**Project Proposal - Development of an ultralow-power battery-operated data logger**

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# Introduction

Continuous environmental temperature monitoring is vital for climate, ecological, and agricultural research, yet conventional data loggers are expensive and often suffer from power limitations, frequent battery changes, and vulnerability to harsh outdoor conditions resulting in data interruptions and high maintenance costs. This project introduces an “Ultralow-Power, Battery-Operated Data Logger” designed for autonomous field deployment beyond one month. It employs energy-efficient microcontrollers, precision temperature and humidity sensors, and optimized firmware strategies deep-sleep modes, clock speed scaling, to minimize energy use. A smart power-budget algorithm paired with rechargeable or primary battery options and ultra-low-leakage regulators ensures exceptionally low quiescent currents. Onboard nonvolatile storage archives time-stamped measurements, while real-time battery monitoring enables graceful hibernation before depletion. Encased in a waterproof enclosure with waterproof connectors and push buttons, this rugged system provides reliable, maintenance-free data logging for long-term outdoor experiments.

# Targets

The main targets to be achieved to complete the project are,

 Accurately measure and record ambient temperature.

 Measure and record relative humidity.

 Operate autonomously for at least one month on a single battery charge.

 Buffer and organize time-stamped data in non-volatile local storage.

 Monitor battery voltage and gracefully shut down before depletion.

 Withstand outdoor conditions with a waterproof, rugged enclosure.

# Methodology

The ultra-low-power data logger is built around a low power microcontroller that wakes via an RTC alarm or timer interrupt to sample temperature and humidity from a factory-calibrated sensor (e.g., AHT2415C) and battery voltage, logs these timestamped readings to nonvolatile storage, and then returns to sleep, an ultra-low-leakage LDO and optimized firmware minimize quiescent current. A waterproof charging connector feeds a Li-ion charger and BMS to protect and manage the battery, while a GPIO-controlled resistor divider (which gates the divider ground to eliminate idle current) scales the pack voltage for ADC measurement altogether enabling over one month of maintenance-free outdoor operation on a single charge.

A diagram of a device

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Figure 3.1: Block Diagram of the System

A diagram of a battery charger

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Figure 3.2: Block Diagram of the power supply