International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.049 ISSN: 2581-4621

DESIGN AND DEVELOPMENT OF A SMART ROVER WITH COMPUTER VISION FOR IMPAIRED NAVIGATION ASSISTANCE FOR VISUALLY IMPAIRED INDIVIDUALS

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Abstract— This paper reports the consequences of a global review in a few distinct nations on the mentalities, prerequisites and inclinations of visually impaired and outwardly weakened individuals for a mechanical aide in air terminals. A brief synopsis of previous research on robotic travel aids and other mobile robotic devices serves as the survey's introduction. The survey involves three segments on private data about respondents, existing utilization of portability and route gadgets, and the capabilities and different elements of a mechanical aide. The study discovered that respondents were exceptionally keen on the mechanical aide having various capabilities and being helpful in a large number of conditions. They didn't like any of the designs that were suggested, but they thought the robot's appearance was very important. According to their comments, respondents desired the robot to be discreet and inconspicuous, lightweight, portable, easy to use, long-lasting, resistant to damage, and requiring little upkeep.
Keywords— **Robotic Guide, Obstacle avoidance, low cost, Raspberry pi.**

I. INTRODUCTION

A robot with Raspberry Pi sensors can be a useful tool for helping people who are blind in an airport. The robot can utilize its sensors to distinguish hindrances and guide the individual through the air terminal, furnishing help with route and wayfinding.
To avoid collisions and detect obstacles, the robot can be outfitted with various sensors, including ultrasonic and infrared ones. It can also use a camera to recognize and understand signs, guiding the user through the airport to the appropriate terminal, gate, or baggage claim area.
Using voice commands or a tactile interface, the robot can communicate with the person, offering guidance and assistance as required. The Raspberry Pi board gives the essential figuring ability to handle sensor information and control the robot's developments.
As a whole, a robot equipped with Raspberry Pi sensors has the potential to significantly enhance the travel experience of people who are blind in an airport by providing them with a reliable and effective method of assistance and navigation.
Robots equipped with Raspberry Pi sensors can be programmed to detect obstacles in the environment and alert the user through sound or vibration feedback. They can also be programmed to follow a specific path, which can be very helpful for guiding the user through an airport or other unfamiliar environment. In addition, robots can be equipped with cameras that provide real-time visual information to the user, which can be especially helpful in identifying landmarks or finding their way around complex environments. Moreover, robots can also be equipped with natural language processing capabilities, enabling them to communicate with the user and respond to voice commands. This can make it easier for the user to interact with the robot and receive the information they need in a more natural and intuitive way. Overall, robots using Raspberry Pi sensors can be very helpful for blind people, providing them with greater independence and improved access to information in complex environments like airports. However, it's important to note that robots cannot replace the human interaction and support that some blind people may require, and it's essential to ensure that the technology is designed with the needs and preferences of the user in mind.
Robots using Raspberry Pi sensors for obstacle avoidance are becoming increasingly common in a variety of applications. These robots typically use a combination of sensors, including ultrasonic

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sensors, infrared sensors, and cameras, to detect obstacles in their path and navigate around them. Ultrasonic sensors work by emitting high-frequency sound waves and measuring the time it takes for the sound waves to bounce back from an object. This information can be used to calculate the distance to the obstacle and determine if the robot needs to change its course.

II.SYSTEM DESIGN

1. Problem identification

In some cases, blind travellers may be accompanied by a human guide, such as a family member or airport volunteer, who can provide additional support and assistance. The absence of human guides or assistance can make it difficult for blind people to navigate through an airport. Finding the way to the gate or the luggage area can be a daunting task, especially if there are multiple terminals or changes in the route due to construction. Blind people may have difficulty accessing information about their flights or other airport services. .Many airports have self-service kiosks for checking in or printing boarding passes. These kiosks may be difficult for blind people to use without assistance.

2. Proposed system

The working of our project is based on RFID technology. Initially the user smart Rfid and button gives a input robot. Raspberry pi is a main controller and device IC interfaced with this robot. DC motor is used for movement of the robot. User gives a route map forward, reverse, left, and right. Based on this input robot is moving. All these are pre-programmed in raspberry pi and it will receive input from the user, which is designed specifically for use in supermarkets and shopping centres, provides the additional functionality of locating products using an omnidirectional bar code reader. However, the process is time consuming, since a large number of bar codes need to be scanned, and it is possible to miss the item. Most robotic guides try to use off-the-shelf components. They have some combination of laser range finders, ultrasonic and infrared sensors for obstacle detection and to support robot localisation, with lasers considered the most accurate.

III. OBJECTIVE AND METHODOLOGY

1.Objectives

Providing a reliable and efficient means of navigation and assistance for blind people in the airport. Helping blind people to avoid obstacles and hazards that could potentially cause harm or hinder their ability to move around the airport. Providing real-time information about the airport layout and helping blind people to find their way to the right destination. Providing a means of communication and interaction with the robot, so that the blind person can receive guidance and assistance as needed. Improving the overall travel experience for blind people in the airport, making it more accessible and user-friendly.

2.Methodology

Designing a rover for blind people in an airport would require a combination of research and methodology from various fields such as engineering, psychology, and human-computer interaction. Here are some steps you could take to develop a research and methodology plan for such a project:

Identify The Needs and Requirements Of Blind People In An Airport:

Conduct research to understand the challenges faced by blind people while navigating an airport. This could involve interviewing blind people or observing their behaviour in an airport setting. Some of the factors to consider include the layout of the airport, the signage, the crowds, and the availability of assistance.

Review Existing Technology:

Look at the existing technology available that can be used to design a rover for blind people in an airport. This could include sensors, cameras, GPS, and voice recognition technologies. Research the limitations of these technologies and their potential applications in an airport environment.

Develop A Design Plan: Based on the needs and requirements of blind people and the available technology, develop a design plan for the rover. This should include the physical design, the sensory technologies to be used, and the software and user interface for controlling the rover.

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Prototype And Test**:**
Build a prototype of the rover and test it with blind people in an airport setting. Observe their behaviour and gather feedback on the usability and effectiveness of the rover. Use this feedback to improve the design.
Conduct A User Study:
Once the design is refined, conduct a user study to evaluate the effectiveness of the rover in aiding blind people in an airport. This study should involve blind people navigating the airport with and without the rover and measuring the difference in their experience.
Evaluate The Impact:
Evaluate the impact of the rover on blind people in an airport environment. This could include measuring the time taken to navigate the airport, the ease of navigation, and the level of independence provided to blind people.

IV. COMPONENTS AND ITS SPECIFICATION

There are several components are used mainly,

- Raspberry Pi-PICO
- RFID TAG
- RFID READER
- DC MOTOR
- ULTRASONIC SENSOR
- BATTERY

1.Raspberry Pi-PICO
Raspberry Pi is a series of low-cost, single-board computers that were developed by the Raspberry Pi Foundation in the United Kingdom. The boards are small and credit-card sized, but they have powerful hardware and are capable of running a variety of operating systems, including Linux-based operating systems like Raspbian and Ubuntu. The Raspberry Pi board typically consists of a processor, memory, input/output (I/O) ports, and other components necessary for running a computer system. The specific hardware components of the board can vary depending on the model, but typically include:
Processor: The processor is the "brain" of the computer, responsible for executing instructions and performing calculations. Raspberry Pi boards use ARM-based processors, which are energy-efficient and capable of handling a wide range of tasks.
Memory: The Raspberry Pi board includes RAM (random access memory), which is used for storing data that the processor needs to access quickly.
I/O Ports: The Raspberry Pi board includes a variety of input/output (I/O) ports, including USB ports, Ethernet ports, HDMI ports, and GPIO (general-purpose input/output) pins. These ports allow the board to connect to a variety of peripherals and components, such as keyboards, mice, displays, and sensors.
Power Supply: The Raspberry Pi board can be powered using a micro-USB port or GPIO pins, depending on the model.
In addition to the hardware components, Raspberry Pi boards are also designed to be easily programmable using a variety of programming languages, including Python and Scratch. This makes them popular for a wide range of applications, including robotics, home automation, and education.
2. RFID
RFID Passive tag is composed of a integrated electronic chip and a antenna coil that includes basic modulation circuitry and non-volatile memory. For most general applications passive tags are usually the most cost effective. These are made in a wide variety of sizes and materials: there are durable plastic tags for discouraging retail theft, wafer thin tags for use within "smart" paper labels, tiny tracking tags which are inserted beneath an animal's skin and credit card sized tags for access control. The reader powers the tag (transponder), by emitting a radio frequency wave. The tag then responds

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by modulating the energizing field. This modulation can be decoded to yield the tags unique code, inherent in the tag. The resultant data can be the passed to a computer from processing. Tags have various salient features apart from their physical size: Other available features are: Read Only, Read Write, Anti-Collision.

3. Antenna

A reader reads identifiers from tags on pallets conveyed past the reader. The reader includes two interleaved linear arrays of antennas with circularly polarized fields. Each antenna is composed of a pair of crossed rods phased to have adjacent antennas of an array generate circularly polarized fields of opposite rotation. The vector components of the polarization in the direction across the width of the conveyor have peaks and nulls, and the interleaved arrays are arranged such that the nulls of one array's fields are covered with the peaks of the other array's fields. This arrangement allows the reader to the identifier from the tag when the tag is at any orientation. A tag at the side of the reader is aligned in the direction of travel by rails on the conveyor. The reader has antennas aligned in the direction of travel to read such tags.

3. Ultrasonic sensors

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 20,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. For example, foam on the surface of a fluid in a tank could distort a reading.

4. DC Motor

A DC motor is a type of electric motor that converts electrical energy into mechanical energy. DC stands for Direct Current, which means that the electrical current flows in one direction through the motor.

DC motors consist of two main parts: the stator and the rotor. The stator is the stationary part of the motor, while the rotor is the rotating part. The stator contains one or more coils of wire, which are connected to a DC power supply. The rotor contains a permanent magnet or electromagnet. When electrical current flows through the coils of wire in the stator, it creates a magnetic field that interacts with the magnetic field of the rotor. This interaction causes the rotor to rotate, which in turn generates mechanical energy.

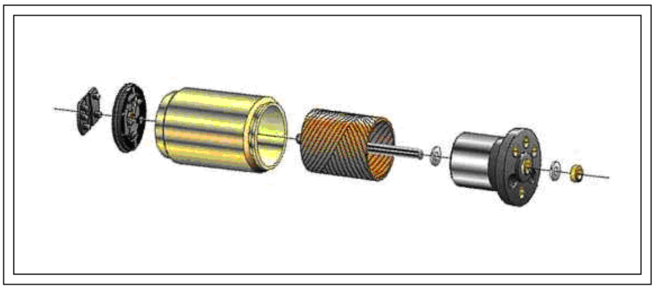

Fig 3.1 Coreless design for DC Motors

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V. WORKING PRINCIPLE

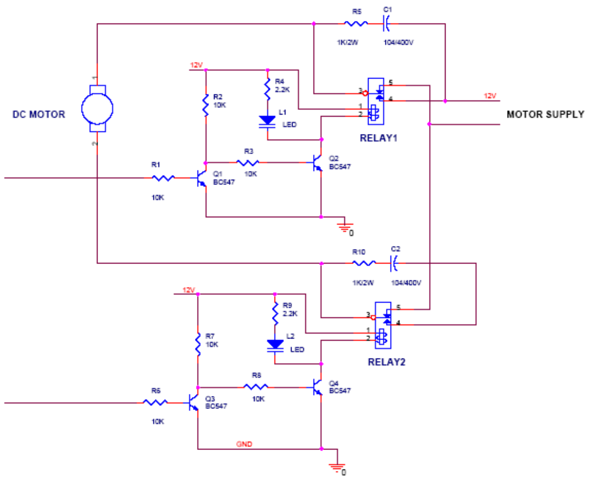

Fig 4 .1 Circuit diagram

This circuit is designed to control the motor in the forward and reverse direction. It consists of two relays named as relay1, relay2. The relay ON and OFF is controlled by the pair of switching transistors. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally Close (NC) and Normally Open (NO). The common pin of two relay is connected to positive and negative terminal of motor through snubber circuit respectively. The relays are connected in the collector terminal of the transistors T2 and T4.

When high pulse signal is given to either base of the T1 or T3 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the T2 or T4 transistor. So the relay is turned OFF state.

When low pulse is given to either base of transistor T1 or T3 transistor, the transistor is turned OFF. Now 12v is given to base of T2 or T4 transistor so the transistor is conducting and relay is turn ON. The NO and NC pins of two relays are interconnected so only one relay can be operated at a time.

The series combination of resistor and capacitor is called as snubber circuit. When the relay is turn ON and turn OFF continuously, the back emf may fault the relays. So the back emf is grounded through the snubber circuit.

A delay is provided in buzzer sound to mimic the right direction of the object. For all the three directions, the buzzer sounds with different delay times. With different delay times, the user can understand the correct direction of the object and can act accordingly.

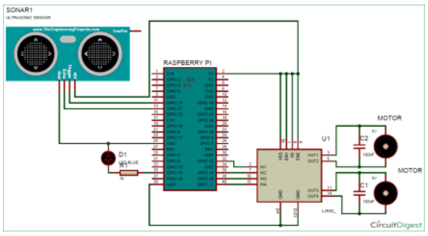

Fig 4.2 Raspberry pi sensor

Circuit is very simple for this Obstacle Avoiding Robot using Raspberry Pi**.** An Ultrasonic Sensor module, used for detecting objects, is connected at GPIO pin 17 and 27 of Raspberry Pi. A Motor Driver IC L293D is connected to Raspberry Pi 3 for driving robot’s motors. Motor driver’s input pins 2, 7, 10 and 15 are connected to Raspberry Pi GPIO pin number 12, 16, 20 and 21 respectively. Here we have used two DC motors to drive the robot in which one motor is connected to the output pin 3 & 6 of motor driver IC and another motor is connected at Pin 11 & 14 of motor driver IC Working of this Autonomous Robot is very easy. When the Robot is powered on and starts running, Raspberry Pi

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measures the distances of objects, in front of it, by using Ultrasonic Sensor Module and stores in a variable. Then RPi compares this value with predefined values and take decisions accordingly to move the Robot Left, Right, Forward, or backward.

VI. RESULT AND DISSCUSION

We presented a comprehensive literature review on design and development of smart rover with computer vision for improved navigation assistance for visually impaired individuals and strategies used for rover shows that none of the evaluated systems was 100% satisfactorily in terms of the essential features. These features not only meet the user's needs, but are also crucial from an engineering perspective. Those features are the main building blocks to design such a device to provide services for blind people. It is remarkable that each system supported special feature(s) over the other and might have more features than the other, but none of them supported all the evaluated features. That means we cannot consider any of them as an ideal device or system that the blind person can rely on and feel confident about using.

Devices that have all the fundamental features will offer an effective performance. The reason for this limitation is that most of the researchers work on providing a new feature, but they never ensure that they support the fundamental features before they add new ones. Another reason for this is that the designers do not run enough experiments which have to be detail.

Fig 6.1 Model

VII.CONCLUSION

1.Conclusion

- In this effective way we are designing a virtual telepresence robot using Raspberry pi. The Virtual telepresence robot moves almost simultaneously with the robot operator.
- Positions are successfully obtained by the smart phone using Bluetooth wireless communication.
- This unilateral control method provides the human operator with visual telepresence and enables him/ her to remotely control the robot Solves the lack of cost efficient telepresence robotic platform for complete and immersive remote operation, with stereoscopic machine vision and suggestive feedback and ready deployment in indoor environments such as hospitals, museums.
- Providing accessibility to stereoscopic stream in harsh environments such as war prone areas, debris and dust affected regions, nuclear armament or industrially radioactive zones using remote links.
- The main feature of this project Bluetooth based wireless communication it will controlled by user smart phone Bluetooth.

2.Future Scope

One expected future degree for aiding wanderers for blind individuals in air terminals could include consolidating cutting edge innovations, for example, PC vision, normal language handling, and AI calculations.

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For instance, the meanderer could be furnished with cameras and sensors to identify obstructions and give sound criticism to the client. The wanderer could likewise be coordinated with a voice collaborator to give headings and answer inquiries concerning the air terminal.

Another potential advancement could be the utilization of haptic input innovation to give material criticism to the client, permitting them to feel their strategy for getting around the air terminal climate. This could be especially helpful in areas where there is a lot of foot traffic or where the airport's layout changes frequently.

Moreover, the meanderer could be intended to coordinate with existing air terminal framework, like signage and advanced shows, to give constant data about flight updates and door changes.

In general, there is a ton of potential for the improvement of wanderers for blind individuals in air terminals, and with headways in innovation, we can hope to see much more refined and viable arrangements later on.

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