ANDROID BASED PORTABLE SMART CANE FOR VISUALLY IMPAIRED PEOPLE

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Abstract - It is exceedingly challenging for blind persons to go from one location to another. Therefore, we present the smart stick to assist the blind individuals on their own. To identify the obstruction, an ultrasonic sensor alerts us with a buzzer. When a blind person is in a life-threatening scenario, we have a panic switch button that they can click to send a GSM alert to a helper. One of them is having confidence when walking, which can present different difficulties in various settings or nations. We took into account the setting of India, where outdoor spaces are frequently congested and noisy. The development of a new smart stick that can detect barriers of any height in front of or slightly to one side of the user took these difficulties into consideration. Through vibration in the hand, the stick provides a good indication of the proximity and placement of obstacles. Depending on how far away the impediment is, different vibrational frequencies are produced. Real-time trials to test the stick's accuracy have been carried out in various settings by various individuals, and the results are highly encouraging. The Smart Cane is an electrical device that helps visually impaired people identify obstacles. The Smart Cane is an electronic gadget that attaches to walking sticks used by people with vision impairments as a handle. Our project's primary goal is to enable blind people to move independently.

I. INTRODUCTION

The World Health Organization (WHO) estimates that there are 285 million visually impaired persons worldwide, 39 million of whom are blind or sightless. 82% of all blind or visually impaired people are 50 years of age or older. Uncorrected refractive errors (43%) and cataracts (33%), which are the leading causes of blindness, respectively, are the main causes of visual impairment. Visually challenged people regularly struggle with issues related to education, transportation, employment, and independent life.

The hardest hurdle for them, however, is probably just getting around freely. because they do not rely on their own sight. As a result, we used technology to create a lightweight, affordable, and dependable device to help people who are blind or visually impaired overcome obstacles. This device allows them to walk confidently while having the most control over their mobile device through wireless communication and performs some essential functions by pressing buttons from their mounted device on the white cane. In this research article, an Android application that is connected to a portable smart device mounted on a white cane using a Bluetooth module as well as additional sensors and modules that are managed by an Arduino UNO has been created.

Blind people tested the gadget, which performs better in terms of dependability, use, portability, weight, and affordability so that anyone can easily buy, mount, and configure to walk more confidently. The ability to operate a mobile device from the mounted device, such as sending a message to carers, dialing a call, reading an SMS, or opening Google Maps to navigate, is also provided. This wireless Bluetooth communication allows for obstacle detection in the range of 5 feet with varying buzzer frequency after every 12 inches to give better understanding of distance to obstacle.

What's more, by simply shaking the phone horizontally, a blind person can launch an Android application and connect to the device, immediately starting both. Additionally, after a successful connection with the gadget on the white cane, it produces a confirmation voice. The Smart cane is an electronic tool that helps visually impaired people identify obstacles. People who are visually impaired can use the Smart cane, a gadget that attaches to walking sticks as a handle. Our project's primary goal is to enable blind people to move independently.

II. EXISTING METHOD

In this project, the main focus is on the Android application, where we leverage the smart phone's built-in sensors rather than adding more, which lowers costs and reduces the device's size and weight while increasing its intelligence and economy.

The accelerometer, GSM, GPS, and speaker are the aforementioned sensors. Comparing this device to other smart canes on the market, these qualities make it stand out. Blind people use smart canes to detect obstacles. We employ ultrasonic sensors, ESP8266 (IoT), touch sensors, buzzers, GSM, and IoT.

We may send a distress message through the phone using a solar-powered battery while receiving information about the cane via a web server using GSM.

III.HARDWARE COMPONENTS

A. Arduino UNO:

A microcontroller board called the Arduino UNO is based on the ATmega328 (datasheet). It contains a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (of which 6 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; to get started, just plug in a USB cable, an AC to DC adapter, or a battery. Because it does not employ the FTDI USB to serial driver chip, the UNO is unique from all earlier boards.

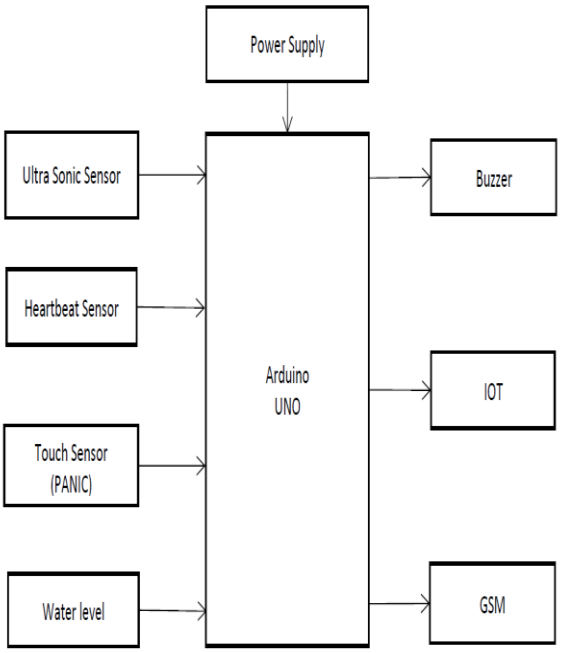

Fig 1. Block Diagram

Instead, it has an Atmega16U2 (or an Atmega8U2 up to version R2) that has been configured as a USB to serial converter. The 8U2 HWB line is pulled to ground by a resistor on the UNO board's revision 2 to make entering DFU mode simpler.

The Arduino board's input voltage when it is powered externally (as opposed to using the USB connection or another regulated power supply, which provides 5 volts). You can access voltage through this pin if it is being supplied via the power jack or you can supply voltage through this pin.

The boot loader takes up 0.5 KB of the ATmega328's 32 KB of memory. Additionally, it features 1 KB of EEPROM (which can be read and written using the EEPROM library) and 2 KB of SRAM. Entry and Exit Using the pin Mode(), digital Write(), and digital Read() functions, each of the Uno's 14 digital pins can be utilised as either an input or an output.

They use 5 volts to work. Each pin contains an inbuilt pull-up resistor of 20 to 50 kilo Ohms that is unplugged by default and has a maximum current capacity of 40mA.

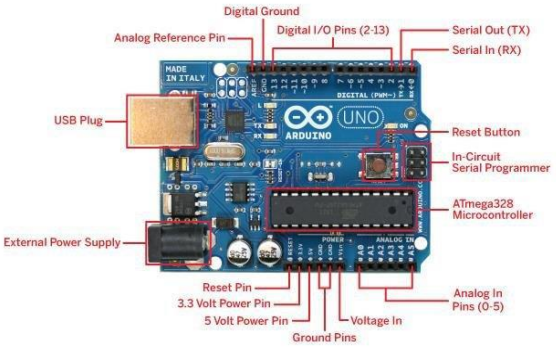

Fig 2. Arduino UNO

B. EP8266 Module:

Espressif Systems, a firm based in Shanghai, China, produces the ESP8266, a low-cost Wi-Fi microprocessor with a full TCP/IP stack and microcontroller functionality. The ESP-01 module, produced by a third-party company AI-Thinker, first attracted the attention of western manufacturers in August 2014. This little module enables microcontrollers to establish straightforward TCP/IP connections using Hayes-style commands across a Wi-Fi network.

However, there was initially very little information available in English about the chip and the orders it would receive. Many hackers were drawn to investigate the module, chip, and software on it as well as translate the Chinese documentation because to the extremely low price and the fact that there were so few external components on the module, which suggested that it would ultimately be very inexpensive in volume.

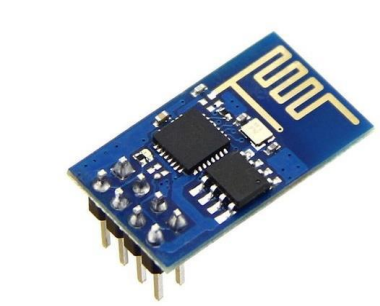

Fig.3 ESP8266 Module

C. GSM Module:

Due to its small size and adaptability, the SIM800L is a very small GSM/GPRS module that may be included into numerous IoT projects. This module supports quad-band GSM/GPRS, which enables it to function everywhere in the world. It can perform all of the functions that a typical mobile phone can, including sending and receiving text messages, making and receiving phone calls, and connecting to the internet via GPRS.

- Blink every one second:
  The module is functioning but currently unable to connect to the cellular network if the LED on the module is blinking once every second.

- Blink every two seconds:
  The GPRS data connection you requested is active and prepared to accept requests when the onboard LED on the monitor blinks once every two seconds.

- Blink every three seconds:
  The module is connected to a network and capable of sending and receiving voice calls and SMS messages when the LED on the module blinks once every three seconds.

D. HEARTBEAT SENSOR:
The heart rate, or pace of the heartbeat, is measured using a device called a heartbeat sensor. The fundamental actions we do to maintain our health include checking our body's temperature, heart rate, and blood pressure.

Fig.4 Heartbeat Sensor

We use thermometers to gauge body temperature and a sphygmomanometer to track blood pressure or arterial pressure.

There are two ways to check heart rate:
1. The pulse can be manually checked at the wrists or neck
2. The pulse can be manually checked by using a heartbeat sensor.

E. BUZZER:
A buzzer or beeper is a mechanical, electromechanical, or piezoelectric (short for piezoelectric) auditory signaling device. Buzzers and beepers are frequently used as alarm clocks, timers, and to validate human input such a mouse click or keyboard.

Fig.5 Buzzer

F. ULTRASONIC SENSOR:
An ultrasonic sensor is a device that uses ultrasonic sound waves to calculate a distance to an item. An ultrasonic sensor transmits and receives ultrasonic pulses from a transducer to determine the proximity of an item. Boundaries reflect high-frequency sound waves, creating distinctive echo patterns.

Fig.6 Ultrasonic Sensor

The frequency of ultrasonic sound vibrations is higher than the range of human hearing. The microphones used to capture and transmit ultrasonic sound are known as transducers. Like many others, our ultrasonic sensors use a single transducer to transmit a pulse and receive the echo. The sensor establishes a T-Sonic pulse's distance.

Any illumination condition and either indoors or outdoors can be used with ultrasound with confidence. As long as the robot isn't moving too quickly, ultrasonic sensors can handle frequent movement and collision avoidance for robots. Because ultrasonic is so widely used, it can be dependably employed for drone applications, water level detection, grain bin sensing, and sensing cars at your neighbourhood drive-thru or bank. Ultrasonic rangefinders are frequently employed in collision detection technology.

The best applications for ultrasonic sensors are in the non-contact detection of:

- Presence
- level

G. WATER LEVEL SENSOR:
To determine the level of substances that can flow, level sensors are utilized. These materials come in liquid, slurry, granular, and powder form. The level of a river or lake can be measured as well as the level inside containers.

Fig.7 Water Level Sensor

H. TOUCH SENSOR:

Electronic sensors that can recognize touch are called touch sensors. When touched, they act as a switch. These sensors are utilized in lighting, mobile touch screens, etc. The user interface provided by touch sensors is simple.

Fig.8 Touch Sensor

Tactile sensors are another name for touch sensors. These can be easily designed, are inexpensive, and are mass produced. These sensors are quickly taking the place of mechanical switches as a result of technological advancement. There are two different types of touch sensors: Resistive sensor and Capacitive sensor.

Working Principle of Touch Sensor:

Like switches, touch sensors function similarly. They get activated and function as a closed switch when they are subjected to contact, pressure, or force. These elements function as an open switch when the pressure or contact is released. Two parallel conductors and an insulator separate the two conductors in a capacitive touch sensor. With a capacitance value of C0, these conductor plates function as a capacitor.

Our fingers transform into conductive objects when they come into contact with these conductor plates. The capacitance will thus increase in an unknown manner. The capacitance C0 of the sensor is continually measured by a capacitance measurement circuit. This circuit generates a signal when it notices a change in capacitance.

The pressure that is applied to the surface in order for the resistive touch sensors to detect touch is calculated. These sensors have two conductive layers that are separated by a very tiny distance and coated with indium tin oxide, a good conductor of electricity. A steady voltage is applied across the films' surface. The bottom film is touched when pressure is applied to the top film.
This causes a voltage drop, which a controller circuit detects and uses to generate a signal to identify the contact.

IV. SOFTWARE REQUIREMENTS:

A. Arduino IDE

Although the Arduino IDE is relatively simple, it offers a nearly perfect environment for the majority of Arduino-based applications. Standard menu items such as "File" (new, load, save, etc.), "Edit" (font, copy, paste, etc.), "Sketch" (for compiling and programming), "Tools" (helpful choices for testing projects) and "Help" are available in the top menu bar. You can enter program code in the straightforward text editor located in the centre of the IDE. The output window, which is located at the bottom of the IDE, is used to view information such as the compilation status, memory use, program faults, and several other helpful notifications.

The sketches used to create projects for the Arduino are often written in a condensed form of C++ that omits a number of C++ features. There are several device-specific libraries available since programming a microcontroller differs from programming a computer in a few ways (e.g., changing pin modes, outputting data on pins, reading analogue values, and timers). This occasionally misleads people who believe that Arduino is written in a "Arduino language." The Arduino, on the other hand, is actually C++-programmed. It merely makes use of specific device libraries.

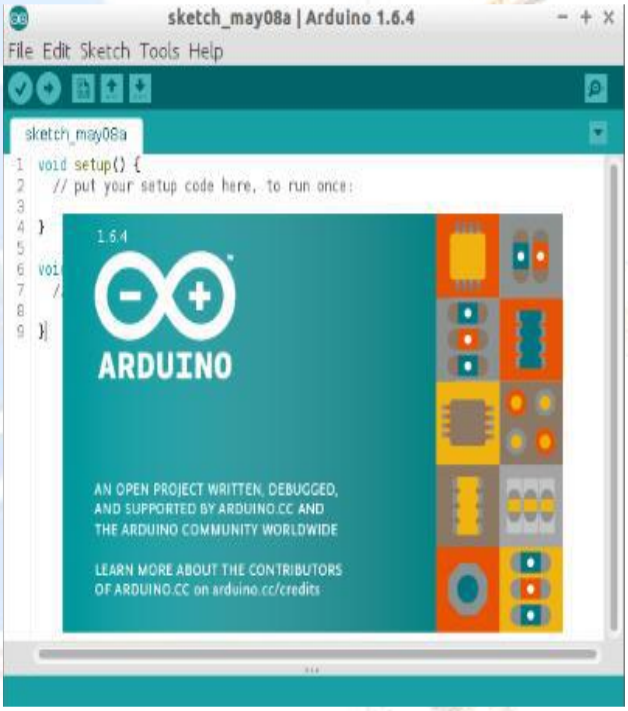

Fig.9 Arduino IDE Software

B. Embedded C:

Every single embedded system we come across in our daily lives, such as a mobile phone, washing machine, and digital camera, is powered by a CPU that is programmed in embedded C. Each CPU has integrated software attached to it. The embedded software is the primary factor in determining how well an embedded system works. The microcontroller is most typically programmed using embedded C.

Earlier, assembly level programming was used to create a large number of embedded program. They did not, however, offer portability. The development of several high-level languages, including C, Pascal, and COBOL, overcame this drawback. The C language, however, initially received and

still enjoys widespread adoption for embedded devices. The C code that was built is simpler to understand and more dependable, scalable, and portable.

Dennis Ritchie created the C programming language in 1969. It is a collection of one or more functions, each of which is made up of a number of statements that carry out a certain purpose. As it allows both high-level and low-level applications, C is a middle-level language. We need to understand the structure of RAM memory before delving into the specifics of embedded C programming. To build programs, embedded system designers need to be familiar with hardware architecture. These programs are crucial for keeping an eye on and managing external gadgets. Additionally, they directly control and make use of the microcontroller's internal architecture, including its interrupt management, timer, serial connection, and other functions.

CONCLUSION:

Our primary focus in this project is to increase the device's intelligence and economics by leveraging current sensors and adding new ones at a lower cost and in a smaller, lighter package. The sensors stated above are a GSM and an accelerometer.

Comparing this device to other smart canes on the market, these qualities make it stand out. The ESP8266 (IOT), Touch sensor, buzzer GSM IOT, and ultrasonic sensor are used in the smart cane for blind people to identify obstacles. The information about the cane is then provided through the web server. GSM allows us to send emergency messages via phone using a solar panel battery.

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