Department of Electronics and Telecommunication Engineering
University of Moratuwa

IoT Project Proposal

- PlugWise -

Submitted in partial fulfillment of the requirements
for the module

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- Team Protocol Pros -

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1 Introduction

1.1 Purpose

This project proposes the development of an IoT application that will allow users to monitor and control power outlets in their home or office from a remote location. The application will be web-based and accessible through any device with an internet connection.

1.2 Background

Converting a traditional power outlet to a smart power outlet involves upgrading the existing electrical outlet to enable remote control, automation, and additional functionality. The motivation behind this conversion stems from the growing demand for greater convenience, energy efficiency, and improved home management.

2 Solution

The proposed solution will provide a number of benefits to users, including:

- Convenience: Users will be able to control their power outlets from anywhere in the world, using a web browser.
- Energy efficiency: Users will be able to schedule their power outlets to turn on and off at specific times. This can help to reduce energy consumption and save money on energy bills.
- Improved home management: Users will be able to monitor the power consumption of their devices. This information can be used to identify the situations where the device remains connected to power without being turned on.

2.1 End device - The smart outlet

In the following section, we will explore into a detailed explanation of the smart outlet, highlighting its key features and functionalities.

2.1.1 Features

- Voltage measurement - The ZMPT101B voltage sensor is used for measuring the AC voltage across the load. It accurately detects voltage fluctuations, converting them into a proportional analog signal.
- Current measurement - The ACS712 current sensor is measuring the AC or DC current flowing through the circuit. It uses the Hall effect principle to generate an analog output proportional to the current passing through the sensor.
- Timer - The timer function enables users to schedule when the smart outlet should turn on or off, adding convenience and energy efficiency.
- Remote management - The smart outlet's remote management feature, accessible via an IoT dashboard, provides users with the convenience of controlling devices remotely. This feature offers real-time monitoring, scheduling and user access control.
- Over-current protection - A built-in fuse provides over-current protection to prevent damage to the outlet and connected devices.

2.1.2 Block diagram

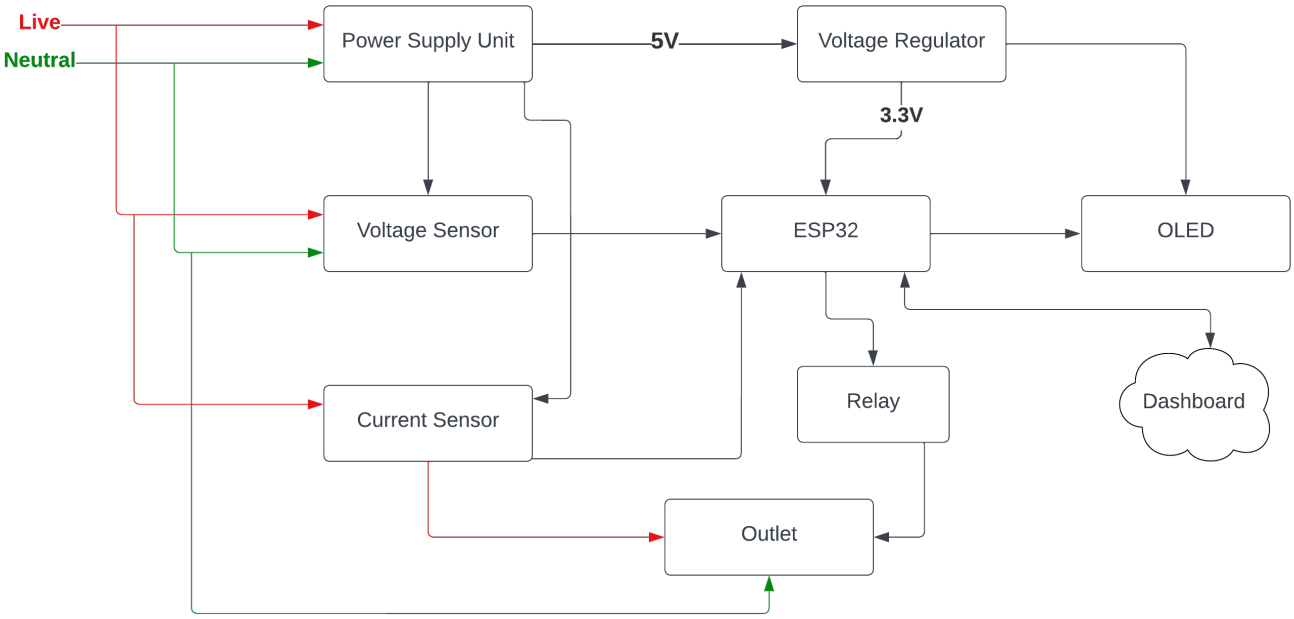

Figure 1: Functional Block Diagram

2.1.3 Interface

Received voltage and current data from the sensors are used to calculate essential parameters,including real-time power consumption, energy usage, and unit consumption. These calculations are then displayed on the OLED display, providing users with instant access to their energy usage data.

2.1.4 Enclosure

For the smart outlet, we have modified the existing enclosure to accommodate the new interface components. The enclosure is designed to ensure the safety and protection of the internal electronics while allowing easy access to the user interface. Drawings and specifications for the enclosure modifications have been provided below.

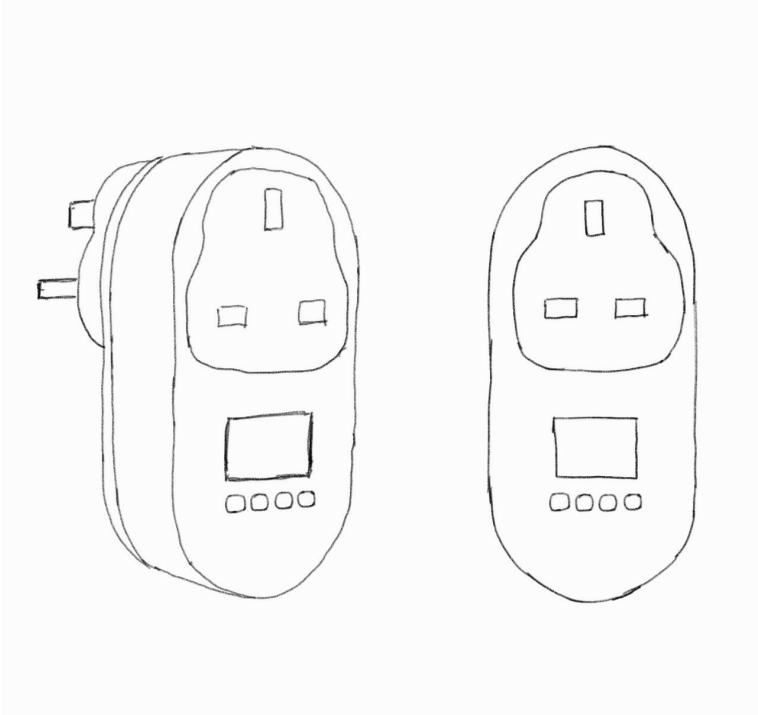

Figure 2: Hand Sketches

3 Management interface - Dashboard

The management interface offers users a comprehensive dashboard, providing a centralized platform to monitor and manage the smart outlets efficiently. Within this dashboard, users can access various functionalities tailored to optimize their control over the power outlets.

3.1 Monitoring

Under the monitoring section, the dashboard presents users with a clear graphical view of the real-time current consumption and voltage supply. This graphical representation allows users to track fluctuations in current and voltage, empowering them to make informed decisions regarding their power usage.

3.1.1 Graphical view - current, voltage

The dashboard displays real-time graphs illustrating the dynamic patterns of current consumption and voltage supply. Users can easily track and interpret fluctuations in current and voltage levels, aiding in effective energy management and informed decision-making.

3.2 Notifications

3.2.1 Over-current

When over-current situations occur, the system notifies the user, and disconnect the device to reduce the potential harm. Alternatively, the outlet can be configured to automatically turn off when it reaches a threshold defined by the user.

3.2.2 Low voltage

Notifications regarding low voltage conditions are provided to help users ensure the stability and safety of their power supply and connected devices.

3.2.3 Power loss/connection lost

The dashboard provides real-time alerts for any instances of power loss or connection disruption. These notifications enable users to take action, ensuring the continuity of the smart outlet system and the devices connected to it.

3.2.4 Timer set

Users can conveniently schedule specific times for their smart outlets to power on or off using the dashboard's timer set feature. This automation facilitates optimized energy consumption based on individual preferences and routines, contributing to more efficient management of power outlets.

3.3 Analysis

3.3.1 Report generation

In addition to real-time monitoring and notifications, the dashboard also offers a detailed analysis of the overall usage patterns and power consumption trends of the smart outlets. The dashboard generates comprehensive reports on requested time periods, providing users with a summary of their power consumption and device usage. These reports enable users to track their energy usage patterns over time, facilitating better energy management practices and promoting a more sustainable and efficient approach to power utilization.