Smart Stick For Differently Abled

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Abstract— Recently there has been a lot of Electronic Travel Aids (ETA) designed and devised to navigate independently and safely. It is well known that the disabled people carry a hand stick with them whenever they need a support. Sometimes even when they use this stick, there is no guarantee that they are safe and secured in reaching their destinations. There may be an obstacle in their path but is not encountered by the person with the help of the stick. Thus, the people may be injured if the obstacle is big enough or dangerous. Thus, a design has been developed to assist the blind and provide them a clear path. In most instances, people who are deaf and dumb find themselves working with colleagues, where they are unable to be a part of communication going on around them This paper put forwards the design of smart stick using microcontroller This Stick helps speech-impaired people to convey important messages. People with physical disabilities that affect movement can use mobility aids, such as wheelchairs, scooters, walkers, canes, crutches, prosthetic devices, and orthotic devices, to enhance their mobility. The project is based on a theoretical model and a system concept to provide a smart electronic aid for disabled people. This smart stick will perform the main task of identifying the obstacles in the part of the blind person. In addition to this a communication system is installed in which the stick is used to convey important messages. The stick utilizes the RF Module for turning on/off devices from a distant place. This paper put forwards the design of smart stick using microcontroller. Paper presents the design and implementation of obstacle avoidance module and wireless home appliances control module via smart stick. The system so devised is a low cost system and is highly scalable with less modification.

Keywords— Smart Stick; Differently Abled; RF Module

I. INTRODUCTION

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 285 billion people in world with visual impairment. 39 billion of which are blind and 246 with low vision. The traditional and oldest mobility aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs.

The most important drawbacks of these aids are necessary skills and training phase, range of motion and very little information conveyed. With the rapid advances of modern technology, both in hardware and software front has brought potential to provide intelligent navigation. The paper to create a stick which assist the physically impaired persons without the human need. However in comparison to other technologies many blind guidance systems use ultrasound because of its immunity to the environmental noise.

Another reason why ultrasonic is popular is that the technology is relatively inexpensive, and also ultrasound emitters and detectors are small enough to be carried without the need for complex circuitry. Apart from the conventional navigation systems, a blind aid systems can be provided a new dimension of Real-time assistance along with dedicated obstacle detection circuitry. This different units are discussed to implement the design of a 'Smart stick' .This Stick helps speech-impaired people to convey important messages. Stick consists of voice recorder and playback with two speakers. Recorded messages are played using buttons present on the voice module. Important Messages such as 'I need Water', 'I need food' can be conveyed. Also we can record any type of message on the device and speech-impaired person can play this to convey the recorded message at any time.

Thus this stick is convenient tool for not only blind persons but also all kind of physically impaired people. People with physical disabilities that affect movement can use mobility aids, such as wheelchairs, scooters, walkers, canes, crutches, prosthetic devices, and orthotic devices, to enhance their mobility. Smart Stick has two parts: Obstacle Avoidance Module and Wireless Home Appliances Control Module. The paper aims to discuss the implementation of both the modules. The paper aims to create a theoretical model and a system concept to provide a smart electronic aid for physically impaired people. The main objective of this paper is to discuss a way of using different technologies to design a smart stick for physically impaired people.

II. OBSTACLE AVOIDANCE MODULE

The important component of this module are as follows and discussed below in detail:-

- Microcontroller AT89S52
- Ultrasonic sensor HC-SR04
- ISD1820 voice module
- Liquid crystal display 16x2

This Smart Stick consists of an ultrasonic sensor, which will perform the main task of identifying the obstacles in the part of the blind person and the range of the smart sensor could be till 4 meters, so this sensor will detect the obstacle from a distance of 4 meters or lesser and a motor and buzzer will be placed in the stick that will start moving causing a vibration in the stick and also alarm in the buzzer, so in this way the blind person could know about the obstacle that might come in way and thus the obstacle could be avoided using this smart ultrasonic module. Microcontroller AT89S52 controls all the devices connected to it. Components Ultrasonic sensor, Buzzer, Motor, LCD, ISD1820 Voice Module and Power Supply are connected to it. Power supply includes a voltage

regulator which regulates the voltage to 5V. This 5V power supply is given to microcontroller as well as driver circuit (which connects to the motor).
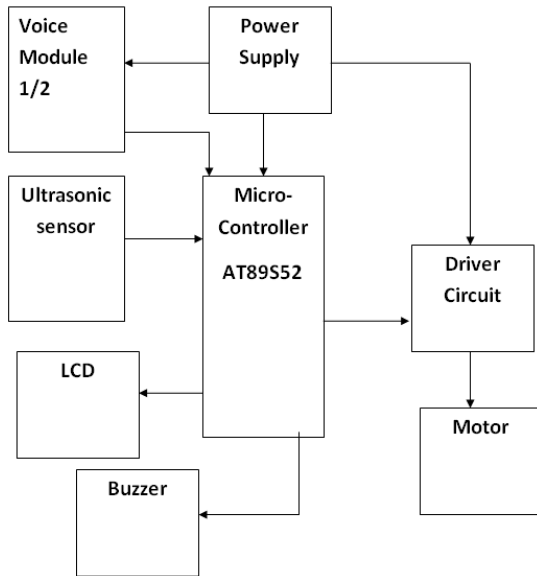

Fig. 1. Obstacle Avoidance Module

Most microprocessors operate at low voltages and require a small amount of current to operate while the motors require a relatively higher voltages and current. Thus current cannot be supplied to the motors from the microprocessor. This is the primary need for the motor driver IC. Another reason to use driver circuit is to protect the microcontroller from back emf produced by the motor. This emf can damage whole system. When supply is given to microcontroller, Ultrasonic sensor will detect the obstacle in its path through transmitter-receiver pair and the distance will be displayed through LCD. If the distance will be less or equal to the set range, buzzer as well as vibrator will start working, so in this way the blind person could know about the obstacle that might come in way and thus the obstacle could be avoided using this smart ultrasonic module. .Also there are two buttons on stick. Stick has speakers, when the person will press these buttons, it will convey messages pre-recorded in it. Thus, in this way dumb person can convey his message to another person.

A. Microcontroller

The microcontroller used in obstacle avoidance module can be preferably a MCU AT89S52. It is a 8- bit micro controller having 40 pins. In which 2 pins are used for Vcc,2 pins for ground,2 pins for crystal oscillator,1 pin for reset and all other pins are used as i/o pins. This micro controller is having 4 ports. Four ports perform different functions. The first one is to perform input/output operations and the second one is used to implement special features of the microcontroller like counting external pulses, interrupting the execution of the program according to external events, performing serial data transfer or connecting the chip to a computer to update the software. Each port has 8 pins, and will be treated from the software point of view as an 8-bit variable called 'register', each bit being connected to a

different Input/output pin. There are two different memory types: RAM and EEPROM. Shortly, RAM is used to store variable during program execution, while the EEPROM memory is used to store the program itself, that's why it is often referred to as the 'program memory'. It is clear that the CPU (Central Processing Unit) is the heart of the micro controllers. It is the CPU that will Read the program from the FLASH memory and execute it by interacting with the different peripherals

B. Ultrasonic sensor

It consists of a transmitter and receiver pair on the device. There are two different transducers for transmitter and receiver. The transmitter transmits and the receiver waits for the reflected signals. The following figure illustrates the transmitter/receiver pair.
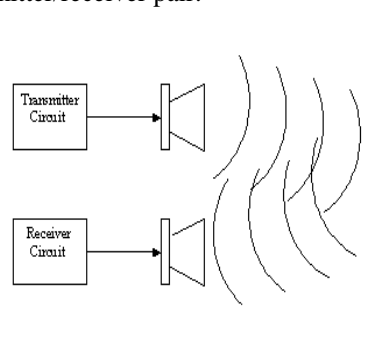

Fig. 2. Ultrasonic Sensor

It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound, distance can be calculated. The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Microcontroller respectively and the trig and echo pins to any pin on the Microcontroller.). An Ultrasonic Ranging System is a unit that detects the presence of an object and calculates the distance to that object. This is accomplished by transmitting an ultrasonic (high frequency) sound. This sound is above the range of normal human hearing. Sound travels at a known speed and when the sound strikes an object it are reflected back to the source. This reflected sound is called the "echo." All that is required to calculate the distance to an object is to measure the time between the transmitting of the sound and the return echo. Sound travels at the rate of 1' every 0.0009 s. The Ultrasonic Ranging System (URS) developed by Polaroid to automatically focus cameras is ideally suited to such applications.

C. ISD1820 voice module

ISD1820 Voice Module is a low cost, high performance sound record/replay IC, incorporating flash analogue storage technique. The device offers true single chip voice recording and play back capability for 40 to 60 seconds. The replayed sound exhibits high quality with the low noise level. Sample rates are user selectable which allows the designers to

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customize their design for unique quality and storage time needs. There are 3 keys on the board: REC, PLAYE and PLAYL to control various functions.

III. WIRELESS HOME APPLIANCES CONTROLLING MODULE

The various components included in this module include the following:-

- Microcontroller AT89S52
- Step down transformer
- Relay
- Receiver
- Remote control
- 4N35 opto-coupler

People with physical disabilities that affect movement can use mobility aids, such as wheelchairs, scooters, walkers, canes, crutches, prosthetic devices, and orthotic devices, to enhance their mobility. The project is based on a theoretical model and a system concept to provide a smart electronic aid for physically impaired people. This circuit utilizes the RF Module for turning on/off devices from a distant place. This feature is specially designed for physically impaired persons who are not fit to do much physical work. Stick has a unique feature through which any physically impaired person can use devices through RF signaling. Another microcontroller is used for this. Remote control is used which works with a battery. Microcontroller is connected to relay system. This has an extension circuit and bulb holder connected to it. 4N35 is an optocoupler integrated circuit in which an infrared emitter diode drives a phototransistor. They are also known as optoisolators since they separate two circuits optically.
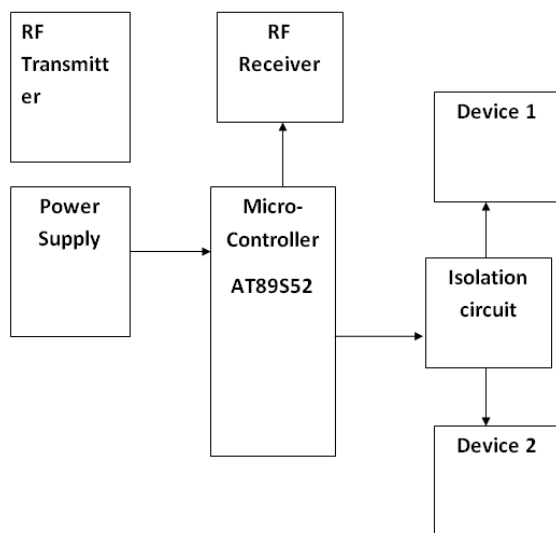

Fig. 3. Wireless Home Appliances Control Module

These are used to couple two circuits without any ohmic contact. They allow one of the circuits to switch another one while they are completely separate. The first circuit is connected to IR diode while the other circuit with the phototransistor. The isolation ensures that no damage occurs

in either of the circuits while the other one has a fault. An optocoupler is analogous to a relay which isolates two circuits magnetically. They differ with relays in the sense that they are smaller in size and allow fast operation. 4N35**s** are commonly used in interfacing an electronic circuit with the parallel port of a computer. Remote control has four buttons which transmit RF frequency and accordingly this frequency is received by the receiver connected with microcontroller. This frequency is used to turn on and turn off the corresponding devices i.e. Bulb as well as devices on extension. Thus, this way a physically impaired or person with disability while walking can easily switch on the devices while sitting. This stick is much convenient and cheaper with all these amazing features.

A. RF module

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

B. Isolation circuit

4N35 is an optocoupler integrated circuit in which an infrared emitter diode drives a phototransistor. They are also known as optoisolators since they separate two circuits optically. These are used to couple two circuits without any ohmic contact. They allow one of the circuits to switch another one while they are completely separate. The first circuit is connected to IR diode while the other circuit with the phototransistor. The isolation ensures that no damage occurs in either of the circuits while the other one has a fault.

IV. CONCLUSION AND FUTURE SCOPE

A. Conclusion

Advances in electronic technology, coupled with economical (low) prices, make monitoring cost- effective and a powerful tool in measurement of parameter. The reliability, sensitivity and accuracy of the instrument are considerably enhanced by the use of AT89C51 micro controller for controlling various functions. Ultrasonic sensor has been used for the displacement of the distance of the object comes in front of it. To provide safety in system the ultrasonic sensors are used which help in giving the accurate result of the distance. The system is capable of measuring distance with the help of the transmitter section, receiver section and which are interfaced with the microcontroller. These products are used in all industries measuring the distance to or size of material objects. That covers a lot of territory, and almost any size and type of object can be measured. The complete implementation

and testing of the system has been done. Finally it is concluded that the aesthetically and ergonomically designed is versatile and user-friendly intelligent system for distance measurement, which can be used in the field of robotics for finding out the obstacle and the circuit designed is highly accurate and the product is easy to operate. The paper proposed the design and architecture, of a new concept of Smart Electronic Travel Stick for disabled people. The advantage of the system lies in the fact that it can prove to be very low cost solution to millions of disabled person worldwide. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure.

B. Future Scope

Although ultrasonic range sensor for the measurement of the distance of the obstacle that comes in its path has been developed in this thesis work, but some more features can be added to increase its utility. The system can be enhanced by making some modification. It can be used to provide the robot with more intelligence and advanced sensor system in order to deal with various situations like losing its master and avoiding collision with an obstacle. This will be implemented by providing a motor which make turn towards the strongest signal which comes from its master. A GSM and a GPS modem could be included in order to detect the actual location of the person and the same could be used to track the person. A vibration sensor could be used to identify for any vibrations if the person falls or meets accident and the location of the individual could be sent using the GSM module. One suitable approach is to use multiple range sensors. This can be useful to overcome the inaccuracies observed in the range measurements due to limitations in the sensor specifications. More no. of sensors providing the capability of individual range measurement results from any of the sensors, at any time. Flexibility was also achieved in terms of enabling the future addition of more sensors, of similar or different types. Ultrasonic range system has lack of positional information. This is well known to be a major problem of which much work has been focused. Dead reckoning using the encoders will be used to avoid such problem. Landmark recognition may be a good resolution for such problem.

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