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Smart Glasses for Visually Impaired Person

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ABSTRACT

This aids the visually impaired in avoiding potential hazards. To help the sight challenged with their travels, we offer a smart glass. In this manner, many persons who are visually impaired may go about their day without worrying about encountering any obstacles. Traveling from one location to another is very challenging for those with visual impairments in the modern world. Our approach is on giving them with personalized vocal support to overcome whatever challenges they may have. They may reach out to the faraway individual for advice when things go wrong. As a consumer product, it aids the vision handicapped in getting about independently. A built-in sensor emits ultrasonic waves in the direction the user is walking, scanning a radius of up to 10 meters. A vibration sensor, which shakes and makes a beep when it senses an obstacle in the person's path, is also useful for this purpose. The Global System for Mobile Communication (GSM) is a means of contact that will allow people to send a text message to loved ones in the event of an emergency. The blind individual can go about and go about their daily life without any assistance from others.
A pair of glasses with an integrated obstacle detecting module in the middle, together with a central processing unit, an output device (in the form of a buzzer component), and a power source make up this apparatus. The central processing unit is coupled with the obstacle detecting module and the output device. The CPU requires electricity, which is provided by the power supply. The ultrasonic sensors are managed by the control units, which analyse the data they collect about the barrier in the man's path and then relay the results to him through a buzzer.

Keywords- Smart glasses, visually impaired, communication

I. INTRODUCTION

About 285 million people worldwide have some kind of vision impairment, including 37 million who are totally blind. Recent public health initiatives have drastically decreased the number of people rendered blind by infectious illnesses. Disabilities associated with aging, however, are on the rise. Except in the most industrialized nations, cataracts continue to be the major cause of blindness worldwide. People who are visually impaired often rely on others for basic mobility and mobility in new environments. They require guidance in order to safely navigate and recognize any threats to their journey. A person who is blind has a far more difficult time finding and acquiring the tools they need to improve their quality of life. We offer an ultrasonic-sensor-equipped smart guiding glass for the blind as a means of resolving this issue. As a marginalized population, the blind need additional support from the general public in order to fully participate in mainstream society. A blind person's independence is greatly enhanced by the wide availability of many forms of adaptive technology.
Wearable glasses with ultrasonic sensors for detecting obstacles in the path of a blind man, a buzzer to give the sound in the direction of the obstacle from the man, a central processing unit consisting of an Arduino UNO to take the information from the sensor about the obstacle distance and process the information according to the coding done, and a power supply of g.
The sensor in these glasses is placed in the space between the top bar and the bridge. A USB cable supplies power to the main device, while single-strand copper wires link all the parts together.
Since ultrasound is a strength, the energy consumption of sluggish wave propagating in a medium relatively great distance, ultrasonic sensors will be the best that can be utilized. For this reason, it is the standard unit of measurement for long-distance travel. As a result, the buzzer's beeping will occur in more rapid successions and with shorter pauses. With the man's distance increasing, the beeping will occur less often. These smart glasses need nothing in the way of training or explanation.

Problem Statement

Persons with visual impairments have significant challenges recognizing and engaging with new environments.

The technological challenge that this idea seeks to address is how to create a blind smart glass so that blind people may participate fully in society. The technology monitors the user's immediate surroundings and feeds back audio information through headphones. Those utilizing a standard blind stick will have a difficult time navigating their environment. When a regular blind stick user is experiencing an emergency or just becoming lost in a public place, nobody can find them.

Existing System

People who are visually impaired encounter a number of challenges that may be alleviated with the use of technology. Assistive technology (AT) is the umbrella term for these tools. There are a plethora of suggested ATs meant to aid the visually impaired. The following section details current projects or solutions that might be useful for visually impaired. Blind people One of the most useful aids for those who are sight impaired is the cane. It was designed to see how well a visually impaired participant's mind could remember a series of things. It helps the person become more aware of their environment, but if they go into an unfamiliar place, they may have trouble remembering where things are. The inability of a visually impaired individual to recognize an item, particularly in an emergency situation, is a major issue.

Proposed System

The suggested solution uses Global solution for Mobile communications to provide a visual assistance for the visually handicapped. The blind may use this equipment to detect potential hazards.

To help the visually handicapped overcome transportation barriers, we offer a smart glass. Using an inaudible gadget, it will monitor the dangers and avoid them. The information is sent to the individual who is blind or has low vision. The device has a button that may be used in an emergency to capture a live video feed from the site and transmit it to the guide. Several blind passengers may benefit from this reliable guiding system, as they won't have to worry about any potential dangers along the way. As such, it serves as a client device for guiding the visually impaired to their destinations.

Objectives

- Create a working prototype of cutting-edge blind glass hardware.
- To facilitate optimal route finding for the visually impaired.
- The main goal is to protect the visually impaired individual from harm and loss.
- Develop accessible technology for those with visual impairments.

II. LITERATURE SURVEY

1. K. Sundar Srinivas et al., submitted a proposal for a technological aid that would employ obstacle detection and facial recognition to facilitate social interactions for the visually impaired. The suggested gadget was a pair of "smart spectacles" outfitted with an ultrasonic sensor, a pi camera, and a raspberry pi. The ultrasonic sensors are wired into the raspberry pi, which then processes the data signals to locate obstructions within a thousand centimeters of the user. The sight impaired may use a pi camera to identify the person in front of them by matching their face against a database of known faces. This gadget helps with easy persons recognition. It's a gadget that's easy on the wallet and easy on the environment.
2. Pavan Hegde et al., stated Smart Glasses optimized for the usage of persons with vision impairments; intended to be inexpensive, dependable, portable, user-friendly, low power, and sturdy. This technology is as convenient to use as a pair of glasses and doesn't break the bank. A sensor inside the gadget emits ultrasonic waves in the direction the user is walking, scanning a range of no more than 5-6 meters. Basic image processing and computer vision methods were employed in the first version of this system, and further enhancements were made to locate a secure route for user navigation. The sensor picks up on the presence of the obstruction and relays that information to the gadget, which then plays a prerecorded message into the user's earphone.
3. Wu Tang et al., technique allowing blind individuals to identify and avoid outdoor hazards was suggested. As a new standard for outdoor obstacle identification, they developed the OD dataset, which includes 15 commonly used items. There were three object identification algorithms employed in their work—YOLO, SSD, and Faster RCNN— & assessment findings showed that YOLO was most effective model for object detection.

4. Muhammad Sheikh Sadi et al., developed and tested a prototype pair of glasses for the visually handicapped. The ultrasonic sensors in the walking aid detected potential hazards in all directions. The device utilizes a second ultrasonic sensor in conjunction with the Deep Learning algorithm Convolutional Neural Network to identify road surface potholes. The integrated controller drives a convolutional neural network (CNN) that scans the road ahead for potential hazards. To classify images in real-time on the embedded controller, a CNN was first trained on the host computer. The experimental evaluation shows that the system's ultrasonic sensor has a 98.73% accuracy at a distance of 50 cm from the barrier.
5. A. Annapoorani et al.,proposed Using cutting-edge methods in computer vision and object detection, this technology allows the visually impaired to identify objects in their environment. The goal of the system is to create a more automated version of the human visual system. Classifying an image's characteristics into predetermined categories requires the usage of image classification methods. About 123,287 photos were manually labeled and placed into 80 different categories for the COCO dataset utilized in this study. The position of things and their connections to one another and the surrounding environment may be described using this comprehensive data collection. The system use the You Only Look Once Object Detection framework to do this. The denominations of Indian rupees were also identified by use of a currency identification module.

III. REQUIREMENT SPECIFICATIONS

Hardware Requirements

- Arduino Uno.
- Ultrasonic Sensor.
- Vibration Motor.
- Switch.
- Buzzer
- GSM
- GPS
- Power Supply.

Software Requirements

- Arduino Ide
- Embedded Python

IV. METHODOLOGY

Proposed methodology

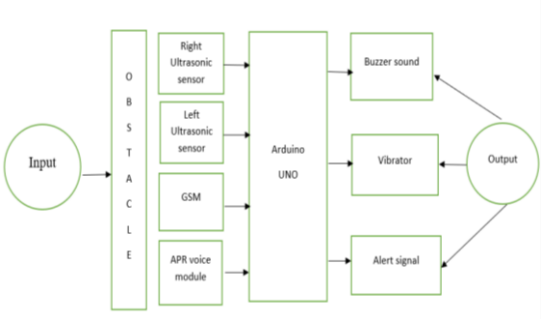

Figure 1: Proposed Methodology of Visually Impaired Persons

Ultrasonic Sensor

The item in front of the individual is detected using an ultrasonic sensor. Ground, Vcc, trigger, and Echo are the four pins of the HC-SRC04 ultrasonic sensor. Sizes vary from 2 centimeters to 4 feet. There are two major ports: one for sending the signal (the transmitter) and another for receiving it (the receiver). It broadcasts high-frequency ultrasound pulses and picks up the echo.

About Ultrasonic Sensor

In order to detect and react to electrical or optical signals, sensors are often utilized. For the purpose of electrical measurement, a Sensor transforms the physical parameter (such as temperature, blood pressure, humidity, speed, etc.) into a signal.

Criteria to choose a Sensor

When selecting a sensor, it is important to keep in mind a few key characteristics. Details are as follows:

Table: 1

1.	Accuracy
2.	Environmental condition - usually has limits for temperature/ humidity
3.	Range - Measurement limit of sensor
4.	Calibration - Essential for most of the measuring devices as the reading's changes with time
5.	Resolution - Smallest increment detected by the sensor
6.	Cost
7.	Repeatability - The reading that varies is repeatedly measured under the same environment

ULTRASONIC SENSOR

In order to determine how far away an item is, ultrasonic sensors convert electrical energy into mechanical motion. Ultrasonic waves are a kind of longitudinal mechanical wave that moves through a material by compressing and rarefying at regular intervals along the path of passage. There are several applications for ultrasonic sensors beyond distance measurement, including object identification, position detection, ultrasonic mice, and the detection of faults in ultrasonic material (such as fractures, air bubbles, and other imperfections in the goods).

Based on the underlying physical phenomena, these devices may be broken down into two distinct types: piezoelectric sensors and electrostatic sensors. Here, we focus on the piezoelectric principle-based ultrasonic sensor. The ultrasonic waves in piezoelectric ultrasonic sensors are produced by a piezoelectric substance.

Working of Ultrasonic Sensor

In order to determine how far away an item is, ultrasonic sensors convert electrical energy into mechanical energy in form of ultrasonic waves. Ultrasonic waves are a kind of longitudinal mechanical wave that moves through a material by compressing and rarefying at regular intervals along the path of passage. Ultrasound refers to any audible sound frequency exceeding 20,000 Hz. The range of frequencies has been widely classified according to the kind of use, as illustrated in the figure below:

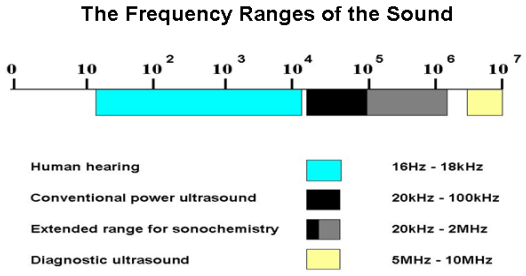

Figure 2: Frequency ranges

Diffuse reflection of ultrasonic waves occurs across a solid angle that may be as large as 180 degrees when they strike an object. As a result, the transducer picks up on echoes that carry a portion of incident energy. Using speed of ultrasonic waves (v) through medium, we may determine distance to object (L) using relation

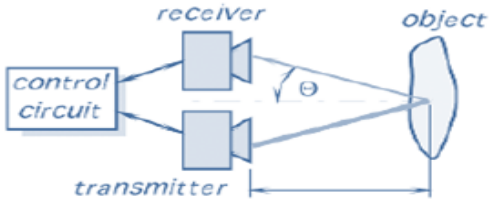

Figure 3: Reflection Angle

$$L = \frac{v\, t \cos\theta}{2}$$

Where 't' is the angular distance between the horizontal and the wave's return route to the sensor. Doppler shift instruments are employed if the item is moving.

- **Buzzer**

A transducer that normally runs on electrical energy and turns it into mechanical energy A buzzer's audible frequency range is just below the 20 Hz to 20 kHz threshold for human hearing. To do this, mechanical energy in the form of auditory waves is converted from an electric, oscillating signal in audible range.

Figure 4: Buzzer

- **Vibration motor**

Using vibrations, the technology provides a visually impaired user with a more accurate sense of what is in front of each eye.

- **Switch**

When a visually impaired person is in danger, the system may do something like send an SMS to the subject's guardian with details like the time, temperature, and position.

- **Arduino UNO**

Ultrasonic sensors are used to identify potential hazards.

- **Speaker**

The glasses have a tiny speaker built into them to let the visually impaired hear what's going on around them.

- **GSM/GPS Module**

Microcontroller will begin processing message with stored keyword when GSM modem receives it. After that, the GPS modem will determine the stick's position and relay that data to GSM modem so it may reply to the sender. Pressing the stick's emergency button causes the microcontroller to retrieve the user's position data from GPS modem & transfer it to the GSM modem, which in turn sends an SMS message to all of numbers stored in the microcontroller.

GSM Technology

Connecting a PC to a GSM-GPRS network requires a GSM module. Almost every country employs the GSM architecture, which stands for the Global System for Mobile communication. Increasing the data transfer rate of GSM, Global Packet Radio Service (GPRS) was developed. The components of a GSM/GPRS module include a GSM/GPRS modem, a power supply circuit, and computer communication interfaces (such as RS-232, USB, etc.).

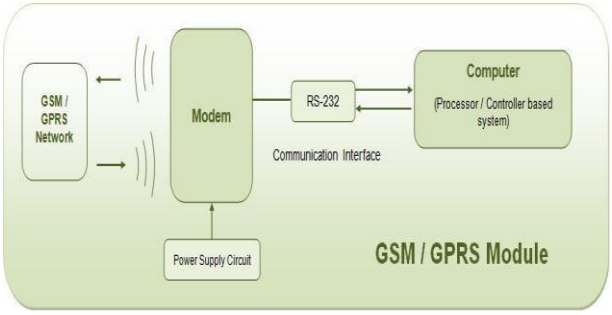

Figure 5: General block diagram of GSM/GPRS Module interfaced with computer

WIRELESS MODEMS

In order to create connection between a cellular network and a computer, wireless MODEMs are the MODEM devices that produce, transmit, or decode data from a cellular network. These are created for a certain kind of cellular data standard (GSM/UMTS/GPRS/EDGE/HSDPA) or technology (GPS/SIM) or cellular network (GSM/UMTS/CDMA). In order to talk to a computer (or any microprocessor or microcontroller system), wireless MODEMs employ serial communication and need Hayes-compatible AT instructions.

GSM MODEM

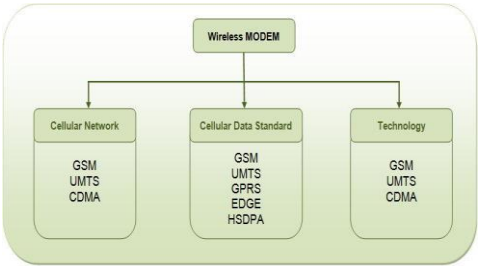

Figure 6: Classification of wireless Modems

To connect a computer to the GSM and GPRS networks, you need a GSM MODEM, which is a kind of wireless MODEM device. Like cellular phones, it uses a Subscriber Identity Module (SIM) card to connect to the internet. Like mobile phones, they are identified by a unique number called an IMEI (International Mobile Equipment Identity). The tasks below are all within the capabilities of a GSM/GPRS MODEM:

- SMS may be received, sent, and deleted from a SIM.
- Ability to access, edit, and search the SIM card's phonebook.
- Voice calls may be made, received, and declined.

In order to connect with processor or controller, the MODEM requires AT instructions, which are sent serially. The controller or processor has issued these instructions. When MODEM gets a command, it responds with an output. The processor/controller/computer may send various AT instructions provided by MODEM to communicate with GSM & GPRS cellular network.

GSM Module

To facilitate its connection to a computer or microprocessor/microcontroller-based system, a GSM module integrates a GSM modem with common communication interfaces such as RS-232 (Serial Port), USB, etc. The module incorporates a power supply circuit that may be triggered with an appropriate adapter.

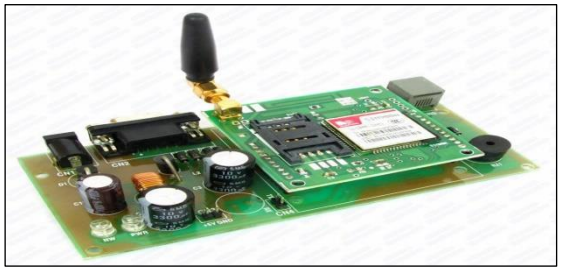

Fig-7: GSM Module (With serial converter port)

Mobile Station (Cell phones and SIM)

A mobile station is comprised of a mobile phone & a SIM card. The mobile network is in communication with the user's equipment. There are three parts to a mobile phone: the terminal adapter, the terminal equipment, and the mobile termination.

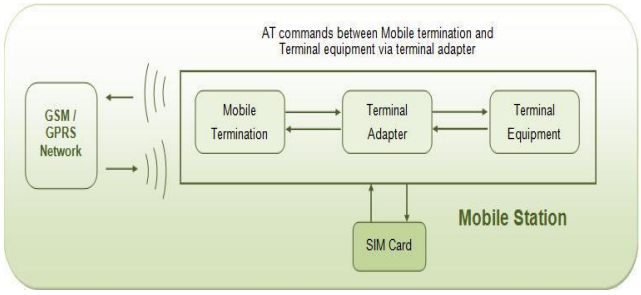

Figure 8: Mobile station and communication network

Mobile Termination is managed by a baseband processor and interfaced with the GSM mobile network. It's in charge of things like SIM card access, voice encoding and decoding, network signaling, and more. Terminal Equipment is an application processor that manages tasks relating to the handset's keypad, display, memory, and other built-in hardware and software services. Through the use of AT instructions, the Terminal Adapter links the Terminal Device to the Mobile Termination. In a GSM/GPRS mobile, the baseband processor handles all of the communication with the network.

V. PROPOSED ARCHITECTURE

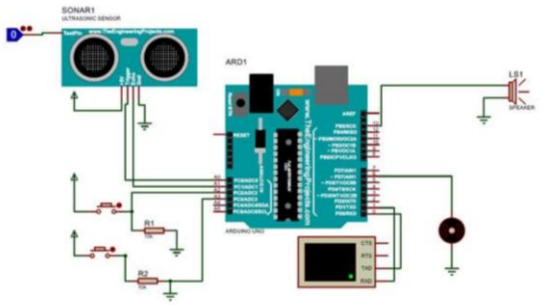

Figure 9: Proposed Architecture

VI. WORKING PRINCIPLE

This GPS and GSM module-based enhanced informative blind glass operates on the premise of sensors feeding information to a microcontroller, which in turn notifies a caretaker's phone or the blind person themselves of what's in front of him. This state-of-the-art instructive blind glass is coded in the c language and controlled by a microcontroller.Connectivity options include cellular, GPS, and ultrasonic.To show how it works, we power the blind glass with a DC current, and while it is in its usual state, any item put in front of the ultrasonic sensor causes a logic high signal to be sent to the microcontroller.

The microcontroller then sends a logic high signal to an onboard buzzer and light. A blind person may readily tell when anything is in front of him by hearing the buzzer go off. When blind persons are in a situation of fear, they may hit the panic button on this arrangement, and the microcontroller will send a logic high to the GSM module. The caregiver's phone got an alert with their precise position since the GSM module is connected to a GPS receiver.

Blind people have historically relied on their canes to help them navigate unfamiliar environments; by tapping the ground or walking around an object, the cane's direction is determined. This method is straightforward and simple to use, but it comes with a number of drawbacks that can seriously compromise the safety of blind people on the road. Our goal is to let people go about more freely by creating smart glasses that can be used both indoors and outside. When worn, the glasses are able to identify impediments like a stairway, table, door, etc., and inform the wearer with a beep and a vibration. The utilization of GSM solves any emergency situation. In the event of an emergency, the blind person's loved ones are notified by GSM, perhaps saving his or her life.

VII. ARDUINO UNO BOARD

The ATmega328P is the foundation of the Uno, a microcontroller board. It comes with a USB port, a power jack, an ICSP header, a reset button, and 14 digital I/O pins (6 of which may be utilized as PWM outputs). It has everything you need to get started with the microcontroller; all you need is a USB connection to connect it to a computer or an AC-to-DC converter or battery to power it. You may experiment with your UNO without too much concern about ruining it, since the chip can be replaced for a few Rupees if necessary.

"Uno" was selected to commemorate the launch of Arduino Software (IDE) 1.0 since it means "one" in Italian. The Uno development board and the Arduino Software (IDE) 1.0 served as the platform's foundation, but have now given way to more recent revisions. For a comprehensive list of current, historical, and obsolete boards, see the Arduino index of boards. The Uno board is the first in a series of USB Arduino boards and serves as the platform's reference model.

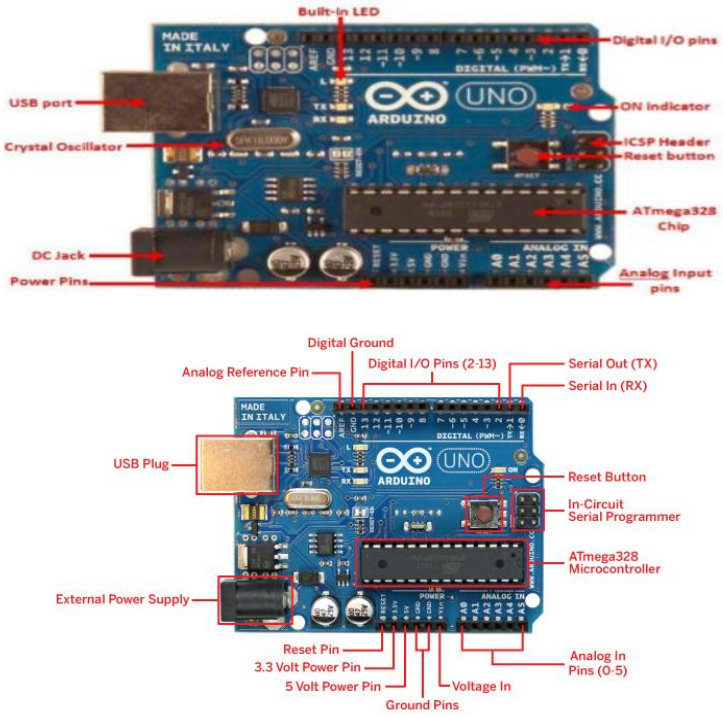

Figure 10: Arduino Uno Board

Component Explanations:

- **Analog input Pins:** Connectors (labeled "A0" through "A5") for an analog-to-digital converter (ADC) that accepts analog values from 0 to 1023 as output.
- **ATmega328 chip:** 8-bit microcontroller that processes the sketch you programmed.
- **Built-in LED:** You must alter the settings of pin 13 to which this pin is attached in order to have access to or control it.
- **Crystal Oscillator:** clock that has a frequency of 16MHz
- **DC Jack:** where the AC-to-DC adaptor or battery is plugged in. Input voltages of 6V-20V are supported, with a sweet spot between 7V-12V.
- **Digital I/O pins:** The analogWrite() method may be used to provide PWM (Pulse Width Modulated) output on six of the input/output pins (0-13). It is also possible to send and receive serial data via the 0 (RX) and 1 (TX) pins.
- **ICSP Header:** pins for a different kind of programming called "In-Circuit Serial Programming."
- **ON indicator:** When the board is powered, an LED indicator light will turn on.
- **Power Pins:** VIN (voltage from DC Jack), 3.3V, and 5V-capable power supply pins.
- **Reset Button:** To reset the board and begin running the sketch again, hit this button.
- **USB port:** Provides a USB connection for drawing uploading and powering the board from a computer. The Arduino software's serial monitor makes use of this for serial communication.

VIII. About ATmega328 MICROCONTROLLER

Arduino Pin-Map:

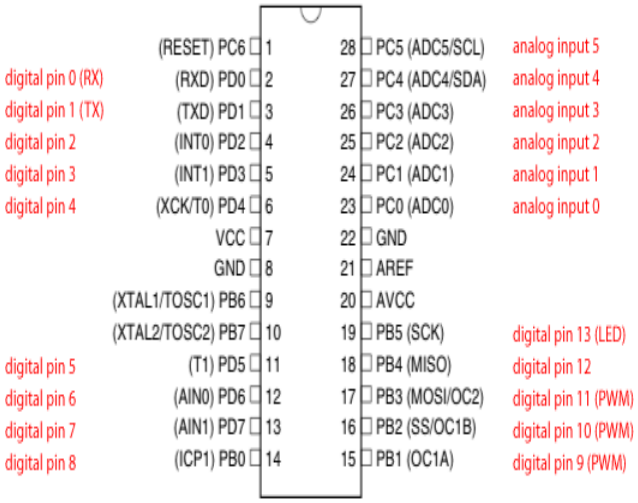

Figure 11: Arduino Pin-Map

Technical Specifications

Table:2

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25

IX. CONCLUSION

Third Eye for the Blind aims to create a product that will be of great assistance to the visually impaired and others who are often dependent on others. Those with visual impairments may utilize it with confidence since it can identify potential hazards along the path. They need merely wrap themselves in this band or fabric to benefit from this technology. This Arduino-based obstacle detector for the visually impaired is an innovative solution to the difficulties they face. Distances between items and the sensor may be easily determined by the system. The blind individual may use it to sense things in any direction. A blind person may go from one location to another and go on with their daily life without assistance from others. So, unlike traditional guiding devices and canes, the suggested system gives the visually impaired user accurate information about the item and impediments in their path.

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