# SQL-Based Data Logging and Retrieval System using PIC18F Microcontroller and Python

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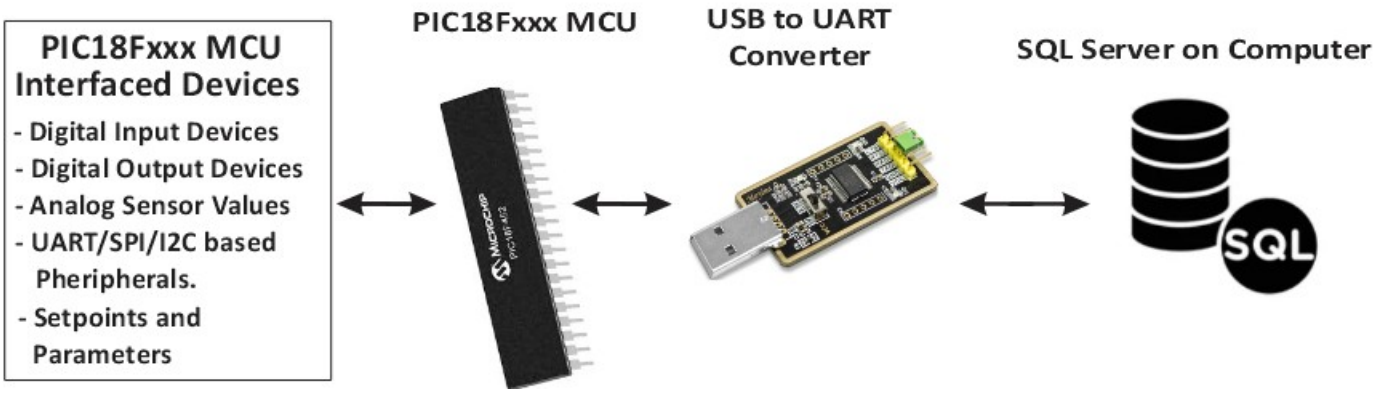
## Abstract:

This project focuses on developing a low-cost, PC-based Data Logging and Retrieval System using a **PIC18F Microcontroller** and a **Python-based desktop application**. The microcontroller continuously monitors and collects data from various **digital inputs** and **analog sensors** such as temperature, pressure, voltage, or machine status signals. This data is transmitted to a laptop via **UART through a USB-to-Serial Converter**.

On the PC side, a **custom Python desktop application** receives this incoming data stream and stores it in a **structured SQL database** (such as SQLite or MySQL). The application also features a user interface to **retrieve stored data** based on user-defined **time and date filters**. The retrieved data is presented in tabular or graphical formats for real-time monitoring and post-analysis.

This project offers a scalable and cost-effective alternative to traditional SCADA or HMI systems, using open-source tools and microcontrollers instead of industrial-grade PLCs. It provides hands-on experience with **data acquisition**, **serial communication**, **SQL database operations**, and **Python GUI development**, making it ideal for academic learning and low-budget industrial monitoring.

## Block Diagram:



## Major Components Used:

- PIC18F452 / PIC18F47K42 Microcontroller
- UART to USB Converter (e.g., CP2102 or CH340)
- Laptop with Python Installed
- SQLite / MySQL Database
- Python Libraries: PYSerial, Tkinter, SQLite3, Matplatlib (or similar)

## Applications:

- Low-cost industrial data monitoring systems
- Academic labs for data logging experiments
- Real-time system diagnostics and history tracking
- Remote device telemetry and analytics platforms

## Advantages / Pros:

- **Cost-effective** alternative to SCADA systems
- **No need for proprietary software or expensive PLCs**
- Enables **real-time visualization and data analytics**
- Data stored in **standard SQL database**, compatible with BI tools
- Enhances student understanding of **embedded systems and database integration**