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Original Article

AI Based Shopping Assistance for Persons with Disabilities

P.Kavitha[1], L S Tamilmani[2], A. Yasmeen Banu[3], Rajeswari A[4], HalilaNasifa G[5]
[1,2,3]*Dept. of Electronics Communication Engineering, M.A.M School of Engineering, Tamilnadu, India.*
[4,5]*Dept. of Mechtronics, M.A.M. School of Engineering, Tamilnadu, India.*

Abstract: *AI-based ocular movement detection is being added to shopping carts to help those with disabilities. Sophisticated computer vision algorithms are used to precisely track users' eye movements in real time. Integration of Convolutional Neural Networks (CNNs) to convert eye motions into commands that can be used to navigate trolleys. This project's major goal is to empower people with disabilities – especially those who have mobility issues – by giving them access to independent and accessible shopping experiences. Flexibility via profound education: Over time, the system adjusts to each user's unique tastes and behaviours in order to maximize performance. Extra features: Item identification and voice commands improve accessibility and use, encouraging self-reliance and inclusivity in retail settings. In order to improve accessibility even more in retail settings, we suggest incorporating RFID-enabled lift systems. This extra element makes it easier for those with impairments to enter stores' raised areas.*

Keywords: *Data Preprocessing Techniques, CNN Architectures for Feature Extraction and User-Friendly Interfaces.*

INTRODUCTION

Convolutional Neural Networks (CNNs) and state-of-the-art computer vision algorithms have come together in recent years to enable revolutionary breakthroughs in real-time tracking systems. Of the many uses, improving accessibility and independence for people with disabilities—especially those who have mobility impairments—is one particularly revolutionary area. We set out to transform shopping experiences by utilising the potential of these advanced algorithms, making them not just autonomous but also easily accessible. Central to our approach is the utilization of deep learning techniques within CNNs, enabling them to adapt dynamically to individual user behaviors and preferences. This adaptive framework not only facilitates real-time tracking of users' eyeball movements but also holds the promise of continuously optimizing performance over time. Our proposal encapsulates a holistic solution comprising key components such as data preprocessing, meticulously crafted CNN architectures, and an intuitively designed user interface, culminating in an experience that seamlessly integrates into users' daily lives.

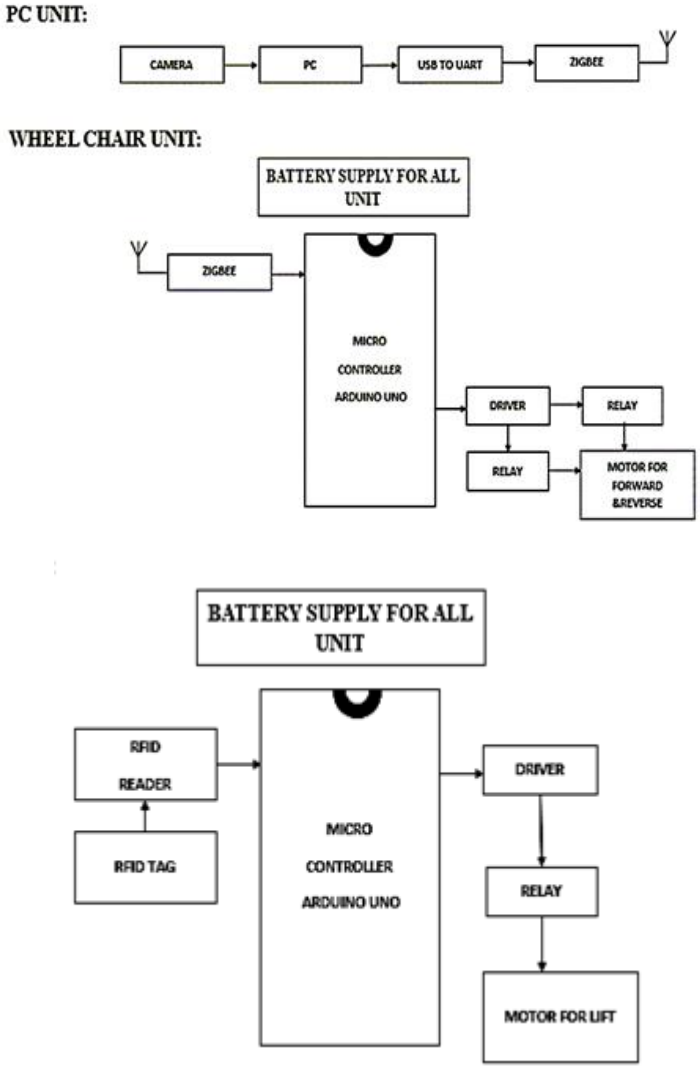
Moreover, we advocate for the integration of lift mechanisms imbued with RFID technology within retail spaces, thereby augmenting accessibility for individuals with disabilities to unprecedented levels. This innovative inclusion transcends traditional barriers, empowering users to navigate and access products with unprecedented ease and independence. In tandem with technological advancements, our system prioritizes usability and accessibility through innovative features such as voice commands and item recognition. These enhancements not only streamline the shopping process but also foster a sense of empowerment and inclusivity among users. Through rigorous testing and validation, we showcase the efficacy of our system in providing accurate and reliable assistance during shopping activities for users with disabilities. By bridging the gap between cutting-edge technology and real-world accessibility needs, we aspire to catalyze a paradigm shift in the way individuals with disabilities engage with the world around them, fostering a future where independence and inclusivity are the cornerstone of everyday experiences.

EXISTING SYSTEM

Tracing the development of navigation aids for BVIPs from early electronic devices to modern artificial vision and models, highlighting ongoing challenges. Overview of various navigation methods, including e-canes, guide dogs, and technologically advanced solutions like infrared and laser-based aids, along with their respective limitations. Explanation of the systematic research approach employed, encompassing keyword selection, research

questions formulation, criteria for article selection. Summary of findings from 191 relevant articles spanning 2011 to 2020, focusing on trends, gaps, and empirical evidence in BVIP navigation assistance. Discussion on the implications of research findings for researchers, engineers, practitioners, and BVIPs, emphasizing potential impacts on safety and suggesting future research directions.

BLOCK DIAGRAM



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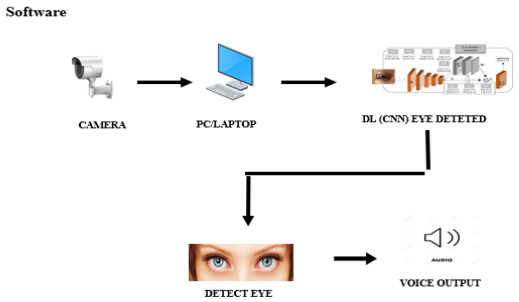


PROPOSED SYSTEM

In this Proposed method, Cameras track eye movements, capturing patterns in real-time. These patterns serve as input for further analysis. Convolutional Neural Networks process the captured patterns, recognizing specific commands or actions.

They are trained to interpret various movement patterns accurately. Interpreted movements are translated into actionable commands for trolley control. This translation ensures precise execution of user intentions.
The system promptly executes commands, enabling smooth and responsive navigation. Users experience immediate feedback to their actions.

Deep learning algorithms continually learn and adjust to user behaviors and preferences. This adaptation optimizes the system's performance over time. An intuitive interface facilitates easy interaction with the system.
Users receive visual feedback and can customize settings as needed. Voice commands and item recognition further enhance usability and accessibility.

Users can interact with the system using alternative methods. RFID-equipped lift mechanisms seamlessly provide access to elevated areas within stores.This integration enhances overall accessibility for users with disabilities.

COMPONENTS DESCRIPTION

Battery

An apparatus that directly transforms chemical energy into electrical energy is a battery. It is made up of several voltaic cells, each of which is made up of two half cells joined in series by a conductive electrolyte that contains cat and anions.

Anode, or the negative electrode, is the electrode to which anions, or negatively charged ions, migrate; cathode, or the positive electrode, is the electrode to which anions, or positively charged ions, migrate. Both electrolyte and cathode, or the positive electrode, are components of the other half-cell. Cat ions are reduced (more electrons are added) at the cathode and anions are oxidised (less electrons are withdrawn) at the anode in the red ox reaction that powers the battery. The electrolyte connects the electrodes electrically; they are not in contact with one another. Two half-cells with distinct electrolytes are used by certain cells. Ions can move across half-cells thanks to a separator that keeps the electrolytes from mixing.

Arduino UNO

An ATmega328P-based microcontroller board is the Arduino Uno. It contains a 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you have to do is use an AC-to-DC adapter or a USB cable to connect it to a computer. Several features allow the Arduino Uno to communicate with other microcontrollers, computers, or other Arduino boards.

Among the most often used prototyping boards is this one.The board has an integrated Arduino boot loader. It features an on-board resonator, a reset button, six PWM pins, six analogue inputs, on-board UART, SPI, and TWI interfaces, and mounting holes for pin headers.The board can be powered by USB while being programmed, and it can be connected to a PC via a USB port. The 32 KB Flash memory, 1 KB EEPROM, and 2 KB SRAM of the Arduino

UNO.The board is compatible with most IoT platforms and may be linked to several Arduino Shields for Ethernet, Bluetooth, WI-Fi, Zigbee, or cellular network access.

In our project, we use 3 types of sensor- Heartbeat, SPO2, and temperature sensor. Arduino consists of 14 digital pins and 6 Analog pins. Since temperature sensor gives the output in analog, it is connected to the analog input of the Arduino uno A0 pin. Since MAX30100 sensor works on the I2C protocol, it is connected to the Arduino UNO through I2C protocol mode (A4 and A5 pin).Six digital pins (8, 9, 10, 11, 12, and 13) on the Arduino UNO are utilised to link the LCD's data pins.The Pumps are switched by a Driver Relay, those The two digital pins of the Arduino are linked to two driver relays (6, 7).

ZIGBEE (WSN)

The IEEE 802.15.4-2003 Low Rate Wireless Personal Area Network (LR-WPAN) standard must be followed by ZigBee devices. According to the standard, the data link layer's Media Access Control component and the physical layer (PHY) are the lowermost protocol levels (DLL). The ZigBee specification aims to describe a technology that is less complex and more affordable than other wireless personal area networks (WPANs), such Bluetooth or Wi-Fi. Transmission distances are limited to 10–100 metres line-of-sight because to its low power consumption, depending on power output and ambient factors. By sending data over a mesh network of intermediary devices to reach farther-off ones, ZigBee devices may transport data over vast distances. Low data rate applications that need long battery life and secure networking are usually where ZigBee is deployed.With a predetermined rate of 250 kbit/s,ZigBee is most useful for sporadically transmitting data from an input device or sensor.

RFID TAG AND READER

Radio frequency is used by RFID tags, a kind of tracking technology, to locate, recognise, track, and connect with objects and people. RFID tags are essentially smart labels with the ability to hold a variety of data, including pages of information, brief descriptions, and serial numbers.The tag is made up of an IC and an antenna. The IC is used to store the ID of the tag and other data, while the antenna is used to send and receive RF signals.

An RFID reader is a network-connected gadget that can be fixed or carried about permanently. It transmits impulses that activate the tag via radio waves. The tag transmits a wave back to the antenna when it has been activated, where it is converted into data.The RFID tag itself houses the transponder.

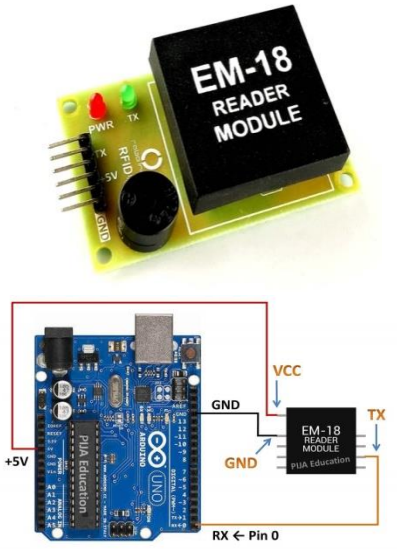
RFID Reader: An RFID reader also called a scanner, works similarly to a barcode scanner except that it employs electromagnetic waves instead of a laser beam to scan barcodes. The scanner utilises an antenna to communicate

with the tag's antenna by sending out a signal in order to transmit these waves. The tags antenna delivers its unique chip information to the scanner after receiving data from it.

One of two types of memory is often used to store the data on the chip. The most popular type is called Read-Only Memory (ROM), and as its name implies, once it is programmed onto a chip during the manufacturing process, it cannot be changed.

An RFID tag is an item or tag that can be attached to or integrated into a blood pack at a blood bank with the intention of employing radio waves for blood pack tracking and identification.Details on the RFID-enabled blood bag may be viewed via the IoT module in the Cayenne app.

An RFID tag is a piece of equipment or a tag that can be attached to or integrated into a mall purchase.In these kind of institutions, the RFID system is quite effective at protecting the newborn. The aforementioned problems can be resolved using specially made RFID tags affixed to the child and his mother, tag readers, and automated systems.

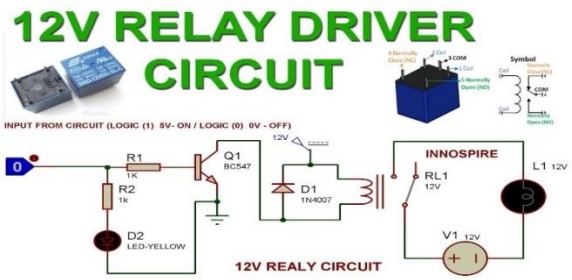


DRIVER RELAY

Relay drivers are switching circuits that have the ability to drive or operate relays to switch the appropriate load.Relays are opened or closed by driver circuits based on the requirements of the circuit and how it operates.
An electromechanical device that functions as a switch is called a relay.Its job is to respond to a relatively tiny electrical power provided to an associated coil by switching an external load linked to its contacts.The coil is essentially twisted around an iron core; when a tiny DC is supplied, the coil becomes energised and begins to function like an electromagnet.Five-pin relays have two pins for coil control and three pins that are common, generally closed, and open. Relays are used to switch two circuits from low voltage to high voltage.

Their connection pins are generally closed and normally open. The normally closed pin will lose power and become normally open when the coil is triggered.Our project's microcontroller requires a minimum of 5 volts of DC power to operate, while the relays require 12 volts of DC power. A larger load can be driven by a micro-controller.A digital signal applied to a load will be controlled by the microcontroller. The digital circuit's ON output pulse is used to bias the transistor. Subsequently, it operates the relay as an ON/OFF switch.A semiconductor device that functions as a switch electrically is called a transistor. It has three terminals, such as an i/p, an o/p, and a control line. These are referred to as the base (B), collector (C), and emitter (E). Transistors turn audio waves into electronic waves by acting as both switches and amplifiers.The transistor's input is called base. Here, the emitter is already linked to the ground through the relay (C1), and the common is connected to 12 volts. The common is currently configured to close properly.

The transistor switches the ground to the relay (C2) and triggers the typically open state of the common when it receives an input signal from the base. The motor has been linked here in the ordinarily open and will be turned on.A semiconductor device that functions as a switch electrically is called a transistor. It has three terminals, such as an i/p, an o/p, and a control line. These are referred to as the base (B), collector (C), and emitter (E). A transistor converts audio waves into electrical waves by acting as both a switch and an amplifier.



DC MOTOR

One way to think of geared DC motors is as a continuation of DC motors. A gear assembly is fixed to the motor of a geared DC motor. RPM, or revolutions per minute, is the unit of measurement used to describe a motor's speed. The gear assembly aids in reducing speed and raising torque. A gear motor can be made to run at any desired speed by using the right set of gears. Gear reduction is the idea that a vehicle's speed can be decreased while its torque can be increased.

FEATURES

Supplyvoltage:12VDC
Speed:100rpm
Long Lifetime, Low Noise, Smooth Motion

SOFTWARE INSTALLATION

ARDUINO IDE

Arduino is an open-source electronics platform based on easy-to-use hardware and **software**. **Arduino** boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

Writing Sketches

Sketches are programmes created with the Arduino Software (IDE). These drawings are saved as files with the.ino extension and are created using a text editor. The editor offers tools for searching through and replacing text as well as cutting and pasting. In addition to displaying faults, the message box provides feedback during

exporting and saving. Complete error warnings and other text output from the Arduino Software (IDE) are displayed in the console. The configured board and serial port are shown in the window's lower right corner. You can build, open, save, and verify programmes with the toolbar buttons. You can also access the serial monitor and create, open, and validate sketches. Draw − The first new word is "sketch," which refers to an Arduino programme. Three basic components make up Arduino programmes: Structure, Values (constants and variables), and Functions.

Let us start with the Structure. Software structure consists of two main functions:

Setup() methodA sketch begins by calling the setup() function. It is utilised to begin using libraries, pin modes, initialise variables, etc. The setup function will only execute once, following each Arduino board power up or reset. The Serial.begin(9600); instruction is visible here, opening the serial port so that the board can transmit output for the serial monitor to display (see the "Output" sub-section below).

Loop() function

The setup() function initialises and sets the starts values. The loop() function then does exactly what its name says, looping repeatedly so that your programme can respond and modify. The Arduino board is actively controlled by it. The Serial print ln (sensorValue); statement is used to display the value that has been read from an analogue pin (see to the "Understanding microcontroller pins" subsection below) in this example.

IV. RESULT

The installation of an AI-based ocular movement detection system in shopping carts has produced a number of noteworthy benefits, such as more independence and accessibility for people with disabilities. By virtue of its personalised adaptation capabilities and real-time responsiveness, the system has improved usability and efficiency, resulting in favourable comments from users. In order to further enhance inclusion and accessibility in retail contexts, ongoing research and development activities will concentrate on improving the system's capabilities and expanding its deployment going forward.

V. CONCLUSION

The adoption of AI-based eyeball movement detection technology in shopping carts is described in this research as a ground-breaking advance in the direction of fostering independence and accessibility for people with disabilities. Through the utilisation of sophisticated computer vision algorithms and deep learning techniques, the system has effectively enabled users to independently traverse retail surroundings, hence augmenting their overall quality of life. We are dedicated to promoting diversity and making retail spaces more accessible for everyone, regardless of ability, even while we develop and improve this technology.

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