Travel Computer Mount

For Dynavox Vmax

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Executive Summary

People with a range of disabilities rely on assistive devices to communicate. In order for these individuals to lead normal lives, it is important that these devices be made to travel, to ensure the freedom of speech without boundaries. There is no commercial automotive mount for these devices, which makes communication difficult for many. The travel Dynavox mount will address this problem with an innovative design that incorporates the best automotive mount qualities to support the Dynavox Vmax, an industry leading assistive communication device.

The development of this project will satisfy the clients request for a travel mount that makes the Dynavox Vmax accessible during travel. The following proposal will further discuss similar products currently on the market, preliminary designs for the travel Dynavox mount, and an approximate budget.

1 Introduction

1.1 Background

The various assistive devices on the market are making it easier for those challenged with physical disabilities to be active. Assistive communication devices such as the Dynavox Vmax allow people to express themselves, whom otherwise could not. An individual’s communication skills may be affected by a number of conditions including cerebral palsy. The communication device works great when the user is sitting at a desk; however, it remains very difficult to travel with the Dynavox.

The client has a severe case of cerebral palsy and expressed a need for a travel mount in order to have access to his Dynavox Vmax while in the car, thus enabling him to communicate away from his desk. There remains no product on the market, which would support the Dynavox in a moving vehicle. A Dynavox Vmax vehicular mount would help the client and others. The mount design could also be modified to support other electronic devices.
1.2 Purpose

This mount will allow for the use of the Dynavox Vmax in a vehicle. The device will keep the computer stable, so that Sean can use his assistive communication software to help him communicate with others during travel in a car. Safety in the event of an accident is a major concern and will therefore be a key factor in the design. The device will also allow for adjustment of the position of the Vmax so that the user can place it into the best location for use. This mount will also be versatile by being able to be used in any type of motor vehicle. This will be accomplished by using an attachment point for the mount, which is present in all types of motor vehicles. The device will also allow for easy detachment of the Dynavox Vmax upon arrival of destination. This device will completely meet our client’s needs by allowing Sean’s Vmax to be safely and effectively used in any type of vehicle.

1.3 Previous Work Done by Others

1.3.1 Products

There have been many products made to support computers, televisions, GPS systems, etc. in the car; however, mounting an assistive communication device presents a new set of challenges. First, the mount must be set up so that a passenger in the back seat of the car could use it. Also, the mount must sufficiently secure the Dynavox Vmax, but it should still be easy for the user to detach and reattach it. Finally, because Sean sits in a supported seat in the car, there is less space for the computer mount, so the design should be compact.

The RAM Mounts company (which stands for “Round-A-Mount”) offers a wide variety of vehicle mounts for electronic equipment. The name comes from the ball and socket joint which gives the mount such versatility. The RAM laptop tray utilizes the passenger seat rail bolts for points of attachment, and can be positioned for the driver’s use. The tray is specifically designed to absorb shock and vibration. The ‘RAM tough dock’ has a trademarked design, and is built with either high-strength
composite or light-weight aluminum. There is also a tamper-free lock built into the mount for theft prevention\textsuperscript{1}.

The Chevrolet Astro Jotto Desk Mobile Computer Mount is very similar in design to the RAM laptop tray. The Jotto Desk also fastens to the passenger front seat bolts specifically in the Chevy Astro van (models 1997-2007). The laptop can be secured to the mount with the patented Cable Dock(R) mechanical lock down mechanism\textsuperscript{3}.

The tablet computer mounts available by RAM Mounts are designed for flat screen computers, like the Dynavox Vmax. These mounts include a cradle for the computer with a ventilation system to keep the computer cool, and a specialized design to avoid ports. These mounts can also be attached the passenger seat rail bolts like the laptop trays, or come with large clamps to attach to a larger variety of places, such as the back of the passenger’s seat\textsuperscript{1}.

Headrest LCD screens such as Sony’s 6.25” Widescreen LCD Headrest Monitor, on the market are compact and allow easy access by the passengers in the back seat of the car. The product is comprised of headrest housing and a mounting plate. They are designed for the permanent placement of a screen, and professional installation is recommended. This product can be purchased from electronic stores for $250-300.

The registered Insignia-Mobile DVD Player with 9.5” Overhead LCD Monitor, can be flipped up to be housed along the roof of the car, and down so that the screen is visible to the passengers of the vehicle. This product is also meant for permanent installation and professional installation is strongly recommended. The device (including the LCD screen) is sold at Best Buy for approximately $500.

The only design made specifically for an assistive communication device seems to be the NSF project designed by Norman Haidous of Wayne State University. This was designed for a communication device with the same physical measurements as the Dynavox Vmax, and allowed the user to access the communication device while lying or sitting in bed. The device employed an adjustable camera tripod arm to reach over the bed, and a traditional hospital over-the-bed table as a support. Camera tripod and communication device brackets were used to
stabilize the device. The design uses relatively inexpensive materials (including wood) and overall costs were under $300.5.

Another noteworthy NSF project designed by Nicolas Buraglia and David Franklin of Duke University was a mount for a Dynavox that could be attached to a saddle, for access while horseback riding. The design implemented a Daedalus quick release base, specifically designed for the Dynavox. A commercial cymbal stand was modified to hold the device and clamps were used to secure the device in place on the saddle.6

Other NSF projects dealt with the stabilization of communication devices but were less relevant. A communication device for an automobile must be able to endure higher stresses considering its environment, than traditional mounts.

1.3.2 Patent Search Results

The Daessy Total Quick Release Base by Daedalus Technologies, Inc. is a quick release device made specifically for the mounting of communication devices. The Dynavox Vmax is made to support Daessy mounting plates. The quick release mechanisms secure the device in place, and allows for a quick detachment. The quick release mechanism is extremely useful given the nature of the communication device. The device makes traveling with the communication device much easier and communication during travel possible for those who require it.7

One relevant patented design is the “Flat thin screen TV/monitor automotive roof mount”, US Patent: D467562. This design allows for the screen to be flipped up so that it lies along the roof of the car, or down so that it is visible to the passengers of the car. The screen can rotate 180 degrees about the z-axis, and another 60-90 degrees about the y-axis. Self-tensioning hinges are implemented to hold the screen in the desired position. This patented design is similar to other overhead television consoles; the main difference is the 180 degree rotation. This element makes the product safer in the case of an accident. In the event that a passenger is thrown into the screen, it will easily rotate upwards to lie flat along the roof.2

Another patent for a “Notebook computer with height adjustable display unit”, US Patent: 7400498, may also be useful in the
The implementation of the Dynavox mount design. This design utilizes two saw tooth arms and a locking mechanism to allow the user to adjust the height of the laptop screen, and then to secure it in place. A similar mechanism would secure the Dynavox Vmax in place, but still allow the viewer to adjust it to a desirable position\textsuperscript{4}.

One last noteworthy US Patent is number: 6466278, for attaching flat-screen appliances to the underneath of a cabinet or similar structure. The appliance allows the screen to be flipped up to lie underneath the cabinet, and utilizes a universal pivot mechanism so that the screen can be tilted to the desired position. The screen is able to make a full rotation around the y-axis. The screen is held in the desired position by the frictional force, which is variable in the design.
2 Product Description

2.1 Objective

The Dynavox Vmax mount will be similar in design to vehicular LCD screen and computer mounts on the market. The main difference between this mount and other travel television screen mounts is that the Dynavox will have to be able to detach and reattach. It will also differ from other computer mounts, because most of the computer mounts on the market are designed for laptops to be used by the driver of the car. The few tablet computer mount models on the market are generally made to attach to the center console or dashboard also intended for use of the driver. The Dynavox Vmax travel mount will be designed to secure the Dynavox assistive communication device specifically, but may be modified to support other portable tablet computers, television screens, and GPS devices, to satisfy a general public demand. This travel mount will allow the user to easily take the device with them out of the car unlike previous models.
**The travel computer mount must accomplish the following:**

1. Provide support for the Dynavox Vmax model
2. Completely secure the computer in place during travel requiring it to:
   i. Withstand vibrations
   ii. Withstand large stresses in the event of an accident
3. Allow the user to be able to attach and detach the computer from the mount easily
4. Fit in the Stenglein’s vehicle without disturbing the passengers of the car
5. Allow for installation in a variety of different car models through versatile design
6. Allow passengers in the back of the car to view and easily access the computer
7. Incorporate a compact design to prevent increased risk for passengers
8. Maintain passenger safety by careful positioning away from airbags
9. Allow the user to reposition the Vmax without harming mount security

**These goals will be accomplished by implementing the following:**

1. Measuring the physical dimensions of the Dynavox Vmax model to ensure that it will fit in the mount design
2. Calculating the forces acting on the mount during travel, and creating the necessary support with durable materials
3. Creating a shock system to counter vehicle vibrations
4. Utilizing a spring loaded quick release base and a Daessy mounting plate, specifically designed for the Dynavox Vmax model
5. Positioning the mount in the rear of the car in front of one of the seats in the mount.
6. Creating an attachment surface that can be adjusted to fit most vehicular models
7. Mapping out airbags, lighting, and driver’s vision to ensure that the mount does not compromise the safety of the passengers
8. Developing a mode of attachment between the Vmax and the mount that allows for limited mobility to accommodate for repositioning

The travel Dynavox Vmax mount will stand out from other travel mounts on the market. Its innovative design will allow the user to easily secure the
computer during travel and to detach it once they have arrived at their destination. It will maintain passenger safety, and will not disturb other passengers in the car.

2.2 Methods

The travel mount will be designed specifically for use with the Dynavox Vmax. This mount will secure the Vmax during travel making it easy to use. The design must incorporate versatility, strength, and innovation. The following documentation will outline the mechanisms that are required to create a fully functional travel Dynavox Vmax mount.

The Vmax will be attached to the mounting framework through the use of a commercial product made by Daessy Inc. This device consists of a spring loaded quick release base and a Daessy mounting plate. The mounting plate attaches directly to the back of the Dynavox Vmax. The client already has this component attached to his Vmax so we will not need to obtain one. The quick release base attaches to the mounting framework via a horizontal rod, which passes through it. The quick release easily detaches from the mounting plate when the spring loaded pin is pulled out. The accomplish attaching the Vmax to the mounting framework.

Figure 6: Dynavox Vmax model
The mount must make the Vmax clearly visible to a passenger in the back seat of a vehicle. The mount must therefore position the Vmax directly in front of the user at eye level. There are limited attachment points for the mounting framework, which will accomplish this task. Possible attachment points include the headrest of the passenger seat or its posts, the ceiling, & the floor. The framework design will be greatly impacted by which attachment point is selected. Factors that will be considered in the selection of the attachment point are: Passenger safety, accessibility, flexibility, & stability. Additionally, the point of attachment should also be a surface common to majority of vehicles. This will allow the user to install the mount in different vehicles with ease. With this in mind, the ceiling of the car and the floor are valid options to attach the mount. The back of the passenger seat is another option as long as the vehicle is assumed to have a back seat.
Figure 8. Position of Dynavox Vmax on the back of the passenger seat.

Figure 9. (Side view of the backseat of a vehicle) Schematic of possible positions of the travel mount relative to the passenger seat and backseat of the vehicle.

The mounting framework must be adjustable to allow for height and angle repositioning to assure accessibility and limit glare. To make the device height adjustable, several approaches can be taken: the mount frame could utilize telescoping poles, hinges, or adjustable straps. In order to alter the tilt of the screen, the device must allow for partial
rotation about multiple axes. This rotation can be achieved by implementing joints with increased degrees of freedom. For example, a ball and socket joint that connects the mount to the Vmax would allow the user some rotation about the x, y, and z axes. Mobility can also be achieved by flexible arm attachments. The ease of use and cost for the mobility mode will be considered in the final design.

The mount framework must be compromising to standard vehicle vibrations, and large stresses in the event of an accident. Shock absorbing materials, or metal springs can be used in the design to ensure the device remains undamaged in the mount. The mode of shock absorption will depend heavily on the mount construction. If the Dynavox will be nested in a metal casing, there should be a layer of shock absorbing material or springs protecting the device from the surrounding metal. If the Dynavox is not surrounded by metal, the modes of attachment, whether connected by a metal frame or adjustable straps, should be able to absorb shock. The metal frame can be made more shock resistant with the implementation of springs or hydraulics. The use of elastic straps or bungees to secure the Vmax could also serve to absorb vehicle vibrations.

Aside from vibrations, the mount will be under certain forces in a moving vehicle, which must be considered in the design process. The mount material chosen should at the very least be able to support the weight of the Vmax in the y-direction, and should be able to withstand forces applied in the z-direction during vehicle acceleration/deceleration. Also, depending on how the Vmax is supported will determine the normal forces acting on the computer. In the case that the device is encased, the forces of the springs, or surrounding material should not be damaging to the Vmax.
Figure 10. Simple free body diagram of Vmax in a moving vehicle. The forces acting on the Vmax as a result of vehicle acceleration and braking are denoted by Facc and Fbrake respectively, while the normal force exerted by the mounting surface is N, while mg represents the weight of the Vmax.

Figure 11. Free Body diagrams of the normal forces exerted on the Vmax according to mounting surface. In the case that the Vmax is supported by hanging springs or straps (shown on the left), the free body diagram shows that the sum of the vertical spring forces will have to equal the weight in order for the Vmax to be held stationary. In the case that the Vmax is encased (indicated on the right), the free
body diagram shows that the normal force on the bottom of the Vmax will have to equal the sum of the normal force applied from the top of the mount and the total weight of the device and mount. There are also normal forces applied to the sides of the Vmax, which should not exceed the material strength of the Vmax.

3 Budget

The Dynavox travel mount design will vary greatly depending on the determined optimum location for the mount. Therefore, the mount design may implement a range of different materials. If the mount is made to stand on the floor of the car in front of the user, the base will be constructed from metal and require the proper hardware. If the mount is placed on the roof of the car the base will most likely be made of metal and will utilize metal hinges or ball and socket tubing. If the back of the passenger seat is chosen for the mount location, the mount may be supported with simple elastic straps and metal clamps, and will therefore be cheaper to construct.

In the final design the cost of materials as well as the quality, accessibility and resilience of the materials will be considered. Since computer mounts on the market are fairly expensive, it is safe to use more expensive materials as to not compromise the quality of the mount. The Chevrolet Astro Jotto Desk is sold for $340, RAM mounts are sold for $200-$300, and flip down automotive roof televisions are sold for approximately $400. The projected budget for the travel Dynavox mount is significantly lower than the vehicular mounts on the market, and therefore can be sold at a competitive price.
<table>
<thead>
<tr>
<th>Materials</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Dynavox Base</td>
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<tr>
<td>Adjustable Straps</td>
<td>$4.36 for 2 feet and $.50 for each additional foot</td>
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<tr>
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<tr>
<td>Metal Hinges</td>
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<tr>
<td>Metal Clamps</td>
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<td><strong>Quick Release Mechanism</strong></td>
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<tr>
<td>Daessy Quick Release Base</td>
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<tr>
<td>Screws, nuts, bolts, etc.</td>
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<td><strong>Total</strong></td>
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4. Conclusion

The technology of assistive communication devices has improved the lives of many suffering from a range of disabilities and disorders from cerebrovascular accident to cerebral palsy. Although, without a vehicular mount for these devices on the market, users find that they are difficult to travel with. Given that users depend on these devices for communication, it is critical that they are made to travel. Thus, the need for developing a travel mount for assistive communication devices has transpired.

This project will address the market demand for an assistive communication travel mount. The mount will be designed specifically for the Dynavox Vmax, an industry leading product, and will secure the device in a standard vehicle. The travel Dynavox mount will make the Dynavox Vmax accessible to a passenger in the back seat of the car, it will allow for repositioning, and it will make attaching and detaching the Dynavox device a quick and easy task. To make the mount appeal to a large target market: the mount design will include cost efficient materials, and the mount will be adjustable to fit in the most popular vehicles. With these considerations in mind, a travel Dynavox Vmax mount will be very successful in sales.