Proximity Card-based Copy Management

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Abstract: The increase of the computers, the expansion of the networks and lots of information on the Internet raised the amount of copier and printer devices. Therefore more and more paper is used for the daily routine. The manuscript copying, the document and electronic mail printing have became very easy tasks. The prices of the copiers and printers decrease and all components for the devices are less expensive. But the costs of the copying continually increase because of the increasing claims.
We have to think of how can we produce the funds for the growing amount of paper. We must look for such a solution that reduces the using of paper. It follows that this is cost effectiveness. And there is an other favourable factor. Using less paper is an eco-friendly solution and this is very important in our days.
In this paper the Copy Management System will be described what was elaborated in KD_INTEG_06_SCM_2006 project. This system contains hardware and software components and it may be applied as a standalone system or part of integrated systems. The architecture of this system will be shown and the functional requirements, technology proposition for the system implementation will be defined. In the last section will be examined the applicability of Copy Management System, especially in educational institutes.

Keywords: proximity card, copier, printer, Linux, Copy Managment

1 The Reasons of SCM System's Developing

The increase of the computers, the expansion of the networks and lots of information on the Internet raised the amount of copier and printer devices. Therefore more and more paper is used for the daily routine. The manuscript

copying, the document and electronic mail printing have became very easy tasks. The prices of the copiers and printers decrease and all components for the devices are less expensive. But the costs of the copying continually increase because of the increasing claims. We develop the **proximity card based copy management system** for control of this tendency because of the following reasons:

- The risk of the wasting. We can copy and print easily the some documents. We do not listen to how many papers use our jobs.
- Easily printing and copying of the documents increase the personal use.
- We would like to split the costs proportionally to effective use.

We have to think of how can we produce the funds for the growing amount of paper. We must look for such a solution that reduces the using of paper. It follows that this is cost effectiveness. And there is an other favourable factor. Using less paper is an eco-friendly solution and this is very important in our days.

Therefore it should be measured that who, when and how used the copier devices. And these measured data must be sent to the management and the depot department. We can make riports and statistics from databases and we can check and control the paper usage.

In the following chapters will be demonstrated such solution and concept what give a exact answer for the above problems. The point of conception is that the devices have special identifier unit. All employees get the card. This card is a proximity card. If we use it when we do not have to touch the reader unit. We have to approximate only to reader unit. We cannot execute the copying and printing jobs without them.

In this paper the Copy Management System will be described what was elaborated in **KD_INTEG_06_SCM_2006** project. This system contains hardware and software components and it may be applied as a standalone system or part of integrated systems. The architecture of this system will be shown and the functional requirements, technology proposition for the system implementation will be defined. In the last section will be examined the applicability of Copy Management System, especially in educational institutes.

1.1 The Prospective Advantages of the System

- Reduction of the paper usage
- Decrease of the operational costs.
- The total costs can be split beetwen the parts of usage.
- The copying habit can be analyzed by right of the reality data.
- The resources can be distributed by the reality user demand.

- Easily operation and maintenance
- Data retrival from the system for the quality assurance
- The system installation is expensive but it can result in significant saving.

1.2 Requirements of the System Installation

- Install the system infrastructure. All copier devices can have identifier unit.
- All employees can have proximitiy card for the using of the copier devices.
- Data acquisition through the computer network for the data processing.
- Training the system's users.
- Make the archiving system and fast access for the archive data.
- Satisfy the ISO 2002 quality assurance.

1.3 Possibility of the Further Developing and Using

- Printer management by analogy with copier management.
- All devices can be integrated into the computer network.
- This Copy Management System can be integrated with the entry system and the rooms with expensive devices can be protected with this integrated system.

2 System Specification

2.1 Hardware System

It is important for the users to be able to access to the devices securely, to identify the person making use of the service, the precise, up-to-date, personal calculation as the service is not free. The system has to secure the management of the restrictions according to personal and local matters.

There are two possible ways for developing configuration

1 '**Minimum configuration**': it covers the conditions written in application, and can be completed with minimum capacity, however in

the environment of the local LAN it has not got the required flexibility. (see 2.1).

2 **'Configuration integrated into LAN'**: it requires more developing capacity, but adapts well to today's LAN technology, and makes it easier to integrate copy management to any of company informatics (see 2.2).

2.1.1 Minimum Configuration Including in the Application

On the basis of examining and analysing the criteria above, you can find main hardwer unit see the scheme below:

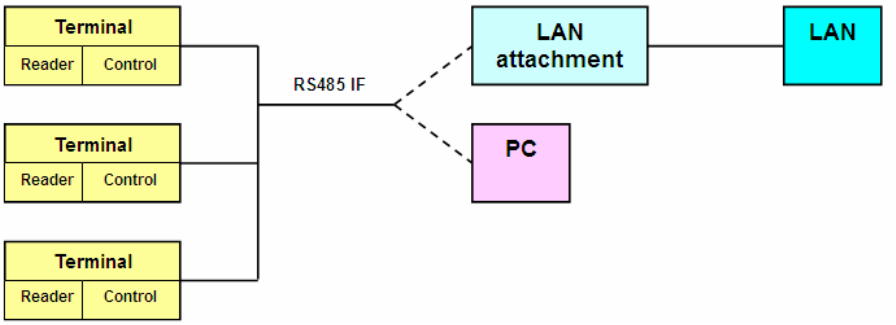

Figure 2.1
Minimum hardwer configuration systematic scheme

Each HW units have to provide the following essential functions:

Terminal

The unit positioned next to the copy machine. This unit organises and logically conducts copy management, furthermore it has a non-line connection with the personal computer providing user services (PC). In fact over and above a generally constructed micro PC it has to be able to provide the following special tasks:

1 In order to increase safe usage and access, the terminal unit should be able to work in **autonomic (off-line) way**. **It means, that even in the case of the line not functioning it has to be able to provide its task reliably for a while.**

2 The control unit has to contain flash module, which, on the one hand is able to secure competence data, and on the other hand it can store. The control unit has to contain flash module as well, which is responsible for competence data and it is able to store copy data before transmitting. Therefore it can work off-line.

3 **The flash module can be use for the temporary storage.**

The terminal contains three essential functional unit:

- ⇨ RS 485 interface control,
- ⇨ Reader unit,
- ⇨ Control needed for the given equipments.

Reader

Equipment for personal identification; the solution of proximity cards developed and distributed by Seawing Controls Ltd. can be used for it.

To make access safer, PIN code should be used. In order to increase the flexibility of te system, if there is a system development – supposing there is a solvent demand – it is useful to take into consideration the coin inserting supplement and the possibility of foreign application.

Control

According to the given equipment and the requirements of management it allows the use of device only for authorized person.

In the operating hardware, the bone of concentration of the application, the control units should be able to carry out the following **essential tasks**:

1 managing the functions needed for the use of the copy machine directly.

2 counting the copied volume.

2.1.2 More Up-to-Date Configuration Integrated into LAN

Considering that nowadays most of the PCs are operating connected into Ethernet LAN, and this is passed for mass product in hardwer as well as software point of view, it is inevitable to integrate the copy management system into LAN.

The copy management system with minimum configuration contains separated LAN connection unit; this solution is modular enough but expensive. Therefore instead of the minimum configuration we suggest the device illustrated in fig. 2.2. The control unit, which is provided with standard Ethernet LAN interface can be integrated simply and into any standard Ethernet LAN, moreover software sources already existing in the network can be used economically.

The task of units on the block scheme:

Employee Card

There is a proximity card for identifying workers. We can use more different types of cards with the following characteristic features: safety, life spam, accurate technology, thickness, etc.

Advantages of RFID cards:

- Accurate, fast in identifying the person and competence.
- If we apply computer network then we can manage centrally the login authorization, roles and other parameters.
- Copy results can be reviewed and listed.
- One card is suitable for more equipments.
- When losing the card or it is stolen it can be fast and for free.

Choosing the right type for the card you have to take into account the accurate technology: it has to have a consequent reading distance. Different environmental conditions do not make an influence on the operation. Its life spam should be as long as possible, it should operate without battery. It should be possibly small, light, resistant against mechanical effects, eg. it should not be fragile. It should be able to be printed data on because of easier identification; and with the help of this we can reduce the possibility of theft. It is not necessary to obtain the most difficult model; AM-ASK cards meet the requirements of the conditions above.

Copier

Large type scale of copy machines, which have permitting/prohibitive input and an interface output which memorizes the number of the copied pages.

Copy management unit

Main units

- ⇨ Card reader
- ⇨ Terminal module (for being connected to the copier)
- ⇨ Control unit (containing LAN attachment)

Main part of the copy management is the control, which should be established with high-power micro-control management. Because of its suitable technological parameters we suggest the application of **AT91RM9200** microcontroller, which can operate under inner Linux operating system. Linux is complex functionally, and secure reliable support to the use of different programs of the system.

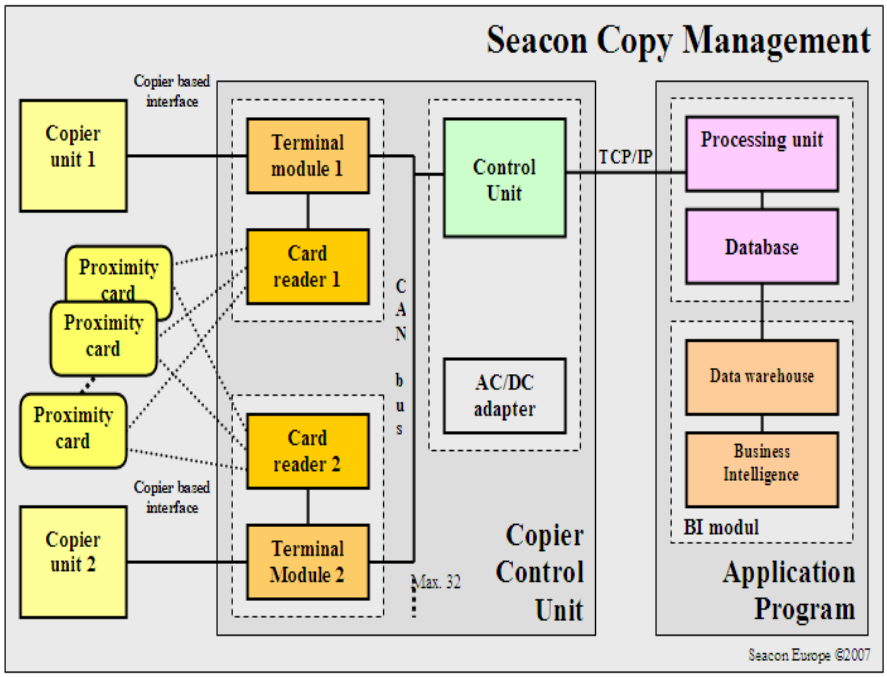

Figure 2.2
Systematic scheme of configuration integrated into LAN

Essential functions of the management system:

- ⇨ On the one hand it provides standard **Ethernet** interface to the copy management to be connected into Ethernet LAN, on the other hand it makes possible to establish standard **CAN BUS** with maximum 32 pieces of terminal module and through that 32 pieces of copy equipments to be connected. It is economical, since with only one control unit you might as well control 32 pieces of copy machines.
- ⇨ It handles accesss competence according to the data from the card reader and the application program.
- ⇨ It counts copied pieces, observes volume restrictions, and sends the data to the processing program.
- ⇨ If there is no connection in the network it can allow copying in off-line mode up to the given restrictions, it collects the copied volume, and after repairing the network connection it sends the collected data to the processing program.

The system in Fig 2.2 has further advantages, like simple cable laying on the two interface surfaces (Ethernet, CAN-bus).

The control unit **Ethernet interface** can be connected into standard structured Ethernet LAN without any supplementary cable connections.

A **CAN-bus interface** is also standard and reliable, error protected serial transfer. It is mainly used for industrial management functions. The more wide-spread communicational softwares support its application. Moreover the slow speed and trouble free environment of copy management makes it possible to use UTP cables. With the help of it the physical transmission of CAN-bus – like int he case of Ethernet interface – is possible in a structured cabling system, therefore no new cable-connection is needed here.

The application program

Main modules:

- ⇨ User program
- ⇨ Database
- ⇨ Business intelligence module (containing data market)

2.1.3 Developmental Proposals for Longer Period of Time

Information technology has been improving for the last 30 years, and we can observe similar technological improvement in all fields of the technological area. More difficult nd expensive devices are needed to meet the technological requirements. It is true for manufacturer, testing and control devices.

Less profitable institutions (eg. education), smaller companies are not able to obtain these equipments, therefore they have disadvantageous position in this respect. To solve these problems many organizations are established (integration, regions, industrial innovation parks, etc.).

With the help of these organizations expensive devices can be bought, but for establishing safe acces, and sharing the costs precisely there is no unified and reliable solution. By integrating the results of cost sharing and the ebtrance systems developed by Seawing Controls Ltd. earlier effective systems can be developed in these areas as well, which can guarantee safe access and precise cost distribution.

2.2 Software System

In this chapter will be analyzed the database services, the data storage and security, the network security and management.

2.2.1 Database Systems

The database is the important part of this proximity card based system because the all data (entry unit, copier, printer, systemlog) are stored in the database. There are the following data: who, what time, how many was used the system by users.

The statistics and riports are built on these data. The several riports may be created manually or automatically from the database by scripts. We must take some important point of view into consideration at the database developing:

- Reliability and availability of data
- Data backup functionality
- Security of the authorization system

There are some terms of the inside security of the database. We must satisfy these conditions:

- Create user and developer accounts
- Create superuser accounts for the database administrators.
- Protect these accounts with secure passwords.

Nowadays the data is stored in the relation database systems. The all data can be retrieved and managed with the standard **SQL** language. The SQL language has became autocrat in the database systems. We recommend to use the Microsoft SQL Server or Oracle SQL server.

The regular and automatically data backup is very important task. Some database systems support data export function. We must use them because the regular data backup safeguards us from trouble. The reliable database system has not only software requirements but hardware requirements too. Therefore the using of the **RAID** based storage system is very important.

2.2.2 Network Software Technologys

Protocol

In this section the network protocol will be examined between the controller and processing module. The recommended protocol is the standard **TCP/IP** protocol stack where we must create the encryption and authentication methodes on the application layer. The all data is encapsulated in **XML** documents and these XML messages are sent and received in the network communication. The all XML messages must be encrypted in the application layer. It is the function of the this layer. Why good technology is XML in the network communication? Beacause XML is platform-independent, all programming languages have included XML parser API, so the interpretation and processing is very easy and fast.

Operating System

Nowadays the more familiar operating systems offer the TCP/IP library for the programming the network applications. These operating systems have some standard encryption and authentication methodes.

We use for the controller unit the ATMEL microprocessor based card where run small Linux operating system. The Linux is free and opensource and built opened standards. The Linux GNU C and C++ programming language library has some standard encryption and authentication methodes. The architecture of the Linux system can be seen below:

The Linux kernel is built Unix system. The Linux kernel is free and opensource. Anybody can download and use it. In fact this is the Linux flexibility. Therefore the Linux kernel is used in the ambient systems. Because it can be configured and optimized for these hardware units. So we get small, fast, reliable and stable operating system kernel.

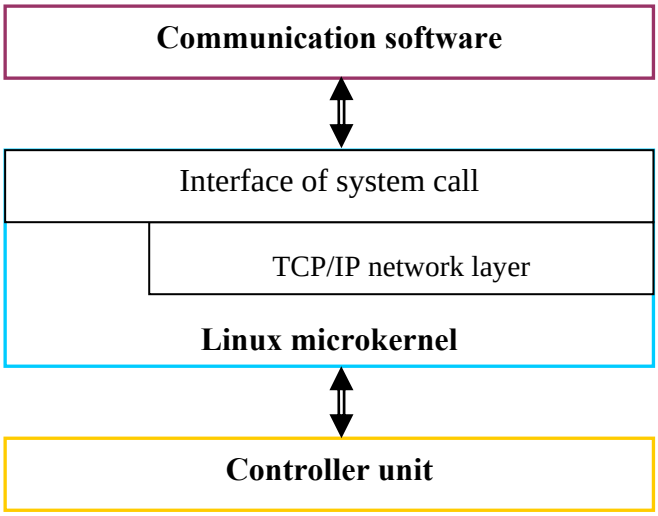

Figure 2.3
The architecture of the Linux system

There are other small operating systems, for example Microsoft Windows CE. But this system is not free and opensource, so it is less flexibility for the satisfaction of the developing requirements.

3 Application of the SMC System in Educational Institutes

In this study two types of configurations were proposed. We examine the applicability, advantages and disadvantages of the planned system in both cases. Let's begin with the simpler model.

3.1 Application Possibilities of the Minimal Configuration

Copiers are used by the staff and the students for different tasks. We analyse the effects according to this fact.

3.1.1 Logging the Copier Use of the Staff

In the higher education, because teachers organize their work with a relative independence, logging can have a particular importance. With our planned system recording can be more comfortable and accurate. Accuracy concerns both the number of copied sheets and the time of copying. It can make the staff more thoughtful, makes controlling, statistics and purchase planning easier.

3.1.2 Logging the Copier Use of the Students

As the prices of devices decreased, the number of copier devices increased in the educational institutes as well. This fact makes possible that students use some copiers installed e.g. in the library or at the laboratories. Of course, the institute can offer this service only against payment, so the receipt making should be solved as well.

- In case of using the minimal configuration, probably the simplest solution is that the student transfers the amount of the bill, made on the basis of the logged sheet number (cash handling was ceased in most of the institutions).
- A less risky, but more complicated solution is when the student **transfers** a certain amount of money **in advance**, practically „refills his/her card" and can copy until this amount runs out.

3.2 Application Possibilities of the Advanced Configuration

In this chapter the application possibilities of different systems with hardware or software improvements will be discussed.

3.2.1 Logging the Copier Use of the Staff

The statements of paragraph 3.1.1 refer to the advanced systems as well.

In advanced systems it is by all means favourable to **connect copier using with tasks (projects, subjects)**. Technically the simplest solution is when a person has more cards; however using this method is uncomfortable. Probably the optimal solution is if the user types a task code on the terminal connected to the copier, after or before showing the card. In advanced systems we proposed the use of PIN-codes for the sake of increasing security. In this case inputting the task code is only a simple question of software.

Connecting copier using with tasks is favourable, because it will be possible to make statistics not only by persons and organizational units, but by tasks as well. This helps not only the calculation of project costs, but also estimating paper needs of the different subjects. The latter depends on the size and amount of teaching materials and worksheets as well, not only on the number of students.

3.2.2 Reports Based on the Staff Copier Use Log

The main intention of the reports is to make possible to follow and predict the utilization of the copiers and the copying needs of the projects and subjects. One can plan the paper and toner purchase, and timing of the regular maintenance, moreover the purchase of a new copier device. Additionally, potential abuses can be screened (in case of especially large copying activity of persons or projects the reasonability of this activity can be supervised).

In the reports the following data should be collected about the copying activity:

- point of time,
- copying person,
- identifier of the copier device,
- identifier of the project/subject,
- number of pages.

3.2.3 Logging the Copier Use of the Students

The statements of paragraph 3.1.2 refer to the advanced systems as well.

The main intention of logging is – contrary to copier use of the staff – determination and collection of charge. Charge calculation can be done on the basis of the formerly described cost determination. Of course, the extent of the fee depends on the decision of the management. It can contain some profit, but students can be also supported by a lower price.

The student copier use log makes also possible the preparation of reports for making possible to follow and predict the utilization of the copiers and the copying needs of the projects and subjects.

For preparing reports copying fees should be stored as well.

3.2.4 Identification at the Copier Use of the Students

In addition to the methods usable at the identification of staff members, it will be possible to identify students also with their student identity card, when its realization will be suitable for this purpose.

The hoped perspective is a complex education card family, which will afford advantages and authorizations for everybody involved in the education: students, teachers, technical staff members. This card could replace the proximity card and solve the access to our system, too. We have such plans, but their realization requires more time.

Invoicing Solutions

In case of such hardware development, the copier use of students can be realized with slot machine or chip card. These are clear solutions, but providing enough coins or refilling the chip card can be a problem. Removing coins from the slot machine requires regular operator intervention and taking in money should be solved as well (as mentioned before, cash handling was ceased in most of the institutions). Accepting bank cards using bank networks carries significant cost.

In the higher education money transfer is possible through the unified study system. This solution requires software development and connection to the internet. It is also conceivable to receive bank transfers in order to ‘refill the card’. This solution is universal; it can work in any educational institute.

3.2.4 Printing and Copying Teaching Materials

If not only the copiers, but also printers are provided with card terminals, then students will be able to print teaching materials, lecture notes distributed by the teachers as files. **Fee of printing can be collected similarly to that of copying.**

3.2.5 Proximity Card-based System of Admission to Laboratories

Laboratories must be closed for safeguarding reasons when nobody works, and the work of guests must be documented by all means. However, logging the work of staff members can be advantageous for both the institution and the person.

During lessons the instructor ensures the supervision, beyond lessons a traditional form of control is that students place their student card at a supervisor.

Using an admission system supervising and documenting will be less labour intensive. Authorized staff members and students of the institution can enter to the laboratory with a private proximity card or another tool mentioned in this study and the system logs the time of their entry and exit.

Some laboratories can be used by external persons against payment. In these labs there are usually special equipments of great value, hired by external firms. Besides security aspects, logging of the use can be the base of billing as well.

Laboratories with equipments of great value are established very often with cooperation of several institutions. This is especially reasonable if one of these institutions requires only a part of the lab time. In that case the admission system can support the distribution of costs.

3.2.6 Using Equipments of Great Value with Proximity Card

Use of especially valuable special equipments, instruments, measuring systems can be managed also separately, instead of, or even besides the admission management. In this case admission management serves safeguarding, and equipment management supports billing, or the distribution of costs.

In such an application the equipment is connected uniquely to a terminal described at the copier, and the use can be logged separately. This solution is especially reasonable if the equipment is hired by an external firm, or it was purchased and is operated together by several institutions. Logged data can be used in the first case for billing, in the second case for the distribution of costs.

Practically, rent will be transferred subsequently, by the bill; either equipment or a whole laboratory is hired.

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