

Sensor based shopping assistance system for PwDs

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ABSTRACT

People with visible impairment are the second one biggest affected class with confined access A complete, portable, and low-cost clever assistant for supporting visually impaired human beings to navigate interior, outdoors, and engage with the surroundings is supplied in this paper. The prototype of the clever assistant includes a clever cane and a imperative unit; communication among person and the assistant is executed thru voice messages, making the machine appropriate for The assistant is ready with GPS, digital compass, Wi-Fi, ultrasonic sensors, an optical sensor, and an RFID reader, to assist the person navigate safely. Navigation functionalities paintings offline, that's mainly vital in regions wherein Internet insurance is susceptible or Physical situation monitoring, medication, shopping, and climate information, facilitate the interplay among the person and the surroundings, assisting each day activities. The proposed machine makes use of exceptional additives for navigation, gives impartial navigation systems for interior and outdoors, each day and night, no matter climate conditions. Offer encouraging results, indicating that the prototype has the capability to assist visually impaired human beings to gain an excessive stage of independence in each day activities

Keywords - smart assistant; visually impaired; navigation; obstacle detection; route recommendation; intelligent sensors; daily activities

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I. INTRODUCTION

At the give up of 2021, an anticipated over 2 billion human beings have close to or distance imaginative and prescient impairment. Vision impairment impacts human beings of every age and poses a vast worldwide economic burden with the yearly worldwide charges of productiveness losses. For low- and middle-income regions, the superiority of distance imaginative and prescient impairment is 4 instances better than Invasion loss is related to low profits, decreased nice of life, affected now no longer most effective at a clinical level, however additionally at reasonably priced and mental tiers [1,2]. The fitness and wellness of a visually impaired man or woman and their own circle of relatives can be advanced by assistive technologies, which additionally convey broader socioeconomic Visually impaired human beings are the second one biggest affected class with nugget entry to assistive

products—greater than two hundred million human beings [3]. Daily struggles of visually impaired human beings are (and now no longer restrained to): loss of cap potential to perceive and interact with the environment, issue in out of doors dependence on others (own circle of relatives/friends) for buying groceries and goods. For a visually impaired person, unassisted touring calls for tiers of navigation: [4] Macro-navigation is the cap potential of the person to recognize their contemporary location, orientation, and to have facts approximately the direction to follow Micro-navigation includes the person's cap potential to perceive possible barriers alongside the direction including pedestrian crossings, constructing walls, obvious doorways or different barriers that could intrude with the person.

The conventional methods of supporting visually impaired human beings in outside navigation are a white cane, a manual canine, and a human assistant. The white cane is reasonably-

priced and provides treasured statistics best approximately boundaries in the front of the consumer [5]. navigation, the consumer needs to realize the path perfectly, in addition to the placement of every crosswalk. A manual canine improves the consumer's navigation abilities and the cap potential to handle greater tough conditions however this answer is high-priced, and it can take some time earlier than the request The 0.33 option, having a human assistant via way of means of the visually impaired person's side, is the nearest you can get to dwelling a regular existence. Answer comes with the best price, and the non-public existence of the human assistant is also new methods of supporting visually impaired human beings, in each indoor and outside navigation, are an instantaneous outcome of the lower in length of digital components. Small, on-invasive gadgets are being prototyped, with various complexities and functionality. Three essential instructions are being followed: (1) the usage of sensors to come across boundaries basically in the front of the consumer [6], (2) the usage of cameras for vision-primarily based totally assistance [7,8], and (3) the usage of however, best few of them cope with each outside and indoor navigation [6,7,9], and their right and entire use stays low.

II. METHODOLOGIES

A device that publications visually impaired human beings in indoor environments, including industrial centers, hospitals, and markets. It calls for high-priced equipment located within the regions of interest, ultra-wideband sensors, a database to keep spatial statistics approximately the places, a server, a Wi-Fi community, and a phone [10]. A deep neural community is used to discover the person's vicinity internally, a huge building. The person turns on the software for the use of a vocal command. The software calls for a lively Internet connection, because it accesses far off resources (cloud). An augmented white cane as a part of a prototype of a micro navigation device that enables the visually impaired to transport in indoor environments. The device identifies the placement of someone and calculates the rate and path of their movements [11]. Using these statistics, the device determines the person's trajectory, locates viable barriers in that direction and gives navigation statistics to the person. The device includes an augmented white cane with infrared lights, infrared cameras, a phone, and a pc jogging software program software, which makes the device. now no longer portable. A software become to assist the blind navigate competently in indoor environments such schools, libraries, and buying malls, primarily

based totally on 4 primary units: navigation, impediment detection, vacation spot detection and voice command modules [12]. The device relies upon pc vision, picture processing and pixel manipulation, which are excessive purchasers of computing resources. Detection of the human skeleton become used to discover human beings and suggest a secure direction for visually impaired pedestrians in [13]. The device includes RFID playing cards, an RFID reader, a lively Internet connection, a monocular camera, and a phone. The person has an RFID reader connected to his ankle; this reader translates tags placed under the sidewalk. The vicinity of the person is observed through combining the statistics dispatched through RFID playing cards and GPS coordinates. The device is examined in laboratory conditions, with easy scenarios. When the device becomes used outdoors, in which the illuminance changes, the accuracy of item detection and secure direction advice becomes reduced. A device that carries a YOLO CNN (You Only Look Once Convolutional Neural Network) to come across, song and recognize, in actual time, static and dynamic boundaries encountered at some point of outside navigation turned into proposed in [14]. YOLO acknowledges cars, bicycles, and pedestrians; however, phone poles, fences, stairs, and trash cans are handiest detected as items. The device calls for a brand-new era smartphone, a pc prepared with a performant video card, a couple of wi-fi headphones and Internet connection. As a drawback, the device does now no longer advises an opportunity path to keep away from recognized boundaries. In [15] a wearable navigation assist device for blind and visually impaired people turned into proposed. The device has 4 ultrasonic sensors positioned at eye level, 3 on a couple of glasses and one sensor on the proper wrist, an Arduino board, and a Beagle Bone Black board. Distances measured using the sensors are the inputs of a common-sense fuzzy device. The device doesn't provide localization or different steerage features. A navigation clever stick primarily based totally on an ultrasonic sensor, smoke gas sensor, Rx/Tx module, Wi-Fi module, GPS module, Buzzer module, and Text-To-Speech synthesis module turned into defined in [16]. The prototype is rudimentarily constructed and is primarily based totally completely at the GPS module for outside navigation. The answer proposed in [6] incorporates sensors to come across items in proximity and works with pre-recorded messages that assist customers keep away from boundaries. When the device detects an obstacle, the consumer is knowledgeable via an audio message. Unfortunately, with pre-recorded messages, the quantity of data transmitted to the consumer is limited. Recommendation of the

quickest and most secure path to reach at a given factor with inside the indoor surroundings is furnished in [17]. The device includes a clever cane with ultrasonic sensors, digital digicam and accelerometer. The path advice relies upon the connection with the cloud service. However, the visually impaired want greater than simply journey aids for each day activities. Interaction with the surroundings, along with medicine signals or shopping, is likewise important. A cell software designed to assist visually impaired customers with their medicine is proposed in [18]. The software has 5 capabilities: attempting to find medicinal data, a medicine adherence useful resource and timer, a map directing customers to drug stores, a medicine records to report man or woman medicine records and developing the consumer's non-public medicinal database. After testing, the capabilities requiring customers to enter data had been proven now no longer to be appropriate for visually impaired people. Moreover, voiceover and voice recognition capabilities had been complexing because of pronunciation and the want for IT skills. Users' ability to apply the software relied on their background, IT skills, and revel in in the use of clever technology. A device designed to help the visually impaired in purchasing sports changed into proposed in [19]. Guidance in purchasing surroundings is primarily based totally on a clever cart, geared up with sensors for detecting boundaries and with an Internet connection. The device gives list creation, data approximately discounts, purchasing history, the route of departures from the store. The consumer needs to create an account in a cellular application, anticipate confirmation, and ensure that the shop has a to be had clever cart. Helping the visually impaired in deciding on and matching garb gadgets is achieved in [20]. Clothes are diagnosed with the usage of NFC (Near Field Communication) technology, and their traits are uploaded onto an internet platform. The platform recommends clothes mixtures and color palettes. An emergency alert alternative in structures designed for the visually impaired is in [21–27]. The essential additives utilized in growing such structures are inertial sensors (gyroscope and accelerometers), GPS, ultrasonic sensors, radar, a standalone digital digicam or smartphone digital digicam, and RFID tags and readers. Usually, those additives are connected to an ordinary cane, as a result reworking it into an augmented cane. When it involves features, the most critical are indoor and outside operation, day and nighttime operation, portability, and emergency alert activation. In addition, path advice and situation tracking are to be had, in some structures: path advice in [13,17,28–30], and situation tracking in [17,27,31]. While video

processing the usage of a digital digicam is frequently hired in structures that provide dependable day navigation, troubles arise in low-mild conditions (night-time). In phrases of resource intake and computational effort, this answer is exceptionally demanding, considering that processing the video flow needs to be completed in nearly actual time. On-chip radar forums may be utilized in severe out of doors conditions, offering accurate place measurements. The downside is the excessive fee of those components, starting from \$300.

III. FIGURES AND TABLES

Requirements for prototype	Quantity	Amount (in INR)
GPS	1	1000
Ultrasonic	1	500
Radar	1	9000
RFID	1	500
Alert	1	500
Phone	1	-
Portable	1	-
Walking stick	1	500

Table 1. Summary of components and features of representative electronic travel assistants for visually impaired persons.

When it comes to pricing, not all papers in Table 1. provide the cost of the proposed system. Based on [30], the minimum price for a cane equipped with sensors is \$200, while a complete assistive system can cost as much as \$6000.

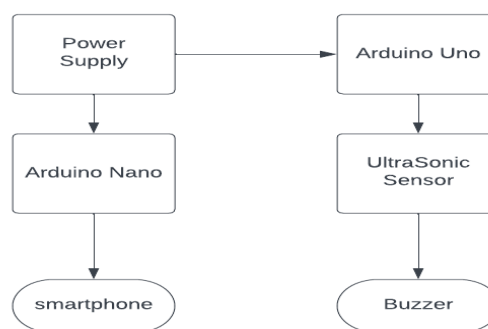


Figure 1. Block diagram of the smart assistant

IV. COMPASS MODULE HMC5883L

The HMC5883L is a triple-axis magnetometer compass module that communicates via the I2C interface. The compass module contains an integrated 12-bit analog-to-digital converter and can be supplied with either 3.3 V or 5 V, for use with 3 V or 5 V microcontrollers. The accuracy of

the module is 1–2 degrees [38]. The magnetic field value on each of the three axes (X, Y, Z) is stored into an internal 16-bit memory. Data read by the HMC5883L is converted, to obtain the difference between the angle defined by the user orientation and the north–south poles direction. Since the north geographic pole and the north magnetic pole are not the same, the angle for direction used by the smart electronic assistant needs to be calibrated, using the magnetic declination:

$$a = \arctg(Hy/Hx) + \text{declination},$$

$$\text{If } a > 2 \times \pi \text{ then } a = a - 2 \times \pi$$

$$\text{If } a < 0 \text{ then } a = a + 2 \times \pi$$

(1) where H_y and H_x represent the magnetic field values on the X and Y axes and a = angle.

To identify the user orientation, only X and Y axes were used, as seen above. Then, the angle is converted to degrees.

The HMC5883L module was used in [39] to build a cane for the blind, and in [40] to implement a substitute vision system, that uses visible light communication and geomagnetism.

V. CONCLUSION

From the study review we built the smart assistant for PWDS where it will assist the people in shopping and the device has its own GPS to track so risk of finding people will be low. The Stick will carry with people, and it will act as the external eye for the people with disabilities.

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