An innovative autonomous wheelchair conversion kit

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Abstract. Independent mobility is very important for human beings for fulfilling their needs. Some people use wheelchairs to improve their limitation in mobility due to their disabilities. However, some wheelchair users cannot use it independently and therefore they might need help from others who are not always available. Therefore, they need an assistive device that able to detect the surrounding environment, choose the path and move along it while avoiding any obstacles. In this paper, an innovative autonomous conversion kit preliminary design is presented. The proposed system contains two main subsystems: Self-positioning and mapping systems. The main problem in autonomous vehicles is accurate localization and accurate heading toward the destination. To improve the accuracy averaging technique is proposed. Moreover, two rotary encoders are used to calculate the rotation of the wheels to make sure the wheelchair can move straight. Moreover, the rotary encoder readings were combined with a compass reading to adjust the rotating angles to be more accurate. Experiments have been conducted on the ability of the system in getting the accurate and precise location. Moreover, the initial ability to find the path to reach the destination is evaluated. Results demonstrate the ability of the wheelchair to move autonomously in the real time.

Keywords: Wheelchair; Autonomous; EV; Assistive technology.

5. Conclusion

In this paper, an autonomous conversion kit has been presented using a GPS navigation system for self-positioning to get the updated current position. The reading has been optimized by using the averaging technique to get more constant and accurate reading. Compass is used to get the information on the wheelchair heading. Two rotary encoders are used to calculate the rotation of the wheels to make sure the wheelchair can move straight. Moreover, the rotary encoder readings were combined with the compass reading to adjust the rotating angles to be more accurate. The design applied the add-ons concept to give more options to the users so that they only need to buy the system instead of buying a new autonomous wheelchair. The system was tested and validated in real time. By applying both rotary encoder and compass, the turning error has been minimized from 9.30% to 1.40%.

The future improvement includes adding the obstacles detection to the system so that the wheelchair is able to detect and avoid any harms that appear on its path. The wheelchair is supposed to be able to change the direction when there is an obstacle and apply a new path to reach the destination point. Moreover, a robust algorithm is to be developed in order to choose the shortest and safest path to reach the destination.

6. References

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Acknowledgments

The authors acknowledge University Malaysia Pahang for supporting this research under the postgraduate research scheme grant PGRS180350 and the UMP grant RDU180334.