

# Walking Assistance for blind Using Microcontroller in Indoor Navigation

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**ABSTRACT:** Many blind people require travel aids to navigate in unknown environments. However, the majority of the corresponding devices are not designed for people with walking disabilities. In our project we provide walking assistance. But also enables blind users with mobility impairment to avoid obstacles. By leveraging existing robotics technologies, our system detects both positive and negative obstacles such as curbs, staircases and holes in the ground and transmits obstacle proximity information through haptic feedback. Our project aims to provide a solution for the above problem by using the modern technology by developing a robot to assist the visually impaired people to fulfil their basic needs like walking assistance in indoor environment.

**KEYWORDS:** Voice detection, Microcontroller, Arduino operations, servo motors.

## I. INTRODUCTION

According to a recent report of the World Health Organization 81.7% of all 39 million blind people worldwide are 50 years and older. These people have an inherent risk towards walking disabilities. However, established navigation aids for the blind such as white canes or guide dogs provide limited assistance.

A conventional technique for blind people who depend on a walker is to regularly stop and monitor the environment with a cane stick. This is tediously slow and it comes with the inherent risk of missing objects that do not touch the ground, such as tabletops. A system which guide or assist people with vision loss, ranging from partially sight to totally blind, by means of sound commands is referred as Navigation assistance for visually impaired (NAVI). Many researches are being conducted to build navigation system for blind people. Most of these technologies have limitations as its challenge involves accuracy, usability, interoperability, coverage which is not easy to overcome with current technology for both indoor and outdoor navigation. Existing electronic aids for the blind solve this problem to some extent, but most of these devices are not designed for blind people with walking impairments. Furthermore, in most cases, these devices are able to detect positive obstacles but fail to recognize dangerous negative obstacles, such as downward staircases or road curbs. However, it is difficult for them to do this all the time when surrounding environment could suddenly change, or when they get lost memory of locations. This proposal will give the solution for helping them to detect and avoid obstacles in the walking paths Initial experiments show that our smart walker.

In this paper aims to provide a solution for the above problem by using the modern technology by developing a robot to assist the visually impaired people to fulfil their basic needs. This device is to design to help blind or visually impaired users navigate safely and quickly among obstacles and other hazards

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## A. SAFETY & RELIABILITY RELATIONSHIP

Safety and Reliability of assets are closely linked with each other. Deterioration in the safety performance is preceded by the increase in the number of failures. Overlooking these warning signals can be disastrous as each of these is an accident waiting to happen. Although no technology is fail-proof, an error rate, however so ever small, being inherent in any man-machine system, reliability of the equipment is the most important factor in the efficiency and safety of a transport system. Objective of the various research organizations is to develop equipment and systems which have near zero level of failure rate. Side by side with the induction of advanced technology, it is imperative that the same is maintained properly and replacements, renewals made as and when needed. If the accidents have to be minimized, it is imperative that the equipment in use is always kept in fine fettle.

## B. SURVEY OF CONTEMPORARY SOLUTIONS

The Visually challenged persons face constraints in independent mobility and navigation. Mobility means the possibility of liberally moving, without support of any supplementary person, at home and unfamiliar scenarios. People with visual impairment tackle enormous limitations in terms of mobility. A system which guide or assist people with vision loss, ranging from partially sight to totally blind, by means of sound commands is referred as Navigation assistance for visually impaired (NAVI). Many researches are being conducted to build navigation system for blind people. Most of these technologies have limitations as its challenge involves accuracy, usability, interoperability, coverage which is not easy to overcome with current technology for both indoor and outdoor navigation. A system "Roshni" determines the user's position in the building, navigation via audio messages by pressing keys on the mobile unit. It uses sonar technology to identify the position of user by mounting ultrasonic modules on ceiling at regular intervals. This system is portable, easy to operate and is not affected by environmental changes. But this system is limited only for indoor navigation because it requires detailed interior map of the building. RFID based map-reading system which provides technical solution for the visually impaired to pass through public locations easily using RFID tag grid, RFID cane Reader, Bluetooth interface and personal digital assistance. But its initial development cost is quite high and chances of interference in heavy traffic. A voice operated outdoor navigation system developed using GPS, voice and ultrasonic sensor. It can alert user's current position and provide verbal guidelines for travelling to a remote destination but fails to give obstacle detection and warning alert.

## II. RELATED WORK

Over the past few decades some research has been dedicated to navigation assistance for the blind or visual impaired persons. Many of these navigation assistances can be categorized into basic obstacle avoidance systems for example like the NavBelt from Shoval et al. [10] that produces a 120-degree wide view ahead from the users current location. This information is translated into a stereophonic acoustical sound that allows the user to notice if a certain direction is blocked. Similar to this approach the Haptica Corporation developed Guido© [2] a robotic walking frame equipped with a sonar sensor. Recent and very promising approaches rely on the usage of robotic assistances like the work from Kulyukin et al. [5]. Although they work very well in new, unknown indoor environments they still rely on certain provided infrastructure.

## A. AUGMENTED NAVIGATION FOR THE BLIND

A new plastic housing of the sensor module was developed which allows an easy and ergonomic handling of the sensor module with or without the cane (see Figure 1). It was possible to reduce significantly the size and weight of the module. Meanwhile, the sensor module includes acceleration sensors, inertial sensors and magnetic sensors besides the previous stereo camera and keyboard. The information gained from several sensors can be used to optimize the location measurement that is currently determined by using the conventional WiFi system of our institute.

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## B. OVER ALL SYSTEM DESCRIPTION

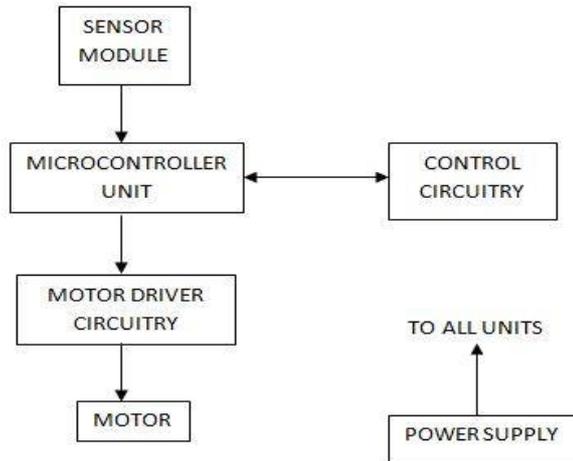


Fig no 2.1 overall system description

## C. PROPOSED CONCEPT

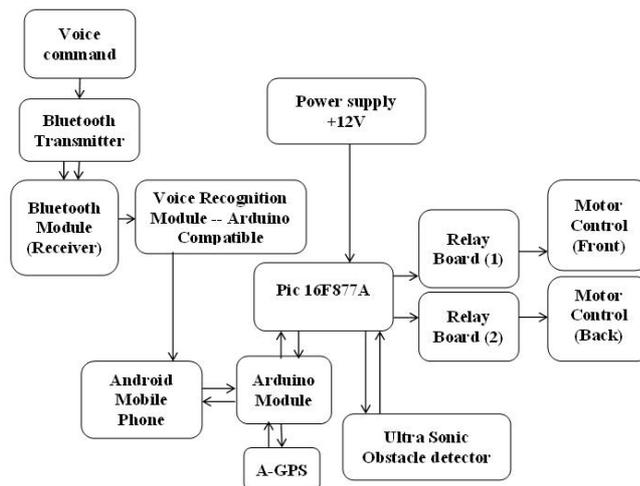


Figure shows the proposed block diagram. Guide dogs are being employed to guide visually impaired however it's not adaptable and antagonistic. That's the intention of coming up with robotic dog which can guide those individuals to travel to their endpoint securely. In the proposed system, visually impaired people have to give a voice command of their preferred terminus. Bluetooth transmitter is positioned at the ear of visually impaired individuals. Bluetooth receiver is placed with the Robotic dog. Voice recognition module makes the voice

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command free from noise. Then voice is given to android mobile that consists of offline map information regarding the destination. A-GPS tracks the present location and therefore the suggestion of directions to the target. Then microcontroller processes the input and thereby the wheel starts to work. Ultrasonic obstacle sensor detects obstacles and so the wheel stops functioning and it changes its suitable direction.

## III. SYSTEM IMPLEMENTATION

Sensors continuously senses for the presence of obstacles around their operating angle. If the ultrasonic sensors, detects any obstacles within their range and sends back responses as digital signals. A short 10 $\mu$ s pulse to the trigger input to start ranging is given and the module will send out an 8 cycle burst of ultrasound at 40kHz and raise its echo. Echo is a distance objects that is pulse width and the range in proportion. We can calculate the range through the time interval between sending trigger signal and receiving echo signals. The responses are sent to Arduino board for processing the signals. The board upon receiving the signals from the sensor calculates the distance. 4.3Obstacle Detection When the system finds the obstacle in front of it within the range, it halts the motion by sending signal to the microcontroller.

### A. MICROCONTROLLER

The arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

### B. MICRO CONTROLLER (16F877A)

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller. PIC's are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability. They are also commonly used in educational programming as they often come with the easy to use 'pic locator' software. A PIC's instructions vary from about 35 instructions for the low-end PICs to over 80 instructions for the high-end PICs. The instruction set includes instructions to perform a variety of operations on registers directly, the accumulator and a literal constant or the accumulator and a register, as well as for conditional execution, and program branching.

### C. MEMORY ORGANIZATION

There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The program memory organization is as follows: The PIC16F87XA devices have a 13-bit program counter capable of addressing an 8K word x 14 bit program memory space. The PIC16F876A/877A devices have 8K words x 14 bits of Flash program memory, while PIC16F873A/874A devices have 4K words x 14 bits. Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms.

### D. SMART WALKER

Easy VR 2.0 is a speech recognition module which recognises the received voice command given by visually impaired people and it is powered at 3.3V – 5V. It is easy to connect it to an Arduino board in two ways. Bridge mode– control process is done by software serial library. Adapter mode– can use the Arduino board as a USB/Serial adapter when the microcontroller in reset. The receiver uses the messages it receives to determine the transit time of each message and

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computes the distance to each satellite using the speed of light. In our design, the purpose of GPS is to find the exact location of the fault.



Fig no 3.1 smart walker

The smart walker, a modular system composed of a standalone processing unit and an off-the-shelf walker. The processing unit includes two laser scanners and the required computing capabilities. The lower laser scanner is fixed and used for ego motion estimation. A servo motor tilts the upper scanner continuously up and down to acquire a three-dimensional Our system consists of a standard off-the-shelf walker, retrofitted with sensors and data-processing capabilities. The sensing and processing unit is built in a modular fashion, such that it can be easily mounted on different walker brands. The system additionally includes a vibration belt comprising five vibrating motors, which provide haptic feedback to the user. An image of the smart walker is shown in Figure 1, while Figure depicts the vibration belt.

### ***E. ULTRASONIC SENSORS***

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) 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. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.

An ultrasonic transducer is a device that converts energy into ultrasound, or sound waves above the normal range of human hearing. While technically a dog whistle is an ultrasonic transducer that converts mechanical energy in the form of air pressure into ultrasonic sound waves, the term is more apt to be used to refer to piezoelectric transducers or capacitive transducers that convert electrical energy into sound. Piezoelectric crystals have the property of changing size when a voltage is applied; applying an alternating current (AC) across them causes them to oscillate at very high frequencies, thus producing very high frequency sound waves. The location at which a transducer focuses the sound can be determined by the active transducer area and outline, the ultrasound rate, and the sound velocity of the propagation medium. Since piezoelectric crystals generate a voltage when force is functional to them, the similar mineral can be used as an ultrasonic sensor. Various structures use separate transmitter and receiver components while others combine both in a single piezoelectric transceiver.

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### F. RF TRANSMITTER / RECEIVER

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signs an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

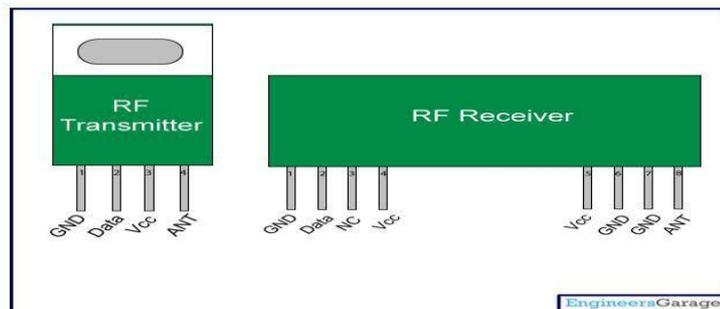


Fig no 3.2 Transmitter and Receiver

### G. MOTORS

To control the motor we need a motor driver as the current drawn by the motor is large to be provided from the micro-controller. Thus a motor driver IC L298N is mounted on the shield. This IC can control two motors. An H- Bridge setup is needed to provide the sufficient power to the motor. The driver controls the motors through this H Bridge. The motors could be connected to the shield through the screw terminals which are named as MOTOR A and MOTOR B. The screw terminals in between these two motors are the dedicated power source to the motor. The MOTOR A is connected to Pin 6 and 5. The MOTOR B is connected to 10 and 11.



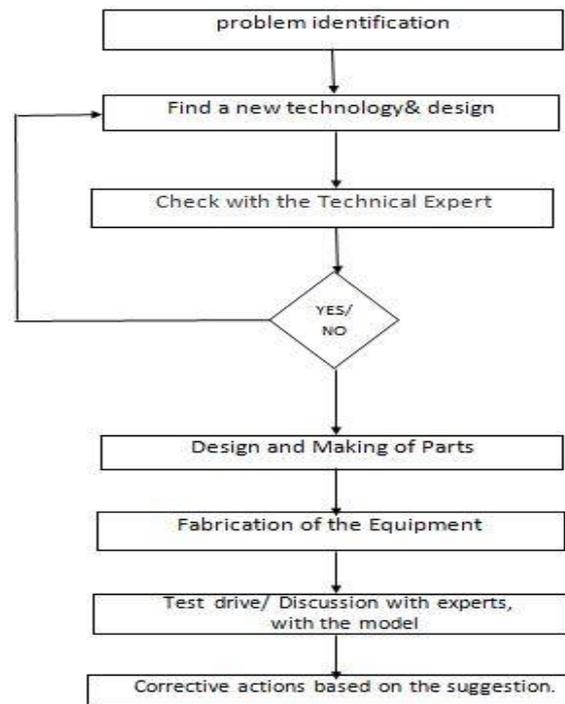
Fig no 3.3 DC gear motor

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## IV. METHODOLOGY



## V. CONCLUSION

In this Research, We proposed a robotic based walking aid , which continuously looks for detecting obstacles which comes along the user way. On detecting any obstacles the front sensor mounted on the mini-servo motor searches for the alternate path, hence the bot steers through the corresponding angle guiding the user along that path. The driving servo motors movement are controlled by the microprocessor signals. And also provides voice assistance for the user through voice board for the current location reached. The Robot can be further extended by using GPS/Google Maps to find the current location of the user.

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