

# Assistive Consumer Product for Credit Card Use: The Card Commando

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**Abstract—** There is a need for a device which will allow a user with decreased key pinch grip to be able to use a credit card with significantly less difficulty than normal. The device itself will be able to assist in both the common sliding motion of a card for use of the magnetic strip, and the insertion motion, from the now emerging computer chip technology.

## I. INTRODUCTION

Credit cards are becoming the prevalent means of currency when conducting standard commerce within the United States. Primarily, the elderly population of the United States tends to have a decreased pinch grip which can lead to significant difficulties with instrumental activities of daily living, (IADLs). Difficulty in performing IADLs highly inconvenience the individual/s involved [1]. Approximately, 44 million (14%) of the total U.S. population are over the age of 65. Of the elderly, about 49.7% of them have been given a medical diagnosis of osteoarthritis, which can be a significant contributor to decreased key pinch grip [2].

When considering the motions of sliding a credit card, and inserting the credit card into a chip reader, it is important to remember that both motions rely on the key pinch grip. Therefore, the product will be designed in a way that complements alternative methods to use a credit card without the user having to fully rely on key pinch grip.

## II. CUSTOMER NEEDS AND TECHNICAL SPECIFICATIONS

The customer needs were developed through consultation with occupational therapists and were prioritized into 8 individual groups: strength, texture, portability, cost, handling, color, simplicity, and multifunctionality. From these categories, several high priority customer needs were ascertained, e.g. the device needs to lower the force commonly used for current credit card use, it must have more defining surface features to increase friction in the user's hands, it must be low cost and easy to use, and it must be light weight while being highly portable.

From this set of customer needs, the following technical specifications were developed: the device needs to be designed so that the total force exerted by the subject is 30% less than using a normal credit card without the Card Commando. The device should have a greater surface area than a lone credit card but does not exceed a length of 127 mm, a width of 102 mm, and a thickness of 26 mm. Additionally, the device ideally should not weigh more than 1 lb, it should not cost over \$40 (USD), and it should allow the user to have access to

both the swiping motion and the chip insertion motion during use.

## III. FINAL DESIGN

The Card Commando will share the aesthetic of a common pocket knife, as shown in Fig 1. This allows the device to address most of the prior mentioned technical specifications pertinent to surface area.

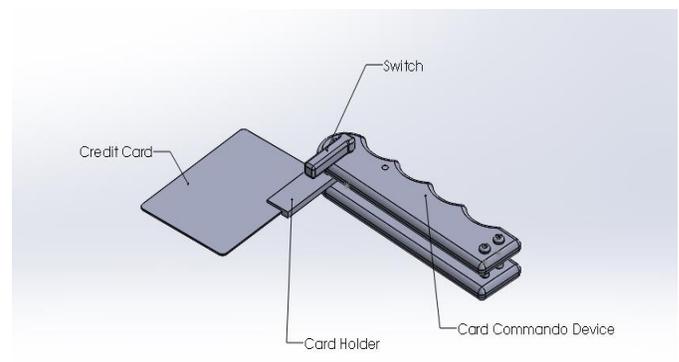


Fig. 1. Annotated visual representation of the Card Commando.

The grips, card holder, and the switch of the device will be constructed out of Delrin, while the screws, standoffs, and metallic dowels are commercial stainless steel products (McMaster Carr, Princeton, NJ). Delrin was used as a preferred material because it does not rust and is malleable enough to form the shapes needed for the grips, card holder and switch. This allows the subject to have an ergonomically satisfying grip while maintaining a large surface area and reasonable weight.

The Card Commando utilizes a system that relies on friction to lock/hold the credit card holder in place while it remains sandwiched between the grips. Additionally, the ergonomic grips will allow the user to use their credit card without having to rely on the key pinch grip with an improved grip style that wraps the user's hand around the device and allows their fingers to rest into the finger grooves as seen in Fig 1.

## IV. VERIFICATION AND VALIDATION

In order to properly test the forces exerted by the user, multiple FSR 400 Short Compression Load Cells, (Interlink Electronics, Westlake Village, CA) will be used. The force sensor will be integrated into the circuit shown in Fig 2.

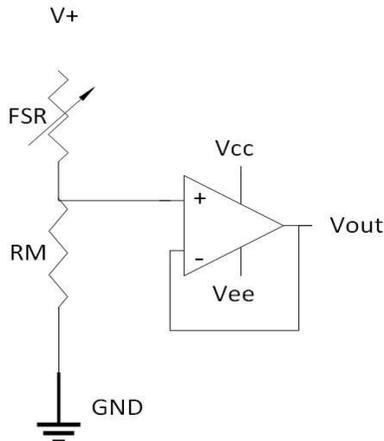


Fig. 2. Circuit schematic that will be required to construct the circuit needed to utilize the compression load cells.

The output voltage from the circuit will be read into an oscilloscope to obtain a proper calibration curve. Once the load cells are calibrated, they will be attached to a glove for human testing which will begin following approval from the Institutional Review Board of Western New England University. Prototype testing will consist of the subjects testing designated cards that are identical to credit cards in both size and shape while utilizing common credit card readers. A reader often found in supermarkets, (model M094-409-01-RC, Verifone San Jose, CA), will be used to test the swiping and insertion motions. In order to test the ATM insertion motions, an additional card reader will be utilized (Nautilus Hyosung, Dallas, TX) as shown in Fig. 3. Subjects will be instructed to use a mock credit card on all three readers with and without the Card Commando while their grip forces are measured using the force resistor glove to test the hypotheses that the Card Commando will reduce the amount of pinch force exerted by the operator while using a credit card.



Fig. 3. Fully constructed test stand with card readers.

This device will be successful if the forces exerted by the user are measured to have a 30% reduction while the Card Commando is in use, as verified by a one sample t-test with a level of significance of 95%. Future work on the Card Commando will consist of applying adhesive rubber pads onto the outer surfaces of the grips in order to further increase the surface texture of the device for the user.

#### V. ACKNOWLEDGMENTS

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