

# TEKNOFEST

## AEROSPACE AND TECHNOLOGY FESTIVAL

### TECHNOLOGY FOR HUMANITY COMPETITION

#### PROJECT DETAIL REPORT

**PROJECT CATEGORY:** Health and First Aid

**PROJECT NAME:** Electric Foot Zone

**TEAM NAME:** Sadia Sohail

**TEAM ID:** #63926

**TEAM LEVEL:** High School

**TEAM MEMBERS:** 2 (including Advisor)

**ADVISOR NAME:** Ms. Horia Tariq

## Project Detail Report

### 1. Project Summary:

My vision is to make an electric foot stand for those people who are disabled to walk and are tired of sitting idly on a wheelchair while they face muscle cramps all over their body because of being in the same posture for such a long time. The project proposes the use of leg braces in which a hover board system will be installed to each of its sole to make a person wander around while he stands still. The hover board system will be consisting of gyroscopes, logic boards, power switches, wheels, motors and many more components.

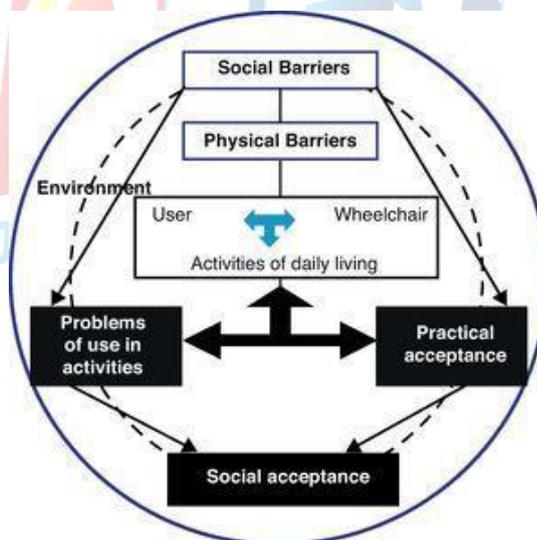


### 2. Problem/ Issue:

Disabled people are large minority groups, starved of services and mostly ignored by society, live in isolation, segregation, poverty, charity and even pity. This project basically aims to make the disabled people especially handicapped people comfortable when they feel exhausted while being sit on a wheel chair for a longest time. And it targets those handicapped people who wish to stand on their own feet obviously with a little effort to feel congenial with the new service. Due to discrimination disabled people do not go to public places and not free to get those rights which a non-disabled person gets. One of the first areas where information technology improved the quality of life for disabled individuals is the wheelchair. But there are the problems of pressure sores or muscle cramps developing because of long periods of sitting. Wheelchairs are below the expected and accidents can result if the wheelchair user or those around don't react quickly enough. If all of those challenges weren't tough enough, wheelchair users have to deal with the attitude of the society towards them. Wheel chair still makes them dependent upon someone.



Although the invention of wheel chair brought such people a little ease but there are still number of problems that wheel chair users face. Dirtying of hands as a result of pushing one's own wheelchair forward is one such issue. If sanitary equipment is not at one's frequent disposal, it may result in serious health disorders as individuals eat or drink with the same dirt intact. Moreover, With mirrors usually above or below the average wheelchair level, those handicapped find it unable to smoothly conduct their daily activities, i.e., such as shopping and getting dressed. Over a billion people live with same form of disability which corresponds to about 15 % of the world population and especially among these people disability is more common between women, and adults.



### 3. Solution

So we think that this is an idea whose time has come to be implemented as soon as possible because the use of leg braces beside the hovering system in an innovative way will eventually help us to resolve all the above stated issues. The leg braces will provide the stability to the legs by making handicapped or disabled people stand on their own feet and will give their legs the musculoskeletal alignment. Beside that the hovering system attached to its sole will let riders who has worn leg braces move with ease and stability. This could be the most suitable solution for the mentioned problems, while focusing on every aspect of ones life. This project could turn the dream of such people into a reality of being stable on their own feet and being independent.



Above all, The main purpose was to design and construct a fully functional two wheeled balancing vehicle which can be used as a means of transportation for a single person. It should be driven by natural movements; forward and backwards motion should be achieved by leaning forwards and backwards. Turning should be achieved by tilting the handlebar sideways which would be attached to the leg braces and the whole system in such way that it would give support to the rider to stabilize themselves. Because standing of the disabled person without the support is something we can't think of at first Therefore the handle bars will definitely align the posture of a person by giving a flexible support.



#### 4. Method

This section explains the methods used in attempt to reach the purpose and goals setup above. Since time was short, a to the authors well-known CAD software and well proven and asserted methods taught in engineering educations were consistently chosen for each phase of the project.

The first step was to gain knowledge about the dynamical system such that the hardware could be designed to be controllable from the start. It was decided to use an existing model found in literature (legbraces) and adapting it rather than deriving it completely from scratch. This was motivated by the possibility to review several models and compare them to eachother in the same time as it would take to derive a new model. Thorough investigations of papers on modelling of electric foot zone vehicle were then conducted, rendering a number of dynamical models. Then finally a model comprising of leg braces, handle bars and hovering system was selected.

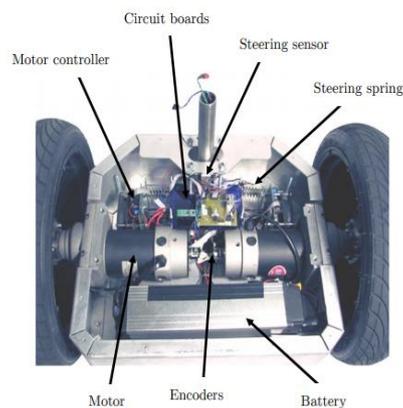
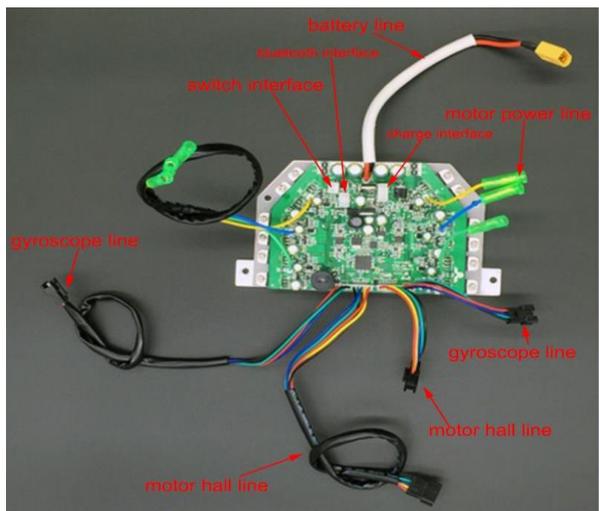
The model would be giving such look which is divided into two parts.



When a study of the proposed system dynamics had been conducted and a final model had been selected it was time to design the real system. Electric foot zone will be built in such a way that each of the wheels will have its own Gyroscope, Tilt and speed sensor. They will generally be placed below the frame where rider places the feet. **Logic board.** is the ‘brain’ of the hoverboard, which computes real time hoverboard data. It computes and controls all hoverboard aspects such as speed, wheel tilts, direction of wheel spin and LED indicators. Many hoverboards use a common logic board, known as the TaoTao logic board. Therefore, we may also use the same logic board under the sole of leg braces .It houses and controls different sensors like gyroscope and infrared sensors. **Gyroscopes** are two tiny sensors, which balance the board on two wheels. They will rely on the information provided by the logic board, and determine to what extent the rider has tilted forward/backward. Each of the two wheels will have electric motors inside them, which are accompanied by a **tilt sensor** and **speed sensor**

each. These sensors will detect the revolutions per minute of the individual wheel and send information to the gyroscope and the speed control module in the logic board.

Another important component required is the **Battery packs** which are readily available and there are various choices available for this component but most commonly used battery for this application is a 36V 4400mAH battery. You can also make your own battery pack using the battery of an old Laptop (Although, it is not recommended as you'll need to handle it with utmost care!)



## 5. Innovative Aspect

Perhaps the most well-known similar product is the Segway, a popular personal transportation device. The Segway successfully moves a person without the use of their legs, but it would be appropriate for the purposes of the performance due to its bulky frame.



In the same way, hover shoes or hover board are kind of similar product that allows the riders to wander around without allowing the movement of his/her legs.



**BUT**, The use of hovering system on the leg braces in a form of segway's structure is a never before proposed theory because there are no such stands or self balancing vehicles for handicapped people which can make them wander around while they only stand. This whole project illustrates an innovative use of already introduced hovering system and medical structure.

## 6. Applicability

“Disabled but not disqualified.”

Around the world, more than 1 billion women and men and boys and girls are living with some form of disability. Although most people will experience disability at some point in their lives, understanding the meaning of disability and its impact on the ability of each individual to be active participants in social, economic, sociocultural, and political life remains a challenge. Physical, social, and legal barriers continue to limit access to education, health care. So this project will help to survive in the current advance circumstances. This project can be implemented for any person who is willing to be independent with all his passion because obviously this will require alot of hardwork. Basically this electric footzone; the self balancing vehicle would too even require a little harder effort to make themself comfortable with it. But its applicability is now has become very important in such advance and fast era.

## 7. Estimated Cost and Project Scheduling

15th-25th July 2021	Buying materials	10th-25th August	Rough prototype
26th-5th August	Circuit builtup	23th-25th August	Experiment
6th- 10th August	System installation	30th August-5th sept	Final prototype

### ESTIMATED COST-BREAKDOWN

materials to be used	Project plan	Estimated cost (pkr)
▪ Leg braces	Leg braces	8000 pkr
▪ wheels	Wheels	2000 pkr
▪ gyroscope	Gyroscope	8000 pkr
▪ logic board	Logic Boards	4000 pkr
▪ suitable wires	Battery packs	2000 pkr
▪ battery packs	Sensors	5000 pkr
▪ required sensors	Handle bars	2000 pkr
▪ handle bars	Bundle of wires	1000 pkr
▪ gearbox	Leftover System builtup cost	5000 pkr
▪ motors	Designing+construction of a whole project	10000pkr
	Final prototype	<u>47,000 pkr</u>
	In USD	<u>300 usd</u>

This estimated cost has been taken with an account of the best components to be used in this project. This project as targets the special handicapped people so we cant take any risk by minimizing its cost by lowering the quality of its components. Ist best quality should be prioritized.

Secondly we donot have any similar product like this before but the product which are somehow used for same purpose are segway and hover shoes whose average cost is 30,000 maximum in Pakistan. But our project provides more facilities to the person and is advancely used.

#### 8. Target Group of the Project Idea (Users):

This project targets the people with the diseases that force them to wheel chair and become their users [such as polio patients, handicapped people]. This project targets such people just to provide them the joy, opportunities or the services they are lacking. My brother is also categorized amongst those people who are unable to walk. We experimented the legbraces on him and found out that it will defiitely take time to make him comfirtable with a new movement or an activity in his life. Because such people's bone has then become so hard and are found reluctant to make movements. Making him try only the leg braces made him cry because of pain but later on after letting him wear it for a no.of days He somehow got comfortable with those braces. So as a result we may conclude that this project will definitely be used for such people by gradually making them comfortable with it, by teaching them, by taking this project as an exercise of their bones and gradually adding this exercise into their daily routine.

## 9. Risks

In every country one in every five person is facing the same kind of disability; who are unable to walk or wander around according to their wish. Electric footzone will undoubtedly provide numerous benefits to that one person once he gets comfortable. But during the time he is learning to get comfortable he might go into a mental trauma in fear of falling from that vehicle which hundred percent acceptable.

At the same time if such products came into production, which means that this will too become a part of a business. A supplier or a producer will definitely try his best to gain the highest profit by reducing the quality of a product which is not acceptable in any case because such people can't afford any more risk in their life while they are still on the wheel chairs.

Another problem which can be caused is actually taken from the incidents caused in US while using the hoverboards which says that,

There were many instances of units catching fire, with claims that they were responsible for numerous residential fires between late 2015 into 2016.<sup>[11]</sup> In the United Kingdom, authorities expressed concerns with the boards, regarding possible faulty wiring.<sup>[32]</sup> Many airlines banned the transportation of the boards, both as stored or carry-on luggage.

The US Consumer Product Safety Commission (CPSC) launched an investigation into the safety of the device in late 2015 and determined that the lithium-ion battery packs in the self-balancing scooters/ hover boards could overheat and posed a risk of catching fire or exploding, and that defects had led to 60 fires in over 20 states.

### RISK ANALYSIS

#### LIKELIHOOD

#### CONSEQUENCES

VERY LOW	Definitely will not happen	VERY LOW	A little shake of fear in your body
LOW	Unlikely to happen	LOW	Minor injury
MEDIUM	Little chance of a small accident	MEDIUM	Injury would stop casualty continuing with task.
HIGH	Likely to happen	HIGH	Injury leading to bed rest
VERY HIGH	Will happen surely	VERY HIGH	Medical assistance

## 10. Resources

- ✓ <https://www.who.int/features/factfiles/disability/en/#:~:text=Fact%201%3A%20Over%20a%20billion,increase%20in%20chronic%20health%20conditions.>
- ✓ <http://www.jonestherapyservices.com/blog/understanding-leg-braces/>
- ✓ <https://circuitdigest.com/article/what-is-hoverboard-how-does-it-work>
- ✓ Final Project Report: Motorized “Hover Board” by Gabriele Pregadio
- ✓ <https://publications.lib.chalmers.se/records/fulltext/163640.pdf>
- ✓ [https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course\\_id=17987&parsergrp=3](https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=17987&parsergrp=3)
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