

Walking Cane for Visually Challenged

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Abstract— Visually impaired face various difficulties while performing daily routine activities which individuals who can see performs with much ease like walking on the street, crossing the lanes etc. without any other person's assistance. For the visually challenged people it becomes very dangerous to walk on the streets due to lot of impediments in their way in form of traffic, stray animals, stones, spilled water, potholes etc. The problem for visually challenged people doesn't arise only when they are outside on the streets but also when they are indoor as they might have to use staircases, lifts. The smart cane proposed in this theoretical paper has tried to overcome certain difficulties faced by visually challenged people. The smart cane proposed in this solution will ensure safety and will provide them help during emergency. The smart cane makes them not only self – reliant but also add some more security features for the problem which they might face outside while they are on streets. This smart cane contains various sensors which can alert the person holding this smart cane by producing the beeping sound and also sending the vibration. The smart cane is also equipped with a Microcontroller which has connection to the Bluetooth and the Bluetooth in cane is paired with the Bluetooth in smartphone of the individual holding cane.

Keywords—Ultrasonic sensor;Visually- impaired; infrared sensor; water sensor; Microcontroller;Accelerometer; Vibrating Motor

I. INTRODUCTION

A person is said to be visually impaired if the ability of the person to see is either absent or very low in the best eye. The criterion for determining whether the person is visually challenged or not can be different for each country. For example, In India, the person with visuality of 6/60 or less, field of vision of 20 degree and less is termed as completely blind. Similar criterion is used in USA and several other States to classify their citizens as visually impaired, blind or people with completely fine eyes. According to WHO report October 2019 there are estimated 2.2 billion people of all ages who falls in the category of visually challenged. The person may be visually impaired from birth or may become visually impaired at the later stages of life due to certain diseases like retinopathy,traumatic injuries, maculardegeneration, glaucoma etc. Visual impairment includes both the blindness and low

vision. Blindness is when the person is unable to see from both the eyes completely.Sometimes visual impairment in the eye can be corrected using eye glasses, contact lenses or even the surgery if the need arises. The smart cane proposed in this paper will alert the cane holder with the vibration as well as by producing sound from buzzer. The vibration is caused by the vibrating motor used in the smart cane. Some sensors which cane involves are ultrasonic sensor which sends the alert through vibration and beep sound when any obstacle is detected within the range of ultrasonic sensor, the infrared sensor which help the individual while using the staircases, water sensor at the bottom of the cane to send an alert if there is presence of water in path while the person is walking. All these sensors, whenever are triggered will then automatically trigger the buzzer in the cane and also at the same time sends the vibration to the person holding the cane.

Following are the devices which are used:

A. Microcontroller



A microcontroller is an integrated circuit (IC) which is programmed in order to perform specified tasks. Microcontroller are just mini – computer used in the circuit which maintains the control over the entire

circuit. It is basically the brain in the circuit. Microcontrollers are used in almost every electrical appliance like television, refrigerator. Microcontrollers are the brain of any embedded system.

B. Ultrasonic Sensor



Ultrasonic waves are used to measure the distance by ultrasonic sensor. The sensor head produces the ultrasonic waves and waves are reflected back after hitting the target, it receives these waves. The sensor then measures the time between the emission and reception which helps in calculation of distance between the target and receiver.

C. Infrared Sensor



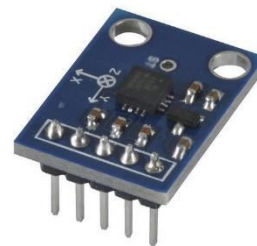
These sensors are used in order to sense some characteristics of surroundings. These sensors produce infrared radiations. These sensors measure the infrared (IR) light striking back from the objects in its area of view. They are good for range within 2 meters. Infrared sensors start creating problem and don't give very accurate results when the light is being interfered by another light source. For Example – In bright sunny days infrared sensor light gets interfered by the sun rays.

D. Water Sensor



Water sensor is the devices which is used for the detection of the water level for various applications. It senses rainfall, leakage, spill, flood and water level.

E. Accelerometer Sensor



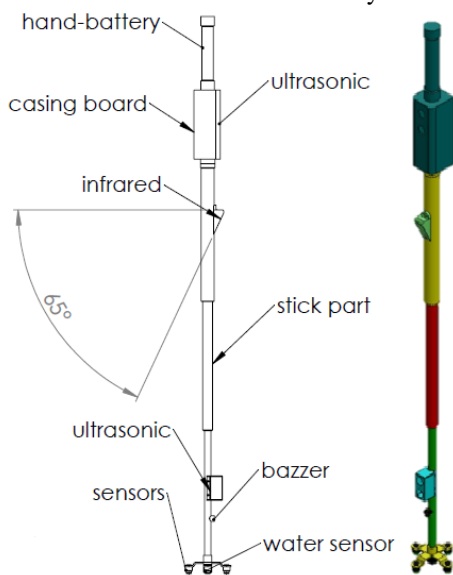
It is an electro-mechanical device which is used for measuring proper acceleration. This can easily measure any force exerted on the sensor. They can be helpful to measure the tilt or orientation to the object with which they are attached.

II. LITERATURE REVIEW

- Smart blind walking cane – Vipul V. Nahar, Jaya L. Nikam, Poonam K. In this research paper, the ultrasonic sensors are used with combination with the moisture sensor to detect the occurrence of water. Ultrasonic sensor used to detect any obstacle in the path of the person easily using ultrasonic waves. When sensing is done by the sensor then data is transferred to microcontroller which performs calculation on the data to determine if the obstacle is close enough, if it is microcontroller sends a signal that triggers the buzzer. This paper also proposed a use of wireless based remote use for the purpose of finding the cane. In this the button provided on remote when pressed can trigger the buzzer in the cane.
- Voice Based Guide and Location indicator system for blinds using optical device, GPS and GSM indicator by K. Usha & M N Kumar this paper provided theoretical model to provide a smart e-aid for blinds. The system consisted of an ultrasonic sensor, a GPS module and a vibratory circuit and GSM module. The

paper proposed the development of ETA (Electronic Travel Aid) which is attached on the cane of visually impaired to provide the path free from obstacle. If detection of obstacle is done by any of the sensors it is send via vibratory circuit (headphone or speaker).

- Effective & Fast Responding Smart Cane for the blinds by Samia M., Ayat Nada, Md. Fakhar and A. F. Seddik. This paper proposed a low weight and low-cost cane that provides the solution for detecting staircases by using the infrared sensor. The use of ultrasonic sensors was also incorporated to sense any obstacle within range of 4 meter with a fast response time of 39ms. Another ultrasonic sensor was also provided at the bottom of cane to avoid the puddles that are present in path. Speech warning message and vibration motor was also used. Speech warning message played the pre-recorded message provisional to the obstacle found in path. The water sensing device used in the bottom of cane could easily sense water pits, puddles. Microcontroller, a vibration motor and a flash memory.



Smart Cane Proposed by Ayat, Samia, Mahmoud, Seddik

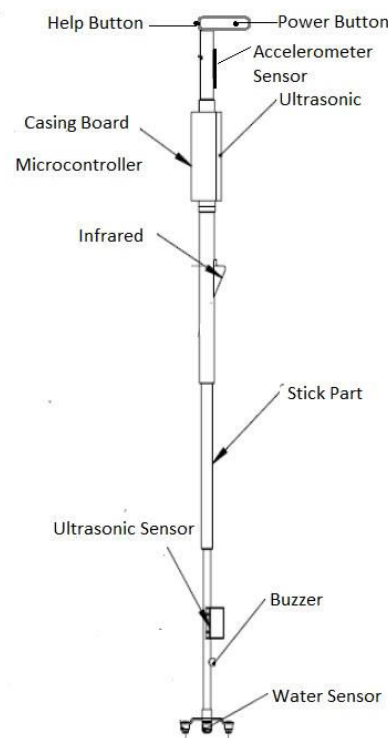
III. PROPOSED MODEL

This research paper proposes the use of accelerometer and also the use of multifunction help button. The Bluetooth setup on the circuit controlled by Microcontroller will be used to establish the Bluetooth connection from the smart phone of the person. Handle of the cane contains the power button, a help button and below the handle an accelerometer sensor will be added which will help in tracking the orientation and tilt of smart cane. The cane proposed in this paper will help visually impaired person in need of emergency. Help button provided

in the cane can be useful for the person who is holding the cane. There are two functions provided by help button in the cane which are as follows:

- Help button if pressed once will produce the continuous beeping sound and also the vibration. The vibration produced by the cane will help the person holding the cane which will help visually impaired person to get help from the people around him.
- Help button if pressed for three times will send their live GPS location and a message to the emergency contacts which are saved in a pre - installed application in their smartphone that is controlled via Bluetooth pairing between the smart cane and the mobile phone.

Power button provided in the cane simply turns on the whole circuit and provides it the power from the battery.



Design of Cane after employing changes in proposed System

The introduction of accelerometer in the cane adds another feature in the cane and will provide added convenience to visually impaired person. While walking, the data for tilt and orientation will be continuously monitored by the application installed in the smartphone. For certain cases if the criterion is not met the emergency message feature will get triggered. The accelerometer sensor used in this research paper measures the tilt and orientation in three - dimension which are x - axis, y -

axis and z -axis. Following are the cases when the buzzer will be triggered because of certain tilt and orientation positions and the message will be send to the provided emergency contact(s) with GPS location.

- If the angle along x – axis and z – axis is zero and the acceleration along y – axis is one.
- If the angle along x – axis is zero y – axis is zero and angle along z – axis is one.

The above both conditions represent the fall of cane so in both of the above condition after the time duration of 20 seconds a message will be sent to the emergency contacts saved in the pre -installed application in the mobile phone of visually impaired person.

IV. LIMITATIONS

Accelerometer though very useful in determining the tilt and orientation, it has the limitation in this cane as sometime the fall of cane may not make the angle required to trigger the buzzer. The angle required to trigger the buzzer will not be obtained when during the fall cane gets stuck somewhere.

V. CONCLUSION

There is the need to not only guide visually impaired while they are moving but to also make them feel safe. There was the need of the system which will help them to easily connect to their loved ones during emergency and get help.

This paper provides the insights and blueprint for making the smart cane which contains the Bluetooth and paired with Bluetooth of smartphone of the person. The connection established between the Bluetooth of smart cane and smartphone will let the cane holder to get help in case of emergencies as data of few sensors present in the cane will be monitored continuously and if the need arises the decision will be taken by the microcontroller of the cane if certain criterion is met. Cane is light weight so it simple to hold.

VI. REFERENCES

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