Technical University of Munich

Informatics 10 – Chair of Computer Architecture and Parallel Systems (Prof. Schulz)

Master Praktikum: IoT (Internet of Things) (IN2106, IN4224)

MILESTONE 2

Power measurements and tuning, report

Group: 2

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1. Collected measurements

Measurements that we collected during the meeting on campus are presented in the next table (we took a few measurements for each of the modes):

Mode	Description	Current Consumption (mA)
Wifi active	Transmitting	281, 236, 310
	Receiving	123, 113, 108
CPU active, wifi idle	240 MHz	77.4, 84.3
	160 MHz	54.4, 51.3
	80 MHz	30.9, 32.5
	40 MHz	15.8, 16.1
	10 MHz	10.6, 10.3, 9.25 (without display)
Light sleep	160 MHz	4.72, 3.2 (without display)
Deep sleep		942 µA

2. Elaboration

Firstly, we measured maximum consumption of transmitting and recieving the data with our own code loaded to esp. We can see that consumption of transmitting is relatively high, more that double consumption of receiving.

Then, we loaded code for light sleep in which we incorpoated our own counting algorithm and we tried it with different frequencies. As we already know higher frequency -> more power. That can indeed be seen in our table, for example when we reduced our frequency from 240MHz to 180MHz (factor of 0.67) our currency consumption droped with the same factor (77.4 -> 51.3)

We also took a few measurements plugging the display out, both in active and light sleep mode and we can see that consumption drops for at least 1mA, which makes a significant difference while the board is in light sleep.

Best performance is by far with the deep sleep mode, but one can argue if deep sleep is good for such kind of tasks where we have constant flow of data (especially during the day and working hours). It may be more suitable for less frequent events.

As a conclusion from all seen and said, power tuning of our code can largely impact our batery life, and we should always aim to reduce current consumption by adjusting our CPU frequency, setting larger wifi listen interval and what is most important take advantage of light/deep sleep modes whenever we can.

3. Task

Q: How long is the lifetime of a 600 mAh battery. Assume that every 2 hours between 8:00 and 18:00 there will be a batch of enter/exit events. Assume a clock frequency of 160Mhz and that the automatic light sleep mode is switched on.

A: Let's say we have 15mins of enter/leave events on every 2 hours, five times a day (8:00, 10:00, 12:00, 14:00 and 16:00, we didn't include 18:00 since we guess after that we shouldn't have more data). Our board in active state consumes 54.4 mA and in light sleep 4.72mA.

Therefore while:

- Active -> 15 * 5 mins a day
- Light sleep -> 24 * 60 – 5 * 15 mins a day

Now our daily consumption is:

((24 * 60 – 15 * 5)/60) * 4.72 + (15 * 5 / 60) * 54.4 = 107.38 + 68 = 175,38mAh

Lifetime of our battery would be around 3,5 days.