

Domain: IoT

Topic: IoT energy meter

Short Description: Monitors overall power usage per house to send the data to a central server for the electricity service. Users in the house can view the stats conveniently in an app.

Firebase: <https://console.firebase.google.com/project/power-iot-meter>

Device design aspect:

- **Measurements:**
 - Apparent power
 - Active power
 - Reactive power
 - Current draw (RMS)
 - Mains Voltage (RMS)
 - Max. Peak Voltage
 - Power outage log*
 - Holds date and time from NTP server
 - Battery health (for electric companies)
 - Pricing estimate as per current rate (for the users)
- **Memory:**
 - On network failure it should hold certain time stamped statistics.
- **Network architecture:**
 - WiFi (ESP32) (for the domestic and configuration side)
- **Backup:**
 - Battery
 - Data Storage
 - Power usages
 - Timestamps

Prototype design:

- Users can only view the stats and not modify them
- Users connect to the meter via wifi
- The meter will have a backup battery (only replaceable by the electric company)

- Data will be pushed to the server using wifi network (later will be changed to a different network facility on demand, as a fallback)

Languages Used:

- C/C++ (algorithm, to implement the task, flowchart)
- Js

Working Procedure:

- **Server Infrastructure:**
 - Firebase (infrastructureless)
 - Realtime Database (RTDB)
 - Authentication (email, google)
- **Hardware aspects:**
 - Schematic (later)
 - Single sided PCB layout (later)
 - Enclosure (later)
 - ESP32 code:
 - Firebase RTDB Impl
 - Calculations and Conversions
 - Power Measurement Impl
 - NTP server Impl
 - Scheduling
 - JSON handling
 - WiFi Management
 - Power Measurement side using (module to be decided later):
 - Apparent
 - Reactive
 - Active
 - Either RTC module or Battery Backup Management System (Li-ion)
 - 1200mAh 3.7V nom.
 - TP4056
 - Discrete components for transitioning from battery to mains
 - Battery Health Monitoring (assume)
 - Power Supply (internal, frameless):
 - 5v (for charging)
 - 3.3v
- **(Progressive) Web App using Angular:**
 - Firebase Auth UI (login/logout)
 - RTDB services
 - Auth services

[Flowchart for the data flow \(hyperlinked to the document\):](#)

[Flowchart for the firmware working \(hyperlinked to the document\):](#)

[Firebase Project \(hyperlinked\):](#)

Name:

Project name

power-iot-meter

Price Plan: Spark

Services Used:

1. Authentication
2. Real-time Database
3. Web Hosting
4. Analytics

Functionality:

- All the data is stored and organized in firebase realtime database to keep everything synchronized across devices
- Authentication ensures that the data is safe with users, electric companies and the authorized devices
- Web hosting to host the web-app for the user

[Hardware Parts List \(hyperlinked\):](#)

Particular ▲	Unit Price	Quantity	Price
ESP32	350	1	350
Hi Link 5V	250	1	250
Perfboard	35	1	35
Power Meter Module	899	1	899
RTC Module (optional)	59	1	59