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COMPREHENSIVE SERVICE OF CONFERENCE PARTICIPANTS USING AUTOMATIC IDENTIFICATION

P. Zajac[*], L. Kowalczyk[**]

Abstract: *This paper discusses the issue of logistic service of conference participants in terms of their automatic identification. A conference participant ID badge was de-signed for purposes of this paper. A participant information vector was developed and coded using different bar code symbologies. Subsequently, on the basis of the presented criteria, the best solution was chosen. On the basis of questionnaire surveys conducted in 2014 – 2015, feedback concerning service of conference participants was compiled for comparison purposes. Further, a comparative assessment of the labour intensity of registration of conference guests was carried out.*

Keywords: Reliability, Automatic identification systems, RFID.

1. Introduction

Security requirements in the organisation of events such as a scientific conference are being constantly raised. Currently, at the Wroclaw University of Science and Technology, there is a requirement of identification of conference guests. "Logistics" Student Scientific Circle, which is active at the Faculty of Mechanical Engineering of the Wroclaw University of Science and Technology, has been organising the Translogistics.pl, conference since 2005, (Kowalczyk, 2016). In 2014, at a member meeting summing up a conference, directions of improvements were brainstormed, one of them having been the introduction of a person automatic identification system. It applies to persons working in the registration section. One of the larger difficulties, in particular during the registration of students for workshops and trips, lies in the manual action. The basis for collecting and storing information are handwritten lists which introduce a great deal of difficulties. Not only are the data recorded on the forms only, meaning they can be easily damaged or lost, but also their updating or a change of mind of a participant lead to crossing-out and make the content less legible. Hastily carried out registrations may cause failure to observe registration limits/double registration of one of the students or result in unclear information which will prevent clear identification of a participant. Moreover, control over the number of participants, who have not chosen the form of their classes for the second conference day yet, gets more difficult. A boundary condition had been to develop a conference database which was carried out, the database having been optimised, (Kwasniowski et al., 2011). Next, the database was programmed in Microsoft Access, (Świeboda, 2016 and Świeboda, 2015).

2. Automation participant identification

GS-1-13 bar codes and tags were initially taken into account. Additionally, a prerequisite was adopted that the code had to fit onto the participant ID badge, in the paper (Zajac, 2015).

Bar codes reflect graphically various kinds of data. EAN-13 codes are commonly used in marking goods in retail. They consist of 12 coded digits and a control digit, in the paper (Kwasniowski, 2004). It is worth pointing our here that the GTIN (Global Trade Item Number) method-ology is currently used in commerce, including GTIN-13 which identifies consumer units – a unique code of a retail item presented in the form of the EAN-13 bar code, in the paper (Bujak and Zajac, 2012). Nevertheless, one should

[*] Pawel Zajac, PhD.: Wroclaw University of Science and Technology, 27 Wybrzeze Wyspianskiego st.; 50-370, Wroclaw; RP, pawel.zajac@pwr.edu.pl

[**] Lucyna Kowalczyk, Msc.: "Logistics" Student Scientific Circle, Wroclaw University of Science and Technology; 27 Wybrzeze Wyspianskiego st.; 50-370, Wroclaw; RP, 210101@student.pwr.edu.pl

distinguish at this point between the use of a code for commerce purposes, which is supervised and subject to strict rules, and the use of a code symbology in a local project, as in the case discussed here. Since we do not deal with publication of codes and their common use, it is possible to use the EAN-13 symbology skipping part of the requirements established for the use of the GTIN. Further on in the paper, references to the EAN-13 code are to be understood as the use of the code symbology without taking into account the commercial context. The codes themselves allow clear identification of a participant on the basis of an indi-vidual identification number in the form of a code which was assigned to them. Additionally, they are cheap and simple to create and use. Since they are supposed to have meaning solely within a conference database, it is not necessary to preserve the conventional meanings of digits whereby the first two ones are the country code, the next five ones identify the manufacturer and the subsequent ones designate the product. It should be taken into account, however, that a scanner is still necessary to read such codes.

RFID tags give the ability to store a larger amount of data. Apart from the participant identification number, it would also be possible to record such data as first name and last name or scientific circle. The use does not require that the tag "estab-lish a visual contact with a scanner", which is one of the greatest advantages of this technology. In addition, here we can edit the data and therefore one could also save in a tag the information on selected activity on the second day or confirm the registration. Work with many tags at the same time would also be possible, (Bujak and Zajac, 2013). Obviously, a drawback is the cost of purchase of tags whereby it would not increase the expenses on participant ID badges when using codes.

Both technologies would constitute a good solution in the implemented system. However, it was necessary to make a decision and choose the technology. Since it is always the budget which is a limitation, additional costs connected with the purchase of the RFID tags may prove to be unnecessary if their application does not provide additional improvements. In the discussed case, it is most important to enhance the work with data and for this purpose the use of bar codes such as EAN-13 will suffice. The biggest advantage of RFID tags for the Scientific Circle is reading many participants at the same time. Nonetheless, in reality these deficiencies can be made up for with right software and code structure. Lack of additional costs and a far simpler placement on the ID badge make one choose the bar codes.

3. Impact of bar codes on the participant ID badge project

However, the choice in the context of development of a bar code system does not end the decision process. For comparative purposes, the EAN-13 code was used. Other bar codes also serve the same function while keeping the above-mentioned advantages. The choice of the right coding has to take into account the ability to code data in the context of a database as well as the minimum area taken up on a finished ID badge. As standard, participant ID badges have the A7 size: *105 mm x 74 mm* and the minimum area occupied by a bar code will be assessed relative to this size. The following symbologies were taken for consideration: EAN-8, EAN-13, GS1-128, 39, RSS, 2z5, PDF-417, QR, AZTEC.

The EAN-13 code will be considered in the first place. 12 characters can be specified in coding which leaves one free relative to the required whole. It will be added to the participant ID which in result gives the following order: rrrr uu kk oooo cwhere:r – year, u – higher education institution code, k – scientific circle code, o – individual (participant ID), c – control digit. The code for sample data was shown in Fig. 1; "2" is the control digit calculated following the modulo39 rules. In accordance with the magnification factors and provided that the magnification is kept at *0.80*, the code will take up *29.83 mm x 20.73 mm*, i.e. it will occupy *7.96 %* of an ID badge. Other codes, along with their factors and descriptions, were included in Tab. 1.

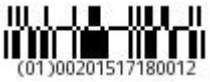
4. Comparative analyses of processes in 2014-2015

Further improvements came into view in the information processing phase. Thanks to better control when introducing the data, it is not necessary to re-check all e-mails and compare them with the data. Instead, relationships are verified concerning whether or not all users have a scientific circle and a higher education institution selected. Subsequently, simple generation of data can be performed which will be used to create ID badges or certificates using the mail merge function. In addition, there is a bar code generation step. However, it is worth reminding that it only requires to turn on the query before the export

of data and start up a script before using the mail merge function. New tasks are not only simple to accomplish, but they also bring about large benefits in the later part of work with the system.

The biggest changes occurred while working on the conference day. Thanks to the system, registration is carried out more efficiently and accurately. Participants spend less time in queues, in particular during the time of registration for activities of the second conference day. Moreover, the organisers have better control and can verify faster the registrations and the number of already registered students. For instance, if one scientific circle still has not registered after the end of registration period, this can be quickly verified by contacting the tutor of the scientific circle designated by the organisers or the participants directly.

Tab. 1: Sample data coding in different coding methods with determined magnification factors, occupied areas on the ID badges, ranges and comments. Source: own work.

Code name	*Code*	*Magnification factor*	*Occupied area [%]*
GS1-128		0.5	23.19
39		0.8	13.41
RSS		1.0	3.65
2z5		1.0	6.09
PDF-417		1.0	15.87
QR		0.5	6.81
AZTEC		0.5	5.07

One of the main criteria of making a decision was simplicity and area occupied on a participant ID badge. Codes which took up over 10 % of the area were eliminated due to high importance of the sign in the project. Other codes were analysed in terms of their disadvantages and advantages. The focus here was to satisfy software needs while maintaining minimum impact on the project. Simplicity, legibility and commonness were also taken into account. Due to the specified parameters of the individual codes, a decision was made to use the EAN-13 coding, since it fully met system expectations, having occupied little space on the ID badge which made its placement easier. Furthermore, it was commonly recognised and that was why it did not require any additional explanation. The issue of colour selection was passed

over in the paper, which had been analysed. Having made those decisions, it was possible to design the ID badge. On the basis of the created maps of processes before and after system implementation, it is possible to assess the labour intensity of solutions which will additionally help to identify the disadvantages and advantages of the solution. As can be seen in Table 1, in the case of the implemented system, demand for persons and equipment gets reduced, except for the phase of service of participants on the conference day when it is necessary to use a computer and a bar code scanner. It is worth emphasising that work of one person at the stages of data preparation allows maintaining continuity of correspondence with participants and decreases time demand for information exchange. Maintaining the database in the cloud makes it possible for other members of a scientific circle to control or select the needed data at the same time. With the use of the system, the quality of service of participants increases. One of the main criteria concerning this point is time. Members of scientific circles come many a time from places far away. After a long journey, they unwillingly spend time waiting for registration, and it is impossible to get admitted without it. Waiting time reduction and division of the registration into two stages make the participants wait for a much shorter time, even when there is a lot of scientific circles. Firstly, they receive their ID badges. Next, the code gets read and their presence gets checked. However, the greatest amount of time is saved during registration for workshops and trips. The participants have time to talk to company representatives and members of befriended scientific circles. Once again, they do not intend to spend time in queues. Thanks to scanning of codes, registration of a single participant takes a dozen or so seconds. What is more, the ability to perform a context search additionally speeds up the process if participants from one scientific circle or higher education institution report for registration in groups. Quality of service is also the number of complaints and the ability to make corrections. During a conference, it may happen that an identification number/certificate printout is incorrect or that the data for the invoice are wrong. Since it is possible to fully eliminate human errors, every effort should be taken for the errors to be rectifiable as soon as possible. A change of data of a participant does not cause a change of bar codes which depend on the identification numbers of a higher education institution, a scientific circle or a participant. Thus, the impact on the rest of the data is not a concern. The last element of quality is reliability. Scanning a prepared code not only speeds up the work, but also reduces the number of errors compared to manual service.

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