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Low Cost Bus Alert System for Visually Challenged People

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Abstract: ***One of the common problems faced by visually challenged people is their inability to travel alone in public transport services like bus. They have to depend on others to identify the bus at the bus stops. This scenario should be changed. It's the role of engineers to bring the change in the lives of visually challenged people. A low cost bus alert system for visually challenged people using Radio Frequency (RF) technology is proposed in this paper. Once the appropriate bus arrives near the visually challenged person, he/she will be intimated about the arrival of the bus by an audio message. If the blind person decides to board the bus he can acknowledge the driver by pressing the acknowledgement button in his module. The bus driver will get acknowledged by LED indicator near his cabin. With the help of this project visually challenged commuters can transit without the aid of fellow commuters and their need to depend on others for public transport transit can be reduced.***

Keywords: ***Visually Challenged, Mobility Assistance, RF Technology.***

I. INTRODUCTION

Visual impairment is a decreased ability to see to a degree that causes problems not fixable by usual means, such as glasses which is also known as vision impairment or vision loss. Visual impairment may cause people difficulties with normal daily activities such as reading, driving, socializing, and walking. Global data on visual impairments 2010 [1] provides up to date information on prevalence and causes of visual impairment. This data sheet is provided by World Health Organization (WHO) which carries out a systematic search and review of all available data to obtain a global estimate of visual impairment as of 2010. These estimates provide essential information for the prevention of visual impairment and the improvement of eye health globally.

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Sightsavers India [2] lists out various policies and schemes of central and state governments of India for people with disabilities. This document is compiled by [2] with support from blind people's association, Ahmedabad, India. It is intended as a useful resource for managers and practitioners engaged in the disability sector, policy makers, and most importantly, by persons with disabilities.

Jerry et.al [3] stated that a bus notification system using bluetooth technology can be developed to enable automatic audio notification of the requested bus number that the commuter is planning to board via their mobile phone or other mobile device. Visually challenged persons are provided with a ZigBee unit which is recognized by the ZigBee in the bus and the indication is made in the bus that the blind people are present in the station [4], [8] [9] and [12].

A text-to-speech module giving more independence to the visually impaired person to travel on his own using global positioning system (GPS) technology is proposed in [5]. Jalila Al Kalbani et.al [6] and Swapnil Gholap et.al [7] constructed a bus detection system for blind people using RFID. A cost analysis on this paper showed that it is hardly affordable by poor blind people to buy this technology. The details about the bus will be conveyed to the users (visually challenged people) in terms of text format through BLE beacon (Bluetooth Low Enabled Beacon) then the text will be converted into audio format for visually challenged people [10]. P. Prashanti et.al [11] developed bus boarding system for visually impaired passengers using both RFID and RF module.

In the proposed system RFID module is removed and only RF module is used for providing assistance to visually impaired person to board the bus thereby the cost the module is reduced so that even poor people can also buy it.

II. MOTIVATION

The motivation behind the project is the suffering faced by the blind people in performing their day-to-day activities. Before starting the project a survey has been conducted at Government Blind School, Uliyampalayam, Thondamuthur, Coimbatore, Tamilnadu to identify the problems faced by them. The responses showed that the two major problems by them are obstacle detection and bus identification at bus stops. Since Smart Cane had been developed to detect obstacles, this project mainly focuses on developing a system for easy and economic identification of buses at bus stops.

III. FLOW CHART

The proposed prototype consists of two modules namely Bus Module and Mobility Assistance Module. The conceptual flow chart for complete understanding of bus module and mobility assistance module are shown in figure 1 and figure 2 respectively.

In the bus module the process starts with the bus driver feeding the destination into the controller. The destination of the bus is transmitted through RF module. If acknowledgement is received from the blind person then the bus driver will get alerted and wait for the blind person to board the bus.

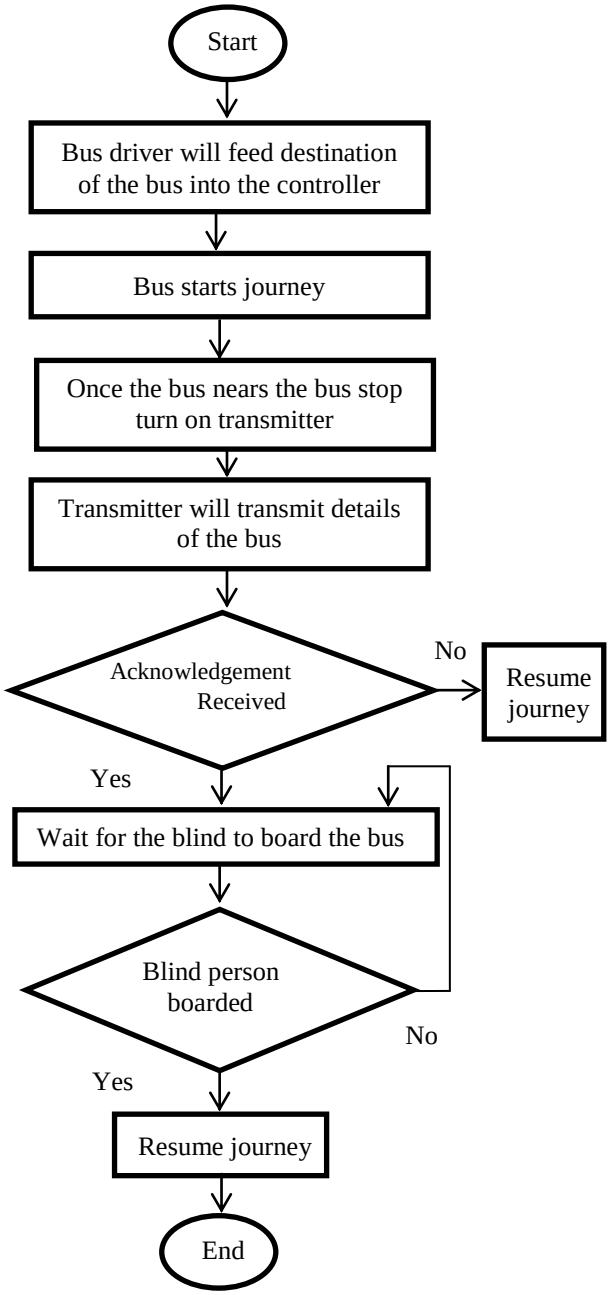

Fig.1. Flow chart of Bus Module

In the mobility assistance module the process starts with blind person receiving the message from the bus about the destination of the bus. The message is converted into audio by the microcontroller. If the blind person decides to board the bus, he should press the acknowledge button in his module to acknowledge the bus driver.

IV. BLOCK DIAGRAM OF THE PROPOSED SYSTEM

The bus module and mobility assistance module consist of two sections namely transmitter section and receiver section. Figure 3 shows the block diagram of the transmitter section of the bus module. The keypad is used to enter the destination of the bus which is processed by the Arduino UNO and it is transmitted by nRF24L01 module which is a highly integrated, ultra-low power 2Mbps RF transceiver IC at 2.4 GHz.

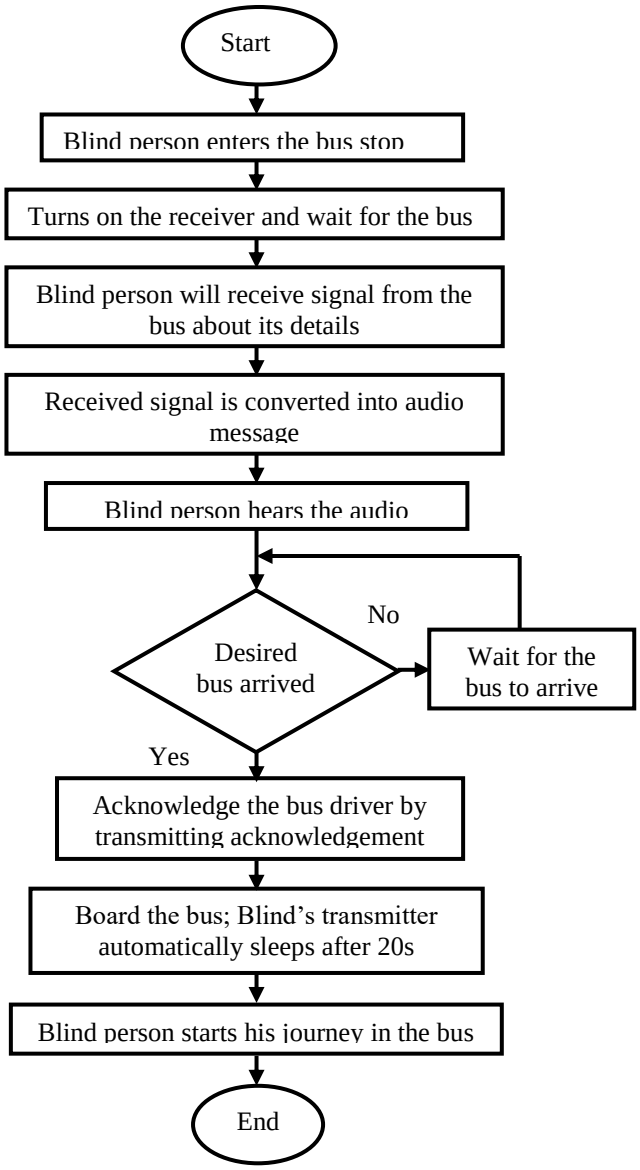

Fig. 2. Flow chart of Mobility Assistance Module

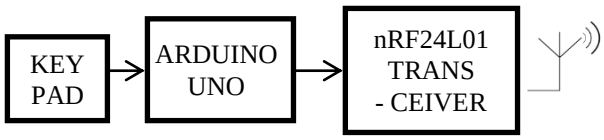

Fig. 3. Block Diagram of Transmitter Section of Bus Module

Figure 4 shows the block diagram of the receiver section of the bus system. The nRF24L01 module receives the signal from the blind person and the driver acknowledges his presence at the nearby bus stop. Arduino UNO converts the signal into data and LED glows according to data received.

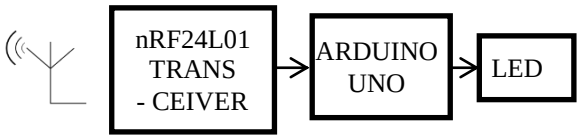

Fig. 4. Block Diagram of Receiver Section of Bus Module

The block diagram of receiver section of the mobility assistance module is shown in figure 5. The blind person receives the details of the bus through nRF24L01 module. The received data is converted into corresponding audio message which is stored in the SD card by Arduino UNO. SD card allows adding mass storage and data logging to this module.

Fig. 5. Block Diagram of Receiver Section of Mobility Assistance Module

The block diagram of transmitter section of the mobility assistance module is shown in figure 6. Once he receives the message from the bus, the blind person has to decide upon whether he should board the bus or not. If he decides to board the bus then he should press the button which is then processed by Arduino and is transmitted by nRF24L01 module.

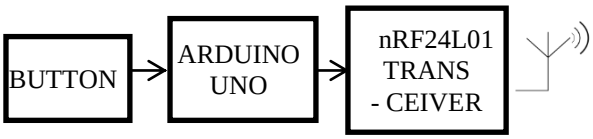

Fig.6. Block Diagram of Transmitter Section of Mobility Assistance Module

V. CIRCUIT DIAGRAM OF THE PROPOSED SYSTEM

The circuit diagram of the bus module and mobility assistance module are shown in figure 7 and figure 8 respectively.

A. Bus Module

The 3x4 keypad is used to feed the destination of the bus into the Arduino UNO. As direct connection of keypad into Arduino utilizes more pins, a multiplexer circuit has been designed using resistor circuit so that keypad can be connected to Arduino with only one pin. The main reason for keypad in the system is to give provision for the driver to easily alter the destination of the bus. The data from keypad is sent into Arduino and then transmitted using nRF24L01 module. The same nRF24L01 module acts as receiver to receive the acknowledgement message from the blind person and it is indicated using LED near the driver's cabin. If LED glows then driver will have to wait for the blind person to board and then he will resume his journey.

B. Mobility Assistance Module

The blind person receives the details of the bus through his nRF24L01 module when the bus enters the vicinity of RF range. The received data in converted into audio which is stored in the SD card by Arduino. The library used for this purpose is "SimpleSDAudio". SD card is connected to Arduino using SD card module. Once the blind person hears the audio message he has to decide whether he should board the bus or not. If he needs to board the bus then he should press the acknowledgement button in the module.

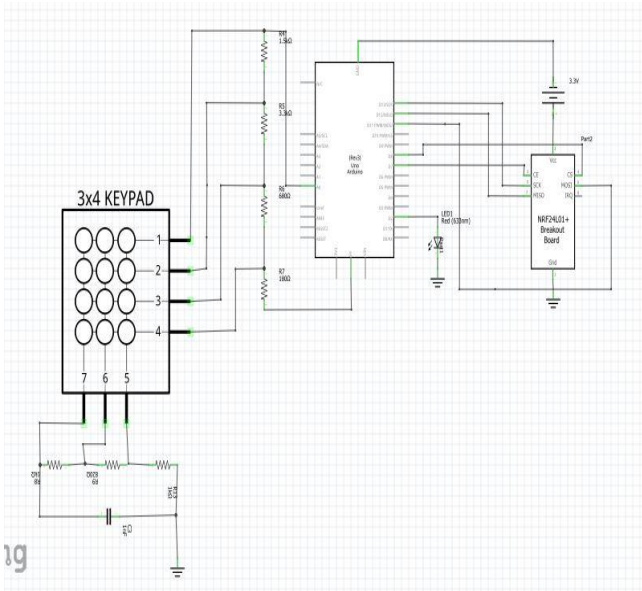

Fig.7. Circuit Diagram of Bus Module

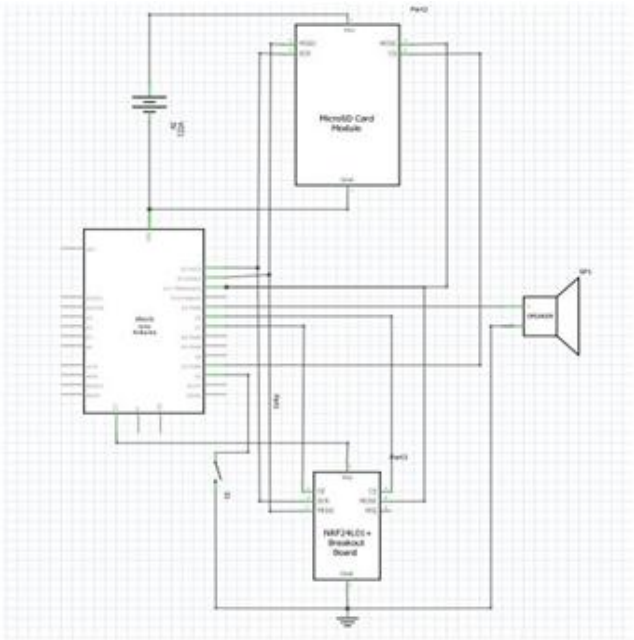

Fig. 8. Circuit Diagram of Mobility Assistance Bus Module

C. Simulation and Hardware

The simulation was done using 'Proteus ISIS 8.0 Professional' application which is available for Windows platorm. The entire connection was drawn in the software and the circuit was complied. The programs for the transmitter and receiver Arduino's were compiled using Arduino IDE application which is available to compile the programs. The simulation has been carried out successfully and the results were verified. The circuit diagram shown in figure 7 and figure 8 were implemented in hardware and the same results obtained were achieved.

The cost of the bus module and mobility assistance module are Rs. 730 and Rs. 990 respectively (Table - I). This cost can be easily afforded by the blind person. The cost of the proposed system is found to be low when compared with the cost of existing systems.

Table – I : Cost of the Proposed System

S.No	Equipment	Price (Rs.)
Bus Module		
1	Arduino UNO	450
2	nRF24L01 transceiver	140
3	Keypad	100
4	Resistors	5
5	Led	5
6	Connection	30
	Total Cost	**730**
Mobility Assistance Module		
1	SD card module	120
2	SD card (1 GB)	100
3	Headphones (Basic)	150
4	Arduino UNO	450
5	nRF24L01 transceiver	140
6	Connection	30
	Total Cost	**990**

VI. CONCLUSION

Helping blind people to get familiar with technology in order to become more independent on their daily life is a necessity. This paper presented a new approach to bus identification system for visually impaired persons using RF technology. With this device, the life of those people will change and they can overcome their weaknesses related to the ability to move freely without the help of anyone. Also, the cost analysis showed that the components of such a system are cheaper than other systems at the same time providing better performance.

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AUTHORS PROFILE

Dr. Kavithamani A, is currently working as Assistant Professor in the department of Electrical and Electronics Engineering, Coimbatore Institute of Technology, Coimbatore. She obtained her doctoral degree from Anna University, Chennai. She did her masters in Electrical and Electronics Engineering at PSG college of Technology and Bachelors in Electrical and Electronics Engineering at Government College of Technology, Coimbatore. She has 20 years of teaching experience and more than 25 punlications international and national journals. She has received three funded projects from AICTE and UGC. She has organazied one international conference and three faculty development programs.

Abhisheik K, received his B.E degree in Electrical and Electronics Engineering from Coimbatore Institute of Technology, Coimbatore, India which is affiliated to Anna University, Chennai. His area of interest include microcontroller based system design and digital signal processing. He has participated in student level symposium and shown his technical skills. He has gone six week training in industries to enhance his design skills. He has attended workshops and seminars on embedded system design. He is one of the organizing member of national level technical symposium conducted by Electrical and Electronics Engineering, Coimbatore Institute of Technology.

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