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Smart Electronic Crutch Along with Android Smartphone for Visually Impaired Individuals

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ABSTRACT

The aim of this project is to detect an obstacle at a close distance in front of the visually impaired while walking outside and alert the user through a buzzer. The proposed system focuses on developing an android application to track the location of the user using GPS in case of any emergency and intimate to their caretaker when the user sends the location by pressing the switch. Aged peoples with blindness find problem while walking, such as unable to view obstacle at a close distance in front of them, which may inflict injuries to one-self. To overcome such problems faced by visually impaired, we have come up with a solution, which helps them to walk freely, detect the obstacle through ultrasonic sensor, and intimate to the person by buzzer. It also senses the intensity of light through LDR and illuminates LED Lamp when needed. All the hardware devises required are mounted on Renesas RL 78 microcontroller for programming the proposed system. Hence, the proposed system provides an intelligent device as a navigation tool for visually impaired. This device is used for both indoor and outdoor navigation. The main advantage of this project is to help visually impaired as well as aged people to navigate independently.

Keywords: Visually Impaired, Crutch, Renesas RL 78 microcontroller, Ultrasonic Sensor, GPS, LDR, LED Lamp, Buzzer, Switch

I. INTRODUCTION

According to World Health Organization [WHO], there are, about 285 million people suffer from lack of vision. It is estimated worldwide: 39 million are blind and 246 million have less vision. Around 90% of the visually impaired live in low-income conditions. 82% of people living with blindness are around 50 years of age and above. Globally, uncorrected refractive errors are the main cause of moderate and severe visual impairment; cataract is the leading cause of blindness in middle- and low-income countries. The number of people visually impaired from infectious diseases has reduced in the last 20 years according to global estimates work. 80% of the visual impairments can be prevented or cured.

In today's lifestyle, technology has become very dependable in many ways thereby simplifying day-to-day life. As age of human beings increase most of the people lose their eyesight nowadays, they face more problems in their daily routine life. Aged peoples with blindness find problem while walking, such as unable to view obstacle at a close distance in front of them, which may inflict injuries to one-self.
In this competitive world, the basic problem which every blind person faces is navigation. The most basic tools for them are walking cane and guide dogs and on kindness of fellow commuters. The most commonly used tool is still the blind stick. It suffers from drawbacks like lots of practice, range of motion, less reliability in terms of dynamic hurdles and range detection. Hence, the effort is to try to modify this

cane with electronic components, android application and sensors.

II. METHODS AND MATERIAL

A. Existing System

The existing system consists of the blind navigation system, which is very less and is not efficient. The blind traveller is dependent on other guide like white cane, information given by the people, trained dogs etc. Many visually impaired people use walking sticks or guide dogs to move from place to place. A guide dog is trained for guiding its users to avoid the accidents from objects and barriers over a fixed path or in a fixed area. When a visually impaired person uses a walking stick, waves the stick, finds the obstacle by striking the obstacles in their way. The usage of such old devices might be dangerous in some situations which cannot be relied on. Some new technologies which uses electronic travelling aid and sensors to develop a smart cane, work efficiently but even they are having disadvantages wherein they use all the recent technology which is of high cost which cannot be affordable by common people and such new devices are not user friendly as they are not been taught to the needy.

B. Proposed System

The proposed system consists of a system concept to provide a smart electronic aid for blind people. We propose to design an intelligent device which alerts the person on occurrence of obstacles. Here, this intelligent device not only alerts but also traces the location of the person and informs the current position of the person to their care taker through the use of GSM & GPS. The proposed system also glows LED Lamp with the help of LDR, when the intensity of light decreases. The main advantage of this project is to help visually impaired as well as aged people to navigate from one place to another. This system can be used for both indoor and outdoor navigation. The Figure (1) represents the architecture of smart electronic crutch.

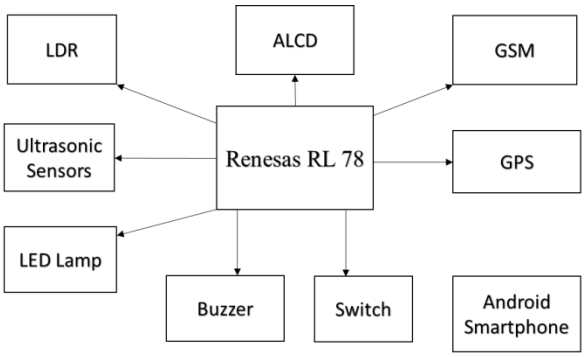

Figure 1. Typical Architecture of Smart Electronic Crutch

III. METHODOLOGY

1. **Detection of Obstacles**

   The obstacle detection circuit consists of an ultrasonic sensor interfaced to the Microcontroller Board. The sensor detects the presence of obstacle in each direction and then the range of the obstacle is calculated. If the distance is within 200cm then Buzzer will be on.

2. **Detection of Potholes**

   The pothole detection system consists of an ultrasonic sensor and a buzzer interfaced with the Microcontroller Board. The working of this circuit is based on the assumption that the height of the ultrasonic sensor mounted on the stick will remain constant in case of a plain path. But if there occurs any noticeable increase in its height from the ground above a certain threshold level (13 cm) then the buzzer will start buzzing. This will help the visually impaired person in detecting a pothole or a staircase ahead.

3. **Emergency**

   The GSM_GPS module is used in emergency situations. This module receives the information from the GPS satellite in NMEA format and transfers the latitude and longitude information as SMS message to a predefined mobile number in case of emergency.

4. **Getting latitude and longitude**

The Global Positioning System (GPS) tool is used for determining the distance between two points. The distance between two points can be found using GPS co-ordinates and earth terrestrial co-ordinate system as the GPS latitude and longitude are in terrestrial co-ordinates.

5. Create a Google Map

The link is created for calculating distance between two points. Using a DGPS (differential corrected GPS) to determine the latitude and longitudes of two points on the earth surface and determine approximate elevation measurements (feet, meters, yards, kilometres, and miles) rather than degrees, between two points is not trivial.

6. LED Lamp

When the Intensity of light decreases the LDR sensor senses and if found less than 40% then LED lamp turns ON. This provides indication to the visually impaired that they are in a darker region and it is indication to the commuters to avoid accidents.

IV. RESULTS AND DISCUSSION

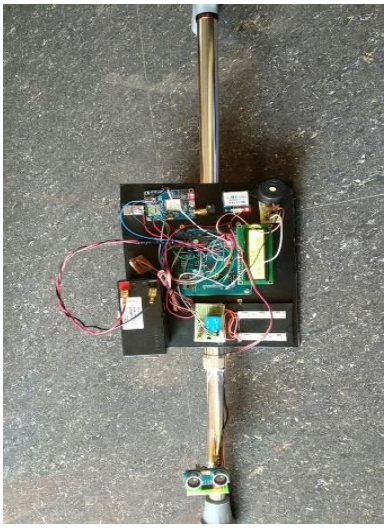

Figure 2. Working Model Of Smart Electronic Crutch

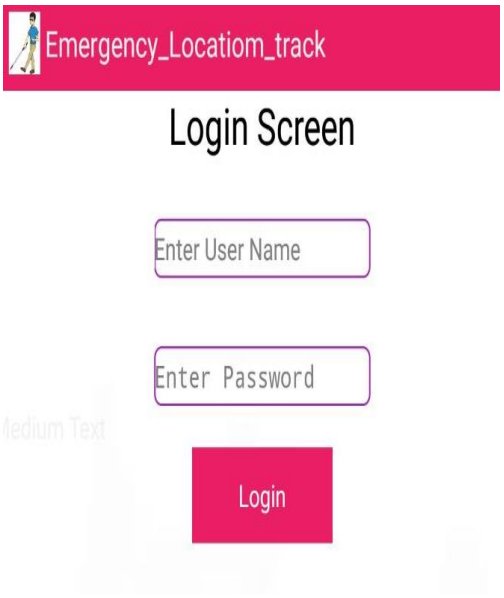

Figure 3. Care taker Login Form

The working model shown in the figure (2) gives an overview of the smart electronic crutch, which contains Ultrasonic sensor, ALCD, Buzzer, Switch, Battery, Renesas RL 78 microcontroller, GSM module, LDR and LED Lamp. The sensor is placed at the bottom of the crutch, which is placed 13cm above ground level. It will detect the obstacle, which is at the range from 13cm to 200cm. When the LUX value in LDR crosses more than 3 then the LED Lamp glows. In emergency condition, the user press the switch which is connected to GSM module which sends the location of the user through the message to the care taker.

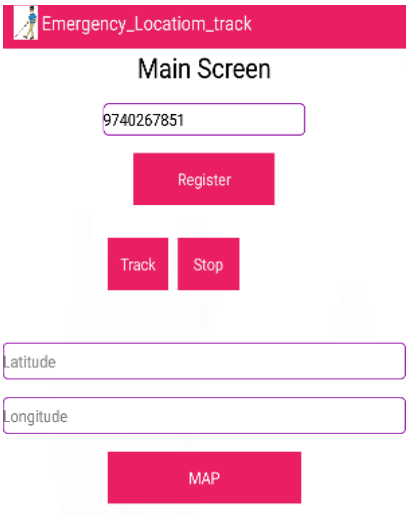

Figure 4. Registration Form

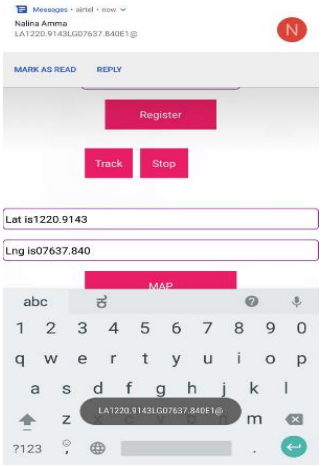

Figure 5. Fetching Latitude and Longitude

Figure 3,4,5,6 & 7 represents the snapshots of output results of an Android application been installed by the care taker. Figure (3) represents the login form for the care taker. Figure (4) represents registration form where the number used in the GSM module of the crutch is been registered. Figure (5) shows the fetching of latitude and longitude automatically through the SMS sent to care taker when the user activates the emergency switch.

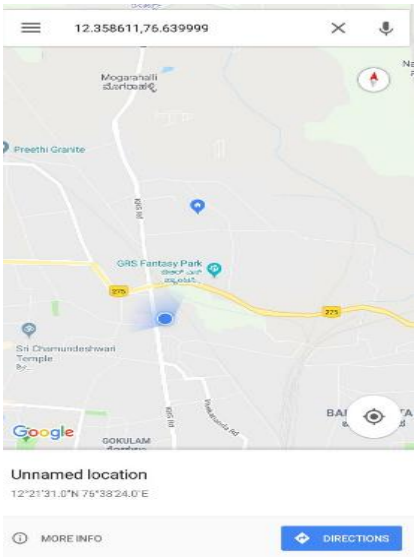

Figure 6. Location of the User

Figure 6 shows the location of the user in the google map after pressing the MAP button shown in Figure 5. The application finds the exact location of the user by using latitude and langitude data.

V. CONCLUSION

In this paper, a solution is proposed and implemented to help blind to move safely and detect obstacles in their path. Solution was composed of a stick with an ultrasonic sensor mounted on it along with an emergency switch. The proposed system contains single ultrasonic sensor through which the obstacles are detected. It also includes a two way transmission of location through GPS and it also have LEP lamp incorporated in case of emergency to protect the user. This paper can be concluded in a single sentence that is it gives an alert to the user about the obstacle using ultrasonic sensor and sends the location of the user to the care taker during emergency conditions.

With the ongoing changes taking place in today's technology the entire unit can be made into a simple and compact device. Flexible solar power developed on a plastic strip can be attached to the unit as the source of power supply.

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