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Wheel Chair System with Eye-Blink Control

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ABSTRACT:

Mobility options for physically challenged persons have been substantially enhanced by the development of assistive technology. This project showcases an eye-controlled wheelchair technology that aims to empower those with significant mobility disabilities to freely traverse their environment. An Eye Blink Sensor is a part of the system that can regulate the wheelchair's mobility by detecting when the user voluntarily blinks their eyes. To make sure the wheelchair can go safely, it has a Passive Infrared (PIR) sensor that can detect impediments. To warn consumers of impending danger or technical issues, a buzzer is often used. In response to detected eye blinks, the L293D motor driver controls the wheelchair motors. A microprocessor regulates the whole system and facilitates the interaction of its many sensors and actuators. All of these parts work together to make the wheelchair a practical and easy-to-use mobility aid for people with disabilities, raising their level of autonomy and happiness.

EMBEDDED SYSTEMS

A computer system that is purpose-built to carry out a single or limited set of tasks, often under the restrictions of real-time computing, is known as an embedded system. As with other physical and mechanical components, it is often integrated into a whole device. A personal computer or other general-purpose computer, on the other hand, may be programmed to do a wide variety of functions. These days, many of the everyday items we use rely on embedded systems to function. Design engineers may improve the embedded system to decrease product size and cost while boosting reliability and performance since it is devoted to certain functions. Because of their mass production, certain embedded systems are able to take advantage of cost savings. From small, handheld gadgets like digital watches and MP3 players to massive, permanently installed systems like those managing nuclear power plants, traffic lights, and industrial controls are all examples of physically embedded systems. From simple systems using a single microcontroller chip to complex systems housing several modules, peripherals, and networks in a massive chassis or enclosure, complexity may range greatly. The phrase "embedded system" lacks a precise definition because the majority of systems have programmability in some form. While they share some components with embedded systems, such operating systems and microprocessors, handheld computers are not technically embedded systems as they enable the loading of multiple programs and the connection of peripherals. Computer hardware and software, either fixed in capability or programmable, particularly intended for a certain sort of application device—this is what's called an embedded system. Embedded systems may be found in a wide variety of objects, including but not limited to: vehicles, medical devices, cameras, home appliances, aircraft, vending machines, toys, and, of course, cellular phones and personal digital assistants. A programming interface is given to programmable embedded devices, and programming for embedded systems is a niche field in and of itself. Embedded Java and Windows XP Embedded are two examples of embedded-specific operating systems and language platforms. On the other hand, certain budget consumer goods include integrated application and operating system components, employ very cheap microprocessors, and have limited storage space. Instead of being loaded into RAM (random access memory), as applications on personal computers are, in this situation the program is written permanently into the system's memory.

CHARACTERISTIC OF EMBEDDED SYSTEM

- Speed (bytes/sec): Should be high speed
- Power (watts): Low power dissipation
- Size and weight: As far as possible small in size and low weight
- Accuracy (%error): Must be very accurate
- Adaptability: High adaptability and accessibility
- Reliability: Must be reliable over a long period of time

APPLICATIONS OF EMBEDDED SYSTEMS

Here, in the Embedded World, we are living. The smooth operation of the various embedded goods that surround you is crucial to your day-to-day existence. In your living room, you have a TV, radio, and CD player; in your kitchen, you have a washing machine or microwave oven; and at your office, you have card readers, access controllers, and palm devices that let you do a lot. In addition to all of this, your automobile has a plethora of built-in controls that handle functions between the bumpers, most of which you probably don't give a second thought to.

- **Robotics:** industrial robots, machine tools, Robocop soccer robots
- **Automotive:** cars, trucks, trains
- **Aviation:** airplanes, helicopters
- **Home and Building Automation**
- **Aerospace:** rockets, satellites
- **Energy systems:** windmills, nuclear plants
- **Medical systems:** prostheses, revalidation machine.

MICROCONTROLLER VERSUS MICROPROCESSOR

When comparing microprocessors and microcontrollers, what are the key differences? Any general-purpose microprocessor, such an 8086, 80286, 80386, 80486, or a Pentium from Intel, or a 680X0 from Motorola, etc., is considered a microprocessor. In addition to lacking on-chip I/O ports, these microprocessors also lack random-access memory (RAM). Because of this, they are often called general-purpose microprocessors. Designing a working system around a general-purpose CPU like the 68040 or Pentium requires the addition of extra components like as RAM, ROM, I/O ports, and timers. Though these systems are more costly and cumbersome due to the inclusion of external RAM, ROM, and I/O ports, they provide the benefit of being versatile in that the designer may choose the quantity of RAM, ROM, and I/O ports required for the work at hand. Microcontrollers are an exception to this rule. On a single chip, you'll find a microprocessor, random access memory (RAM), read/write (ROM), input/output (I/O) ports, and a timer in a microcontroller. So, since the CPU, random access memory (RAM), read/write memory (ROM), input/output (I/O) ports, and timer are all integrated into a single chip, the designer is unable to include any more memory, I/O ports, or timer into the product. Because of its set quantity of on-chip ROM, RAM, and number of I/O ports, microcontrollers are perfect for many applications where space and cost are important considerations. It is not necessary to have a 486 or even an 8086 CPU for many applications; for instance, a TV remote control. Typically, these programs will need some kind of input/output function in order to read signals and toggle bits.

INTRODUCTION

Wheelchairs were originally intended to assist those with physical disabilities in moving around and performing everyday duties. However, what good would they be for someone whose disability is so severe? As technology continues to evolve, more and more sophisticated wheelchairs are being developed to assist individuals with severe disabilities. We have made an effort with our wheelchair to make it possible to control the vehicle using basic eye and head motions. We also communicate by linking the different room devices to the wheelchair. We are presenting the concept and execution of an eye-movement controlled wheelchair. Paralyzed and disabled persons can make their lives simpler using this wheelchair. The infrared sensor is attached to the goggles so it can record the motion of the eyes blinking. His eye blinks were recorded by this sensor, which then sent a signal to the motor driver circuit, allowing the wheelchair to move or stop. The circuit will execute left, right, forward, backward, and stop operations based on the number of eye blink movements.

LITERATURE SURVEY

In 2.1, we see a voice-controlled wheelchair that operates automatically with the use of speech recognition technology. Those who are physically unable to use their hands might find it much easier to go around in a voice-controlled wheelchair. Motors propel the motorized wheelchair forward, while speech recognition software gives the user the ability to steer. The motors, HM2007 voice recognition module, and Arduino make up the circuit. In response to a user instruction, the speech recognition module reads out the relevant data encoded in memory and sends it to the Arduino microcontroller. The controls for the movement are handled by the Arduino microcontroller. Smart Electronic Wheelchair Using Arduino and Bluetooth Module also includes a joystick attachment for users with physical disabilities who are unable to use their hands for other tasks. 2.2 Designing an Embedded System for a Smart Electronic Wheelchair with an Arduino and Bluetooth Module: The creation of a motorized, voice-controlled wheelchair. The proposed design incorporates manual operation to provide a voice activation system for physically disabled users. For

those with physical disabilities, this paper depicts a "Voice-controlled Wheel chair" that moves in response to voice commands. To operate the wheelchair, the user speaks the command into a Bluetooth-enabled mobile device, which the BT Voice Control for Arduino translates into strings and sends to the Bluetooth Module SR-04, which is linked to the Arduino board. If the user presses "Go," the chair will go ahead; pressing "Back" will cause it to travel backward; pressing "Left" and "Right" will rotate it in the left and right directions, respectively; and pressing "Stop" will bring it to a halt. The patient's time, money, and effort may be better used using this method. Additionally, an ultrasonic sensor was incorporated into the design to aid with the detection of any obstructions that may be lying ahead of the wheelchair's path.

2.3 An Arduino-Based Voice-Controlled Wheelchair:

Conventional, manual, or motorized wheelchairs can meet the demands of a large number of disabled people. Wheelchairs can be a challenge for certain people with disabilities. There is a lot of literature on computer-controlled chairs that employ sensors and smart control algorithms to reduce the amount of human involvement. In this paper, I lay out the blueprints for an embedded system-based smart motorized wheelchair that can be voice-operated by those who are physically challenged. People with physical disabilities can use the voice activation system that incorporates manual operation with the help of the proposed design. The wheelchair's navigation has been enhanced with the help of an Arduino microcontroller and a speaker-dependent voice recognition processor. A fabricated voice command will not activate the wheelchair. The microcontroller directs the wheelchair in the direction chosen by the user using the joystick. You may also control this using your voice. We can avoid obstacles by employing ultrasonic sensors.

2.4 Intelligent Wheelchair Conceptualization and Development Driven by Speech Recognition and Head Movement

Independent movement is a difficult challenge for handicapped persons. They can't go about their everyday lives without assistance. Paraplegics can get assistance with electric wheelchairs. Quadriplegics, who are unable to move any part of their body save their head owing to age or sickness, are one example of a severely impaired individual who cannot utilize them. Giving persons with disabilities access to an automated system is the primary goal of this initiative. When the user moves their head, the wheelchair will respond accordingly. In order for the wheelchair to move in response to the user's intentions, the controller receives motion control commands based on the recognized gestures. With the use of MEM sensors

and a microprocessor, a head-motion-controlled wheelchair has been designed and developed. Everything is running smoothly with the system's realistic implementation. When the user's head moves in a certain direction, the MEM sensor detects it and sends a signal to the microcontroller. With the use of DC motors, the microcontroller determines the wheelchair's LEFT, RIGHT, FRONT, and BACK directions based on the acceleration's direction.

2.5 A robotic wheelchair device that uses voice recognition to help the disabled

The overarching goal of this system is to develop, integrate, and evaluate a protocol for a motorized wheelchair that can understand spoken commands. This concept aids patients with physical disabilities to three steer the vehicle without using any kind of physical pressure from outside. The typical joystick-interfaced wheelchair is difficult for many individuals to use. By utilizing raspberry pi for voice recognition, a speech-controlled wheelchair may offer effortless accessibility. Here, an Android phone and a Raspberry Pi are connected using a Bluetooth interface. A Bluetooth connection is established between the Android phone and the HC-05 module. The Bluetooth module that is linked to the Raspberry Pi is HC-05. The goal is to create a system that will facilitate the daily lives of those with disabilities. Thus, a wheelchair navigation system that incorporates many alternative input interfaces allows users who are unable to use their hands to control the wheelchair with voice commands transmitted through an Android Bluetooth smartphone. In this robotic system.

EXISTING SYSTEM

New Approach Manual operation is key to traditional mobility solutions for people with physical disabilities, such as wheelchairs that are operated by joysticks or push-rims. Even while powered wheelchairs do exist, many of them need controls that need to be manipulated by hand, which is not always possible for those with severe impairments. Voice or head movement controls are available on certain high-tech wheelchairs; however, they may not work well in loud places or for people who have trouble moving their heads. Another safety issue is that the majority of wheelchairs on the market do not have obstacle detection capabilities, which increases the likelihood of accidents. It is also difficult for users to notify emergency circumstances due to the inadequate integration of automatic alarm systems. Because of these restrictions, a new, controllable, hands-free mobility system is urgently required.

PROPOSED MODEL

By incorporating features like automatic notifications, obstacle avoidance, and eye blink recognition, the suggested eye-controlled wheelchair improves mobility for those with physical disabilities. Motions like forward, backward, left, and right may be controlled by processing deliberate blinks captured by the Eye Blink Sensor. In order to avoid accidents, the wheelchair can be stopped when an impediment is detected by the PIR sensor. To further guarantee safety, a buzzer is integrated to give audible notifications in the event of obstacle detection or system malfunctions. The L293D motor driver is responsible for controlling the wheelchair's motors, enabling them to move with ease and precision in response to control inputs. People with severe physical limitations can benefit from the system because of its safe design, high responsiveness, and user-friendliness. Wireless connection and Internet of Things integration for remote control and monitoring are two potential additions to future upgrades.
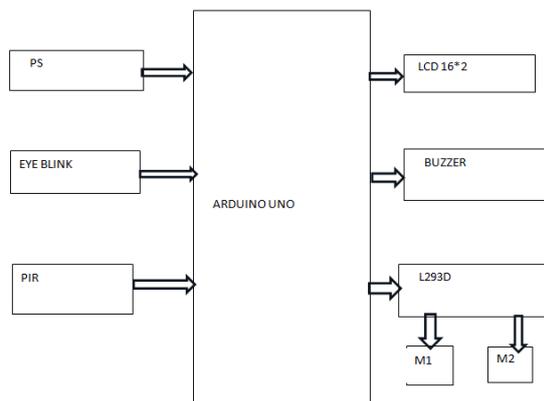
BLOCK DIAGRAM

Figure 1: Block Diagram

Microcontroller:

A tiny controller, or microcontroller, as the name implies. Often used as a processing or controlling unit, they are similar to single-chip computers. For instance, microcontrollers that do decoding and other regulating operations are likely integrated into the control you are using. They find further use in vehicles, home appliances, microwaves, toys, and any other area requiring automation.

Arduino Uno Microcontroller:

One such microcontroller board is the Arduino Uno, which uses the Atmega328 (datasheet). It has a 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (6 of which may be used as PWM outputs), a power connector, an ICSP header, a reset button, and a

USB connection. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

A key difference between the Uno and all previous boards is the absence of the FTDI USB-to-serial driver chip. Rather of that, it has an Atmega8U2 that has been configured to convert USB to serial. To celebrate the impending release of Arduino 1.0, the name "Uno"—which means "One" in Italian—has been chosen. The Uno and Arduino version 1.0 will serve as the foundational versions for future Arduino releases. For a comparison with prior generations, see the index of Arduino boards. The Uno is the newest in a series of USB Arduino boards and the standard model for the Arduino platform.

ARDUINO UNO BOARD:

One board that uses the Atmega328 microprocessor is the Arduino Uno. A 16 MHz ceramic resonator, 6 analog inputs, 14 digital I/O pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.
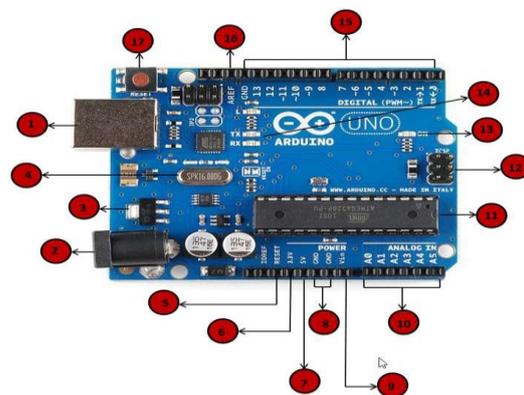

Figure 2: Arduino uno board

In contrast to all of its predecessors, the Uno does not have the FTDI USB-to-serial driver chip. As an alternative, it makes use of USB-to-serial converters coded into the Atmega16U2 (Atmega8U2 up to version R2).

HARDWARE COMPONENTS

POWER SUPPLY UNIT

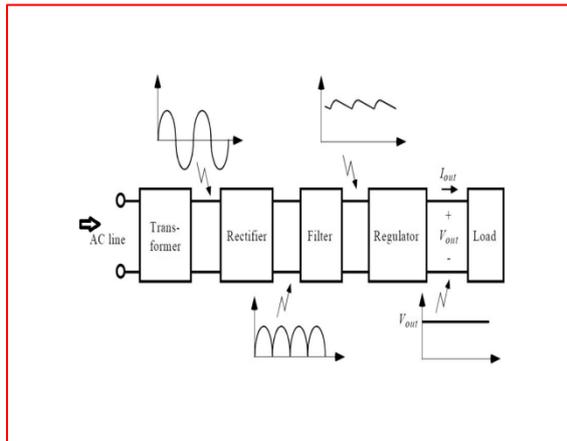The power supply for this system is shown below.

Figure 3: power supply

Diodes:

Only one path of electrical current may pass through a diode. Current may flow in either direction, as shown by the arrow in the circuit symbol. Originally termed valves, diodes are essentially an electrically enhanced version of the mechanical component.
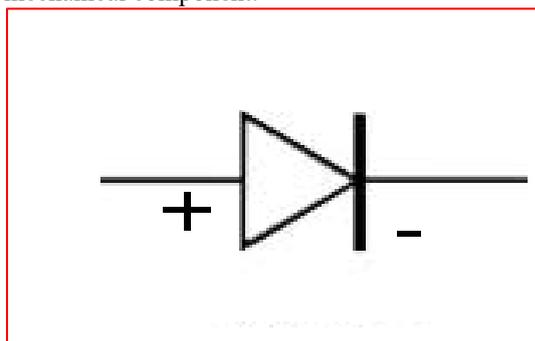

Figure 4: Diode Symbol

One kind of electrical component that restricts current flow is the diode. A voltage loss of around 0.7V will be the sole influence on the signal when the diode is "forward-biased" in this way. No current will flow through a diode that is "reverse-biased" when the current is applied in the other direction.

Rectifier

A rectifier's job is to change the phase of an alternating current (AC) waveform so that it appears as a direct current (DC) waveform. Both "half-wave" and "full-wave" rectifiers are used for rectification. Diodes are used in both devices to convert AC current into DC current. The Half-Wave Resettable The graphic shows that the half-wave rectifier is the simplest rectifier type since it only employs one diode.
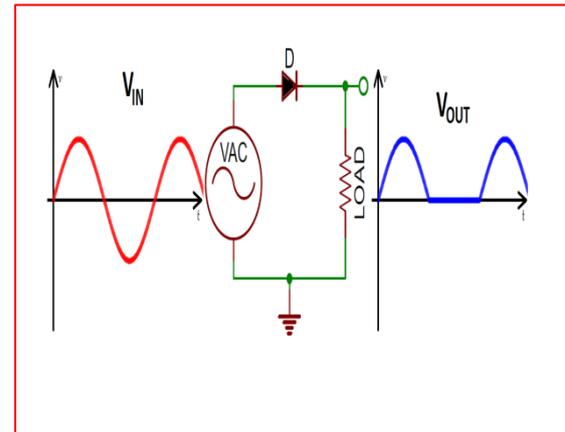

Figure 5: Half Wave Rectifier

LIQUID CRYSTAL DISPLAY

An array of color or monochrome pixels arranged in front of a light source or reflector makes up a liquid crystal display (LCD), a thin, flat display device. Two polarizing filters, with their polarity axes perpendicular to one other, and a column of liquid crystal molecules hanging between two transparent electrodes make up each pixel. Light would not be able to travel through them if the liquid crystals weren't interposed. To make light flow through two filters, the liquid crystal changes the polarization of the light entering the first filter.
A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. 16X1, 16x2, and 20x2 LCDs are among the most popular types of displays that are often linked to the controllers. Which works out to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line. The use of "smart LCD" displays allows for the visual output of information by many microcontroller devices. Affordable, user-friendly, and capable of producing a readout utilizing the display's 5X7 dots plus cursor, LCD displays built on the LCD NT-C1611 module are a great choice. They use mathematical symbols and the usual ASCII set of characters. The display needs a +5V power and 10 I/O lines (RS, RW, D7, D6, D5, D4, D3, D2, D1, D0) for an 8-bit data bus. The only additional lines needed for a 4-bit data bus are the supply lines and six more (RS, RW, D7, D6, D5, D4). The data lines are tri-state and do not affect the microcontroller's function when the LCD display is disabled.

Figure 6: 2x16 LCD Display

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.
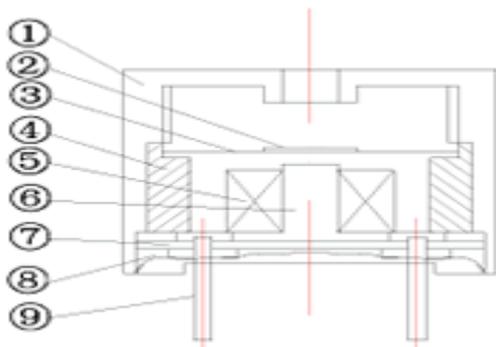
ESP8266 Wi-Fi Module

This project revolves on this. Because the project relies on WIFI control of appliances, the module is a crucial part of it. One remarkable feature of this tiny board is the integrated MCU (Micro Controller Unit), which allows for the control of I/O digital pins via a simple programming language that is almost pseudo-code like. Another benefit is that the ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability. The Chinese company Es press if Systems is situated in Shanghai and makes this gadget. In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. He was His tiny size and cheap pricing (1.7–3.5$) enticed a lot of hackers and geeks to look into it and utilize it for all sorts of projects. Because of its enormous success, Espressif now offers a wide variety of models with varying size and technological specs. Its replacement includes ESP32.

RELAYS:

Industrial controls, automotive systems, and home appliances all make extensive use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.
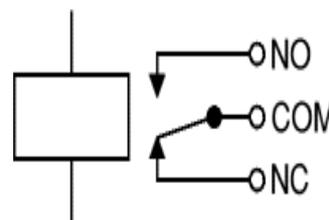
Inductor

Fig7 : Circuit symbol of a relay

DRIVING A RELAY:

Two of the SPDT relay's five pins are used by the magnetic coil, one serves as the common terminal, and the other two are typically closed and normally connected. The coil is activated when a current passes across it. At the beginning, when the coil is deenergized, the usually closed pin and common terminal will be connected. A new connection will be formed between the common terminal and usually open pin when the coil is activated, breaking this connection. Therefore, the relay will be activated whenever the microcontroller sends an input signal to it. You may drive the loads connected between the common terminal and typically open pin while the relay is on. Consequently, the high-current loads are driven by the relay, which receives 5V from the microcontroller. This means the relay may be used as a means of isolation. The microcontroller and digital systems do not have enough current to operate the relay. In contrast to the 10 milliamps required to activate the relay's coil, the microcontroller's pin can only provide 1 or 2 milliamps. This is why the

microcontroller and the relay are separated by a driver, like ULN2003, or a power transistor. By connecting ULN2003 to the relay and microcontroller, it is possible to activate many relays simultaneously.

SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board. The main characteristics are:
• Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more.
• The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board.
• A separate device, known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks.
Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

RESULTS
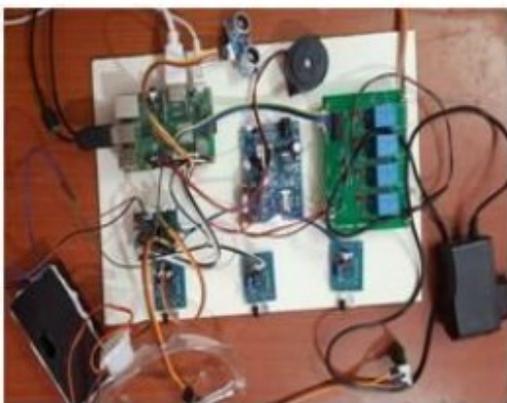
Output

CONCLUSION

People with severe impairments now have an efficient and intelligent mobility option with the Eye Blink Controlled Wheelchair System. This system guarantees safe and simple navigation by incorporating eye blink detection for movement control, PIR sensors for obstacle detection, a buzzer for notifications, and the L293D motor driver for motion control. An excellent piece of assistive technology, this hands-free wheelchair does away with the requirement for physical contact. Safety and usability are both boosted with the addition of a warning system and the ability to avoid obstacles in real time. Further improvements to mobility aid may be possible in the future with the use of AI-based gaze monitoring, Internet of Things connectivity, and voice-assisted controls. When implemented, the suggested method will greatly improve the mobility and freedom of people with disabilities.

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