Cairo University
Faculty of Graduate Studies for Statistical Research
Department of Computer Science

The Smart Battery Charger

A Project Presented for Fulfillment
For Diploma Project in Computer Science

Submitted by

Mohamed Sayed Hemed
Sherif Mostafa Samy

Supervised by

Dr. Ahmed Hamza

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- ## Introduction:

  In recent decades, smart devices have played the most significant role in human's life, and power consumption has been one of the most trending issues. As a result, batteries and their lifespan have been one of the most sophisticated topics.

  We propose to design a device that automate charging process by protecting the human from headache of monitoring percentage of charging periodically.

- ## Project Background:

  As students in computer science department, laptop is one of the most important tools for us, so we want to save its battery's life cycle as much as we can.

  This is the first serious contribution to overcome this issue by building an intelligent device from scratch that save batterie's life, which based on Embedded Systems by combining software with hardware.

- ## Problem statement:

  Batteries do not have an infinite lifespan. Most battery manufacturers claim that their products have a 300-500 cycle rating. After this, batteries would be unable to carry as much energy and will only be able to fuel the computer for limited periods of time [qur21]

  The wrong way of charging Lithium-Ion batteries which included in laptops leads to decrease batterie's lifespan by 25% which in turn lead to replace them frequently, as well as frequently and randomly power outage which lost user's work.

  Leaving the battery connected to the charger when the battery is completely charged while you are using it may lower battery lifespan if you do it repeatedly [sam21]

  "So, a good range to aim for when charging a Li-ion battery is from about 40% to 80% in one go. Try not to let the battery drop below 20%" [qur21]

  As battery's cost has risen, it is necessary to save money and enhancing batteries' performance, so solving this problem now not later is the correct chosen.

- ## Goals and objectives:

  We are seeking for provide realistic solution, design, and implement a cheap, portable, and energy-saving device which behalf of humans in recharge batteries using methods that increase battery lifespan and recharge it with smart methods.

- ## Beneficiaries:

  Anyone who have laptop and want to save his battery life as much as possible, or who those want to test batteries in case of buying new/used laptops.

- **Proposed methodology:**

Project consists of two level of work; first level is hardware layer which responsible for charging or discharging laptop battery depending on second layer's signal which is a software that monitoring battery status of laptop using some functionality in operating system.

Hardware layer is consisting of:
  - o Microcontroller.
  - o Bluetooth module.
  - o Relay module.

Software layer is consisting of:
  - o High level code that monitoring battery status from operating system and send Bluetooth signal to microcontroller to charge or discharge laptop battery.
  - o Send Bluetooth signal from microcontroller to laptop as a feedback (handshaking) to verify that the action (charge / discharge) has been done correctly.
  - o Generate some types of reports that inform user about battery status, expected residual life and its performance.

- **Work plan:**

Trying to find a way to control the DC charger of the laptop battery by switching (ON/OFF) the charger internally depending on the operating system methodologies, but this trial failed so, transferring to plan (B) is best choice via designing a small and portable smart embedded device that control the (220 VAC) line socket.

This plan has two main factors:

1- Hardware:
  - Criteria of choosing microcontroller.
    - Speed what is the highest speed that the microcontroller supports.
    - Packing (DIP Dual Inline Package, QFP Quad Flat Package) this is important in terms of space, assembling and prototyping the end product.
    - Power consumption this is especially critical for battery-powered products.
    - Amount of RAM and ROM.
    - The number of IO pins and the timer on the chip.
    - Ease of upgrade to higher-performance or lower-power-consumption versions.
    - Cost per unit in the case of production [mazi21]

2- Software has two types of code:
  - Code that runs at the laptop on background and written in high level language (C-Sharp which support cross platform for future development)

  - Code that burns at microcontroller that written in (C++ which is the nearest to HAL hardware abstract layer)

- ## **References:**

  - [mazi21] Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi. 2010. AVR Microcontroller and Embedded Systems: Using Assembly and C (1st ed.). Prentice Hall Press, Upper Saddle River, NJ, USA.

  - [qur21] https://www.quora.com/How-should-we-charge-mobile-phone-battery April 8, 2021

  - [sam21] https://www.samsung.com/nz/support/mobile-devices/tips-for-battery-charging-and-how-to-make-your-battery-last-longer/ April 20, 2021