University of Moratuwa
Faculty of Engineering
Department of Electronic & Telecommunication Engineering

EN 1190: Engineering Design Project
Tronic Pros
Smart Extension Cord

Group Members	
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Abstract

Our innovative IoT-enabled extension cord is designed to help users manage their electronic devices more efficiently and reduce their carbon footprint. The product features advanced technology, including sensors and scheduling functionality, to enhance convenience and user-friendliness. With a unique feature that automatically powers down an iron after recognizing inactivity, the extension cord also promotes energy efficiency and reduces the risk of fire. Users can easily monitor and manage their electronic devices from anywhere using a smartphone or other Internet-enabled device, making it a significant advancement in home automation technology. The product is technically feasible, and the project budget includes all necessary resources. With a focus on marketing, sales, and after-sales service, we are confident that our innovative product meets the needs of our target market.

Content

1 Problem Description

1.1 Arriving at a problem

In our daily lives, there are numerous instances where we unintentionally fail to turn off electronic devices after use, resulting in a waste of energy and potential damage to the devices. For instance, we may forget to switch off an iron after ironing clothes or leave our smartphones plugged in for extended periods of time, leading to overcharging. Similarly, we may overlook the need to turn off our Wi-Fi routers for months, putting unnecessary strain on their components. These situations highlight the importance of developing solutions that can help us manage our electronic devices more efficiently and reduce our carbon footprint.

1.2 Arriving at a solution

Our innovative product aims to enhance the functionality of traditional extension cords by incorporating advanced IoT technology, Sensors, and scheduling features, making it more user-friendly and convenient. In addition to IoT control functionality and scheduling, we have identified a common and dangerous problem: forgetting to turn off the iron after use. To address this issue, we have developed a unique feature that detects when the iron is not in use and automatically powers it down, preventing the risk of fire and promoting energy efficiency.

With this innovative self-switching option, users can rest assured that their devices are always safe and that energy is not being wasted. With our IoT extension cord, users can easily manage and monitor their electronic devices from anywhere, at any time, using a smartphone or other Internet-enabled device. This product represents a significant advancement in home automation technology, offering users a more convenient and efficient way to manage their electronic devices.

1.3 Motivation

Our product addresses a common and dangerous problem: forgetting to turn off electronic devices after use. This problem can lead to wasted energy, potential device damage, and even fire hazards. By incorporating a unique feature that automatically powers down electronic devices when not in use, our product ensures that users can enjoy greater peace of mind knowing their devices are safe and energy-efficient.

In addition to providing advanced functionality, our product is also user-friendly and accessible. Users can easily manage their electronic devices from anywhere, at any time, using their smartphone or other Internet-enabled device. This feature allows users to schedule charging times for their devices, turn on and off their Wi-Fi routers, and even control their devices with voice commands.

1.4 Justification for Selection

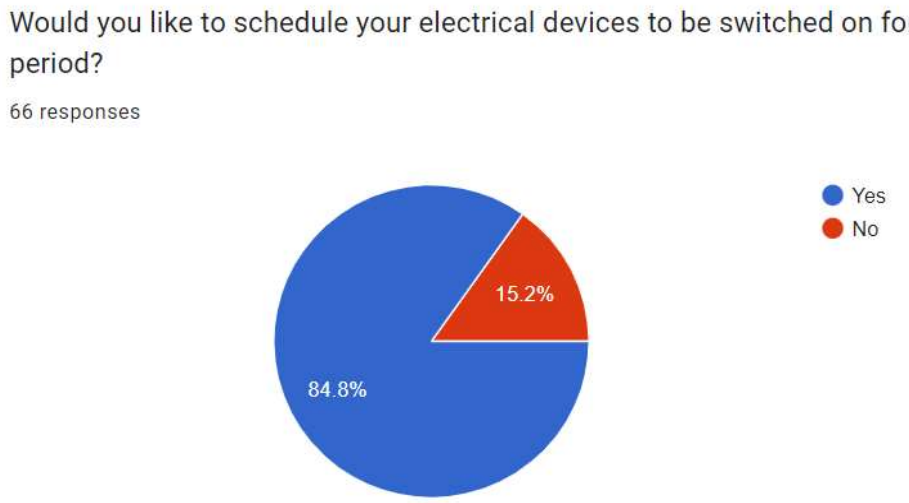
We conducted a survey among potential customers to validate the problem and to understand their needs and preferences. The survey included the following questions.

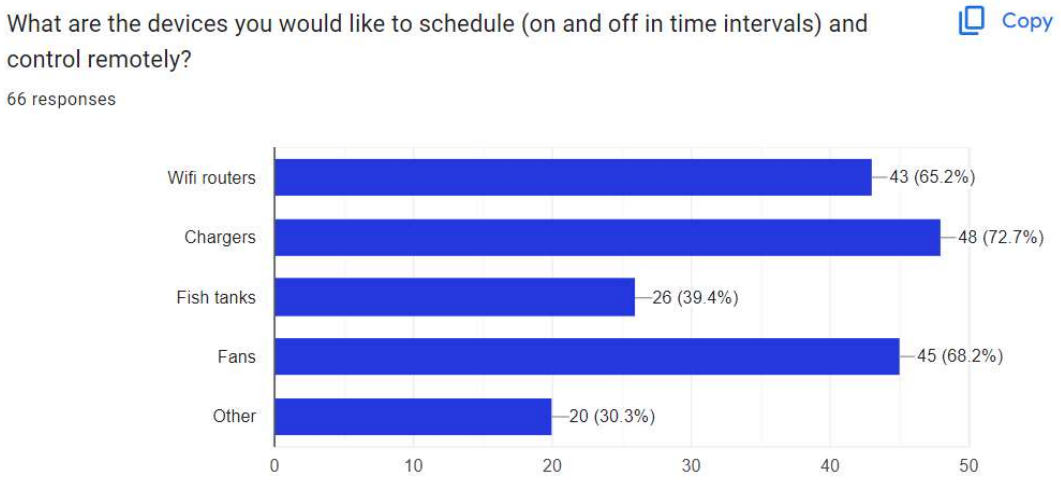
1. Have you ever been concerned about whether you have switched off an electrical device when you are away from home?
2. Would you like to control your electrical devices remotely?
3. Would you like to schedule your electrical devices to be switched on for a certain time period?
4. What are the devices you would like to schedule (on and off in time intervals) and control remotely?

We were able to arrive at the following conclusions from the survey results.

- Scheduling electronic devices is highly preferred. Nearly 85% of survey participants prefer that.
- People prefer scheduling chargers, wifi routers, and fans more. The need to schedule fish tanks is less.
- People are concerned about energy wastage from not switching off the iron. Nearly 83% of survey participants are concerned.

This data highlights the need for an efficient and user-friendly solution to managing electronic devices.





2 Feasibility

2.1 Technical Feasibility

The project is technically feasible, and all resource requirements were met easily.
Our product involves the integration of advanced IoT technology, sensors, and scheduling features to enhance the functionality of traditional extension cords.

We designed the PCB and printed it by hiring professionals. We used black PLA+ to 3D print the outer casing with proper spaces for internal circuits. 3D printing was done by Xydder 3D printing solutions. Soldering was done by us at the soldering room.

2.1.1 Hardware Feasibility

The purpose of the product is to help users manage their electronic devices more efficiently by scheduling them. Choosing cost-effective, quality components is our priority.

The hardware components which we used are,

- ESP 8266 and Atmega328
- Step-down components for the Power supply
- Relays
- Push button switches
- PIR and other sensors
- Main PCB to interconnect modules

With the availability of resources and components, we managed to meet our performance targets and developed a highly functional product that meets the needs of our users.

2.1.2 Software Feasibility

Software requirements to program the microcontroller are C++. Our main priority was to produce a more user-friendly product. To achieve this goal, we used advanced IoT technology and sensors to develop a reliable and intuitive software interface that is easy to use and understand. We ensure that the software is optimised for efficient performance, enabling users to easily monitor and manage their electronic devices from anywhere, at any time.

2.2 Economic Feasibility

We believe that our IoT extension cord has significant potential for success in the market. Our product offers a range of features that are not currently available in traditional extension cords, making it a unique and desirable option for consumers. Additionally, the growing trend toward home automation means that there is a high demand for products that can simplify daily tasks.

The cost of production is Rs. 7000, which we believe is a reasonable price point for the features it offers. We used cost-effective materials and components that are readily available in the market, which helped us keep our production costs low and maximise our profit margins.

In terms of market potential, we have conducted market research and found that there is a high level of interest in smart home devices. We have also identified specific target markets for our product, including homeowners who are looking to reduce their energy consumption and increase their home automation capabilities, as well as tech-savvy individuals who are interested in the latest advancements in technology.

Overall, we are confident in the economic feasibility of our IoT extension cord project and believe that it has the potential to be a profitable and successful venture in the market.

3 Applications

• **For Irons:** Our smart extension cord includes a feature that automatically turns off your iron after 2 minutes of inactivity.

• **To schedule phone charging at night:** If you want to charge your phone overnight, you can schedule the charging time and especially you can use this feature for laptops as well. It will protect the battery life.

• **Voice control:** You can add voice control to any plug and you can control it with voice commands.

• **To schedule Wi-Fi routers:** You can schedule the router to turn on and off at specific times.

• **To keep track of your devices no matter where you are:** With IOT you can log in to the web interface of the smart extension cord and control your plugged devices from your smartphone

• **USB adaptive charging:** You can charge any device with a USB port

4 Product Architecture

The product architecture consists of the following subsystems:

• **Power Supply:** The 230V to 5V power step-down module provides power to all other subsystems.

• **IoT Module:** The ESP 8266 is used to connect the product to the internet and enable remote control via smartphone or other internet-enabled devices.

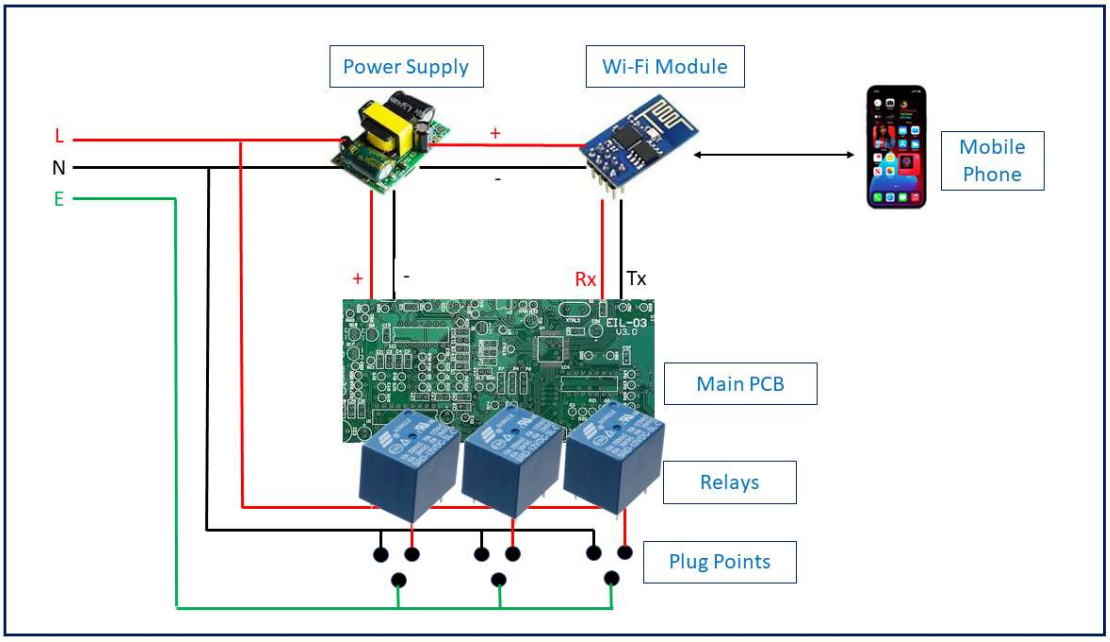
• **Main PCB:** The main PCB interconnects all other subsystems and connect other components such as relays and sensors with Atmega328.

• **Relays:** Relays are used to control the current flow through the product.

• **Sensors:** We use PIR sensors to input certain user data, such as the presence of the user or the iron's activity.

We use black PLA+ to 3D print the outer casing with proper spaces for internal circuits.

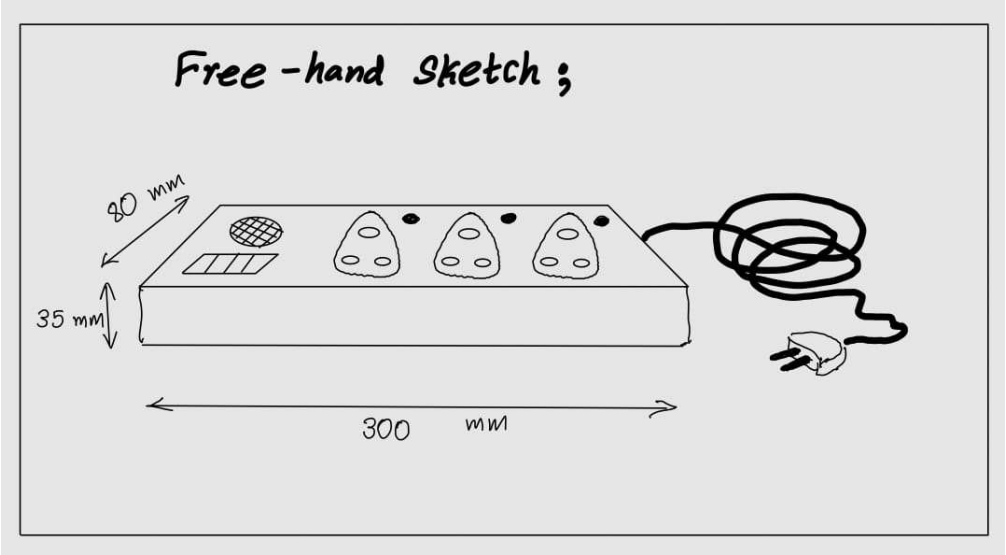
The block diagram view of the product's architecture is shown below.



5 Sketches of the Product Enclosures

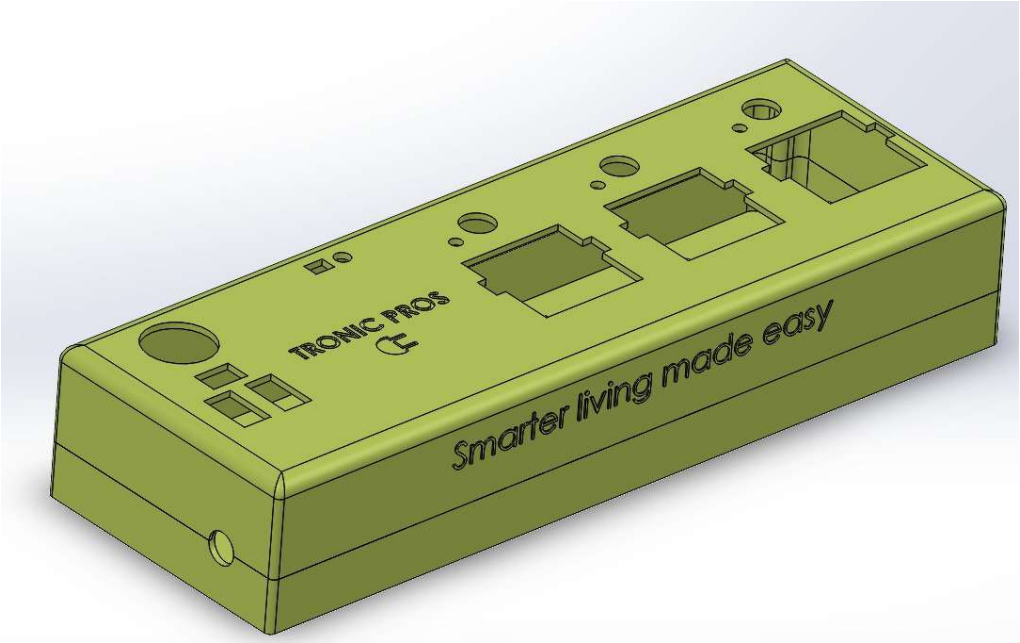
5.1 Initial Sketch

The initial sketch of the product enclosure is shown below.



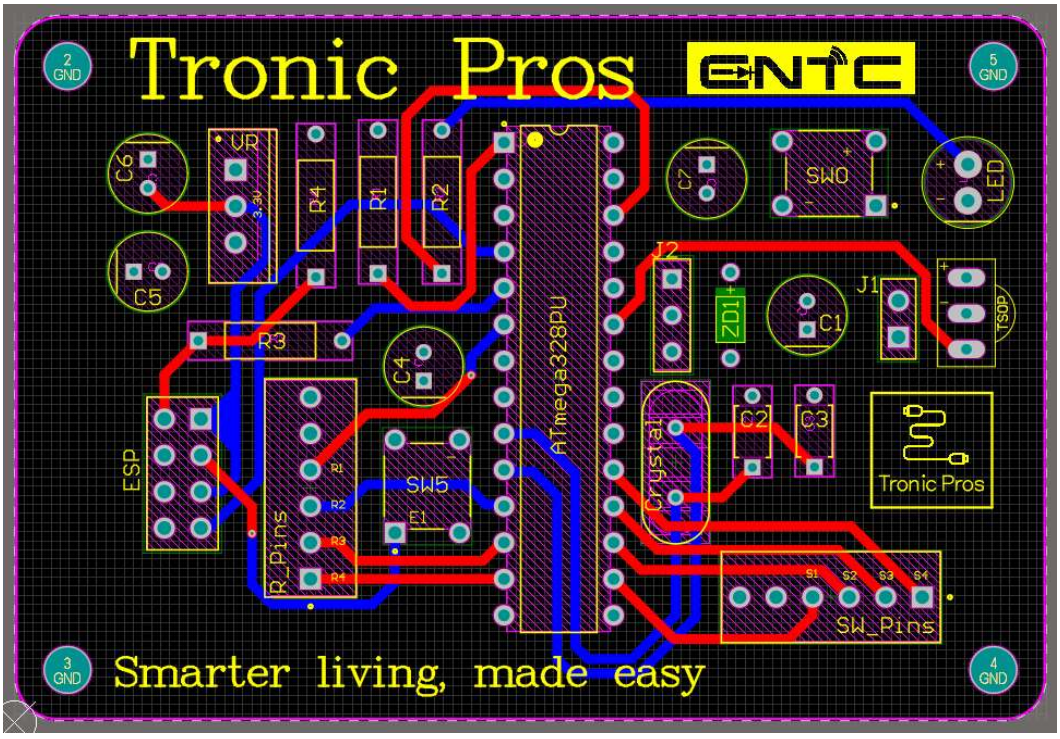
5.2 Final Sketch

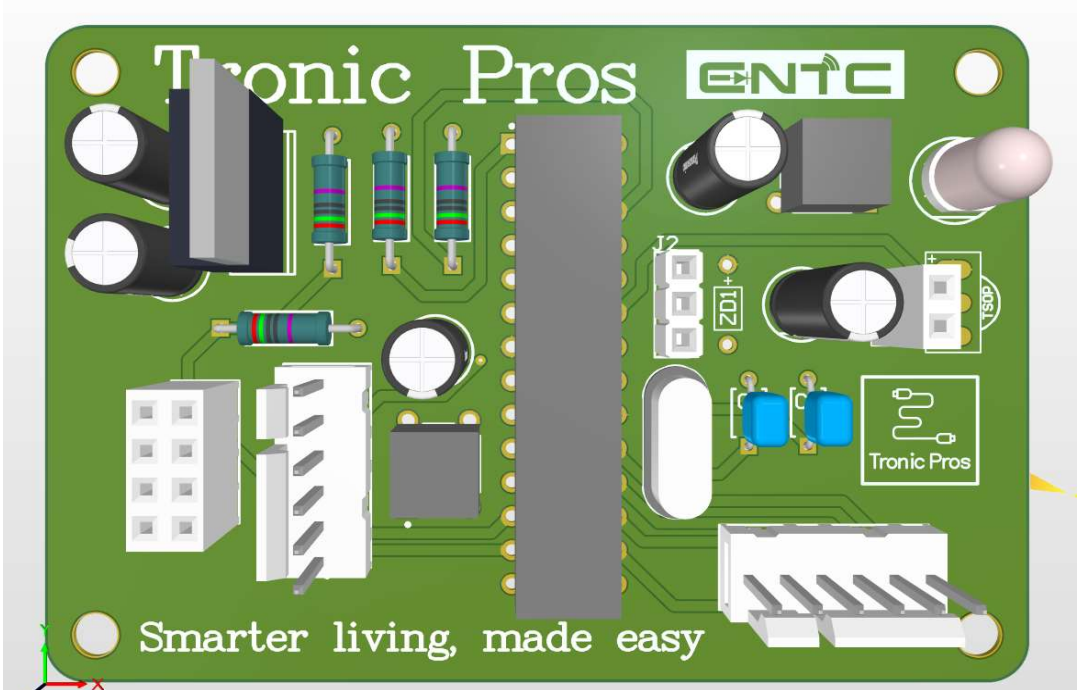
The finalised sketch of the product enclosure from SolidWorks is shown below.



6 PCB Design

The PCB design of our product is shown below.





7 Final Product

8 Marketing, Sales, and After-Sale Service Considerations

Our IoT extension cord offers several unique features that address common issues associated with electronic devices, making it an attractive option for potential customers. To effectively market our product, we need to highlight its key features, such as the automatic shut-off function for irons, the ability to schedule device usage, and the convenience of remote control via a smartphone.

We can utilise social media platforms and targeted online advertising to reach our target audience. We will use online advertisements to target potential customers. Additionally, we can collaborate with home appliance stores and mass extension cord producers like Orange and Kevilton to increase product visibility and accessibility.

In terms of sales, we offer a competitive price point of Rs.9000, as we aim to make our product accessible to a wide range of customers. We can also offer promotions and discounts to incentivize purchases. After-Sale Service is also crucial to ensuring customer satisfaction. We will offer a warranty period and a customer service helpline to address any queries or concerns. Additionally, we will conduct customer feedback surveys to continuously improve our product.

In summary, effective marketing, competitive pricing, and comprehensive after-sale service are key factors in promoting our IoT extension cord to potential customers. By addressing common issues associated with electronic devices, we hope to provide a solution that enhances convenience, promotes safety, and reduces energy waste.

9 Task Allocation

The workload is equally distributed among all the team members and all are doing equally well to attain the objectives.

R.N.Abeywardhane - Altium and PCB design
A.A.W.L.R.Amarasinghe - Circuit Designing
M.M.H.H.B.Gallella - Microcontroller programming
S.M.S.M.B.Abeyrathna - Solidworks and Enclosure design

10 Project Budget

Component	**Unit Price**	**Quantity**	**Price**
5V Relay	Rs.100	4	Rs.400
Push Buttons	Rs.50	3	Rs.150
ESP 8266	Rs.550	1	Rs.550
Atmega 328P	Rs.1500	1	Rs.1500
AC 230V to DC 5V Step Down Module	Rs.400	1	Rs.400
PIR Sensor	Rs.400	1	Rs.400
16 MHz Crystal Oscillator	Rs.50	1	Rs.50
Plug Base	Rs.200	3	R.600
USB Ports	Rs.100	2	R.200
Extension Code Wire	Rs.250	1m	Rs.250
3D Printing			Rs.2000
PCB			Rs.500
Total			Rs.7000