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Smart Wheelchair Based on IoT for Physically Challenged People

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ABSTRACT-

The world is technologically evolving day by day. As every second passes by new technologies are emerging into existence and knowledge of mankind is getting augmented. Numerous are problems are being faced by the man kind since it's dawn among which providing safe and unrestricted mobility for physically challenged people is one. As the world is twirling around automation, this is our rudimentary effort to help those people move with less manual dependency.

This project deals with designing a Smart Wheel Chair with IoT to help people deal with natural mobility issues. It comprises of various sensors, camera and mobile application which ensures safe and unrestricted mobility. The wheel chair is designed to have two distinct modes which cater both physically and visually challenged respectively.

Keyword: - IoT, Smart wheel chair, Arduino, Android App.

1. Introduction: -

According to World Health Organization (WHO) there are around 70 million people fighting with locomotive disability. As a part of civilization, one should feel obliged to eradicate that disability through the knowledge and wisdom we have gathered since the dawn of mankind. Over the years technologies have established a realm where almost every object we make today is smart.

These smart devices are the result of in tricatebl end of science and technology. These smart devices make the average day of a human being significantly efficient. Now these smart devices can do the mundane and repetitive tasks as well as complex tasks with utmost precision saving our valuable time and effort.

There is lot of smart wheel chairs available in the market. Often these smart devices are costly as they involve immense engineering and resources for creating them. According to a study done by WHO, only minuscule percentage of total disabled are able to afford those smart wheel chairs. Different technologies have taken their part in powering these smart wheel chairs. Involvement of these sophisticated technologies makes those smart wheel chairs are not affordable for many.

But what majority of those people wish for is, a wheel chair which makes their ordinary life better and less dependent on other affordable price. The need for this kind of smart wheel chair is increasing. So, the predominant aim of this project is to design a smart wheel chair for physically and visually challenged people within an affordable price range and without compromising safety and comfort by using emerging technologies such as IoT.

2. Proposed Methodology:-

The fundamental aim behind this project is to design a smart wheel chair which provides safe and unrestricted mobility for disabled at an affordable price range. The wheelchair we aim to design serves both physically and visually disabled people respectively. The design of this wheel chair involves incorporation of ultrasonic sensor and camera module at its forefront. The wheels are attached to the motors which are powered by motor driver circuit [L298N motor driver].

Here an Arduino development board will be used to process the data which will be received from ultrasonic sensor and also to drive the motors in desired direction. IoT technology is incorporated into the design in order to send and receive commands from user/Guardian and wheel chair.

This Smart wheel chair we aim to build here comprises of two distinctive modes which respectively assists both physically and visually challenged people. A dedicated switch will be included into the wheelchair which is useful for switching modes.

3. Manual Mode:-

This mode is to assist people who are having complete mobility issues or vision impairment issues. This mode involves a Guardian / second person for assisting the user as they are unable to operate the wheelchair.

This method basically tries to lessen the manual dependency and physical effort of the guardian. A camera module is incorporated into the wheelchair at its fore front which provides the visual data before the wheelchair to the guardian who will be operating the wheel chair. This helps the guardian to operate wheel chair from a distance but within the network range.

So, using a mobile application the user can give commands to the wheel chair using IoT technology. In our design, we have preferred telegram application for the above-mentioned process. The commands include instructions such as 'f' (Front), 'b' (back),'l'(Left),'r'(Right) respectively. Since the design is a prototype, only few commands are used. The commands can always be customized depending upon the user requirement.

The mobile and wheelchair are connected through Wireless LAN (network type can be changed depending upon the user requirements). A user who faces only mobility issues can always connect wheel chair and his mobile through Bluetooth and operate the device without any involvement of external assistance.

4. Automatic mode:-

This mode is helpful for the user during the absence of Guardian. However, making a wheelchair completely automatic and providing unrestricted mobility to the users involve complex sensors and algorithms which make the device costly and far to reach for most of the people. So, we are trying to design a mode which helps the user to perform daily chores, such as moving insides a house.

An example would be user trying to move from bedroom to living room. The users will be provided with restricted mobility indoors whose geometric features and dimensions are well known. Since we live in a dynamic environment, things around us changes quickly. In order to ensure the safety of the user, a pair of Infrared sensors has been included into the wheelchair at its forefront. Whenever user switches to Auto mode, these sensors get ON and whenever there is an obstacle in the path of the wheel chair the sesensors detect them. Whenever an obstacle is detected, the wheelchair stops moving and buzzer goes on for to alert the user. So, these IR sensors act as obstacle detecting devices for this design. This mode doesn't change the life of the disabled in a highest exalted way rather tries to lessen the manual dependency to perform their daily chores.

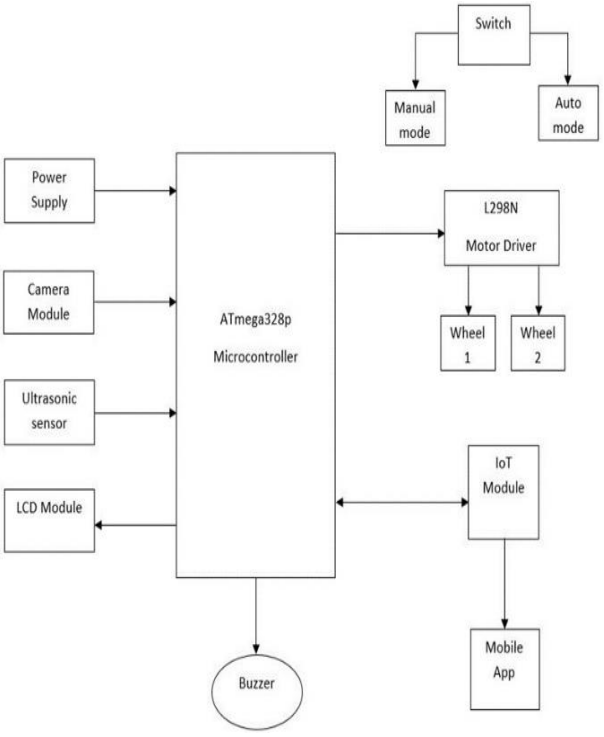

Fig.1.SmartWheelchairIoT Block Diagram

5. Hardware Requirement:-

The design comprises of various Hardware components for implementation. Arduino UNO has been employed in this design for the primary processing which contains AT mega 328p micro controller.

An IoT module (ESP8266) has been used for trans- mission of data to and from mobile application to wheel chair. Camera Module (ESP32) is used for visual data gathering Motor Driver (L298N) used for driving the two DC motors.

IR sensors are used for obstacle detection purpose. LCD module is used for displaying Wheelchair direction of motion. Buzzer used for to produce alert sounds during obstacle encountering. Slide switch used for switching between the two modes. DC Motors are used for to provide mobility to the wheelchair.

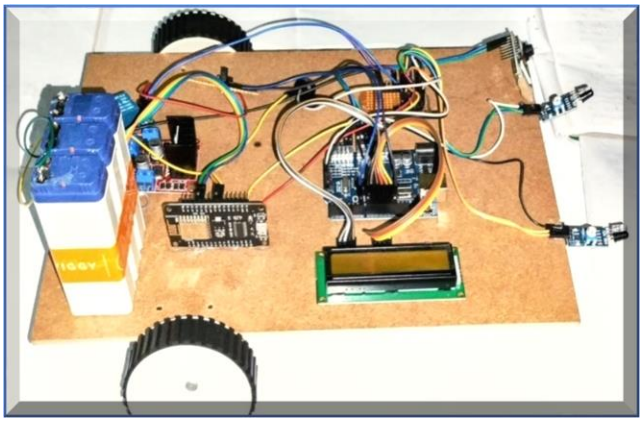

Fig 2: Smart Wheelchair based on IoT

6. Software Requirements:-

The programming of Arduino has been done in Arduino IDE. Arduino IDE is a special software running on your system that allows you to write sketches (synonym for pro- gram in Arduino language) for different Arduino boards.

The Arduino programming language is based on a very simple hardware programming language called processing, which is similar to the C language. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, at ext console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help.

7. Results:-

The wheelchair is powered by a smart phone in this design. The IoT module is used to establish communication between smart phone and wheel chair.

The Telegram android application is used for controlling the wheelchair by providing respective commands. When a command such as‘f’(Front),‘b(back),’l’(Left),’r’(Right) is given through the telegram application, the command will be received by wheelchair through IoT module via telegram server.

The visual data gathered by the camera module can be accessed through any mobile browser. The wheelchair travelling direction status will be provided by the telegram application when valid commands are given.

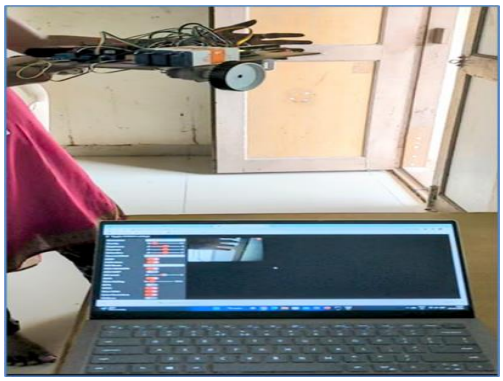

Fig 3: User accessing Visual data from ESP32 Camera module.

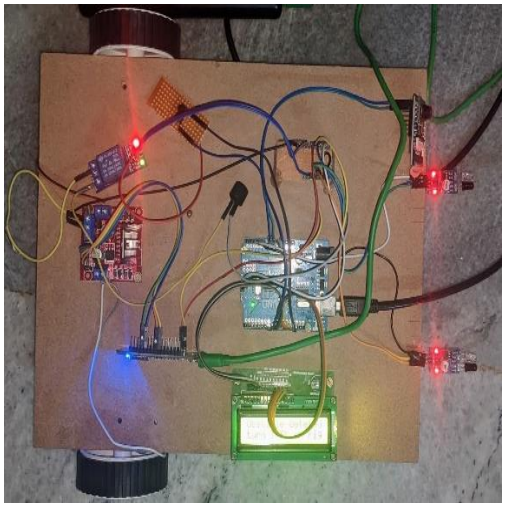

Fig 4: Smart Wheelchair upon power supply.

8. Conclusion:-

Technology has been long serving the mankind to get rid of the problems or at least mitigating them. Designing of less expensive smart wheel chair is one among them.

The first and foremost application of this design is to help people with mobility and visual impairment issues. The design of this smart wheel chair includes comparatively less expensive elements such as Arduino and IR sensor which makes the device accessible and affordable for larger masses of people.

On the flip side this methodology of the Smart wheelchair can be adopted to design other robots which can perform human base deactivities.

Few changes to the device and the device can also be used in rescue operations (such as fire outbreaks, earthquakes) without actually risking the lives of rescue teams / Police to save the vulnerable. They can be industrial robots for operating machines and assembling or panting different automation-related objects.

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