OOM ECG

1)

Version Update: -

Release History: -

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2.1) Software Requirement Specification

Aim:

To write a documentation on Battery for Medical Devices.

Problem Statement:

To write a document for a battery related to medical industry.

Outline:

This section outlines the overview of the battery product and it should have a lifetime of 10 days. As we are using a PCBA Board with a two placeholders at each end to fit a small size battery in it. The battery capacity used by the company in this document is 350 MAH and 180 MAH in capacity, should be connected in parallel. The lithium polymer battery should be rechargeable. There existing design should not have any changes.

When the product is going to be used, certain assumptions must be made to ensure that it is working properly.

The device should have a battery reading monitoring gadget attached to it to track the
battery.

Two small battery on the PCBA board should be put in the existing design volume, **so it should work like a single battery**.

No matter what port as adapter we use be it Laptop or Mobile, the capacity of the battery should not change.

Constraints:

The accuracy of the battery calculation depends on the precision of the battery monitoring circuit.

The LED used in the board PCBA functionality depends on proper operations of the LED components being used.

When battery in the PCBA device undergoes charging for a period of full charge[approx 60 minutes], the device should be able to use it for atleast 3 days.

Warning:

Do use a proper adapter.

The device should not overheat by the environment 50 degrees and above.

Don't use power adapter above 45 Watt.

 Safety

Quality Type:

The battery could not overcharge [the battery criteria should be 4.2+ or - 0.1 in full charge].

Battery should not be overheat while charging.

Other Safety Requirements:

Precise indications ensure that the users using the battery are well guided about the battery status.

Test Cases:-

a)Test Case 1:
Full charge battery upto to it's total capacity.

Verification - The different colored LEDs are always displayed when the USB is plugged in, regardless of the switch position.

Validation - Output of the system displayed should correctly match.

Under full charge the battery should indicate Green and under charge battery should indicate Red.

b)Test Case 2:

When battery in the PCBA is fully charged it should work for 3 days minimum.

Verification - Make sure to confidently unplug and plug in the correct USB cable.

Validation - The PCBA board should be able to display the LED status accurately.

c)Test Case 3:
  If the range of voltage comes more than 4.2 Watt then the Battery is faulty.

Verification - The voltage passed must not exceed 4.2 volt.

Validation - If Battery voltage is increasing beyond certain limits it can damage the PCBA components.

d)Test Case 4:
==Less than 45 Watt power, the battery should not work.==

==Verification - A steady supply of current is essential for full functioning of battery at==

==optimum level.==

==Validation - Lipo Battery's are a good example.==

e)Test Case 5:
Battery discharging test ratio should satisfy 7 to 10 days of battery backup.

Verification: after fully charged device turn it on, connect with smart phone and note

start time and end time of battery discharge.

Validation: Battery should last for atleast prescribed hours duration.

Requirements

The primary requirement is to ensure the proper installation (mounting) of the battery on

the PCBA board, enabling it to function without operational issues for 10 days (about 1

and a half weeks) when fully charged. Upon reaching a battery charge exceeding 20%

of the total capacity, the LED blinks once every 3 seconds. Conversely, when the

battery charge falls below 20% of its capacity, the LED should blink once every second.

Verification Criteria:-
The system that displays the output should be able to correctly match and display the

battery percentage that has been utilized.

The LED used should change its color according to charging state and battery

percentage(Full charge indicates by green LED)

By plugging and unplugging the correct USB cable the PCBA board should be able to detect the correct LED status change(Under charging of device is indicated by RED LED).

2)Validation:-

BMS[Battery Management Testing]:

Depending on the battery percentage, the LED indicators display different colors when micro USB is plugged on port or switch is on.(red for charging, green for full charge,no colour displayed means LED is faulty).

If a USB cable is plugged in and power supply is on, the LED status changes to indicate charging.

If the power supply is turned off or the USB cable is unplugged, the LED status indicates no charging (LED off).

Things to be kept in Mind:

Battery voltage monitoring should be designed in such a way so as to prevent overcharging and deep discharging which could damage the battery used in the PCBA board.

While choosing and installing LED components safety guide lines need to be followed in order to prevent hazards.

Diagrams:

Block diagram for Battery in medical devices

Block Diagram for
Battery in Medical
Devices

USB PORT

Battery → Battery Management System → Charging

Charging → Green → Full Charge

Charging ↕ Red → Full Discharge

Controller → Percentage
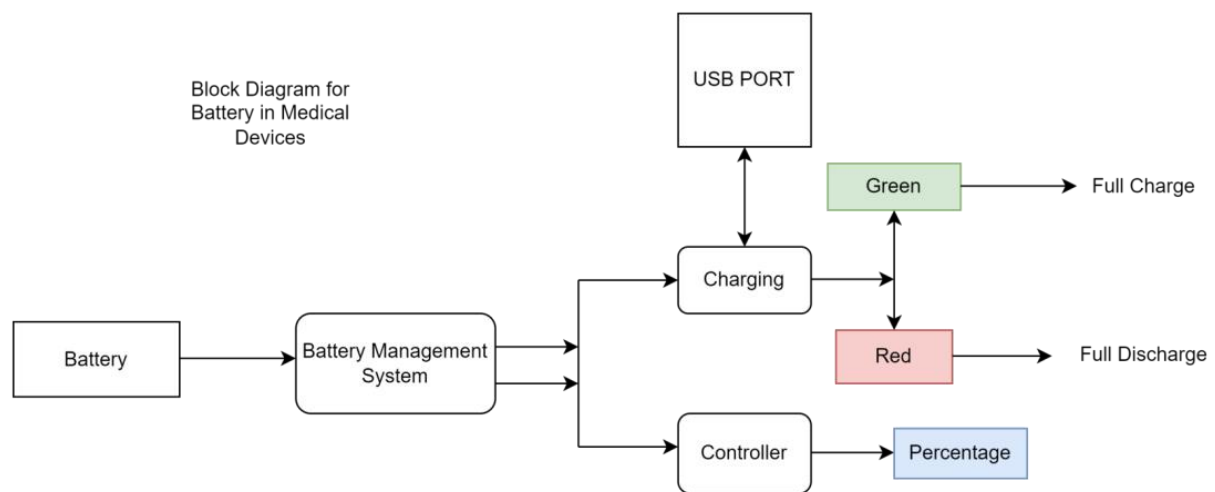
Use Case Diagram for battery in Medical Devices

Use Case
Diagram of
Battery

Input from Battery

Output to Application

Voltage

Temperature

Current

BMS

State of Charge

State of heatlth

Fault Status
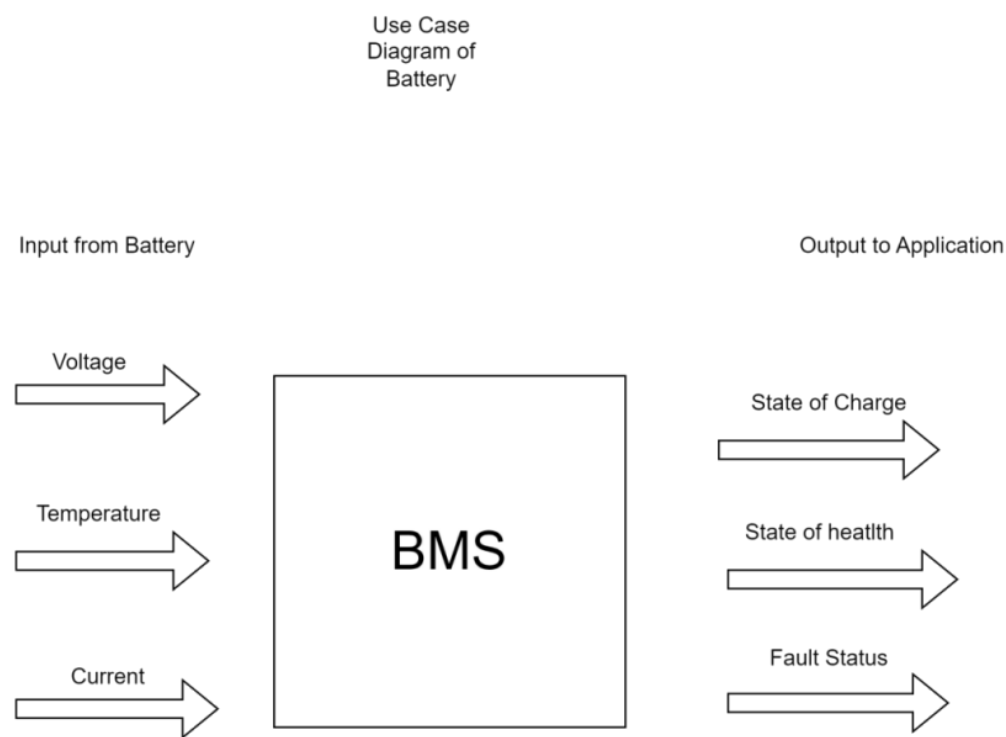
Flow Chart Diagram for Battery Control Functionalty

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │
                           ▼
                    ┌─────────────┐
                    │    PCBA     │
                    └──────┬──────┘
                           │
                           ▼
                     ╱─────────────╲
                    ╱ Read Battery   ╲ ◄─────────────┐
                    ╲   Voltage      ╱                │
                     ╲─────────────╱                 │
                           │                          │
                           ▼                   ┌──────────────┐
                       ◇◇◇◇◇◇◇◇         Yes    │ Send Stop    │
          ┌───────────◇ Voltage > 4.2V ◇──────►│ Charge       │
          │            ◇◇◇◇◇◇◇◇              │ Signal       │
          │               │                   └──────────────┘
          │               │ No
          │               ▼
          │        ┌──────────────┐
          └───────►│ Send start   │◄──────────┘
                   │ charge       │
                   │ signal       │
                   └──────────────┘
```
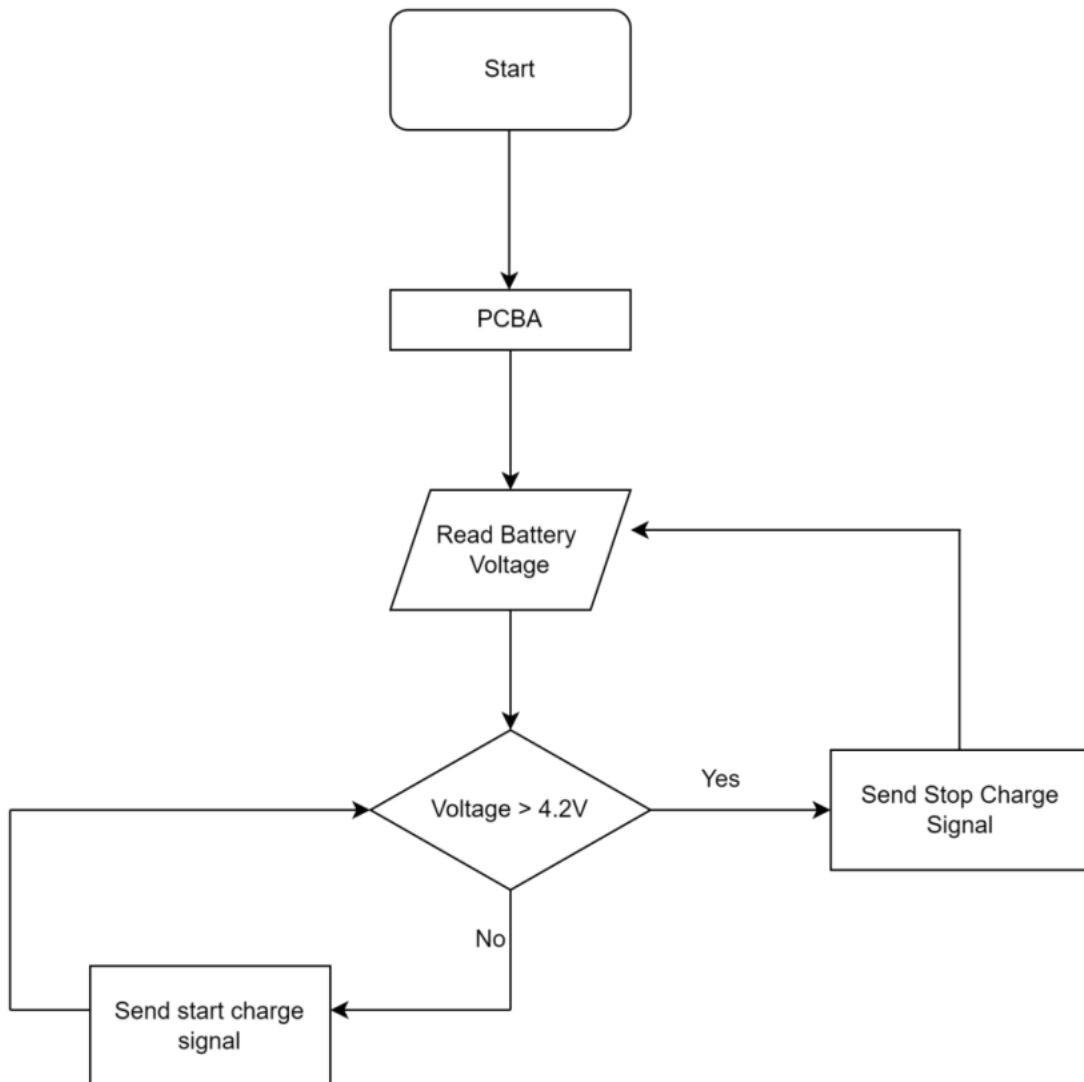
Safety

Battery Type:

The battery that is being used must be of a good quality.

Overheating:

When the battery reaches a certain charging limit[Eg:70%] it should not over heat otherwise the circuit inside the battery can melt and the battery will stop working properly.

Other Safety Requirements:
Precise indications ensure that the users using the battery are well guided about the battery status.

Test Cases:
When battery reaches 95% charge the battery must be able to function for a maximum of 3 to 4 hours or maximum to a day depending on the usage.

Less than 25 Watt power, the battery should not work.

The battery must be kept in a dry place to avoid chemical properties of the battery being changed.

When the battery reaches the 100% charging capacity it should not over heat.