

UNIVERSITY STUDENT ATTENDANCE MANAGEMENT SYSTEM

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ABSTRACT

This article describes the problem of managing the number of attendances or absences in the academic environment, as well as proposing a system of record and control of these data. The article supports the idea of an automated system over the day-to-day handwritten attendance registries, in order to facilitates the process. The system comprises a timekeeping system that will register every student or teacher in a database. The database itself will be managed by the University, so that reports, either individual or collective, can be issued whenever they are needed on both physical and electronic format. Also, these reports would be used to create statistics and further help the growth of the academic process correlated with students' interest or attendance rate on certain classes. The timekeeping machines offer a quick alternative of counting the attendances and the process to do so is very much simplified.

KEYWORDS: *Attendance, registry, electronic, online.*

1. INTRODUCTION

The process of monitoring attendances in any institution is an important part in determining the efficiency of the services offered by the institution and the general interest of those who benefit from the institution's services, in our case, the students. This process is a pain staking routine, and as such, this article proposes a new way of dealing with the old system, which implies handwritten attendance registries, which had to be filled in after wrote every course, seminar or laboratory, for each student individually. These registries would later be sent to the school's secretariat where all the attendances or absences would be counted manually for each student. This method is both time consuming and prone to errors, either by marking a student as absent by mistake or counting the wrong number of attendances when reports or statistics are to be delivered. The present article proposes an automated system that is able to count the number of attendances, store the data for a long time in both physical and/or electronic format, and

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create reports and statistics to show the accurate number of attendances, the general interest for a specific course as well as statistics concerning the attendance rate for each student. Our new proposed system consists in a timekeeping mechanism placed in every class room, and a set of software programs to run the solution. The most important part of our solution is a database containing all the information about students, faculty and timetables.

2. SOFTWARE IN THE ACADEMIC ENVIRONMENT AND TIMEKEEPING SYSTEM

The need for accurate and fast registration of attendance or absences can be satisfied by implementing a software driven method. Software solutions are already a part of educational institutions and they have evolved from providing basic student information to „blending learning environments, supporting data-driven practice, and running their organizations more efficiently”¹, according to Clayton Christensen Institute. If most aspects of a learning institution can and have been improved by software usage, managing the attendances is one of the steps in building a more efficient institution. According to Linnea Boden „in the vast majority of Swedish schools, computer software is used for the registration of the absences and presences of students”².

Our system would have, as stated before, timekeeping machines placed in every class room of an institution and a set of software programs specifically designed to handle such data. Each student would receive a card with their information on it such as first and last name, faculty and year of studies. Each card would have a unique code inscribed on it, which is entered in the data base holding all student and professor information, either by hand or using a card reader. The code on the card becomes primary key corresponding to the according table in the database, so that with each swipe of the card through the timekeeping machine, the code would be recognized and the student can be marked as „present” for a certain time slot, as defined inside the software solution.

3. BIO-MATRIX SYSTEM

As a proposed solution we have chosen the BIO-Matrix machines³ - available commercially on the Romanian market - which allow data registration by means of using an electronic card, a code or even a fingerprint. These systems have a memory that can register at least 2000 cards, codes or fingerprints and as much as 50000 registrations

¹ „Schools and software: what’s now and what’s next” – Julia Freeland, Alex Hernandez and Alyon Samouha

² “The Presence of School Absenteeism: Exploring Methodologies for Researching the Material-Discursive Practice of School Absence Registration” - Linnea Bodén, Department of Social and Welfare Studies, Linköping

³ <http://www.pontaje.ro/>

before the data has to be collected and transferred in order to make room for further usage. The data can be saved on a computer, memory flash drive, external hard drives or online by using cloud technology through internet access. The BIO-Matrix timekeeping systems can be connected into a network and the access to the database can be granted from one computer or multiple ones by installing the BIO-Matrix MICRO MANAGER or BIO-Matrix PROFESSIONAL software programs. To download the data from the machines, all that is needed is a VPN or internet connection. The data can be processed as requested, being made available into some of the most widely used and accessible electronic formats of today: Microsoft Word or Excel and the omnipresent PDF.

SISTEM DE PONTAJ CU AMPRENTA SAU CARD **BIO-1-A**

Cel mai simplu si cel mai practic aparat pentru pontajul cu amprenta digitala sau card

- ✓ Pontare cu Amprenta, Card sau Cod
- ✓ Baterie interna pentru 2 ore de functionare
- ✓ Memorie interna pentru 2.000 amprente, 2.000 carduri si 50.000 pontari
- ✓ Actualizeaza automat modificarile amprentelor in timpul pontarii
- ✓ Se utilizeaza conectat in retea, in conditii de interior
- ✓ Se livreaza cu soft de la fabricantul aparatului



Fig.1 BIO-1-A clocking machine, with card, code or fingerprint registration options¹

To avoid the unfortunate complications due to losing an electronic card for example, presence can be signaled by the student also in an alternative way - with a four digit code. In order to do so, the student must first enter the identification code, for which we propose the use of the personal identification number (CNP), and then, once they are recognized by the system, they enter the four digit code, like a password. Should the card be somehow lost, the student must report this to the institution management so that the old code inscribed on the lost card can be erased from the database and a new one can be issued as a replacement. The student will then receive a new card, with a new code.

¹ Image and information available from: <http://www.pontaje.ro/pontaj-cu-amprenta-pontaj-cu-card-bio1a-biomatrix>



Fig.2 Electronic card management software¹

As an added bonus, the electronic cards used for our proposed system can not only be individualized with pictures/logos and any other relevant information (eg. School, group, series, major etc.) – they can also be integrated with other campus features.

The same cards can be programmed and used, by either students or faculty/staff – according to institution policies, to operate, for example, different restricted access devices (copiers, elevators, lab equipment etc.), to open different doors, to gain access to parking spaces, to issue different printed materials etc,

4. MODIFYING EXISTING SOFTWARE OR CREATING A NEW ONE TO MEET ACADEMIC REQUIREMENTS

Our system needs software to fulfill the goal for which it was designed. The BIO-Matrix timekeeping machines come with their own predesigned software that shows clocking options for two distinct moments: „Arrival” and „Departure” or „Check-in” and „Check-out”. These options are somehow appropriate not exactly for students, but for the staff of the institution and the faculty. This system is intended to be used by all members of the institution, as it can monitor faculty and staff attendance as well.

Absence among professors has been shown to decrease the productivity of the institution they work for, as well as affect students by reducing their achievements. This is done through several mechanisms, two of them being the radical reduction of instructional intensity and creating discontinuities of instruction. „On average, public school teachers in the United States are absent 5% to 6% of the days schools are in session”, also „within the United States, teacher absence rates are nearly 3 times those of managerial and

¹ Image and information available from: <http://www.pontaje.ro/card-design-pontaj-gratuit-soft-pontaj-gratis-pentru-firme-mici-biomatrix-micro>

professional employees” [1]. Our system can track the attendance of all staff members and issue reports concerning them as well.

As far as students are concerned, having only two moments of clocking is not enough, as students usually have more than one course, seminar or laboratory in one day. The BIO-Matrix software give the user the ability to modify the predefined intervals and appoint more than two of them for students by altering the database and the hour intervals so that each interval can be broken down into two or more, according to the number of courses, seminars or laboratories the student has to attend for each specific day. To mend with the dissensions regarding the set hour intervals, the database has to be created containing a timetable that exactly specifies the courses and their interval (the time the courses start and the time they end). The timetable has to be created in such a way that there are no overlapped seminars or laboratories for students that share the same school and group. For example, group „A” cannot have in its timetable two distinct seminars at the same time and also no two distinct groups can have the same seminar or laboratory with the same professor, at the same time. As far as courses are concerned, more groups can have the same course, at the same time, with the same professor, even though they are separated in groups and series. An example of setting different time intervals is: the moment of „Arrival” corresponds to Course 1, by setting the appropriate time interval, and „Departure” would correspond to Course 2, setting a new hour interval. Each student has to clock only once per course, seminar or laboratory.

Starting from the configuration of the BIO-Matrix software, a new add-on program can be made to work with the database in order to fulfill the needs of the faculty. Upon entering their personal code, the database would recognize the user as a professor and show on the clocking machine’s screen the timetable. Then, the professor can choose the day of the week, hour interval and discipline and then clock.

5. POSSIBLE CONFIGURATION FOR THE DATA BASE

Our basic database proposal contains 4 data tables, each of them being connected to the others directly or through another link table.

- **STUDENT** table: has the id of *CNP* and contains information about every student, including the code of the clocking card.
- **ATTENDANCE** table: has the id *registration_code* and registers if someone has clocked in or not in a certain hour interval tracking the registration code from the clocking cards or the personal codes of the students or professors.

- **ACTIVITY** table: has the id *name_of_course* and contains every discipline, the hour interval for the specific discipline and the number of attendances for each student pulled from the **ATTENDANCE** table.
- **TIMETABLE** table: contains information about each discipline and their hour intervals so that there will be no overlapping when clocking.

This configuration is simple, yet efficient and has a simple principle of use, as described before: with each clocking in a set hour interval, the registration code on the card is recognized, the attendance is confirmed, the data base is modified so that the student is marked as „Attending”. Should no clocking be registered for a student in a set time interval, the respective student will be marked as „Absent”. Results from this timekeeping activity are kept in the machine’s memory and can be accessed in real time by the personnel granted with access rights to the database.

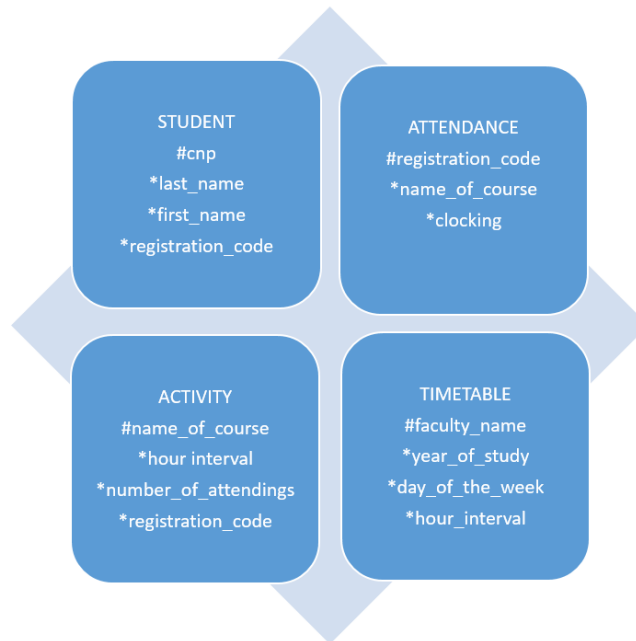


Fig.3 Basic proposal of the clocking system database

6. CONNECTING THE DATA BASE TO A STUDENT ORIENTED ONLINE PLATFORM

In the best interest of the students, the information in the database related to their attendance/absence records should be posted on their personal page on the University platform in real time (<http://paginamea.rau.ro>). This involves connecting the database to

the public website. A web browser cannot connect directly to a MySQL server to retrieve information from the database. In order to achieve this, we will use PHP code that can connect, extract query results from the database and display them in an HTML compatible browser, in a much more aesthetic manner than simple tables. The operating principle is as follows: the browser wants to display a web page containing database information, it connects to the web server and asks for that specific page that was being written in PHP, then the result is sent to be handled by the PHP module installed in the browser. This module analyses the code and upon figuring that information from the database are being asked, it connects to a MySQL server, extracts the specific information through predefined queries and generates HTML code to display the results in the browser.

Of course, for a better security approach, the data that is being exposed to the internet would be protected by use of different techniques. And, as simple and most effective solution to avoid long-term serious problems due to any hacking attempt on the respective data, the data used by the MySQL server for answering queries is only a mirror of the main database repository.

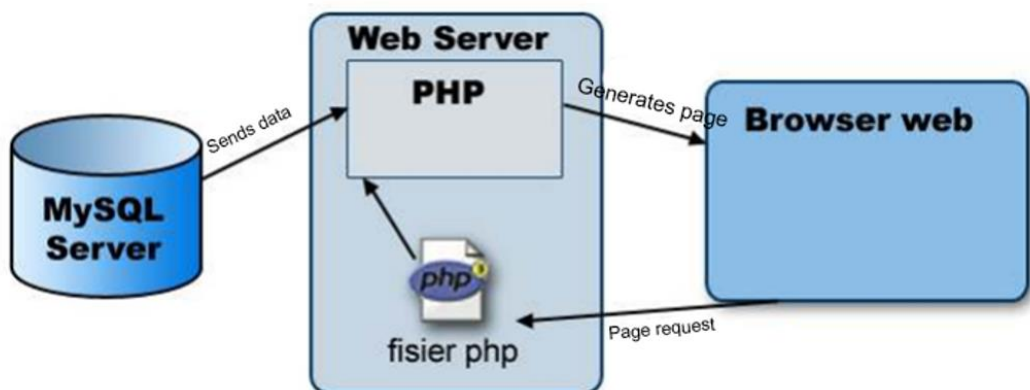


Fig.4 Data transfer between student personal webpage and BIO-Matrix system database

7. REPORTS, STATISTICS AND USAGE

Centralized data can be exported, as mentioned previously, in widely recognized electronic formats, such as: Microsoft Word, Microsoft Excel or PDF formats. The data can be stored either electronically and/or in physical format (printed). These reports can be multiple, depending on what is needed at a certain point in time:

- Daily reports;
- Weekly reports;
- Monthly reports;
- Half-yearly reports;

- Yearly reports;
- Single person report: contains information for a single student or teacher;
- Multiple person report: contains information for groups of students or teachers, separated by faculty, year of study, group or the discipline they teach if the report is about a professor.

Of course, at any time any report or statistics based on the system's input data (attendance clocking) can be designed and presented. For example, a very individualized report for a certain IONESCU I. ION student during the timeframe of January 18 to February 9, every Tuesday between 10:00 am and 13:00 pm.

A similar system has already been implemented in several schools in Brasov, as well as in over 60 schools in Bucharest's second district, where over 40000 magnetic cards have been handed to students. The main difference between our proposal and these working systems is the fact that, for the latter, clocking is regarded mainly as a security measure, allowing access into the institution only for those that are carrying such a card. The only data verification is done regarding the confirmation of student's attendance at the beginning of the day (check-in time). In order to leave the institution, the student must clock again, therefore, this system measures only the time interval the students were (supposedly) inside the institution as a whole. These systems are not designed to show actual data related to real participation in any of the specific classes a student has to attend.

Pros and Cons of the proposed system.

Pros:

- Increased efficiency in presence/absence management
- Can help reduce absenteeism, by listing each student's attending/absent status online, at any given time
- New approach that can augment the image of the institution it is implemented in, at least from the parents' point of view

CONS:

- Psychological effect that induces a sense of constraint among students who might feel as if they are going to work rather than school
- Price of timekeeping machines and software
- Additional working hours/employees needed by the institution in order to supervise/maintain the system

8. CONCLUSIONS

Our proposed system offers a change in the process of monitoring and counting (overall, management) of the attendances or absences as well as keeping track of the activity in the university environment and provides information based on the data it collects, being able to create personalized or batch reports. In the same time, the system gives the opportunity to easily create statistics and to show the general interest for a specific course, the general rate of attendance as well as helping the institutional calculations for faculty and staff, based on their own number of attendances or absences during the school year. Our system also makes storing the data easier as it can be kept on electronic format as well as printed on paper and it is of help for both the staff of the institution where it is installed and the students who benefit from it by using their personal webpages, should their university have an online platform, or through their institutionalized e-mail addresses if these are provided.

Even though our solution requires a relatively high amount of resources, be them financial or human, as a software program needs competent people to run/maintain/develop it, it offers compensating results that will benefit the institution in the future.

From another perspective, the proposed system can be further extended, as a second step in developing and implementing such a solution. As part of the Romanian university mandatory curricula we find the “internship” period (of at least two weeks, depending on study program and/or profile or major). In order to accurately keep track of the students’ presence and time spent with their internship institution we propose a further development of the system.

The institution should buy or rent mobile clocking devices, compatible with the designed and implemented solution. Each internship base – which has to have a previous agreement with the university, as requested by the regulations – will receive such a device. The device will be connected to the internet and the internees will have to cloak by using the same electronic card or code as they would usually use inside the school.

A specifically designed module of the software platform will correlate their cloaking with the information of each specific internship program. At the end of the internship program, the module will generate an automated timesheet with the presence/absence data of each student. This report will go to both the university and to the internship base.

The system would also increase the effectiveness of the internship system. If we just check the clocking data at the end of the internship period, we might find out that a certain student has only 30% attendance and, as a result, it will fail to pass for this task. But, if attendance data is provided online and in real-time, the faculty can intervene very

fast and check and the situation. In most cases the situation will be straightened very fast and the final results will be better. Instead of just “punishing” the student for not fulfilling his internship task, the institution has the possibility to intervene, to check on the actual situation, find out why/how come that the student was not clocked present. The faculty can talk to both the student and the internship supervisor and solve any possible issues as fast as possible, starting just from the point the problem started.

This type of pro-active and pro-student approach we think might provide an advantage to the institution, in comparison with the standard obsolete approach of just verifying a number of attendances/absences, calculating a percentage and providing a pass/failed status (speaking only from the point of view of attendance now).

- ✓ Ceasul de pontaj TAP+ este foarte usor si foarte mic, oferind astfel portabilitatea necesara echipelor de lucru ce nu au un loc de munca fix.
- ✓ Aparatul este proiectat pentru a fi utilizat in exterior, in santiere de constructii, dar poate fi utilizat si in interior, in hale industriale, birouri sau orice locatie unde nu exista infrastructura de comunicatii in retea.
- ✓ Procesul de pontare nu necesita cabluri iar bateriile interne asigura functionarea aparatului pe o perioada de 1 an.
- ✓ Poate stoca in memorie 12.000 de pontari. Dupa descarcarea pontarilor cu ajutorul cablului USB, memoria se elibereaza si poate fi refolosita pentru stocarea pontarilor viitoare.
- ✓ Fiecare aparat poate fi folosit simultan de pana la 2000 de angajati. Pentru mai multi angajati puteti folosi mai multe astfel de aparate.
- ✓ Softul BIO-matrix MICRO, ce se livreaza impreuna cu acest aparat, poate fi folosit pentru un numar nelimitat de angajati si poate gestiona un numar nelimitat de ceasuri de pontaj.

IN TEREN...



Aparatul, dotat cu baterii interne, poate fi purtat de catre seful de echipa: in buzunar, in geanta sau in masina.

Pentru pontare angajatii vor folosi cheia de pontare iButton individuala.

LA BIROU...



Aparatul se poate folosi conectat la calculator sau chiar neconectat.

Procesul de pontare este extrem de simplu si nu dureaza mai mult decat o secunda.

Fig.5 Example of mobile clocking device¹

The only downside of this further system extension, besides the obvious cost increase, is the necessity to have internet connection for the clocking device (for online real-time data). But, nowadays, when internet connection is almost taken for granted - at least by the younger generations – and there are countries that have already legalized mandatory

¹ Image and information available from: <http://www.pontaje.ro/pontaj-portabil-tap-biomatrix>

internet access for their citizens, with Finland being the first country to do it [2], we do not consider this to be a very important issue. There are available at least 3 types of cloaking devices that offer not only cabled network connection (through RJ45 couples) but also wireless connection capabilities. As a more robust, but also pricier solution, there are several types of clocking devices which comprise not only the possibility to “externally” connect to a wired or Wi-Fi network (and by this mean to the internet) – they have a special slot for a sim card in order to have the possibility to connect through a data sim card, directly to the internet from wherever we have mobile phone coverage actually. And, of course, there is always the basic solution (without real-time online data available) of keeping the clocking records inside the machine up to the moment the device returns to the institution, where the data is collected and later interpreted.

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