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Research Article

Next Generation of Indoor Navigation Systems for the Blind

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Abstract

Recently, most industries have become dependent on technological development in the world, especially the industrial and medical fields. Technological developments in smart homes, life-saving hospitals and nursing homes allow people to stay at home in a comfortable, safe, and independent way wherever they want without anyone's help. Most blinding people navigate within the house with help only from other people. One of the reasons is there isn't enough information about the house available to them. Parts of this work were realized within a new prototype of a house navigation and object identification system for the blind, our working on a project that helps the patient to detect obstacles, and identify the time and control by voice commands for TV and radio, air conditioner operation, know the humidity and temperature inside the room and outside the house as well as alerting the patient at times of taking medication or appointments with the doctor. A thorough user requirements analysis of this project has been carried out with blind users. Oneof the goals is that a project should be developed, which helps blind people navigating themselves in public buildingsindependently.

Keywords: Indoor Navigation Systems for the Blind; Impaired Vision; Blind Users

Introduction

Blind people want to know where they are and where they can go to. They want to be aware of the things in their environment and the obstacles. Any object and any object feature may be of importance. Along the way to a specific destination, blind people want more accurate information about appropriate routes, hazards, distances and critical situations to consider. Indoor navigation is important for some applications. Since vision losing them can dramatically reduce individual direction, and individual mobility without hindrance or damage, especially in unfamiliar and complex interior environments. One of the most important basics in the navigation environment for the blind is adequate information about the path of movement,as well as the identification of objects by the following path of movement. Voice acknowledgment is the way toward accepting verbally expressed word as a contribution to the program. The machine can It is the capacity of the machine to get and decipher correspondence or to comprehend and do spoken directions. Exchanging data or directions through voice is a characteristic procedure and Research in Speech Recognition or Voice Recognition is effectively under process. These points must get It is necessary that these points get a wide area of the interest of researchers and their research and work and a view of a better future for all people. Towards that end, the paper proposes a model that can be helped visually impaired people to navigate in the house. The aim of the Blind-Aid project is to develop navigation services for the blind to assist navigation for the visually impaired or for

the blind. The World Health Organization (2010) reported that 285 million people suffer from vision impairment all over the world, of whom 246 have vision impairment and 39 million are blind [1]. According to data from the 2004 National Health Survey, 61million Americans are at risk of severely impaired and losing sight with age, or having vision problems. low vision,and excellence. are over 65 years of age and are aging [2]. The main difficulties in navigating and knowing the internal direction is: the loss of known landmarks, finding locations of obstacles with consideration that they can be risky, and not every blind person can read Braille signs, In terms of price, current inland navigation systems is not compatible with the living income of people with visual disabilities. Even with help such as a guide dog or other animals, it isstill difficult for the visually impaired to navigate independently in such unfamiliar, open and general environments that are unknown shadows and obstacles without the help of sighted individuals. The inability to move freely and independently can hinder the full integration of the individual into society or its integration into the production system of society [3]. There are many studies that enable the visually impaired, and the blind to move and move around indoors [4-14]. One of the main disadvantages of the existing navigation systems for the blind is the high price of the part of the devices, which in most cases does not correspond to the income of the blind. The main objectives of the project is local production and cost reduction, and help makes life simple and easy without relying on others, and raise self-confidenceand integrate the blind in society.

Methodology

One of the most important goals of this project are to design a smart navigation system for the blind, and the system consists of a hat and a small and light bag attached that is easy to move around and which can be more interactive and integrate with the user by means of voice commands, so that its most important goals were to be manufactured locally It is studied, tested and are used in medical care, homes and elderly care. We hope that the project will be the first and not the last in this research and that the design of our system will be widely used all over theworld. The greatest interest in reducing the price so that people with disabilities and limited income can benefit fromit. The aim will be to design a reliable internal mobility system by completing the following objectives:

- To manufacture the system prototype, its development, and experience, and to study the system's effectiveness.
- Study the efficiency of the system in terms of discovering obstacles and job performance.
- Analyzing and implementing the efficiency and accuracy of voice commands.
- Analysis of response speed, and detection of obstacles.
- To analyze all system products and components and study the materials available in the local market.
- Defining and supporting the overall quality of the system.

Related work

Researchers at the National Institute of Standards and Technology (NIST) said inland navigation for first responders or firefighters using the RFID system. Each RFID tag is attached to a site in a building. Any internal use and works on the idea of identifying reference points. The RFID reader is connected to the firefighter and inertial sensor system when the firefighter moves, the sensor approximates the movement. The firefighter location is set by self-calibration when it passes through the site pointreference which is the location of the RFID tags. The researchers found from this research study of this navigation system that it is possible to identify obstacles and give an alert to home users with a site error ranging between 8% and 13% of the distance between waypoints. An RFID-based navigation system for an easy-to-use disability guidance system is suggested. The system uses several techniques for guidance and location including GPS The receiver connected to the Pocket PC for location information, RFID reader for information from embedded RFID Tracks, an infrared sensor for travel direction. The enhanced prototype replaces the Pocket PC device with a GPS enabled mobile phone. The system was tested with 46 people including visually impaired, visually impaired, hearing impaired, wheelchair users, physically impaired and older. Our proposed system is similar to the one proposed. Except that our system is for indoor. In addition, our proposed system adds a bat-like guidance system that is used to help users navigate to a destination using the obstacle-free route. The problem of navigation assistance in academia, primarily from the point of view of human- computer interactions, and in industry, has been addressed by proposing some commercially viable systems that use recent advances in mobile device technology and sensors. In particular for outdoor navigation, the availability of GPS- compatible mobile phones and PDAs

has led to the emergence of a number of software products, some of which have accessibility features making them suitable for blind and visually impaired users as mentioned. The infrared- based Talking Sign has been extensively tested and proved useful, especially for crossing intersections. This system uses directional infrared transmitters installed in the environment, a handheld receiver with a speaker.

Proposed Method

A navigation system is required to navigate and assist the blind, and the system is designed to be light and easy to navigate in a small bag. All this is done by voice commands of the patient and also knows the time, heat and humidity inside the room and outside the home and the operation of the air conditioner, TV and radio. The system consists of a controller with the Arduino Uno system to control the system using Easy Vr 2.0 used to activate voice commands and arduino uno connects with easyvr shield 2.0, hc- sr04 ultrasonic sensor, wireless relay, esp8266 serial wi-fi module, ds3231 real time clock module, voltage source, micro SD card reader module for arduino, a speaker. Figure 1 below illustrates the proposed graph method.

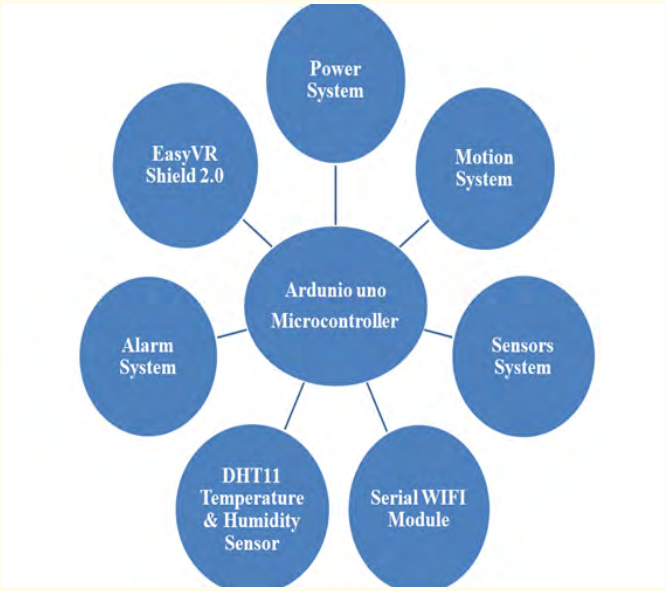

Figure 1: Block Diagram Proposed Method.

Hardware

Arduino uno, easyvr shield 2.0, hc-sr04 ultrasonic sensor, wireless relay, esp8266 serial wifi module,ds3231 real time clock module, voltage source, micro sd card reader module for arduino, speaker, jumper cable.

Ardunio microcontroller

Arduino Uno R3 is a microcontroller board based on a removable dual microcontroller (DIP) ATmega328 AVR. Containing 20 digital input/output pins divided into 6 can be used as PWM outputs and 6 can be used as analog input. Software can be downloaded from an easy-to-use Arduino PC software via the IDE (Integrated Development Environment) port via USB Type-B cable. Arduino has a broad support community, making it a very easy way to start working with embedded electronic devices.

Figure 2: Arduino Uno Microcontroller Board.

EasyVR shield 2.0

Shield 2.0 Standalone (SI) commands with a custom speaker 28. Supports 32 operators or commands based on speaker and user-dependent speaker based on frequencies and different, which helps to use the voice fingerprint for protection. This piece was one of the most important pieces in the project. Figures 3 below shows the EasyVR Shield2.0.

HC-SR04 ultrasonic sensor

The ultrasonic sensor uses the HC-SR04 sonar to determine the distance to an object like a bat. It provides excellent detection of high-precision offline range and consistent readings in an easy-to-use package. Comes complete with ultrasonic transceiver modules.

Are transducers that convert ultrasound waves into electrical signals or vice versa. Figures 4 below shows the HC-SR04 Ultrasonic Sensor.

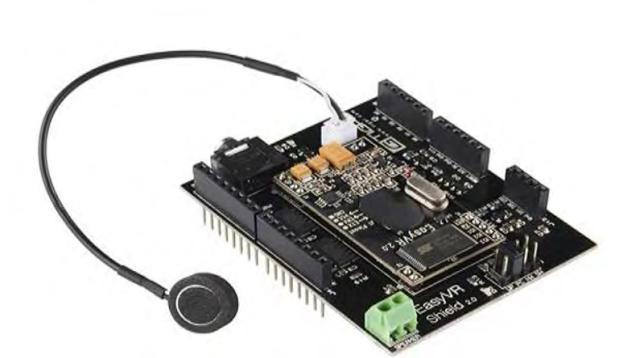

Figure 3: EasyVR Shield 2.0.

Figure 4: HC-SR04 Ultrasonic Sensor.

DHT11 temperature and humidity sensor

The DHT11 humidity and temperature sensor makes it very easy to add humidity and temperature data to the project. It helps in home environment control systems, farm or garden monitoring systems. Table 1 below shows the DHT11 Datasheet.

This sensor enables us to know the temperature and humidity. Figure 5 below show the DHT11 temperature and relative humidity sensor.

Humidity range	-90% RH
Humidity accuracy	± 5% RH
Temperature range	0-50 ° C
Temperature accuracy	± 2% Celsius
Operating voltage	3V to 5.5V

Table 1: DHT11 Datasheet.

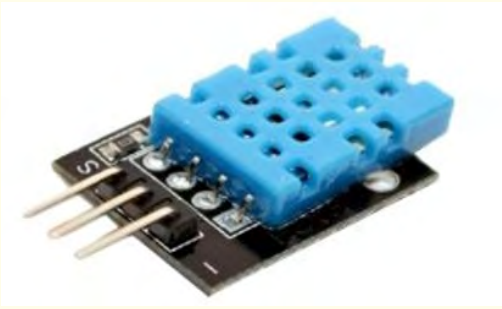

Figure 5: DHT11 Temperature and Relative Humidity Sensor Modul.

ESP8266 serial WIFI module

The ESP8266 is perhaps the most versatile serial unit for delivering "things" on the Internet, which is why it is so popular in the world of IoT. It is a complete unit, including amicroprocessor that can be programmed directly through the Arduino IDE (C), or into other build environments (usually using the same high-level language, "LUA"). Increased service capabilities in projects, especially in this project due to their need for table 1: Coordinated Freedom of Movement and Non-Compliance with Cable and Wire. Figures 6 below show the ESP8266 WIFI Serial Module.

DS3231 real time clock module

The I2C is a time-saving device. The most important thing in the RTC unit is that it works on the battery and can save and know the time even if we reprogram the Microcontroller or disconnect the electrical current to keep the battery internal current. The project can be blindsided to tell time. Figure 7 below shows the DS3231 real time clock module.

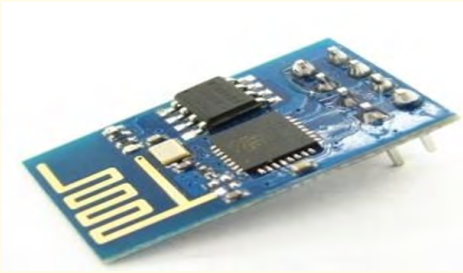

Figure 6: ESP8266 Serial WIFI Module.

Figure 7: DS3231 Real Time Clock Module.

Micro SD card for arduino

The SD card module enables this widget to transfers standard SD data. This enables us to add a large storage space, save data for the project, and add some interactive sentences with the patient. Figures 8 below show the Arduino Micro SD Card.

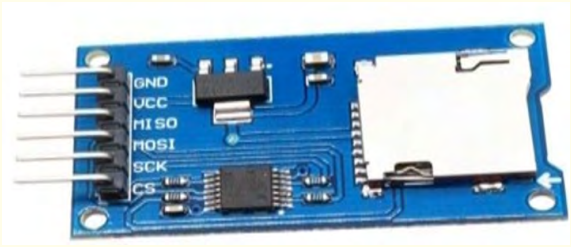

Figure 8: Micro SD Card for Arduino.

Wireless relay

Relay monitoring is an essential part of any automationsystem and evolution of the IoT and AI. With them, you caneasily turn on and off any electrical device in your home, such as lights. In this project, the first part is devoted to how to read data wirelessly from a temperature and humidity sensor. The second part was opening and closing the TV, radio and air conditioner. Figure 9 below shows the wireless relay.

Figure 9: Micro SD Card for Arduino.

Results in Voice Recognition

Test the system and its efficiency in responding to voice commands by calculating the arithmetic means for repeated test times with different people and ages, and almost knowing how efficiently the system responds to voices commands. Blindly says that are having an gives him hope and the ability to continue and optimize in a technological development (Figure 10). Demonstrates the response to the command with taking samples for volunteers of all ages. andgenders. The result was more than good for voice commands, which accounted for 96% of a response andexcellence.

Advantages of next generation of Indoor

Navigation systems for the blind

- Dramatically reduces physical barriers.
- It increases the independence of the person in his movements and in various fields.
- Increase the self-confidence of people with special needs.

- The system is an excellent way to improve mobility.
- Helps and supports the user in practice.

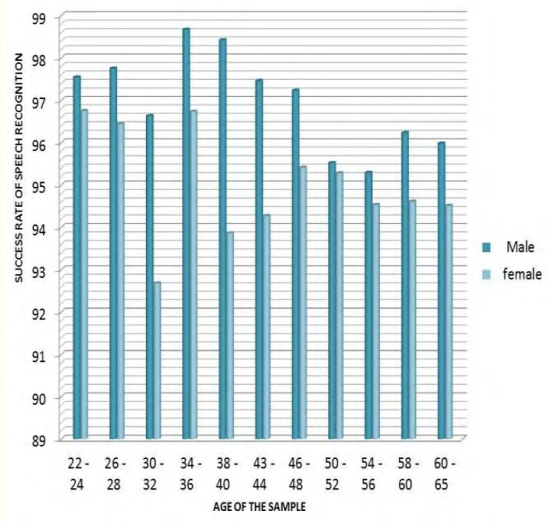

Figure 10: Responding to voice commands for different ages and genders.

Disadvantages of next generation of indoor

Navigation systems for the blind

- The need for a mobile bag.
- Connecting the system to closed places reduces the capabilities of the system.
- Follow-up and periodic inspection.
- Mainly relying on technology.
- The costs are too high to find all those in need.

Project snapshots

System shots designed with circuits and parts used, boards, and the electronic equipment, and an idea and a method for their connection. Volunteer blind show us the possibility of navigating and uncovering obstacles and how the system works and how it is compatible with reality. Figure 11 below shows the moving blind volunteer and project snapshot.

Figure 11: Moving blind volunteer and project snapshot.

Discussion and Future Work

The problem is blind people do not like the question, more than inquiring and feeling the need and feeling harassed by the others despite their need for help and advice. Anyone who accompanies a blind person knows that it is not asimple task just to provide appropriate information and mobility advice for the blind is a great responsibility because it completely depends on the validity of the information provided to him and draws a mental map withit. In general, we look forward to working to support automatic navigation by providing virtual navigation areas and the integration of artificial intelligence and optical fiber connections. Advances in computer science, artificial intelligence, and increased ability to manipulate data in roaming and travel assistance for the blind can be used. These mobility simulations can be used to improve the programmatic work environment, work on effective processing, and know the extent of the insight's need for information and what it is. We will also take into account that blind people want to include their comments to specific sites and create their own transport areas, which increases their morale and integrates them into society as well as the production process.

Conclusion

During the development phase, It has become evidently an excellent and easy way to develop a small, durable, easy, and cheap

navigation device for the blind. This will speed up functionality and allow the system to give, advice to the blind very quickly, as in the real-time system. Using the proposed approach would achieve the quality of Intelligence behavior to recognize the scene including objects. The speech and audio interface provides input, instructions, and alerts to the user in real-time using Easy VR 2.0 and SD Card on Android. Field tests involving the blind show that the proposed prototype implements navigation within the context, is effective and responsive, supports the patientmorally, and helps them feel independent. The device needs to be developed and acquires the skills to have a portion of the perceived power of human perception, logical analysis, and immediate response. However, we believe that through the new prototype achieved good and acceptable performance and benefit in identifying areas of movement and setting barrier alerts, we continue to work on our goal ofsafe and independent guidance and guidance for the blind even in open environments, and the possibility of their integration into society and acceptance.

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