An Automated Wheel Chair: A Step towards Innovation

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Abstract: There are 8 billion people on the earth. Among them, there are 650 million people who have disabilities. Their disabilities are different. Among them, more helpless are those who cannot move for their disabilities. Besides them, some people have difficulties in mobility for the sake of their ages. For the past few decennary the automation of the wheelchair and its technical advancement has been the top most priority to the scientists and researchers. This unique and automated "Automated Wheel-Chair" can be the solution to the problems of those disabled people regarding their mobility. In the wheelchair obstacle detection is implemented using ultrasonic sensors, location tracking by GPS and many more. It provides the rider with a comfortable seat. The design of this wheelchair can provide the feature of self-control with the help of Infrared Sensor or IR sensor. The microcontroller (Arduino Uno) based circuitry design allows sending emergency messages to the mobile application of the user's family through IoT technology.

Keywords: Aged peoples; Disability of movement; IoT; sensors; Obstacle detection.

I. INTRODUCTION

A huge number of people in our society are unable to move due to their disabilities. These disabilities may be caused by different reasons; some may be caused by birth or some may be caused by accident. According to Nayak and his team [1], 650 million people have a disability.
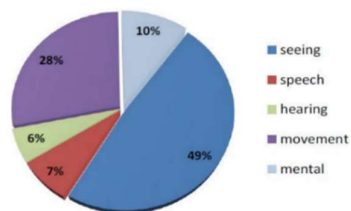

Fig 1: Percentage of distribution of disability [2]

In this research paper, we have worked on the disabilities of mobility and tried to solve their challenges.

A wheelchair helps persons, who have movement disabilities, to move from one place to another. But in a normal wheelchair rider have to operate the chair by whim/herself or he/she has to take help from others. An automated wheelchair can solve this problem.

The advancement of technology has solved many difficulties in our everyday life. Using advanced technology, we can solve the movability problem for those disabled persons.

In this research paper, we have discussed an automated wheelchair which can be operated automatically as well as manually as per riders' choice. This paper presented various objectives which highly differentiate the ordinary wheelchair. Generally, an ordinary wheelchair cannot run automatically or cannot be traced out. But this wheelchair has a sensor which will detect the obstacles in front of it and will move safely. Also, a GPS will help the chair with tracking. In addition, the seat belt will give the rider a safe ride.

II. LITERATURE SURVEY

A team of renowned researchers and scientists have been working on the automation of wheel chair and its technical advancement for the past few years. Many of them have described different bases of wheelchairs and advanced automated wheelchairs which are using different technical parameters. reference we can say, Hartman and his team [9] have presented a wheelchair as a chair with wheels that helps people who face difficulty in walking independently. Wanluk has described [10] an automated wheelchair in which a GPS system is used for location tracking. PU and his team have given an idea [11] on the obstacle detection of the wheelchair using IR sensors, IR camera sand ultrasonic sensors.

III. METHODOLOGY

In everyday life, the wheelchair is helpful to physically disabled people as it helps them to roam around here and

there, without the help of any other person as it has an interface with assistive nature.

There is a microprocessor (Microchip PIC6F88 microcontroller) which helps control the speed and direction simultaneously [3].

A. *System Architecture*:
- Joystick: The manual operation of The Automated Wheel is very simple. The joystick helps the chair in manual movement.
- GPS module: GPS module is used to track the wheelchair as well as to locate the destination if the user wants to go from one place to another.
- DC motor: Give the wheelchair auto-mobility.
- IR sensors: It is used to detect the obstacles on the way.
- A switch for controlling the height of the footrest: A single switch is added to change the height of the footrest of the wheelchair as per the user's comfort.
- Mobile app-based control: A mobile app-based tracker and controller is also installed for extra safety. For any kind of malfunction or glitch of the system the family of the user can track or control the wheelchair through the mobile application.
- Drivers: The drivers are used to control the motor.
- Push-Buttons: The push buttons are used to set the destination in auto mode.

B. *Description of proposed methodology:*
- IR sensor: IR sensors are used to detect any obstacles in the way of the wheelchair. The sensor detects the obstacles and sends a signal to the system [4]. The chair moves according to the signals. For better results, we have used two IR sensors here.
- GPS module: For the tracking [5] of the wheelchair or to set the destination while the user is going from one place to another place the GPS parameters such as longitudes and latitudes are used. For any malfunction, the system can send the notification to the user's family members through the mobile app.

Fig 2: GPS module

- Ultrasonic sensor: For providing extra safety to the user an ultrasonic sensor is also added to the system. It also helps to detect [6] the obstacles on the way.

Fig 3: Ultrasonic sensor

- Joystick: To roam with the wheelchair in manual operation mode joystick helps [7] the user to operate. Here we proposed to use Reinforced Joystick 3.2 for the working purpose.
- DC motor: A DC motor is an electrical device that converts direct current electrical power into mechanical power. It supplies powerfor the movement of the wheelchair. The specification [8] of the used DC motor is: 24V DC motor, required current 15.4 A, rated power of 280W and 2750 RPM.
- Battery: A secondary (means rechargeable) Lithium-ion battery is used to supply the power to the dc motor and the other equipment.

C. *Working principle:*

There are few steps through which an automated wheelchair can detect the obstacles on its way. The steps are:
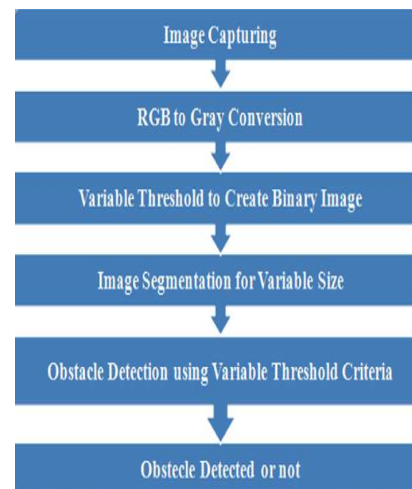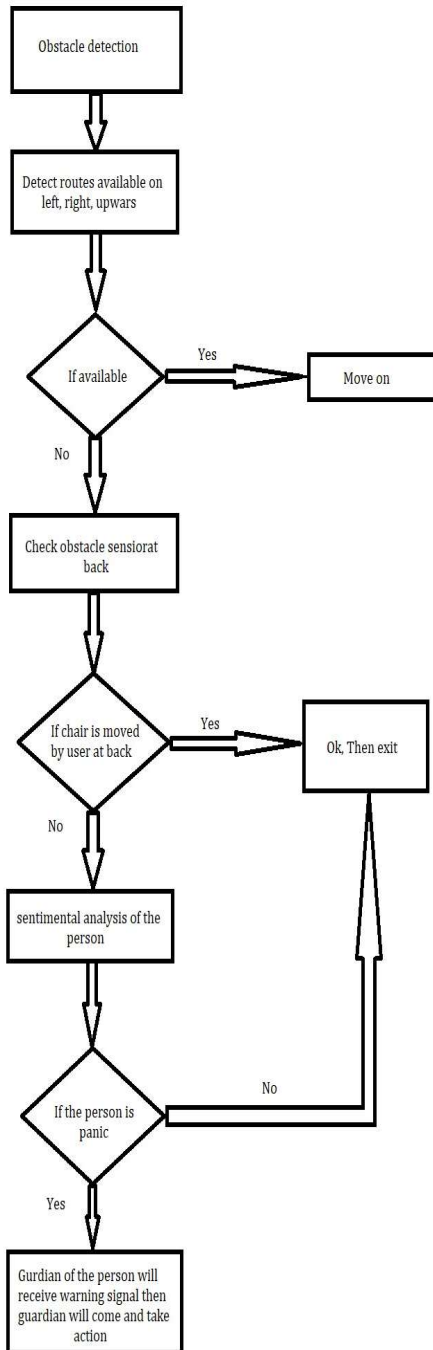

Fig 4: Steps for obstacle detection of an automated wheelchair.

Now, with the help of a simple flow chart, we can easily understand the working procedure of a wheelchair. The flow chart is given below:

```
┌─────────────────────┐
│  Obstacle detection │
└─────────────────────┘
          │
          ▼
┌─────────────────────┐
│ Detect routes       │
│ available on        │
│ left, right, upwars │
└─────────────────────┘
          │
          ▼
      ◇ If available ◇ ──Yes──▶ ┌──────────┐
          │                      │ Move on  │
          No                     └──────────┘
          │
          ▼
┌─────────────────────┐
│ Check obstacle      │
│ sensiorat back      │
└─────────────────────┘
          │
          ▼
   ◇ If chair is moved ◇ ──Yes──▶ ┌──────────────┐
     by user at back              │ Ok, Then exit│
          │                       └──────────────┘
          No
          │
          ▼
┌─────────────────────┐
│ sentimental         │
│ analysis of the     │
│ person              │
└─────────────────────┘
          │
          ▼
   ◇ If the person is ◇ ──No──────┘
         panic
          │
          Yes
          ▼
┌─────────────────────┐
│ Gurdian of the      │
│ person will receive │
│ warning signal then │
│ guardian will come  │
│ and take action     │
└─────────────────────┘
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3 Fig 5: Algorithm for Obstacle detection

IV. RESULT AND DISCUSSION

As we are implementing the both automated and manual mode operation technology in this automated wheelchair, there might occur few complications about the command. Though the destination is set previously in the mobile application; but when the user will use the wheelchair on the

way to the destination there might happen some changes in the situation. Depending on the situation user have to made some decision to change the direction of the wheel chair. So, the first command preference will be the command of joystick.

As for example we can say that, to reach the destination mobile app gives the command to go to the right. But depending on the situation user moves the joystick towards left. In this situation the wheelchair will take the command of the joystick and will go as per user's command from the joystick.

The implementation of the project of The Automated Wheel Chair will help those physically disabled people to roam independently. Sometimes it has been seen that some depression is seen among them due to their disability. But this independent roaming can also cure their mental health. Moreover, The Automated Wheel Chair can be used for the roaming purpose of old age people who cannot freely roam around for their ageing factor.

V. CONCLUSION

In this paper, we have proposed the basic concept of The Automated Wheel Chair which will be able to operate indoors as well as outdoor. The GPS tracking system can ensure the safety of the user. We tried to make the life of a handicapped person a little bit easier. Before the automated wheelchair is widely used there are a few challenges which should be solved. After marketisation, the automated wheelchair will be very useful for physically challenged persons as well as for old age persons.

VI. FUTURE AMELIORATION

In this paper, we have discussed a few basic features of the automated wheelchair. We plan to add more features to this automated wheelchair such as a Heartbeat monitoring system, Blood pressure measure system, body temperature measurement, foot massage system which will help the user in good blood circulation as they can't walk by them, weather detection system and its consequence actions like in sunny or rainy-day automated shading over the user and so on.

We can give every wheelchair a unique serial no through which it will connect to the mobile app and it will also be registered to the hospitals. If any abnormalities occur in the heart rate; if body temperature or blood pressure increases above the normal level, then the user's family will get an alarm or notification on their mobile application through IoT

technology. And they will be able to take the required action.

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VIII.   BIOGRAPHY

Smita Kundu was born in Kolkata, on 8thApril, 1999. She completed her secondary and higher secondary education from Barasat Kalikrishna Girls' High School in 2017 and 1019 respectively. Currently she is pursuing her Btech degree in Electronics and Communication Engineering from Guru Nanak Institute of Technology, Sodepur, and Kolkata.