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MEMS Accelerometer Based Head Movement Controlled Sensing Device

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Abstract – *In this Paper details about design and working of MEMS accelerometer based on head movement controlled sensing device is shown. This device is useful to People who are handicap by birth, old age people and some accidental cases. Today's world works on automation. Everything around us is getting automated. Different type of wheelchairs are available in market but they are not much useful for the handicapped persons as they have to be dependent on other for moving from one place to another. The people who have this kind of disability are not able to perform their everyday actions. Due to dependency on others, he/she loses their self-confidence and desire to live their life independently. With the help of this device they can gain their self-esteem back. This paper introduces the design and implementation of a hands free control system for intelligent device. This could be an achievement for health care and medical sector. Hands-free control system followed by wireless & 2D device and it works on real time basis.*

Keywords- *Gyro Sensor, MEMS Accelerometer, Climbing Wheel Mechanism, Physically Handicap, smart wheel chair.*

I. INTRODUCTION

The aim of our project is to use MEMS accelerometer based on head movement controlled sensing device to automatically move forward, backward, left and right. The overall framework of our project is to restore autonomy to severely disabled people by helping them use independently a power wheelchair. This device is fitted with acceleration sensors; gyro sensor and climbing wheel to help disable drivers achieve some independent mobility. By just tilting acceleration sensor device can be moved in four directions the gyro sensor can help the rider control the device by taking over some of the responsibility for steering and avoiding objects until he or she is able to handle the job. The amount of work that the rider chooses to do and how much control is taken by the chair is decided by the rider and his or her care. Object in the way can be scan by sensor and device will stop automatically. The device can also integrate with head movements the pilot can use the same controls top drive the device and operate another assistive device, so handicap person who is not able to use of his hands they can drive chair by head movements. Taking advantage of technological evolution, in order to increase the quality of life for handicap people and facilitate their integration in to the working world. In order to guide a device various situation can be distinguished. If the user is capable of controlling his heads, the ideal solution is the use of the sensor. After referring around 20 research papers and patents as a part of our literature survey, we have included 2 components or mechanism (Climbing wheel mechanism & Gyro sensor) which will make our device more feasible for the various people around the globe. There are also many other innovations to include in the device, but till now we have worked on the above mentioned points and changes in them. Moreover, we are trying to find some more changes which can be done to make this device more compatible.

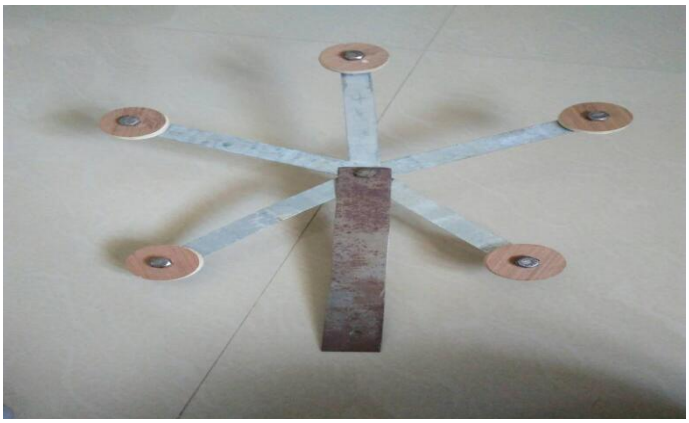
II. LITERATURE REVIEW

The authors RR Gurpude, R D Ashkhedkar, C C Handa and S K Choudhary have published "Design synthesis and simulation of four bar mechanism for wheels for climbing". The concept of the mechanism was wheel to climb obstacles, step with a suitable smooth path. The four bar linkage was installed on each wheel of vehicle. Compactness of the mechanism design makes it suitable for staircase climbing wheelchair for aiding people with disabilities. [1] The creators Satish C, Vinit Mahale, Pradeep Donni, Sachin Sartor and Rajvrat have published "Movement based wheelchair control for physically challenged head". This device consists of digital system (Accelerometer & microcontroller) and mechanical actuator. The output of the digital system was connected with actuator which is used to position the wheelchair according to the user command. Thus the head motion was translated to the wheelchair joystick position. [2] The authors Vignesh S.N, Vivek Kumar A, Bharthi Kannan K have done work on "Head motion controlled robotic wheel chair". Quadriplegics are persons who are not able to use any of the extremities. The main objective of this project was to defeat the challenges like they cannot move from one place to the other due to their lack of movements. As the handicapped peoples are dependent on others this robotics wheelchair was developed for them to become independent. [3] The creators Roshan Alaspure, Chaitali Baumase, Snehal Chamb hare, Manish Mandhre have published "Fabrication of stair climbing wheel mechanism: Alternate for lifting goods". In this the vehicles was designed in such a way that it contains three wheels on each side and are set in a triangular pattern. This vehicle focuses maximum ergonomically beneficial to human being. To carry the load a load carrier having wheeled mechanism device is used which reduces human effort. [4] The authors Asha Arvind, Hari karishnan R have published "Head movement controlled wheel chair using MEMS sensors" Now a day's technology has shifted to automation minimizing the need of human intervention and

the people around the world due to illness or accident is increasing at a very fast rate. For such disabled peoples to drive electric wheelchair is difficult so this device was developed using MEMS sensor interfaced with DC motor. The MEMS sensor is a Microelectromechanical sensor which translates head movement into computer interpreted signals. [5]

III. COMPONANTS

CLIMBINGWHEEL MECHANISM



"Figure 1. Climbing wheel Mechanism

Figure 1. We can show in this mechanism is used for climbing up and climbing down the stairs. In this mechanism we have used six wooden (diameter as required). This mechanism is fitted at the front lower side of the wheelchair.

I) D.C. Gear MOTOR

"Figure 2. D.C. Geared Motor"

Figure 2. We can show D.C Motor is device that converts direct current in to mechanical energy. It contains a current carrying armature which is connected to the supply. Fleming's left hand rule is used to determine direction of force acting on the armature. The rule states the to find exfinger, middle finger and thumb of left hander extended in such a way that if current carrying conductor is placed in magnetic field perpendicular to the direction of current, then the conduct or experiences a force in mutually perpendicular direction .It have electromechanical mechanism to change the direction of current flow. We will need a basic understanding of Ohm's Law. Ohm's law says that if there is a current passing through any resistor, there will be a voltage drop across the resistor that is proportional to the current. The equation is often written V = I R.

II) BATTERY

"Figure 3. 35Ah Battery"

Figure 3.In this we can show a flow batter is a fully rechargeable electrical energy storage device where fluids containing the active materials are pumped through a cell, promoting reduction/oxidation on both sides of an ion-exchange membrane, resulting in an electrical potential. However, for flow batteries, the energy component is dissolved in the electrolyte itself. The chemical process can be generalized to the following half reactions during discharge.

Anode Compartment: $An^{+1} - e^{-} \rightarrow An$

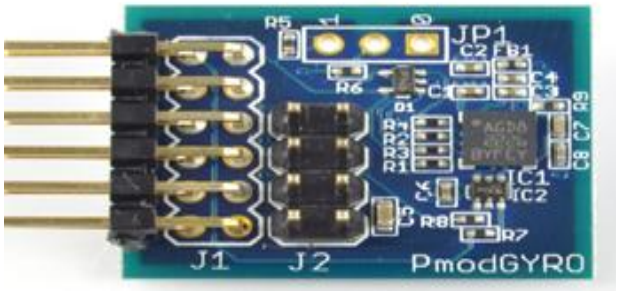
Cathode Compartment: $Cn^{+1} + e^{-} \rightarrow Cn$

Batteries	Energy Density (Wh/L)	Power Density (W/L)
Bromine-polysulfide	20-35	60
Vanadium-vanadium	20-35	60-100
Vanadium-bromine	20-35	50
Zinc-bromine	20-35	40
Zinc-cerium	20-35	50
Lead-acid	60-80	230
Lithium-ion	150-200	275
Nickel metal hydride	100-150	330

"Table no. 1 Battery Comparison"

In this project, lead-acid battery is going to be used with 35Ah capacity.

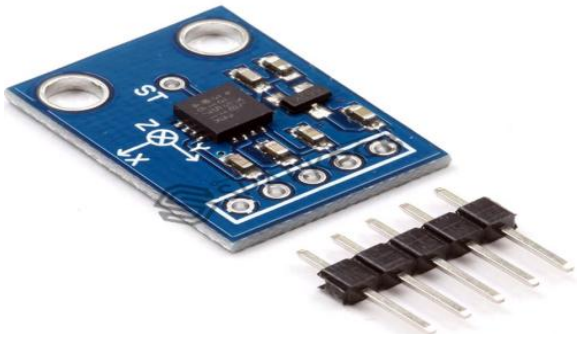
III) **GYRO SENSOR**



"Figure 4. Gyro Sensor"

In this integrated devices or system that combine mechanical and electrical components are created using MEMS technology. They have ability to sense, control and actuate on micro scale and generate the effect in macro scale. It consists of mechanical microstructure, micro sensors, micro actuators integrated on to the same silicon chip. Changes in the system's environment are detected by the micro sensor and corresponding electrical signal is produced. Micro actuators react to this signal. In the proposed system, MEMS sensors measure the till tangles produced by the patients. It is a three direction accelerometer having X, Y and Z direction. The voltage is in range of 1.3V to 1.9V.

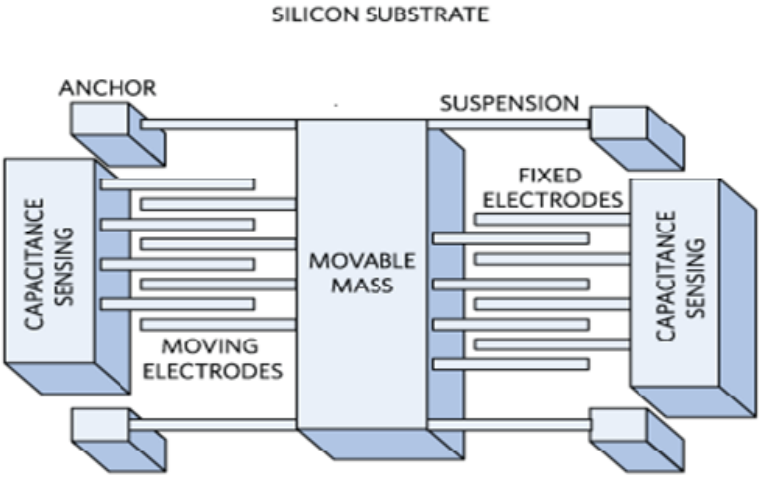
IV) **ACCELEROMETER**



"Figure 5. MEMS Accelerometer Sensor

In this figure we can show that Microelectromechanical system (MEMS) combine mechanical and electrical components into small structures in the micrometer scale. They are formed by a combination of semiconductor and micro fabrication

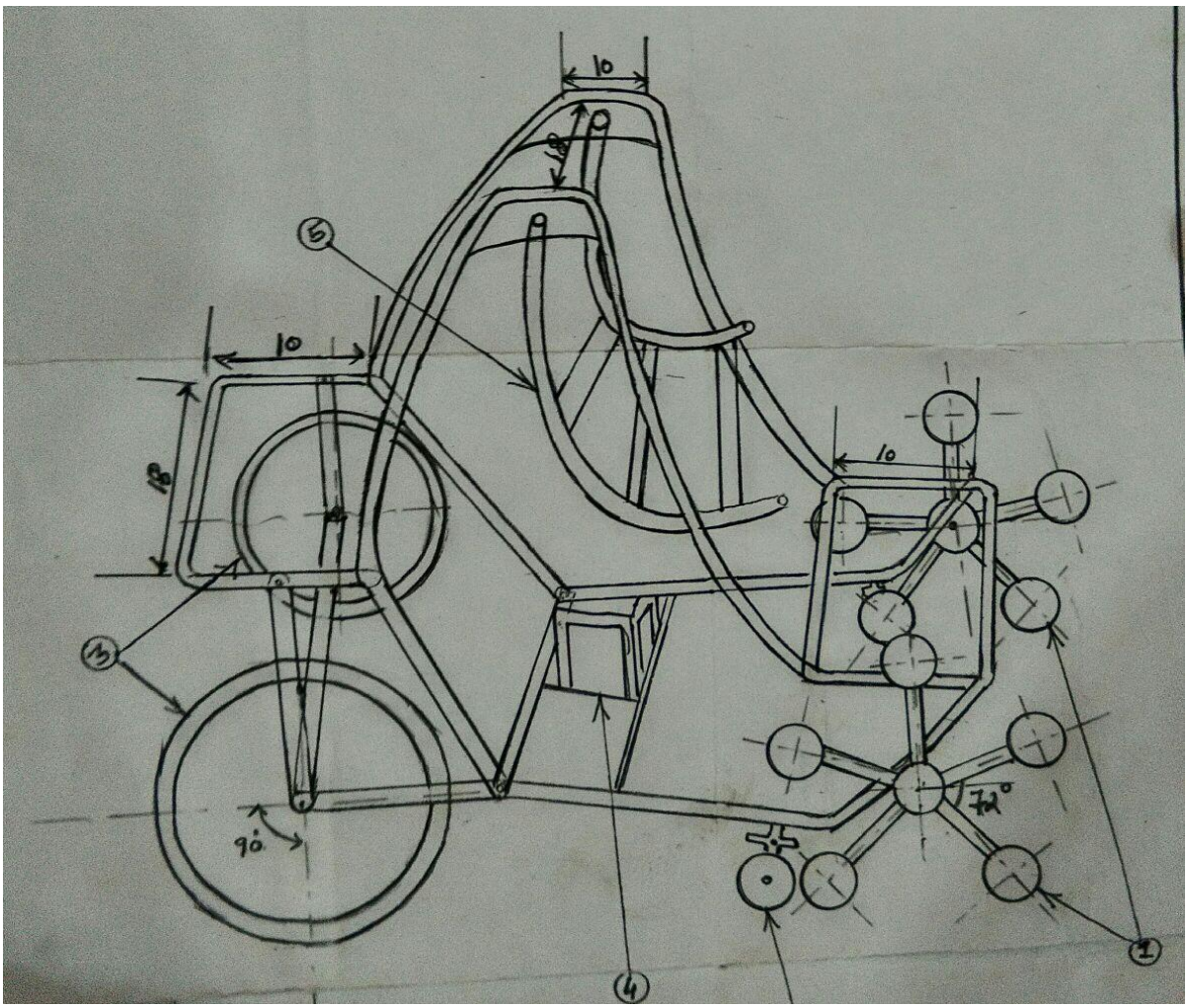
technology using micro machine processing to integrate to all the electronics, sensors and mechanical elements into a common silicon substrate. Major components in any MEMS system are the mechanical elements, sensing mechanism and the ASIC or a microcontroller.



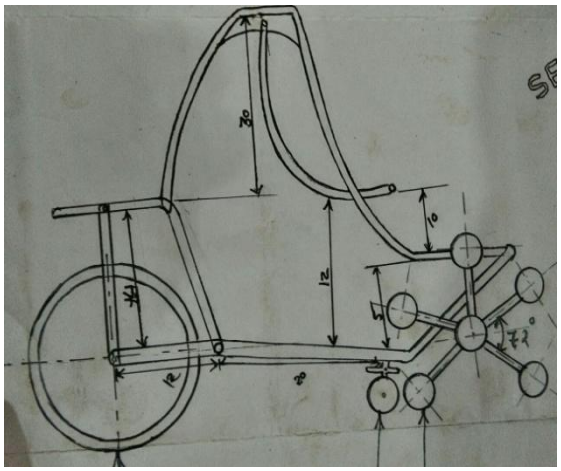
"Figure 6. Mechanical Model of an Actual Accelerometer.

In this mechanical model of an actual accelerometer works and to functioning of using MEMS system to accelerometer and gyro scope to moving to electrons in the circuit.

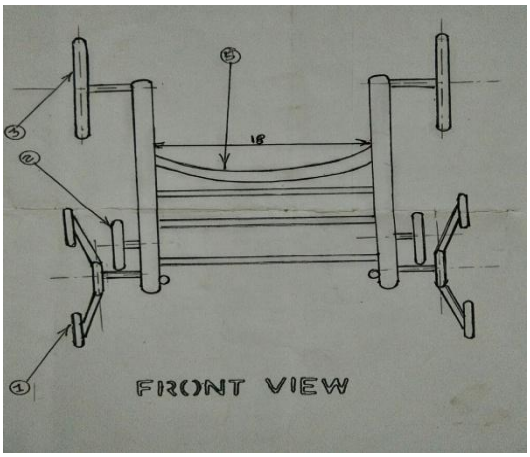
IV. DESIGN AND WORKING



"Figure 7. 3-D View (Design)"



"Figure 8. Side View"



"Figure 9. Front View"

All Dimension in (mm)

1) Wooden Wheel (100 mm)
2) Front Wheel (100 mm)
3) Rear Wheel (450 mm)
4) Sensor, Battery, Motor
5) Seating
6) Shaft Diameter (10 mm)
7) Sprocket Diameter (80 mm)
8) Sheet length (500 x 650 mm), Alloy steel

In this we can show Design of our project. After we can research of some paper in that concept of the other students are to be developing the MEMS Accelerometer and Gyro sensor using to make wheelchairs but one think is most important is that any disable person to seat at wheelchair. And so we conclude that we make our design to more effective and to reliable with we are using new concept of our project it will stairs climbing wheel mechanism. In this we can use the wooden wheel at front of the wheelchair and easily stairs up and stairs down. The main aims of our design easily motion of the wheelchair using MEMS accelerometer and gyro sensor. In that gyro sensor at any person seating at wheelchair on head this chip is using to forward, backward, right and left direction of the wheelchair.

We found the device which works independently. In this we are using various types of components like accelerometer, gyro sensor, magnetometer, microcontroller etc. All these components are assembled with one circuit which helps in controlling and monitoring the device. In this device we used sensor attached headphone which is directly connected with the circuit, this deice runs with help of D.C motor. Motor runs at a required speed with the help of control circuit. We will use a braking system also which will be used to stop our device whenever it is required. This device movement is totally dependent on the head movement of the person sitting on the device. And also we can use to climbing wheel mechanism to easily stairs up and stairs down. In that we can use five wooden wheels to attach to upper of the front wheel. When with help of headphone to moving forward direction at that time one wooden wheel is carried that position at that surface it will freely rotate. Main advantage is to use of wooden wheel friction in between stairs and wooden wheel so it will easily and freely stairs up and down.

V. CONCLUSION

We have described a smart device equipped with sensors and driven by head movement control that allows the rider to interact with and command the system at various levels of abstraction. We are trying to develop a device which could make a handicap one independent and can provide extreme ease in his life. And our mechanical component stairs climbing wheel mechanism use any handicap people to easily move forward, backward, right & left direction. For a person no need to rely on other for his day to day work by using this project.

VI. FUTURE SCOPE

In future we can also apply the solar system for battery recharging. For the safety purpose of a person we will use GPS system to know the current location of our device. Also by using recognition system, this project can be implanted.

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