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Blinds E-World

Dr. Sheifali Gupta
Professor, Chitkara University, Punjab, India
Savjot Singh
Final Year Student, Chitkara University, Punjab, India
Sonakshi Rana
Final Year Student, Chitkara University, Punjab, India
Sonam
Final Year Student, Chitkara University, Punjab, India
Shaveta Kashyap
Final Year Student, Chitkara University, Punjab, India

Abstract:
Living in 21st century we boast about our independence and moving towards living a technical life. Our whole living standard is today looked upon by the pricey gadgets we use and how tech-friendly we are. But living this life we are somewhere forgetting the blind people. It is very important to think about these special people also. Currently, the most widespread and used means by the visually impaired people are the white stick and the guide dog; however both presents some limitations. With the recent advances in inclusive technology it is possible to extend the support given to people with visual impairment during their mobility. In this context we propose a system, named Blinds E-World, whose global objective is to give blind users the ability to move around in unfamiliar environments, whether indoor or outdoor. In this paper we propose the development of different electronic module that helps moving around, in both indoor and outdoor environments. So we introduce this project to help the blinds to live an independent life. We provide them with facility to communicate, travel in their home, detect obstacles and use GSM technology also. Hence, this project provides them with technologies to live an independent life.

Key words*: Microcontrollers, ultrasonic sensor, GSM, accelerometer, RF transmitter and receiver.*

1. Introduction

Blind's E-World is a project that enables the blind to communicate, travel, and enjoy the advancements of the technology.
To prevent them from colliding into any obstacle, we use two sensors: Ultrasonic sensor and IR reflectors. Ultrasonic waist belt [1] incorporates an ultrasonic sensor and helps to detect any obstacle in front of it. It sends ultrasound signals (20 kHz-200MHz) which is outside the audible hearing range. If any obstacle is in front of it, the sound wave gets reflected back and indicates through the buzzer. As the object approaches the sensor the beep frequency increases.
The IR sensors [2] have also been studied from quite a previous time. The IR reflectors use a pair of transmitter and receiver. An IR LED transmits the IR signal which is not visible to human eye. It collides with the obstacle and falls on the receiver indicating that something is present in front of it. Presence of the object is indicated by a buzzer.
For the communication purpose the project provides a keypad to the blind. Each key associated with it has a certain requirement which the blind requires. The communication is done with radio frequency. RF modules are used to enable the communication process. At the transmitting end key pad is installed and at the receiving end a LCD is provided. If the first key is pressed then at the receiver water (say) is displayed indicating to the care taker that the person needs water and also a buzzer is also used so that an audible signal is also there. Similarly every key holds a separate requirement of the blind.
In case of emergency a GSM module is used.GSM stands for Global System for Mobile Communications. It is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. The modem we are using is SIMCOM SIM300. It is a Tri-band GSM/GPRS Modem as it can detect and operate at three frequencies (EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz). Default operating frequencies are EGSM 900MHz and DCS 1800MHz.This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and

develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack. It is connected via a switch. Switch will act as an emergency switch and it will send emergency message to the saved contacts (using AT&T commands) [4]
Mobility is one of the most significant factors for blinds. Hence to solve this problem we came up with a module which has accelerometer embedded on it. An accelerometer is a device that measures proper acceleration. The proper acceleration measured by an accelerometer is not necessarily the coordinate acceleration (rate of change of velocity). Instead, the accelerometer sees the acceleration associated with the phenomenon of weight experienced by any test mass at rest in the frame of reference of the accelerometer device.

2. Solution Proposed

The main aim of this project is to design all the requirements of a blind person which are necessary for survival. We have designed different modules to enable him to live a normal independent life in today's world with the help of electronic gadgets.
The different modules include:
Ultrasonic waist belt & spectacles with IR reflectors
Walking aid using Accelerometer
Emergency communication using GSM
Communication through RF for communicating with a person at other room

3. System Architecture

3.1. Hardware Design

3.1.1. Ultrasonic Waist Belt And Spectacles

This module is of ultrasonic waist belt and IR spectacles. Here we have designed a waist belt with ultrasonic detectors to detect the obstacles and intimate the person using a buzzer. The beep frequency of the buzzer increases as the obstacle approaches it. Similarly we designed spectacles on the same controller using IR Reflectors. IR reflectors also detect the obstacle and intimate the person using the buzzer. (Fig.1)

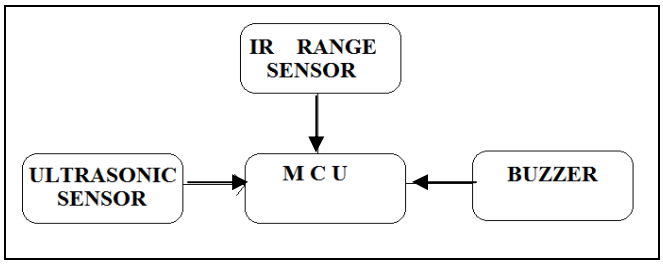


Figure 1: Block Diagram of Ultrasonic Waist Belt and Spectacles

3.1.2. Walking Aid Using Accelerometer

This module is designed to make the accelerometer to count steps. We provide the person with different buttons which correspond to the route of that room where he wants to go in a predefined path. (Fig.2)

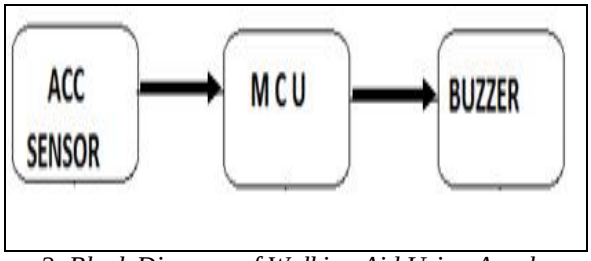


Figure 2: Block Diagram of Walking Aid Using Accelerometer

3.1.3. RF Communication

In this module the person is provided with the provision to communicate with his care taker. He is given a set of buttons which transmit the information on RF channel n display what he needs on the receiver LCD. (Fig.3)

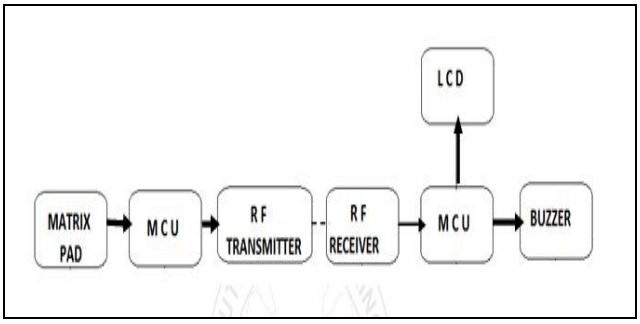


Figure 3: Block diagram of RF communication

3.1.4. One Touch Dialing

This module makes the use of GSM technology to help the blind person in case of any emergency situation. Through GSM a help message will be delivered to the care taker on his cell phone. (Fig.4)

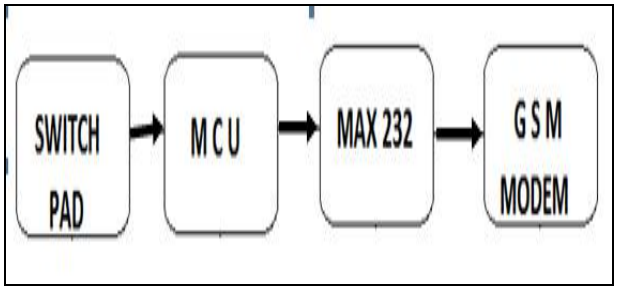


Figure 4: Block Diagram of One Touch Dialing

In this way all the modules come together to make blind person survive in today's world and act as his aids to live freely in his world.

3.2. Software Design

3.2.1. Communication through GSM

In GSM if we press the switch then message is sent otherwise it remains idle. Algorithm is shown in Fig.5.

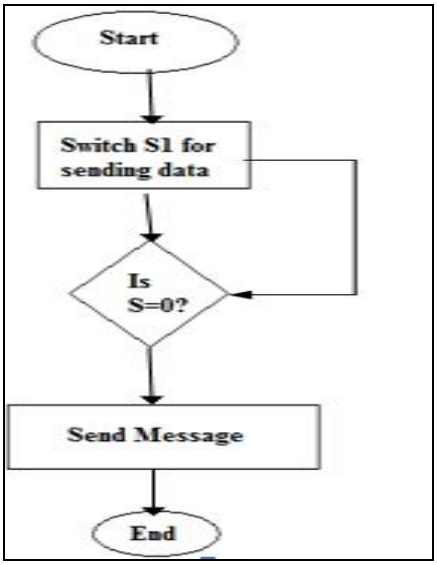


Figure 5: Algorithm of Communication through GSM

3.2.2. Ultrasonic Waist Belt and Spectacles

First ultrasonic measures distance d then this d is evaluated. If d>50 then no buzzer will beep. If d<50the buzzer will beep. As the distance d reduces the beep frequency increases. The beep frequency is increased by decreasing the delay between buzzer on and off. Also if IR=0 the buzzer will be off and if its value is 1 then buzzer will beep. Algorithm is shown in Fig.6.

3.2.3. RF Transmitter and Receiver

- RF Transmitter
  Baud rate is set at 9600bps.Depending on the status of switches different instructions will be executed. Algorithm is shown in Fig.7.
- RF Receiver
  LCD is initialized and "BLIND AID" will be displayed on LCD. If the receive interrupt RI is 1 then the value of SBUF will be put in a variable 'in'. Status of RI will be 0.Depending on the value of in different commands will be printed on the LCD. Algorithm is shown in Fig.8.

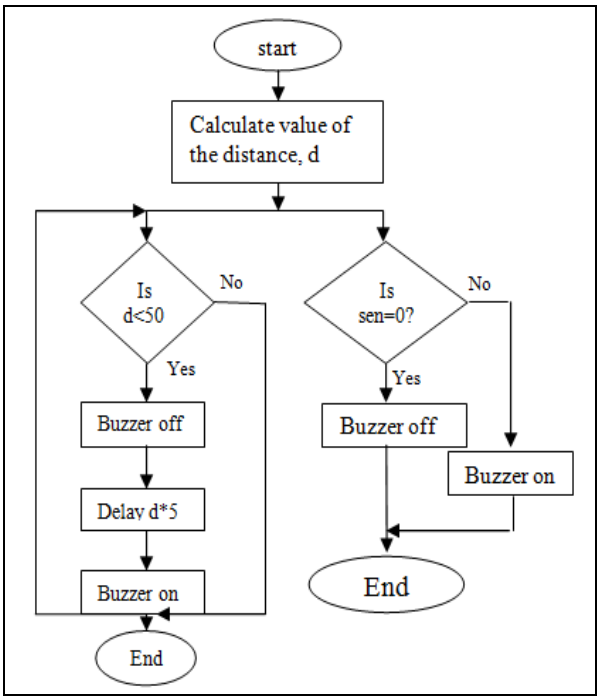


Figure 6: Algorithm of Ultrasonic and IR Sensor

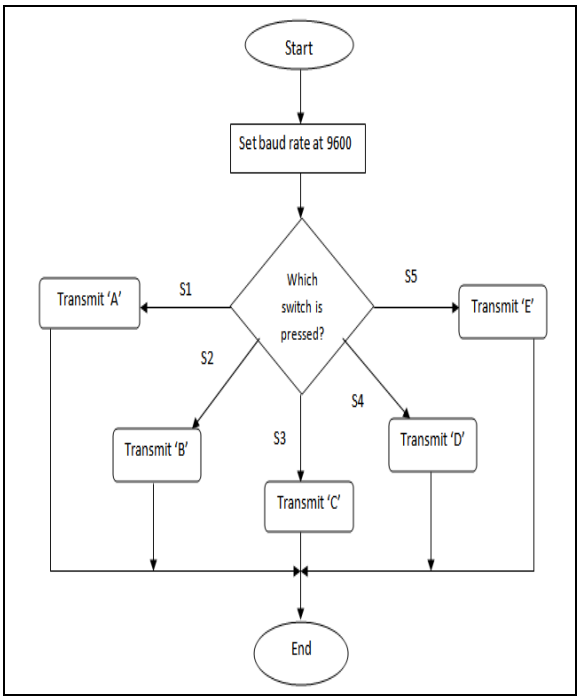


Figure 7: Algorithm of RF Transmitter

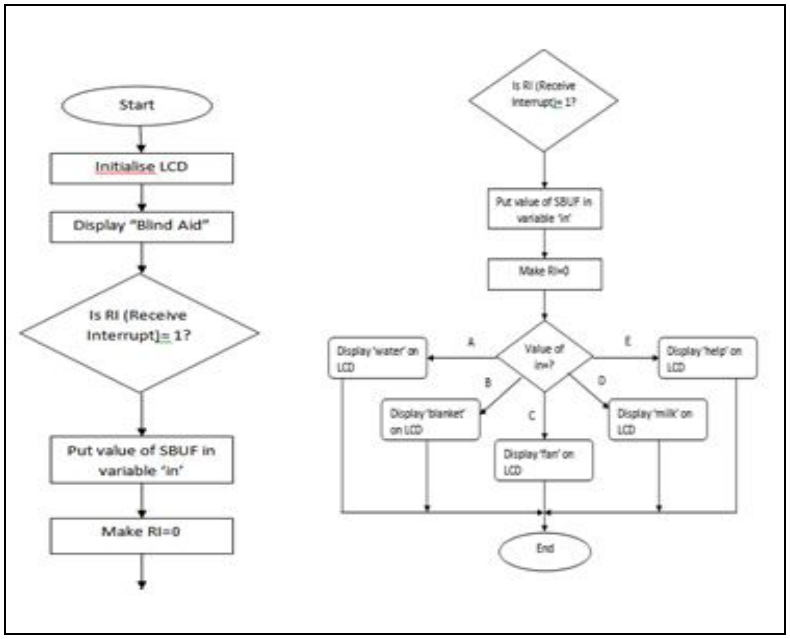
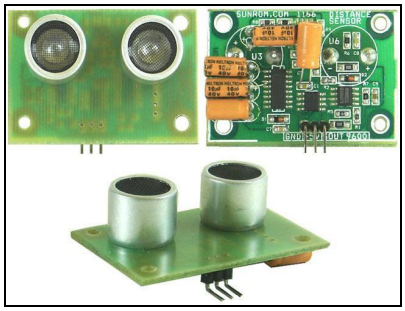


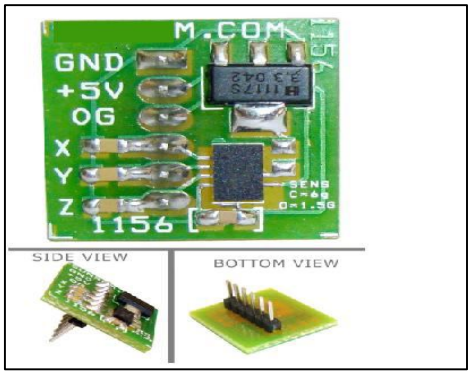
Figure 8: Algorithm of RF Receiver

4. Experimental Set-Up
The modules involved in the project are:

4.1. SRF05Ultrasonic Range Finder
Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping. The SRF05 Ultrasonic Range Finder is a single unit that combines both an ultrasonic transmitter and receiver. The ranger works by transmitting a sound with a frequency of 40kHz, which is outside human range of hearing (approx. 20Hz-20kHz), and this reflects back to the ranger from any object obstructing the path of the sonic wave. The time it takes for the wave to return to the unit can be used to calculate the distance to the nearest object in the wave's path. It is designed so that if the signal is not received back within 36ms it times out and sets the echo pin to low. These units have a range of 3cm – 400cm, and a beam pattern of about 45º.



4.2. Accelerometer
Accelerometer sensor can measure static (earth gravity) or dynamic acceleration in all three axes. Application of the sensor is in various fields and many applications can be developed using this sensor. Accelerometer sensor measures level of acceleration where it is mounted this enable us to measure acceleration/deceleration of object like car or robot, or tilt of a platform with respected to earth axis, or vibration produced by machines. Sensor provides 0G output which detect linear free fall. Sensitivity can be adjusted in two ranges. Acceleration is a vector force which has direction and measured in meters per Second Square. Earth produces gravitational acceleration on all objects on earth. By monitoring the three axis acceleration one can measure the level of tilt of any platform.



4.3. GSM Transceiver Modem
A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. An external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands [4]. You can use a GSM modem just like a dial-up modem.

4.4. RF Transmitter and Receiver
Radio frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. In electronics and telecommunications a transmitter or radio transmitter is an electronic device which, with the aid of an antenna, produces radio waves. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. When excited by this alternating current, the antenna radiates radio waves. A tuned radio frequency receiver (TRF receiver) is a radio receiver that is usually composed of several tuned radio frequency amplifiers followed by circuits to detect and amplify the audio signal. Prevalent in the early 20th century, it can be difficult to operate because

each stage must be individually tuned to the station's frequency. It was replaced by the Super-heterodyne receiver invented by Edwin Armstrong.

5. Results

- In ultrasonic waist belt and spectacle module user can easily get to know about the obstacle.
- Using GSM module just by pushing a button an emergency message will be sent to three contacts (more contacts can be added)
- Using RF Tx. /Rx. User sitting within a range of 35 feet can easily tell other person about his need.
- In accelerometer module user can easily roam in and out of a predefined path.

All the modules that are Ultrasonic and reflector module, GSM module, RF module are working within the prescribed range

6. Future Scope

All the modules can be implemented in a product which would be a great aid to blinds. The key pad used can have Braille letters inscribed on them so that the person can understand easily. In accelerometer the current position of the person can be detected and can be intimated about the route to be taken. Also instead of buzzers voice output can be used.

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