Department of Electronic & Telecommunication Engineering

University of Moratuwa

EN2160 - Electronic Design Realization

Smart extension cord

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This is submitted as a partial fulfillment for the module

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Abstract

This report explores the concept and potential applications of a Smart Power Extension Cord that combines USB charging and AC power capabilities to cater to the increasing security and convenience demands of individuals and organizations. As security concerns grow, traditional measures may prove insufficient. Hence, the report introduces the innovative smart power extension cord which could be controlled by the convenience of a simple mobile app via Wi-Fi. The study delves into the system's components, operation, and its potential as a reliable and effective power solution. Additionally, the report investigates the Smart Power Extension Cord's technology, features, benefits, and its potential as a seamless and intelligent power management solution in modern settings.

1. Introduction

In an increasingly interconnected world, security and convenience are paramount concerns for individuals and organizations alike. The demand for innovative solutions that cater to both needs has given rise to the Smart Power Extension Cord, a revolutionary device that offers the best of both worlds - USB charging and AC power capabilities. By integrating advanced technology, this cord enhances user experience while ensuring utmost safety. This report concisely describes the features, benefits, and potential applications of the Smart Power Extension Cord as a reliable and intelligent solution for modern power management needs.

2. Specifications

The specifications are as follows.

- Three AC power outlets with manual switches
- Two USB charging outlets
- Automatic switching via mobile app

3. Design and Components

3.1 Fuse

For better safety, a 5A fuse is attached to both the main power and the power socket as well.

3.2 Wi-Fi module

The device uses an ESP8266 NodeMCU board to connect to Wi-Fi to enable control via the mobile app.

3.3 AC – DC power module

This power module takes an input of 230V AC an gives a steady output of 5V DC.

3.4 Relay module

This was a custom designed relay module which has three relay channels which facilitates the switching of the power outlets via the mobile app.

4. Operation and functionality

The smart power extension cord is an advanced and versatile device that goes beyond the capabilities of a standard extension cord. It is designed to provide intelligent power management and automation features, enhancing user convenience and safety. The operation and functionality of a smart power extension cord can be summarized as follows:

1. Intelligent Power Management:

The core functionality of the smart power extension cord lies in its ability to intelligently manage power distribution to connected devices. It is equipped with an onboard NodeMCU ESP8266 board which serves as the brain of the device together with the .

2. Remote Control and Automation:

The smart power extension cord is designed to be remotely controlled and automated. It can be connected to a home Wi-Fi network or mobile hotspot. Through a companion smartphone app, users can control the power supply to individual outlets or turn on/off the entire extension cord remotely. This enables convenient operation and automation of connected devices, making it easy to manage energy consumption and schedules.

4. Overload Protection and Safety Features:

Safety is a top priority for a smart power extension cord. The device is equipped with overload protection mechanisms that can detect excessive power draw from connected devices. If the total power consumption approaches or exceeds the extension cord's maximum capacity, the fuse will automatically cut off power to prevent overheating or damage to the devices and the cord itself.
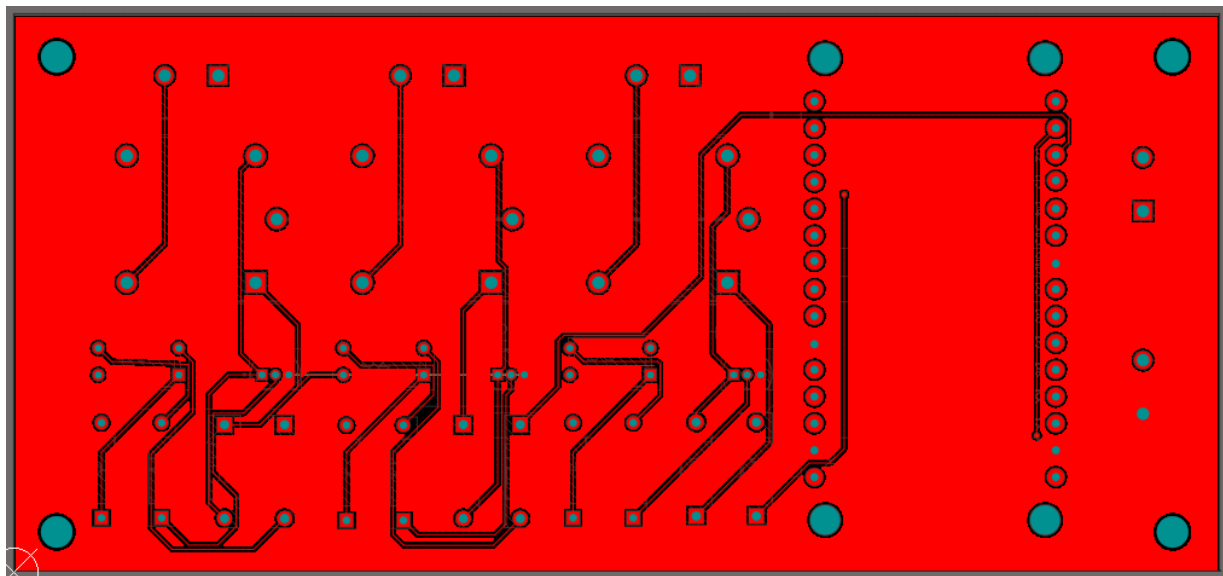
5. User-Friendly Interface:

The smart power extension cord is designed with a user-friendly interface. The mobile app or smart home hub provides a simple and intuitive way for users to control and monitor their connected devices.
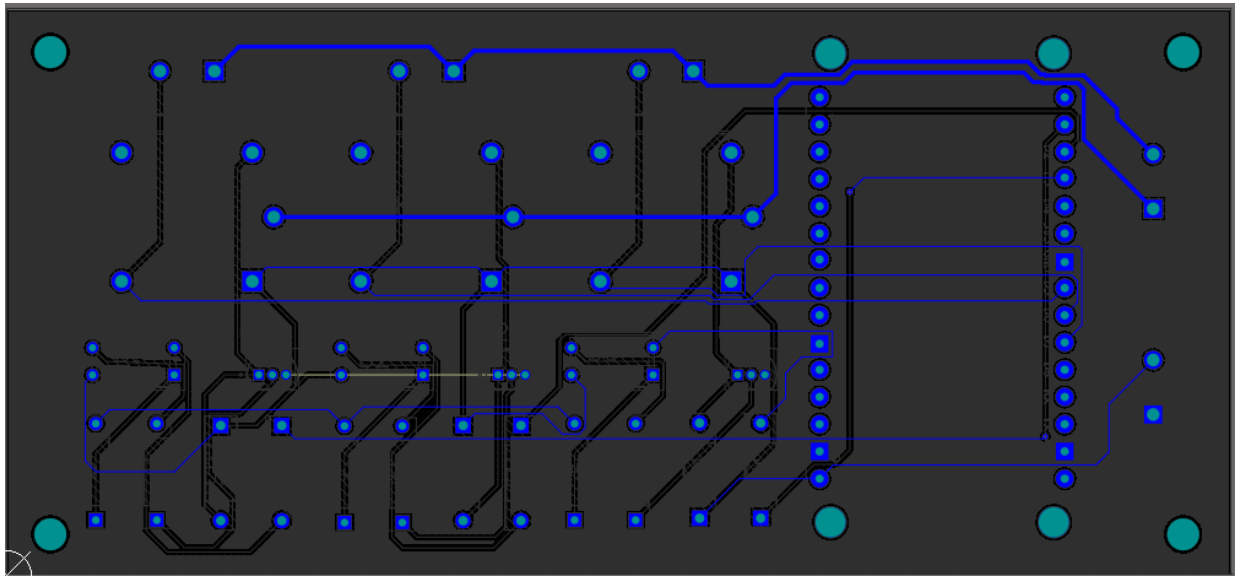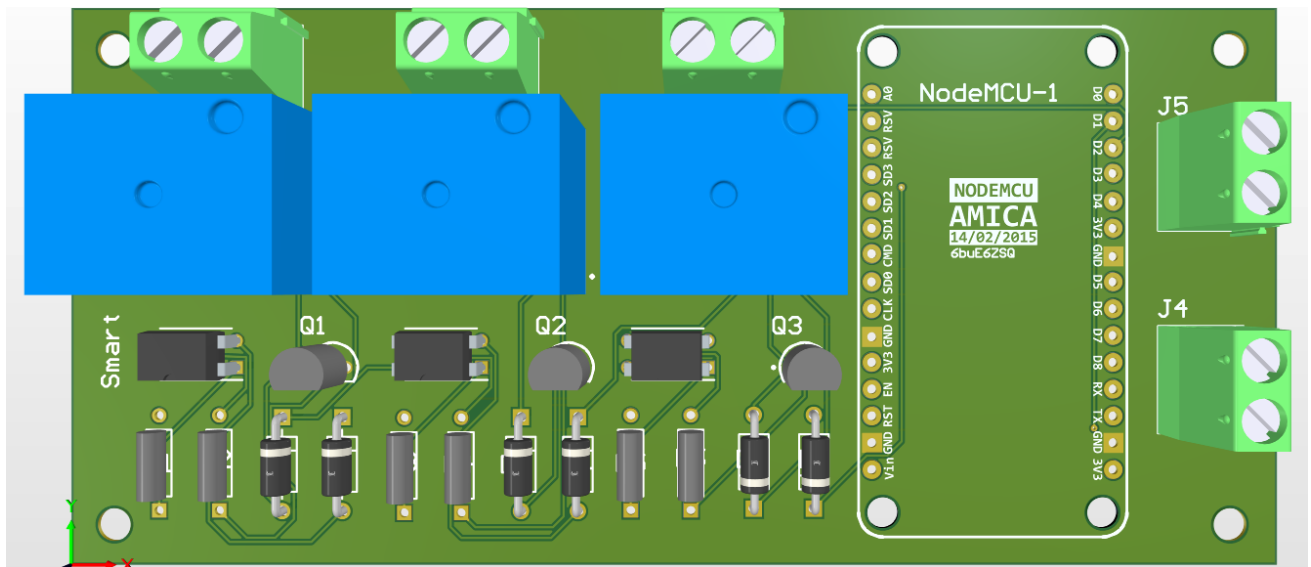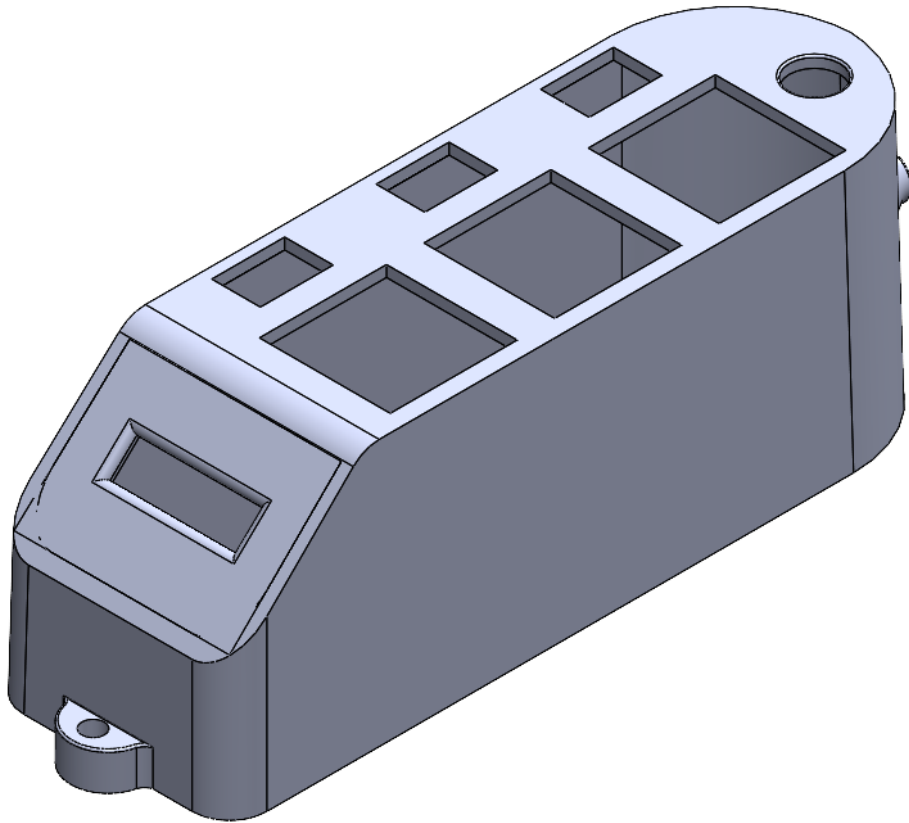
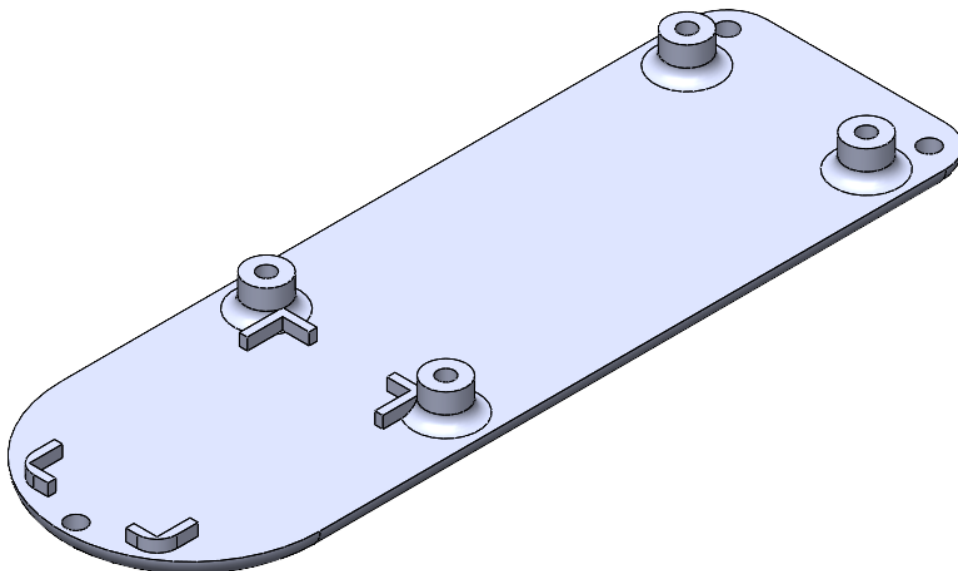# 5. PCB Design
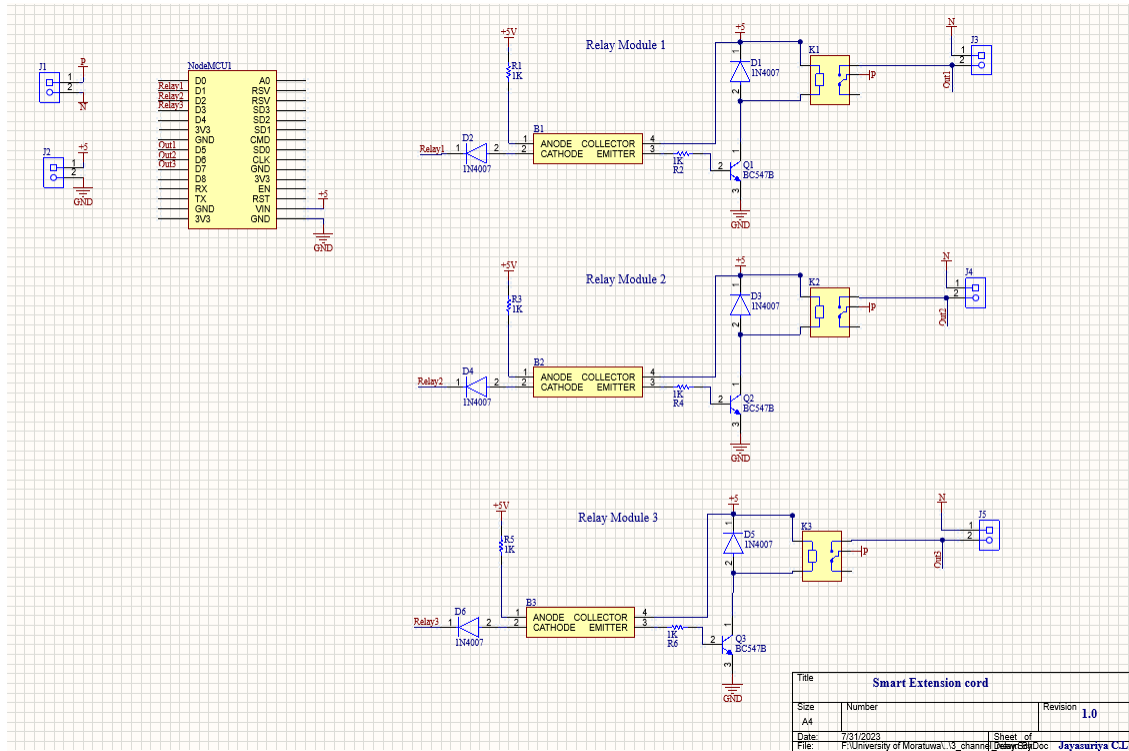
Schematic Diagram

PCB Top Layer

PCB Bottom Layer

PCB 3-D view

6. Enclosure

Main base

Bottom Cover

7. Final Product

Complete product
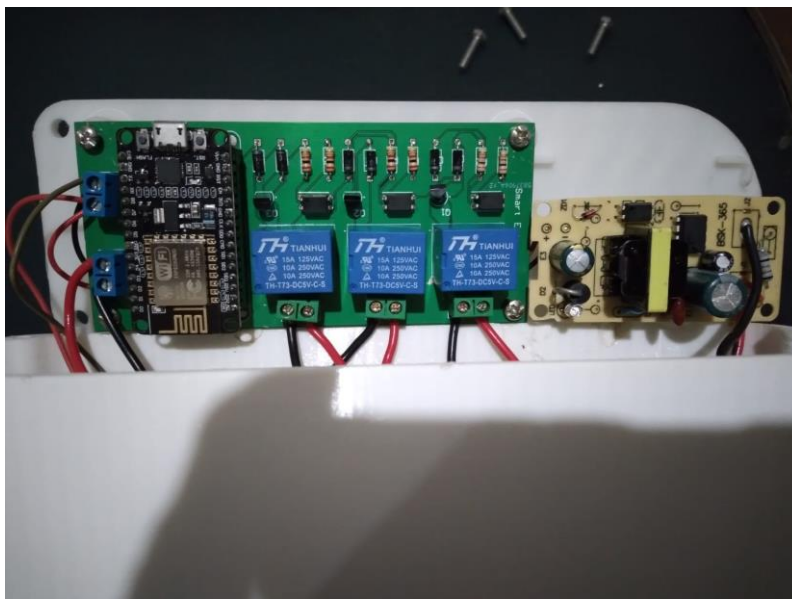
Complete PCB

8. Bill of Materials

Item	Quantity	Total Price
1kΩ resistors	6	3.00
BC547B transistors	3	15.00
1N4007 diode	6	15.00
5A fuse with cover	1	50.00
Optocoupler	3	100.00
5V relay	3	250.00
AC – DC power module	1	500.00
Wiring	6m	600.00
PCB	1	2,795.00
Enclosure	2	14,400.00
Grand Total		18,728.00

9. References

1. *PCB design : [How to make clear and well organized schematics - PCB Design Tutorial - PCBway](#)*

2. *Similar project : [Smart Extension Board - Hackster.io](#)*

3. *Final products : [Amazon.com: GHome Smart Power Strip, 3 USB Ports and 3 Individually Controlled Smart Outlets, WiFi Surge Protector Works with Alexa Google Home, Home Office Cruise Ship Travel Multi-Plug Extender Flat Plug, UL](#)*