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ENHANCING QUALITY OF LIFE: DESIGN AND IMPLEMENTATION OF AN INTEGRATED ASSISTIVE ROBOT FOR ELDERLY CARE

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Abstract: Robots are better equipped to communicate through movement than through spoken language. Herein we propose a method of specifications of tasks for disabled people in terms of robotics service. This approach imposes an automatically operated machine that replaces the human effort so that disabled people could afford their activities on their own. The assistive robot helps the end users to be confident about the situations that they can do things on their own without other human interference. The proposed module depends on different phases with an economically reasonable solution that is implemented as a semi-autonomous control system. The user interface incorporates several functions that include navigation of the robot, target selection for picking and placing an object, obstacle detection and self-following assistive robot. This method evaluates the usability of end-users and gets to know about the user's interaction and awareness. Assistive robot ensures that no environmental assessments were affected and makes sure of this robot being user-friendly.

***Index Terms* - Robotics, Automation, Assistive robot**

I. INTRODUCTION

The definition of "robot" has been confusing from the very beginning. The word "Robot" comes from the Czech word which means forced labor. These robots were robots more in spirit than form, though. They looked like humans, and instead of being made of metal, they were made of chemical batter. The robots were far more efficient than their human counterparts. Automation is a field in constant change, so sometimes it is difficult for some companies to start the path to a smart factory. For this reason, Robotics always facilitates, accompanies and adapts mobile robotics to the specific needs of the company, whatever its size. Automation and robotics go hand in hand. With the invention of machines or computers, their capability to perform different tasks went on increasing exponentially. Humans have developed the power of computer systems in terms of diverse working domains, with increasing speed, and reducing size with respect to time.

A field of robotics that studies the relationship between people and machines. Human–robot interaction has been a topic of both science fiction and academic speculation even before any robots existed. Because much of active HRI development depends on natural-language processing, many aspects of HRI are continuations of human communications, a field of research which is much older than robotics. For example, a self-driving car could see a stop sign and hit the brakes at the last minute, but that would terrify pedestrians and passengers alike. By studying human-robot interaction, robot cists can shape a world in which people and machines get along without hurting each other

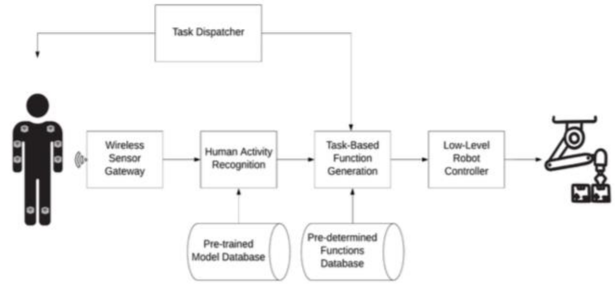

Fig.1 Human-Computer Interaction architecture

In this paper, we present the design and implementation of Integrated Assistive Robot. This proposal records and visualizes user's posture and their pressure data applied to seating pads, so that the user can check their own sitting habits and increase efficiency in posture correction through system's feedback.

II. METHODOLOGY:-

The methodology section consists of a block diagram of the setup, description of the components with its specifications, pin description and working principle. The working of the setup mainly depends on the specifications and properties of the components used.

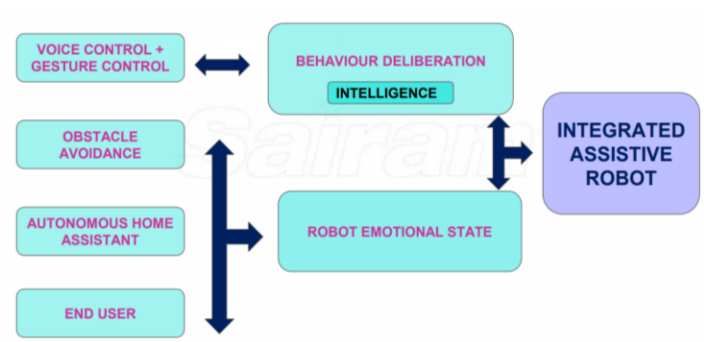

Fig.2 Block Diagram

III. COMPONENTS:-

The components used in this project are listed below:

3.1 Boards:

3.1.1 Raspberry Pi 4
3.1.2 ESP32
3.1.3 ESP8266

3.2 Sensors and Actuators:

3.2.1 Magnetometer
3.2.2 Camera
3.2.3 Ultrasonic proximity sensors
3.2.4 L298n motor driver
3.2.5 Speakers

3.1 Boards:

3.1.1 Raspberry Pi 4:

The Raspberry Pi 4 revolutionizes single-board computing with its potent quad-core ARM Cortex-A72 processor, up to 8GB RAM, and 4K video capability. Boasting Gigabit Ethernet, Wi-Fi, Bluetooth 5.0, and USB ports, it suits various projects like home automation and IoT applications. GPIO pins enable interfacing with electronic components, encouraging exploration in physical computing. Supported by an active community and open-source ethos, the Raspberry Pi 4 fosters innovation, democratizing technology globally.

Fig. 3.1.1 Raspberry Pi 4

3.1.2 ESP32:

The ESP32 microcontroller represents a significant advancement in embedded systems technology, offering enhanced performance, integrated Wi-Fi and Bluetooth connectivity, and a rich set of peripherals. Its improved performance, coupled with optimized power consumption, makes it an ideal choice for a wide range of IoT applications. With robust security features and efficient low-power operation, the ESP32 ensures reliability and data integrity, making it a versatile solution for developers seeking to create innovative and secure IoT devices.

Fig. 3.1.2 ESP32

3.1.3 ESP8266:

The ESP8266 is a highly versatile and cost-effective microcontroller developed by Espressif Systems, renowned for its capability to provide Wi-Fi connectivity to embedded systems. Despite its compact size, the ESP8266 boasts impressive features, including GPIOs, SPI, I2C, UART, and ADCs, enabling seamless integration into various IoT projects. Its low power consumption and affordability make it a popular choice for DIY enthusiasts and professionals alike. With a vibrant community and extensive documentation, the ESP8266 has become a go-to solution for IoT applications, from home automation to industrial monitoring, offering a reliable and accessible platform for wireless connectivity and innovation.

Fig. 3.1.3 ESP8266

3.2 Sensors and Actuators:

3.2.1 Magnetometer:

A magnetometer sensor is a device specifically designed to measure magnetic fields in its surrounding environment. This sensor utilizes various principles, including Hall effect, magneto-resistive, and fluxgate, to detect changes in magnetic field strength and direction. Magnetometer sensors are employed in a wide range of applications, from navigation and geophysics to consumer electronics and aerospace.

Fig. 3.2.1 Magnetometer

3.2.2 Camera:

A camera sensor, found in digital cameras and imaging devices, converts optical images into electronic signals. Common types include CCD and CMOS sensors, with CMOS being more compact and energy-efficient. Sensors vary in resolution and sensitivity, impacting image quality. Advancements in sensor technology drive improvements in photography and computer vision applications.

Fig. 3.2.2 Camera Sensor

3.2.3 Ultrasonic proximity sensor:

Ultrasonic proximity sensors use sound waves to detect nearby objects by emitting ultrasonic pulses and measuring their reflection time. They are highly versatile, finding applications in robotics, automotive, and manufacturing for object detection and distance measurement. These sensors offer reliability, accuracy, and non-contact operation, making them essential for enhancing safety and efficiency in various industries.

Fig. 3.2.3 Ultrasonic Proximity Sensor

3.2.4 L298n motor driver:

The L298N motor driver is a popular integrated circuit used to control and drive DC motors and stepper motors. It operates as an H-bridge, allowing bidirectional control of motors with ease. The L298N can handle high currents (up to 2A per channel) and voltage inputs ranging from 5V to 35V, making it suitable for a wide range of motor applications. It offers built-in protection features such as thermal shutdown and overcurrent protection. With its straightforward interface and robust performance, the L298N motor driver is commonly used in robotics, automation, and hobbyist projects for efficient motor control and driving

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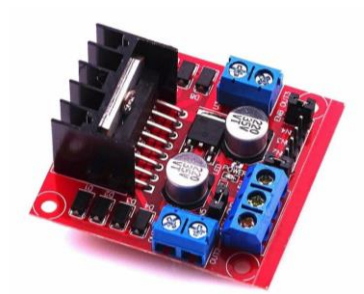

Fig. 3.2.4 L298n motor driver

3.2.5 Speakers:

A speaker sensor, also known as sound sensor or microphone sensor, is a component that detects sound waves in its surroundings. It works by converting sound vibrations into electrical signals, which can the be processed by a microcontroller or other electronic device. These sensors are commonly used in various applications, such as noise detection, voice-activated systems, and sound-activated switches. They play a crucial role in enabling devices to respond to sound inputs, making them essential in fields like home automation, security systems, and audio recording equipment.

Fig. 3.2.5 Speaker

IV. MODULES AND THEIR DESCRIPTION WORKING PRINCIPLE:-

4.1 Collision Avoidance:

Collision detection is simply the act of surveying the known vicinity of the robot
to avoid a collision, a collision must first be detected. Without collision detection, it doesn't seem reasonable to have collision avoidance because there wouldn't be anything to avoid (in the robot's scope).Collision avoidance is the plan for action the robot takes to evade the oncoming collision. As previously stated, there is no need for collision avoidance if there are no collisions to avoid.

4.2 Line Following :

Line Follower Robot (LFR) is a simple autonomously guided robot that follows a line drawn on the ground to either detect a dark line on a white surface or a white line on a dark. The LFR is quite an interesting project to work on! In this tutorial, we will learn how to build a black line follower robot using Arduino Uno and some easily accessible components.

4.3 Human Following :

In this way the robot followed the target (12). An Arduino-based human tracking robot is used to track a person or a person with a leg movement where the person is moving the robot will follow him or her forward, left, right the robot will detect human movement and properly follow its movements.

4.4 Facial Recognition :

A robot face recognition system is a computer application used to automatically identify or verify a person from a digital image or a video frame from a video source. This is usually achieved through a comparison of selected facial features from an image and a facial database

4.5 Voice Controlled :

The Arduino voice-controlled robot car is interfaced with a Bluetooth module HC-05 or HC-06. We can give specific voice commands to the robot through an Android app installed on the phone. At the receiving side, a Bluetooth transceiver module receives the commands and forwards them.

4.6 Gesture Controlled :

Gesture control robot with Arduino totally controlled by the Arduino which gets the instruction by another Arduino with serial communication. There are two parts in this project: one is known as the transmitter and another is known as the receiver. Here the work of both is different. so we will start with the transmitter first and then the receiver. We are using master-slave communication

V. CONCLUSION:-

Assistive robots present huge potential to assist older people to remain independent at home of their choice as they age. Assistive robots that deliver and take care of the wellbeing of independent aging. Perceptions and acceptances of technologies about the positive benefits of technologies need to be emphasized to motivate older people to use and continue using assistive technologies. Through high acceptance of the assistive technology will result in easier to adopt and adapt the assistive technologies, so that older people can feel as a part of their daily life. Finally, it should be noted that this contribution constitutes only a step towards the development of assistive robots capable of helping some problems of older people and disabled people, so that they may remain at home.

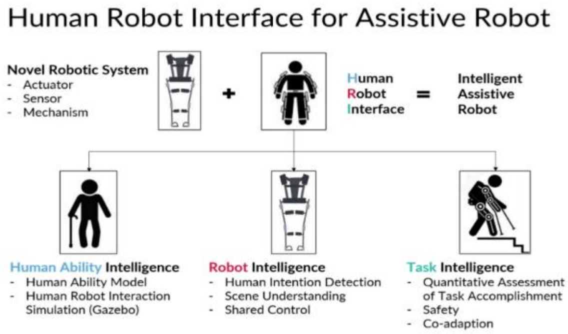

Fig. 5.1

The integrated assistive model is a block for the next generation of assistive technology that can help the impaired people navigate both indoor and outdoor environments safely. It is both effective and powerful. Within a three-meter range, it performs well in detecting obstacles in the user's direction. With a noticeable short response time, this system provides a low cost, dependable, lightweight, low-power, and robust navigation solution. Despite being hard-wired with sensors and other parts, the system is lightweight.

VI . FUTURE SCOPE:-

Our team's future scope and development endeavors revolve around the ambitious goal of creating a semi-humanoid robot capable of providing comprehensive assistance to human beings. We envision a technological marvel that seamlessly integrates advanced robotics, artificial intelligence, and human-centric design principles to revolutionize the way individuals interact with automation. This semi-humanoid robot will be equipped with a sophisticated array of sensors, actuators, and perceptual systems, enabling it to perceive and understand its environment with remarkable clarity and responsiveness.Through intelligent algorithms and machine learning capabilities, our robot will possess the ability to adapt and learn from human interactions, anticipating needs, and providing proactive assistance in various tasks and scenarios. Whether it's aiding household chores, providing companionship and support to the elderly, or assisting in professional settings, our semi-humanoid robot aims to enhance human productivity, well-being, and quality of life. With a relentless focus on innovation and collaboration, our team is committed to pushing the boundaries of robotics technology to create a future where humans and machines coexist harmoniously, forging new frontiers in human-robot interaction and collaborations.

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