Operator’s Manual

Adapted Hungry, Hungry Hippos Board Game

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Important Safety Instructions:

The adapted Hungry, Hungry Hippos device has been designed with the client’s needs in mind. The device operates solely through the use of a push button that can be placed within a reasonable distance of the board game. Because this device utilizes a closed design approach there are not many safety issues that need to be addressed.

One major issue that is of some concern is the fact that the electrical motor/swing arm setup does partially leave the housing unit while the device is activated. This presents the issue of possibly getting a finger or appendage pinched between the board game lever and swing arm, or the swing arm and housing unit. In order to avoid this potential problem the user should keep clear of the swing arms location while the push button is inserted into the adaptive device.

Also if any maintenance is needed the user should be sure to remove all batteries from the battery compartment before opening up the device. By doing so, the potential for an electrical shock or the motors activating unintentionally can be removed.
Parts and Accessories:

- Aluminum Swing Arm
- UHMWPE Swing Arm
- 2x Electrical DC Motors
- Aluminum Sheet Metal Housing
- Jelly Bean Style Push Button
- Four “AA” Batteries
Features:

The adapted Hungry, Hungry Hippo device implements some features that the current adaptive device on the market does not have. These features include:

- A one touch operation system which does not require any force exerted by the user. The device utilizes a motorized setup that provides all the necessary force to the board game levers at the push of a button. Also because both board game levers are activated simultaneously through the use of a single button the need to manage multiple levers/buttons is eliminated. This differs from the other device on the market which makes use of a lever and pulley system. Our design is unique in that it completely eliminates the needed force for operation while the current market design only reduces this force.

- The assistive device is completely removable from the actual board game and was designed for easy storage. What this allows for is simple storage of the game and device without the needed space of storing a full size unit. Also if additional persons wish to play the game without the use of the adaptive device they are able to by simply removing it.

- The device runs off of a battery powered setup which eliminates the need to be tied down by a power cable. This allows the user to play the game virtually anywhere they wish. The device was also fabricated out a sheet metal to ensure durability and a quality product that would withstand repeated use and any abuse without the need for repair.
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1 Introduction:

1.1 Overview of Device

The assistive device is comprised of four main components, the push button, housing unit, two swing arms and motors, and the battery compartment. The housing unit holds all of these components together excluding the push button which can be attached and detached from the housing unit through the use of a 3.5mm mono connector. Figures 1 shows the motor used for operation of the board game levers, and the primary swing arm used on the marble “eating” lever.

![Figure 1. Electrical DC Motor and Primary Swing Arm](image)

This swing arm was fabricated out of aluminum and was created using a CNC mill. The arm attached directly onto the output shaft of the motor and is secured into place through the use of a counter drilled fastening screw. When activated this motor/swing arm setup will repeatedly rotate about its axis at approximately 70 revolutions per minute and make contact with the board games primary lever. Upon doing so the swing arm will force this lever to become pushed downwards and ultimately operate the game. The secondary swing arm which was used for this assistive device is shown below in Figure 2.
This secondary swing arm was fabricated out of U.H.M.W.P.E. which is a very strong plastic that can withstand repeated wearing, and again a CNC mill was used. Like the primary swing arm it is directly attached to the output shaft of an identical motor, however because it does not exert a large amount of force epoxy was used instead of a fastening screw in order to properly secure it. When activated this swing arm/motor setup will rotate about its axis at approximately 70 revolutions per minute and repeatedly come into contact with the marble release lever located on the board game. The lever upon contact will then depress and release the marbles one at a time ensuring that they are all released. The two motors and swing arms which are the heart of this assistive device operate off of batteries which are contained in a casing that can be seen in Figure 3.

The battery compartment is located on the underside of the assistive device and holds four “AA” batteries which provide the six volts needed for operation of the motors. There is a cover piece that is held on by use of a screw, so in order to replace or remove the batteries this screw must be removed and the cover taken off. The housing unit which holds the necessary components for operation is shown in Figure 4.
The housing unit was fabricated using a galvanized aluminum sheet metal. This material was chosen to provide a strong support structure while at the same time being relatively lightweight, and also preventing against rusting. The bottom and side pieces pictures above were fabricated using a series of bends in a flat sheet metal template, which when folded created the piece pictured above. These folds where held in place through the use of a series of spot welds and rivets. Once this main piece of the housing unit was assembled support structures were inserted to hold the motor/swing arms at their proper heights and locations, as well as a cavity which would hold the battery compartment. To finish off the housing unit cover pieces were created which fit over the top of the unit and were secured using several sheet metal screws. Finally in order to operate the assistive device a jelly bean style push button was implemented, and can be seen below in Figure 5.
The push button is used to activate the assistive device. When the button is held both motor/swing arm setups will activate together, and provide the necessary forces needed for operation of the board game. The push button has a large surface area which makes it easy to find and operate, and requires a very small amount of force to use due to its high sensitivity. Also the push button connects to the assistive device through a 3.5mm mono jack, and because of this can be stored separately from the assistive device if desired.

Once all of the necessary components had been fabricated and assembled they were placed inside the housing unit. The individual motors were placed into their designated locations and secured using a fabricated sheet metal jacket and screws along with epoxy. Also the wiring was soldered into place and the covers were secured. The inside of the assistive device can be seen in Figures 6 through 8 below, and the outside view of the finalized device can be seen in Figure 9 below.

![Figure 6. Inside of Assistive Device](image)
Figure 7. Marble Release Lever Setup

Figure 8. Primary Motor Setup

Figure 9. Final Assembly of Assistive Device
1.2 Device Operation

In order to operate the Adapted Hungry, Hungry Hippos Board Game the assistive device should first be placed snugly around the yellow Hippo as seen below in Figure 10. The assistive device should be at the same level as the Hippo board game, and the front edges should be making contact with the edges of the Hippo and game board.

![Figure 10. Attachment of Assistive Device and Board Game](image)

Once the device is properly situated the push button control should be plugged into the 3.5mm mono jack located on the right hand side of the assistive device. See Figure 11 below for location and proper setup of push button. When inserting the push button connector into the unit there should be a strong connection, and the connector should be fully inserted into the jack. Also it is worth noting that care should be taken to keep fingers away from the swing arms during application of the push button just in case the button becomes accidentally pressed and the swing arms activate.
Finally once the assistive device is setup and the board game and unit are placed in the desired location of play the user needs to only press down on the push button in order to play the board game. The assistive device will activate giving the player entire control of the game. Figure 12 shows the setup of the game and assistive device, and Figure 13 shows actual operation by the client.
2 Maintenance:

The adapted Hungry, Hungry Hippo Board Game was designed to be a fully enclosed device that requires little to no maintenance. The housing unit is constructed from galvanized aluminum sheet metal which will resist rusting and maintain structural stability. This housing unit was also coated in layers of red paint which further help to minimize the effects of the environment such as rusting.

One requirement that the assistive device needs however is batteries. In order to replace the batteries the push button should be removed from the 3.5mm jack, and the entire housing unit should be flipped upside down in order to expose the battery compartment. In order to access the battery compartment a Phillips screwdriver can be used to remove the holding screw, and once undone the cover will slide towards the outside. When replacing batteries only “AA” batteries should be used, and all of the old batteries should be removed. Do not mix and match batteries inserted into the device as this could lead to inconsistent performance of the motors. Instead when the batteries need replacing, remove all four of the old ones and replace with four brand new “AA” batteries.

Also if anything is spilled on the assistive device quickly unplug the push button and wipe down the surface to remove any liquid or material present. In additional the 3.5mm mono jack must be well maintained, and only the push button should be inserted into it. Failure to use only the given push button may result in damage to the assistive device and jack.
Finally because the assistive device contains openings which could allow objects to fall into the device there may be a need open up the unit. In order to perform this operation the caulking along the top seams of the cover pieces must be removed, most easily done through the use of a razor blade, and the screws fastening the covers in place need to be removed. After complete removal of the cover pieces the insides of the assistive device will be exposed and any retrieval/cleaning out of foreign material can be accomplished. Upon completion the cover pieces should be reapplied and the fastening screws secured into place.

3 Technical Specifications:

The dimensioned sketches used for creation of the sheet metal housing and swing arms can be seen below in Figures 14 through 19.

![Figure 14. Primary Swing Arm](image)

![Figure 15. Base Structure of Housing Unit](image)
Figure 16. Battery Cavity Compartment

Figure 17. Cover Pieces for Housing Unit
The circuit diagram which was used for wiring the components of the assistive device together is presented in Figure 20, and the three dimensional CAD model of the assembled unit is shown in Figure 21.
Table 1 presented below contains a parts list of all the various components used in the assembly of the Adapted Hungry, Hungry Hippos Board Game.

<table>
<thead>
<tr>
<th>Component</th>
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<tbody>
<tr>
<td>18 – 1/4 inch sheet metal screws</td>
</tr>
<tr>
<td>2 – electric DC geared motors rated for 6 volts and 70rpm</td>
</tr>
<tr>
<td>1 – Jelly Bean Style Push Button</td>
</tr>
<tr>
<td>1 – 3.5mm Mono Jack</td>
</tr>
<tr>
<td>2 – Fabricated Swing Arms (Aluminum and U.H.M.W.P.E.)</td>
</tr>
<tr>
<td>1 – Four “AA” Battery Compartment</td>
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<tr>
<td>1 – Aluminum Sheet Metal Housing</td>
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Table 1. Assistive Device Components

4 Troubleshooting:

The most common problem with the Adapted Hungry, Hungry Hippo Game is that sometime the main board game lever will get stuck in the down position, and thus operation of the game will not function. To fix this issue make sure the push button is not being pressed, and jiggle the main lever until it returns to its normal resting position.
Also if any screws become loose or are misplaced they should be replaced, however they are not vital components to having the assistive device operate. Another potential problem that can occur is that the main board game lever and swing arm do not line up properly. The reason for this occurrence is that the assistive device is not properly placed up against the side of the board game. To fix this issue continue adjusting and testing the position of the assistive device until correct operation is achieved.

One final issue which may present itself is if a wire becomes loose inside the housing unit. Luckily the circuit design is straightforward, and all that is required is location of the broken wire. First remove the housing unit covers and locate the broken/loose wire. Next using a soldering iron, reconnect the wire to its intended location (see circuit diagram if needed). Finally reapply the housing unit covers and test for correct operation.