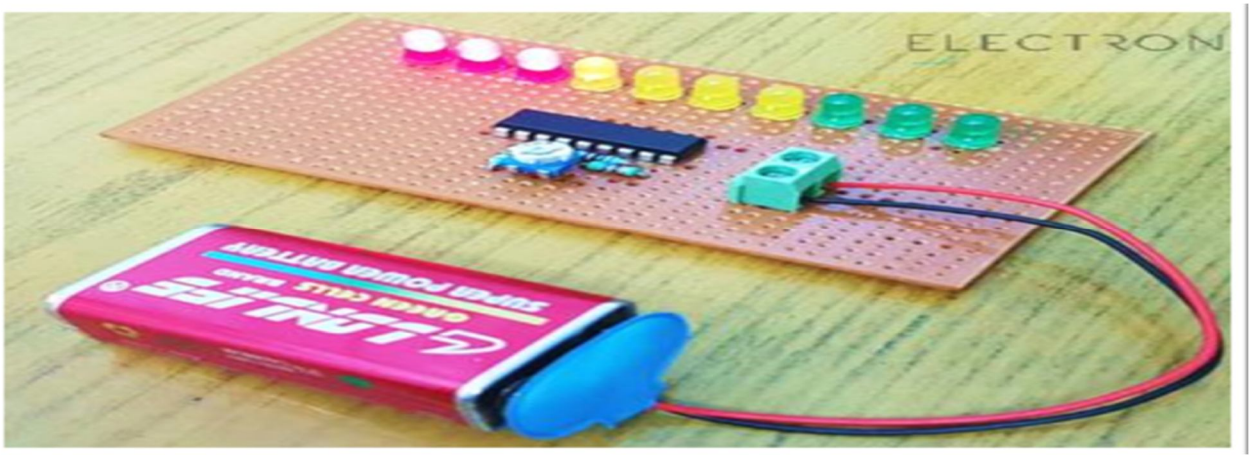


Fig 4: Designed Circuit

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VIII. LM3914 IC FEATURES

1) Internal voltage reference from 1.2 to 12v DC.
2) Programmable output current 2mA to 30mA.
3) LED driver outputs are current regulated.
4) No multiplexing interaction between outputs.
5) It supports wide range of temperature from 0 to 70 degree Celsius.
6) For bar graph display – connect 9th pin of IC to the supply
7) For dot display – leave the 9th pin of IC

We can also connect different colour LED's to indicate the status. Connect D1 to D3 red LED's which indicates shut down stage of your battery and use D8-D10 green colour LED's which indicates 80 to 100 percentage of the battery and use yellow colour for remaining

A. *Advantages*

1) Some cordless tools have a battery-level indicator which lets us know how much battery power the tool has left. And this feature is like having fuel gauge on a car.
2) The location of the battery- level indicator will vary depending on the model.
3) Knowing when the battery is about to run out means we can prepare for it, rather than being cut off-guard when a device stops in the middle of a task.
4) Using battery-level indicator, gives an idea of how much battery power is being used when working with a certain materials.

B. *Disadvantages*

Determining the charge remaining in many battery types not connected to a system that monitors battery use is not reliably possible with a voltmeter. In battery types where EMF remains approximately constant during discharge, but resistance increases, voltage across battery terminals is not a good indicator of capacity. A meter such as an equivalent series resistance meter (ESR meter) normally used for measuring the ESR of electrolytic capacitors can be used to evaluate internal resistance.

And there are some disadvantages of using the ESR meters

1) ESR meters fitted with protective diodes cannot be used, a battery will simply destroy the diodes and damage itself.
2) An ESR meter known not to have diode protection will give a reading of internal resistance for a rechargeable or non-rechargeable battery of any size down to the smallest button cells which gives an indication of the state of charge.
3) To use it, measurements on fully charged and fully discharged batteries of the same type can be used to determine resistances associated with those states.
4) The cost of an ESR meter makes it uneconomic for measuring battery voltages as its only function, but a meter used for cheeking capacitors can take on the additional duty.

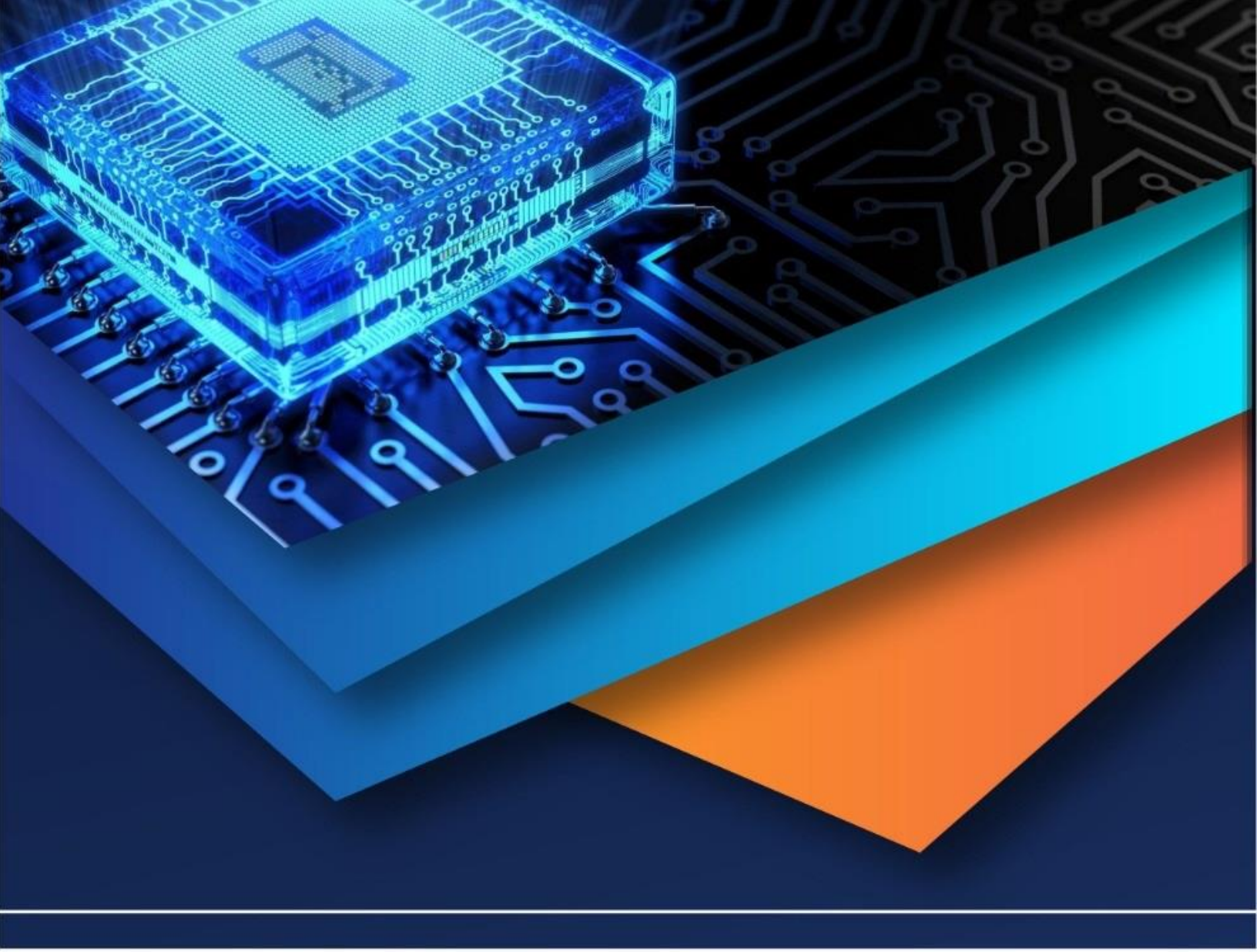
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