E-ATTENDANCE SYSTEM (EAS) USING BLUETOOTH

Muhammad Faiz Mokhtar¹, Che Wan Shamsul Bahri C.W.Ahmad² and Khirulnizam Abd Rahman³

Faculty of Information Science and Technology,
Kolej Universiti Islam Antarabangsa Selangor, MALAYSIA
¹muhdf4iz@gmail.com,
²cwshamsul@kuis.edu.my,
³khirulnizam@kuis.edu.my

ABSTRACT

Nowadays, several office, company, or organization, whether governmental or non-governmental organizations are still using manual or traditional methods to record the attendance of their staff. More than that, they used a punch card machine. In line with technological developments, it can be said almost all workers have at least one smartphone. Therefore, we develop our projects, E-Attendance System (EAS) to utilize the existing technology by using smartphone that capable to record the attendance of staff using their smartphone device with Bluetooth feature. Raspberry Pi equipment is also used in this project.

Keywords: Attendance system, Bluetooth, Raspberry Pi

1. Introduction

In this technology era, everything needs to be done fast and efficiently with help from the technologies that have been invented today. But how many people are able to use all these gadgets efficiently or use every kind of features inside it? It is wastes of money if we are use only a few features inside it. For example, a very well-known gadget nowadays, a smartphone. Do we really use every technology that was built inside our smartphone? There is no reason to buy an expensive smartphone if we are only using it for calling and messaging our friends.

It is a must for every office to own at least one punch card machine in order to obtain every employee attendance. This machine should be able to record the attendance in every time employee enter in office and out from office. But how efficient this machine able to do its’ job these days? Other employees are freely to punch their friends’ card anytime they want in order to help them. Employees’ productivity is not able to be measured using this machine anymore because the management does not really know who actually comes to office at the right time.

In order to overcome this problem, there is a rare invention which not many aware of it. The combination of Raspberry Pi and smartphone is able to replace a punch card machine which is already old.

Raspberry Pi is a low cost computer. It has a small size form factor that looks like a credit card. This small computer can run mostly everything that normal computer do. It has every important part in a small single board computer (Upton, 2012).
1.1 Overview of the Project

The e-attendance system is nearly the same to the punch card machine at most office but with a lot of improvement and better features. This system is able the users to ‘punch card’ or log their attendance wirelessly using their smartphone. There is no need to go to the machine every time users need to enter and out from the office. Users just need to turn on their smartphone’s Bluetooth and just walk away. This machine will detect users Bluetooth address and update it to database. This machine is able a user to work more efficiently and faster. Other users are not be able to punch their friends’ card because this machine requires user smartphone unless if they give their smartphone to them.

In order for Raspberry Pi Wireless Punch Card project to work, first we need a Raspberry Pi itself. It is very cheap for a fully functional computer which is around RM80 to RM180 (Raspberry Pi, 2015). Second, we need a smartphone with Bluetooth to act as a ‘card’. Third, we need storage in order to store database.

Raspberry Pi uses python language (Usage of Raspberry Pi, n.d.). It also supports many operating systems. One of the most popular one is Raspbian. Raspbian is a Debian based system which is optimized for Raspberry Pi hardware (Usage of Raspberry Pi, n.d.).

1.2 Problem statement

There are a lot of problems occur to the traditional punch card machine. Almost all users and companies face it when use this machine. Some of the problems are as follow;

1.2.1 Punch card machine is quite expensive nowadays.
1.2.2 Other users able to punch their friends’ card freely.

1.3 Scope

This project is very useful for most company. There is no restriction on ages. Users can take advantages from it as long as they know what they are doing. Every user should have a smartphone with Bluetooth feature. This project is design for a small and big place.

1.4 Objective

In order to overcome most of the problems, they are four objectives that are suitable to be used for this project. There are as follow;

1.4.1 To save the company budget by buying a cheap and better machine.
1.4.2 To reduce the possibility of user to punch or log for someone else card.
2. Literature review

Before we begin the project, it is important to do a lot of research about the project in order to get a better view and ideas so that this project can be run smoothly without any big problems and mistakes. A deep research on this topic can help to make project become clear and better understanding.

This is where research need to be discussed according to the existing project that already being developed and used by other user. A deep studies need to be done in order to find the advantages and disadvantages of the existing system so that this project can be used either to modify it to become better or to add more functionality to our system.

2.1 Domain Studies

Bluetooth technology is a wireless communications technology that is simple, secure, and everywhere. You can find it in billions of devices ranging from mobile phones and computers to medical devices and home entertainment products. It is intended to replace the cables connecting devices, while maintaining high levels of security (Bluetooth Basics, 2015).

Prabhu & Reddi (2004) stated that Bluetooth is a short range wireless radio technology standard that packs the potential to meet the demands of the present and of the future. The key features of Bluetooth technology are ubiquitousness, low power, and low cost. The Bluetooth specification defines a uniform structure for a wide range of devices to connect and communicate with each other.

When two Bluetooth enabled devices connect to each other, this is called pairing. The structure and the global acceptance of Bluetooth technology means any Bluetooth enabled device, almost everywhere in the world, can connect to other Bluetooth enabled devices located in proximity to one another.

Heydon (2012) said that a radical departure from conventional Bluetooth technology, Bluetooth low energy (BLE) enables breakthrough wireless applications in industries ranging from healthcare to transportation. Running on a coin-sized battery, BLE can operate reliably for years, connecting and extending everything from personal area network devices to next-generation sensors. Now, one of the standard’s leading developers has written the first comprehensive, accessible introduction to BLE for every system developer, designer, and engineer.

Connections between Bluetooth enabled electronic devices allow these devices to communicate wirelessly through short-range, ad hoc networks known as Piconets. Piconets are established dynamically and automatically as Bluetooth enabled devices enter and leave radio proximity meaning that you can easily connect whenever and wherever it's convenient for you.

Each device in a Piconet can also simultaneously communicate with up to seven other devices within that single Piconet and each device can also belong to several Piconets simultaneously. This means the ways in which you can connect your Bluetooth devices is almost limitless (Bluetooth Basics, 2015).

A fundamental strength of Bluetooth wireless technology is the ability to simultaneously handle data and voice transmissions. which provides users with a variety of innovative solutions such as hands-free headsets for voice calls, printing and fax capabilities, and synchronization for PCs and mobile phones, just to name a few.

The range of Bluetooth technology is application specific. The core specification mandates a minimum range of 10 meters or 30 feet, but there is no set limit and manufacturers can tune their implementations to provide the range needed to support the use cases for their solutions.
2.2 Technologies Studies

This idea of a small computer came in 2006, when Eben Upton and his colleagues became concerned about decline in the numbers and skills levels of the A Level students applying to read Computer Science in each academic year. By 2008, the project started to look very realizable since processors designed for mobile devices were becoming more affordable. Then Eben and his colleagues form the Raspberry Pi Foundation (Upton, 2012).

The size of Raspberry Pi looks like a credit card. Specifically, the exact dimension of Raspberry Pi form factor is 85.60mm x 56mm x 21mm. There are a lot of Raspberry Pi models and every of it comes with different prices and hardware. But all of the models come with an important hardware such as processor, ram, USB port, display port, audio port and Ethernet port (Peter, 2011).

Upton (2012) mentioned the processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system on-chip (SoC) multimedia processor. This means that the vast majority of the system’s components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 256 MB memory chip at the center of the board. It’s not just this SoC design that makes the BCM2835 different to the processor found in your desktop or laptop, however. It also uses a different instruction set architecture (ISA), known as ARM.

The ARM-based BCM2835 is the secret of how the Raspberry Pi is able to operate on just the 5V 1A power supply provided by the onboard micro-USB port. It is also the reason why you won’t find any heat-sinks on the device: the chip’s low power draw directly translates into very little waste heat, even during complicated processing tasks.

On the early year of 2015, a new model of raspberry pi is introduced. Raspberry Pi 2. This new model has a built in a powerful processor, ARMv7 processor. This processor has a lot of improvement than its predecessor in term of speed. It is now a 900MHz quad-core processor. Raspberry Pi 2 is now compatible with a lot of software that developed for ARMv7. This model also has a bigger memory chip which is 1GB memory (Gates, 2015).

Raspberry Pi is designed to run an operating system call GNU/Linux. There are a lot of operating system that available for free such as Ubuntu, Pidora, Risc OS and OpenElec. But the best operating system that is design to work perfectly with the Raspberry Pi hardware is Raspbian. On the latest model of raspberry pi, it even supports to run the latest Windows 10 operating system. Microsoft has agreed to give a free copy of Windows 10 to every Raspberry Pi users. It is now available for free and can be downloaded at the internet (Warren, 2015).

Another important difference between the Raspberry Pi and your desktop or notebook, other than the size and price, is the operating system, the software that allows you to control the computer. The majority of desktop and laptop computers available today run one of two operating systems: Microsoft Windows or Apple OS X. Both platforms are closed source, created in a secretive environment using proprietary techniques. These operating systems are known as closed source for the nature of their source code, the computer-language recipe that tells the system what to do. In closed-source software, this recipe is kept a closely-guarded secret. Users are able to obtain the finished software, but never to see how it’s made.

Linux isn’t exclusive to the Raspberry Pi. Hundreds of different distributions are available for desktops, laptops and even mobile devices; and Google’s popular Android platform is developed on top of a Linux core. If you find that you enjoy the experience of using Linux on the Raspberry Pi, you could consider adding it to other computing devices you use as well (Edge, 2011). It will happily coexist with
your current operating system, allowing you to enjoy the benefits of both while giving you a familiar environment when your Pi is unavailable.

Monk (2012) said there are too many things you can do with your Raspberry Pi, from controlling hardware with Python, to using it as a media center, or building games from scratch. The beauty of the Raspberry Pi is that it’s just a very tiny general-purpose computer (which may be a little slower than you’re used to for some desktop applications, but much better at some other stuff than a regular PC), so you can do anything you could do on a regular computer with it. In addition, the Raspberry Pi has powerful multimedia and 3D graphics capabilities, so it has the potential to be used as a games platform, and we very much hope to see people starting to write games for it.

2.3 Example of Existing System

2.3.1 Attendance system using Raspberry Pi and NFC Tag reader

![Raspberry Pi with NFC Tag Reader](image)

This machine requires user to use NFC tag in order for the system to take attendance of user. User needs to bring their NFC tag or smartphone with NFC, go to the machine and tap it. The machine as shown in Figure 1 will detect the NFC card and update the owner of the NFC to the attendance in the database.

This alternative is very good in order to save budget because NFC is very cheap nowadays. The machine also can detect the NFC tag fast without waiting.

Even though NFC is cheap and easy to carry but it is easy to destroy. Especially, when the NFC is put in the small space such as in the pocket and in the bag. The NFC needs to tap or touch the machine which sometime not really fast when there are many users want to use at the same time. A cheap smartphone with NFC also is very rare to find nowadays (Yim, 2014).

2.3.2 Smart Attendance Management System Using Android WIFI Technology

Smart Attendance Management System in Figure 2 is an application developed for daily student attendance in colleges, offices and institutes. This system requires an android device with WIFI. Students will connect to the WIFI and then log in to the system. Lecturer will then collect the attendance
based on those who are logged in. There will be a SMS module that can be implemented which will inform students about low attendance and various events.

This system is a time saving. There is no need to maintain several separate records and manual calculations. It is 24 hours availability of information and more secured than traditional attendance system.

This system needs a smartphone with specifically using Android Operating System. Not all students and lecturers use Android in their phone. This system can easily being hack by student who has high knowledge in networking and programming. They can easily take advantages of the system or just shut it down. There will be difficulties to connect every phone to the WIFI at the same time because some routers only support a few users at the same time. Class with high amount of student will need to be reconsider back either to use this system or not (Biswas, 2014).

Figure 2: Smart Attendance with Wi-Fi

2.3.3 Class Attendance System using Active RFID

This system use RFID in order to collect attendance. The system will use RFID reader to detect the information that consists on matrix card from each student which the data will send from RFID tag to reader by using wireless connection. Then, the data will be sent to central computer. All the information will store in database and compare with data that already in database. This is done to identify the status of the attendance. Finally, the administrator and lecturers can access and update the data in the database.

RFID can detect the tag on the matric card very fast. Almost no more delay at all. There will be a problem if student forgot to bring their matrix card. The student needs to go back to their room and then come back to the class to get the attendance which already use a lot of time. This will consume a lot more time if the student wakes up late (Helmy, Herdawatie, Nurfahmi, Rahmat, & Razali, 2012).
2.3.4 Punch Card System by Using Wi-Fi Device

This system will replace the current punch card system by using Wi-Fi. Staff will need to turn on the Wi-Fi on the phone. Staff needs to connect to the designated hotspot in the office. Staff needs to log in and then system will automatically get the staff data, put it in the attendance and then store it in the database.

By using wireless, it already consumes very less amount of time. It can save user time for other events.

If we talking about Wi-Fi, then a probability of the network to be hacked by someone irresponsible is exist. Some intelligent user can easily hack the system either to shut it down, make chaos in the office or more serious if they are able to gain users’ personal data (Aniza, 2014).

All kind of research has been done in order to gain more extra knowledge in this project. These are include research about the wireless that about to be used later in the project, Bluetooth, the main machine, Raspberry Pi and some research on current or existing system that has been done by other user around the world. These kinds of studies are vital in order to finish this project without having some serious problem at the end of the project.

3. Methodology

This system will use a wireless technology to collect the user attendance. Traditional method requires a lot of work. It uses more time. By using wireless, it consumes very little time to collect every attendance. For wireless technology, we will use Bluetooth which consume less power and shorter range. Wi-Fi will not be used in this system because of something which can lead the system into problem later. One of the problems are there is a risk that the system will be hack by someone. The hacker will easily shut the system down or make it worse by stealing or modifying user personal data. Wi-Fi also has longer range than Bluetooth. Range is not important since every user will also go through in front of the device.

3.1 Network Methodology

In the figure below (refer Figure 3.2) is sequence methodology which will be used in this project. This project will use System Development Life Cycle (Roebuck, 2011) methodology as a main methodology.

3.1.1 Analysis

The planning is to create a system that act as a machine to collect attendances. By using one of the wireless technologies which is Bluetooth, it will attach to the main machine, Raspberry Pi. At first, Raspberry Pi needs to save every users Bluetooth address with their information in the database. User needs to turn on their Bluetooth on the smartphone and just walk away in front of the receiver which is usually place at the main entrance.

User no need to do anything, just walk from the main entrance and go straight to their room. The device will scan any authorized Bluetooth address in range. When it detect, it will produce a sound and will update the owner of the Bluetooth address to the attendance in the database. The device will just ignore any unknown Bluetooth address. Management will just need to plug in their USB to the Raspberry Pi in order to check or get the database.

3.1.2 Design
Figure 3 shows an illustration of how this project will actually work and run.

![Network Design Diagram](image)

Figure 3: Network Design

### 3.1.3 Implementation

This system will be implemented using python scripts which contain every coding to detect Bluetooth address and save every user address to the database.

### 3.1.4 Testing

The device will first save a Bluetooth address of particular user with their personal information in the database. The device will locate at near a door. The user will turn on their smartphone’s Bluetooth. The user will walk through the door without doing anything. A sound will trigger to inform to the user that their attendance is updated. After that, database in the Raspberry Pi will be read in order to check either the user attendance is updated or not.

### 3.1.5 Evaluation

After enough testing, the project will be evaluated in order to find any problem, either small or big problem. All found problem will be investigated and searching for the best solution. This is important stage so that this project will free from any error and problem especially a serious one during a real time usage by the end user.
4. Conclusion

We hope this project will improve a way to record a staff attendance more efficiently and successful and help a user or company to be more productive.

References


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