

# Hand-Held Rehabilitating Device for Cerebral Palsy Kids

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**Abstract**— The Spastic Cerebral Palsy kids have a real problem with their hands. Their fingers are locked into a claw –like structure and even after undergoing the connective tissue surgery to correct it, they need special physical therapy to get stronger. The modern, technological world has fortunately created Artificial Intelligence, biotechnology and mechanical engineering, which today pave the way for the humanity to create various devices that help people with different disorders in their therapies.

**Index Terms**— Steel frame, arm restraint, table, GUI, Future Enhancement, MALCOLM, Rice Holding Hands

## 1 INTRODUCTION

The device examined in the review paper is a wrist strengthening device. It determines a theory by the fact that CP patient will generate force and the device will track progress between the force generated by a normal wrist and the CP patient after connective tissue surgery. It also aims to give functional strength and enhance isolated movements

Normal devices primarily focus on the range of motion rather than force measurement which takes into account the isometric contraction and thereby it is not effective in determining accurately the force exerted by certain set of muscles.

The hand based device also gives into account the help of visual feedback that a doctor can give, also a patient can register to assess and check his rehabilitation after surgery. Software developers say that it is a game that is connected to eight strength Gauges. The game playing tells us how well the user can use his wrist and hand.

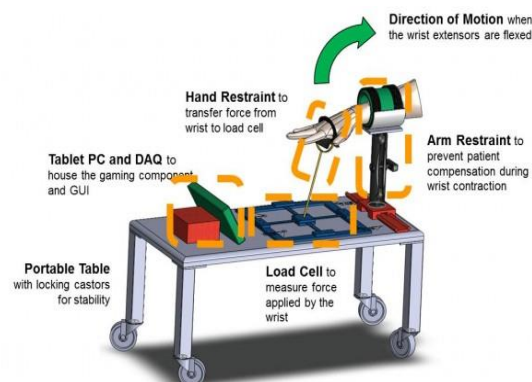
RHM (Rice Helping Hands) has developed a device known as DINO-MIGHT that is capable of measuring force in multiple axes that is helpful in providing a more accurate assessment of wrist strength and in addition to this the hole information is depicted on to graph to assess the progress.

Research has shown that muscle strength has direct correlation to one performance in everyday tasks like eating, holding things, etc.

In the following sections we discuss the various segments of the final handheld robotic device design to better understand the model and its working.

Before this there are certain design constraints that needs to be taken into consideration to develop the hand based robot for CP rehabilitation. They are as follows:

- Exactly compute wrist extensor contractile force.
- Permit Isometric contraction only.
- Engage the patient in visual game.
- Provide muscle strengthening, rehabilitation and diagnosis.
- Easy to work on by an individual.
- Design for children of age group 6 to 14.



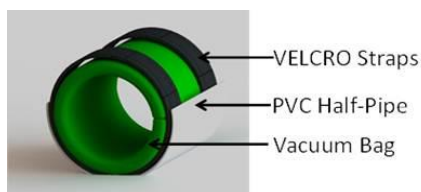
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The steel frame is fitted with aluminum cantilever beams; each cantilever beam has got two strain gauges that are used for measurements of compression and tension. The strain gauges give the strain readings that are collected by National Instruments DAQ and the digital interface

converts the strain readings into force referenced by a calibration matrix.

## 2 ARM RESTRAINT

It consists of a PVC half sized pipe that is mounted with Velcro straps so that it gets easily fitted and adjusts to the patient's arm. For stability, vacuum bags are used that makes it comfortable to be used by patient. These bags can be changed depending on the size of patients' arms for ease of use.



The Arm Restraint is fixed to the table via a Television mount. The television mount actually gives adjustability to the height and angle of the arms restraints and it is secured in place by one knob. In addition to this the arm restraint is mounted on a track on the table to make it easy to be used by both right-handed and left-handed patients.

This arm restraint is supported by:-

### 3 Table

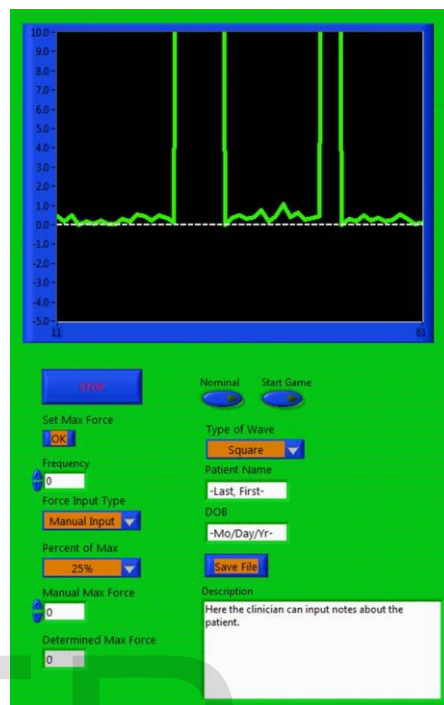
Table is fully customized. The table top is a 13 inch to 30 inch by 2 inch sheet of clear acrylic with rounded edges. The table has got legs which are 10 inch high and are made up of hollow cylinders of aluminum with 5 inch locking wheels. In addition to this handle is provided that gives better mobility. The table top has got MALCOLM (Maltese Cross Multi – Axis Load Cell) and is covered with an acrylic box to protect the electronic and wires attached. It meets all the requirement for stability during testing as well as mobility.



### 4 Tablet and GUI

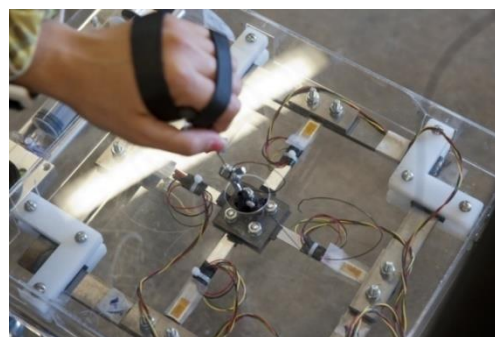
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### 5 HOW THE USER INTERFACE WORKS?

On a wide note, for the patient the Interface will display a video game that helps in strengthening of the wrist extensors. So basically the video game displays a child engaging Image which is followed by shape of several preset functions like sine wave or a step function. So the children have to basically move their hand according to the waves displayed. This increases the force output as well as the mobility of wrist extensors.



## 6 ITS BENEFIT AS COMPARED TO THE OTHER MODELS PROPOSED BEFORE

DEVICE	Measures force	Strength training	Visual feedback	Logs data	Isolates wrist Extensor
Gogola Device (2011 Gogola)	NO	YES	YES	NO	NO
InMotion 3.0 (Pediatric 2011)	YES	YES	YES	YES	NO
Toys & technology for rehabilitation-Sleeves(Gottlieb 2011)	NO	NO	NO	NO	NO
Nicholas Manual muscle Tester (Manual 2007)	YES	NO	NO	NO	NO
Willhabilitation (Decker 2011)	NO	NO	YES	YES	NO
Upper limb Isometric Strength measurement(cortez 2011)	YES	NO	NO	YES	NO
Pointing Device Apparatus (Chen 2006)	NO	NO	YES	YES	NO
Arneo Spring Pediatric (Hocoma 2011)	YES	YES	YES	YES	NO
Tailwind Arm Rehabilitation(Tailwind 2011)	NO	NO	NO	NO	NO

## 7 FUTURE ENHANCEMENT

This device for rehabilitation of CP patient known as Dino-Might is a really good find. As far as its application to the real life treatment is concerned it can be made accessible to all patient by making it economical and enhancing its features to the shoulder and neck of human body when treatment for these certain areas is available in the medical arena.

The monitoring features can be explained to parents so that they do not have to come to clinic every now and then. It is a good and result-driven device that makes use of preset functions. With the help of computer science more complexly designed games, such as car races, or ADLs (Activities of Daily Living) can be developed after the patient has recovered till a certain appreciable stage which may ensure much higher level of improved functional strength in the kids.

## CONCLUSION

CP affects many children every year across the globe. Three children out of 1000 in India suffer from cerebral palsy, hence for parents it is a very challenging task to deal with children affected from it. Rehabilitation process like hand based robot is found to be quite effective but its implementation on a large scale is still not realized.

This process has got promising results in rehabilitation if done with proper monitoring and guidance. The attractive

CP kid- machine interface has the capacity to motivate the child to perform his or her therapy through playful games.

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