NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY
[IJIERT]
ISSN: 2394-3696
VOLUME 2, ISSUE 2 FEB.-2015

Battery Life Estimation for Embedded System

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Abstract

A battery system consist many battery cells with different characteristics to achieve reliable, efficient and extended utilization of battery. The battery management system provides individual level of battery. This level of battery provide information about state of charge, state of health of the battery. The current battery technology provide module level with voltage sensor. The object of this project to determine and the display the supply frequency. This can be done by using c8051f996DK. This designed circuit consist liquid crystal display(LCD),Zero crossing detector(ZCD), transformer, variable power supply unit .The supply power is sinusoidal in nature given to the step down transformer. This output of the transformer are also in sinusoidal in nature given to the zero crossing detector. When signal cross the zero then zero crossing detector send high signal to microcontroller. Based on the source code given to the 8051 microcontroller. It detect the number of zeros crosses and convert into frequency and display on the LCD.

Keywords-Battery life, C8051f996 TB, SOH/ SOC Battery.

Introduction

Battery system and their management are essential for many embedded system including frequency measurement, temperature measurement, humidity measurement .Battery system consist of many battery module having different characteristic issues such as battery aging , imbalance in thermal distribution, charging and discharging rates variable, change in chemical properties. To achieve reliable efficient and extended utilization of the battery system [1].

Battery balancing is essential for the battery management system. Particularly for lithium battery are used for the most of the required supply voltage from the number of batteries. Then they are must be connected in series. During the charging and discharging each battery in the string will be subject to same current but having different state of charge due to several factors. Each battery having different maximum capacities even if manufacture makes the best effort to match the capacities for new batteries. But due to non uniform operating condition cause imposing different thermal electrical stresses of the batteries causing changing the capacity for lithium batteries having small self discharge rate, small different accumulate time, different state of charge in the battery[2]. Even for different batteries capacities. Variation in the impedance and material using leads to the non-uniform battery characteristic. To protect the battery from overheat, overcharging and over discharging.

The operation of string is limited by weakest cell, the reaching state of charge upper or lower boundaries first, cell state of charge impedance in the string prevent the self from supplying their capacities fully and consequently battery run time and battery life cycle. Aim of cell balancing to reduce state of charge impedance with a string by controlling state of charge of the cell [3][4].

Battery module having multiple strings of cells in that setup the voltage of each cell and the string need to be voltage transducer. Each string also require current sensor during the sensor failure reduce battery reliability.

STATE OF HEALTH INDICATOR

Float voltage spread:

A constant voltage charging applied battery float voltage is unreliable for indicating state of health because relation between the float voltage, there is two float voltage high and low, may be an coincides with poor state of health with low capacity. the capacity is inversely proportional to absolute voltage deviation during float[5].

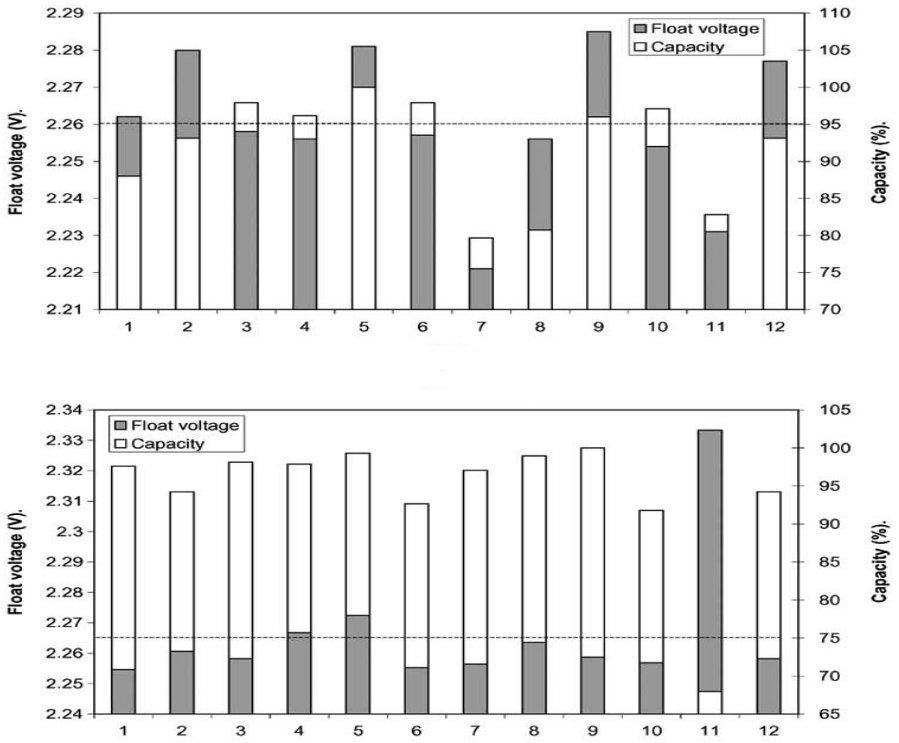

figure1. Float voltage and capacity

Float current:

Float current arise during the end of life of battery. Float current increases due to the thermal and ageing effect of battery. By using float current difficult to extract the state of health of battery.

Temperature

Temperature is most influence parameter of battery. This has affect on the reliability of the battery.

Charging and discharging cycle:

The no. of charge and discharge cycle provides information about state of health of battery. Battery here capable to deliver the power through the lifetime.

Impedance, conductance and resistance:

This technique requires test equipment. This technique provides most reliable information about state of health of battery.

Reserve life estimation scheme:

A check the battery capacity is conducted the following process ,a partial discharge of battery and discharge voltage verses reserve charge characteristic plot which provide battery capacity[6][7].

APPLICATION AND BLOCK DIAGRAM DESCRIPTION

The advanced c8051f996dk having many features by use we can measure what amount power consume by micro controller for run the application.in the frequency measurement we use c8051f996dk having high speed 8051 microcontroller and 512 bytes ram also on chip debug etc.

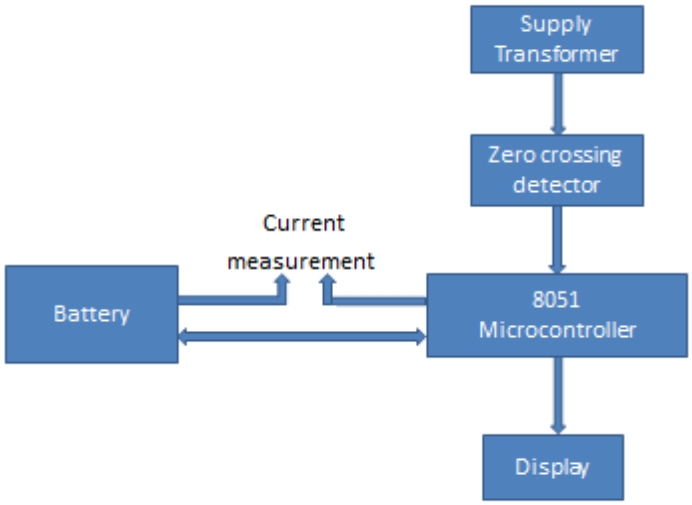

Figure 2. Block diagram

The supply voltage to microcontroller for perform the application is 1.8 to 3.6v given through the pin j17 and H2.the source code provide to the 8051.The 230v given to the step down transformer and create 6v at output side it is sinusoidal in nature.in the zero crossing detector when sinusoidal wave cross the zero then give high signal to the 8051.by use the source code micro controller detects the zero crosses by use number of zero crosses in one second micro controller calculate the frequency and display on LCD. During this application micro controller take power from the battery on the kit C8051f996DK by use pin J17 and H2 current deliver from the battery to the micro controller this can be measure by using multimeter[8][9].

How to estimate the life of battery

Unfortunately this question cannot be answered without knowing the size of battery bank and load to be supported by the inverter. The specific calculation made as follows:
FORMULAS AND ESTIMATION RULES-
1.Watt = volt * amperes
2.battery capacity is expressed by how many amperes for how many hours a battery will lost-ampere-hour(A.H.) capacity.
3.For 12 volt inverter system ,each 100 watt of the inverter load requires approximately 10 dc amperes from the battery.
The first step is to estimate the total watt of load and how long the load need to operate. This can be determine by looking at the input electrical name plate for each piece of

equipment and adding to the total requirement. Some load are not constant so estimation must be made. After the load and running time each established the battery bank can be calculate. The first calculation is to divide the load in watt[10].

LOAD CALCULATION

Suppose we want to run a microwave oven for 10 minutes a day which draw about 100 watts despite the size. To keep it simple think of inverter is as electrically transparent. In other words the 100 watts to run the oven come directly from the batteries if it were a 12 volt microwave. Taking 100 watts from a 12 volt battery requires the battery to deliver approximately 84 amperes .A full size refrigerator about 2 ampere at 120 volt AC. By multiplying 2 A*120 v to find out refrigerator use 240 watts. The battery will need to deliver 20 A to run the refrigerator . Typically refrigerator operate about 1/3 of the time that is 8hours of the day. Therefore the A.H drain will be 160 AH. After load and running time is established . By use we calculate battery bank size[11].

Example

If the load is operate for 3 hours,
For 12 volt battery , 100 A dc *3 hours =300 AH
For 24 volt battery, 50A dc *3 hours =150 AH

Conclusion

In this paper the battery life estimation in terms of basic factors and is proper use for elongated active application. In that the terms related to ageing effect occure in real operation. The validation has been performed on the single battery employing in the steady state condition.

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