The Implementation of Wireless Student Attendance System in an Examination Procedure

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Abstract– An effective information system needs to support a set of activities, which enable human beings to achieve effectively the objectives of the organization, supported by computer-based information technology [1]. Traditional styles of attendance management include hand-written signatures, card bell, magnetic card, IC card and RF card attendance machines. These styles cannot avoid checking out the attendance slip[2]. This paper summarizes an improvement for manual attendance system during examination using Wireless Student Attendance System. The implementation combines the wireless technology to trace, store and transfer of data to the host computer for report generation and data analysis. This system offers effectiveness through its functions in capturing data, minimizing time-constraint, and saving effort to write/collect/check attendance slips. The improved student attendance system provides effectiveness and efficiency in administering and managing the attendance procedure; hence minimizing cost and improving productivity thus improving staff development. *(Abstract)*

Keywords– *Student Attendance System; Examination; Wireless Technology; Barcode (keywords)*

I. INTRODUCTION

Solving real-world problems often requires technological expertise as well as sufficient understanding of a range of economic, social, political, national, and international implications [3]. Information technology makes organizations more efficient by improving transparency and reducing transaction costs. Increased efficiency leads to improvements staffs' productivity and fosters economic growth. Information technology also provides flexibility by providing various supporting applications; dissemination of knowledge; overcoming constraints of time and distance.

This paper consists of a study to improve the current manual student attendance system by incorporating wireless application. Wireless technologies application is chosen to make the system portable; thus providing system flexibility, efficiency and effectiveness; hence improving staffs' work quality, increasing staffs' productivity and minimizing human error.

II. RESEARCH BACKGROUND

The study begins by investigating the examination process and at the same time to look at the work procedure involved in managing the students' attendance in an examination procedure. All examination procedures share a standard procedure and manage manually by examination invigilators. The number of invigilators in an examination depends on the number of candidates taking the examination. Statistics shows that there are 439,232 candidates in 2007 and 442,936 candidates 2008 sitting for Sijil Pelajaran Malaysia (SPM) which is equivalent to O Level, UK [4]. Each year, the number of students sitting for SPM increases by nearly 10%.

Using the current system, student attendance during an examination is done by filling in the examination attendance slip. Every student must fill in an attendance slip as evidence to his or her presence for the exam. Students also need to provide their student matric card (ID), identity card (IC) and the examination attendance slip. The ID and IC provide as evidences to the genuity of the students while the examination attendance slip confirms the examination that the students are sitting for. The attendance slip is then collected and checked against the master record to confirm the student presence. When the examination is over, the examination attendance slips will then be stored for later references. This procedure is administered by examination invigilators. This procedure is administered by examination invigilators.

However, one common issue in managing student attendance is the number of candidate for the examination. If the number of candidate is large, managing the attendance will be very time consuming. Therefore, an effective way to manage student attendance needs to be implemented to reduce the required resource (number of staffs and time taken) needed. Manual attendance system has more probability to be inefficient because it is subjected to human error such as the problem of missing out student's attendance slips and many more. Furthermore, according to the government regulation all examination attendance slips must be stored for seven years before it can be disposed; hence, the need for office spaces to store the examination attendance slips.

Consequently, the objective of this research is to investigate the present students' attendance management, thus to propose an effective and efficient system to improve the system by the implementation of wireless technology. The improved system will reduce the use of manpower and time to keep record of examination attendance as well as minimize storage space.

A. Wireless Technology

Wireless refers to the transfer of information signals without using wires. It also can be understood as cordless, electric or electronic devices without a cable or cord for their main power supply. The wireless LAN standard is "Wi-Fi," which is the wireless counterpart to Ethernet, the standard for wired local networks.

B. Barcodes

Barcode enables automated work process without human interference. The use of barcodes eliminates many errors and often save time and money. Modern handheld barcode readers are operated in wireless networks according to IEEE 802.11g (WLAN) or IEEE 802.15.3 (Bluetooth). Barcodes are machine-readable symbols used to store bits of data. With a simple scanner, all barcode data can be automatically collected, stored in a database, and disseminated [5]. There are different types of barcodes known as barcode symbologies. Different symbologies are used by different vertical markets. An example is the Universal Product Code (UPC) barcode scanned at the cash register. In general, a barcode requires a white or solid color background to be detected [6]. Originally, bar codes represented data in the widths (lines) and the spacing's of parallel lines and may be referred to as linear or 1D (1 dimensional) barcodes or symbologies. They can also come in patterns of squares, dots, hexagons and other geometric patterns within images termed 2D (2 dimensional) matrix codes or symbologies. Table 1 provides a summary of barcodes available.

Two mostly used barcodes are (fig 1):
i. 1-Dimensional (1D) Barcode – A bar code symbology in which the symbol is formed of a single row of symbol characters (made up of narrow & wide bars and spaces) [7]. Fig. 1 shows the 1-dimensional barcode containing a cardholder's driver license, identification number and date of birth [5].
ii. 2-Dimensional (2D) Matrix Code – Optically readable symbols that must be examined both vertically and horizontally to read the entire message. Two-dimensional symbols may be one of two types: matrix symbols and multi-row barcode symbols. Two-dimensional symbols have error detection and may include error correction features [7]. The 2-dimensional (2D) barcode contains all of the information located on the front of the card (name, address, gender, date of birth, height, weight, eye colour, and license number) (fig.1).

C. Barcode scanner/reader

Barcode scanners are optically or laser devices that read and decode barcodes. They interpret the varying widths of bars and stripes or the matrix patterns then transmit the data within the barcode. Most scanners can read most barcode symbologies. Many barcodes include check digit to ensure data integrity.

TABLE 1. THE VARIOUS BARCODE TYPE

Barcode Type	Symbology	Description
UPC, EAN, Bookland & ISSN		Numeric-only, have fixed length and include one or more check digit
Code 128		Numeric only and employs simple compression. Support the lowest 128 ASCII characters
Code 39 (Code 3 of 9)		Full ASCII version supports 128 ASCII characters
Interleaved 2 or 5 (ITF)		Relatively compact and is an older barcode that isn't use much today
Codabar	A3419500A	Numeric-only symbology used by FeDex, libraries and blood banks
MSI-Plessey	3419500	Numeric symbology used in library

Figure 1. An Example of Driving License with 1D & 2D Barcodes [5]

The process involved in reading the barcode is as follows:

- Illumination system – The sensor of the barcode scanner detects the reflected light from the illumination system and generates an analog signal with varying voltage that represent the intensity (or lack of intensity) of the reflection.
- Converter – The converter transforms the analog signal to a digital signal, which is fed to the decoder.
- Decoder – The decoder interprets the digital signal, does that mathematic required to confirm and to validate that the barcode is decipherable, converts it into ASCII text, formats the text and sends it to the computer the scanner is attached to.
- Sensor and Converter – A photo detector senses the reflected light and generates an analog signal with

varying voltage. The voltage fluctuates based on whether the sensor sees the reflected light from the white spaces because the black bars absorb the red light. The technology used in the sensor can vary depending on the illumination method. The output is always the same - a voltage waveform with peaks for the white spaces, and troughs for the black spaces in the barcode.

III. RESEARCH METHOD

This research employs mixed method approach. By definition, mixed method is a procedure for collecting, analyzing, and mixing or integrating both quantitative and qualitative data at some stage of the research process within a single study for gaining a better understanding of the research problem [8],[9]. A survey has been done among examination invigilators and interviews have been conducted with officers from the Malaysian Ministry of Education for the data collection process.

The rationale for mixing both kinds of data within this study is grounded in the fact that neither quantitative nor qualitative methods are sufficient, by themselves, to capture the trends and details of a situation. When used in combination, quantitative and qualitative methods complement each other and allow for a more robust analysis, taking advantage of the strengths of each [10],[11],[12],[13].

V. DATA COLLECTION, DATA ANALYSIS AND FINDING

Based on the data collected and analyzed, it has identified the need for a more efficient and effective way to administer and manage student attendance. Based on this, a wireless student attendance system for examination process has been designed. When using the wireless student attendance system, the examination invigilators need to follow the procedure stated below (fig. 2):

a. Student Matric Card

Students must bring their matric cards during exam. This card will act as the student identification that approves the holder identity. The matric card has barcodes and acts as an input data source.

b. Barcode Reader/Scanner

The examination invigilators need to ensure that each student's matric card is swiped correctly using the barcode reader/scanner. The barcode on the matric card will be read as analog signal. The reader/scanner will then convert it to digital signal to make it available for the computer to receive the data.

c. Data Collection and Storage Computer

When the barcode on the matric card is scanned, the data is captured and stored into a database on the host computer. The database will log students' detailed as transaction data.
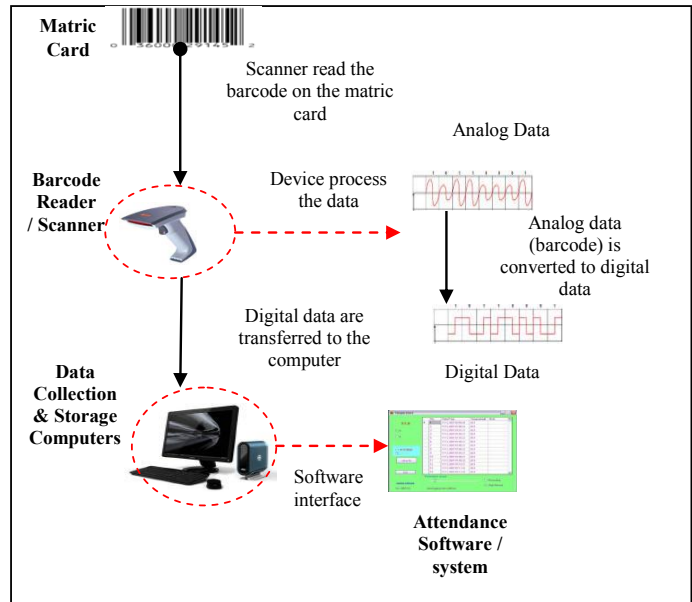

Figure 2. Barcode Scanning Process

d. Attendance System (Software)

The examination invigilators must ensure their readiness to use the system. Attendance software located in the host computer is the most important element to make the system works. The software itself has to be user-friendly and allow the robust reporting and analyzing capabilities in order to maximize system return on investment (ROI).

As depict in fig. 3, the data captured consists students' details (matric number/ID). The barcode reader/scanner reads it as analog data format. The barcode reader will then convert this analog data into digital data format so that it can be transferred to the database of the attendance software located in the host computer and is ready for processing, for example report generation such as list of student names attending an examination or a report of students absent from an examination. The system should also be able to provide some data analysis such as percentage of student absent from an examination.
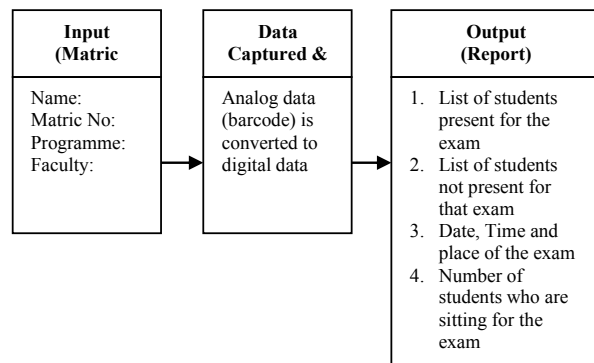
Input (Matric	Data Captured &	Output (Report)
Name: Matric No: Programme: Faculty:	Analog data (barcode) is converted to digital data	1. List of students present for the exam 2. List of students not present for that exam 3. Date, Time and place of the exam 4. Number of students who are sitting for the exam

Figure 3. The Data Transforming Process

V. DISCUSSION AND FUTURE WORK

The implementation of this wireless student attendance system has shortened the time taken to check the students presence in attending an examination. Students details are captured by scanning the barcodes located on the student matric card and these information will be updated on the examination database automatically. Scanned matric card implies that the student is present for the examination; hence a student absent from an examination is determine by failure to scan his/her matric card during the conduct of that examination. The findings of this study revealed that it provides system efficiency and flexibility and at the same time reducing time to process the procedure as well as the number of staffs needed to administer the examination attendance, improving staffs productivity and minimizing errors. Many problems when using manually examination student attendance can be overcome.

However, this system has its limitation. The system is developed as a prototype and it is tested using simulation. Future work would include testing the system in full scale and in a real examination setting.
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VI. CONCLUSION

This paper discusses on the implementation of wireless technology for student attendance system in an examination procedure. This research has provides an excellent opportunity to study how human can be part of the system and integrate ICT from information management to database system, integrated database system, wireless networking, computer and device interface. Wireless system is an emerging technology that should be included in education field. Systematically, the proposed system can improve the manual procedures in managing attendance by incorporating technology elements into working system procedures. Reducing manpower, improving time management and standard procedure, eliminating human error and flexibility, is the answers why Student Attendance System should be implemented.

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