International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Smart Commute
Application for Public Transport Management

Department of Electronics and Computer Engineering, PES MCOE, Savitribai Phule Pune University
Pune, Maharashtra, India

Vyoma Shetty
vyomamshetty@gmail.com

Sarthak Shinde
sarthakshinde9604@gmail.com

Arjun Sawant
ryarjunsawant@gmail.com

Under the Guidance of
Mrs. Ashwini A. Kokate
ashwini279@gmail.com

***Abstract*— An urban city's ever-growing population and everyday commuters have created a serious issue, making it difficult for the governing bodies to handle public transit. This project attempts to present a concise overview of the main issues. The latest technical developments, such as IOT, GPS, smartphones, etc., must b e incorporated.This study proposes a bus tracking system that uses software technologies such as flutterflow and firebase database management system to monitor and control bus movements. Here, we suggest a system that integrates the newest technology into already-in-use bus networks so that passengers may learn about the buses' current location as well as their arrival and departure timings via display boards at bus terminals or through apps on smartphones.**

***Keywords*— Public transportation, governing body, daily commuters, management, technological advancements, IOT, GPS, Smartphone, App's, flutterflow, firebase, bus terminal.**

I. INTRODUCTION

In this era of rapidly developing mobile technology and the internet, mobile applications are becoming more and more significant. The proliferation of applications in modern life is a result of technological advancements and the processing power of mobile devices. These applications provide access to information almost anywhere, at any time, and at any location.Numerous studies have examined the usability of urban transit and passenger information. However, only few have applied user-centered design thinking. This kind of design thinking may enhance public transportation apps, making them more aesthetically pleasing, sustainable, and easy to use. These apps, which prioritize customer needs and real-time schedule access, have the ability to fundamentally alter the transportation experience. Good design requires research, not guesswork. A survey of the literature also examined the impact of IT on publicly accessible apps and public transit, highlighting the importance of choosing sustainable modes of mobility. When paired with a growing public transportation network and a variety of other modes of transportation, innovative mobility concepts offer a viable way to address changing social demands for mobility. With the widespread development of the Internet of Things, the concept of establishing a Smart City has become more accessible. It is imperative to move toward technological solutions to meet the needs of smart cities due to the population expansion that is occurring at a rapid pace in metropolitan regions. Currently, the globe has become aware of the trend toward smart city development, and many nations are working to improve metropolitan areas through technological advancement. [1] [2] [3]

The long-standing human need for mobility is being revolutionized by recent ICT advancements. Context-aware, on-demand travel information and services are offered by mobile and handheld device-based travel services. People choose different modes of transportation depending on how they want to go and how they want to get there. A dynamic public transportation network supports innovative mobility ideas that aim to address both individual mobility needs and societal changes. Nevertheless, it is currently challenging to efficiently plan and book mixed-mode trips across numerous services. This initiative intends to simplify this process by providing a consistent platform for trip planning and booking that incorporates semi-public options like carsharing and e-bike rentals in addition to public transportation. User feedback directs the project's development, bringing together technical and user-centric components to produce a cohesive travel solution. [2] [3]

II. Project Needs Plan

i)Project Overview:

Develop a mobile application using Flutter Flow, a visual UI builder for Flutter, to create a cross-platform app.
The app aims to [describe the purpose and functionality of the app briefly].

ii)Project Objectives:

Create a user-friendly interface.
Implement necessary functionalities.
Ensure compatibility across various devices and screen sizes.
Deploy the app on both Android and iOS platforms.
Maintain code cleanliness and adhere to best practices.

iii)Stakeholders:

Project Manager
Developers
Designers
Quality Assurance Team
End Users

iv)Project Timeline:

Start Date: 1/8/2023
End Date: 28/2/2024

v)Resources Required:

Development Team
Flutter Flow platform access
Development Environment (IDE like Visual Studio Code, Android Studio)
Design Tools (Adobe XD, Figma)
Version Control System (Git)
Documentation Tools (Confluence, Google Docs)

vi)Functional Requirements:

User authentication, data retrieval, data storage.
User registration and login, Profile management, Data input forms, Data display, Push notifications, live bus data and route management system.

vii)Non-Functional Requirements:

Performance: The app should load quickly and respond promptly to user interactions.
Security: Implement secure authentication mechanisms and data encryption.
Scalability: Design the app architecture to accommodate future enhancements and increasing user base.
Accessibility: Ensure the app is accessible to users with disabilities.
Usability: Design an intuitive user interface with clear navigation.

viii)Design Considerations:

UI/UX Design: Create visually appealing and intuitive designs for optimal user experience.
Responsiveness: Ensure the app layout adapts well to different screen sizes and orientations.
Branding: Maintain consistency with brand colors, fonts, and logo.
Iconography: Utilize appropriate icons for actions and navigation.

ix)Development Approach:

Agile methodology with sprints of 2-3 weeks.
Daily stand-up meetings for progress updates.
Regular review and feedback sessions with stakeholders.

x)Testing Strategy:

Unit Testing: Test individual components and functions.
Integration Testing: Test the interaction between different modules.
User Acceptance Testing: Involve end-users to validate the app against requirements.
Compatibility Testing: Ensure the app works seamlessly across various devices and platforms.

xi)Deployment Plan:

Release candidate builds for internal testing.
Beta release for limited user testing.
Full deployment to Google Play Store and Apple App Store.

xii)Maintenance and Support:

Monitor app performance and user feedback post-launch.
Regular updates for bug fixes, security patches, and feature enhancements.
Provide user support and assistance through designated channels.

III. Scope of the Application

A] User Experience and Interface:

To guarantee easy navigation and accessibility for all users, the bus tracking app will place a high priority on a user-friendly interface. It will include an easy-to-use interface with straightforward directions for setting up accounts, logging in, and managing profiles. Users will be able to easily track the bus routes and stops of their choice thanks to the interface's prominent display of real-time bus whereabouts on a map. The app will also offer thorough route information in an aesthetically pleasing and simply comprehensible style, including schedules, fares, and stop details.

B] Real-Time Tracking and Notifications:

Using manual buttons to provide exact bus whereabouts and anticipated arrival times, real-time bus tracking will be the main feature of the app. To keep users updated on any delays, detours, or service interruptions impacting their chosen routes, push alerts will be sent to them. Users will be able to customize these notifications to suit their own travel requirements and tastes by setting up preferences. The app seeks to reduce users' uncertainty when using public transit and improve their overall commuter experience by offering reliable and current information.

C] Inclusivity and Accessibility:

To guarantee that all users, including those with impairments, can easily use its functionality, the app will prioritize accessibility features. To help people with visual or motor disabilities, it will support screen readers and other input modalities. To accommodate a varied user base, the program will also have inclusive language and UI components. Every facet of the app's development and design will take accessibility into account, demonstrating a dedication to giving everyone equitable access to information on public transportation.

D] Customer Feedback and Engagement:

By offering channels for communication and feedback, the bus tracking software will promote user involvement. Through the app, users will be able to rate their bus rides, comment on the level of service, and report any problems or complaints. Customer service channels will be open to answer questions from users and provide assistance with using the app or with bus-related issues. The app seeks to increase trust and loyalty among its user base by encouraging open communication and transparency, which will ultimately enhance the general public transit experience.

E] Integration with Payment Systems:

The app will work with payment systems to enable users to buy bus tickets straight from the app, which will simplify the commuter experience. With the help of this function, users will no longer need to use cash or physical fare cards, giving them a handy contactless payment option. Secure transactions and a flawless user experience will be guaranteed by integration with mobile wallets and payment gateways. The app hopes to encourage more users to take public transit and support the sustainability of urban mobility by offering a simple payment option.

F] Data Privacy and Security:

Data security and privacy will finally be given top priority by the bus tracking app in order to safeguard user data and guarantee adherence to legal requirements. Strong encryption procedures will be put in place to protect private information, including user accounts and credit card information. Consent from users will be sought for the collection and use of data, and clear guidelines for data sharing and storage will be followed. The infrastructure of the app will be kept intact and possible vulnerabilities will be reduced by regular security assessments and updates. By putting user privacy and security first, the app hopes to increase user base trust and confidence, which will promote long-term adoption and engagement.

Feature	**Description**
User Authentication	Allow users to create accounts and log in securely to access app features.
Real-Time Tracking	Track the current location of buses in real-time on a map interface.
Route Information	Display information about bus routes, stops, schedules, and estimated arrival times.
Search Functionality	Enable users to search for specific bus routes, stops, or destinations.

Favorites	Allow users to save favorite bus routes or stops for quick access.
Notifications	Send push notifications to users about bus delays, changes in schedules, or important announcements.
Feedback	Provide a mechanism for users to submit feedback, report issues, or suggest improvements.
Accessibility	Ensure the app is accessible to users with disabilities, complying with accessibility standards.
Settings	Allow users to customize app preferences such as language, notification settings, etc.
Offline Mode	Enable users to access certain features of the app even when offline, such as viewing saved routes.
Social Integration	Allow users to share their bus routes, schedules, or experiences on social media platforms.

IV. Plan for Potential Disruption

Anticipating different scenarios that can impact the bus tracking app's operation and user experience is essential when making plans for any disruptions. First off, technical problems like software glitches, server outages, or connectivity problems could interfere with the real-time tracking feature and provide delayed or erroneous bus location information. The development team should put in place reliable monitoring mechanisms to quickly find and fix any technological problems in order to reduce this risk. In order to minimize user disruption in the event that the primary system fails, backup procedures should also be in place to temporarily move to other data sources or communication channels.

Second, the accuracy of arrival time projections and the dependability of bus services may be impacted by outside variables like inclement weather, road closures, or unanticipated traffic accidents. Although the app cannot control these issues, proactive steps should be done to give users timely updates and other routes in the event that disruptions occur. Users can be empowered to make well-informed travel plans by having access to pertinent information in real-time through integration with emergency response networks or local transit authorities' systems.

Finally, there is a serious risk to the integrity and security of the bus tracking app from cybersecurity risks such hacking attempts, data breaches, and malware assaults. The development team should put strong security mechanisms in place, such as encryption methods, multi-factor authentication, and frequent security audits, to reduce these risks. By encouraging safe usage habits and warning users of potential risks, user education and awareness campaigns can also aid in the prevention of security breaches. Even in difficult situations, the bus tracking software can retain its dependability, credibility, and usability by proactively resolving these possible disturbances.

V. Use of FlutterFlow and Firebase

A reliable way to create a bus tracking application is to combine the capabilities of Firebase for backend services and FlutterFlow for frontend development. With its visual UI builder, FlutterFlow makes it easier to create a responsive and slick user interface that works seamlessly on a variety of screens and devices. Developers may quickly prototype and iterate on the app's design by utilizing FlutterFlow's drag-and-drop feature, which expedites the development process and shortens the time to market.

For the bus tracking app, Firebase is the perfect backend because it provides an extensive range of services that are specifically designed to fulfill the needs of the app. Secure access to the application's functionalities is ensured using Firebase Authentication, which streamlines the user registration and login processes. Developers can store and synchronize real-time bus location data using Firebase Realtime Database or Cloud Firestore, allowing users to precisely track bus movements. Furthermore, serverless backend logic, such changing bus locations or notifying users depending on their choices, can be implemented using Firebase Cloud Functions.

Firebase services may be effortlessly integrated into Flutter apps by developers because of the smooth integration between FlutterFlow and Firebase. Developers

may leverage Firebase features such as Realtime Database, Firestore, and Authentication straight from their Flutter codebase by utilizing Firebase's FlutterFire plugin. Developers may concentrate on creating a feature-rich bus tracking application instead of being bogged down by difficult backend setup or management activities thanks to this tight connectivity, which makes the installation of backend functionality simpler.

There are many benefits to using Firebase and FlutterFlow together when developing a bus tracking application. Front-end development is accelerated by FlutterFlow's user-friendly visual UI builder, while real-time bus tracking and user authentication are made possible by Firebase's stable backend services, which also offer scalability, stability, and security. Together, these two formidable powers can help developers create a bus tracking app of the highest caliber that satisfies the requirements of users and transit agencies alike, improving the general effectiveness and convenience of public transportation networks.

VI. METHODOLOGY

The bus driver manually enters the station details into the bus tracking system as the bus arrives at its assigned stops. This simple but extremely effective method updates station information. The driver's workflow is effortlessly incorporated into this data entry procedure, which requires little extra work or equipment. The technology does away with the necessity for expensive hardware installations or specialized equipment on each bus by utilizing the drivers' current cell phones or tablets. This simplified method guarantees that station modifications are recorded in real-time, giving passengers and transit authorities accurate and current information.

The workflow of the driver will be seamlessly and non-disruptively integrated with manual data entry. Drivers can input pertinent station details, like the stop name and projected departure time, with ease using an intuitive interface on their smartphones or tablets. The method is easily incorporated into their daily work, guaranteeing that maintaining station information won't get in the way of their main duties, which are to drive the bus safely and make sure passengers are comfortable.

Through utilizing the drivers' current gadgets, such tablets or smartphones, the system makes use of widely available technology without necessitating further hardware purchases. This economical method lowers the initial outlay as well as the continuing maintenance and support expenditures. Additionally, utilizing vehicles that drivers are already accustomed to improves user acceptance and reduces the requirement for in-depth training.

All things considered, the mobile app's real-time updates and bus drivers' manual station entry provide an effective and affordable way to track buses and provide passenger information. This strategy makes the most use of the resources already in place, simplifies processes, and guarantees that passengers have access to correct information whenever and wherever they need it.

In terms of effectiveness and affordability, this method has many benefits. First of all, it does away with the requirement for intricate hardware configurations, like RFID readers or GPS trackers, which may be costly to buy, set up, and maintain. Rather, the system takes advantage of bus drivers' widespread smartphone use to update station information in real-time at a low cost by using their devices.

Furthermore, the driver only needs to spend a few seconds manually entering the pertinent station details into the app, making this method of data entry quite efficient. This simplified method guarantees that station updates are swiftly reflected in the user-accessible live feed while minimizing disturbances to the driver's tasks. Travelers thus gain precise and current information on bus locations and arrival times, which improves their entire experience and sense of trust in the system.

Additionally, the system lowers overhead costs related to hardware procurement, installation, and maintenance by making use of already-existing technology and resources. By taking this cost-cutting approach, transit agencies can better organize their resources, putting money toward other important areas of service extension or enhancement. All things considered, the combination of bus drivers manually entering stations and users receiving real-time updates through the mobile app is a workable and affordable way to track buses and provide passenger information.

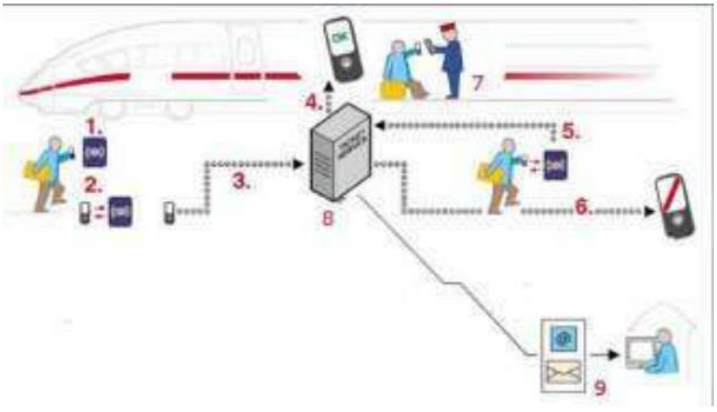

Fig 6.1 Typical use of system[6]

Start of the journey
1-Passenger places his mobile phone near an RFID tag or reads a QR barcode at the check-in point on a station. 2-Application on mobile phone gets the name of the station.
3-Application sends a request for issuing a ticket to the server.
4-Application on the server authorizes the user and sends a back ticket in the form of QR code or confirmation of a valid prepaid ticket.
End of the journey.
5-Name of the check-out station is read from an RFID tag or QR code and sent to the server.
6-Server finalizes the journey.
Ticket verification
7-A conductor uses an application on his Android mobile phone to read the ticket from the screen of the passenger's phone and verifies it.
Calculating the fare
8-Based on the known check-in and check-out station, the application on the server calculates the fare.
9-Users receive receipts for their past journeys on the SMS. [6]

VII. RESULTS

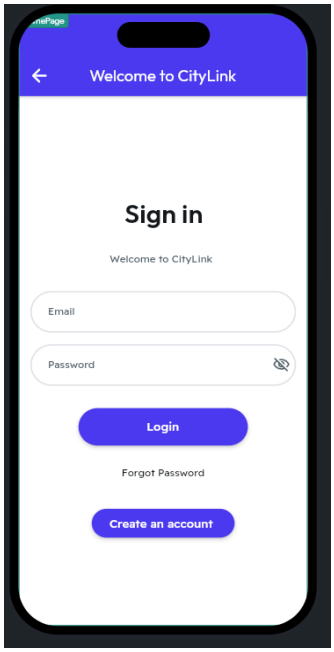

Fig 6.1 Sign-in page

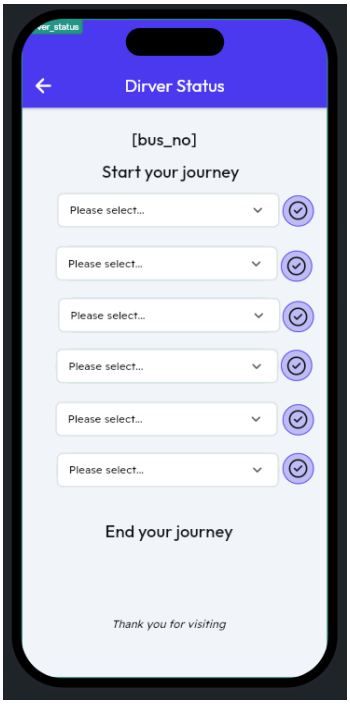

Fig 6.2 Driver page

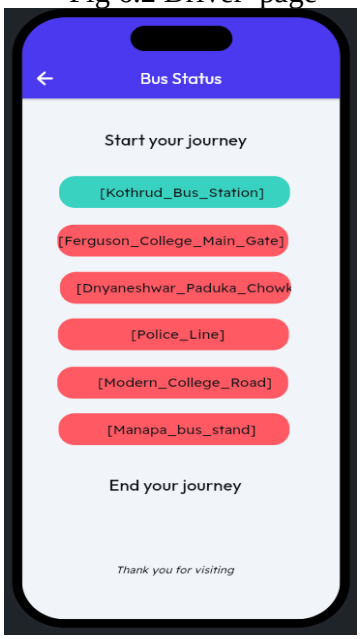

Fig 6.3 Live-Status

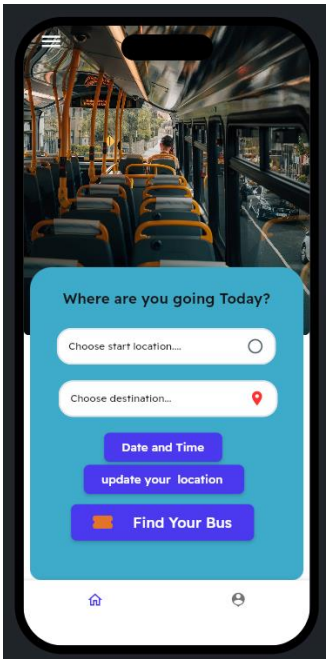

Fig 6.4 Home-Page

Document ID	Kothrud_Bus_Station	bio	bus_no	c
AEumimmpaNaJP6pu0oXOGqP3Xos2	"Kothrud Bus Station"		"25"	
O34hfc3JLGalEMOfIW0k3LhbCmk1				
k9p9e5dt7fUkrosCIWMs2cIsSBa2				
ubUN9LrMPJOf2zrI4uSyirOYtL93			"MH12AB9804"	
xvD891qqf7Ve4RCjTJi2gzWxRE03				
zsQv8zcyzdRu3U7QiPHgAnDLIF22		"hello citylink"		"l

Fig 6.5 Database

IX.CONCLUSION

To sum up, the combination of Firebase and FlutterFlow has made it possible to create a state-of-the-art bus tracking app that is transforming public transit. Using the powerful backend services of Firebase and the user-friendly visual UI builder of FlutterFlow, we have developed a feature-rich and easy-to-use solution that satisfies the requirements of both passengers and contemporary transport systems.

We have shortened the development process and produced a scalable, dependable, and secure bus tracking application by seamlessly integrating Firebase's real-time database and authentication services with FlutterFlow's fast prototyping capabilities. We were able to swiftly develop and refine the application's frontend with FlutterFlow, guaranteeing a slick and adaptable user experience on a range of screens and devices. In the meantime, Firebase's backend services enabled smooth user authentication, effective data management, and real-time bus location tracking, giving users instant access to accurate and current information.

Furthermore, the FlutterFlow and Firebase integration provides developers with unmatched speed and flexibility, making it simple to incorporate sophisticated features like analytics, user feedback, and push alerts. We are able to provide a feature-rich bus tracking application that improves the overall passenger experience while increasing the effectiveness and convenience of public transportation systems because of the synergy between frontend and backend technologies.

In conclusion, the effectiveness of using Firebase and FlutterFlow to create our bus tracking app demonstrates the strength of contemporary app development tools and technologies. Through the utilization of Firebase's backend services and FlutterFlow's frontend development capabilities, we have developed an advanced yet approachable solution that raises the bar for public transit apps. We are dedicated to giving transit agencies and riders a dependable, effective, and pleasurable bus tracking experience as we develop and improve our offering.

X.REFERENCES

[1] Gajewska, T., & Walczyk, D. (2023). Development of Transport Management Software. *Sustainability*, *15*(15), 12083.

[2] Habermann, A. L., Kasugai, K., & Ziefle, M. (2016). Mobile app for public transport: A usability and user experience perspective. In *Internet of Things. IoT Infrastructures: Second International Summit, IoT 360° 2015, Rome, Italy, October 27-29,015,RevisedSelected Papers,PartII*(pp.168-174)Springer International Publishing.

[3] Dr. D.Vakula and Bandari Raviteja (2017). Smart Public Transport for Smart Cities. Proceedings of the International Conference on Intelligent Sustainable Systems (ICISS 2017) IEEE Xplore Compliant - Part Number:CFP17M19-ART, ISBN:978-1-5386-1959-9

[4] Deb, K., & Filippini, M. (2013). Public bus transport demand elasticities in India. *Journal of Transport Economics and Policy (JTEP)*, *47*(3), 419-436.

[5] de Feijter, R., Evers, J. J., & Lodewijks, G. (2004). Improving travel-time reliability by the use of trip booking. *IEEE Transactions on Intelligent Transportation Systems*, *5*(4), 288-292.

[6] Finžgar, L., & Trebar, M. (2011, September). Use of NFC and QR code identification in an electronic ticket system for public transport. In *SoftCOM 2011, 19th* International Conference on Software, Telecommunications and Computer Networks (pp. 1-6). IEEE.

[7] Singh, S. K. (2005). Review of urban transportation in India. Journal of public transportation, 8(1), 79-97.

[8] Maruthi, R., & Jayakumari, C. (2014). SMS based bus tracking system using open source technologies. International Journal of Computer Applications, 86(9).

[9] Kenteris, M., Gavalas, D., & Mpitziopoulos, A. (2010, June). A mobile tourism recommender system. In The IEEE symposium on Computers and Communications (pp. 840-845). IEEE.

[10] Maithili Dhule (2018).NFC Based Smart Urban Public Bus Transport Payment System. 2018 3rd International Conference for Convergence in Technology (I2CT) The Gateway Hotel, XION Complex, Wakad Road, Pune,
India. Apr 06-08, 2018

[11] Varun Kaushik; P. Suhas,"Fool Proof Ticketing System for Public Transport ",Proceedings of the International Conference on Communication and Electronics Systems
(ICCES 2018)

[12] WenjingXue, Dong Wang, Linbing Wang' " Monitoring the Speed, Configurations, and Weight of Vehicles Using an In-Situ Wireless Sensing Network" IEEE Transactions On Intelligent Transportation Systems, Vol. 16, No. 4, pp . 1667- 1675, August 2015.

[13] Ha DuyenTrung, Pham Tien Hung, Nguyen DuyKhanh, and Hoang Van Dung, "Design and Implementation of Mobile VehicleMonitoring System based on Android Smartphone", 2013 Third
World Congress on Information and Communication Technologies (WICT)-IEEE, 2013.

[14] Rajesh Kannan Megalingam, Nistu\ Raj, Amal Lehar Soman, Lakshmi Prakash, Nivedha Satheesh, Divya Vijay "Smart, Public Buses Information System" International Conference on
Communication and Signal Processing, April 3-5, 2014, India

[15] System of German railways for paying train rides with mobile phones, http://www.touchandtravel.de/site/touchand travel/ de/start.html, 2010.

[16] System for mobile payments Moneta, http://www.Moneta.
si/predstavitev/postopek_placevanja/lpp, 2010.

[17] Austrian railways web portal for buying tickets, http: //www.oebb.at/de/Fahrkarten/Online-Ticket/index.jsp, 2010.