PRODUCT DESIGN SPECIFICATIONS

Inductive Charging

Practicum Team 10

Team Members: Tyler Gilbert, Kati Dahn, Jann Messer, Jeff Brown
Project repository: https://github.com/tjgilbert/ece411

Table of Contents

1   Introduction

1.1   Objective

This project will address a desire for wireless charging unit for a mobile phone or similar device. The charging unit will be portable and intuitive to use *(portable and intuitive are defined further in the Requirements section)*. The basic use of the product requires the user to place their device on the charging unit pad. There will be no user inputs other than placing their device on the charging station.

1.2   Needs Statement

The need for this technology is sufficed by the convenient enhancements upon wired chargers. Wireless chargers are more convenient, because they negate the requirement of plugging and unplugging your device. The technology can also help people with physical impairments that are unable to manipulate traditional charging cords. Wireless charging technology is also inherently more robust than a physical connector. Charging cords and receptacles can wear out or be damaged by careless insertion.

2   Requirements

The purpose of the requirements document is to outline the direction of this project within the requirements of the *ECE411* practicum. All of the requirements weighted *Must* need to be satisfied in order to qualify as a minimum viable product. Requirements weighted *Should* specify desired features, which should be realized before the products' final release, but are not necessary for the minimum function.

2.1   Functional Requirements

Req#	*Requirement*	*Weight*	*Justification*
1.1	Have one or more sensors and actuators	Must	Course requirement
1.2	Have a digital or analog processor	Must	Course requirement
1.3	Wirelessly charge a USB device	Must	This is the premise of the project, this is its sole purpose
1.4	Turn on transmitter when device to be charged is placed in range	Should	This will save energy because the product will not transmit energy if no device is present
1.5	Turn off transmitter when device is removed	Should	Same as 1.4

2.2   Performance Requirements

Req#	*Requirement*	*Weight*	*Justification*
2.1	Provide USB spec power (4.75-5.25V, 500mA) [1]	Should	Meeting this spec would guarantee it would work on most mobile devices
2.2	Can fit charging unit into a backpack (300mm x 300mm x 150mm)	Should	Meeting these dimensions would qualify the charging unit as portable
2.3	Receiver is smaller or equal to 138mm x 67mm	Should	This is the dimension of the iPhone 7, meeting this footprint would make it compatible with more devices

2.3   Economic Requirements

Req#	Requirement	Weight	Justification
3.1	Prototypes not to exceed $75 each	Should	We are not made of money
3.2	Product components not to exceed $20 ea for quantity 1000	Should	We are not paying our engineers, or technicians, If we sell the product for $20+S&H we *might* turn a profit

2.4   Health and Safety Requirements

Req#	Requirement	Weight	Justification
4.1	Shut off if base draws excessive current (current rating of Tx coil wire)	Must	This will serve as short circuit protection, which could lead to damage of product, and/or fire
4.2	Shut off if the base unit overheats (exceeds $35°C$) [2]	Should	$35°C$ is the maximum operating temperature of the iPhone

2.5   Legal Requirements

Req#	Requirement	Weight	Justification
6.1	Code and hardware design will be open source or generated by us	Must	To preserve our academic honesty and integrity
6.2	Any borrowed or modified code/designs will be credited according to the applicable license	Must	It's the right thing to do

2.6   Environmental Requirements

Req#	Requirement	Weight	Justification
7.1	Charging unit compliant with IP22 [3]	Should	Users may spill liquids on the base unit, but as most mobile devices are not water resistant the receive units will not carry this rating

2.7   Usability Requirements

Req#	Requirement	Weight	Justification
8.1	Orientation/location for device placement on charging unit is marked	Should	Marking the location for optimal charging will reduce the time to full charge
8.2	User able set up within 5 minutes without user manual by a college student	Should	This is a metric to decide if the device is user friendly
8.3	Base station will indicate when device is coupled/charging	Should	User feedback will increase confidence that the product is operating correctly
8.4	Base station will indicate when device is done charging	May	Further user feedback on charge state would would be a more obvious indication than having to check the phone

References

[1] "Universal Serial Bus Specification Revision 2.0" *Compaq Computer Corporation, Hewlett-Packard Company, Intel Corporation, Lucent Technologies Inc, Microsoft Corporation, NEC Corporation, Koninklijke Philips Electronics N.V.* [PDF DOCUMENT], 2000 1

[2] "Keeping IPhone, IPad, and IPod Touch within Acceptable Operating Temperatures." *Apple Support.* N.p., 28 Sept. 2016. Web. 24 Oct. 2016. https://support.apple.com/en-us/HT201678 2

[3] "IP Rated Enclosures Explained" *The Enclosure Company (International) Ltd* N.p., n.d. Web. 23 Oct. 2016. http://www.enclosurecompany.com/ip-ratings-explained.php 2