Bat-Cap: Smart and Innovative Charging Solution

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Abstract - **Battery is one of the fundamental driving forces for Smart devices. The urgency to charge our devices in public places is a huge concern when there is an absence of power bank. Our main objective with Bat-Cap is to design compact and pocket friendly sized battery capsules. These capsules are wirelessly rechargeable batteries capable of charging a device. These compact capsules will overcome the limitations of existing Power banks. A Vending machine will act as an accessing interface for the user from which the user can lend the capsule or can put it back for recharging. Wireless panel fitted along with Arduino UNO, Servo Motors and LCD interface for the users and proper storage for the capsules will be housed inside Vending machine.**

Keywords: Rechargeable, Power bank, Vending Machine, Capsule.

I. INTRODUCTION

The need for power in today's world is never ending. Charging of mobile phone devices during the time of emergency in public places is still a difficult task. Currently, we do have charging stations in few public places but a user charging his/her device on the charging station will have to wait until the device is charged from the stationary charging source. To overcome this challenge Power banks were developed that ensure mobility to the user. But the shortcomings of existing Power bank charging solution are that they are bulky to carry, expensive and non-handy. To eliminate the charging problems in public places we have developed a Battery Management System. It will try to counter all the issues faced in today's world.

Our main objective with Bat-Cap is to design compact and pocket friendly sized battery capsules. These capsules are wireless rechargeable batteries capable of charging a device. These compact capsules will overcome the limitations of existing Power banks. In order to access and recharge those capsules there will be a Vending machine where the battery capsules will be stored.

A wireless charging section in the vending machine will charge the battery capsules after the user uses the battery and disposes the used battery in the vending machine. Wireless panel will comprise of suitable sensors and driving motors, Interface for the user and proper storage for the capsules will be present. This Vending machine will act as an accessing interface for the user from which the user can lend the capsule or can put it back for recharging.

II. COMPONENTS

1) Arduino UNO: It is a microcontroller with 14 digital input and output pins. It has 16 MHz quartz crystal, 6 analog inputs, a reset button, power jack and a USB connection. This Arduino UNO drives the servo motors.

2) LCD Display: It is the screen used to display the information to the user.

3) Servo Motor: It is an electromechanical device which provides torque based on the supply voltage and current. It is used to perform motion activities in the vending machine.

4) Li-ion Battery: This is rechargeable cell with a capacity of 2000mAh and 3.7 Volts with charging time of 1 hour.

5) 7805 Voltage Regulator: It is an IC used to ensure +5V supply.

6) Relay: It is an automatic switch used to control a high-current circuit with a low-current signal.

7) Buzzer: It is an audio signal device used for alarming when the charging time is over.

8) Wireless Transmitter and Receiver Coils: These coils are used to charge the battery capsule and are fitted within the vending machine.

III. METHODOLOGY

The purpose of this project is to curb the issues of mobile phone charging during the time of emergency at public places.

The two major parts of the project are the vending machine and the battery capsules stored inside the vending machine.
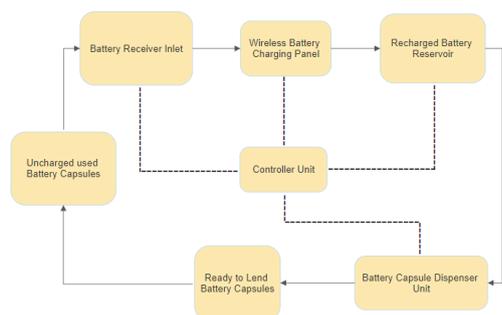
Figure 1: Block diagram of complete user cycle

A. Battery Capsule: This is the charging element or the device which will charge the mobile phone devices in need of charging. Unlike existing power banks these capsules will be much more compact and there would be no use of connecting wires in it. A capsule would be made using rechargeable batteries of 2000mAh to get faster charging. The batteries would be connected to a power bank circuit board. On the power bank circuit board, the output port will be connected to a USB which will act as a charging connector for mobile phones and the input port will be connected to the wireless receiving coil which will help in the wireless charging mechanism of the Battery Capsule. The coating of the capsules will be done using plastic material.
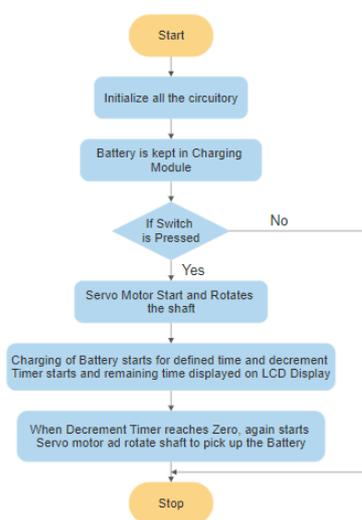

Figure 2: Flow diagram of internal operation

B. Vending Machine: The working of the vending machine will be based on an Arduino UNO. This vending machine will have a wireless charging panel which will charge the drained-out battery capsules in contact with it. Below this charging panel slot of the vending machine there will be rotating coils which will act as a storage part of the battery capsules. These coils will be connected to servo motors which will rotate the coils so that the battery capsules stored in them will fall out of

those coils and reach the accessing panel from where any user could access the capsules. To access the battery capsules there will be an interface on the vending machine from where the user can get the capsules with a click of a push button. The interface will comprise of LCD screen and push buttons which would be connected to the Arduino UNO. Below the interface there will be a coin acceptor slot which will give access to the interface. The vending machine will have two other slots. First one will be the accessing slot from where the user can access the charged battery capsules and the other will be the receiving slot where the users will put back the drained batteries which will be charged by the wireless charging panel inside the vending machine. The outer body of the vending machine will be fabricated by acrylic sheets.

IV. IMPLEMENTATION

Figure 3: Vending Machine using Servo motor

The vending machine is responsible for the wireless charging of the battery capsule. The charging station has an IR sensor which detects whether battery is present or not. When the battery is detected by the IR sensor, the battery capsule is moved to the charging unit with the help of a servo motor. When the battery is moved to the charging unit, the battery will automatically be charged because of the wireless charging mechanism. It will be charged for a fixed duration of time that is set. This time has been set based on the charging time required to charge the battery completely. Usually Li-ion 2000mAh 3.7V rechargeable battery takes 2 hours to charge completely.

Figure 4: Battery Capsule

When the battery is charged completely, the battery is moved to the output section so that the user can collect the charged battery. Arduino UNO drives the entire operation. Wireless transmitter and receiver coils are implemented using 28 turns. The transmitter coil generates 6V for charging of the battery capsule. LM2596 is used as a step-down converter. A 5V relay is used to control the transmitter section. If the relay is in ON state then the transmitter coil will charge the battery and in OFF state the battery will not be charged.

Figure 5: LCD Display with remaining time indication

IC L293D moves the servo motor; an LCD screen displays the instructions and remaining time. When the entire charging time is over the LCD displays zero second followed by a buzzer sound so as to ensure proper charging of battery capsule and to avoid over charging problem. Now the user can collect the battery from the output section and use it. This way the entire user cycle with respect to the operations gets completed.

V. APPLICATION AND FUTURE SCOPE

- Smart Charging Solution for Smart Cities based on Plug and Use mechanism.
- In Private spaces like corporate offices, it will facilitate our less dependency on stationary charging solution which is present today.
- Setting up the system at public places like airports, malls, and railway stations will provide movable charging solution.

VI. RESULT

The final product has been executed as per plan. This project has a structure where every component is mounted and movements are controlled through servo motor controlled using Arduino UNO. The battery capsule is charged using the coils, although its efficiency is nominal but by increasing the coil turns the efficiency can be increased. The end result is a steady system which can used for deploying at public or private spaces and the overall system meets all the safety parameters.

VII. CONCLUSION

This paper presents an approach which can be implemented and used for eliminating the battery charging issues by overcoming the limitations of existing devices such as power banks and stationary charging solutions and this approach can be implemented and used at public or private spaces.

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