

## APPLICATIONS AND BENEFITS OF USING KIOSKS AND INTEGRATED KIOSK SOFTWARE IN EDUCATION SPHERE

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***Abstract:** This article argues the use of the kiosk-terminal device, emphasizing the benefits it brings through its applications in our lives. The problems with the existing system of kiosk terminals, built on the campus of the University of Ruse "Angel Kanchev", its advantages and disadvantages are discussed in detail. Based on this analysis, the need for change in the established system is substantiated. The decision for updating the existing solution, the characteristics of the new system, how it is built and what components it consists of are described in detail.*

***Keywords:** Kiosk, Web application, Information, New technologies.*

### INTRODUCTION

In the XXI century, information has become a major resource supporting the development of all spheres of modern life. Access to information is available to any average person with a smart device (often carried in their pocket), internet connectivity and an average level of computer literacy. These are powerful resources through which miracles can be achieved (Kallweit, K., Spreer, P., & Toporowski, W., 2014).

However, information does not always have to be accessible to everyone. Large enterprises and organizations often have internal networks (LANs), respectively internal information, available only to its employees (The World Bank, 2020). This data can be used by computers connected to this network or through dedicated devices - computer terminals called kiosks.

In the Bulgarian language, the word "kiosk" has entered the meaning of a computer terminal that provides access to digital information. The modern meaning of the term is influenced by the introduction of the iconic British red telephone booth (kiosk), which has influenced society in an unprecedented way, allowing connectivity and exchange of information between people (Kiosk Bulgaria Ltd., 2021).

The first self-service interactive service kiosk, has been developed in 1977 at the University of Illinois, was designed to provide information about the campus and managed to attract more than 30,000 people in just the first six weeks of its opening (Berry, L. L., Seiders, K., & Grewal, D., 2002). It was followed by the first kiosk connected to the Internet, shown in 1991 at an exhibition of computer dealers with the main purpose of locating missing children (Frantz, S., Durlak, R., 1992).

In the early years of the new millennium, interactive kiosks began to appear everywhere, providing visitors with plenty of information, as well as services, and today there are, indeed, kiosks that can meet all needs in every sphere (Ivanov, S., & Webster, C., 2017).

## EXPOSITION

### Kiosk-terminal - essence and application

Kiosk-terminal (or simply kiosk) is a type of computer set to use a narrow set of tools or to perform specialized tasks in a given area (Fig. 1). Kiosks can be of different shapes, sizes and accompanying peripherals (keyboards, speakers, scanners, barcode readers, printers, etc.). An obligatory element of every kiosk nowadays is the connection to the Internet, as kiosks are devices designed for quick and easy access to information - whether publicly available or with limited access.

Kiosks are an old but not so common technology (especially in our latitudes). However, this trend is starting to change in recent years, and lately we see more and more devices of this type all around us. Kiosks are widely used in all areas of our lives, as they are computers and as such can be very easily adapted for use for various purposes. Moreover, they interact with a wide range of connected devices (Interactive kiosk, 2021).



Fig. 1. Common looking kiosk terminal

These devices are used in different places and in different areas such as:

**Trade and tourism** – placing kiosks in larger stores or malls, in order to make it easier for visitors to find information about a product or service simply and quickly, without the need for the assistance of a sales consultant. It is also possible to run short commercials in order to acquaint the user with the new discounts and goods offered in the store.

**Banks and financial institutions** – setting up information kiosks in order to acquaint visitors with the operations they can perform in the institution, as well as the order of events when performing a financial operation. The kiosk also offers the opportunity to play short informational videos, acquainting the potential user with new intriguing services that the institution offers - an easy marketing campaign.

### The software providing operation of the kiosk terminals

The software that serves the needs of a kiosk terminal can be conditionally called a kiosk software/application. Often this software is a combination of a well-chosen operating system and application software, tailored to serve the needs of the area, in which the kiosk will be used.

The operating system that kiosk terminals use is the most common version of Microsoft Windows, current at the time of launch of the kiosk - Windows XP, Windows 7, Windows 8.1, Windows 10. Another freely available alternative to the operating system are the distributions of the Linux kernel, as they offer much greater system stability. Ubuntu ecosystem distributions, such as Lubunty and Ubuntu Mate, are particularly suitable for use on a kiosk terminal. Other suitable distributions are Linux Mint and Fedora OS Light. These distributions use a minimal amount of machine hardware resources, which means that the rest of the hardware resources can be employed by the application to provide the user with a pleasant and smooth operation of the device. It is important when selecting the OS to thoroughly review the specification of the user interface, as one of the key parts is the support of touchscreen technology. 98% of kiosks do not have an external keyboard or pointer to control the content, so touchscreen technology is extremely important for working with such a device.

The application that runs on the kiosk terminal may vary depending on the field in which it is used. The alternatives for implementation are many and varied, but the most common are 3 main ones: use of Windows 10 Kiosk mode; use of an application program launched in kiosk mode (Scalefusion Kiosk Software - PC & Mobile); use of a web browser (Mozilla Firefox, Google Chrome, Microsoft Edge) to preview a website used as an application. All three methods have their advantages and disadvantages, but in recent years the use of a web application running on a web browser has become predominant as it is the most widely available and the easiest to maintain and manage.

Regardless of which operating system and application method is selected for the respective need, it is important for the software to work as stably as possible, with minimal "crashes, interruptions, bugs", etc. It is also necessary to build mechanisms for automatic response of the software in the event of an irregularity.

### **Benefits of using kiosk terminals and their applications in education**

Every country needs educated young people. They are its future and the most valuable resource, so the goal №1 of educational institutions should be to modernize the educational system, learning environment, textbooks and facilities. This would maintain a high level of interest and will provoke a desire for successful learning in students. Kiosks are a good addition to the learning environment and facilities of a school, and help students to be always informed, which has a positive impact on the learning process. Quick and easy access to any information is crucial for all visitors to the institution - students, teachers, students, teachers, staff, external visitors.

Some possible applications that kiosk terminals offer:

- Providing personal information for students;
- Free internet access;
- University / school map;
- Legislation;
- Curriculum references;
- Information for the program of all teachers;
- References for teachers - office (s), office telephones, titles, disciplines.

### **Application of kiosk terminals at the University of Ruse "Angel Kanchev"**

More than 10 kiosk-terminal devices are located on the territory of the university. There are two varieties – two "large" and a number of "small" kiosks. They are located mainly in the Main building and in the newly built Second Building, with one terminal in each of the other buildings. The information system was installed at the university about 14 years ago, and it faithfully served the students and faculty at the time. Due to certain circumstances, as well as due to the already outdated hardware and software, for a long time this system was rather unnecessary than helping the learning process.

After joining ICSC (Information and Computer Service Center), Multimedia Department, I gradually began to get to know the existing system implemented in the kiosks. The more I became interested the more I realized that this system had long been ineffective and did not help students and faculty, and that kiosks had become mere advertising screens for clubs held at the university, as they are often overlooked. I felt it was time for a change, and then I was inspired to build this new system from scratch.

### **Old vs New system**

The complete system, which was integrated on the kiosk terminals, was created 14 years ago, which is a long time, especially when it comes to software. One of the reasons for the "decline" of the system is the lack of a team to maintain it. The kiosks had Windows XP SP3 (later upgraded to Windows7, 8.1, 10), and each machine had its own hard disk drive (HDD). The software used for the kiosk application was a combination of the long-outdated Microsoft Internet

Explorer 9 and a web application written on already unsupported web technology, also owned by Microsoft.

The old kiosk system creates a lot of problems and currently has a number of shortcomings. Here are some of them:

- Common cases of misuse of the kiosk device – opening web pages and applications to which the end user should not have access;
- Reaching terminal cases where the user cannot return to the kiosk web application;
- Frequent cases of unexpected interruption of the application itself and/or the browser on which it was running;
- Frequent servicing of the device due to instabilities and malfunctions related to the operating system itself;
- Outdated and unfriendly design, which leads to a brief retention of the user's attention;
- Lack of responsive web design – designing the user interface so that it changes according to the screen size of the respective device;
- Lack of application inactivity mechanism – It has often happened that a kiosk terminal stays in the same view/page for days until the next user arrives and he returns it to its original view.

In summary, it can be said that the system is not up-to-date, modern and most importantly - does not fulfill its purpose, namely to serve students, faculty and staff of the university. Problems with legacy systems like this often cannot be fixed by updating, upgrading, etc. In this case, the lack of access to the source code of the old application required the construction of a new system from scratch.

### **The new system and its development process**

The construction process started from the beginning, so I decided to start from the lowest layer of the system - the hardware. I looked at the available hardware base of the devices and moved on to exploring the possibility of implementing an operating system that takes up minimal hardware resources of the devices. Then I moved on to the selection of a methodology for delivering the kiosk application to users. It was best to use a web browser running in "kiosk" mode and visualize a web application on it. The longest stage of the development of the whole system was the stage of designing and writing the web application. The last stage, which was the most dynamic of all, was the commissioning of the system on the territory of the university.

Detailed description of the components of the new system:

**Hardware** – It started with an analysis of the available hardware resources that kiosk terminals have. During this stage, a detailed analysis of the hardware of each device located on campus was made. This included a site visit and use of the available operating system or system BIOS to collect information about hardware components such as the CPU, Motherboard, RAM, Network Card, make and model of the touchscreen panel on the screen and others. After analyzing the information gathered, it was found that most devices have outdated hardware. This guided the idea of the next step in the development of the system, namely finding a suitable operating system.

**Operating system** – The operating system must have a minimum consumption of hardware resources. This left as an option various Linux distributions. The following OSes were analyzed: Lubuntu, Xubuntu, Ubuntu Mate, Linux Mint, Zorin OS Lite. Two of the distributions met the requirements - Lubuntu and Ubuntu Mate (Ubuntu MATE for a retrospective future, 2021). Although Lubuntu has a few percent lower resource consumption, I chose to use Ubuntu Mate because of the operating system's graphical shell. The user interface to support touchscreen technology was crucial. Ubuntu Mate uses the Gnome Shell – a common GUI shell in the Ubuntu ecosystem. This user interface is built with integrated touchscreen functionality, making it ideal for this purpose.

**Drivers** – After analyzing the hardware and choosing an operating system, I came to choosing the appropriate drivers. Fortunately, the minimal installation of Ubuntu Mate, like any

other Linux distribution, offers a driver package suitable for the available hardware devices. The problem at this stage of development was finding suitable drivers for the additionally applied touchscreen matrix on the kiosk screen. Because the technology is not built into the screen, but is upgraded, Ubuntu Mate did not detect the screen as a touchscreen and therefore did not apply a driver to manage the matrix. This posed the difficult task of finding compatible drivers for each of the matrices, as well as applying and configuring them. Unfortunately, due to the fact that the matrices are of Asian and old origin, finding the right drivers was a real pain, and for some screens to this day no suitable drivers have been found.

**Network card and PXE Boot setup** – One of the problems I wanted to solve with the new system is the labor-intensive maintenance of the software (and parts of the hardware) of the kiosk terminals. In the event of a software problem or a desire to upgrade the system, a site visit had to be made, which was not always possible to happen quickly and unnoticeably. I started researching options to eliminate the problem, finding a solution through the *PXE Boot* network technology (PC Deployment over network using PXE environment, 2021). *Pre eXecution Environment* is a method for booting a client computer using only its network card, therefore the presence of a storage device is not required. This technology allows the device to be started via a signal sent over a local network and loading OS Image, in order to use the centralized distribution of one operating system and software configuration to all other machines on the network. This solves the problem of system maintenance and upgrades by eliminating one hardware component - the available HDD or SSD on the machine, and the use of a centralized OS Image solves the problem of easily distributing the update to the machines.

**Web Browser** – Choosing a browser was not difficult. I knew from the beginning that I wanted to use a Chromium-based web browser, because I had worked with its V8 Engine for a long time before and I knew its capabilities well (V8 documentation, 2021). Google Chrome was chosen because of its stable and trouble-free operation, as well as because of its wide range of browser extensions. The web browser is used to visualize the web application running at the kiosk. Due to the built-in kiosk mode, the integration of the browser for the purposes of the kiosk happened easily and fast.

### Web application - interfaces, modules and user types

The design, development, coding and testing of the web application was the longest and most laborious stage of the system development. The application consists of two main components – user and administrator. The user (client) part consists of two main views: Home page/Main menu and Page-Preview page.

The home page (Fig. 2.) has 3 main components: A feed with current news published on the website of the university; Panel containing the logo and the name of the university, subtitle, exact time and current weather forecast; Main menu – navigation for the main pages of the application.

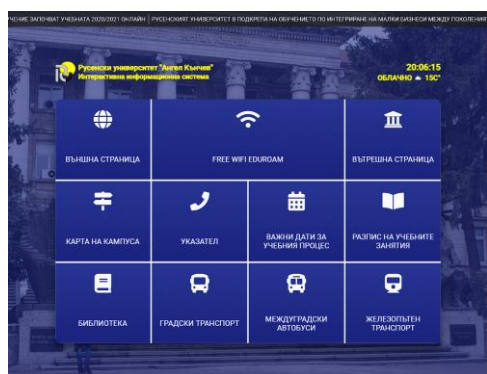


Fig. 2. Application`s Home page (Main navigation menu).

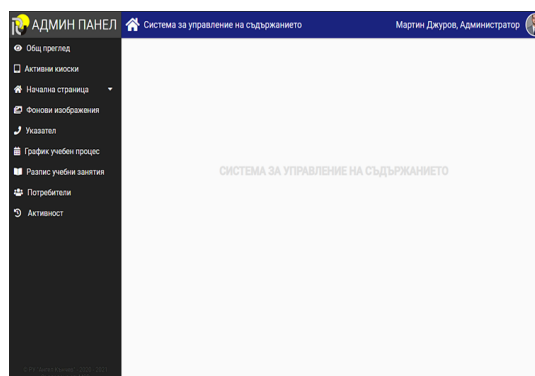


Fig. 3. View of the home screen, of the content management system, when a user of the "administrator" type logs in.

Administrator component (Content Management System) (Fig. 3.) – This part of the system is designed to administer it, as well as change the content that users of the application see and use. The admin panel is accessed from a hidden url, inaccessible from the client side of the application. This part of the application has features separated by access levels. Only users with pre-created profiles and access rights - administrator and editor - have access to this part of the application.

## **CONCLUSION**

The user is the supreme judge! – After the launch of a system comes the most nerve-pulling moment for a developer, namely – whether the system will cope with its users, or not. Fortunately, the integration of the system went smoothly and successfully, receiving quite a good feedback from colleagues and teachers, as well as great suggestions for upgrading the system and application in the future releases.

## **REFERENCES**

- Berry, L. L., Seiders, K., & Grewal, D. (2002). Understanding service convenience. *Journal of Marketing*, 66 (3), 1-17. <https://doi.org/10.1509/jmkg.66.3.1.18505>
- Frantz, S., Durlak, R. (1992). "Interactive computer kiosks for vertebrate Ipm—status report", *Proceedings of the Fifteenth Vertebrate Pest Conference*. URL: <https://digitalcommons.unl.edu/vpc15/29>, (Accessed on 28.05.2021).
- Interactive kiosk – open-source information. (2021) Wikipedia – the free encyclopedia, URL: [https://en.wikipedia.org/wiki/Interactive\\_kiosk](https://en.wikipedia.org/wiki/Interactive_kiosk). (Accessed on 16.04.2021).
- Ivanov, S., & Webster, C. (2017). Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies – a cost-benefit analysis. *International Scientific Conference “Contemporary tourism – traditions and innovations”*, Sofia.
- Kallweit, K., Spreer, P., & Toporowski, W. (2014). Why do customers use self-service information technologies in retail? The mediating effect of perceived service quality. *Journal of Retailing and Consumer Services*, 21 (3), 268-276. <https://doi.org/10.1016/j.jretconser.2014.02.002>
- Kiosk Bulgaria Ltd. (2021). Webpages „Applications“&„Kiosks“. URL: <http://www.kioskbg.com/applications.htm>, (Accessed on 16.04.2021).
- PC Deployment over network using PXE environment. (2021). URL: <https://download.paragon-software.com/doc/PCDeployment.pdf> (Accessed on 28.05.2021).
- The World Bank, (2020), Automated Teller Machines (Atms) (Per 100,000 Adults), URL: [https://data.worldbank.org/indicator/FB.ATM.TOTL.P5?name\\_desc=true&page=1](https://data.worldbank.org/indicator/FB.ATM.TOTL.P5?name_desc=true&page=1), (Accessed on 28.05.2021).
- Ubuntu MATE for a retrospective future. (2021). URL: <https://ubuntu-mate.org/>. (Accessed on 28.05.2021).
- V8 documentation. (2021). URL: <https://v8.dev/docs> (Accessed on 28.05.2021).