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Motility Device

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Abstract— Out of world's population 15% of them have any kind physical disabilities most of them have issues with lower limbs. They are struggling and cannot move without aid. Most commonly above 65 years old person struggles the most. The standup Motility device helps to overcome these problems and helps to move without external aid. The device can be remote controlled when you are on bed or away from the device. It helps to person to stand and sit anywhere. The device is also smartphone connected. The speed of the device is controllable and can acquire a maximum speed of 10km/h. Our project can help the disabled by making themselves confident and competent.

Keywords— Stand up motility device, disabled people, remote and smartphone controlled, maximum speed 20km/h

I. INTRODUCTION

By the statistics of the World Health Organization more than one billion people have some kind of disabilities. People have having problem in walking use mostly wheelchair, which is not suitable for all situations. A person can be immobile due to many reasons, maybe they are disabled from inborn, by caught some disease, by accidents or by ageing. They are highly dependent on other people to move due to lack of efficient devices. They need help to get into the bed from wheelchair and vice versa. And the wheelchairs are not as much as helpful on certain circumstances. Our project is intended to make the disabled people to move from one place to another without any help of other individual on stand up position. The standup motility device is an electrical powered vehicle. The user is supported by the vehicle in an adjustable sitting and standing positon. The device is capable of folding mechanism so the person can sit anywhere when folding and unfold when the user wants to stand. The folding mechanism is done by gas spring. Main features of our project are:

A. Able to move in stand up position.
B. Bluetooth or Remote controlled
C. Able to stand and sit

The dimensions of the device are height 57",length 35", when folded the height 37". The maximum safe slope is 4°. The maximum weight it can endure is 110kg. The device consists of mainly mechanical body and electronic part. Mechanical body endure the weight of the person and helps to control the motion. The device is easily rotatable and stable. It controls centre of gravity and avoid falling by stabilizing it. The backward motion is restricted to avoid accidents due to sudden movements. The device can take rotation within a small space, so the problem is solved. The current design only allow to move through plane surface an advanced version can be implemented to jump steps. Standing at least five times a week improves bone density, bladder and bowel function, digestion, circulation, and respiratory function. The standing position improves self-esteem and psychological well-being. The standup Motility device is smaller size so no problem in crossing doors and height is adjustable. The device has accessibility which will help you on the roads. The speed of the device is controllable and the maximum speed is 10km/h. The device intended for above 20 years only.

II. DESIGN

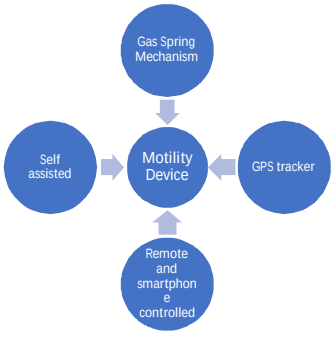


Figure 1: Block diagram of Motility device features

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III. DEVICE REQUIREMENTS

Stand up Motility Device consists of both mechanical and electrical components. Main components require for the device are Ebike motor, Gas spring mechanism, sling cushion and back belt, remote controller, GPS tracker . The features of the components are:

- *Arduino UNO*: Arduino is electronics platform which controls the hardware components like joystick, speed and batter indicator. It is also used for controlling the device through smartphone.
- *Transceiver*: It is a hardware component used to control device through remote.
- *Ebike Motor:* The device requires 300W high torque brushless motor. For this device, we requires low speed and high torque. Speed is not prominent for this device
- *Gas Spring Mechanism:* This mechanism helps to assist the person to sit and stand.
- *Back Belt and Cushion*: Back belt supports the person to get lifted and able to stand by himself with the help of sling cushion.
- *Remote Controller*: The device is be controlled by remote controller or by smartphone to control if the person is away from the device. Remote controller is connected by Bluetooth.
- *GPS Tracker:* It is used for tracking the device location.
- *Battery:* It uses 24V rechargeable battery which can drive distance about 4km.

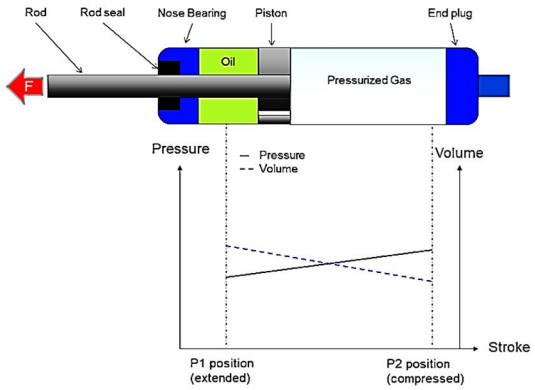
These are the primary components of the device, there are also other components which controls the device. They consist of different functions. The purpose of the device is to make the person stand and move. For this we give support to get lifted and support from back and front. Device has a user panel to control the motion and speed of the device. User panel consists of:

- *User Panel Activation Button*: This activates the device.
- *Joystick:* The joystick controls the direction and motion of the device. It is 360 degree proportional joystick. The user can push the joystick half way or full way, depending on how fast the user like to move.
- *Speed Controlling Button:* Speed also controlled by speed buttons near the joystick.
- *Belt Tightening Button:* Tightens the belt which supports the person to stand.
- *Speed Indicator:* Show how fast the device is moving on a scale 1(slowest) to 10(highest).
- *Battery Indicator:* Shows the battery percentage.
- *Horn:* Activates horn when pressed.

Other components the device consists of to give the support to the user for standing and sitting. Mainly the components are:

- *Chest Plate:* It is cushion plate situated top of the device. Chest plate gives support on the chest so that the person does not lean forward then lose balance and tumble down.
- *Additional Chest Support:* It gives additional support to make sure that the user gets maximum support.
- *Gas Spring:* This is a type of spring which used to fold the device for assisting the user to stand from sitting position. It helps to lift the person by the principle of gas spring.
- *Gas Spring Principle:* Gas spring consists of a rod attached to a piston, moving, within a sealed cylinder containing pressurized nitrogen gas and oil. Their force (F) equal to the pressure differential (P) between internal and external (environment) pressures, acting on the cross sectional area of the rod (A)

$$F = \Delta P/A$$



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- *Gas Spring Locking Mechanism:* The locking mechanism is to prevent the user from the sudden twitch.
- *GPS System:* GPS helps to track the device location to control remotely by Bluetooth or smartphone connection.
- *Back Belt Cushion:* It has a soft interior and harder exterior relatively. It gives support from back to get lifted so that the user doesn't tumble while lifting.
- *Brake Levers:* The brake levers are used for both gas spring brake for locking gas spring and handle brake to apply the brake to stop.
- *Foot Plates:* It is a plate on the base of the device where your feet is placed before mounting.
- *Knee Support Pad:* It supports the knee for proper upright position with straps.
- *Emergency Shut Off:* In emergency situation, the system can be switched off with the help of device main switch. Once it is flipped, it's brake will engage and all electric function will cease. If any malfunction occur, the software will disengage the device and trigger the emergency brake system.

IV. OPERATION

A. *Getting on the Device*

To mount on the device make sure it is in start up position(ie, folded position). If not press the brake levers and pull. Then turn on the main switch and user panel activation button. Remove the back belt cushion from the device and place it behind your back. Place your feet on the plate and knee on the pads. Maneuver the device with joystick so that the chest plate slightly touches your chest. Attach the back belt to the device and lift yourself up gently by holding to the handle and remove the gas spring brake. The gas spring will assist you to lift easily. Then user can move in stand up position. The device maximum speed is 10Km/h. User panel enables you to control the speed, direction and the display will notify you the speed, battery percentage.

B. *Driving*

After mounting on the device the user can control the device by activating the user panel by activation button. The direction and speed is controlled by variable joystick integrated in the user panel. Speed also adjusted by speed up and down button. Speed 1 button is not for driving. It is maneuver the device while getting on and off. Joystick is a 360° rotatable so the user can direct the angle they would like to move.

C. *Getting Off from the Device*

While getting off from the device do not use the joystick. Move backwards until you reach in front of chair or bed. Loosen the belt until they are very loose. Remove the straps from knee pad. Set the speed at 1 and use joystick to move slowly to the seating position. Remove your feet put of the device. Then with the use of remote move the device to a side for charging.

D. *Charging Batteries*

The battery indicator has 10 levels. The charger is compatible with 230V outlets. To charge the motility device, turn off first then insert main plug of the charger into the socket.

V. FUTURE WORK

At the present our device is only meant for those who are disabled below hip. People who are fully paralyzed will not be able to use the joystick for the device movement. In the future a voice automation feature can be expected, which can be used by fully paralyzed people who can command the device through voice.

In the future a design change will also happen in case of wheels which will be capable to climb steps. An app will also be developed through which the user can control and analyze the status of the device.

VI. CONCLUSION

The automatic wheelchairs was a big consolation to the ones who can't walk. We intended to overcome that short comings with our project. Our main focus of the project was to help people with walking disabilities and we have put in a lot of effort to make this happen. Usually person on wheelchair need an assistance to stand or to fetch something from the shelves or cooking or do dishes. With our new project they stand and move which feels like walking. User able to strap themselves to the device without any external assistance. We also made this device in a very low cost method, so that most of them could get access to our device. We also have a plan to make more advancement and add more features to our project in the near future. We are sure that this device, life of the people who cannot walk will be a lot better.

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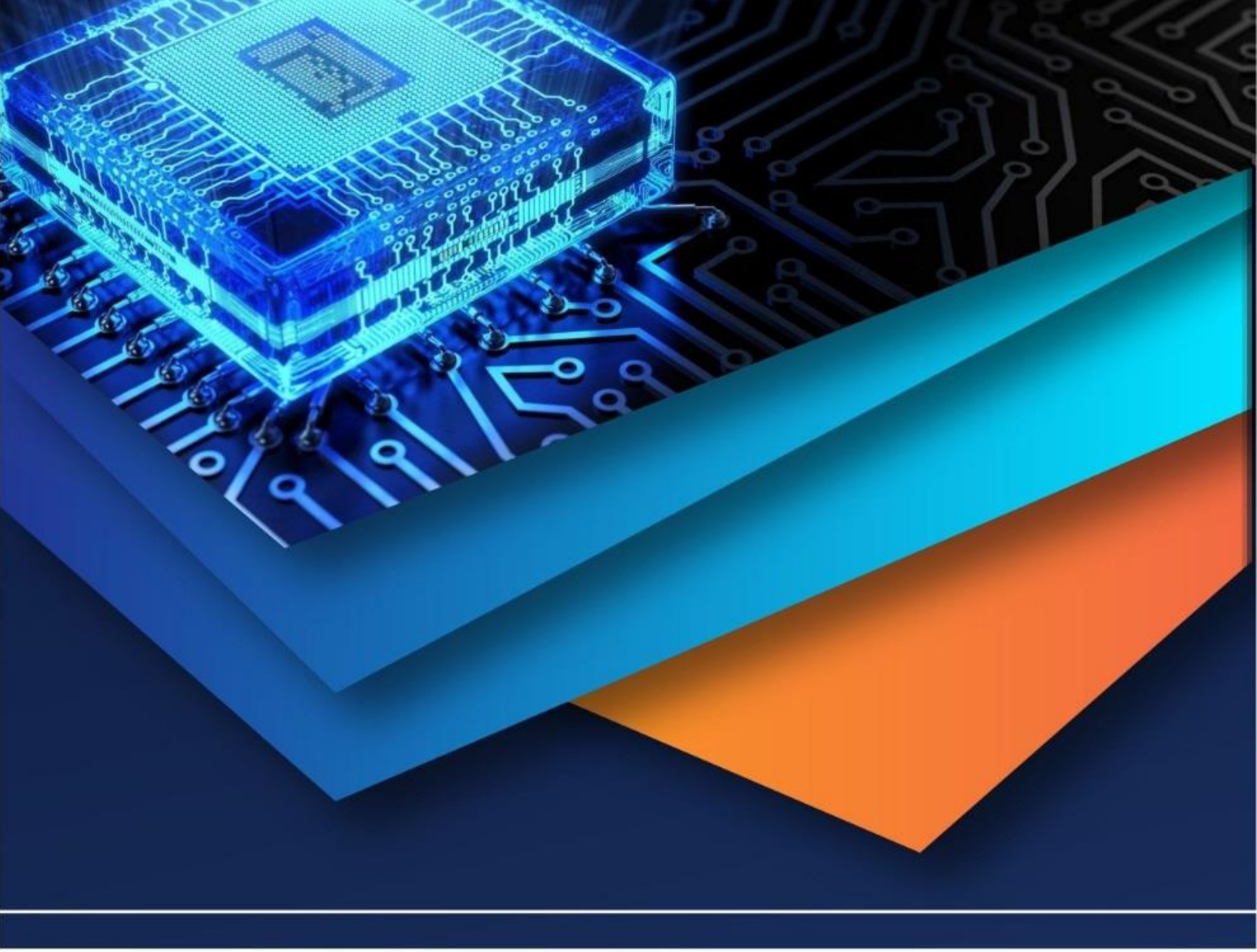
VII. ACKNOWLEGDMENT

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