ELECTRICAL MOTOR SCOOTER ON-BOARD COMPUTER

Ing. Marian SZTULA, Doctoral Degree Programme (1)
Dept. of Power Electrical And Electronic Engineering, FEEC, BUT
E-mail: xsztul00@stud.feec.vutbr.cz

Supervised by Ph.D. Pavel Vorel

ABSTRACT

We need to determine condition of batteries dischargement in battery systems. For example, if it is electric vehicle, we want to know battery voltage and current that's taken. These values would be provided by low - cost and not too complicated measuring device. But this device can't display taken charge, or charge that's left. Microprocessor with analog digital converter could serve as well. This problem has been already elaborated in [1].

In this article you can find a description of whole microcomputer system with changes I decided to do for function improvement of the whole system.

1 INTRODUCTION

I kept the same microprocessor that have been used in [1] in wiring. It is micro - converter with CPU's kernel 8051, built - in memory EEPROM, AD and DA converters.

For application in electrical motor scooter we need to measure battery voltage and current going from batteries. By means of these quantities it's possible to figure out instantenous power $P = U * I$ supplied by batteries by using a program.

We also need to count down a time for measurement of energy left in batteries.

We need to save continuously all values if we want to have a possibility of displaying energy after shutting down whole system, I use a special part of memory EEPROM, which is also located on microprocessor chip for this.

2 CURRENT MEASURING

For current measurement I used different way than the one described in [1]. On the picture 1 we can see connection diagram. It's necessary to have bipolar input, if we want to measure both polarities of current. However this input is not available. In the [1] there are two used amplifiers. The first one is used for the positive part of measurement and the second one for the negative part. The problem appeared in fact that operational amplifiers and converters have certain non - linearity and close to zero and maximum tension (2.5V) they have strong non - linearity. I tried to solve this problem by using only one operational amplifier for both

current polarities. It was necessary to set up such a voltage shift on entry of the amplifier to gain output voltage of amplifier on zero input current (tension) approximately

$$\frac{V_{REF}}{2} = \frac{2.5V}{2} = 1.25V$$

I use reference tension source 2.5V, that is accessible from micro - converter for this purpose. It's necessary to use buffer amplifier (TLC272), because it's the source with large inside resistance.

I add contacts relay into the wiring that can help me to calibrate converter to the zero current.

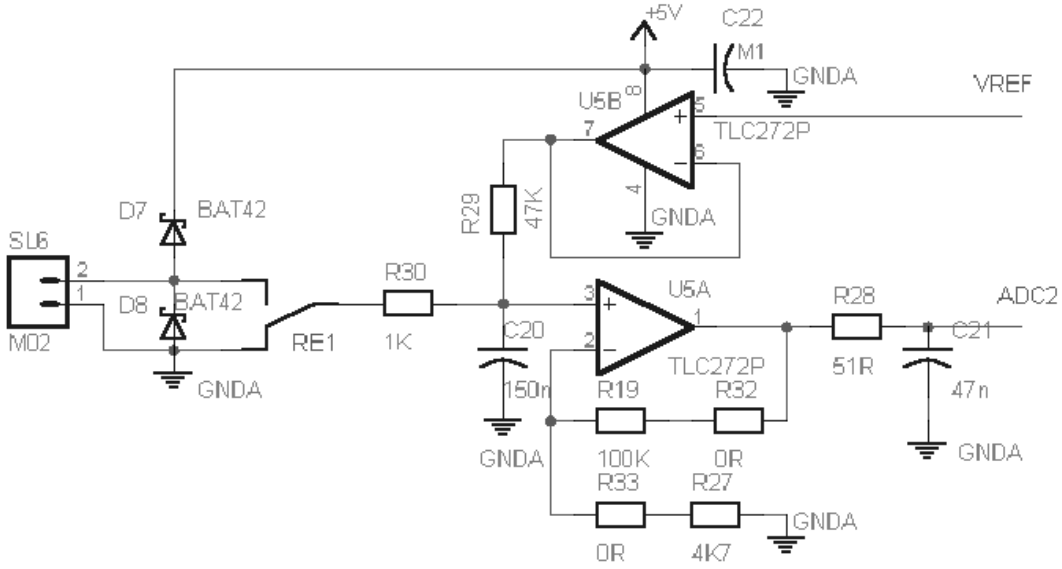

Fig. 1: *Current circuit.*

3 PROGRAM DESCRIBE

Program for microprocessor has been written in ASEMBLER51 language. Conversion time was set on every one second regarding purpose and usage of microprocessor. Picture 2 and 3 show program flow diagrams.

Picture 2 represents run of the main program. Device setup and load energy values saved in FLASH memory of processor after startup. Then program proceeds to endless loop and displays measured results all the time.

Major calculation runs by the help of second program loop (picture 6.). Current measurement and calculation, voltage measurement and time measurement belong there. After voltage conversion a test if voltage didn't fall below specified level of 35V is performed. Calculation of current is performed this way: I have to know which value is corresponding to 0A (0V) to be able to calculate positive and negative result. Relay connected on input converter is used for this (current measurement). I perform a conversion when the

measuring contact is grounded and record the result as current offset. Afterwards I switch contact of the relay to measured bypass and perform new conversion. I subtract both these numbers and the result is the current (tension) and its sign corresponding to the current direction (tension).

Calculation of energy is performed this way: Current measured for 1 second is mean value of current and so the energy is in As [ampere – seconds]. If I subtract these values from number 3600 every second, I'll remove 1Ah from the battery after zero result is reached. This value is displayed.

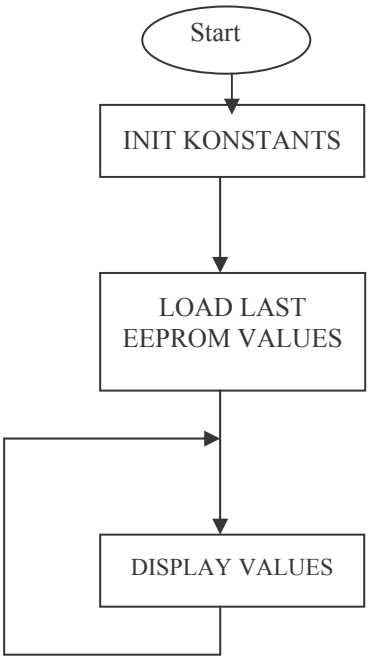

Fig. 2: *Main program*

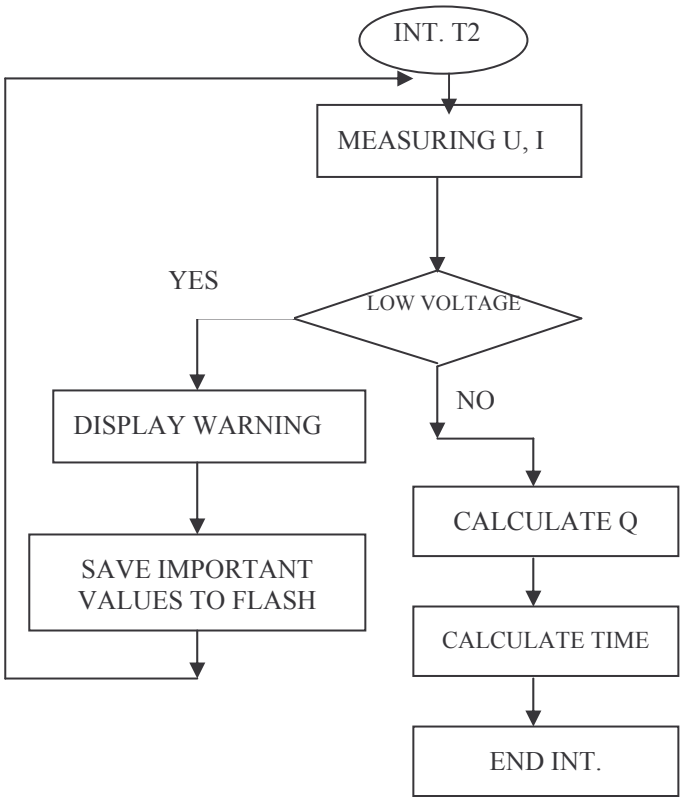

Fig. 3: *Measuring program.*

4 CONCLUSION

This paper presents the idea and procedure to measuring important values from electric scooter. Presented methods are used onto real vehicle and are fully functional.

REFERENCES

[1] Gajdůšek, P.: Diplomová práce, Brno, VUT 2002

[2] ADuC 812C datasheets, http://www.analog.com/productSelection/pdf/ADuC812_c.pdf