RES MILITARIS Social Science Journal

BLUETOOTH WITH GSM BASED SMART WHEELCHAIR TECHNOLOGY WITH SAFETY AND CONTROL FACILITY

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ABSTRACT
Bluetooth technology integration facilitates smooth connection between the smart wheelchair and user-operated devices like smartphones and tablets. This project focuses on the development of two cutting-edge assistive technologies: mobile-based and voice controller-based wheelchairs. These technologies aim to improve the mobility and freedom of persons with disabilities. These technologies use mobile apps and speech recognition algorithms, respectively, to provide effortless wheelchair control and navigation.

The mobile wheelchair system integrates a mobile application that is loaded on a smartphone or tablet. The instructions are sent to the wheelchair control system, allowing users to navigate their wheelchairs using visual and aural prompts supplied by the program. The voice controller-based wheelchair system utilizes speech recognition technology to understand spoken orders from the user.

Individuals with restricted physical capabilities may enhance the efficiency of using their wheelchairs by removing the need for manual controls. Both systems provide top priority to ensuring user safety by integrating temperature sensing techniques and obstacle avoidance capabilities. Here, GSM technology is used to receive signals when the temperature or barrier is detected.

The project's objective is to build a wheelchair that includes technologies such as obstacle detection and electronics to prevent collisions. Integrating an embedded systems solution into a self-propelled wheelchair improves its potential to be upgraded. Physical impairment is a significant detriment to human existence. The primary function of the wheelchair is to provide safe mobility for those with disabilities. In addition, a regulated LCD has been included to accommodate those with auditory disabilities.

I. INTRODUCTION

In an era marked by technological advancements, innovation in mobility solutions has become imperative, especially for individuals with physical disabilities. One such groundbreaking innovation is the integration of Bluetooth and GSM technology into smart wheelchairs, offering unparalleled safety and control features. This amalgamation of cutting-edge technologies not only enhances user experience but also fosters independence and autonomy for individuals with mobility impairments.

Gone are the days when wheelchairs were merely passive devices; the advent of Bluetooth and GSM connectivity has transformed them into intelligent, interconnected devices capable of seamless communication and remote monitoring. By harnessing the power of Bluetooth, these smart wheelchairs can synchronize with a myriad of devices, including smartphones, tablets, and wearable gadgets, thereby enabling users to control their mobility aids effortlessly through intuitive interfaces.

Moreover, the integration of GSM technology empowers smart wheelchairs with real-time

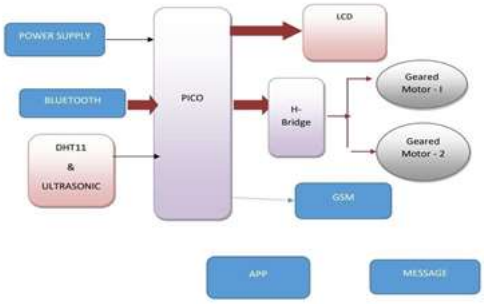
tracking and remote monitoring capabilities. Through GSM-based communication, caregivers and loved ones can remotely access vital information such as location, speed, and battery status, ensuring enhanced safety and peace of mind for both users and their support network. In the event of emergencies or unexpected situations, instant communication facilitated by GSM technology enables swift assistance, thus mitigating potential risks and ensuring prompt intervention.

Safety lies at the core of smart wheelchair technology, and Bluetooth-enabled GSM-based systems take it a step further by incorporating advanced safety features. From collision detection sensors to obstacle avoidance mechanisms, these smart wheelchairs employ state-of-the-art technologies to anticipate and prevent accidents, thereby enhancing user safety and reducing the risk of injuries.

Furthermore, the control facility offered by Bluetooth connectivity enables users to customize their wheelchair experience according to their unique preferences and requirements. Whether adjusting speed settings, modifying control interfaces, or accessing supplementary features such as voice commands and gesture recognition, Bluetooth connectivity empowers users with unparalleled flexibility and control over thir mobility aids.

In essence, the fusion of Bluetooth and GSM technology in smart wheelchair systems represents a paradigm shift in mobility assistance, heralding a new era of independence, safety, and empowerment for individuals with mobility impairments. As these innovative solutions continue to evolve, they not only redefine the concept of mobility but also exemplify the transformative potential of technology in enhancing quality of life for all.

1.2 BLOCK DIAGRAM:



1.3 BLOCK DIAGRAM DESCRIPTION:

1.3.1 Power Supply:

All digital circuits require regulated power supply. Here we used +6V battery or direct power supply is given.

1.2.1 Bluetooth Module:

The Bluetooth module, enables short-range wireless communication between the smart wheelchair and user-controlled devices like smartphones or tablets. It establishes a secure and efficient data link, allowing users to control the wheelchair and receive real-time feedback via a dedicated mobile application.

Figure 1. Bluetooth Module

1.2.3 DHT11 Sensor:

The DHT11 sensor is a digital temperature and humidity sensor. It features a calibrated digital signal output and provides real-time data on the wheelchair's environmental conditions. This information ensures the user's comfort by

allowing the system to adapt to temperature and humidity variations. If the temperature exceeds more than the actual temperature then the sensor detects it and sends an alert message to the mobile as a notification. Similarly, the DHT11 Sensor can also detect the humidity levels in the environment.

Figure 2. DHT11 Sensor

1.2.4 Ultrasonic Sensor:

An Ultrasonic Sensor is an instrument that measures the distance to an object using ultrasonic soundwaves. An Ultrasonic Sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. It emits ultrasonic waves and measures the time taken for the waves to bounce back. By calculating the distance to obstacles, the system can identify potential collisions and navigate around them. This enhances the wheelchair's safety and helps in avoiding accidents.

. Figure.3 Ultrasonic Sensor

1.2.5 H-Bridge:

An H-Bridge is an electronic circuit that allows the Raspberry Pi Pico to control the direction and speed of the geared motors. It uses transistors to switch the current flow, enabling precise control over the motors. This component is crucial for the wheelchair's manoeuvrability and responsiveness to user commands.

H-bridge drivers are a long-established means for enabling bidirectional motor driving. By using one, rotation of the motor can be driven, and the polarity of the supply to the motor can be swapped in order to change the direction of rotation.

Figure .4. H-Bridge Module

1.2.6 Geared Motors:

Geared motors are responsible for propelling the wheelchair. With two motors, differential steering can be achieved, allowing the wheelchair to make precise turns. Each motor's speed and direction are independently controlled, contributing to the wheelchair's overall agility. They are 2 geared motors used in this project which are controlled by H-Bridge.

Figure 5. Geared Motor

1.2.7 Liquid Crystal Display (LCD):

The LCD (Liquid Crystal Display) serves as an onboard interface, providing visual feedback to the user. It displays critical information such as battery level, environmental conditions, and system alerts. This enhances user awareness and contributes to a seamless interaction between the user and the wheelchair. In this Project LCD displays the commands given in mobile application and the temperature degrees in it.

Figure 6 Liquid Crystal Display

1.2.8 GSM Module:

The GSM module, enables long-range communication through the GSM network. It expands the wheelchair's communication range beyond Bluetooth, allowing caregivers to remotely monitor the wheelchair's location, receive status updates, and send control commands via SMS.

Figure,7. GSM Module

1.2.9 Raspberry Pi Pico:

A Raspberry Pi Pico is a low-cost microcontroller device. Microcontrollers are tiny computers, but they tend to lack large volume storage and peripheral devices that you can plug in (for example, keyboards or monitors). A Raspberry Pi Pico has GPIO pins, much like a Raspberry Pi computer, which means it can be used to control and receive input from a variety of electronic devices.

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Figure .8. Raspberry Pi Pico

2 PIN DESCRIPTION:

Raspberry Pi Pico is a microcontroller board (released on 21 Jan 2021) mainly developed for robotics and embedded applications. Unlike other Raspberry Pi modules, this board is not a full computer.

Pico is the most economical board among other Raspberry Pi modules. At the time of writing this article, you can get this device in only $4 which is a cost-effective solution to your electronic needs.

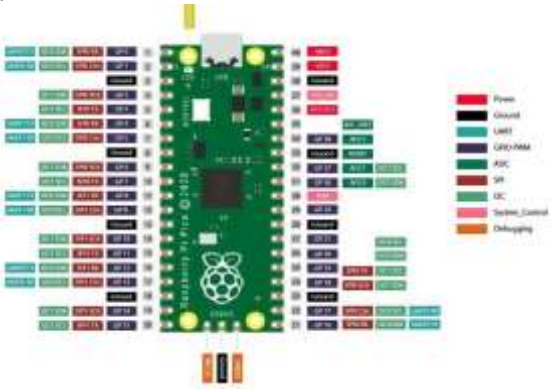

Figure .9. Complete Raspberry Pi Pico Pin Description

Dual-core Arm Cortex-M0+ processor is added to the board that comes with flexible clock frequency up to 133 MHz This frequency is required for the synchronization of all internal functions. The SRAM of this

unit is 264KB and flash memory is 2MB that is employed to store different files.

Pico board comes with an on-board buck-boost SMPS that can produce the desired 3.3 volts (to power RP2040 and external circuitry) through a range of input voltages (~1.8 to 5.5V)

II. RESULT:

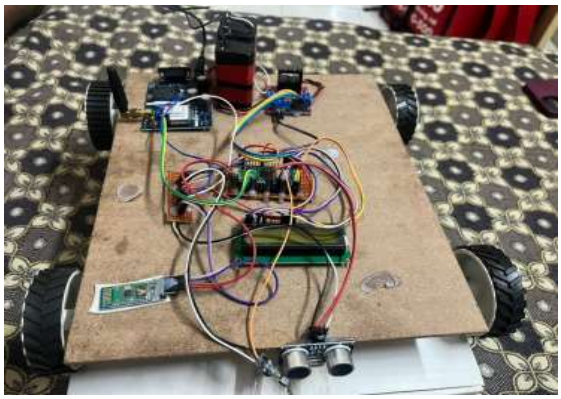

Figure .10. Result Module

The result of the project to create a Bluetooth and GSM-based smart wheelchair technology with safety and control features would be a fully functional prototype or product that enhances the mobility, safety, and convenience of wheelchair users. Here are some key outcomes and benefits of the project:

III.Conclusion:

This wheelchair system is a fusion of mechanical, electrical, and communications systems. The primary goals were to create an android application capable of controlling wheelchair movement, to implement voice recognition and touch modes to assist elderly and physically disabled individuals in independently operating their wheelchairs, and to enable control of wheelchair movement through android smartphones for elderly and physically disabled individuals.

The developed system has passed many testing and has successfully satisfied the fundamental performance requirements. The goals were successfully accomplished, as the software and hardware implementation functioned precisely as anticipated.

This system aims to assist elderly individuals and those with physical impairments in operating wheelchairs using either a touch mode or speech recognition mode. As a result, this achievement will benefit a wide range of individuals with disabilities.

The performed study unequivocally demonstrates that a mobile controlled wheelchair has a promising future. The project should be further advanced and expanded in the future because to its immense potential for enhancing performance, dependability, and safety.

To enhance future performance, it is recommended to use a more robust and less burdensome motor that can accommodate users of different weights. In addition, this system requires other upgrades in order to better its accuracy and effectiveness. To enhance the performance, it is recommended to reduce the latency in speech mode and install an object sensor to prevent wheelchair collisions.

Future Scope:

The project to create a Bluetooth and GSM-based smart wheelchair technology with safety and control features has significant future scope for further development and enhancement. Here are some potential avenues for future expansion and improvement:

1. **Integration of AI and Machine Learning:** Implementing AI and machine learning algorithms can enhance the smart wheelchair's capabilities, such as improving obstacle detection and navigation in complex environments, predicting user behaviour and preferences, and optimizing energy consumption.
2. **Enhanced Sensor Technology:** Continued advancements in sensor technology can lead to the integration of more sophisticated sensors, such as LiDAR, radar, and depth cameras, to provide higher accuracy and reliability in detecting obstacles, navigating terrain, and ensuring user safety.

3. **IoT Connectivity and Cloud Integration:** Integrating Internet of Things (IoT) connectivity and cloud integration can enable additional features such as remote firmware updates, data analytics for performance optimization and predictive maintenance, and seamless integration with other smart home devices and healthcare systems.

4. **Wearable Devices and Biometric Sensors:** Incorporating wearable devices and biometric sensors, such as heart rate monitors and fall detection sensors, can provide real-time health monitoring and emergency response capabilities, allowing caregivers and healthcare providers to monitor the user's well-being remotely.

5. Voice Control and Natural Language Processing: Implementing voice control and natural language processing (NLP) technologies can enable hands-free operation of the smart wheelchair, allowing users to control it using voice commands and conversational interactions.

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