Smarty Plug-
Smart Extension Cord
Project Proposal

Team Name	**Tronic Pros**
Category	**University**
Theme	**INDUSTRY 4.0**

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Problem Definition

Introduction

Our team's identification of the issue stemmed from a culmination of day-to-day observations, workplace experiences, and specific incidents that collectively highlighted a pervasive problem in the management of electronic devices. The focal point of our concern was the unintentional and frequent neglect to power down electronic devices after use.

Through our day-to-day lives, team members noticed instances where commonly used devices such as irons, smartphones, and Wi-Fi routers were left powered on for extended periods unnecessarily. This behavior, observed both at home and in professional settings, led to a dual problem: not only did it result in energy wastage, contributing to higher utility bills and a larger environmental footprint, but it also posed potential risks such as device damage and fire hazards.

Workplace experiences further highlighted the prevalence of this issue. In offices and industrial settings, electronic devices and machinery were often left operational even during periods of inactivity, leading to increased operational costs and compromising overall efficiency.

Specific incidents, such as instances of forgotten device shutdowns leading to overheating or damage, underscored the urgent need for a solution. Recognizing the gravity of this problem, our team set out to develop an innovative solution that addresses this widespread issue of unintentional energy waste and device negligence.

Therefore, the identified problem that our team aims to address revolves around the **inefficient management of electronic devices**, particularly the failure to power them down after use. This behavior not only has financial and environmental implications but also poses risks to the longevity and safety of the devices. Through our proposed IoT-enabled solution, we strive to introduce a **transformative approach to device management, mitigating energy waste, enhancing safety**, and providing users with a more efficient and conscientious way of interacting with their electronic counterparts.

Problem Analysis

Significance and Impact

The identified problem of unintentionally leaving electronic devices powered on after use carries significant consequences across various sectors. In the residential sector, it leads to energy wastage, contributing to higher utility bills and a larger carbon footprint. In the commercial sector, similar issues can result in increased operational costs and environmental impact. Moreover, the potential for device damage and fire hazards poses risks to both individuals and property.

Relevance Across Different Sectors

Residential Sector:

- **Energy Efficiency:** Wasted energy translates to higher utility bills and increased environmental impact.
- **Device Longevity:** Continuous operation without proper shutdown contributes to premature wear and tear of devices.

Commercial Sector:

- **Operational Costs:** Unattended devices lead to increased electricity consumption and operational expenses.
- **Sustainability:** Reducing energy waste aligns with corporate sustainability goals.

Industrial Sector:

- **Equipment Efficiency:** Unchecked devices, such as machinery or tools, can compromise overall efficiency.
- **Safety:** Device overuse poses safety risks, particularly in industrial settings.

Specific Aspects Addressed through IoT

- **Automation**: IoT enables automated detection of device inactivity and subsequent shutdown, eliminating the need for manual intervention.
- **Remote Monitoring and Control:** Users can remotely monitor and control their devices through IoT, promoting convenience and ensuring that devices are turned off when not in use.
- **Scheduling:** With IoT scheduling capabilities, users can set specific times for devices to turn on or off, optimizing energy consumption.

Alignment with Industry 4.0 Principles

The identified problem aligns seamlessly with Industry 4.0 principles, which emphasize the integration of digital technologies for enhanced efficiency and productivity:

- **Interconnectivity**: Our IoT extension cord creates a network of interconnected devices, allowing seamless communication and coordination.
- **Information Transparency**: Users gain transparency into their device usage patterns, empowering them to make informed decisions about energy consumption.
- **Technical Assistance**: Automated device shutdown and scheduling represent a form of technical assistance that streamlines user interactions with electronic devices.

Potential of IoT / AI / Automation Integration

The integration of IoT, AI, and automation transforms the identified problem by:

- **Predictive Analytics:** AI algorithms can analyze user behavior and predict optimal times for device shutdown, further reducing energy waste.
- **Learning Capabilities**: Over time, the system can learn from user habits and automatically suggest or implement energy-saving strategies.
- **Adaptive Scheduling**: AI-driven adaptive scheduling can dynamically adjust device usage patterns based on energy demand and cost fluctuations.
- **Enhanced Safety:** Automation, backed by AI, can enhance safety by preemptively detecting potential hazards and initiating preventive measures.

In conclusion, our IoT-enabled solution not only addresses the immediate problem of energy wastage but also aligns with Industry 4.0 principles, showcasing the transformative potential of integrating IoT, AI, and automation to create a smarter, more efficient approach to managing electronic devices.

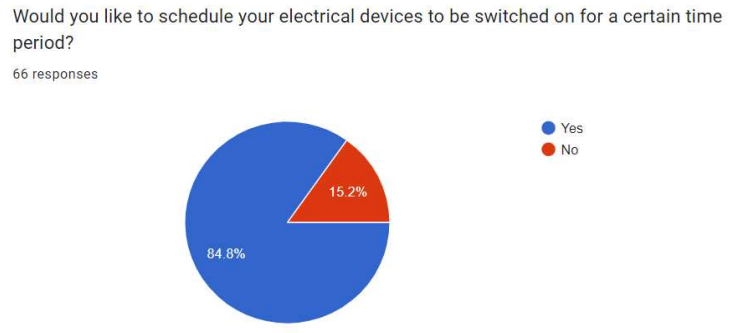
Validation of the Problem

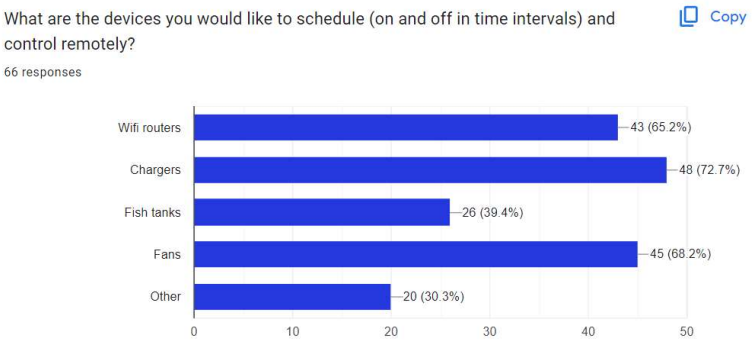
We conducted a survey among potential customers of our product to validate the problem and to understand their preferences. It included the following questions.

1. Have you been ever 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.

Proposed Solution

Proposed Product- Smarty Plug - Smart Extention Cord

Our groundbreaking solution, the Smarty Plug, represents a paradigm shift in the way we manage electronic devices. This IoT-enabled extension cord is designed to address the identified problem of unintentional energy wastage and device neglect, offering users a sophisticated, yet user-friendly, means of managing their electronic ecosystem.

Key Features

1. Automatic Device Shutdown:
   - Smarty Plug is equipped with advanced sensors that detect device inactivity, automatically initiating a shutdown process. This feature ensures devices like irons are powered off after a short period of inactivity, mitigating energy waste and reducing safety risks.

2. Scheduled Charging:
   - Users can schedule the charging time for their smartphones, laptops, and other devices. This not only optimizes battery life but also contributes to energy efficiency.

3. Voice Control Integration:
   - Enjoy the convenience of voice control by adding this feature to any plugged device. Users can effortlessly manage and control their electronic devices with simple voice commands.

4. Router Scheduling:
   - Smarty Plug allows users to schedule Wi-Fi routers, enabling them to turn on and off at specific times. This contributes to energy savings & network optimization.

5. Remote Device Management:
   - Utilizing IoT technology, users can log in to the web interface of Smarty Plug from anywhere. This remote accessibility ensures that users can monitor and control their plugged devices using a smartphone or internet-enabled device, promoting convenience and flexibility.

6. USB Adaptive Charging:
   - Smarty Plug features USB ports for adaptive charging, allowing users to charge any device with a USB port efficiently.

Industry 4.0 Integration

1. Interconnectivity:
   - Smarty Plug establishes a network of interconnected devices, promoting seamless communication and coordination among devices, aligning with Industry 4.0 principles.

2. Information Transparency:
   - Users gain transparency into their energy consumption patterns and device usage through Smarty Plug, aligning with Industry 4.0's emphasis on information transparency for informed decision-making.

3. AI-Driven Automation:
   - The adaptive scheduling and automatic shutdown features leverage AI-driven automation, demonstrating Smarty Plug''s alignment with Industry 4.0's principles of intelligent, automated systems.

Smarty Plug is not just an extension cord; it is a transformative solution that seamlessly integrates IoT technology, automation features, & Industry 4.0 principles.

Uniqueness of the Solution

Our SmartCord IoT stands out in the market due to its innovative features and capabilities, addressing the identified problem of energy wastage and device neglect in a unique and comprehensive manner.

1. Automatic Device Shutdown with Activity Sensing:

   - Unlike traditional extension cords, our solution incorporates advanced sensors for automatic device shutdown. Specifically designed for devices like irons, Smarty Plug detects inactivity and powers down the device after a brief period, mitigating safety risks and reducing energy waste.

2. Voice Control Integration:

   - Our solution allows users to add voice control to any plugged device, offering a hands-free and convenient method of device management. This voice control feature sets Smarty Plug apart from conventional extension cords that lack this level of interactivity.

3. Remote Device Management and Web Interface:

- While some existing smart plugs provide remote control, Smarty Plug takes it a step further. Users can log in to a web interface from anywhere, ensuring they have complete control over their devices at all times. This level of remote accessibility distinguishes our product from competitors.

4. Router Scheduling for Network Optimization:

- Our solution uniquely addresses the energy consumption associated with Wi-Fi routers. By enabling users to schedule router activity, Smarty Plug contributes not only to energy savings but also to network optimization. This feature goes beyond the capabilities of standard smart plugs and extension cords.

Technical Overview and Implementation

Technical Details

Hardware Overview:

Our solution, Smarty Plug, is designed with a focus on efficient device management through advanced hardware components. The selection of hardware components prioritizes cost-effectiveness and quality, ensuring a high-performing and reliable product.

The key hardware components include:

- **ESP 8266 and Atmega328**: These microcontrollers form the backbone of our system, facilitating communication and control processes.
- **Step-down components for Power Supply**: A dedicated power step-down module converts 230V to 5V, providing stable and safe power to all subsystems.
- **Relays**: Employed to control the flow of current through the product, allowing for seamless device shutdown and scheduling.
- **Push Button Switches**: Provide user-friendly manual control options, enhancing the accessibility of Smarty Plug.
- **Main PCB**: Serving as the central hub, the main PCB interconnects all subsystems, ensuring smooth communication and coordination among different components.

Software Overview:

The software aspect of Smarty Plug is crafted with user-friendliness and efficiency in mind. The primary programming language for the microcontroller is C++. The software interface is designed to be intuitive, allowing users to easily monitor and manage their electronic devices from anywhere at any time. Key features of the software include:

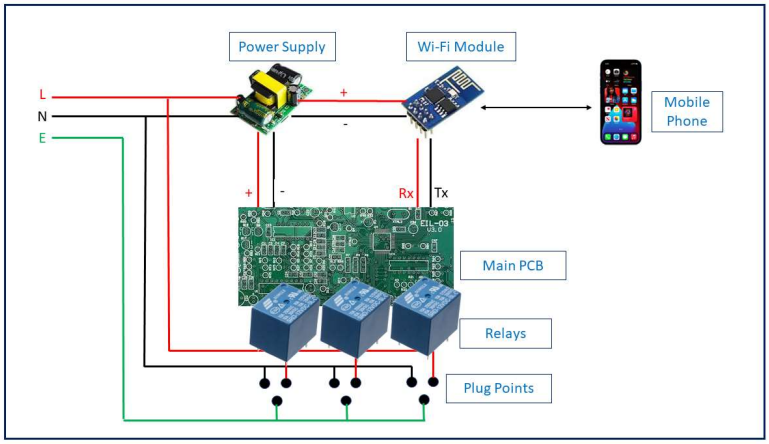
- **Advanced IoT Technology**: The software leverages advanced IoT technology to enable seamless communication between Smarty Plug and user devices.
- **Intuitive Interface**: Prioritizing user experience, the software interface is designed to be user-friendly, ensuring that users can easily navigate and control their devices.
- **Efficient Performance**: The software is optimized for efficient performance, enhancing the overall responsiveness and reliability of Smarty Plug.

Product Architecture:

The architecture of Smarty Plug is organized into distinct subsystems:

- **Power Supply**: The power supply subsystem, equipped with a 230V to 5V step-down module, ensures stable power distribution to all other subsystems.
- **IoT Module (ESP 8266)**: Facilitates internet connectivity, enabling remote control via smartphones or other internet-enabled devices.
- **Main PCB**: Acts as the central hub, interconnecting all subsystems and facilitating communication among components such as relays and sensors.
- **Relays**: Control the flow of current, allowing for intelligent device shutdown and scheduling.

Block Diagram:



User Scenario

Hashini, a busy professional with a hectic morning routine. She is accustomed to the common struggle of juggling multiple devices, ensuring they are charged and ready for the day while also being conscious of energy consumption.

1. Adaptive Shutdown:

- Hashini wakes up early for a busy workday. She irons the clothes. After ironing, she forgets to switch off the iron. Smarty Plug, utilizing its adaptive scheduling feature, detects the inactivity and automatically powers down the iron.

2. Voice-Controlled Convenience:

- Rushing to leave, Hashini realizes she forgot to switch off the Wi-Fi router. Instead of searching for the app, she uses the voice control feature, simply saying, "Smarty Plug, turn off the Wi-Fi." Smarty Plug responds promptly.

3. Remote Monitoring at Work:

- Arriving at the office, Hashini remembers she left her laptop charger plugged in at home. Using Smarty Plug web interface, she remotely turns off the charger, ensuring energy efficiency even when away.

4. USB Adaptive Charging:

- During the workday, Hashini needs to charge her smartwatch. Smarty Plug's USB ports come in handy, providing adaptive charging for various devices with USB ports.

5. Safe Return Home:

- At the end of the day, Hashini returns home to a space that's efficiently managed by Smarty Plug. Devices are charged optimally, and unnecessary energy consumption is minimized.

6. Evening Relaxation:

- As Hashini relaxes in the evening, she uses the app to schedule the Wi-Fi router to turn off during the night, contributing to energy savings without interrupting her evening routine.

In this user scenario, the SmartCord IoT seamlessly integrates into Hashini's routine, addressing the identified problem of energy wastage and device neglect. Hashini can focus on her day without worrying about unnecessary energy consumption.

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