Multi-purpose IOT-based smart walking stick for visually impaired peoples

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Abstract— This project is designed for the visually impaired, specially-abled persons, patients as they face challenges in going out without being dependent on anyone. This stick will help blind person by providing a more convenient means of life. This project will have an IR obstacle sensor to sense the any object and a buzzer on the blind person to understand the object is present, an SPO2 sensor to sense the Heartbeat of a blind person, and GPS to know the location of the blind person, a GSM is integrated with GPS which sends SMS regarding location. A flame sensor was used to detect the fire which is integrated with a buzzer that alarms. The prepared prototype is lightweight, user-easy to use, and feasible, making it accessible to a wide range of users. Primary tests ensure its effectiveness in obstacle detection, navigation, and emergency response, it also mentions its potential to significantly improve independence which improves the quality of life for visually impaired individuals..

Index terms- Walking stick, IoT, white cane, smart stickl.

INTRODUCTION

According one survey (2016-2019), 1.8% population above 50 years and above are suffering from visual impairment. In USA, around one quarter of the population above the age of 71years have visual impairment. The visual impairment takes away the independence to roam alone. The patient always need a guardian's help who would guide the patient to move from one place to another. There is a need of an innovation that would enhance the quality of life for visually impaired peoples. The smart stick could be a reliable alternative that would help an individual to move independently. The smart stick helps in navigation assistance which helps to reach at the destination, obstacle detection sensor helps to avoid the accident and many more IOT sensor can be integrated and can be used to carry out different purposes

METHODOLOGY

Basically, this smart stick is designed for multiple uses and not just blind people can use it, but it can also be used by specially-abled individuals and farmers. It comprises of multiple sensors and modules.

The ESP32 microcontroller: It is a microcontroller which provides interface and processing power to carry out the function for sensors and modules. It uses simplified C- language to integrate multiple devices connect. It is a reliable & integrable across platforms which also provides a simple programming environment, some of the advantages of the ESP32controller is, it is cost-effective.

MAX30100 sensor: It is a heartbeat and pulse oximeter sensor which senses the heartbeat and blood oxygen, threshold is set (below 60 and above 120) so, in case of emergency when there is bp high or low (bradycardia/tachycardia), the guardian gets an assigned template message with real time gps location. And it is also integrated with an LCD module which shows the reading in real-time.

GPS module: is used to know the current location where the blind person is present in real time.

GSM module: It is used in the stick to integrate sim card connectivity with GPS module stored in the controller in case of an emergency.

IR obstacle sensor: it is used to detect obstacle and to alarm the patient by buzzing the buzzer which will help to avoid any accident.

Flame Sensor: The flame sensor is used to detect the flame from a safe distance which is integrated with a buzzer, when the flame is detected, the buzzer will buzz and alarm the user.

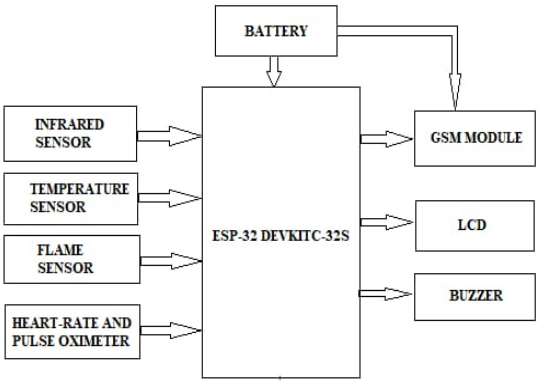

Fig 1 (Block diagram of smart stick)

The protype uses ESP32 as the main driver of the model. The ESP32 is powered using a 7.4V battery. The input devices connected to the ESP32 are heart-rate and pulse-oximeter sensor, temperature sensor, flame sensor and the infrared sensor, The heart-rate and pulse oximeter sensor is used to measure the oxygen level and the heart rate, the temperature sensor measures the body temperature of the user, the flame sensor is used to measure the presence of fire and the infrared sensor is used to detect the obstacle. The GSM module is used for the output of pulse-oximeter sensor to send alert and location. The GSM module is powered using 7.4V battery. The LCD is integrated to display the output of temperature sensor and pulse-oximeter sensor. The buzzer is used to produce the output of flame sensor and the infrared sensors except at the beginning of a sentence.

Fig .2 & Fig. 3 (IOT based Smart stick)

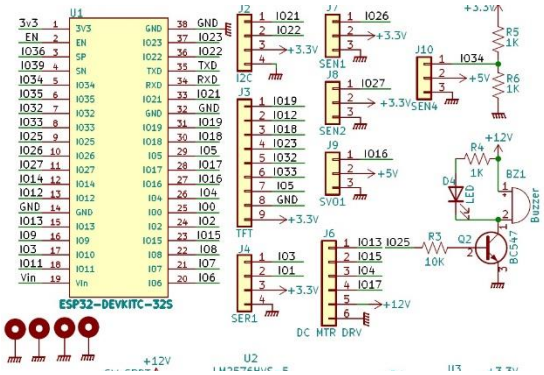

Fig.4(Schematic diagram of smart stick)

The schematic diagram illustrates the connections between an ESP32-DevKitC-32S and various sensors and components. The sensors are connected to various connection modules used to integrate the sensors with ESP32 and also enhance the application of the controller. The ESP32 interfaces with four sensors labeled MAX30100(Heart-rate and Pulse Oximeter sensor) which is connected to J2 connection module (I2C pins I021 and I022), IR sensor which is connected to J7 connection module (pin IO26), a flame sensor which is connected J8 connection module (pin IO27), and temperature sensor which is connected to J9 connection module (pin IO16). The output devices include a GSM module which is connected to the J4 connection module (pins IO1 and IO3), LCD which is connected to J3 connection module and a buzzer connected via a BC547 transistor, which is controlled through pin IO25. The common ground connections across all components ensure stable voltage reference points. A DC motor driver is also depicted, interfaced through J6 and controlled by IO13, IO15, IO4, and IO17, powered by a +7.4V supply. An LED indicator is linked to IO34 via a resistor. This setup allows the ESP32 to effectively read sensor data and control actuators, making it suitable for diverse monitoring and control applications.

CONCLUSION AND FUTURE SCOPE

The implemented stick is a major help to the visually impaired user as well as the carer/guardian of the user ensuring safety while commuting in the world. We make use of various sensors to detect the obstacles, raise and alarm in case of fall, and to monitor heart-rate and oxygen level. We take the benefits of GPS module and GSM module, where GPS module helps to share location data detected by it and the GSM

module sends SMS to the carer/guardian sharing the crossing of set thresholds heart-rate and in case of an emergency. All these features are beneficial in lending a hand to make the visually impaired people become self-reliant while navigating.

The model can be further improved by implementing various technologies into it. This can be done by integrating a camera module to track the visually impaired through live visuals. The stick can be made self-sustainable by implementing solar panels on it. The stick can integrate with a Braille input device giving the blind person an uncomplicated method to provide the destination address for navigation. Thus, the model has enormous possibilities to improve and make navigation safer for the visually impaired.

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REFERENCES

[1] S. A. N. Kudva, Shreedhar, Pratik N K, Poornesh V, “Smart Blind Stick,” Int. J. Latest Trends Eng. Technol., vol. 9, no. 3, pp. 273–275, 2018.
[2] A. F, A. NADA, M. A, and S. MASHALI, “Effective Fast Response Smart Stick for Blind People,” no. April, pp. 5– 11, 2018.
[3] A.P. K.S.Manikanta, T.S.S. Phani, “Implementation of Smart Stick for Obstacle Detection and Navigation,” vol. 02, no. 05, pp. 45–50, 2016.
[4] W. Motwakil, I. Ahmed, and E. M. Hussein, “Design and Implementation of Eye Stick for Blind People,” vol. 45, no. 01, pp. 83–87, 2017.
[5] P. K. D. Vipul V. Nahar1, Jaya L. Nikam2, “Smart Blind Walking Stick”, Int. J. Mod. Trends Engineering Research, vol. 2, no. 4, pp. 226–232, 2015.