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BUS IDENTIFICATION SYSTEM for VISUALLY IMPAIRED PERSONS USING INFRARED

Mohini Ghuge*, Prajakta Hundekari*, Namrata Karmakar*, Prof. Mahesh Bhagwat#

* Dept. of E&TC,SKN-SITS,Lonavala
#Asst.Professor,SKN-SITS,Lonavala

Abstract— Although many studies have covered the need and utility of accessible urban transport system for visually impaired persons, this paper will focus on the field of transportation to improve the quality of life of the visually impaired persons (VIPs) using INFRARED technology. The motivation behind this project is that buses are vital mode of transportation in enabling blind people to participate fully in society. This prototype will allow blind people to safely board buses with the help of handheld module and IR sensors. An Infrared based, completely user-triggered system helps the user first to identify the route number and then enables the user to board the bus using the auditory cues from the entrance of the bus. The objective of our study has been to generate empirical evidence that would facilitate the move towards incorporation of such a system in public buses globally.

Index Terms—Bus Identification, IR Sensor, Visually Impaired Persons(VIP)

I. INTRODUCTION

In developing countries, public transportation is the sole medium of access to society to the visually impaired persons. It is, more often than not, an absolute necessity rather than a choice. By society, medical facilities, employment, other recreational activities and various community resources are implied. According to India's 2011 census, 15 million of the world's 37 million blind people are Indians and the impairment increases with age. Of these, only 32.8 percent are employed. The lack of means of reliable and safe transportation is clearly mentioned as one of the contributing factors [1].

This paper presents a new approach in helping the blind go about their daily activities. The IR transmitter consists of an LED that emits INFRARED radiation. This radiation is reflected off the surface and falls upon the photodiode. It is received by the photodiode which acts as IR receiver at the receiving end. The IR radiation is invisible to the human eye and hence perfect for using in wireless communication. For two way communication, two pairs of IR transmitter and receiver are required.

II. LITERATURE SURVEY

In a study carried out at university college of Ireland, various issues regarding access to public transport for people with low vision or sight loss were explored. The study conveyed that providing auditory cues at different stages of boarding will help improve their access to public transport. But, it does not focus on how a visually impaired could independently identify and board his/her desired bus of interest. Also, there was no such mechanism mentioned that could guide a VIP in identifying the entrance door of the public transport especially when buses stop in a wide range at a bus stop [2].

There are many Bus Identification Systems already available in the industry. One such system is the PAVIP Public Traffic System. In this system, the RFID transponder tags are placed on the bus stops and they transmit the information about the buses approaching the stop. However, the problem with this system arises that the user does not get a choice in selecting the bus he requires when a number of buses arrive simultaneously at the stop. Moreover, the problem of boarding of the bus remains unresolved [3].

Another similar system is the Step-Hear system which is based on RF. It comprises of a transmitter on the handheld device and a small activator. There is no way for the user to choose between different transmitters and is unable to handle the case of multiple activators and transmitters within range of each other [4].

Broadcasting bus is a GPS based system announcing the bus number upon arrival at the bus terminal. A pilot survey showed that the smart bus stops are not adequate when equipped only with the voice reporting system because voice information is difficult to decipher when many buses simultaneously arrive at the same terminal [5].

Of all the systems that have been proposed, each one has one or more of the following limitations:

(1) Too expensive.

(2) VIP having to rely on fellow travellers.

(3) Unavailability of GPS connectivity in buses in developing countries.

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(4) Inability to board a desired bus, since multiple buses arrive and line up arbitrarily at random positions at bus stops.

(5) Requirement of electricity or structural support that is not available at most of the bus stops.

(6) As no auditory cues are present at the entrance of the buses, VIP has difficulty in boarding it.

To the best of our knowledge, there is no such affordable and user validated system which provides the auditory cues from the bus. This system helps the VIP to identify the bus of his/her interest before it approaches the bus stop. Further this system also helps in identifying the entry door of the bus. This system has been designed so as to address the limitations mentioned above and also to meet the specific requirement of public bus service providers. Study of challenges faced by visually impaired in accessing public buses and design and user testing of an affordable bus identification system had already been addressed. The initial prototype and design was discussed in an earlier publication [6].

III. METHODOLOGY

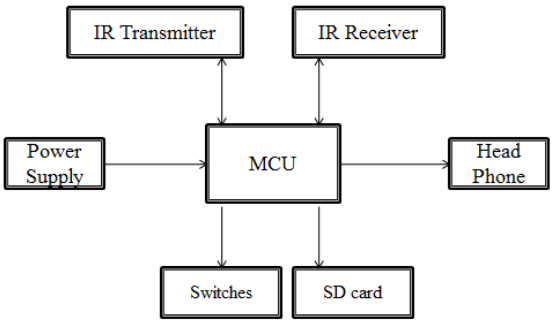

Fig.1 User Module

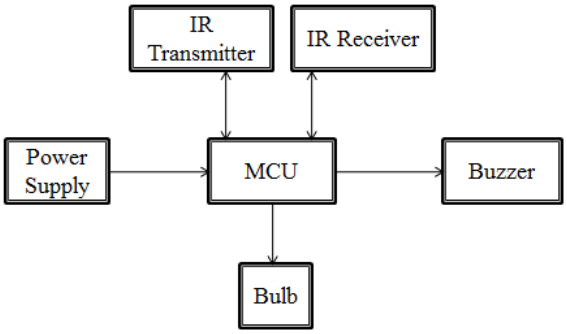

Fig.2 Bus Module

This system consists of two modules, a mobile like handheld user module and bus module installed inside the bus. When the user is standing at the bus stop the user will press the query button to obtain the route numbers of the buses in the vicinity. These numbers are read out to the user via headphones in user module. This will solve the problem that the user faces to know if the desired bus is available at the bus stop. Once the route number of the desired bus is read out, the user will select it by using the selection button. This triggers an audio output from the speaker installed at the door of the bus.

This acts as an auditory cue and helps the user to navigate towards its entry. This select button can be pressed multiple times to generate the audio output. Once the select button is pressed, it activates the bulb at the driver panel informing the driver about a person with special needs.

ARM 7:

Fig.3 ARM 7 LPC 2148

Features:

- Single 10-bit D/A converter provides variable analog output.
- Low power real-time clock with independent power and dedicated 32 kHz clock input.
- Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
- Power saving modes include Idle and Power-down.
- Single power supply chip with Power-On Reset (POR) and BOD circuits.
- One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 us per channel.
- Up to nine edge or level sensitive external interrupt pins available.
- CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/Opads.

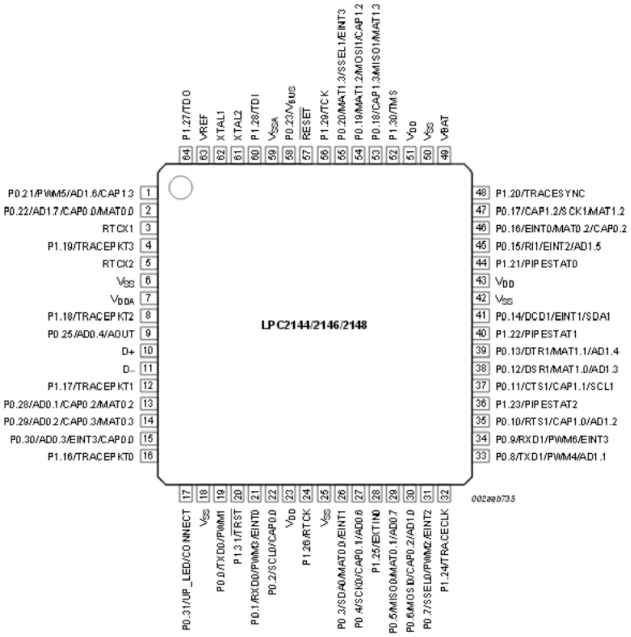

Fig.4 Pin Diagram of LPC 2148

Infrared:

We use infrared transmitters and receivers. The transmitters operate between 940-950nm and work well for generic IR systems including remote control and touch-less object sensing. They can be paired with IR receivers. 1.5VDC forward voltage and 50mA max forward current.

Fig.6 IR Sensor

Features:

- Very low supply current .
- Photo detector and preamplifier in one package.
- Internal filter for PCM frequency.
- Supply voltage: 2.5 V to 5.5 V.
- Improved immunity against ambient light.
- Insensitive to supply voltage ripple and noise.
- Material categorization.

Atmel 2051:

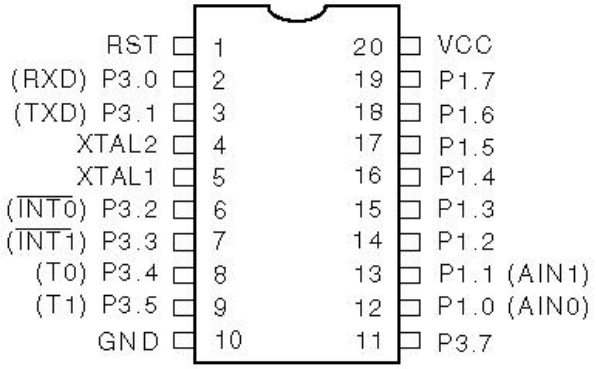

Fig.6 Atmel 2051

Features:

- Fully Static Operation: 0 Hz to 24 MHz.
- Two-level Program Memory Lock.
- 128 x 8-bit Internal RAM.
- 15 Programmable I/O Lines.
- Two 16-bit Timer/Counters.
- Programmable Serial UART Channel.
- Direct LED Drive Outputs.
- On-chip Analog Comparator.
- Low-power Idle and Power-down Modes.

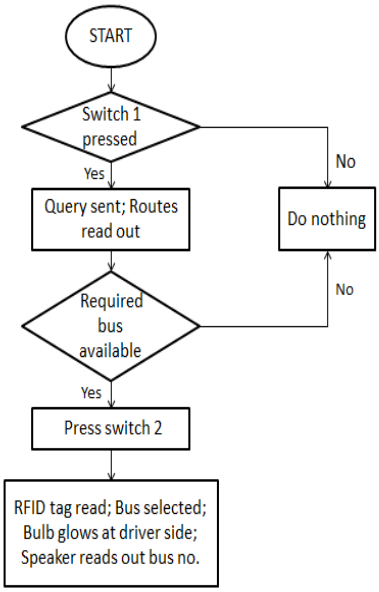

Fig.5 Illustration of the working of Bus Id System

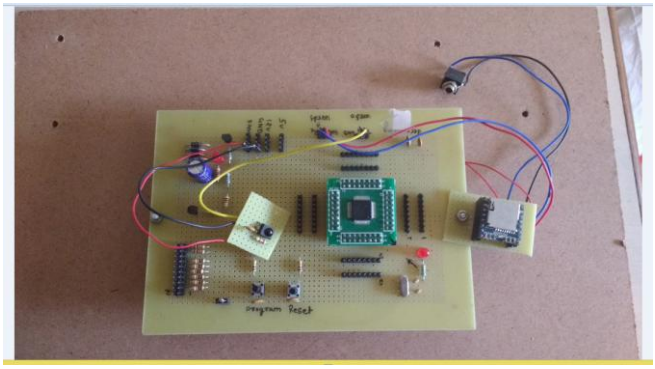

Fig.7 Handheld Module

Fig.8 Bus Module

IV. FUTURE SCOPE

Although the major application of this prototype is to assist people with low vision in boarding public transport, mainly buses, it also has wide applications other than just helping the blind people inform their presence to the bus driver. If developed further, this project can be used to

enhance the safety and comfort of a larger section of the society consisted by physically challenged people as well. Following are some of the anticipated future scopes:

1. This system, if manufactured on a large scale, is very economic and thus can be made available commercially, so that women, children, senior citizens and other physically handicapped people or any section of society can use it.

2. This system can be installed in a number of public transportation like taxies and not just public buses, all over the city so that people can very easily communicate with them.

3. With few changes in the hardware and programming, this prototype can be integrated to make it work as a security device.

V. Conclusion

Considering the fact that the society consists of a large number of blind people, that is, nearly 285 million blind people in the world, helping them to get familiar with technology in order to become more independent in their daily lives is no more an option but has become a necessity that everyone should be aware of. Thus, this paper attempts to present a new approach to bus identification system for VIPs using IR. This new prototype has many advantages which make it a good alternative to the current approaches since it facilitates for the VIPs the searching of the destination and the finding of the appropriate bus number. With this new addition in technology, the lives of people will change and they will be able to contribute positively to the society and overcome their weaknesses related to the ability to move freely and without the help of anyone. Also, the financial analysis showed that IR used in place of RF technology in such a system proves to be cheaper than other systems; however, the performance is higher.

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