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**ECE411: INDUSTRY DESIGN PROCESSES: PROJECT PROPOSAL**

1) **Rudder Pedals (for Simulator Use)**- All planes have a flap on the tail that is used to help the plane turn left or right based upon the flap’s position. These are controlled by a pair of pedals in the cockpit that upon depressing the corresponding left or right pedal shifts the rudder into position for turning left/right. Many video games that involve plane flight simulate this rudder as a part of the game’s mechanics. While usually these are pre-programmed to react perfectly due to the limited number of inputs a player has access to.

Many people who play games that involve plane flight prefer to use a H.O.T.A.S. (Hands On Throttle And Stick) setup in order to have a more intimate and realistic experience. The downside of this setup is that you no longer have access to keyboard shortcuts that allow control of the plane’s rudder. Many of these H.O.T.A.S. setups solve this by making the flight stick have a rotational axis for rudder control, Some companies even offer highly priced pedal sets to appease the gamers who prefer a more realistic experience. The proposal is to design a microcontroller based system that could be easily self assembled and turned into rudder pedals that can be used in these simulation games.

2) **Transformer Soft Start** – When a transformer is first powered up, it can grab as much as forty times its rated operating current, causing very serious heat rise in the laminations of the core. Each time this happens, the lifespan of the transformer is reduced. In times past, this has been a very minor issue, but grid power becomes more and more distributed, especially with intermittent power supplies from renewable sources such as wind turbines and photovoltaics, transformers are being switched on and off more and more, thereby greatly increasing wear and tear and shortening the lifespan of the transformer.

Given that the purchase lead-time on a utility scale transformer is around three years, the need to maximize transformer lifetime is paramount. Additionally, many of the locations for renewable sources of power such as wind turbines and wave power generation sites are in very out-of-the-way locales that have no back-up transformers that can be paralleled in to maintain a continuous flow of power. What this translates to is that potentially hundreds of millions of dollars worth of power generating equipment sits idle while the transformer is either repaired in field or removed and replaced.

What we propose is a soft starting mechanism similar to that used by large DC motors, especially ones with large physical loads present on startup. A bank of resistors would be placed in-line for the start up of the transformer with a resistor being removed each time the transformer reaches a predetermined level of power so that the startup is much more gradual and thereby does not superheat the laminations inside the transformer core. Our device would monitor the flux increase inside the core and pull out resistors as the transformer meets predefined criteria, thereby increasing life expectancy and decreasing maintenance costs.

3) **Transcranial Magnetic Therapy Device (TCrMT)** – Transcranial Magnetic Therapy (TCrMT) has been a boon for bipolar, schizophrenic, and head trauma patients, but so far has been used mostly in a laboratory context. This valued treatment is not widely available to patients that desperately need it when it should be available everywhere. Our proposal is to make a small, portable TCrMT device that can be carried around in a backpack and is ready for deployment at a moment’s notice so that the patient does not have to live in fear of having an episode of seizures or a psychotic episode out in the general public. The patient would self-conduct the treatment by placing a special cap on their head and plugging it into the TCrMT device and pressing a single start button.

The length of the treatment would be determined by simple mechanical switches and push buttons that are ruggedized to withstand the inevitability of being dropped and tossed about. Power will come from a lithium-ion polymer battery that can be recharged from 120/240 VAC or 12 VDC power sources. This device would be mostly absent of sophisticated ICs to hold down device cost and to increase reliability and device longevity.

4) **Mobile Charge Detection Device** – Electricians have very simple detection devices that will tell you if a cable is energized or not, but what we put forward is a mobile device that detects not just power, but what type. Specifically, this device would be able to discern the difference between AC and DC power sources, and if the power detected is AC, then the components of real and reactive power would be displayed in their respective proportions on an easy to view lighted screen. Such a device would be very useful for diagnosis in large IC fabrication units and laboratory settings so that the safety and integrity of hypersensitive test equipment, some devices costing millions of dollars, is assured. We would also like the device, if it is so possible to achieve, to be able to see power conduits through sheet rock so that electricians and handymen do not injure themselves by accidentally striking hot power lines that they cannot see.

5) **Slot Cars!!** - The proposal here is to design a track and car base system. The tracks should be usable like a puzzle piece allowing players to design their own track as long as it contains the keystone track that has the controllers attached. This can be as simple as an oval for demonstration purposes. As for the cars, if we can design a base that allows tops to be clipped on we could make it so that the bodies of the cars themselves can be 3-D printable.

6) **Useless Box!!** - A box with a switch on top, as simple a design as could be. What happens when we flip the switch? A lid lifts away from the rest of the box and out pops a little finger shaped object that rotates up and flips the switch back. This can scale up in difficulty or down very easily, with extra time we can add to the software and hardware making the box react differently (back away from it’s original position, drive around, spin in place, make faces on LED arrays etc.)

According to the Decision Matrix attached

1. **Useless Box**
2. **Mobile Charge Detection Device**
3. **Rudder Pedals**
4. **Slot Cars**