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## AUTOMATION OF TELLER/COUNTER SERVICES IN SMART CITIES CONCEPT USING UNIVERSAL DIGITAL DEVICES

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**Abstract:** This paper considers, proposes and describes possibilities and methods of using digital electronic technologies for transformation of classical way of teller/counter services in cities and municipalities into modern automated and robotic digital teller/counter services. It is proposed that in the smart cities and municipalities concept for such services be used specially designed universal digital devices. Practical way of transformation in offering and organisation of teller/counter services in the smart city using specially designed digital devices is proposed and described in the paper. Proposed specially designed digital device for such application and way of its usage are also described. Advantages of using digital technologies and digital teller/counter services in comparison with classical way of teller/counter offering are given.

**Keywords:** Digital electronic technologies, Information technologies, Teller/counter services, Smart cities, Universal teller/counter devices/terminals

### I. INTRODUCTION

The impact of modern information and mobile digital technologies is visible in all business segments and activities. That impact is so strong in some areas of business and human work that it requires major and significant changes in the way of organizing and providing many services. For example, book publishing, as well as music industry jobs, have already undergone drastic changes. Also, major changes are to be made in the way how banks and whole financial sector are organized and how provide services [1]. Very similar situation is in the organization and functioning of services provided by institutions of cities and municipalities (especially in the concept of a smart digital city) where faster, more efficient and cheaper teller/counter services are required [2].

Smart city is town or urban area that uses different types of electronic sensors to collect data and use that data to manage efficiently its all property and resources [2]. That concept includes data collected from citizens, devices, and property that is analyzed to monitor and manage all community services. Smart city concept integrates efficiently all information and communication technologies and different devices connected to the city computer network to optimize the efficiency of city operations and services.

This paper considers problem of providing and organizing teller/counter services offered by the smart city in the spheres that are covered by the city institutions. That is mainly related to solving problems of modernization and robotization of the services currently provided in the cities and municipalities (e.g. issuing of birth certificates and various other certificates). But, this concept and in this paper proposed solution can also be used for automation and robotization of other similar services, such as e.g. issuing of city transport tickets, tickets for theatres, cinemas, services related to the city tourist offer, etc..

Possibility and way to apply modern digital electronic technologies for effective transformation of classical way of teller/counter services offering into digital robotization and automation way are considered, proposed and described in the paper. Concrete model of the digital teller/counter device and its application are also proposed and given.

### 2. PROVIDING TELLER/COUNTER SERVICES USING MODERN DIGITAL TECHNOLOGIES

Until recently, the provision of teller/counter services was only possible by using of the human workforce. The degree of automation with the use of existing technologies still requires necessity of use of human labour in the provision of teller/counter services.

However, with the occurrence of new digital technologies, it is possible, with the proper use of certain hardware and software, to implement a fully automated and robotized device/terminal that can provide certain teller/counter services without the presence and assistance of teller/counter workers [3]. The benefits of that type of providing and offering of such service are many [4]:

- Providing of the service is no longer limited to the working hours of the institution providing the service, and the service is available non-stop (of type 24/7/365),
- Customer may choose, in accordance with his/her needs and other obligations, right time to receive the service,
- Number of places where that service can be obtained can be much higher than before,
- Organization of the provision of the service and the place from which the service is provided is simplified,
- Cost of providing services is significantly reduced, leading to a decrease in the prices of these services,
- In order to simplify of service offering, due to possibility of free choice of time by the user, and because of reduction of the cost of the service, it is realistic to expect increase in the number and types of such services,
- User becomes more satisfied because of all mentioned reasons.

For the city institutions providing various types of services to citizens and visitors, one of the important elements in the implementation of the so-called „Smart city concept“ is to place digital multifunctional smart devices in adequate locations in the city. Their purpose is to automate and robotize the way of offering teller/counter services. Some of the most significant and the most important such services that could be realized in a smart city, using the device proposed and described in this paper are:

- Citizenship excerpt,
- Marriage certificates,
- Birth certificate,
- Children birth certificate,
- Payment of real estates and taxation,
- Various types of certificates and power of attorney,
- Cadastre services,
- Theatre, museum and cinema tickets,
- Parking fees,
- Charging of electricity,
- Water utility bills,
- Communal utility bills,
- Annual, monthly and daily tickets for various types of city transport,
- Education related services,
- Tourist services,
- Other city services offering from companies engaged in teller/counter service activities.

The basic requirements of users of these services have always been availability, ease of delivery, quality, speed and affordable price [5]. It is clear that with the conventional (traditional) way of providing these services, the first problem was and remains, accessibility. It is very difficult to arrange availability as user would like. Problem is because the institutions that provide that services have such working hours that most often coincide with the working hours of the users. That causes the situation in what the user is needed, in order to obtain the desired service, to seek in his company permission to interrupt his work during working hours and to go to an institution, which provides the service that the user wants or has to finish. That creates problems and dissatisfaction for both the user and his employer.

In order to improve availability of services performed in the classic way, more working shifts should be introduced and more workers should be employed. That kind of organization not only leads to the need to hire more teller/counter workers, but also to need for other staff who are essential for that work process. Also, the cost for maintaining of such workplace (e.g. security providing costs, etc.) is increased. Increase in the number of workers and other costs also affects the cost of the corresponding services, that results in increase of the prices of these services. From all this, one thing can be clearly seen: the basic problem of such organizing of greater availability of services is the fact that the basic demand of the users (the greater availability) is not satisfied.

In order to increase availability, quality and speed and decrease the price of services delivery in smart cities, it is necessary to make a different approach to organization of these services. It is proposed that following should be done:

- Simplify (automate) the process of providing a specific service,
- After automation of the service offering, the service should be robotized using modern digital information technologies,

- Implement an adequate software solution that will fully support the robotization of the process,
- Design a hardware solution that will incorporate and fully support adequate software solution with the aim of fully automated and robotized service delivery.

By the introduction of an automated and robotized digital teller/counter device or terminal, which for many services can be an adequate replacement for a classic teller/counter, the availability of the service can increase to the level of 24/7/365 availability type. Such, it meets basic user requirements, availability. Higher availability raises quality of services and increases the speed of service delivery. Job automation and service robotization reduce service costs. It fulfils all the basic requirements of the user. There is also much higher level of customer satisfaction than in the traditional way of providing these services.

### 3. PROPOSED UNIVERSAL DIGITAL DEVICE AND ITS APPLICATION IN SMART CITY

The universal teller/counter device proposed here can own and use a wide range of hardware components. Depending on the type of services the device is intended for, adequate hardware components can be selected and used. Only in very rare cases would be needed and used all possible hardware components given in this paper.

Proposed basic hardware configuration of universal digital teller/counter device/ terminal consists of [5]:

- Housing,
- Power supply (UPS),
- Desktop computer – industrial standard,
- Touch screen display (“22),
- Light for better picture.

To achieve satisfactory user authentication the following components can be used, individually or in combination:

- Webcam,
- Personal document ID and passport scanner with OCR software,
- Barcode reader,
- QR code reader,
- Fingerprint scanner,
- Signature pad.

This equipment can be used in combination for stronger authentication or it can be used only one method of authentication. POS device and electronic cards can be also useful for user authentication. Webcam is in most cases used in combination with Passport Scanner (with OCR Software), to use face recognition method for user authentication.

Service charges can be paid through the following devices, individually or in combination:

- Payment with bank notes, top up and recycler,
- Payment with coins, top up and recycler,
- Payment with credit/debit bank cards via EFT POS.

The final service result of the performed service using the universal digital teller/counter device/terminal, as well as printing receipts for payment of the service, can be achieved using the following devices:

- Printer device (usually A4 format),
- POS printer for printing receipt on thermal paper,
- Color card printer.

For purpose of better automation of payment of different bills, A4 scanner can be used.

Also, some additional devices can be used as options for the device improvement:

- Instant issuing of mobile phone SIM cards,
- Plastic card color printer,
- Phone set (for offering help service, usually via Call Centre),
- Additional advertising 22” monitor (for commercial and marketing reasons),
- Dual iris camera.

Figure 1 shows the proposed hardware solution of the universal digital teller/counter device/terminal for usage in smart cities. The shape of the device itself can be completely adapted to the specific purpose, necessary implemented services and conditions of the space in what it would be placed and installed [6]. It is important that adequate software solution is implemented and provided, which adequately communicates with the hardware components. Such the housing of the devices can be designed that all the necessary hardware components can be placed in. It must be taken care to ensure that all hardware components are easily accessible to service personnel.



Figure 1 shows the universal digital teller/counter device in case it functions to support providing of services offered by the municipality and the city in a broad sense. It is envisaged that the identification of the user is performed using personal ID or passport, so that the device communicates with the data base of the competent institution. Additional verification, if necessary, can be performed using a built-in Web camera and face recognition software solution. Payment of costs for obtained services can be performed via built-in POS device and electronic payment cards or by accepting cash, with possibility of returning cash change. Various types of documents can be printed, which are otherwise obtained in the city or municipality buildings, depending on the type of service required and selected. Also, using built-in scanner it can be read invoices and bills, automatically printed on electronic payment slips and performed payment very easily, without having to fill out electronic payment slips, using the touch screen. There is also support for the issuance of various types of tickets, such as e.g. tickets for theatres, cinemas, various types of public transportation, etc.

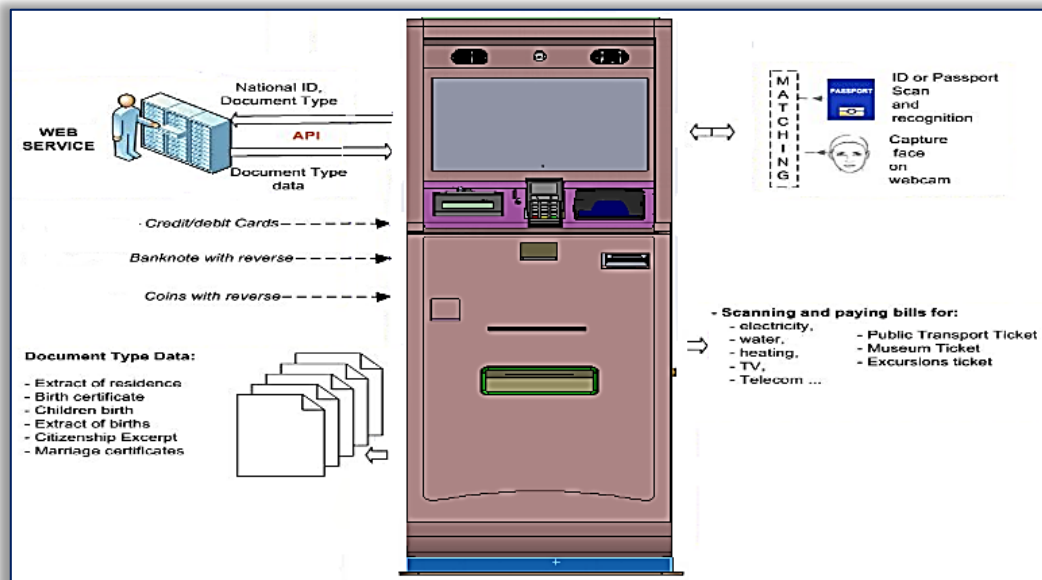


Figure 1 - Proposed model of universal digital device/terminal for teller/counter services in smart city

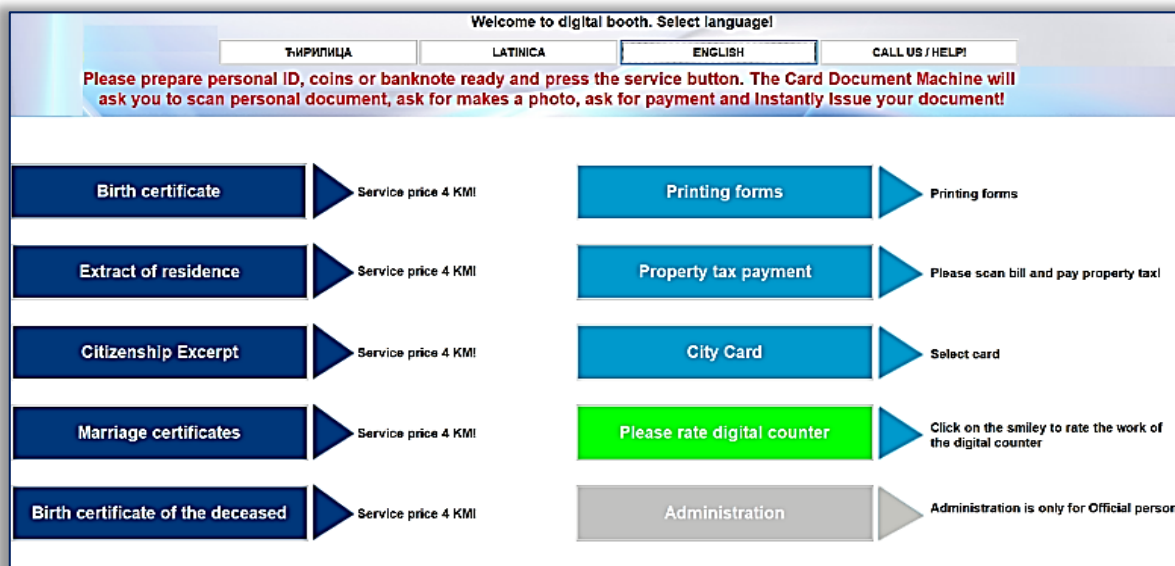


Figure 2 - Main menu of software solution implemented for needs of smart city and municipality

This universal digital teller/counter device is connected to computer network and appropriate database of the city or municipality. That enables the device to receive all the necessary data through that network, as well as to send the data it has collected to the necessary places, all according to the needs and realization of the specific service.

Figure 2 shows the main menu of the software solution (application) of the proposed universal digital device/terminal for use in smart cities and municipalities. This menu is displayed on the touch screen display of the device. It shows what type of services can be implemented on that device and what services are offered to users. Also, it shows how much each type of service costs, in case that service is paid. The user selects

desired service by pressing appropriate option on the touch screen display. Then, the appropriate submenus are opened, what further lead user through the application to desired result, i.e. until final realization of required service.

All these activities are organized and realized in a logical order and they are very simple to use. So, the user can easily and intuitively navigate from option to option and to final realization of required and desired service.

It is clear that the software solution, in order to be functional and not to be a factor of user rejection, must be so realized that its operation is very simple, easy and logical. Such, it can be easily used by all age groups of users. It is also advisable to support and provide multilingualism when using all services. That is especially important for those services that are expected to be used by customers coming from other areas, foreigners, tourists, etc.

#### 4. CONCLUSIONS

It is very clear that serious changes should be implemented in the way of offering and realization of teller/counter services in the future. The changes will be implemented applying modern digital and mobile electronic technologies and systems. The same situation is also in application of such functions in the smart cities and in such concept. The way how to perform it can vary in accordance with the specific factors, needs, services and applications. Here is proposed and described one of possible and the most expected ways for implementation and automation of teller/counter services in smart cities and their institutions.

By using proposed universal digital devices/terminals it will be enabled implementation and automation of all possible and needed teller/counter services in all cities and municipalities and in all their institutions that use and offer such services. Also, by very simple way of needed hardware selection and configuration and needed software adaptation it will be very easy to create appropriate devices for needed services. Proposed and described modular way of design and implementation of the devices and their way of application will also enable very simple using devices and very simple and easy obtaining and performing of all needed services by the users. The main advantages of such solution compared to traditional way of offering such services is speeding-up the services and possibility that they can be finished instantaneously. In comparison of this solution with mobile applications and mobile solutions the main advantage is extremely high security of user identification.

Speed of introduction of all mentioned activities and technologies in cities and municipalities will depend largely on the speed of adoption and introduction of necessary legal regulations. It is mainly related with introduction of the digital signature and other regulations that should make these activities and services simplified and simpler. Speed of introduction of such services and systems will also depend on the degree of clients pressure to the cities and city institution to provide and use such services. It is recommended that city representatives as soon as possible organize such activities and introduce such digital systems in order to more readily accept these changes.

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