MOBILE PHONE CHARGING USING COIN INSERTION

EC316 MICROPROCESSOR LAB PROJECT

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We would like to thank Prof. Dhananjay V. Gadre for providing us this opportunity and his constant support which helped turning this project into a reality. We would also like to thank all our peers for constantly motivating and helping us during the process.
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Introduction & Motivation

In this age of technology, where we constantly use our cell phones day in and day out, the need to charge our phones on the go requires us to carry our phone chargers with us at all times. Evidently, this is an added burden or a first world problem. Not to forget the futility of carrying chargers in a country like India where there is a lack of proper charging ports in public spaces. This project aims to eliminate this problem by developing a prototype which will provide an easy access to phone charging facilities to the users. Also, this model can be implemented in rural areas without access to regular electricity with reduced charging rates.

Our biggest motivation to undertake this project was the constant support and help from our teacher Prof. Dhananjay V. Gadre, who encouraged us to expand our horizons beyond the limited scope of books and experiment with the practicality of various electronic components and devices.
Synopsis

This project, ‘Mobile phone charging using coin insertion’ or ‘Paycharge’ aims to provide the facility of charging mobile phones on the go. It consists of a coin based charging system that charges a mobile for a stipulated amount of time on inserting coins of either the same or different denominations. As a prototype, it accepts coins of denomination Rs 2, Rs 5 and Rs 10 which provide 10, 20 and 30 seconds of charging respectively. It comprises of a coin recognition module consisting of three opto-interrupters for each of the three denominations which sense the coins as they are dropped between the opto-interrupters. These opto-interrupters then signal the microprocessor that one or more coins have been dropped in the module. As a consequence, the microprocessor signals the power MOSFET to start charging the mobile phone connected to the circuit for a time determined by the coins dropped. A reverse counter is started at the same time and the total time left for charging is displayed on an LCD. When the time on the LCD elapses, charging is disabled and the user can insert more coins for further charging.
Project Description

Components used in the project mainly include an 8085 microprocessor, an 8255 peripheral interfacing device, an 8K RAM, an 8K ROM, two address decoders, one latch, a power MOSFET, a 16x2 LCD display, three opto-interrupters, a mini USB port, two USB ports, a preset, a 4Mhz crystal, switches, resistors and capacitors. The schematic has been enclosed for further reference.

The circuit is powered through the mini USB port. The user is asked to press the SID switch to initiate charging. The coin detection module consisting of the three opto-interrupters, is used to accept the coins. They are connected to the lower three bits of port A of 8255. Each opto-interrupter which corresponds to a pre decided coin denomination, detects the coin as it is dropped between the photo diode and the photo transmitter of the opto-interrupter and hence signal the microprocessor to begin charging.

Before the charging starts, the user is asked whether they wish to insert more coins, which can either be of the same or different denomination out of the specified three. If the user inserts more coins, the
corresponding charging time is added to the previous one prior to the charging of the phone by the microprocessor. When the total time is determined and the user doesn’t insert any more coins, a reverse countdown is displayed on the LCD and the charging of the mobile phone is started. The charging mechanism utilizes the bit 4 of port C of 8255 which is connected to the gate of a power MOSTEF which acts as a switching mechanism to charge the phone. When the bit 4 of port C of 8255 is set high, the drain and the source of the power MOSFET are shorted and the mobile phone receives the required ground needed for charging.

The 8255 is also used to interface the LCD display. All the eight bits of port B and the lower three bits of port C of 8255 are connected to the data bus and the control signals of the LCD display respectively.
Board File
Gantt chart

- Expected
- Actual
Flowchart

1. Display "Press button to charge"
   Monitor SID to check for button press

2. Is SID low?
   NO
   YES: User wants to charge

3. Display "Drop coin"
   Wait for the user to drop a coin

4. Are either of PA0, PA1, or PA2 high?
   NO
   YES: Coin dropped

5. Ask for more coins
   Display "Press for more"

6. Have 3 seconds elapsed?
   NO
   NO: Is SID low?
   YES: User wants to charge

7. Display the time left
   Start charging

8. Is time left equal to zero?
   NO
   YES: Disable charging

9. Disable charging
Testing

The LCD was tested by running a separate code snippet (dummy code) to display a word on the LCD. The LCD Timer was tested separately from the charging mechanism, by modifying the code, after which the code containing the charging mechanism was tested.

Bit 4 of port c of 8255, which on receiving a high from the opto-interrupter input was signaling the MOSFET to initiate the charging, was tested using a multimeter.

It was found that the two tasks of charging the mobile phone and displaying the reverse timer on the LCD were not being executed simultaneously. The BSR mode in 8255 was used to set the fourth bit of port C but when the same was tested using a multimeter it was found that the bit was not being set, which in turn was not able to power on the MOSFET for charging. The reason for which came out to be, that, since the first three bits of port C were also being used by the LCD, every time the timer was being displayed on the LCD, port C was being reinitialized according to the command word corresponding to that of the LCD. Hence bit 4 was being overwritten before it got the time to signal the power MOSFET.

This problem was overcome by setting the PC₄ bit high using the input output mode instead of the BSR mode i.e. modifying the LCD command and data words by including the bit to set PC₄ when the reverse countdown timer was being displayed on the LCD, hence implementing the timer and charging simultaneously.
Conclusion

The project was completed successfully within the stipulated time under the guidance of Prof D V Gadre. Both the hardware i.e. the electrical and electronic components used in the circuit as well as the software i.e. the code used to execute the required functionality were found to be working properly till the end of the project. The objective of the project which was to provide a paid mobile charging facility was met.

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