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Li-Fi Based Smart Shoe for Blind

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Abstract:
Blindness is a qualitative term that describes the clinical condition whereby individuals have no light perception as a result of total vision loss. The daily life of a blind person is affected largely by navigation and mobility issues. The oldest and traditional mobility aids for persons with visual impairments are the walking cane and guide dogs. The short comes of these aides are range of motion and very little Information conveyed. With the rapid advancement in modern technology, this paper proposes a smart shoe that helps the visually impaired in navigation through voice commands which are conveyed through light source in their path. The shoe also detects any obstacles in their path. The main aim of this project is to provide reliable navigation and mobility to visually-impaired.

Keywords: Li-Fi, Obstacle Detection, Ultrasonic Sensor, Water Sensor, Voice Command

I. INTRODUCTION

The statistics by the World Health Organization (WHO) in 2014 estimates that there are 285 billion people in world with visual impairment,where 39 billion of people are blind and 246 billion with low vision. The visually impaired had to depend on someone or something to do their day to day activities. The cane used by them are not advantageous while walking or travelling. This Smart Shoe is being proposed to help them to be independent. Shoes being the basic need to walk places this smart shoe becomes a wearble device. It is used as a safety device as well as a navigation devce. Thus the main motivation of the paper is to promote easy mobility and reliable navigation.

II. LITERATURE SURVEY

Several works have been done to help visually impaired people to travel and live like normal people. Navigation and mobility being the major issues in the lifestyle of blind, the existing methods either promotes reliable navigation or safe mobility. The system that could provide both navigation and mobility are either costly or has some drawbacks. Mobility assistance for blind was provided earlier by Differential Global Positioning System (DGPS) and Radio Frequency Identification Tags (RFID). In the RFID method the data was transferred from the tag to an object through radio frequency electromagnetic field. The tag contains electronic stored information. The tag reader is placed on the Smart Cane and the tag are placed in different locations of the city. The RFID reader detects all information stored on the tag, it is then analyzed and the data retrieved is transmitted to a control unit that translates the information into braille code. The handle of the cane has a braille interface which lowers or elevates the dots forming words to convey the information. This is a tie consuming and costlier process. [1] This method involves both reliable mobility and navigation. It contains a GPS module, GSM module along with ultrasonic and IR sensors. When the blind person senses any danger, he presses a button on the cane, which immediately sends the location of the person, using GPS module, as a text message to stored contact numbers through the GSM module.The Ultrasonic sensor is used for obstacle detection and the IR sensor is used for detection of water in the path. It acts as a safety device as it also contains a vibrator interfaced at the handle which vibrates when an obstacle is detected or water is sensed. [2] Voice operated navigation system was later developed to help visually blind in an effective manner. This method involves sensing of immediate surrounding environment against obstacles and warning them by means of vibration and voice feedback system. Obstacle detection is done using Ultrasonic senor. The vibrating motor vibrates when it detects an obstacle. There are three Ultrasonic sensors used on all sides of the Smart Shoe. The voice feedback informs the direction of the obstacle.[3] Visible light communication involves data communication through visible light. Light intensity is manipulated to send data by tiny changes in amplitude. The light flickers for billions of time per second which cannot be noticed by human eye. The receiver receives this flickering light and converts it into electrical signal. The signal is then converted to binary data which is recognized as audio signals. Thus navigation is done using Li-Fi. [4]

III. PROPOSED SYSTEM

The proposed system contains two sections. The Transmitter section or the Li-Fi module and the Receiver section or the Shoe module.

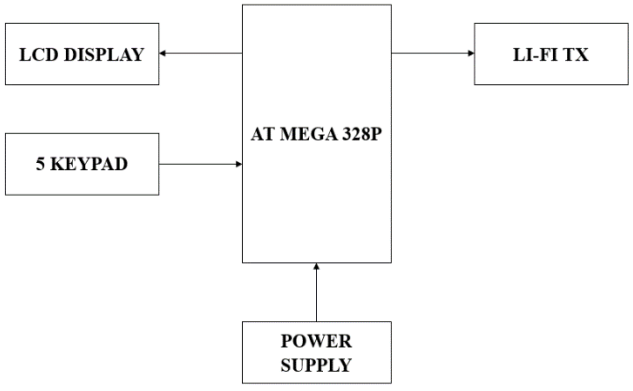

Figure .1. Block Diagram of Li-Fi Module

The Li-Fi module here is the transmitter side which contains a LED source. It produces flickering light of data. The LCD is used to display the data being transmitted through the LED. The 5 keypad is used to change the data transmitted through the controller

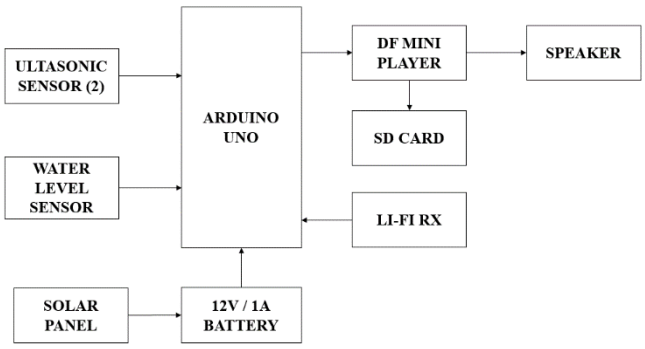

Figure .2. Block Diagram of Shoe Module

The Shoe module contains two ultrasonic sensors placed on the front and side of the shoe, water level sensor is also attached at the side of the shoe. The controller used here is Arduino Uno which connects with DF Mini Player and a speaker. The power supply used here is a 12V/1A battery. Solar panel could also be used to recharge the battery.

III. HARDWARE DESCRIPTION

a) Arduino Uno: This is the main controller in the Shoe module. It receives input from all the sensors connected to it and ends output through the speaker.
b) At Mega 328p: This is the main controller in the Li-Fi module. It receives command from the 5 keypad and shows output in the LCD display and sends flickering light through LED.
c) Ultrasonic Sensor: The ultrasonic sensor detects the presence of object in the path of the shoe.
d) Water Level Sensor: It detects the presence of water in the path of the Shoe and sends the signal to the controller.
e) DF Mini Player: This is the SD card slot, where the commands to be played are stored.
f) Li-Fi TX: The LED source is the Li-Fi transmitter. It sends flickering light as commanded by the controller.
g) Li-Fi RX: The Photo Diode is the Li-Fi receiver here. It detects the LED and sends it to the controller for analyzing.
h) LCD: It displays the data being transmitted by the LED on command of the controller.
i) 5 keyad: The 5 keypad helps in changing the data being transmitted by the LED through the Controller.

IV. METHODOLOGY

When the Ultrasonic Sensor detects an obstacle in the path of the shoe, it sends signal to the controller. Similarly the Water sensor sends signal to the controller when it detects water. As the software is installed in the controller to warn the person whenever an obstacle is detected, a voice signal is played by it through the speaker. The Li-Fi module is a separate circuit which are to be placed on various locations in the society. The Li-Fi module produces LED which transmits data to the shoe module. The Li-Fi receiver at the shoe detects this signal and the controller plays this data through the speaker. For the prototype to transmit different data, the 5 keypad is used. The data is communicated only when the LED light falls on the Photo diode.

V. CONCLUSION

The Smart Shoe uses the most reliable source, light, to communicate data to the visually-impaired. This not only helps in navigation but also helps in general information sharing like sales and offers. By detecting obstacles, it becomes a wearable safety device. Thus the Smart Shoe promotes an independent blind society.

VI. REFERENCE

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