

WALK-MATE - A Smart Walking Cane

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Abstract

Globally, at least 2.2 billion people have a near or distance vision impairment. Visually impaired people find it difficult to self-navigate outside well-known environments. It affects their ability to perform several jobs, duties, and activities. They are dependent on external assistance which can be provided by humans or special electronic devices for better decision making. In this proposed system we develop a walk-mate that is a special stick that helps the visually impaired self-navigate without any assistance. This proposed system will include features such as obstacle detection by using ultrasonic sensors and an emergency button that helps the visually impaired send a message to emergency contacts. The proposed system can be accessible to people so that the visually impaired will feel a sense of independence as they do not need to depend on others for assistance.

Keywords :

1. INTRODUCTION

India is the second-most populous country in the world. But unfortunately, India also contains the largest number of visually challenged people. Globally, it is estimated that there are 441 million visually impaired people encompassing a range of impairments from mild levels to blindness. The majority of these are living in South Asian countries which include India. Visual impairment, also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems not fixable by usual means, such as glasses. Some also include those who have a decreased ability to see because they do not have access to glasses or contact lenses. Visual impairment is often defined as a best-corrected visual acuity of worse than either 20/40 or 20/60. The term blindness is used for complete or nearly complete vision loss. Visual impairment may cause difficulties with normal daily activities such as reading and walking without adaptive training and equipment. One of the major problems faced by the visually impaired especially the one with complete vision loss, is navigating around unknown places. This makes them always

take assistance while going out even for a general walk. This assistance might not be available all the time. Visually impaired thrive for independence.

As one of the leading technologies in the present, IoT can be incorporated in electronics which will help in making useful products. One such idea is to build WALK-MATE with IoT, i.e building a smart walking cane using electronic components and connecting them on the basis of IoT. Arduino can be used to connect multiple devices to each other and allow them to exchange real-time data. In this project we connect all the components to the Arduino board and program them according to the requirement. We program them in such a way that the components can exchange data between them. This proposed system will include features such as obstacle detection by using ultrasonic sensors and an emergency button that helps the visually impaired send a message to emergency contacts. GPS features will be included so that the guardians of the user can track them. Light Emitting Diode (LED) with a Light Dependent Resistor (LDR) will be included. The LDR senses the light intensity of the environment and illuminates the LED in case of low light intensity to make people around the user aware of the user's presence. A button will be present at the user that will help to find the stick if the user misplaces it in the closest surroundings.

2. LITERATURE SURVEY

Smart Stick for Blind People[1] proposed a stick for blind people that includes different features in the stick such as object detection and another feature that helps the user find the stick in case the user misplaces it. There is a button that can be put on the user's wrist to find the stick if misplaced. When the push button in the wrist band is pressed the buzzer gives an alarming sound and helps the person to find where the stick is present.

Arduino based Smart Walking Cane for Visually Impaired People[2] described easy navigation of the visually impaired. The first and the most important feature is object detection using ultrasonic sensors. Other features include water detection to detect water on the way while the user is walking. There is also an LDR included which is connected to a buzzer and makes noise to let the user know the darkness around.

Automatic Light Intensity Control using Arduino UNO and LDR[3] have proposed an automatic light intensity control unit using Arduino UNO and Light Dependent Resistors. In this system, four LDR's are placed at four different corners of the room precisely taking care of their blockage of light. The required intensity of light is obtained by taking the average of all four LDR's and compared with the reference intensity of the light as specified by the user.

RADAR based Object Detector using Ultrasonic Sensor[4] proposed another way of detecting objects in case of far distances or not being visible due to different factors such as weather conditions, day/night light cycles, Radio Detection And Ranging (RADAR) can be used for detecting objects. Even though it has advantages over other sensors, it uses a long time to detect, has a short detection range and is not targeted specifically because of its wide range.

Embedded Assistive Stick for Visually Impaired Persons[5] executed a blind stick using multiple ultrasonic sensors for different purposes. Firstly, pothole detection and avoidance systems are implemented by setting the ultrasonic sensor at a 30-degree angle on stick. Secondly, a moisture sensor is placed at the bottom of the stick to measure the degree of water and soil moisture in forward-facing of the user. Thirdly, knee above obstacle detection and avoidance systems are implemented by using an additional ultrasonic sensor on the top of the stick to turn an alarm. Fourthly, an ultrasonic sensor is placed down the stick at about 20 cm from the ground level to detect and avoid knee below obstacles and stairs at a distance of 70 cm in front of the user. Different buzzers were used to alert the user in case of obstacles .

Tracing Path with Arduino Uno using GPS and GPRS/GSM[6] developed a system to trace paths and send a message to our emergency contacts in case they are lost. To trace the path GPS sends the coordinate to the GSM modem through the Arduino Uno R3 microcontroller. The microcontroller acts as an interface between GPS receiver GPRS/GSM modules. After receiving the location coordinates from the GPS module, the coordinates values are sent to an Android Mobile phone through Short Message Service.

Ultrasonic Sensor Based Smart Blind Stick[7] proposed a blind stick for navigation without requiring any assistance. In this project an ultrasonic sensor module, HC-SR04 is used for

obstacle detection in the path of the blind person and a buzzer is used to make the person alert. The proposed system is implemented using PIC microcontroller 16F877A. This stick can detect obstacles within the 5 to 35 cm range of distance.

The working principle of an Arduino[8] discussed how Arduino can be used for many different purposes. Arduino makes things easier due to the simplified version of C++ and you can program, erase and reprogram at any given time. In this paper hardware components are used in the Arduino board, the software used to program it (Arduino board) with the guide on how to write and construct your own projects. This gives the overall view of an Arduino Uno and how it can be used in terms of our project.

3. SYSTEM ANALYSIS AND DESIGN

3.1 Proposed System

One of the major problems faced by the visually impaired is not being able to self-navigate. They always need someone to help them navigate. It is high time that we develop adaptive equipment to let the visually impaired feel that sense of independence. WALK-MATE is one such attempt to help the visually impaired navigate without requiring assistance. WALK-MATE has the following modules.

Object Detection

Using this feature of object detection, the user will be intimated when he/ she is about to encounter any object in front of them. To implement this, an ultrasonic sensor and a buzzer are used. The ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. With the help of an ultrasonic sensor, one can measure the distance between it and the object present in front of it. This measurement is sent to Arduino which acts as an interface between all components. By using this measurement, if the distance is measured to be low, it can be said that there is an object in front of the user,i.e, once it is noted that the distance is lower, a buzzer starts buzzing as a warning signal to the user.

Sending Emergency Messages

When a user encounters any kind of difficulty, the user can intimate their guardians with a single click. This is possible by using GPS GSM modules. SIM 800L GSM/GPRS module is a miniature GSM modem, which can be integrated into WALK-MATE. This module can accomplish SMS text messages, make or receive phone calls, connect to the internet through GPRS, etc. GPS module gets the location information from satellites in the form of latitude and longitude. The microcontroller processes this information and sends it to the GSM modem. The GSM modem then sends the information to the owner's mobile phone.

Finding Misplaced Stick

There is a chance that the stick might get misplaced by the user and there is a high chance of not being able to find it by the user's self. So by providing a remote control that consists of a button that the user can long-press such that the stick starts vibrating until the user finds it. This can be implemented using the RF Module. An RF module is a small electronic device used to transmit and receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wireless, like in WALK-MATE where the stick and remote will be connected by radio signals. This wireless communication may be accomplished through optical communication or through radio-frequency communication. In WALK-MATE, the remote consists of a transmitter, and when the user clicks on the button present on the remote, it transmits radio signals which are received by the receiver attached to the user's stick and a buzzer starts making noise on the stick which helps the user to find the stick.

Identifying User

In the case of low light areas, it becomes difficult for the people residing in the surrounding area of the user to detect them. The Light Dependent Resistor detects the lights and makes the Light Emitting Diode glow. This can help the people around the user be aware of the user's presence. This is an automatic process happening in the system and the user does not have to do any work since they cannot detect the intensity of light.

3.2 Architecture Design

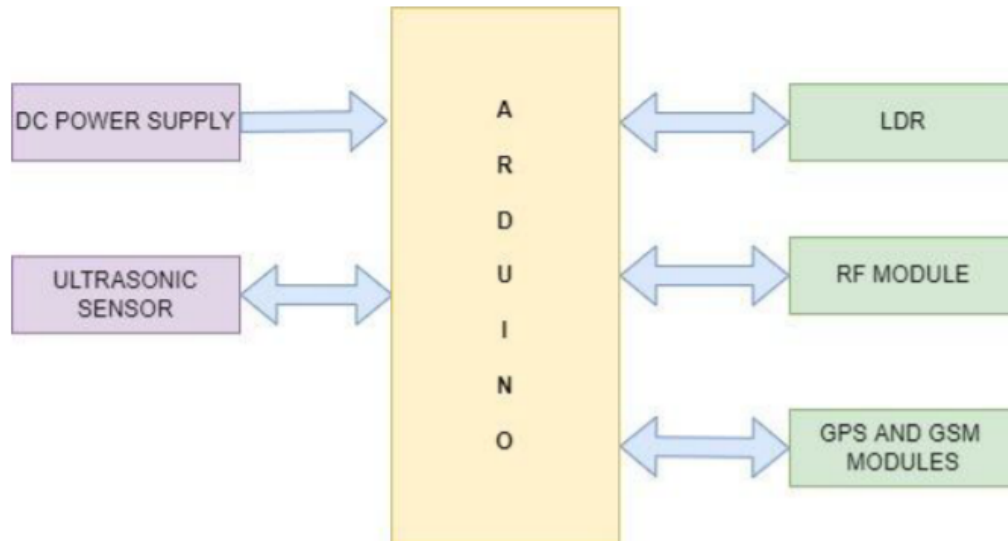


Fig 3.1 Architecture Design

The architectural design of the Walk-mate has different modules with each having its own importance in the project. The first feature of the project is to detect objects in the way of the user. This can be achieved using ultrasonic sensors that help us in detecting the objects by sending waves that are reflected by objects in the way. The second feature is to locate the user's location and send it in the form of an SMS to the user's emergency contacts. If the user thinks he/she is lost or if the user is in any danger he/she can simply press the button on the stick that will get the user's location in the form of longitude and latitude and send it to the contacts. The location is sent in the form of a hyperlink to the emergency contact that can be clicked to view the user's location. In case the user loses his stick and is unable to locate it, there is an RF module included that can help the user find his stick. The user has a remote at his/her end with a button on it. If this button is pressed, signals are sent out from the RF transmitter and the stick has an RF receiver that vibrates on receiving signals from the transmitter. Another important feature that is included in the stick is to identify user in the dark. There is a Light Dependent

Resistor added to read the intensity of surrounding light. If this value falls beyond a threshold then the Light Emitting Diode glows an indication to the people in the surrounding area that the user is walking. In order for all these components to be embedded into one system, they have to be connected to the Arduino board. After making all the required connections, the Arduino board has to be programmed using the Arduino IDE for all the hardware components to perform their respective functions.

3.3 Output images:

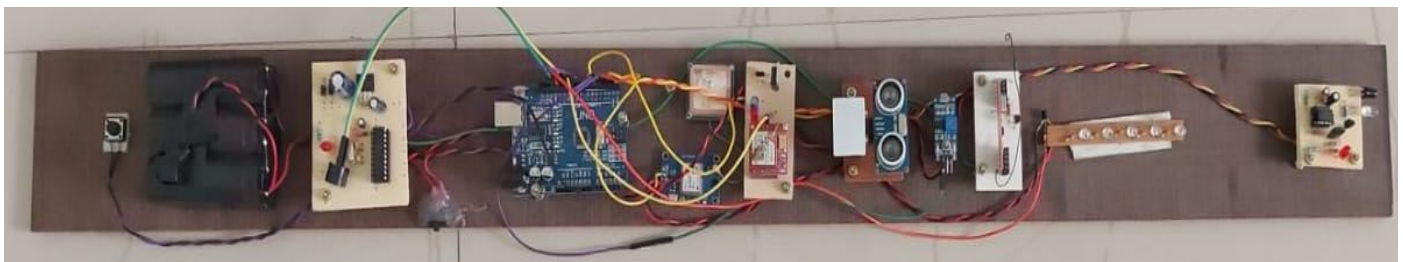


Fig 3.2 WALK-MATE Stick



4. CONCLUSION

This paper proposes a smart walking cane for visually impaired people which can detect obstacles and along with it, can sense the darkness of the environment in which the user is moving. The GPS module in the device finds the location of the user and the GSM module sends the location to the specified mobile number of the family member or guardian. So, in case they feel insecure or lost anywhere, they can be helped. In case the user loses his stick and is unable to locate it, there is an RF module included that can help the user find his stick. All the modules

of this device have been programmed such that they will alert the user when required. Overall, this work proposes a fully-featured smart walking cane for visually impaired people.

REFERENCES

[1] Loganathan, N.; Lakshmi, K.; Chandrasekaran, N.; Cibisakaravarthi, S.R.; Priyanga,R.Hari; Varthini, K.Harsha (2020). [IEEE 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS) - Coimbatore, India(2020.3.6-2020.3.7)] 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS) - Smart Stick for Blind People.

[2] Bansal, Malti; Malik, Saurabh; Kumar, Mohit; Meena, Nikita (2020). [IEEE 2020 Fourth International Conference on Inventive Systems and Control (ICISC) - Coimbatore, India (2020.1.8-2020.1.10)] 2020 Fourth International Conference on Inventive Systems and Control (ICISC) - Arduino based Smart Walking Cane for Visually Impaired People.

[3] Kilari, Geethika; Mohammed, Rizwana; Jayaraman, Ramesh (2020). [IEEE 2020 International Conference on Communication and Signal Processing (ICCSP) - Chennai, India (2020.7.28-2020.7.30)] 2020 International Conference on Communication and Signal Processing (ICCSP) - Automatic Light Intensity Control using Arduino UNO and LDR.

[4] Kulkarni, Akshaya U; Potdar, Amit M; Hegde, Suresh; Baligar, Vishwanath P (2019).[IEEE 2019 1st International Conference on Advances in Information Technology(ICAIT) - Chikmagalur, India (2019.7.25-2019.7.27)] 2019 1st International Conference on Advances in Information Technology (ICAIT) - RADAR based Object Detector using Ultrasonic Sensor.

[5] Himanshu Sharma, Meenakshi Tripathi, Amit Kumar, Manoh Kumar Singh (2018). Published in 9th ICCCNT 2018 July 10-12, 2018, IISC, Bengaluru Bengaluru, India -Embedded Assistive Stick for Visually Impaired Persons.

[6] Agrawal, Tarun; Qadeer, Mohamaad Abdul (2018). [IEEE 2018 International Conference on Computing, Power and Communication Technologies (GUCON) - Greater Noida, Uttar Pradesh,

India (2018.9.28-2018.9.29)] 2018 International Conference on Computing, Power and Communication Technologies (GUCON) - Tracing Path with Arduino Uno using GPS and GPRS/GSM.

[7] Dey, Naiwrita; Paul, Ankita; Ghosh, Pritha; Mukherjee, Chandrama; De, Rahul; Dey, Sohini (2018). [IEEE 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT) - Coimbatore, India (2018.3.1-2018.3.3)] 2018 International Conference on Current Trends towards Converging Technologies(ICCTCT) - Ultrasonic Sensor Based Smart Blind Stick.

[8] Badamasi, Yusuf Abdullahi (2014). [IEEE 2014 11th International Conference on Electronics, Computer, and Computation (ICECCO) - Abuja, Nigeria (2014.9.29-2014.10.1)] 2014 11th International Conference on Electronics, Computer and Computation (ICECCO) - The working principle of an Arduino.