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Arduino based intelligent walking stick for blind people

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Abstract

Eyes are foremost blessing to enjoy the nature. Blind people face lot of hurdles in day to day life. Blind people always have to depend on others for daily activities. Accessing reading materials, identifying objects, and arranging laundry can also be difficult for them. Another challenge faced by them is the communication gap as they often have to ask for help with their daily tasks. A study conducted by North Carolina State University has highlighted the importance of providing support to people with visual impairment by being polite, using humor, offering help directly and specifically, and using nonverbal cues like guide dogs. the social isolation that can result fromvisual impairment can have a significant impact on a person's mental health and wellbeing. Blind individuals may struggle to participate in activities or events that require visual cues, and may feel excluded from certain social circles as a result. The Arduino-based intelligent walking stick for blind people is a revolutionary device that provides a new level of independence and safety to the visually impaired. The device comes equipped with ultrasonic sensors that detect obstacles, sound signals and vibrations that alert the user, a GPS module for location tracking. The ultrasonic sensorsin the walking stick are capable of detecting obstacles and determining their distance. The walking stick is powered by a circuit that maintains a constant power supply and processes the data. The Arduino Uno is used to process and calculate any detected obstacles, making the device highly responsive and accurate. The walking stick's GPS module allows users to keep track of their location, making it easier for them to navigate their environment. Overall, the Arduino-basedintelligent walking stick for blind people is a highly innovative device that offers a wide range of features to assist visually impaired individuals in navigating their surroundings with ease and safety. Its lightweight, portable, and easy-to-use design makes it an ideal aid for visually impaired individuals, providing them with an unprecedented level of independence and safety.

Introduction

Due to the absence of visual perception, people are deprived of enjoying the beauty of nature and lack to fulfil their desires and needs. Visual impairment refers to a condition in which an individual's ability to see is reduced or completely lost. Visual impairment can have a significant impact on the quality of life of both the affected individual and their families. For instance, families who lack knowledge of visual impairment and receive a diagnosis often feel that the health professionals who make the diagnosis lack understanding in this area. Blind people have very less interactions with surroundings. Even though government provides many opportunities for them to express their talents, it is sometimes demotivating for them because they are not able do things which we perform with quite ease. To address these problems, there is a need for affordable small sticks to assist the visually

impaired peoples. Internet of Things (IoT) brings revolution by automating the manual processes to automated processes with the help of other emerging technologies like wireless sensor networks, data analytics, cloud computing, machine learning, etc. IoT digitalizing every field of life from medicine to agriculture and education to industry. In this research paper, we have developed an intelligent smart Walking Stick which is empowered by IOT to support blind people to lead a comfortable life. Our smart stick is incorporated with ultrasonic sensor to detect an obstacle ahead of them and that causes buzzer to trigger to let them know of the impending object ahead of them. An android application [BLYNK IOT] is used to generate an important notification and send it to their family member along with their precise GPS location.

Literature Review

Paper 1

Topic: IOT Empowered Smart Stick Assistance for Visually Impaired People.Year of Publish: October,2020

Published by: Ayesha Ashraf, Saba Noor, Muhammad Arslan Farooq, Asad Ali, Ahmad Hasham.

The development of IoT-enabled smart stick assistance for visually impaired people has been a significant breakthrough in improving the quality of life for the visually impaired. The smart stick isequipped with ultrasonic sensors that can detect obstacles ahead and alert the user through an alarm system. The stick also has GPS and GSM modules that offer anti-theft protection and water sensors to detect wet surfaces. This technology has been developed using an Arduino board and an HC-SR04ultrasonic sensor, which detects the distance between the user and the obstacles ahead. This technology provides visually impaired individuals with greater independence and mobility, allowing them to navigate their surroundings with ease and safety. It is important to continue to develop and improve such technologies to create a more inclusive and accessible society for all individuals, regardless of their abilities.

Paper 2

Topic: Smart Stick for Elderly.Year of Publish: 2019

Published by: Lakshmi Boppana, Vishal Jain, Ravi Kishore

A smart stick or cane for the elderly can be a great tool to help them maintain their independence andmobility. As people age, they may experience difficulty with balancing and walking, which can lead to falls and injuries. A smart stick can provide additional support and safety features to prevent falls and ensure that the elderly is able to move around safely. Some features that could be incorporated into a smart stick for the elderly include a GPS tracker to help locate lost or misplaced canes, an anti-theft alarm to prevent the stick from being stolen, and sensors to detect changes in terrain and alert the user to potential hazards. Additionally, the stick could be equipped with a flashlight for improvedvisibility in low-light conditions and a built-in seat for resting. Overall, a smart stick for the elderly can be a valuable tool to help them maintain their independence and safety. By incorporating advanced technologies, these devices can provide a range of features that can make a real difference in the lives of elderly individuals and their families.

Paper 3

Topic: Elder Assist - An IoT Based Fall Detection System.Year of Publish: May 2022

Published by: Prashant Wakhare , Hrishikesh Tavar , Priyanka Jagtap , Mayur Rane, HarshvardhanWaghmare

Elder Assist is an IoT based fall detection system designed to provide immediate assistance in case of a fall or emergency. The system consists of a network of sensors, cameras, and alarms that work together to detect falls and notify caregivers or emergency services. The system is easy to install and can be integrated into any smart home. The sensors are placed in strategic locations throughout the home, such as the bedroom, bathroom, and living room. These sensors are designed to detect changes in motion and orientation, which can indicate a fall or other emergency. In the event of a fall, the system will immediately notify caregivers or emergency services. The system can also be configured to send alerts to family members or friends, providing them with real-time updates on thestatus of their loved one. Elder Assist is particularly useful for the elderly, who are at a higher risk offalls and other accidents. The system can help to reduce the risk of injury or death, as well as providepeace of mind for caregivers and family members. The system can also be customized to meet the specific needs of the user. For example, the sensors can be adjusted to detect different types of motion, such as walking or sitting, and the alarms can be configured to sound different tones depending on the severity of the alert. Overall, Elder Assist is an innovative and effective solution for fall detection and emergency assistance. The system can help to improve the quality of life for the elderly and provide peace of mind for caregivers and family members.

Paper 4

Topic: IoT-Enabled Smart Mobility Devices for Aging and RehabilitationYear of Publish: 2020

Published By: Nafisa Mostofa , Kelly Fullin , Sharare Zehtabian , Safa Bacanlı , Ladislau Boloni,Damla Turgut

Smart mobility devices are becoming increasingly popular as assistive technologies for individuals with disabilities and the elderly. Among these devices, IoT-enabled smart sticks and canes are gaining traction due to their ability to provide enhanced safety and independence to users. The development of intelligent walking sticks for blind people is a prime example of how IoT-enabled devices can improve the quality of life for individuals with disabilities. Arduino-based intelligent walking sticks are designed to provide real-time feedback to visually impaired individuals, helping them navigate their surroundings safely. These devices use ultrasonic sensors to detect obstacles andprovide haptic feedback to the user, allowing them to avoid collisions. Additionally, these smart sticks can provide audio feedback to the user, notifying them of nearby objects or hazards. The benefits of IoT-enabled smart stick assistance extend beyond the visually impaired community.
Smart sticks can also be used to aid the elderly in maintaining their independence and safety. Forexample, a smart stick could detect when a user has fallen and alert caregivers or emergency services. Additionally, smart sticks can be equipped with GPS tracking capabilities, allowing caregivers to monitor the user's whereabouts and ensure their safety.

Paper 5

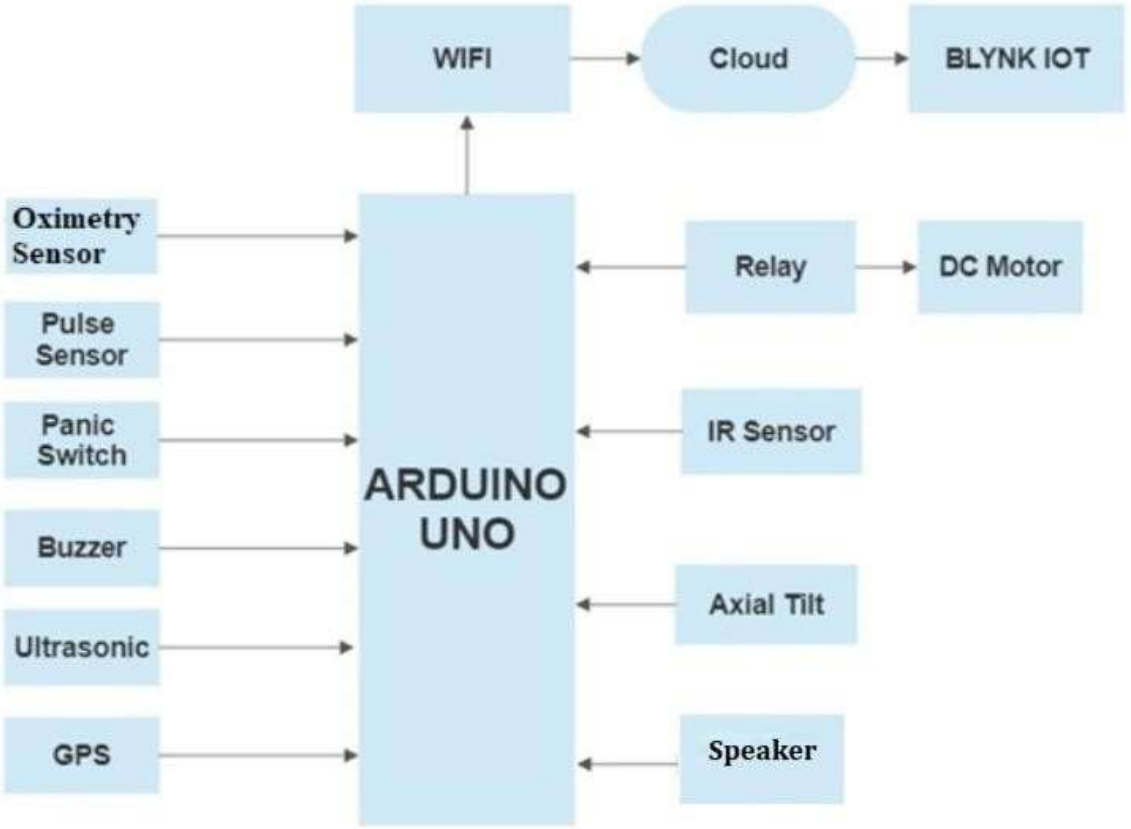
Topic: Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification

Year of Publish: February 4, 2022

Published by: USMAN MASUD , TAREQ SAEED , HUNIDA M. MALAIKAH , FEZAN ULISLAM1 , AND GHULAM ABBAS

Visual impairment is a condition that affects millions of people worldwide, making everyday tasks a challenge. Walking, for instance, can be particularly difficult due to obstacles that are not immediately visible. However, with the development of IoT-enabled smart stick assistance, the visually impaired can now navigate their surroundings with greater ease and safety. This smart assistive system uses object detection and classification to detect and alert users of potential obstacles in their path. The IoT technology is integrated into the smart stick, which is equipped with a camera that captures images of the user's surroundings. These images are then processed using advanced algorithms to identify and classify objects in the environment. Once an object is identified, the smart stick uses audio and haptic feedback to alert the user of its presence. This feedback can be customized based on the user's preferences, making the system more intuitive and user-friendly. In addition to the smart stick, IoT technology has also been used to develop Elder Assist, an IoT-based fall detection system. This system uses sensors and machine learning algorithms to detect and predict falls, which can be particularly dangerous for the elderly. When a fall is detected, Elder Assist sends out an alert to caregivers or emergency services, ensuring that help is provided as quickly as possible.

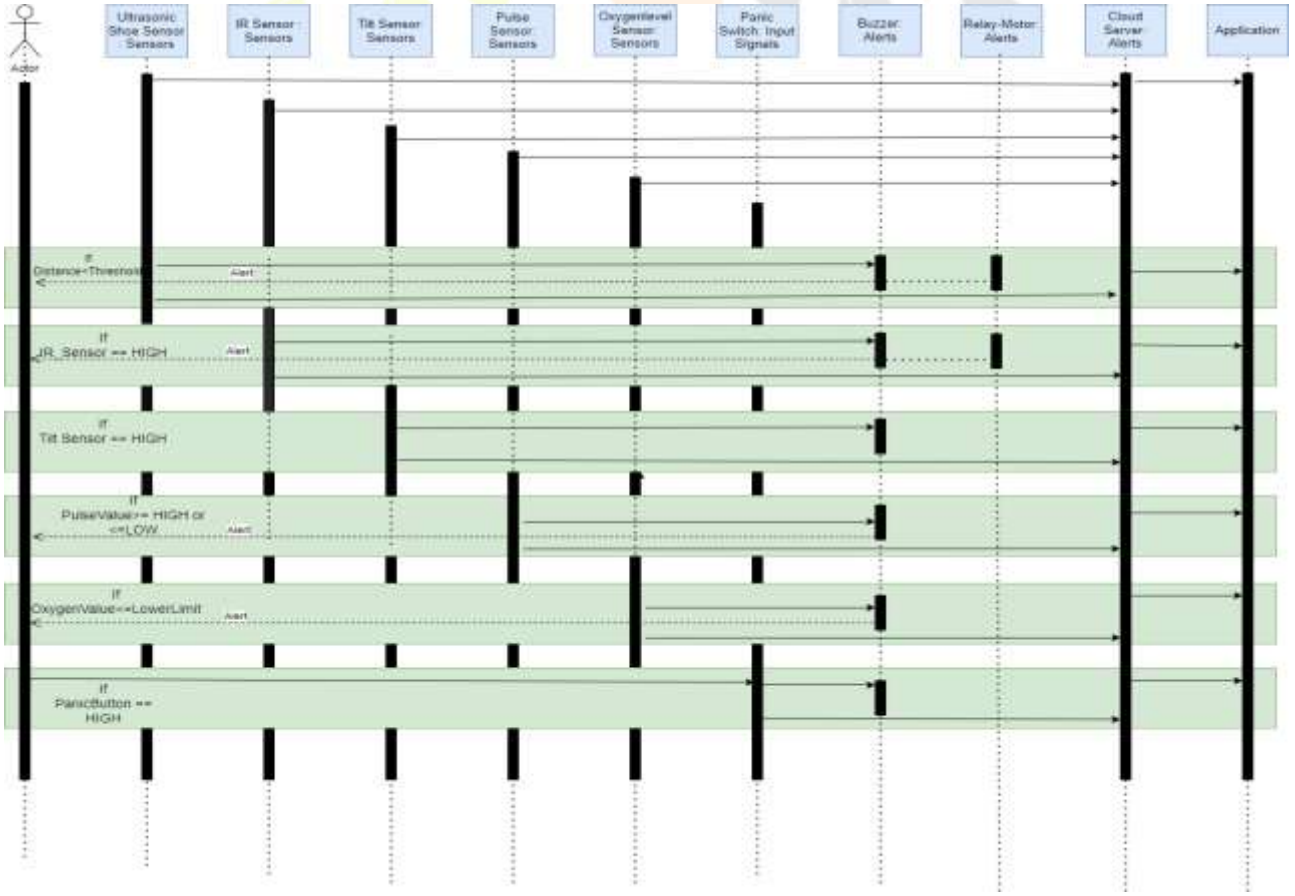
Methodology



The above Flowchart depicts the flow of proposed system. We are using Arduino UNO(Italian) whichis low cost, flexible and easy to use programmable open source micro controller board that can be integrated into a variety of electronic projects. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on anLED, publishing something online. This board can be interfaced with other Arduino boards, shields, Raspberry Pi boards and can control relays, LEDs, Servos, and motors as an output. The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. LM35 uses basic principle of diode, whereas the temperature increases, the voltage across the diode increases at a known rate. We use LM35 to measure the body temperature of the person. BPM180 is a high precision sensor designed for consumer application. Barometric pressure is nothing but weight of air applied on everything.

The air has weight and wherever there is air its pressure is felt. BPM180 senses that pressure and provides that pressure in digital output. This output is sent via app for their family members to know the heart rate of the blind person. The ADXL345 is a small, thin, ultra-low power, 3 axis accelerometer with high resolution (13 bit) measurement at up to plus or minus 16g. This is used to detect if the stick is fallen to the ground which would imply that the blind person has dropped the stick or has fallen over. This will lead to the buzzer to go and set the alarm off notifying the people around. The Infrared sensor is a radiation sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780nm… 50 x10^8m. It is mainly used in motion detection. It is used for finding obstacles. Panic switch will set off an alarm alerting the nearby pedestrians that they are in danger and help the needy. GPS will be installed in the stick to let their loved ones know the exact position of blind person. The data collected from all these devices are sentvia WIFI using BLYNK App to their family.

Sequence Diagram



Results and Discussion

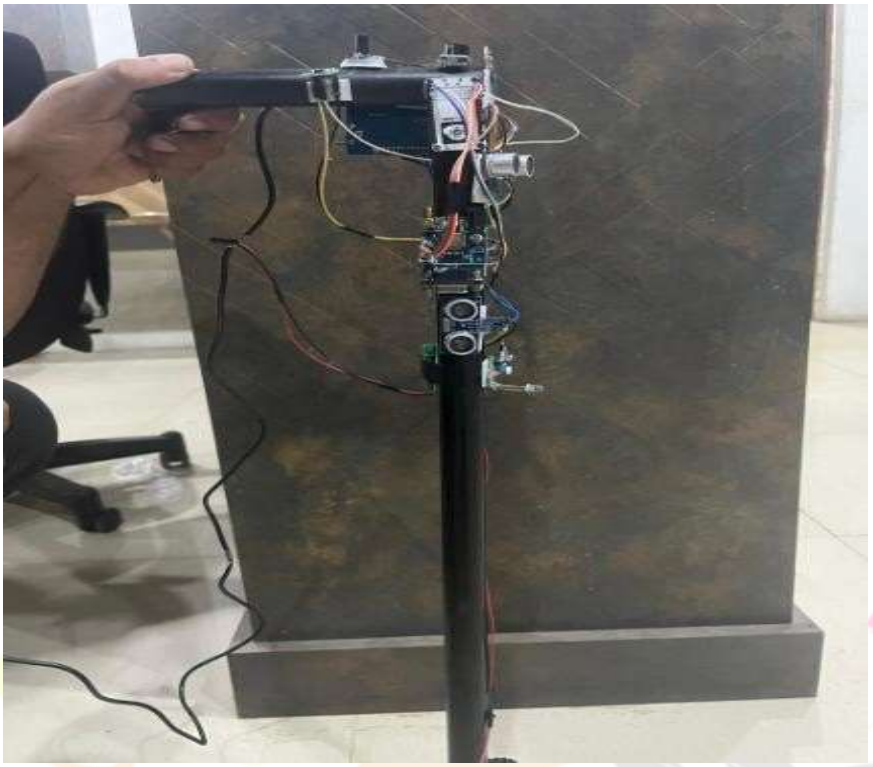


FIG: Right View of Smart Stick

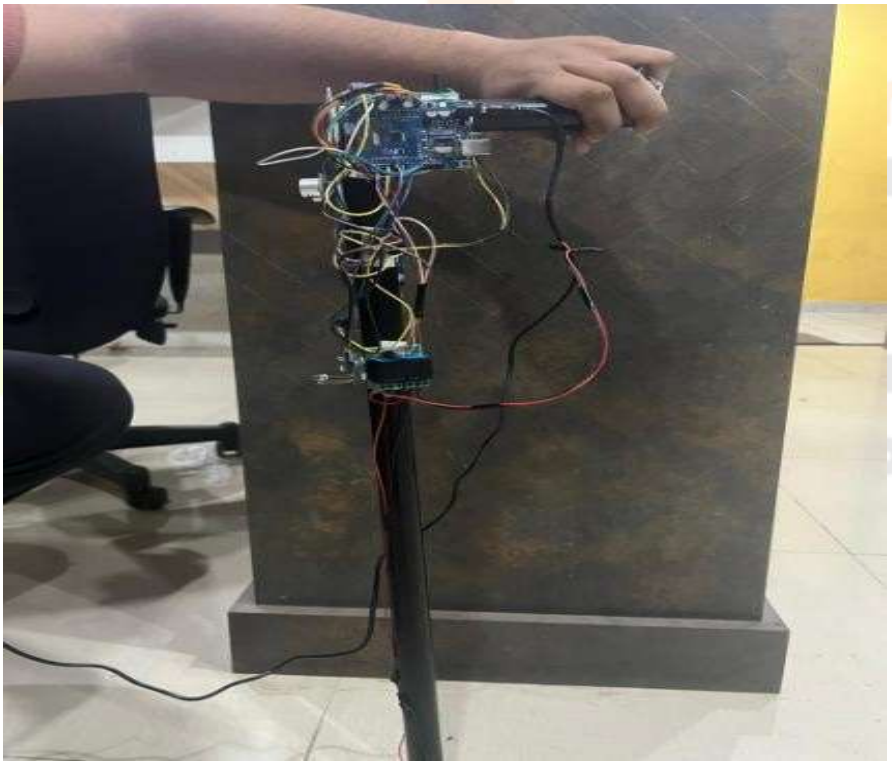


FIG: Left View of Smart Stick

FIG: Front View of Smart Stick

Conclusion

This article proposed the construction of an intelligent system. Which aims to prevent and reduce fallsin the elderly. As previously seen, it was found that most falls occur within the elderly's own home. Some of the factors responsible for these falls are obstacles on the way, slippery floors, insufficient lighting, and pets. What makes the solution built as a tool that can be extremely relevant for the elderly. The shoe can easily detect some of these factors. And if there is a risk of falling, the shoe can trigger an alert. Thus, alerting the elderly that there is a risk of falling at that moment. So the shoeends up helping to prevent a possible fall.
One of the essential aspects that makes this work relevant is applying this type of footwear, which detects objects, to prevent falls in the elderly. Another relevant part is the ease of use of the shoe. One of the contributions of this work, about the majority, is that it aims at avoiding fall before it occurs.
It is crucial to test smart shoes in the laboratory and with older people in future work. Thus, one canverify the shoe's effectiveness in preventing falls and accepting this population to the smart shoe.
Such tests were not possible due to the social isolation that had a reason to avoid the contagion and spread of covid-19. Also, calibrations and adjustments must be made to the shoe to work well in different environments. Another exciting development for this work would be implementing a systemfor detecting falls through web servers. Thus, it would be possible to integrate smart shoes with otherintelligent devices. Consequently, the system would be able to detect and prevent falls at the same time.

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