BLET : Battery Lifetime Enhancement Technology

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***Abstract*— In recent years, mobile devices and high-hearth because of the multifunctional, battery capacity has been increased. In this paper, without the overhead by using the battery discharge characteristics, and application of technology to extend the battery life is explained. Experiment H.264 video transmission to take some losses and extended battery life was achieved.**

Keywords*— *low-power, battery lifetime,H.264

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1 Introduction

Recently Most mobile device increase Power consumption and battery capacity in order to Multi-functional and High performance. In mobile Device, study of Low-Power technology archive optimization through Trade-off given workload and time slot. Dynamically adjust the supply voltage and operation frequency control through the performance and power consumption, which he designed in accordance with the mode switch for the overhead solve the problem of time, is difficult. Therefore, in this paper using the battery discharge characteristics, without the overhead of a separate, extended battery life is achieved. The image quality of video data using some of the losses and the trade-off time is extended.

2 BLET FEASIBILITY TEST

The battery of one or more electrochemical cells is connected to the serial or parallel. Chemical energy stored inside the cell through the electrochemical reaction is converted into electrical energy. Electrochemical cell consists of anode, cathode and electrolyte and two electrodes are separated. In this paper, we use the battery model is the Kinetic Battery Model [1][2][3].

The battery life of the battery discharge characteristics that affect important is the presence of two different effects.

In this paper, the effect of battery discharge and recovery system using the experimental device for the application of the USN Kmote-S1 [4] was used. The battery discharge experiment was consumed. Kmote-S1 consists of MPS430 microprocessor, CC2420 RF chip [5] and 3 sensor (light, humidity, temperature) for the USN.

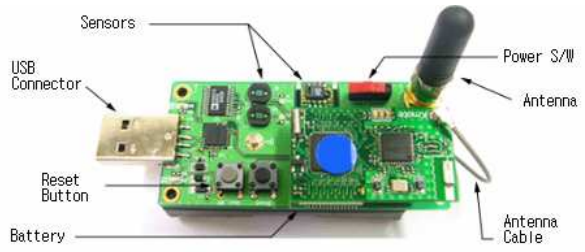

Fig. 1 Kmote-S1

Figure .1 this was used as a CR2032 3V Li/MnO2 220mAh battery. The operating system TinyOS ver 1.1 [6] was used, NesC [7] based on the implementation of recovery effect and was tested for the complete Software. Determination of Kmote-S1 is connected to the battery was running and operational Kmote-S1 is one of the battery voltage was measured using the NI USB-6009[8] that is DAQ(Data Acquisition) device of National Instrument Corp. Battery Recovery in order to verify the effect the same Kmote-S1 with each other Software installed and operating hours of battery life time difference was confirmed. In order to implement the behaviour of intermittent discharge mps430 was supported by the Sleep mode, Kmote-S1 of the current consumption during active mode and sleep mode were measured.

Active mode measurements of about 23mA, sleep mode current is passed around 0.001mA. Recovery effect for a test pattern TABLE I. was set up in Software like, 2.5 seconds, and this behavior, USN, for each angle 0 , 0.5 , 1.0 , 1.5 , 2.0 , 2.5, 5.0 and 10.0seconds, 2.5 seconds back to rest in the sleep mode operation in the repetitive pattern, an experiment was conducted. In Table 27, the first column, the behavior of the A2.5S0 slip is 0, 2,5 seconds is a program that performs continuous discharge. Working Rate an active time interval (active time + sleep time) is divided by the ratio. In fact, the entire pattern for calculating the time the item is active. The actual valid entry Working Time active time is calculated. Continuous discharge A2.5S0

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pattern, based on the pattern of the Working Time Intermittent discharge A2.5S0 compared with the calculated gain was calculated using the time. Maximum A2.5 S10 (Working Rate: 0.2), then up to 913% increase in battery life time gain were found.

TABLE 1. In Active Time 2.5 sec, Sleep mode changes according to the time change of battery.

A:S ratio	Working Rate	Working Time	Gain
A2.5S0	1.00	2,519.0	
A2.5S0.5	0.83	2,957.5	**17.408%**
A2.5S1.0	0.71	4,765.0	**89.162%**
A2.5S1.5	0.625	4,698.1	**86.508%**
A2.5S2.0	0.555555556	5,337.2	**111.879%**
A2.5S2.5	0.5	6,251.5	**148.174%**
A2.5S5	0.333333333	9,628.3	**282.228%**
A2.5S10	0.2	25,538.8	**913.847%**

Here, Working Time in the Start Time that the battery voltage was fixed by 3.0, End Time, or the battery voltage of 2.0V USN points system was determined to start malfunctioning. We determined endpoint that is below 2.0V and system malfunction point.

Therefore, the malfunction was determined by Working Time up to the starting point(TABLE 1).

3 H.264 BASELINE PROFILE IMAGE TRANSMISSION SIMULATION – TRADE-OFF BETWEEN PERFOMANCE AND BATTERY LIFETIME

Test video sequence using the H.264 Baseline profile encoding, the encoded image data is transmitted Kmote-S1.

Battery power is consumed in the transport behavior of individual conditions, using the discharge characteristics and encoding parameters required for effective and Recovery of lead time control system sleep mode through the use of Kmote-S1 used as transport only by increasing the time to verify. Battery Recovery Effect Kmote-S1 to the application of the video signal used to transmit only a simulation was carried out. Recovery Effect maximize battery lifetime and minimize the overhead for the system and transfer the image quality to achieve maximum optimization of the damage was set points.

TABLE 2. Each activities / Sleep Ratio Working Time. When discharge pattern cycle is 0.33 second

A:S Ratio	Working Time	Battery lifetime Improve rate
10:0	1,542	0.000%
9.5:0.5	2,301	49.222%
9:1	2,927	89.818%
8.5:1.5	3,358	117.769%
8:2	4,894	217.380%
7.5:2.5	4,837	213.684%
7:3	5,654	266.667%
6.5:3.5	8,074	423.606%
6:4	9,679	527.691%
5.5:4.5	11,611	652.983%
5:5	12,846	733.074%

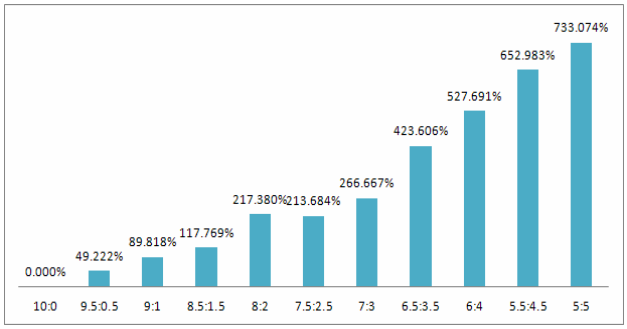

Figure 2. Each activities / Sleep Ratio Working Time. When discharge pattern cycle is 0.33 second.

Test sequence is QCIF (176x144) resolution at 30 frames a second, GOP (group of Picture) 3 dogs 10 slices per 1GOP (IPPPPPPPPP) is made. KMOTE using the Zigbee communication in the 2.4GHz band to support transfer speeds of up to 250Kbps. Therefore, the encoding part below the 192kbps CBR (Constant Bit Rate) method to test the imaging characteristics QP (Quantization parameter) for transmission by adjusting the value to generate encoded video. Target bit rate equation (1), such as working rate of 192Kbps for the best calculated by multiplying.

$$Target\,Bitrate = \frac{Active\ Time}{Active\ Time + Sleep\ Time} \times 192Kbps \quad (1)$$

To do this, first of all, according to the generated image of the Bit Rate Kmote-S1 and the active mode, sleep mode, set the cycle in the active mode and sleep cycles and time to set the rate of change improved the Recovery effect on the percentage of candidates to select. In TABLE 2, The QCIF, 30 frames, 3 GOP according to the pattern of the discharge characteristics of intermittent cycle of 1 / 3 seconds to set up and discharge experiments were conducted by each pattern.

The experimental results TABLE 2, such as using up to 733% of the time it was confirmed that the benefits occur. The second test image encoded as 192Kbps and PSNR of the image based on the CBR control of the Bit Rate and Bit Rate reduces PSNR by a small portion will be sent in to determine the Bit Rate. Other papers are often used in image processing of standard video test sequences are selected. Figure 3, Figure 4 are the standard video sequence "foreman"," bridge-far" changes in the QP-minute changes in a graph of the PSNR is shown.

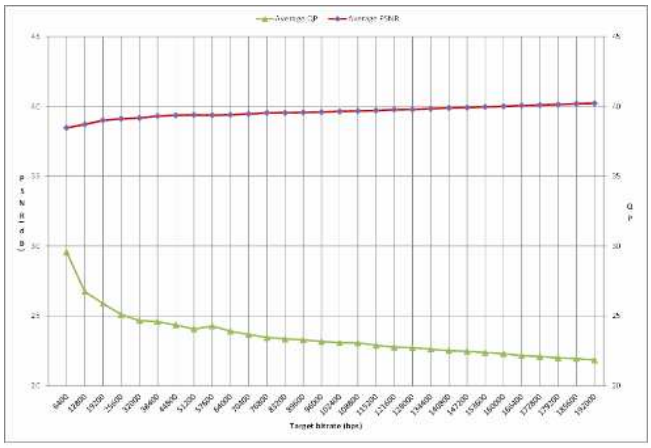

Figure 3. "bridge_far" changing the QP and PSNR Comparison

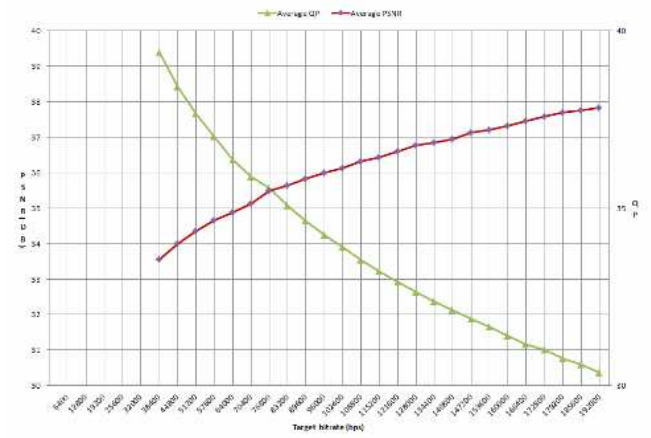

Figure 4. "foreman" changing the QP and PSNR Comparison

PSNR for each standard image changes depending on the difference between the QP of each other is different. Typically, about 1dB PSNR of QCIF reduced in the eyes of the people because they are not well defined, The video of Figure 6 is "bridge_far" point drop in PSNR 1db to 64Kbps, 192Kbps, because 33% of the battery discharge pattern of activity / Sleep ratio is 0.5 to select and operate approximately 316% improvement in battery life and get results. 192Kbps from the standard video sequence "foreman" of Figure 7. 1db from comparison of the actual image is reduced in 147.2Kbps. 1db loss of image quality and PSNR, but the 0.8 Working rate of the battery because it can operate as a 153 percent improvement in battery life time is made of. In addition, the battery lifetime gain and PSNR of standard video "bridge_far" is a graph with Figure 6 is -1db in PSNR decreasing the battery can get over 733% gain.

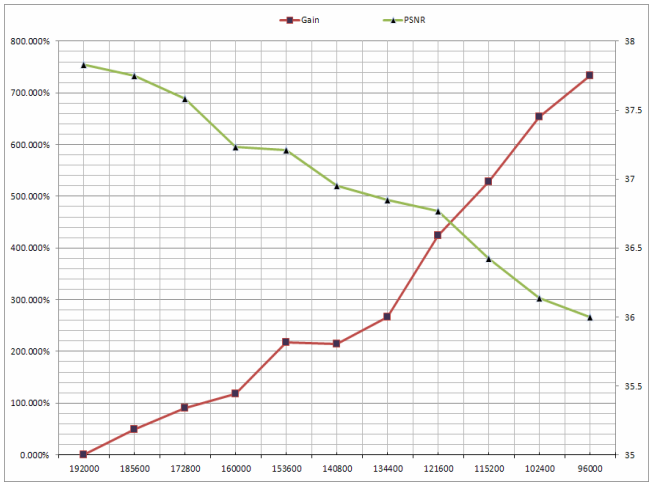

Figure 5. Comparison of The battery lifetime gain and PSNR in "foreman".

Depending on the objective characteristics of the video transmission bit rate QP (quantization factor) through the adjustment of the optimal battery life benefits can be obtained. Here, the gain depending on the type of battery used is the width changes. Battery 3.0V 220mAh Li/MnO2 all of the experimental results from the battery is a similar result. However, the majority of the batteries in the battery recovery effect of idle time, which was found to appear.

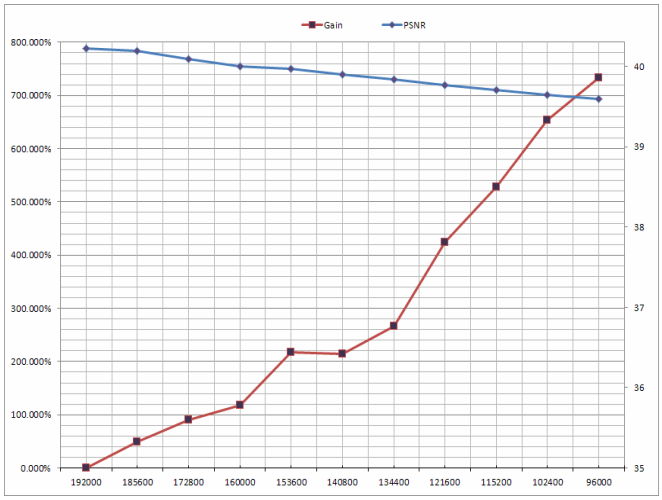

Figure 6. Comparison of The battery lifetime gain and PSNR in "Bridge_far".

Figure 7. Comparison with 192Kbps, 147.2Kbps, 102.4Kbps, 64Kbps and original in “foreman”

5 Conclusions

In this paper, the effect of battery discharge and recovery effect using the proposed extended battery life. Video transmission applications, the video image quality by reducing the PSNR 1db up to 733 percent depending on the battery life time was extended. Performance characteristics of a given application are used to adjust the battery recovery effect can be achieved using the extended time.

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