

# IoT School Bus Evidence Fact Sheet

NFC and Android based app with both off-line and on-line operations



## INTRODUCTION

Every morning, millions of children go to school by bus. And every afternoon, they get on the bus again and they ride home. It is critical to make sure that every child get off the bus at the correct stop, especially for smaller children which otherwise might get lost. Our School Bus Evidence solution allows the users to track the boarding and deboarding.

## SOLUTION OVERVIEW

Driver is using an Android device with NFC-enabled (Near Field Communication) hardware and with the BellaDati App installed. The Android device is mounted at the front entrance to bus. The BellaDati application includes database of students, name, final station name and GPS coordinates, name of their teacher and mobile phone of the teacher. The application also includes database of stations including GPS coordinates if possible.

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Before starting the shift, the driver must login into the application. Once logged in, the application is logging events all day. At the end of the day-shift, all data are uploaded to BellaDati when Wi-Fi or mobile internet connection is available.

The children are using NFC tags with appropriate data programmed into it, such as name of pupil, bus stop name or GEO Coordinates of bus stop. NFC chip is economically very efficient and replaceable in case it is lost by the user.

## BOARDING AND DEBOARDING PROCESS

The user is entering the bus through the front door and taps the tag to Android phone. The application reads the RFID protocol from NFC chip and validates user data against the database. The pupil is marked as boarded. It is highlighted on the screen for driver by a user figure in green and the name of the user above the figure. Additionally, the application plays a sound to driver. The application is using GPS (Internet connection is not required) to validate that the bus has arrived at the station. If GPS is blocked by trees or high-rise buildings, the driver must manually confirm arrival to the station.

When the bus driver arrives to station, the application is validating users final stop data (GEO, name of the station) with the current station of the bus. Pupils, that are supposed to leave the bus are highlighted for driver as red.

Considering the number of children is 10-12. They leave the bus via the front doors. Again, taping the NFC chip on the Android phone. The application will notify the driver by sound and the user figure of student disappears. When the bus driver is leaving the station, the application will recognize it by validating GPS coordinates with current one or by manual click of driver for the next stop. If some pupils stayed boarded, student figure starts blinking in red.

If possible, the driver can stop the bus and notify pupils to leave the bus. If it is not possible due to traffic or other situation., the application will send an SMS to the teacher of the student notifying teacher about further actions.

## BUS STATION LOG UPLOAD

The log upload should be covered with Wi-Fi or mobile internet connectivity.

The application will record all day events and sent them to the BellaDati backend.

Bus operations manager and school management can view the results.

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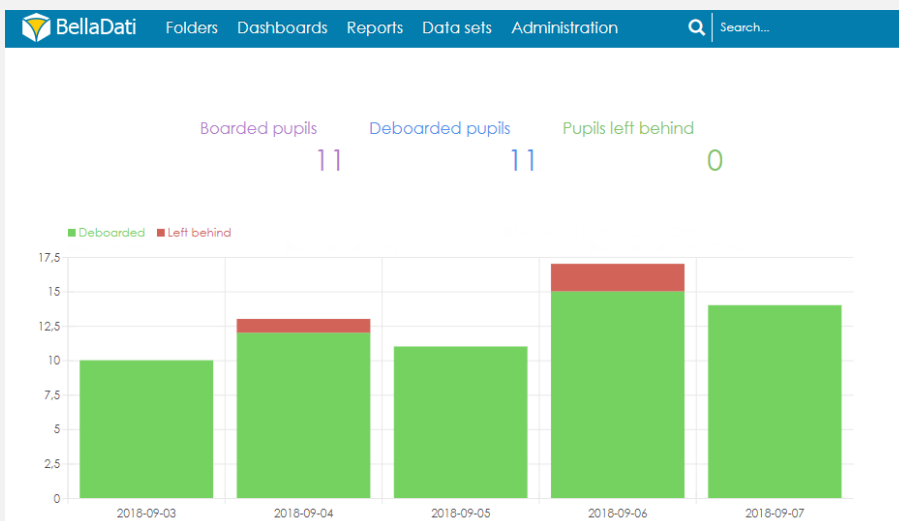
## IoT Interactive Dashboard features and Administration

Pupils database is created and stored in BellaDati DWH. This allows easy updates of the database into the driver's application. Administrator can update all devices at once with newly updated database. They can also **disable lost NFC chips and replace them**. During that, the devices need to have at least Wi-Fi network connectivity to BellaDati backend.

Secured database of drivers inside BellaDati data warehouse includes their names, passwords to validate their login to Android terminal-based app. For the first login, the driver has to use terminal in vicinity of Wi-Fi/mobile Internet connection to create the password. Their name and e-mail must be validated with BellaDati. Later that password is securely stored on device in the particular bus. Driver must login before starting using device in the bus. One android device can handle login of different drivers.

Creation of database is possible in multiple automated ways, also including through UI or forms modules. The NFC chip is programmed from BellaDati Android App - that app is focused only on programming NFC chips. This app uploads database of pupils from BellaDati. App is used by authority, that can issue new NFC chips for pupils.

Upload of data gathered by the driver's mobile app into the BellaDati database is done automatically at the end of the day-shift. Android terminal must be in the vicinity of the Wi-Fi network of BellaDati on-premise.



The solution also includes BellaDati Dashboard showing results of daily shift, performance of drivers, children left behind, amount of SMS sent to teachers, delays of buses etc.

If mobile internet connection is available, live dashboard will be showing real-time data. It includes access for parents/teachers of children, who can track if their children/pupils arrived at school on time etc.<sup>1</sup>

<sup>1</sup> RL GNZLZ - Nissan NV - <https://www.flickr.com/photos/juanelo242a/17202450466>