Design of battery charging system coupled to solar panels with failure detection features

The purpose of this project is to answer the following questions:

1. What is the best capacitor to use to charge our system taking extreme weather conditions into consideration?
2. What is the best battery configuration to use to keep the capacitor charged as required?
3. Is it possible and feasible to utilize rechargeable batteries for this configuration?
4. What is the most efficient way to recharge these batteries and can this be done without user intervention?
5. Can a simple solar charging system be used as a trickle charge system to maintain full battery charge?
6. What is the best way to detect an electrical system failure such as a sensor failure, a connection failure, a PCB failure, a battery failure or a capacitor failure?
7. What is the best way to indicate a system failure within the device to notify an end user of a problem?
8. Would a simple RED LED indicator indicating a problem be the easiest and most energy efficient notification model?

The desired end result would be the design and development of an electrical system that utilizes a capacitor that can work in extreme weather conditions powered by a battery system that can be recharged using solar/ambient lighting to maintain a constant charge. The system would include a failure detection system that clearly and simply warns an end user that the system is not ready for use and should be charged or replaced. This battery system needs to be small and conveniently fit within the collar assembly and can be integrated with the CO2 housing assembly or the PCB housing.

With each design decision, size, functionality and price must be taken into consideration. The goal is to have the smallest, most efficient and least expensive solution available.