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Smart Wheel Chair for Specially Abled People

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Abstract:- Numerous people experience either temporary or permanent disability as a result of illnesses or accidents. When one's mobility is difficult or impossible, using a wheelchair becomes essential. Wheelchairs that are manually or electrically operated sufficiently satisfy the requirements of people with mild to moderate disabilities, enabling them to drive the wheelchair on their own. However, using a wheelchair independently becomes difficult or impossible in cases of severe handicap. To overcome these obstacles, wheelchair technology researchers are working to create intelligent wheelchair solutions. This paper reviews recent research on smart wheelchair systems with the goal of evaluating current technology and identifying future areas of research.

Keywords:- *Accidents, Illnesses, and Disability, Wheelchair, Manual Electric ,Technology.*

I. INTRODUCTION

Power wheelchairs (PW) are essential for the mobility demands of those with cognitive, motor, or sensory impairment, regardless of the cause—disability or illness. Some disabled individuals employ alternate systems of control, including thinking control, sip-n-puff, chin and head joysticks, to navigate their personal wild west. PW users frequently struggle with everyday manoeuvring chores and may use assistance with an automatic guidance system. In addition to their limited mobility, people with disabilities rely heavily on their carers for tasks like eating and drinking, dealing objects, and socialising, particularly in large gatherings. To meet the needs of the population of people who find it difficult or impossible to operate a PW, a number of researchers have created smart wheelchairs using technologies originally intended for mobile robots. Typically, a smart wheelchair (SW) is made up of two bases: a mobile robot base with a seat connected, or a normal PW base with a computer and many sensors added. According to Pineauet al. (2011), the switch from manual to powered wheelchairs is not as significant as the switch to wheelchairs that work with the user; in fact, it may be even more significant because it would represent a paradigm change as opposed to just a technological one..

A multidisciplinary strategy based on new technologies is needed to develop new systems for the assistance of the aged and disabled, according to their needs. Researchers in the domains of advanced technologies, paramedicine, and medicine can work together to directly develop new approaches that range from basic support to different access services like websites, smartphones, and so forth. Intelligent wheelchairs, a type of rehabilitation device, can be very helpful in enabling the elderly and disabled to live more freely and independently.

II. LITERATURE REVIEW

The literature review delves into previous research studies conducted to assess the needs of individuals with disabilities and their quest for independent mobility. It encompasses a comprehensive exploration of smart wheelchair-related literature, incorporating insights from various patents and research papers considered during project design. The following summaries highlight key aspects of the reviewed works:

- The first paper concentrates on developing an IoT- driven smart wheelchair designed specifically for people with disabilities. It investigates the fusion of sensors, communication modules, and Internet of Things technologies. to enhance mobility and overall user experience. Emphasizing with the use of obstacle detection, navigation algorithms, and user-friendly interfaces, the project hopes to provide a complete solution that will increase impaired people's freedom and quality of life

- Another article discusses the necessity for a wheelchair control system that is both effective and user-friendly, especially for those with impairments. The proposed Human Machine Interface Wheelchair utilizes Wi-Fi communication for seamless interaction between the user and the automatic wheelchair. Equipped with various sensors, a microcontroller, and a Wi-Fi module, the system detects user commands and facilitates wireless communication, allowing for easy navigation and control.

- A third paper introduces an automated solution for enhanced mobility and independence in electric wheelchairs. A microprocessor, sensors, motors, and a power source make up the system. Sensors pick up on ambient barriers and human commands, and the microcontroller processes the inputs to control motors for appropriate wheelchair movements. The integration of technologies such as ultrasonic and accelerometer sensors enhances functionality, ensuring safety during navigation.

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People are unable to carry out daily chores due to infirmities affecting their hands, feet, and lower extremities. There are numerous technologies available to solve this issue. There are numerous apps available on the market that assist persons with disabilities in carrying out their responsibilities in order to solve this issue. The proposed design includes a voice activation mechanism for physically challenged people as well as manual control. A person with a disability depends on other people to do daily tasks like getting about. Numerous studies have shown that independent mobility—which includes walkers, motorised wheelchairs, and manual wheelchairs—can be beneficial for both adults and children. Independent movement fosters sense of self-sufficiency and lessens reliance on family members and carers.

For those with disabilities, the voice-activated wheelchair that is being designed would be more convenient. The gadget can also improve safety for users of regular joystick-controlled powered wheelchairs by decreasing collisions with walls, furniture, immovable objects, and other persons. Such a system has numerous benefits, including:

It lessens the labour of humans. For those who are unable of using due to physical impairments hand controls for household appliances, this is useful. As some people are too sluggish to go turn off the appliances by hand, this will assist save energy to some extent. For those who have used it before, it is simple to use and eliminates the need for manual hand operation of the household appliance. It lowers the danger.

The authors of this paper concentrate on an Internet of Things (IoT)-based smart wheelchair system that uses sensors to collect information about the wheelchair's surroundings and its user's health. Wheelchair motions are made possible by actuators, which respond to inputs and process data, while the microcontroller manages operations. A wireless communication module facilitates connectivity with external devices, and the integration of IoT technology allows connection to several smart tools and services. A tablet or smartphone may be connected to the system, enabling remote control, notifications, and access to additional features for real-time monitoring, automatic obstacle detection, avoidance, and location tracking.

Table 1. Literature reports on smart wheelchairs:

Smart Wheelchair	Range of publication dates
Automated-Guided wheel chair	1992
Autonomous Wheel chair Arizona State	1986
CHARHM CDTA ,Algeria	1996
COACH French Atomic Energy	1993
Hephaestus TRAC Labs, U.S	1999-2003
Intelligent Wheel chair System Osaka University , Japan	1998-2002

III. TECHNOLOGY USED FOR SMART WHEEL CHAIR

- *Ardunio*

Electronics projects are built using the Arduino open-source platform. The Arduino system consists of an IDE (Integrated Development Environment) software that is installed on your computer and is used to write and upload computer code to the programmable circuit board, sometimes referred to as a microcontroller. The Arduino platform has been more popular among those who are new to the world of electronics, and with good cause. Unlike most previous programmable circuit boards, the Arduino can have its code updated via a USB cable rather using a separate hardware device called a programmer. Additionally, the Arduino IDE uses a shortened version of C++, which makes learning to programming easier.

- *Bluetooth*

Short-range wireless communication is a popular application of this technology. It's employed in the HAN network in the context of smart grids. It makes use of radio communication at short wavelengths in the 2400–2480 MHz Industrial, Scientific, and Medical (ISM) band. The primary benefits of this technology are its widespread accessibility, high speed information interchange, and low power consumption. IEEE 802.15.1 is the Bluetooth standard. Its maximum data rate is 1 Mbps, and its reach is 10 m. When a considerable distance is involved in the HAN network, such as in a large commercial building, the short range becomes a drawback [15][16]. It supports significantly fewer nodes, which can be a serious problem for HANs. Interference (using the same 2.4GHz frequency as other WCTs, such as Wi-Fi)

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➢ *Motor Driver(L293D)*

In essence, A motor driver is a current amplifier that raises the low-current signal from a microcontroller to a correspondingly higher current signal. that may be used to drive and control a motor. The majority of the time, a transistor can function as a switch and operate the motor just in one direction.

➢ *Axis Gyro Accelerometer*

The MPU6050 sensor module is a comprehensive 6-axis motion tracking device, encompassing a 3-axis gyroscope, a 3-axis accelerometer, and a Digital Motion Processor. Augmenting its functionality, the module also integrates an on-chip temperature sensor. Facilitating seamless communication with microcontrollers, it employs an I2C bus interface. Moreover, the MPU6050 can be interfaced with additional sensor devices, such as a pressure sensor and a 3-axis magnetometer, utilizing its auxiliary I2C bus. An intriguing feature is its capability to provide a complete 9-axis Motion Fusion output when coupled with a 3-axis magnetometer connected to an extra I2C bus.

IV. CLASSIFICATION FACTORS OF SMART WHEELCHAIR

A smart wheelchair can be categorised according to a number of factors, including the following:

➢ *Form Factor*

Initially the wheelchairs which was produced was costly and are called as mini-robots. Additionally, the other wheelchairs which are available in the markets are different external components that are readily obtainable and easily installed to standard wheelchairs.

➢ *Input Methods*

Based on the preferences of the individual user, there are many feedback methods for the smart wheelchairs. Biometrics, cloud, touch, voice, computer vision, brain-computer interface, haptic feedback, and other methods are a few of the input methods for smart wheelchairs. Every technique for gathering feedback has a purpose and should be customised according to the demands.

➢ *Sensors*

The smart wheelchair is equipped with a variety of sensors, including infrared, ultrasonic, laser rangefinders, cameras, and others. Sensors provide inputs from the surroundings, which the wheelchair's computer manages. Smart wheelchairs are typically equipped with safety measures thanks to sensors.

➢ *Operating Modes*

The operational methods of a wheelchair are another important characteristic element of a smart wheelchair. Wheelchair operating systems are operated by the user and in accordance with current standards. Both independent and semi-autonomous smart wheelchair strategies are possible. Users who are unable to use a wheelchair securely by themselves are satisfied with autonomous devices.

V. SMART WHEELCHAIR

In the last few years, Smart Wheelchair have been significantly careful over the power wheelchair. Power-driven wheelchairs with computers and several inputs and sensors are the typical type of market wheelchair. Growing advances in robotics, computers, and artificial intelligence have influenced the creation of smart wheelchairs. A computer is a component of a smart wheelchair, and it controls the wheelchair's functions by using sensor inputs. Sensors use input from the environment to collect information, which is then processed by a computer to perform necessary actions. Similar to a wheelchair powered by electricity, a smart wheelchair may also be measured automatically by the user.

VI. FUTURE RESEARCH

Smart wheelchairs are a promising field for further technical research, especially in the area of machine sensor development with an eye towards vision. These state-of-the-art mobility aids offer a unique platform for researching human-robot interaction, adaptive or shared control, and innovative input methods including voice control, electrooculography (EOG), and eye tracking. Moreover, intelligent wheelchairs serve as valuable test beds for research on robotic control systems.

Although a lot of work has gone into creating smart wheelchairs, performance evaluation of these devices has received noticeably less attention. This problem is highlighted by the Appendix Table, which is accessible online and shows that very few researchers include individuals with impairments in their assessment procedures. Furthermore, no comprehensive, controlled assessment including extended usage in real surroundings has been conducted on any smart wheelchair. It is difficult to conduct user trials using smart wheelchairs since not all users will show improvement in their navigation skills right away in closed-course laboratory tests. This may be due to the user's prior experience or the limits of the smart wheelchair.

One of the main obstacles to long-term research is the high cost of hardware needed to build a sufficient quantity of smart wheelchairs. Even said, there are still obstacles in the way of these investigations being carried out. The unknown long-term implications of utilising a smart wheelchair add to the prohibitive expenses. Some researchers see smart wheelchairs as long-term mobility solutions, while others see them as aids to help people learn how to use traditional wheelchairs independently. Another worry is that an extended

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reliance on smart wheelchairs for navigation support may make it harder for a person to utilise a regular wheelchair.

It's critical to research the distinctions between using a smart wheelchair as a mobility assistance, an assessment tool, or a training tool. The smart wheelchair must behave differently for each function. Its objective as a mobility aid is to enable pleasant and effective transportation without giving off too much input. In a training role, the focus switches to improving user feedback, developing skills, and modifying compliance with user input according to the training task. Finally, the smart wheelchair functions as an assessment tool by automatically recording user action and providing little to no guidance or feedback.

VII. CONCLUSION

Prior to being widely utilised, smart wheelchairs must overcome a few challenges. The trade-off between cost and precision of the current sensors is a major technical challenge. Until a cheap sensor that can identify drop-offs and obstructions in a variety of surface materials and operating conditions is created, smart wheelchair use may be restricted to indoor locations due to liability concerns. Standardising wheelchair motor controller and input device communication protocols is another technological problem because it makes it more difficult to integrate smart wheelchair technology with wheelchairs that already exist. Even if these technology barriers are eliminated, clinical acceptability and reimbursement issues will persist. Until the usefulness and economic viability of smart wheelchairs are established, third-party payers are unlikely to compensate customers for their purchase price. Nevertheless, obtaining the required proof of effectiveness necessitates prescribing a sufficient number of smart wheelchairs, a task made more difficult by the dearth of clinicians and wheelchair technicians knowledgeable in intelligent wheelchair technology. Due to the high cost and complexity of smart wheelchairs, considerable infrastructure and resources are required for familiarisation and training programmes. These resources are often controlled by big wheelchair manufacturers.

The problems with clinical acceptability and reimbursement will not go away even if these technological obstacles are removed. Third-party payers are unlikely to reimburse clients for the cost of purchasing smart wheelchairs until their utility and financial sustainability are established. However, in order to collect the necessary evidence of efficacy, a significant number of smart wheelchairs must be prescribed; this is a process that is made more challenging by the lack of clinicians and wheelchair technicians who are educated about smart wheelchair technology. Owing to the expensive and intricate nature of smart wheelchairs, extensive infrastructure a resources are needed for orientation and training sessions. These resources are often controlled by large wheelchair manufacturers.

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