International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Smart Cane for Visually Impaired People

Anjaly Treesa Varghese[1], Iyrin Sara Varghese[2], Shilpa Susan Binu[3]

Er.Rekha Subash[4]

[1]*UG Scholar, Department of ECE, SAINTGITS College of Engineering, Kerala, India*
[2]*UG Scholar, Department of ECE, SAINTGITS College of Engineering, Kerala, India*
[3]*UG Scholar, Department of ECE, SAINTGITS College of Engineering, Kerala, India*
[4]*Assistant Professor Sr,* Department of ECE, SAINTGITS College of Engineering, Kerala, India

---

Abstract - *According to WHO (World Health Organization) statistics, around 285 billion people worldwide are visually impaired. Despite the enormous technological progress in digital management systems in the last ten years, the topic of assimilation of people with disabilities in the fashionable society is still topical due to the lack of the technology in this area. One of the examples is the movement of visually impaired people who nowadays use a white cane as their main tool for interacting with the environment. The thing about this ancient technology is that the white stick doesn't give enough data about nearby objects. They become aware of the problem during their daily chores and recognize objects in front of them that could be harmful to them. In response to the current problem, we have the trend to introduce a white stick system (smart stick) that helps the visually impaired. The white walking stick is presented as a solution that should help visually impaired people to discover obstacles while walking and to invent dangers in the world. The system is designed as an image processing and alarm unit. It consists of an ultrasonic sensor, water sensors and the microcontroller (Arduino) to receive and short-circuit the signals from the sensors to the Arduino pins wherever the buzzer and vibration motor are connected. A GPS-GSM module is used to send SMS location messages to an extension phone when someone is lost.*

Key Words: **White Cane, Arduino, Ultrasonic Sensor, Water Sensor, GPS-GSM Module**

1. INTRODUCTION

Out of the multitude of severe disabilities, visual impairment is one of all that someone will certainly endure despite some technological advances. The World Blind Union registered 285 billion blind and partially sighted people living everywhere in 2009. The visual impairment could be a kind of handicap within which the person concerned wants eternal help with the most important basic needs in life. Associative degree individual, which part might be attentive, a possibility or the opposite can visually stop visiting disabled person on many occasions and therefore rehabilitation for that particular disability has been and is a test of the benefits of giving limited rehabilitation techniques. Despite such challenges, there is a multitude of people who have come to the aid of the normal white cane. The use of knowledge technology in the field of drugs has tried to make it useful in the case of alternatives for people with disabilities. People with visual impairments sometimes have various difficulties when trying to move with their surroundings. A big challenge for them is that it can be difficult to distinguish where they are and how to maneuver from one place to another. Once they manage to move physically, they must be followed by a loved one or friend, who sees that they limit their movement to the presence of the presenter. We will use available tools and technology to develop devices that can help people with physical disabilities . People with visual impairments are often happy about the outside help that people, trained dogs or special electronic devices can provide as support systems when making calls. Existing devices are ready to detect objects appearing on the ground, but a significant risk also includes objects at great depth or obstacles. One example is the use of Arduino technology in building a white walking stick that can be used by people with visual impairments, making it easier for them to overcome the drawbacks of this condition. Arduino ability in conjunction with the sensors to build a simple white stick, who can detect obstacles and warn users. In addition, it uses a GPS-GSM module to track the user's location. This can improve the standard of living of the visually impaired, save effort and time. This white stick system increases the autonomy of the visually impaired, detects obstacles and warns the visually impaired through completely different gruesome units. The white walking stick is specially designed to identify obstacles that can help blind people to navigate without worry. The vibration response as well as the audio prompts can keep the user alert and greatly reduce accidents. The intensity of the vibrations is an indication of the proximity of an obstacle in the user's path.

2. LITERATURE REVIEW

In order to provide an inexpensive and efficient navigation aid for the blind, a lot of research is carried out in various institutions around the world. In the beginning the visually

impaired were supported by sighted people for their basic needs and then came the era of guide dogs. Guide dogs are trained dogs and help the blind to support mobility. But this solution was not effective. The researchers went to great lengths and designed a number of electronic travel aids (ETAs). This section contains a review on devices . The white stick is considered to be the most widely used navigation aid for blinds in the world. The white stick can recognize obstacles on the ground, holes, puddles, bumps and even steps. easy to transport, because it is foldable and fits easily in your pocket. This means that the purchase costs of the white walking stick are much lower. But when you talk about the total cost, the case is not the same. A user needs a training session of approx. 100 hours to feel comfortable with the device and to be able to walk safely and correctly. Now the investment of "100 hours" is seen as a very high additional expense. They have been developed over the years and are still being developed to better serve blind people. Attempts have been made to rehabilitate the blind for decades. Various electronic devices have been developed for this purpose over the past three decades. The goal in designing all devices, while the same, is security, trust, and speed. 12 in the mobility of a blind person. List of some ETAs are:

C5 laser wand: It was introduced by Benjamin in 1973. It is based on the optical triangulation of three laser diodes and three photodiodes that act as receivers. These photodiodes are silicon photodiodes. The stick were able to detect the obstacle at his head height and in front of him. There are several disadvantages to using a laser wand. Using a laser wand can be harmful if proper precautions are not taken and can damage a person's eyes without the correct lenses. It is likely to react to various environmental sources, sunlight.

The Mowat Sensor and Nottingham Obstacle Detector (NOD) are portable obstacle detection devices. The Mowat sensor uses an ultrasonic based ranging system, while the NOD is a sonar device. The binaural sound aid (Sonicguide) is a device that looks like a glasses frame. These brackets allow the placement of ultrasonic transceivers. The transmitter is located in the middle of the bracket with two receivers, one of which is mounted on the side of the frame.The principle of distance measurement is based on the change in frequency and therefore the receivers have an interaural amplitude difference that helps the user to understand better Determination of the result in the form of distance and direction.

Another sound system is Kaspa.It is a very complex system consisting of a scanning FM ultrasonic transmitter and three specifically moved sensors. The echo signal is rich in obstacle information and, when received, can be used to extract various properties of the obstacle. The frequency of the obstacle is inversely proportional.

The disadvantages of these navigation devices are numerous:

-Continuous scanning by some devices is time consuming.

-The effort was high for some devices because they required a conspicuous installation and maintenance effort.

-The developed devices were many steps to reduce the difference between the mobility of a visually impaired person and a visually impaired person, but they still failed to build trust with the underprivileged and therefore the devices could not succeed in the market achieve.

3. METHODOLOGY

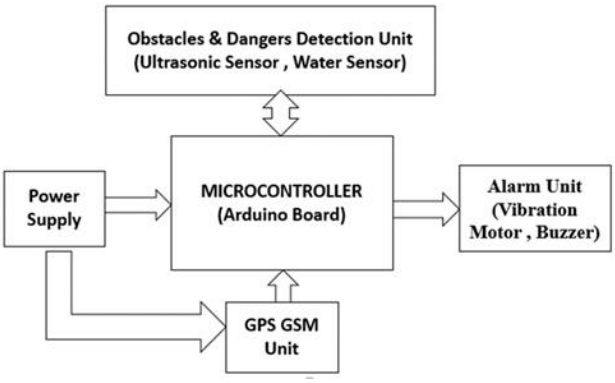

Fig-1 : Block Diagram of White Cane System

The block diagram mainly consist of Obstacles and Danger Detection Unit, Alarm Unit , GPS GSM Unit and Power supply. The obstacles and danger detection unit consist of Ultrasonic Sensor and Water Sensor. The Ultrasonic Sensor is used to determine the distance of any obstacle .Water Sensor located at the base of the cane is used to determine the presence of water. Alarming Unit consist of vibrational motor and buzzer. A Buzzer is used to warn the blind person against obstacles by generating sound proportional to the distance. Vibrational Motor is also included to enhance the overall feedback for the person. GPS GSM Unit is used to know the location of the person. The design of the white walking stick is based on various sensors that can sense and interact with the environment and then provide different responses that can help visually impaired people.

- When the ultrasonic sensor is placed in front of any obstacle, it turns the buzzer ON in three different sound rhythms, as illustrated and as follows: At 100 cm the buzzer produces faint sound rhythm. At 75

cm the buzzer produces medium sound rhythm. At 50 cm the buzzer produces high sound rhythm.

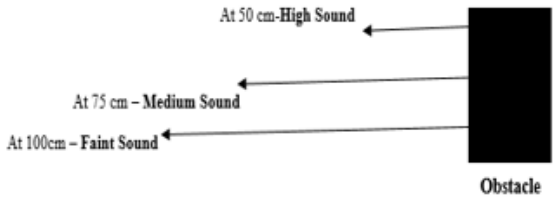

Fig-2: Buzzer response according to obstacle distances

- When the switch is turned on, the water sensor begins to detect the presence of water in the soil and the vibration motor's response is based on the presence or absence of water.
(1) If there is water, the vibration motor turns ON and
(2) If there is no water, the vibration motor turns OFF.

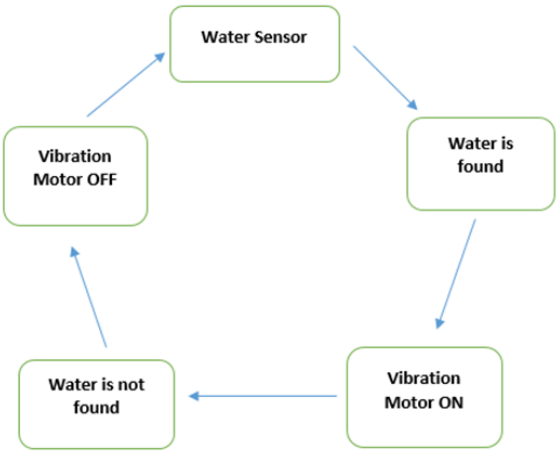

Fig-3: The responses of vibration motor to water

- The GPS-GSM module is controlled by the push button, so when the button is pressed, the position of the cane is sent via SMS message, the figure shows the GPS generation process and the SMS message is sent.

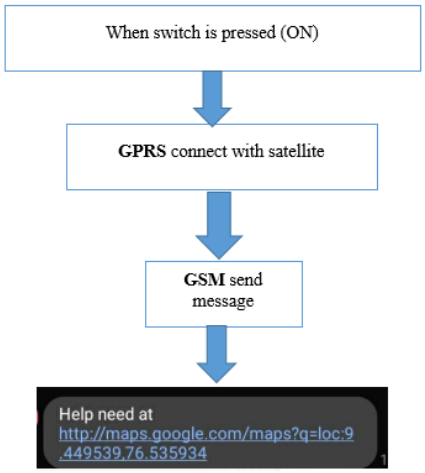

Fig-4: GPS Module working system

4. COMPONENTS REQUIRED

4.1 MICROCONTROLLER UNIT (ARDUINO PRO MINI)

The Arduino Pro Mini is a microcontroller board based on the ATmega328. It has 14 digital input / output pins (6 of which can be used as PWM outputs), 6 analog inputs, a built-in resonator, a reset button and holes for the mounting pin. A six-pin header can be connected to an FTDI cable or a Sparkfun backplane can be connected to supply the board with power and USB communication. The Arduino Pro Mini is designed for semi-permanent installation on objects or exhibits. Use of different connector types or direct soldering of cables. The pin layout is compatible with the Arduino Mini. There are two versions of the Pro Mini. One works with 3.3V and 8 MHz, the other with 5V and 16 MHz.

Fig-5 Arduino Pro Mini

4.2 Obstacles and Dangers Detection Unit

This unit consists of three sensors, as follows:

4.2.1 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance to a target object by sending out ultrasonic waves and converting the reflected sound into an electrical signal.Ultrasonic sensors have two main components: the transmitter (which sends sound through piezoelectric crystals) and the receiver (which finds the sound after it has been transported to and from the destination).In order to calculate the distance between the sensor and the object, the sensor measures the time that elapses between the sound emission of the transmitter and its contact with the receiver. The ultrasonic sensor is used to determine the distance of an obstacle in front of it. The HC SR04 ultrasonic sensor has 4 pins; Gnd (ground), Vcc (common voltage collector), Trig (trigger) and echo.

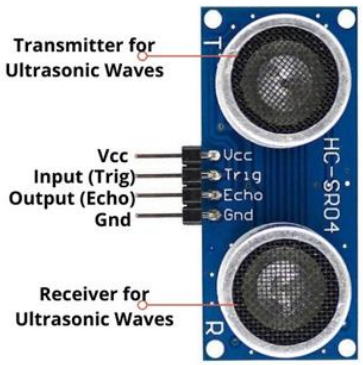

Fig-6: Ultrasonic Sensor

4.2.2 Water Sensor

A water sensor is located at the base of the cane to be careful against the wet surface, which can slip and injure on the floor. When the water sensor hits the wet surface, it creates an electrical signal that triggers the Arduino controller. The module enables humidity measurement via analog output pins and provides a digital output when a humidity threshold is exceeded. It contains the electronics module and a circuit board that collects raindrops such as raindrops. As liquids collect on the circuit board , create paths of parallel resistance that are measured by the operational amplifier. The lower the resistance (or more water), the lower the output voltage. The reverse applies: The less water, the higher the output voltage on the analog pin. The board, for example, will output the module 5V.

Fig-7: Water Sensor

4.3 Alarming Unit

The person is informed through a vibrator and a beep sound of buzzer. It consists of two parts:

4.3.1 Buzzer

A transducer (converts electrical energy into mechanical energy) that works normally. There is a buzzer in the lower part of the audible frequency range from 20 Hz to 20 kHz. The buzzer is used to warn the blind of obstacles by generating a sound proportional to the distance. The Arduino Active Buzzer module produces a single tone when the signal is high. To create different tones, use the passive buzzer module. The active buzzer module consists of a piezoelectric buzzer with a built-in oscillator. It produces a tone of around 2.5 kHz when the signal is high.

Fig-8 : Buzzzer

4.3.2 Vibration Motor:

The vibration motor is a coreless DC motor, and the size of this motor is compact. The main purpose of this engine is to warn the user. These motors are applicable to various applications such as pagers, handsets, cell phones, etc. This is the motor, it has magnetic properties, it is light in weight, and the motor size is small. Based on these characteristics, the engine performance is very constant. The configuration

of these motors can be made in two variants, one is a coin model and another is a cylinder model. The specifications of the vibration motor mainly include the type, maximum operating torque, maximum centrifugal force, weight range, rated current and power

Fig- 9: Vibration Motor

4.4 Global Positioning System (GPS) Unit:

A satellite navigation device, colloquially known as a GPS receiver or simply GPS, is a device that can receive information from GNSS satellites and then calculate the geographical location of the device. Using suitable software, the device can display the position on a map and offer directions. A satellite navigation device can call up location and time information in any weather, anywhere on or near the earth. A clear line of sight to four or more GPS satellites is required for GPS reception and is subject to satellite signal conditions. If a person is lost and cannot see where they are, this device can navigate the place and send SMS messages to the helper's phone to communicate with them. The complete system is connected to the Arduino Pro Mini.

Fig-10: GPS Unit

5. WORKING

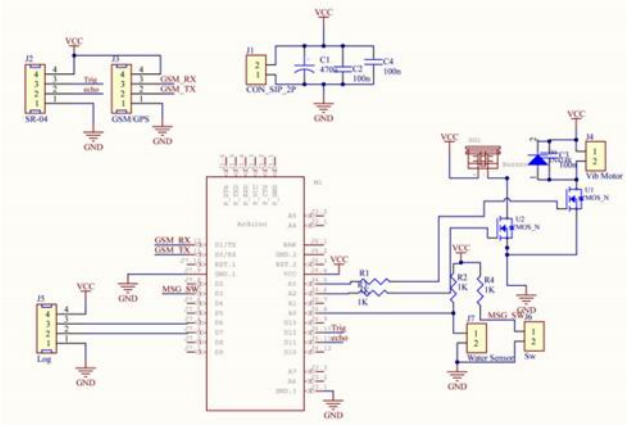

Fig-11: Circuit Diagram

The design of stick is based on using different sensors that can feel and interact with environment and provide different responses that can help the visually impaired people. It consists of an ultrasonic sensor, water sensor, GPS/GSM module, buzzer, vibration motor. All these components are interfaced to Arduino Pro mini which act as the microcontroller in this circuit.

- The Ultrasonic sensor

An ultrasonic sensor is used for detecting any obstacles in front of the stick. It has 4 pins-Trigger, Echo, VCC, GND. When the ultrasonic sensor is placed in front of any obstacles, it turns the buzzer ON. If the distance is less than 1m, the buzzer starts producing sound. As the distance decreases, the sound of buzzer goes on increasing. In this way, the blind person will get to know that he is approaching an obstacle.

- The Water sensor

The water sensor is used to detect the presence of water in the ground and the output is obtained from the vibration motor. Here the water sensor when comes in contact with water, conduction takes place which result in decrease in voltage. This reduction in voltage leads to turn the vibration motor ON. Thus according to the response from vibration motor, presence or absence of water is detected.

- GPS/GSM module

The GPS/GSM module is controlled by using a switch. When the switch is turned ON, the location of stick will be sent via a SMS message to the intended person. It is used when the blind person get lost or couldn't realize where he is and also it helps the other people to keep track of the location of the

user in case of emergency or danger.The GPS identifies the location and a message is sent to the helper's phone via GSM module when the switch is pressed. A buzzer connected to this module produces sound which gives the acknowledgment to the user that the message is being sent. If in case ,if the location is not being sent via SMS ,the vibration motor starts to vibrate indicating that the location is not being sent.

6. PROTOTYPE

Fig-12: Internal Structure

Fig-13: White Cane System

7. RESULT

We have successfully made the white cane system based on the circuit. The developed system has been tested and has been found to be functional. The system acted as a third eye to visual impaired people. The ultrasonic sensor and water sensor implemented were able to detect the obstacles and the presence of water .GPS-GSM module used were able to give the correct location of the person. This system appeared to be very convenient to use.

8. CONCLUSION AND FUTURE SCOPE

The white stick built in this project can be of immense help to people with visual impairment or complete blindness and solve their problems of everyday life. It will also help other people (families and relatives) to keep track of the user's location in an emergency or in the event of danger. In addition to being effective, this stick is affordable and can help millions of people around the world by providing an affordable, reliable, portable, low-power, and rugged solution to an intense problem.

This project can further be improved by providing audio facility instead of vibrating motor and buzzer. An airpod can be provided so that person will get to hear the command if there is any obstacle in front of the person or presence of water. Other sensors such as infrared sensors can be used to measure the heat of an object and detect motion and thermistor as fire sensor.

REFERENCES

[1] G.Gayathri, M Vishnupriya, R.Nandhini, Ms.M.Bhanupriya. "SMART WALKING STICK FOR VISUALLY IMPAIRED". IJECS Volume 3. Issue 3rdMarch, 2014 PP 4057- 4061.

[2] Mohamed Manoufali, Ahmed Aladwani, SaifAlseraidy Ali Alabouli. "Smart Guide Cane for Blind People". 978-1-4673-0098/8/11 ©IEEE.

[3] A. Nurulnadwan, M.R. Nur-Hazwani, E. Erratul-Shela, and A.M. Ariffin, "The Enhancement of Assistive Courseware for VisuallyImpaired Learners," in Proc. ITSIM. 2010.

[4] Iwan Ulrich, Johann Borenstein. "The Guide Cane-Applying Mobile Robot Technologies to Assist Visually Impaired.", IEEE Transactions on Systems, Man, and Cybernetics, — Part A: Systems and Humans, Vol. 31, No. 2, pp. 131-136, March 2001.

[5] IEEExplore White Paper, "Application of Proteus VSM in modelling brushless DC motor drives", May 2011.

[6] J. Banks; J. Carson; B. Nelson; D. Nicol, "Discrete-Event System Simulation". Prentice Hall. p. 3. , 2001, ISBN 0-13- 088702-1.

[7] M. Kumar, F. Kabir, and S. Roy,"Low Cost Smart Stick for Blind and Partially Sighted People,"Int. J. Adv. Eng. Manag., 2017, doi:10.24999/ijoaem/02030018.

[8] A. Anwar, "A Smart Stick for Assisting Blind People," IOSR J. Comput. Eng., 2017, doi: 10.9790/0661-1903028690.

[9] C. Scott, "HC-SR04 Ultrasonic Sensor," Arduino Basics, 2012.

[10] Pallavi B. Thawakar, Dr. N. N. Mhala. "The Smart Guide Cane for Assisting the Visually Challenged for Indoor" in IJRITCC (International Journal on Recent and Innovation Trends in Computing and Communication) ISSN: 2321-8169, Vol 5 Issue 6.