

Head Motion Controlled Wheelchair

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Abstract: *Traditional Wheelchairs though have certain limitations with the flexibility, heavy weight of the chair and limited functions. Tremendous developments have been made in the field of wheelchair technology. Be that as it may, even these noteworthy advancements couldn't help the quadriplegics to explore wheelchair freely. Medical gadgets intended to support the Paraplegic and Quadriplegic patients are exceptionally muddled, once in a while accessible and costly. We go for planning a straightforward financially effective programmed wheelchair utilizing MEMS technology for quadriplegics with head and neck versatility. The control system interprets the situation of the user's head into speed and directional control of the wheelchair. The system is divided into two main units: MEMS Sensor and programmed Arduino Micro Controller. The MEMS sensor senses the change in direction of head and likewise the signal is given to microcontroller. Depending on the direction of the Acceleration, microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, and BACK with the aid of DC motors. In addition we have introduced ultrasonic sensor, vibration sensor, heartbeat sensor.*

Keywords: MEMS sensor, DC Motor Driver, Arduino Micro Controller, Ultrasonic Sensor, Vibration Sensor, Heartbeat Sensor

I. INTRODUCTION

The advancement and development of technology has always influenced a few parts of our lives since quite a while and will keep on doing as such later on with additional capacity and more unexpected development. In our project we have attempted our best to correlate between the advancement of technology and the human requirement, for human ease. The main aim of this project is to control wheel chair through human direction. This project is mainly designed for physically challenged people who are dependent on wheelchairs and especially those people who can't utilize their hand to drag their wheel chair on account of some incapacity. In this system we have used head motion module to recognize the motion of the user for controlling the direction of the wheelchair.

The prototype of the wheel chair is built using arduino, chosen for its low cost, in addition to its versatility and performance in mathematical operations and communication with other electronic devices[1-10]. The system has been structured and actualized in a savvy way so that if our venture is marketed the poor clients in developing nations will profit by it. We trust our project for some valuable activity and give some headway in innovation, and most vital this may give some assistance to the debilitation individual.

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Unfortunately, day by day the number of handicapped people is going on increasing due to road accidents as well as the disease which leading paralysis. Among people with disabilities, percentage of physically handicapped person is most. If a person is debilitated, he is reliant on other individual for his everyday work like transport, food and so on. So a head motion operated wheel chair is developed which will operate automatically on the motion of head from the handicapped user for movement purpose. Use of electrical wheelchair prompts a lot of freedom for people with a physical handicap who can neither walk nor operate a mechanical wheelchair alone[11-17].

II. EXISTING SYSTEM

Wheelchair is a gadget utilized by crippled and elderly individuals for their transportation reason. A few sorts of smart wheelchairs are accessible in the market. For some situation, for example, absolutely loss of motion individual in Amyotrophic Lateral Sclerosis (ALS) and Parkinson illness, it might be extremely troublesome or outlandish for such patient to utilize typical sort of framework. They depend close by motion, eye position, voice acknowledgment, and mind waves and so forth. A self-impelled manual wheelchair fuses a casing, seat, maybe a couple footplates (footstools) and four wheels: generally two caster wheels at the front and two huge wheels at the back. They have designed the control system including software and hardware. Voice controlled posture change and driving was realized, the hardware circuit and software program are tested and debugged, the recognition rates of voice control of the wheelchair for the same person are acceptable. But it can't be applicable in crowded place due to it recognize numerous number of voice.

III. PROPOSED SYSTEM

The Wheelchair operates with head movement, taking motion as an input signal for the movement of wheelchair in a particular direction. An MEMS sensor is used to track these motions. This sensor is fitted to cap on head. The variations of the are trapped and those signals are fed as inputs to the micro-controller. Now based on these variations the micro-controller is programmed to take decisions which in turn control the movement of wheelchair.

If person tilt his head in right or left direction above, chair will move in right or left direction.

PROPERTIES BLOCK DIAGRAM

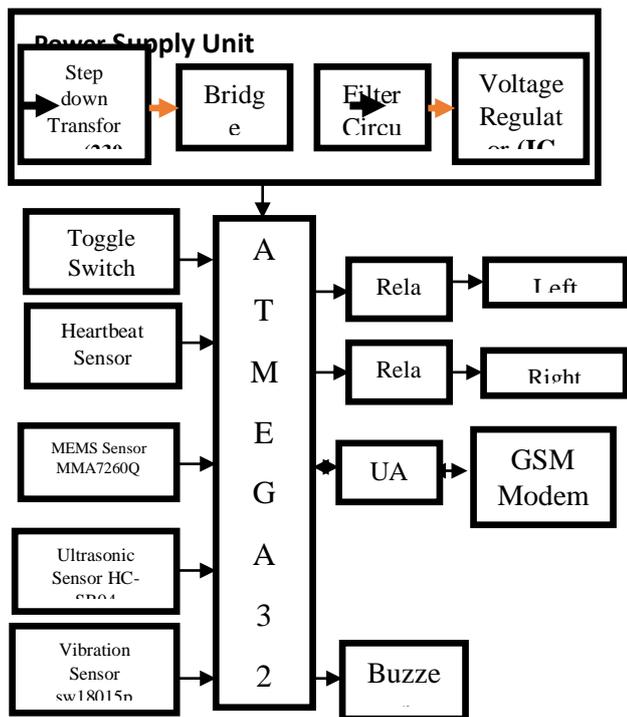


Fig: 1block diagram

POWER SUPPLY UNIT:

Power supply we have attempted our best electrical power. A device or framework that provisions electrical or different kinds of vitality to an output load or group of loads is called a power supply unit or PSU

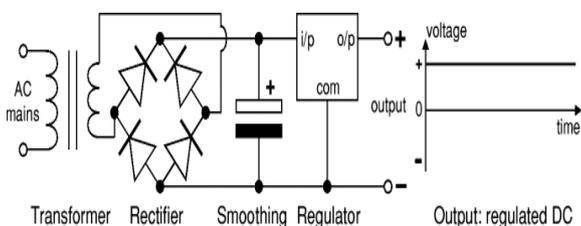


Fig2 : power supply

STEP DOWN TRANSFORMER

The transformer organize must most likely supply the current required. On the off chance that too little a transformer is utilized, all things considered, the power supply's capacity to keep up full output voltage at full output current will be disabled. With too little a transformer, the misfortunes will increase drastically as full load is put on the transformer.

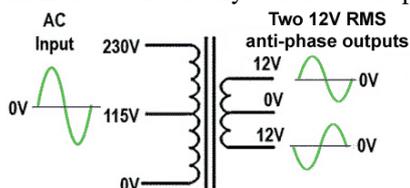


Fig3: step down transformer

THE RECTIFIER STAGE

Rectifier circuit is used to convert the AC input is converted to DC. The bridge rectifier uses four diodes are arranged in a bridge circuit. An additional advantage is that, as two diodes are conducting at any one time, the diodes directing at any one time, the diodes need just a large portion of the invert breakdown voltage ability of diodes utilized for half and regular full wave rectification. The bridge rectifier can be built from separate diodes or a combined bridge rectifier can be used.

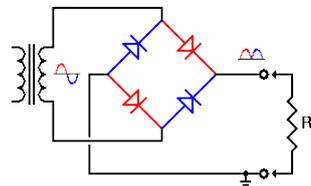
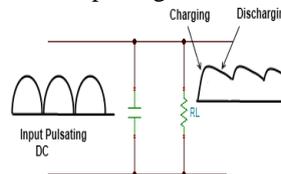


Fig4: bridge rectifier

FILTER

A typical power supply filter circuit can be best comprehended by isolating the circuit into two sections, the reservoir capacitor and the low pass filter. Every one of these parts adds to expelling the rest of the AC pulses, yet in



various ways.

Fig: filter

The activity of the reservoir capacitor on a half wave rectified sine wave. At some point close to Vpk the anode voltage exceeds the cathode voltage, the rectifier conducts and a pulse of current flows, charging the reservoir capacitor to the value of Vpk.

VOLTAGE REGULATOR

Voltage controller ICs are accessible with fixed or variable output voltages. The IC7805 arrangement of three terminal controllers is accessible with a few fixed output voltages making them helpful in a wide scope of utilization. One of these is neighborhood on card guideline, taking out the dispersion issues related with single point guideline. The voltages accessible enable these controllers to be utilized in rationale frameworks, instrumentation, Hi-Fi, and other strong state electronic hardware. Albeit planned basically as fixed voltage controllers, these gadgets can be utilized with outside segments to get adjustable voltages and current.

ARDUINO

The Micro Controller which we are using is ATMEGA328P-PU. The Arduino Uno is a microcontroller board dependent on the ATmega328. It has 14 input/output pins (of which 6 can be utilized as PWM output), 6 Analog input sources, a 16 MHz oscillator, a USB association, a power jack, an ICSP header, and a reset catch. An Arduino is really a microcontroller based unit which can be either utilized specifically by acquiring from the merchant or can be made at home utilizing the parts, inferable from its open source equipment highlight



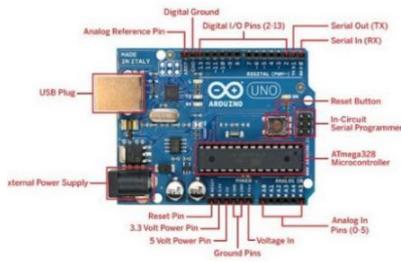


Fig5 : ATmega328

MEMS

MEMS stands for Micro Electro Mechanical System sensor. The types of MEMS devices can vary from relatively simple structures having no moving elements, to extremely complex electromechanical systems with multiple moving elements under the control of integrated microelectronics. The MEMS innovative work network has shown various miniaturized scale actuators including: small scale valves for control of gas and fluid streams; optical changes and mirrors to divert or modulate light beams; independently controlled micro mirror arrays for displays, micro resonators for a number of different applications, micro pumps to develop positive fluid pressures, micro flaps to modulate airstreams on air foils as well as many others.

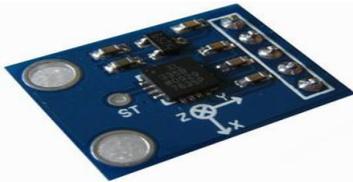


Fig6: MEMS sensor

ULTRASONIC SENSOR

The principle of ultrasonic distance measurement is air spreading velocity, measuring the time from launch to reflection when it encountered obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity.

It practical measuring distance 2cm to 80cm. Theoretical measuring 2cm to 450 cm. The HC-SR04 ultrasonic sensing element uses measuring instrument to see distance to AN object like dotty do.



Fig7: Ultrasonic Sensor

HEART BEAT SENSOR

Heart beat sensor (mode: 1157) is designed to give digital output of heartbeat when a finger is placed on it. When the center beat detector is functioning, the beat LED flashes in unison with each heartbeat. This digital output will be connected to microcontroller on to live the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse. Red LED for

transmitted light illumination and a LDR as detector. With solely slight changes within the preamplifier circuit a similar hardware and package may well be used with alternative illumination and detection ideas. The detectors photo current (AC Part) is converted to voltage and amplified by an operational amplifier (LM358).



Fig8: heartbeat sensor

VIBRATION SENSOR

Works on mechanical device principle vibration rate sensors operate in accordance with the electro dynamics principle and square measure used for activity the bearing absolute vibration supported the piezo effect. Change in resistance because of the force performing on it and convert it into four - twenty mA. They are measuring differences in oscillation, so they probably want a -12 and +12 swing with 0 as the base lineal we have piezoelectric sensor which detects the vibration created on the surface. We can additionally use shock sensing element to observe vibrations.



Fig9: vibration sensor

UART

The Universal Asynchronous Receiver Transmitter (UART) controller is the key part of the sequential communication subsystem of a PC. Converts the bytes it receives from the pc on parallel circuits into one serial bit stream for outward transmission. On inward transmission, converts the serial bit stream into the bytes that the computer handles. Adds a check bit (if it has been selected) on outward transmissions and checks the parity of incoming bytes (if selected) and discards the check bit. Adds begin and stop delineators on outward and strips them from inward transmissions. Handles interrupt s from the keyboard and mouse (which square measure serial devices with special port s). May handle other forms of interrupt and device management that need coordinating the computer's speed of operation with device speeds.

IV. METHODOLOGY

MEMS Sensor

In this project chair is operated victimisation head motion and to sense the pinnacle motion MEMS measuring system is being employed.

Micro Electro Mechanical Systems (MEMS) is that the integration of mechanical parts, sensors, actuators, and physics on a standard semiconducting material substrate through small fabrication technology. Because of their small size and weight, accelerometers are fixed in the cap to sense the head movement. In this model we are using MMA7260Q accelerometer, which is 3axis accelerometer. The MMA7260Q operates on 2.2 to 3.6VDC, and uses very less current (500uA). It has 3 analog outputs, one for every axis. Acceleration on every axis generates a voltage from zero to about three.3V

ARDUINO MICRO CONTROLLER

The Atmega328 may be a highly regarded microcontroller chip made by Atmel. It is associate 8-bit microcontroller that has 32K of non-volatile storage, 1K of EEPROM, and 2K of internal SRAM. The Atmega328 has 28 pins. The Atmega328 has 28 pins. It has fourteen digital I/O pins, of that vi may be used as PWM outputs and vi Analog input pins. These I/O pins account for twenty of the pins. The Atmega328 is one amongst the microcontroller chips that ar used with the popular ArduinoDuemilanove boards. The ArduinoDuemilanove board comes with either one of two microcontroller chips, the Atmega168 or the Atmega328. Of these 2, the Atmega328 is that the upgraded, more advanced chip. Unlike the Atmega168 that has 16K of flash program memory and 512 bytes of internal SRAM, the Atmega328 has 32K of flash program memory and 2K of Internal SRAM..

Power Supply

A device or system that provides electrical or alternative forms of energy to associate output load or cluster of masses is termed an influence offer unit or PSU. The components mainly used in power supply kit are 230V as mains, step down transformer, bridge rectifier (diodes), capacitor filter, voltage regulator(IC 7805).

V. WORKING

The head motion controlled wheel chair is work on principle of Brain Controlled Interface (BCI). The MEMS sensor in connected with pin A1, as following heart beat sensor, vibration sensor, ultrasonic sensor are interfaced with pin A0, A3, A2. These Sensors sense the signal from the human and convert it into the suitable signal which is given to ATmega328 micro controller. The initiating of the movement is taken by toggle switch. The directions of the chair which is perpendicular to each axis forward, right and left.The relay which is used to interface the micro controller and DC motor wheel. The relay for motor R1 is connected at pin 12, for motor R2 at pin 13. The heart beat sensor used to find the heart beat with the help of LDR and LED. On increase of heart beat sensed by the sensor given signal to the micro controller, which help to send a message or call to the companion of the patient. These process is carried through with the help of the Universal Asynchronous Receiver Transmitter (UART) and Global System of Mobile communication (GSM). The Ultra sonic sensor used to find the obstacles in the path of the chair. Object below 80 centimeter can be detected by the ultrasonic sensor. When the object found below 80 centimeter, the

controller uses buzzer to indicate to the patient or companion. Vibration sensor detect the vibration from the chair of any obstacles happen while movement. The message will be given to the companion using GSM.

VI. RESULT AND OUTCOME

The stimulation output is done through proteus software. The simulation output is given below.

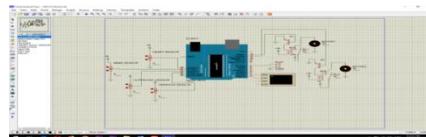


Fig10: Stimulation output

These wheel chair is created for the disable patient those who lost their leg or paralyze of the leg. The aim of the project to use wheel chair without the help of companion. This can be further modified in future. The snap of the prototype is given below



Fig11: prototype

VII.FUTURE SCOPE

- We can make a wheelchair which can be worked by a remote. Output of device are often applied to wireless transmitter circuit and might received at chair circuit by receiver electronic equipment. So wireless operation can reduce wiring arrangements
- Instead of using MEMS we can use eye retina using optical sensor to move wheelchair in different direction. Using tissue layer movement we'd be ready to drive a chair.
- Researchers are going on improvement of handicap wheelchair using nervous system of human.
- The structured wheelchair can be broadened utilizing sun powered boards which is increasingly productive. Sun powered board itself stimulates the wheelchair. But solely the downside is setup of panel and conjointly weight of chair will increase.

VIII. CONCLUSION

This work elaborates the design and construction of Smart Electronic Wheelchair with the help of MEMS Module. The circuit works properly to maneuver because the command given by the user.

After coming up with the circuit that allows physically disabled to regulate their wheel victimisation associate MEMS device application in their sensible phones and it's conjointly been tested and valid. The detection of any obstacle is with success controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle that is anticipated to lie among a spread of four metres are detected by the unhearable device. This planned system contributes to the self-dependency of otherwise abled and older folks

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