Smart Walking Stick for Visually Impaired Person

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ABSTRACT

In this world everyone is in a race of achieving success, so for the betterment and welfare of blind persons, many gadgets are invented, similarly our paper also describe a gadget which will improve the navigation of the person and will help in walking safely on the roads, by making him aware of the obstacle ahead in his path. And this would help such person to cope up with other. The paper describes a stick which is integrated with ultrasonic sensor and water sensors. The ultrasonic sensors detect obstacle ahead using ultrasonic waves and passes this data to microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough or not. And if it is close then it aware him via headphone giving him the knowledge of distance. It also senses pot holes filled with water and alerts the user by a different buzzer, making him aware that there is water in his path ahead. And it has the ability of detecting the live wire in the path. The system has one more advanced feature integrated to help the blind find their stick if they forget where they kept it. A wireless RF based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus, this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

Keywords: Ultrasonic Sensors, Visually impaired Person

I. INTRODUCTION

Vision is the most important aspect of human life. Everything seems to be impossible without vision, our simple daily life task seems to be a mission for that person and people with visual disabilities are often dependent on external assistance which can be provided by humans, trained dogs, or special electronic devices as support systems for decision making. There are approximately 38 million people across the globe who are blind, over 14 million are from India. Even for the non-visually impaired the detection of obstacles is sometimes problematic, it's even worse for the visually impaired. The most common tool that the blind currently uses to navigate is the standard white stick. We decided to modify and enhance the walking stick, since blind are only able to detect objects by touch. Vision is the most important part of physiology as 83% of information human being get from the environment is via sight. The 2011 statistic by the world health organisation (WHO) estimates that there are 285 billion of which are blind and 246 are with low vision. The traditional and oldest mobility aids for persons with visual impairments are the walking cane and guide dogs. With the rapid advances of modem technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities. Recently there has been a lot of electronics travel aids (ETA) designed and devised to help the blind navigate independently and safely and to prevent Collision of the blind person with other objects and hence subject his/her life to danger. However, in comparison to other technologies many blind guidance system use ultrasound because of its immunity to environmental noise. Another reason why ultrasonic is popular is that the technology is relatively inexpensive, and ultrasound emitters and detectors are small enough to

be carried without the need of complex circuitry. We have Accomplished this by adding Ultrasonic Sensor which will detect the obstacle and help blind person in walking safely, but this was not enough because there can be many other things which could create difficulties for him like current carrying wires or water pot holes, so we have added some more features in it which will give information of these things also like water sensor will detect pot holes filled water. Now what if he forgets that where he has kept his stick? So, for this problem we have used a radio frequency module which will help him to find his stick of it is misplaced around.

II. LITERATURE REVIEW

With the rapid advances of modern technology, both in hardware and software front has brought potential to provide detection of obstacles. Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Visually impaired people generally use either the typical white cane or the guide dog to travel independently. Project Prakash numerous attempts have been made in the society to help the blind. "Project Prakash" is a humanitarian mission to help the blind children especially by training them to utilize their brains to learn a set of objects around them. The stick has a ping sonar sensor to sense the distant objects. It also has a wet detector to detect the water. The micro-controller used is PIC microcontroller. The microcontroller circuit is on the outside of the stick but is protected with a code, so its security cannot be breached. The only feedback given to the user is through the vibration motor. Three sensors are used viz. ultrasonic, pit sensor and the water sensor. Even this is a PIC based system. The feedback given is through the vibration as well as the speaker/headphones. Many different approaches have been taken with the primary purpose of creating a technology to aid the visually impaired. The priorities set by different authors are different leaving a scope of improvement in every application.

HARDWARE REQUIRED

Table 1

Name	Specification
Ultrasonic Sensor	0-300 cm,4 terminals,5-10volt
Microcontroller	40 pins, 4 ports, 128 bytes of RAM, 32 I/O lines
Water Sensing Material	-
Led	5volt
Relay	9 volts
ULN 2003 IC	500 mAmp (rated controller current)
7805 IC	7 -35 volt(input)
Battery	9 volts
Crystal Oscillator	11.29 MHz
PCB	copper sheets laminated onto a non-conductive substrate

III. BLOCK DIAGRAM
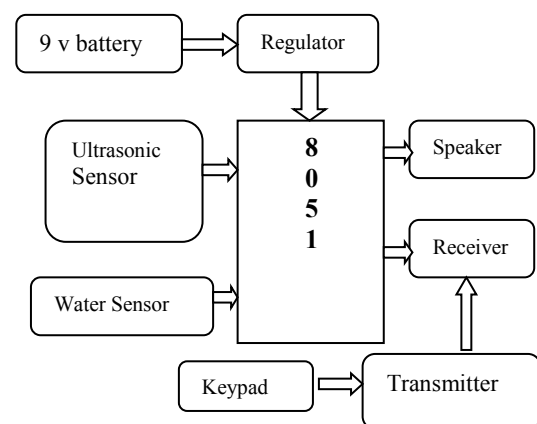
COMPONENT DETAILS

Ultrasonic sensors

Ultrasonic sensors (also known as transceivers when they both send and receive) 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. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultra sonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. For example, foam on the surface of a fluid in a tank could distort a reading.

Calculation for Distance

V = 0.034cm/us

Distance = (t x 0.034)/2

Table 2

Time in Micro Second	Distance in Centimetres
588	10
1176.4	20
2941.176	50
4705.88	80
5882.35	100

Micro-Controller

A microcontroller is a small computer (SoC) on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.

Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analogy components needed to control non-digital electronic systems.

Water Sensing Material

It senses the pot holes filled with the water that signifies the user by buzzer. In this we will be using two live wires and when they will come in contact with water the circuit will be completed, and the buzzer will sound.

LED

Light emitting diodes are semiconductor light sources. The light emitted from LEDs varies from visible to infrared and ultraviolet regions. They operate on low voltage and power. They are used for luminance and optoelectronic application based on semiconductor diodes, LEDs emit photons when electrons recombine with holes on forward biasing. The two terminals of LEDs are anode and cathode and can be identified by their size.

Relay Switch

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a

temporary magnet when electricity flows through it). Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are separate.

ULN 2003 IC

ULN2003 is a high voltage and high current Darlington array IC. It contains seven open collector Darlington pairs with common emitters. A Darlington pair is an arrangement of two bipolar transistors.ULN2003 belongs to the family of ULN200X series of ICs. Different versions of this family interface to different logic families. ULN2003 is for 5V TTL, CMOS logic devices. These ICs are used when driving a wide range of loads and are used as relay drivers, display drivers, line drivers etc.

Speaker Module

This is used to provide an audio output of the distance from the obstacle to the blind person. We are using three speaker modules which will give knowledge of three distances for e.g. One module will get active at 5m and like this we can use it for other distances.Speakers are typically housed in a speaker enclosure or speaker cabinet which is often a rectangular or square box made of wood or sometimes plastic. The enclosure's materials and design play an important role in the quality of the sound.

Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. In this project we will be using a 9volt battery.

Crystal Oscillator

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency. Use of crystal oscillator is not specific or different for 8051. Crystal oscillators have only one function. That is to provide stable clock pulses to the digital circuit. Almost all the digital circuits require clock pulses to operate. A microcontroller requires one too. Clock pulses are required for the synchronization of the operations between various peripherals of the MCU. They also provide the timing for the execution of operations.A crystal oscillator, particularly one made of quartz crystal, works by being distorted by an electric   field when voltage is   applied   to an electrode near or on the crystal. This property is known as electrostriction or inverse piezoelectricity. When the field is removed, the quartz - which oscillates in a precise frequency - generates an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like an RLC circuit.

PCB

A printed circuit board (PCB) mechanically supports and   electrically   connects electronic components using conductive tracks, pads and other features etched from   copper   sheets laminated onto a non-conductive substrate.   Components (e.g. capacitors, resistors or   active   devices)   are generally soldered on the PCB. Advanced PCBs may contain components embedded in the substrate.PCBs can be single-sided (one copper layer), double-sided (two copper layers on both sides of one substrate layer), or multi-layer (outer and inner layers of copper, alternating with layers of substrate). Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components. The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper

planes was concurrent with the adoption of surface mount technology.

RF Module

Basically, the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. When logic one is sent carrier is fully on to about 4.5mA with a 3volts power supply. The data is sent serially from the transmitter which is received by the tuned receiver. Transmitter and the receiver are duly interfaced to two microcontrollers for data transfer.An RF Module is a small electronic circuit which is used to receive, transmit or transceiver radio waves on one of a number of carrier frequencies.

7805 IC

Voltage sources in a circuit may have fluctuations resulting in not giving fixed voltage outputs. Voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a voltage regulator integrated circuit (IC) is a member of 78xx series of fixed linear voltage regulator ICs used to maintain such fluctuations. The xx in 78xx indicates the fixed output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add heat sink as well.The 7805 voltage regulator IC is ease-of-use and available in very low cost. The last two digits of 7805 indicates the output voltage that is voltage.

4096 IC

It has a six-inverter circuit which help us in detecting electromagnetic field, when there will be a live wire in the path so there will be a high electromagnetic field which would be detected by 4096 IC and it will sound a buzzer.
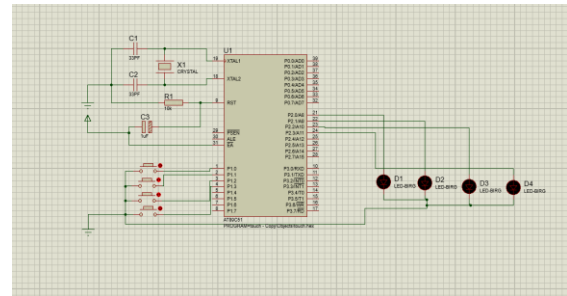
IV. CIRCUIT DIAGRAM

Figure 1

V. PROJECT OVERVIEW

Figure 2

VI. CONCLUSION

After conducting some research and experimental work we are successful in designing such a stick which could be a great help to those 37 million people around the globe who are incapable to see the world. It would help the blind person to overcome the difficulties which theyfacein their day to day life in their navigation this would help them to walk independently without the help of any other human or without the use of any trained dogs. It is well known that theeyes are most important part of human being, as 83% of information is received from environment by humans via sight, so this project will give support to visually challenged person, It cannot be said that this project is a substitute of vision. But yes, it's like a helping hand for a blind person. In our

daily life a person performs many calculations via looking at anything i.e. how far the obstacle is, or is there any pot hole, or he is walking in right direction or not so all such things can be accomplished by using the combination of microcontroller and sensors. Different types of sensors installed will give different information like ultrasonic sensor will give knowledge about the distance from obstacle, in this project water sensing material also installed along with frequency/live wire current detection and RF remote. This combination acts as a smart system and makes blind person aware about the obstacles and help him easy navigation.

VII. FUTURE SCOPE

A global positioning method will used to find the position of' the user using the global positioning system (GPS) and guidance to their destination will be given to the user by voice navigation. A wall following function can also be added so that the user can walk straight along a corridor in an indoor environment. Some more applications like vehicle detection, slippery floor, on-coming vehicle detection and fire or smoke alarm can also be included.

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