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# SMART UNIVERSAL MULTIFUNCTIONAL DIGITAL TERMINAL/PORTAL DEVICES

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**Abstract:** This paper considers, proposes and describes possibilities and methods for design, implementation and usage of smart digital universal multifunctional terminal/portal devices in many practical applications. Using digital electronic technologies embedded in such devices it is possible to design and implement smart digital terminals/portals for very wide variety of purposes of teller/counter type operations, where such digital machines can replace human work. It is expected that this kind of digital devices will be in perspective widely used in all places where there is needed a certain form of teller/counter services. Such places are for example: banks, post offices, municipalities, companies providing services such as electricity and water distribution, hotels, schools, universities, parking places, theatres, cinemas, various types of transport, etc. Application of different types of such embedded smart digital universal devices enables increasing efficiency, speed and security and decreased costs for all such services. It gives many benefits and advantages to the providers and to the users of such services. Way of design and use of such digital devices and technologies to effectively increase functionality and efficiency of teller/counter services is proposed and described. It is also proposed and described one practically designed and implemented smart universal multifunctional digital terminal/portal device for banking purposes.

**Keywords:** digital electronic technologies; embedded systems; teller/counter type services; smart universal multifunctional digital terminal/portal devices; banking smart digital terminal/portal device

## INTRODUCTION

Modernization of almost every kind of teller/counter type operations and services necessarily involves introduction and application of modern digital devices based on using different kinds of digital electronic technologies, automation and robotization and carefully designed software applications. It all increases efficiency, speed and security and decreases cost of such activities and services.

It also brings many other benefits and advantages for providers and for users/clients of teller/counter services. That all creates need for transformation of teller/counter services from classical way with using human work into modern digital organizational model [1,2,3,4]. It assumes creation and application of modern digital devices for performing all needed teller/counter and similar activities and services. One such device is smart universal multifunctional digital terminal or portal that is proposed and described here.

Possibility and way of application of modern digital electronic technologies for design and implementation of embedded devices such is smart universal multifunctional digital terminal/portal for effective transformation of classical to modern way of offering teller/counter type services are considered, proposed and described in the paper. Way of design of the smart universal multifunctional digital terminal/portal device was proposed and described.

The device was practically designed and implemented as banking digital terminal/portal. It could be easily adapted for

many other similar applications in many other purposes and domains.

## CLASSICAL AND MODERN WAY OF PROVIDING TELLER/COUNTER SERVICES

The classical way of providing teller/counter type services, using a human workforce, is a very well known and still is predominant way of organizing and offering of those services. The basic advantage of providing those services in this way is physical personal (human) contact of person providing the services and users of the services. Another advantage would be possibility to provide quality information to the customer about the services. Also, it enables provider to direct the client to correct place in case of need for additional services and other useful information for clients. However, as modern teller/counter services become more and more standardized (template based) the mentioned benefits are becoming less important.

The dominant user requirements in the use of teller/counter type services were, and are even more expressed now, speed and availability. Great efforts should be made in order to achieve this by the classical organization of teller/counter services. In some cases it is either impossible or totally unprofitable for the service providers. For example, it is very difficult to organize the work of bank tellers/counters on the basis 24/7. It is difficult because this requires not only work of teller/counter workers, but also additional number of workers in protection and security, maintenance, hygiene, etc. All that should be organized in at least 3 daily working

shifts. Similar situation is for teller/counter workers in many places like are for example banks, post offices, public, state and school institutions. Apart from the difficulties in engagement of the human workforce to organize such working time, there are also significant additional financial costs, additional heating, physical control and insurance costs, the need for larger premises and significant increase of their rent or purchase costs.

It is proposed and necessary to perform the following in order to adequately solve the problem of organization and quality providing of teller/counter services:

- ≡ Simplify and make easier and standardised as much as possible the way of organizing and providing teller/counter services,
- ≡ Perform and implement full automation of those services,
- ≡ Perform and implement robotization of those services using modern digital technologies.

When these three activities are fully implemented, then it is easy to organize providing of teller/counter services 24 hours a day and those services can be quick and efficient. An adequate algorithm and a flowchart should be created after successful simplifying of such services. On the basis of it a convenient and effective software application could be designed, developed, implemented and installed. That application should be installed on the special embedded hardware equipment, specially designed for this purpose. With this will be performed the final part of the modernization of those services, the part of service robotization.

The teller/counter type services are generally very similar in various institutions that provide such services. So, it is possible and proposed here to consider possibility to create and implement such devices that will be smart, universal and multifunctional and very easily adaptable to provide larger number of such services in different institutions and purposes. Looking generally, almost every teller/counter type service consists of a few basic elements [1]:

- ≡ Client authentication,
- ≡ Determination of the client right to use requested service,
- ≡ Providing needed service,
- ≡ Charge of the service if the service should be charged,
- ≡ Issuing adequate certificate that the service was provided,
- ≡ Issuing adequate confirmation (receipt) that the service was charged if it is such type of service.

These presented basic elements were used for a starting structure in creation, development, design and practical implementation of the smart universal multifunctional digital terminal/portal devices that are proposed and described here. Figure 1 shows model and design of proposed and implemented smart universal multifunctional digital terminal/portal device. The device can be used in many places and for many types of services of teller/counter nature (for example in banks, municipalities, other public institutions, hotels, transport companies, etc.).

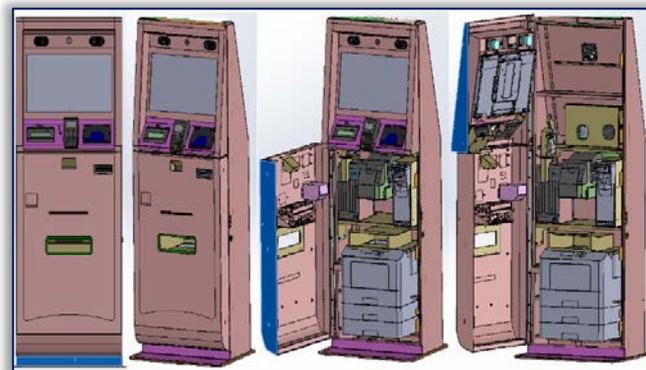


Figure 1. Model and design of smart universal multifunctional digital terminal/portal device

## PROPOSED SERVICES USING MODERN WAY OF ORGANIZATION OF TELLER/COUNTER JOBS

The most of teller/counter type services could be automated and robotized in some way. It enables applying modern way of organization and providing of teller/counter type services using smart universal multifunctional digital terminal/portal devices. Some of the services and places where this could be implemented are:

### — Bank services and offices

Activities of bank teller/counter workers could be automated and robotized with a high degree of success [2,3,4]. In transfer to robotization of this type of activities it is recommended to perform that process step by step. One of the suggestions is to first robotize activities related to the issuance of various certificates, statements and client reports for individuals and for legal entities. After that, it is necessary to robotize procedures of standard payments, such as are paying bills for electricity, utilities, state dues, etc. Then, it is needed to incorporate possibilities and functionalities of complete spectrum of providing of internal and external payment services. After that, it could be realized robotization of exchange transactions, of sale of certain banking services, of processes of signing contracts between banks and clients, and similar.

### — Municipalities and other public and government institutions services and offices

In the municipalities and other similar institutions some types of teller/counter services could be automated and robotized. Such services are issuing of different types of certificates and some types of payments. It could be following services: issuing of birth certificate, children birth certificate, residence certificate, citizenship certificate, marriage certificate, payment of real estates and taxation, and etc.

### — Cadastre services and offices

The following activities could be automated and robotized in the cadastre services and offices: issuance of property legal certificates for land and property holders.

### — Companies providing other standard services

The following activities in other standard services could be automated and robotized: charging and paying bills of electricity and water consumption, communal utility bills, tickets for theatres, museums and cinemas, parking fees, etc.

— Companies providing transport services

The following activities in transport services could be automated and robotized: issuing of annual, monthly and daily tickets for various and almost all types of transport.

— Hotel services

The following activities in hotel services could be automated and robotized: organization of operation of hotel, hostel and motel reception and other similar hotel services.

**PROPOSED DESIGN OF DIGITAL SMART MULTIFUNCTIONAL TERMINAL/PORTAL DEVICES**

Proposed basic configuration of smart universal multifunctional digital terminal/portal device consists of:

- ≡ Housing,
- ≡ Power Supply,
- ≡ Industrial Desktop PC Type Computer,
- ≡ Touch Screen Display.

The following components were also used, individually or in combination, in order to achieve satisfactory user authentication:

- ≡ Webcam,
- ≡ Personal document ID and Passport Scanner with OCR Software,
- ≡ Barcode reader,
- ≡ Fingerprint scanner,
- ≡ Signature Pad.

This equipment can be used in combination for stronger user authentication where it is needed. Also, it can be used one method of authentication if it is enough for concrete purpose. POS (Point of Sale) 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, where it is needed, can be performed using devices for the following ways of payment, 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 smart universal multifunctional digital terminal/portal, as well as printing receipts for payment of the service, could be achieved using the following devices:

- ≡ Printer device (usually of A4 format),
- ≡ POS printer for receipts printed on thermal paper.

Some other devices could be used like options for the terminal/portal device possibilities improvement:

- ≡ Device for instant issuing of mobile phone SIM cards (if intention is to establish 24/7 automated and robotized service for selling and filling SIM cards for mobile phones) and for issuing cards for many financial and other purposes (for example personalization of cards for entering in some special area),
- ≡ Plastic card colour printer (for similar purposes of cards issuing as it is previously described),

- ≡ Phone set (for offering Help Service, usually via Call Centre),
- ≡ Additional advertising 22“ monitor (for commercial and marketing reasons and activities),
- ≡ Dual iris camera.

Figure 2 shows proposed and practically designed and implemented smart teller/counter device used in a bank for purpose of automating and robotizing of the banking teller/counter services. All used equipment in the device implementation is shown and indicated in Figure 2.



Figure 2. Proposed design of implemented modern digital smart banking teller/counter service device

Figure 3 shows block diagram of proposed model of modern digital bank organization for teller/counter services using practically designed and implemented the smart banking digital terminal/portal, implemented for the needs of the bank, that is shown in Figure 2. The Figure 3 also shows a complete scheme of connecting of the terminal/portal device to the functional units of the bank information system.

Practically implemented way of selection of provided banking services on Touch Screen Display of the smart digital banking terminal/portal is shown in Figure 4. The Figure 4a shows menu of the device. Submenu in the “Certificate issuing” option of the menu is shown in Figure 4b.

Proposed, implemented and described digital smart teller/counter device for banking services and offices integrates offered services at device level with the real world. It was implemented integration with bank system that required a set of adapters to be implemented and certain security schemes to be applied. Unfortunately, there is no uniformity in all these when real systems for different practical applications are considered. That were and will be the challenges to overcome in the design and implementation of the devices.

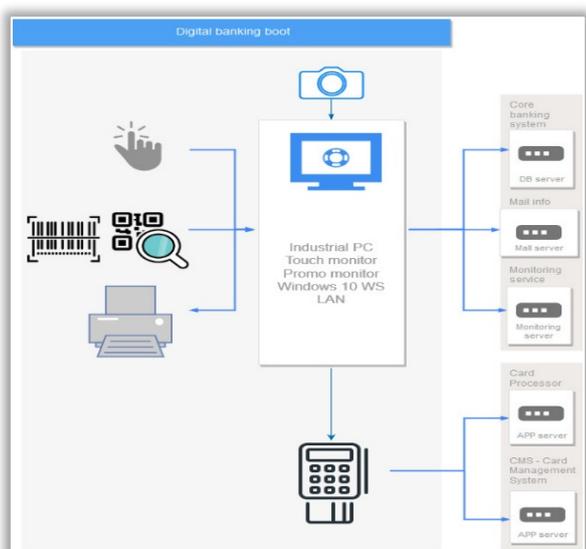


Figure 3. Block diagram of proposed model of modern digital bank organization for teller/counter services



a)



b)

Figure 4. Selection of needed services: menu (a) and submenu (b)

## CONCLUSIONS

It is clear and secure that serious changes should be implemented in the teller/counter services in the future applying modern digital and mobile electronic technologies, systems and devices. The way how to performed it can vary in accordance with specific factors and needs of concrete application. One possible and expected way is proposed and described here. Speed of introduction of all mentioned activities and technologies will depend largely on speed of adoption of necessary legal regulation. It will also depend on differences in teller/counter service prices between using automatic devices and human work.

Initial discomfort of clients in use of automated self-service devices, as are ones proposed here, could be the best reduced by simplifying of operation with these devices and by providing well organized help desk support. However,

greatest impact on popularization of these devices for customers could have significantly lower cost and much greater availability of services.

Proposed, implemented and described terminal/portal devices are smart, universal, multifunctional, modular, adaptable and could be easily used in many and almost all possible needs, purposes and applications where is necessary to realize teller/counter type services and activities. The devices are providing a set of services for citizens and are based on modern set of devices for user authentication, where applicable. Design and implementation was base on the involvement of modern ICT concepts and approaches and modern devices.

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ISSN: 2067-3809

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