1. **General**

The **Center for The Blind in Israel** promoted and supported the development of a system for the accessibility of public transportation in Israel together with the company Step-Hear. The solution has been operating for six months in three cities in Israel. The system is installed in two bus lines which include 167 stations and 62 buses. The system works very successfully and has been approved by various organizations (Blind organizations and wheelchair organization) and the Commission for People with Disabilities in Israel. The system was designed in a modular manner that enables maximum flexibility, while adapting it to installation at stations with or without suitable infrastructure, as well as buses with a vehicle fleet management system that enables interface with the vehicle's computer system. The system contains advanced authentication tools (authentication and guidance for passengers with disabilities) as well as control tools, with the intention of streamlining the level of service and enabling efficient operation of the maintenance system over time.

1. **The purpose of the system**

The System solution is aimed to answer some of the following **barriers** in using public transportation-

* Getting reliable information of the bus arrival time
* Difficulties in finding the correct bus stop
* Finding and reaching the bus entrance
* Informing the driver that a blind person is waiting at the nearest station
* Mutual identification on the bus by the passenger, and the passenger by the bus driver
* At the bus, identifying the next bus stop
* Preparation to get off the bus and notifying the driver that a passenger with disability wants to get of the bus

The System solution in public places-

* The user can receive vocal information about his/her location, and services available at the specific location
* Orientation and directions 360 degrees
* Activating gates, doors and elevators
* Calling and communicating with the service provider
* Allow specific information such as orientation map, accesses arrangements and more
* Activating traffic light systems
1. **Station components - hardware**

Here are the hardware components of the system at the station:

Controller that contains:

* Highly efficient processing unit (with very low current needs) with multiple interfaces
* RF transmitter is designed for a unique electronic bracelet that is provided to visually impaired people as part of the rehabilitation basket provided by the State of Israel.
* Bluetooth transceiver, for identification and operation via smart phone
* Audio management system
* Intelligent control of solar energy supply system
* Cellular modem
* A GPS component used to synchronize all end unit clocks of all systems
* Speaker
* Integrated antenna for all communication components
* Solar power supply
* Waterproof enclosure
1. **Components of the station - hardware**

Here are the hardware components of the system at the station:

* Step-Hear controller that contains:
* Highly efficient processing unit (with very low current needs) with multiple interfaces
* RF transmitter is designed for a unique electronic bracelet that is provided to visually impaired people as part of the rehabilitation basket provided by the State of Israel.
* Bluetooth transceiver, for identification and operation via smart phone
* Audio management system
* Intelligent control of solar energy supply system
* Cellular modem
* A GPS component used to synchronize all end unit clocks of all systems
* Speaker
* Antennas for communication components
* Solar power supply
* Waterproof enclosure
1. **System processes -**
	1. Identification of the arrival of the person with disabilities to the station

When a traveler with a disability reaches a range of about 20 meters from the station:

* The bracelet (or mobile phone) vibrates
* It sends a message to the system that there is a person with disabilities within the station range
* An option to activate a voice signal (public or other) to attract attention and direct the person with disabilities to an appropriate and safe spot in the station compound.
* Optional voice indication to attract the attention of other passengers near the station to the presence of the person with disabilities at the station (required mainly in rainy or dark conditions where the person with disabilities needs further assistance).
	1. Reading lines
* After pressing button # 1 Reading lines in the bracelet (or mobile phone):
* Registering the Step-Hear controller in the Step-Hear server.
* Query the stops at the station according to the latest data
* Monitoring readability and sending alerts as needed
* Routing alerts to the call management system and / or calls to the control system for software and interfaces
	1. Line selection by passenger with disabilities
* After pressing button # 2 Select a line in the bracelet (or mobile phone):
* Recording the execution of the Step-Hear controller
* Quiring the system for updated time
* Reading the line includes the expected time for the arrival of the next bus
* Routing alerts to service management system and / or system calls
* Ordering a service for a line chosen by a passenger with a disability
	1. After pressing button # 3 ordering a service on the bracelet (or mobile phone):
* Recording the execution of the Step-Hear controller
* Quiring the system for updated time for the selected line
* The line call has a predicted arrival time
* Sending a message including receiving confirmation of the click to the Step-Hear server
* Enabling logic to determine the operator and sending a valid acceptance permit for the person with the disability
* Reading a message to a passenger with disabilities regarding the receipt of the line selection
* The transmission of a message includes verification of acceptance to the control system of the relevant bus company
* Routing alerts to service management system and / or system calls
	1. Bus selection, driver notifications and follow-up

Step-Hear servers perform the following processes:

* Choosing the bus closest to the station where a disabled passenger is waiting
* Sending a message to the operator's command and control system
* Tracking the bus
* Queries for the system to obtain updated forecasting time and operation of algorithms for the decision-making system. Is there a significant gap between the information passed on to the person with the original disability and the current information requiring additional reading for the person with disabilities.
* Send a replay message to Step-Hear servers
* Monitoring all the buses that operate on the line and using algorithms to select the bus that best suits the needs of passengers with disabilities
* Sending a message to the Step-Hear controller on the selected bus includes confirmation of receipt of the message
* Updating the operator's command and control server
* Continuing to monitor the activity of the selected bus in relation to other buses on the same line and to use logic to deal with situations in which two buses travel close to each other
	1. The course of the trip
* After pressing button # 1 by a person with a disability in the bracelet (or mobile phone):
* Registering the Step-Hear controller
* Sending a message includes confirmation of receiving the click
* Reading the next line, from the bus system
* Send a read health alert message for monitoring and control purposes
* The system will support the option of receiving a "personalized line" which will be maintained in the system for passenger service with a restriction that is required (with the explicit permission of the user)
	1. After pressing button # 2, ask for a drop at the next station on the bracelet (or mobile phone):
* Recording the execution of the Step-Hear controller
* Sending a message includes receiving confirmation of the click
* Audio and visual indication on the driver's display
* Sending a health message Displays the notification for monitoring and control purposes
	1. Monitoring, control and maintenance

All information regarding the use of the public transportation system is collected and left:

* Arrival time to the station
* Waiting time at the station
* Bus arrival time
* Bus duration
* Collection station and download station
* Reading calls at the station and on the bus

In addition, information is collected on activities that are not related to the accessibility leap:

* Monitoring the rate of voltage in the battery
* Entry to work in a way that reduces energy consumption in the station system in low-charging situations
* Monitoring continuous communication
* Monitoring the integrity of the reading system
* Create automated calls for technicians from the monitoring system
* Securing information for external penetration -
* User level - the user interface is one-way and operated by a "dry contact"
* At the network level - secure encrypted communication
1. **The system infrastructure for solutions in development**
* Identification of the passenger's type of restriction for appropriate assessment
* Planning a personal route in advance for the passenger and automatic reading
* Location inside the bus along a track