THE MONITORING SYSTEM OF SOLAR CELLS PARAMETERS BASED ON SOC

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Abstract. This article shows the monitoring system based on SOC, which is to be used in testing of solar cell parameters.

1. Introduction

Nowadays, lack of energy and pollution are gradually increasing, in such situations, solar energy is becoming an important research topic to solve this problem. Therefore, improving the methods of measuring of solar cells is a key point in the research and manufacture of solar cells. Moreover, under the trend of the development System on Chip (SOC), measuring using a minicomputer has a brightening future

2. Beaglebone Black description

Many makers who work with electronics love microcontroller platforms like the Arduino, but as the complexity increases in their projects, sometimes an 8-bit microcontroller doesn't have the power or capabilities to do what they need it to do. For example, if you want to use a camera and computer vision algorithms to detect dirty dishes in your sink, it might be a good idea to explore your options with embedded Linux development boards. These boards are generally more powerful and more capable than their 8-bit cousins and are sometimes the perfect solution for projects that are too complex for our beloved Arduino.

Not only that, but as the price of embedded Linux platforms drops, the community of support around them grows, which makes them much more accessible to novice and intermediate makers than ever before.

The BeagleBone (Figure.1) is an embedded Linux development board that's aimed at hackers and tinkerers. It's a smaller, more barebone version of their BeagleBoard. Both are open source hardware and use Texas Instruments' processors with an ARM Cortex-A series core, which are designed for lowpower mobile devices.

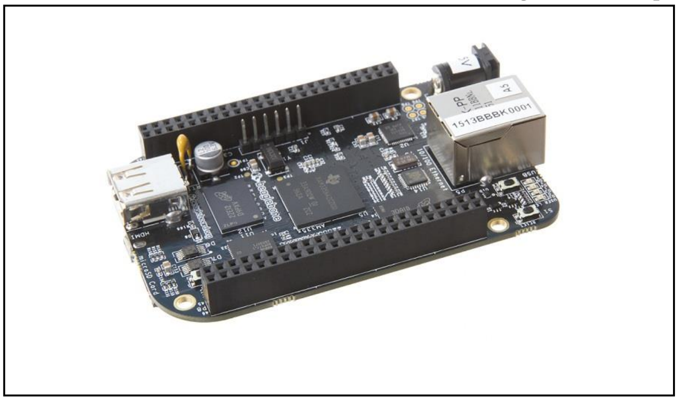


Fig.1 The BeagleBone Black

3. System designing

Typically used for the measurement of current-voltage characteristics of solar cell parameters (Figure. 2). Added electronic load on the solar cell, if solar cell is short-circuited (load resistance is zero), the excess separated by a p-n junction, the generated charge carriers will be able to circulate through the short circuit, creating the highest possible value of the current - short-circuit current Isc. In this case there is no accumulation of excess charge from the p-n transition occurs. The potential barrier will have the same height as the absence of optical radiation. Emf (Photoelectromotive force) will be zero. If the circuit of solar cell is open (infinite load resistance), all separated by a p-n junction, the charge carriers are collected at the p-n junction and compensate potential barrier, creating a photoelectromotive force equal to the voltage of idling Voc. With electronic control of the load resistance from the ground up to the limit, current-voltage characteristics of solar cell is obtained.

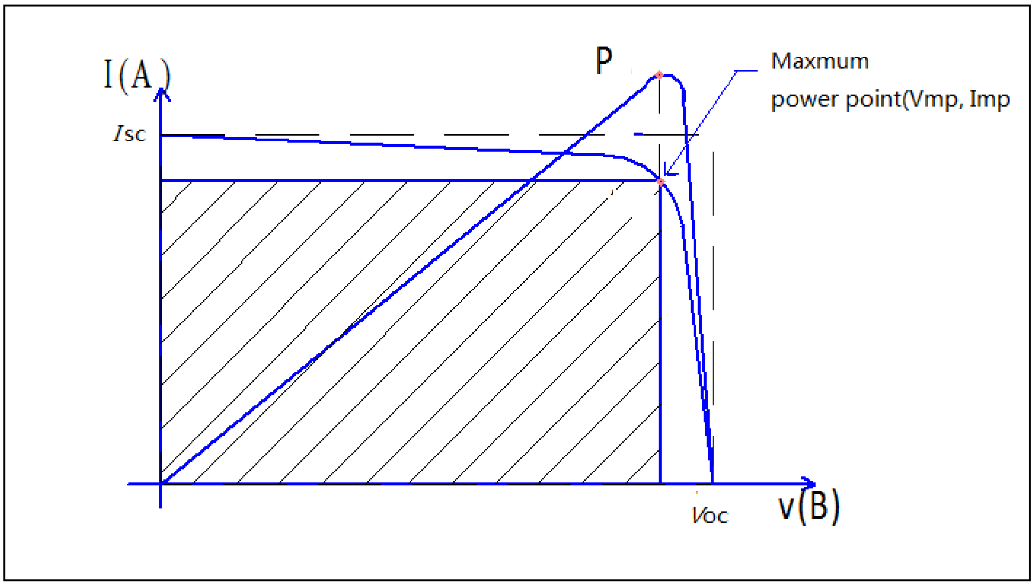


Fig. 2. Current-voltage characteristics of the solar cell

With the help of ADC, read the current and voltage became available.
ADC
To setup ADC, simply import the module, and call setup:

```
import Adafruit_BBIO.ADC as ADC

ADC.setup()
```

Then, to read the analog values on P9_40, simply read them:

```
value = ADC.read("P9_40")
```

The values returned from read are in the range of 0 - 1.0. You can get the voltage by doing the following:

```
import Adafruit_BBIO.ADC as ADC

ADC.setup()
value = ADC.read("P9_40")
voltage = value * 1.8 #1.8V
```

Thus, the measurement consists of two parts:

Read the voltage and current on solar cell: Beaglebone black there is 7 ADC connectors available on Beaglebone Black as to simultaneously measure multiple parameters possible.

Regulation of the value of electronic load: type in the program cycle, which increase the value of e-load from the ground, when the current value of solar cell less than 0.1 (mean solar cell circuit open), the measurement is completed.

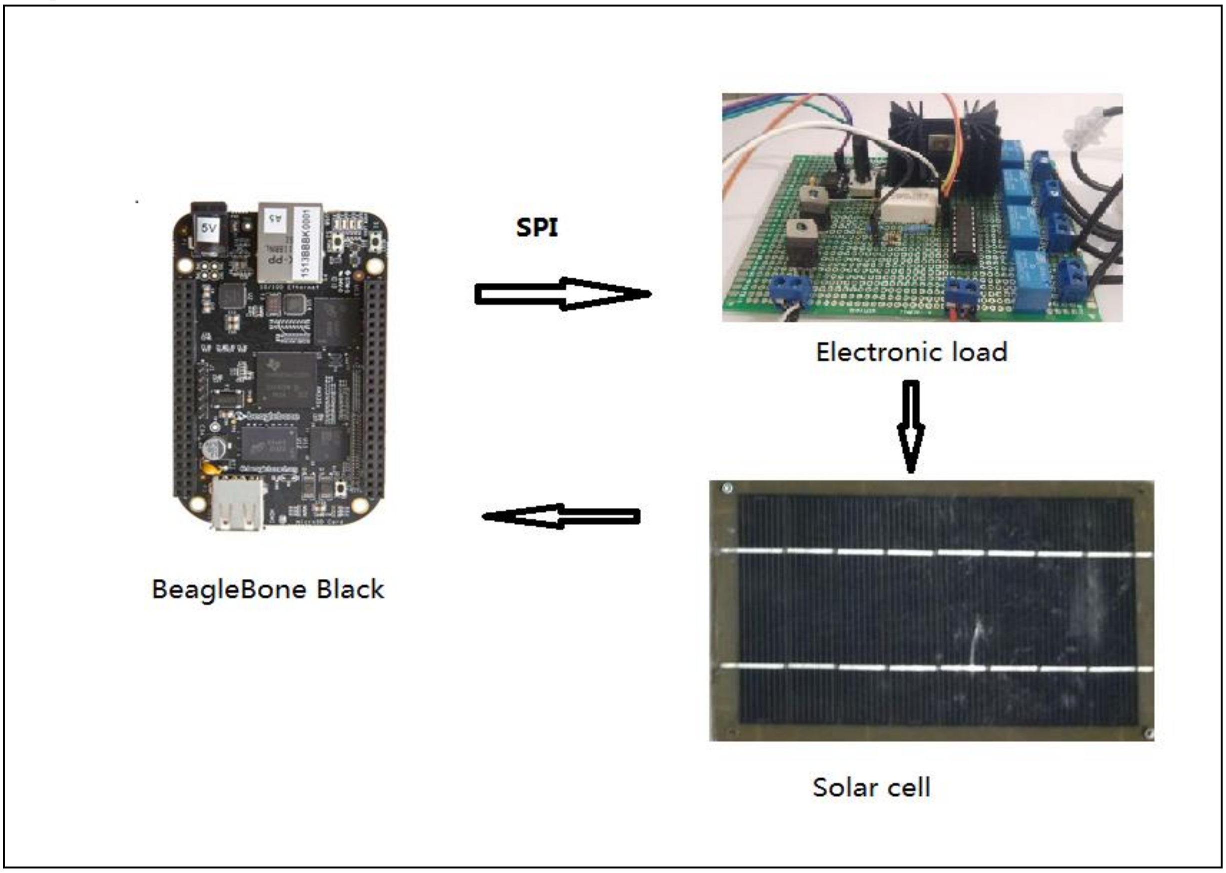
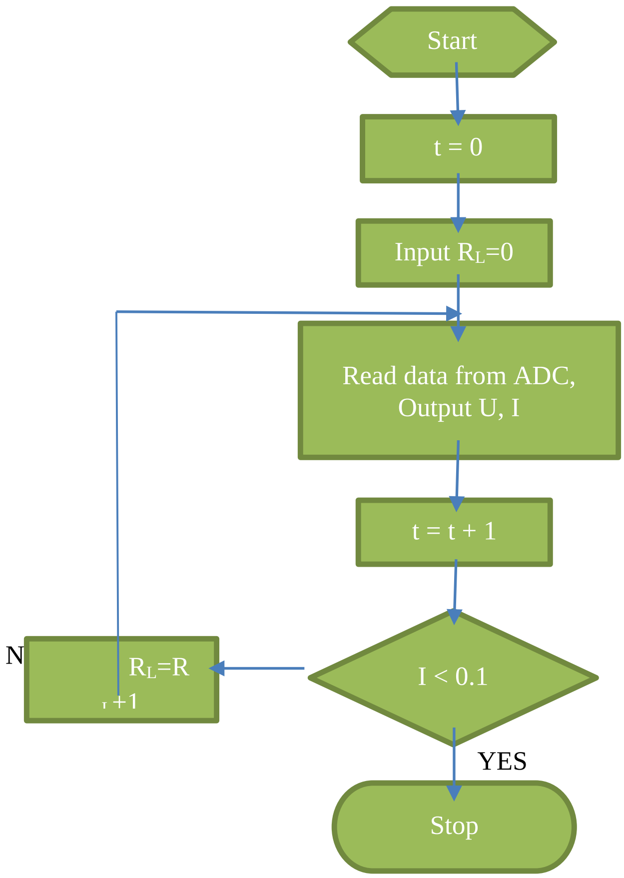


Fig. 3. Diagram of the measurement parameters

Launching the program, Beaglebone Black will record the current data and the voltage of the solar cell when the load change, with the findings to build a voltage-current characteristic and obtain the necessary parameters.

Measuring algorithm



4. Results and conclusions

Launching the program, Beaglebone Black will record the current data and the voltage of the solar cell when the load change, with the findings to build a voltage-current characteristic and obtain the necessary parameters.

These days, a typical microcontroller-based board costs around $20, while the BeagleBone Black retails for $45 at the time of press. Other than a more powerful processor, what are you getting for the extra money?

There's a lot of buzz around Raspberry Pi, and while it's quite similar to the BeagleBone, there are certainly a few differences. For one, the Raspberry Pi is meant as a low-cost computer to encourage the younger generation to learn about how computers work and how to program them. Because of that, the hardware, software, and documentation are geared towards that objective. On the other hand, the BeagleBone is aimed more broadly at people interested in embedded Linux development boards and therefore has more options for connecting hardware and has a more powerful processor.

References

[1] Matt Richardson // Getting Started With BeagleBone. – Maker Media, lnc. 2013. –3 c.
[2] Antonio Luque, Steven Hegedus // Handbook of Photovoltaic Science

ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В НЕРАЗРУШАЮЩЕМ КОНТРОЛЕ

ОПЫТ ПРИМЕНЕНИЯ УЛЬТРАЗВУКОВОГО КОНТРОЛЯ ПАЯНЫХ СОЕДИНЕНИЙ МЕТАЛЛОКОНСТРУКЦИЙ В УСЛОВИЯХ ЭКСПЛУАТАЦИИ

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Переменные нагрузки, воздействующие на стальные конструкции в процессе эксплуатации, вызывают развитие усталостных дефектов. При ремонте вершину трещины высверливают, что уменьшает коэффициент концентрации напряжений. Для восстановления жесткости элементов конструкций обычно применяют болтовые соединения. Использование высокотемпературной пайки по сравнению с болтовыми соединениями позволяет создать более долговечно усиление, которое не требует технического обслуживания и не создает дополнительные концентраторы напряжений. Качество паяных соединений элементов конструкций с усталостными трещинами, изготавливаемых в условиях эксплуатации, зависит от неровности поверхности, места расположения и ориентации дефекта, деформации кромок дефекта при нагреве. Неразрушающий контроль в этих условиях является необходимой технологической операцией, способной повысить надежность паяных соединений.

Целью работы является создание методики и технологии контроля паяных соединений при ремонте элементов мостовых конструкций с трещинами. Контролю подвергались паяные нахлесточные двух- и трехэлементные соединения, толщина которых варьировалась от 4 до 10 мм. Ширина шва составляла от 10 до 40 мм. В соответствии с технологической документацией на пайку подлежат выявлению наиболее распространенные дефекты типа непропай [2], доля которых превышает 85 % [1]. В зависимости от места расположения паяного соединения на конструкции возможен как двухсторонний, так и ограниченный – односторонний доступ.

Для контроля паяных соединений получил распространение эхо-метод [1, 3], который позволяет при изготовлении в заводских условиях обнаруживать дефекты с эквивалентным диаметром от 2 мм. Малая толщина соединяемых элементов 4 мм не позволяет использовать акустические волны на частоте 2,5 МГц. При ремонте конструкций с трещинами толщина паяного слоя может изменяться в достаточно широком диапазоне 0,1 до 0,2 мм, при этом амплитуда эхо-сигналов продольных волн от паяного слоя на частоте 5,0 МГц варьируется в диапазоне от – 35 до – 15 дБ относительно донного импульса. В этих условиях применение эхо-метода существенно ограничено и не позволяет решить задачу контроля паяного соединения.