

Quick Response Codes & Facility Management

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Abstract

The process of managing, monitoring, and maintaining the mechanical, electrical, (MEP) and plumbing systems in a facility is a challenging task. Some Facilities Managers (FM) used Barcodes to aid in tracking and managing assets, including mechanical systems. Quick Response codes (QR codes) are essentially the next generation of Barcodes. This paper will examine to what degree the use of QR codes in a Computerized Maintenance Management System (CMMS) will be able to improve the FM's ability to track and manage inventory and assets, and the management and retrieval of information about the mechanical system. It will also examine to what extent QR codes may be able to improve the efficiency of mechanical, electrical, and plumbing equipment maintenance in the operations of their facilities. Information on how facilities managers of Higher education Institution in STATE NAME REMOVED are using Barcodes and QR codes is presented.

Keywords: Barcode, CMMS, QR Code

Introduction

As technology is ever improving, it is essential that Facilities Managers (FM) have access to that technology. Historically Barcodes have been used as a means to track and inventory assets in an organization's Mechanical Electrical and Plumbing (MEP) systems. Quick Response (QR) codes have the potential to replace barcodes in that function, as well as providing a more versatile use and dynamic interface.

Both Barcodes and QR codes are apparatuses that store information, like a CD or a flash drive, (Dong-Hee et al. 2012). Both can be use to hold a cereal number of a product purchased at the store, or the VIN number of a car, or a ticket number at a baseball game (Baik, 2012).

Barcodes are made up of a series of black lines on a white background (shown in Figure 1). Originally barcodes could only be read with the use of a special laser scanner. The scanner would shine a laser onto the barcodes, then read the light, reflected off of the white portion, and translates that information into numbers or letters (National Barcode, 2012). Barcodes are one-dimensional meaning that the information is stored in a straight line and each white space can only represent one letter or numeral (National Barcode, 2012). The only thing that limits the number of digits a barcode can hold is the length of the barcode itself (Yarmey, 2012).



Figure 1: Barcode example.

QR codes differ from bar codes in that they are considered a 2-dimensional code; information is held both horizontally and vertically, see Figure two (Jin Soon, 2008). The more advanced configuration of the QR code allows it to hold more information than a bar code in less space. The largest possible code, Version 40, is a matrix of 177×177 pixels, and can contain 7,089 numeric characters or 4,296 alphanumeric characters (Yarmey, 2012).



Figure 2: QR code example.

QR codes, unlike bar codes, do not require any special equipment to interpret them. QR codes are read with the use of a camera and interoperated using software (Yarmey 2012). This means that almost any Smartphone with the right application can access the information stored in a QR codes (Yarmey,2012).

QR Codes were developed by a Toyota subsidiary as a quick way to track car parts as they move down the assembly line (Jin Soon, 2008). Since that time they have been used in a variety of places. Because of there ability to hold a large amount information QR codes can be programmed to do many things including: navigate to a website, add a contact to the address book, add an event into the calendar, or send a text message (Baik, 2012).

QR Codes and Facilities Management

QR Codes have the potential to benefit the facilities management industries in many ways. Because of their ability to store more information than the conventional Bar code, they can do

more than provide a way to track inventory. The following hypothetical example will demonstrate how QR Codes can make maintenance more efficient:

If an air handler were to malfunction, a QR code on the air handler could be programmed to do many things. This QR code for example could pull up the manufacturer of the air handler's web page, or a page containing the owner's manuals and schematics of the device. The QR code could also take the technician to take a webpage that contains the maintenance records of the unit including when the unit was last serviced. It could also open and close work orders. The QR Code, in this case would save the technician time, as he would not have to spend any time finding information on the piece of equipment or searching for owners manuals and maintenance records prior to inspecting the equipment, but all the information he needed could be attached via a QR code on the internet, to the air handler.

A study done by the Department of Civil Engineering at Taipei University of Technology indicates that, "maintenance staff can download the most up-to-date maintenance schedule from the internet and enter facility maintenance results directly via a tablet or notebook. Additionally, [smart devices] display the checklist for every facility maintenance task. Maintenance staff can record information such [as] dates, conditions, inspection results, descriptions of problems ... and recommendations." (Lin et al.).

Furthermore a QR placed on a piece of equipment, could act as a means of communication from the occupants of the facility to the manager. If the piece of equipment were to malfunction the user could scan the QR code to create a work order, alerting the FM as soon as it gets placed. This open communication would decrease the time it takes to report a problem, and increases the occupants trust in the FM.

Aim

The aim of the pilot research, presented in this paper, was to determine two things: first if, and how, QR codes are being utilized in the facilities of Higher Education Institutions, and second, what is the market availability of QR codes in CMMS.

Methodology

In order to determine if, and how, Higher Education Institutions in STATE NAME WITHHELD were utilizing QR cods, two pilot surveys were initiated. One survey was sent to all Public Universities in STATE NAME WITHHELD as well as a few private universities. The other pilot survey was directed to CMMS providers.

The schools we selected to include in the survey were all of the Universities in STATE NAME WITHHELD that offered a 4 year degree. The first survey was conducted either over telephone or by email. The first attempt at contacting each FM was done by the telephone. If a phone number was not listed on the universities website or they did not respond to the phone call, an email was sent. In each conversation, had with the FM, a short interview was conducted. Each FM was asked questions regarding the CMMS that was being used and how it fulfilled their needs. At the end of each interview the FM was asked the following two questions relating to their MEP maintenance and work order software:

- What software and/or web-based subscription do you currently use for your MEP maintenance and work orders?"
- Are QR codes or barcodes on your equipment as part of your system?

Results of this survey are shown in Table 1.

Once the data from the first survey was collected, the second pilot survey began. The second survey was designed to determine two things: determine if the Schools that participated in the first survey had access to barcodes and QR codes with their current CMMS, and what is the market availability of QR Codes and barcodes. The survey started by contacting each CMMS provider that the schools that participated in the first survey were using. The questions that were asked each company are the following:

- Are QR codes a part of your CMMS program?
- Are Barcodes a part of your CMMS program?

Results of this survey included Table 1.

Table 1. Schools CMMS and their use of BR and Barcodes

School	Use of QR Codes	Use of Barcodes	CMMS	Offer QR Code	Offer Barcode
Name Withheld	No	Yes	AiM from Asset Works	No	Yes
Name Withheld	No	Yes	web-based provided by State	No	Yes
Name Withheld	No	No	WebTMA	No	Yes
Name Withheld	No	No	WebTMA	No	Yes
Name Withheld	No	Yes	Magic	No	Yes
Name Withheld	No	Yes	Sprocket	No	Yes
Name Withheld	No	No	Ai	No	Yes
Name Withheld	No	No	MP2	No	Yes
Name Withheld	No	No	Sprocket	No	Yes
Name Withheld	No	No	FAMIS by Accruent	No	No
Name Withheld	No	No	in-house / self-perform	N/A	N/A

Findings

At the close of the surveys we found that 0% of the schools that participated used QR codes as part of their MEP maintenance and work orders. However, 36% of the schools were using barcodes. In the interview many of the facilities manager provided collaborating reasons as to why QR codes were not being used. One reason for not using QR codes was the cost of the smart devices compounded with the cost of changing or upgrading their current CMMS made QR codes impractical to implement. An other reason was the time it takes to change from one CMMS to another in order to incorporate QR was not worth the benefit of QR codes. Additionally the fear of the smart devices being damaged in day-to-day operation stopped some managers from using QR codes.

In the second survey we found 0% of the CMMS providers that the higher education institutions used offered QR codes. Additionally only 18% of the CMMS provider did not offered barcode solutions for their clients.

It seems that that added benefit of QR codes is not worth the cost of updating a working CMMS. This can be seen by the fact that none of the schools have tried implementing QR codes. Also the

majority of the schools surveyed were not using barcodes even though all of the CMMS that were used by the schools had barcode capabilities.

Conclusion

QR Codes have been making their way into many industries and have become commonplace in daily life (Baik 2012). From conversations with facilities managers in Higher Education Institutions it is apparent that they recognize the potential for good QR Codes have. Unfortunately the cost associated with implementing a new technology is preventing the use of QR Codes. The research showed that barcodes were being used by facilities and the technology is available through CMMS providers. The few added benefits that QR codes have over barcodes do not seem to justify the added expense of implementing them.

Further Research

This pilot research project is undergoing evaluation and will be expanded to include other universities, and commercial facilities to determine the availability of QR codes and their implementation into CMMSs

In conjunction with this research a case study can be conducted to calculate a cost benefit analysis on implementing QR codes. The objection of this case study would be to determine the feasibility of switching from one CMMS to another with QR code capabilities.

While doing this research several questions were brought up. QR codes seem to have the potential to increase an organizations productivity, and efficiency a responding to work orders and doing repairs, but is that really the case. A case study should be preformed on a few locations that have QR codes implemented to see how frequently they are used and if

This reassert in this project did not take the size of the schools into consideration. Research to determine if the size of an Organization impacts the use an efficiency of tracker like QR codes.

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