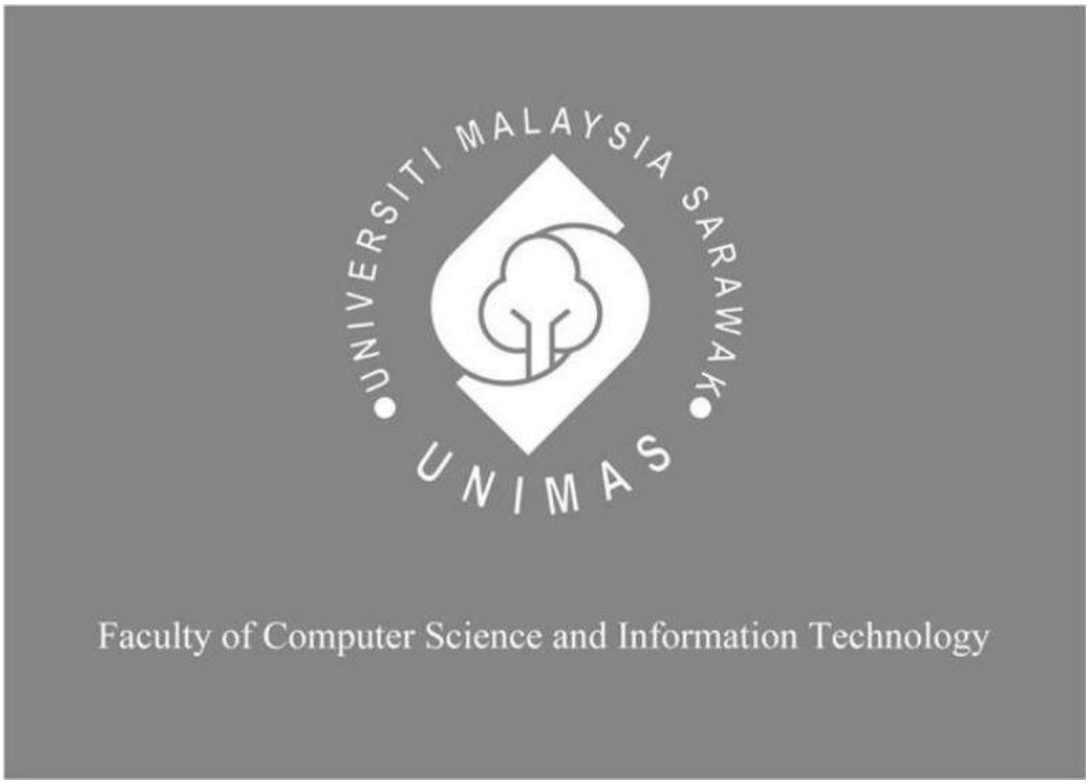

ATTENDANCE SYSTEM USING BEACON TECHNOLOGY FOR COURSE TRAINING SESSION

Holifield William

Bachelor of Computer Science with Honours (Network Computing)

2023

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HOLIFIELD WILLIAM

This project is submitted in partial fulfilment of the

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ABSTRACT

Attendance system has evolved to various kind of methods in the last decade. Current existing traditional methods such as writing attendance on a piece of paper or punch card are lacking in terms of time efficiency. To overcome this problem, an attendance system using Bluetooth Low Energy (BLE) beacon is proposed to record attendance by just connecting a mobile device with the BLE beacon. This will increase the time efficiency when taking an attendance for an event or program. Moreover, all of the attendance records are stored in a database where this will eliminate the needs to check the attendance record one by one manually. In this project, a mobile application will be developed in order to establish the connection between the mobile device with the beacon to perform the attendance record process. The ultimate goal of this project is to replace the traditional method to reduce the time consuming when taking an attendance for a program or event.

ABSTRAK

Sistem kehadiran telah berkembang kepada pelbagai jenis kaedah dalam dekad yang lalu. Kaedah tradisional sedia ada seperti menulis kehadiran pada sehelai kertas atau punch card adalah kurang dari segi kecekapan masa. Bagi mengatasi masalah ini, sistem kehadiran menggunakan suar Bluetooth Low Energy (BLE) dicadangkan untuk merekodkan kehadiran dengan hanya menyambungkan peranti mudah alih dengan suar BLE. Ini akan meningkatkan kecekapan masa apabila mengambil kehadiran untuk acara atau program. Selain itu, semua rekod kehadiran disimpan dalam pangkalan data di mana ini akan menghapuskan keperluan untuk menyemak rekod kehadiran satu per satu secara manual. Dalam projek ini, aplikasi mudah alih akan dibangunkan untuk mewujudkan sambungan antara peranti mudah alih dengan suar untuk melaksanakan proses rekod kehadiran. Matlamat utama projek ini adalah untuk menggantikan kaedah tradisional untuk mengurangkan masa yang digunakan semasa mengambil kehadiran untuk sesuatu program atau acara.

CHAPTER 1 : INTRODUCTION

1.1 Background

Attendance is a state to show the presence of a person during an event. The most popular of these tracking systems are the time card, the perforation clock, and the time sheets (IceHrm, 2020). In the current era of globalization, these methods seem to have drawbacks in some aspect where there are many technologies that available to fix and fulfill any drawbacks that these systems have. The manual methods of obtaining attendance are ineffective and getting out-of-fashion with introduction of new technologies (Bajpai, 2020). Despite the availability of automated technologies, these manual methods are still widely used. These are usually used by smaller business operations (TimeRack, 2021). It is about time to change these traditional methods with an automated system in order to keep up-to-date with the current era of technologies.

Technologies nowadays has evolved so rapidly if to compare with the technologies that are available before. The most popular phrase that widely known for these technologies is the word "Smart". It is a technology that uses artificial intelligence, machine learning and big data analysis to provide cognitive awareness to objects that were in the past considered inanimate (bowers, 2019). The totality of smart technologies and the potential offer is often referred to as the *Internet of Things* (IoT). There are many existing IoT products that are available today such as Google Home Voice Controller, Amazon Echo Plus Voice Controller and many more. It is a matter of fact today that a number of IoT products have surpassed a huge number of humans on this planet (Software Testing Help, 2022).

In this project, Bluetooth Low Energy (BLE) beacon is introduced to change the current attendance system for course training session. BLE beacon technology is the most common technology used for providing indoor positioning (Mapsted, 2021). Proposed system is a

system whereby it can record attendance by establishing a communication between devices such as mobile phones with BLE beacon. A beacon is a small device that constantly sends out radio signals to nearby smartphones and tablets, containing a small amount of data (Akpinar, 2022). Bluetooth beacons are part of the Internet of Things, which is the connection between different devices and machines to collect and transfer data without human-to-human or human-to-computer relationships (Mapsted, 2021). Hence, no physical interaction is needed since current era are everything about automation.

1.2 Problem Statement

In current existing attendance system, there are several limitations. For instance, manual attendance system requires manual time entry which is very time-consuming and sometimes there will be incorrect entry of times (IceHrm, 2020). The manual attendance record system is not efficient and requires more time to arrange record and to calculate the average attendance of each student (Shbib et al., 2019). A simple mistake in manual data entry may result in an error in a student's overall attendance percentage (PayPeople, 2022). This could affect the student's enrolment in those particular classes. Furthermore, we are entering Industry 4.0 phase where manual attendance system is ineffective and outdated if compare to current technology's ability that can easily overshadowed this method. As such, using such outdated methods can significantly affect business activities and can also be as costly affair (Bajpai, 2020). QR-Code system also has its own downside. It forces switch from "tracking absences/makeups" to "tracking attendance" in which it eliminates absences and make-ups functionality (Purdy, 2015). This method may result in attendance proxy as the QR-code can be screenshotted and forwarded (SEAtS, 2022).

1.3 Objectives

The objectives of this system are:

1. To design an attendance system with Bluetooth Low Energy (BLE) beacon.

2. To implement the attendance system based on the proposed design.

3. To evaluate the efficiency and effectiveness of the proposed attendance system.

1.4 Project Scopes

The scopes of this system are explained as follows:

Target User

In this system, the target user is participants that are participate in any course training and the course trainer for the particular course. The course training is not limited to any specific course and it could be involving a number of students and lecturer.

Target Location

After the system is fully developed, the system is estimated to be implemented in one particular class of any faculties at Universiti Malaysia Sarawak (UNIMAS) for functionalities testing purposes.

Limitation

The system is limited to certain type of event that required fast attendance recording. For instance, the system is only applicable for course training session and cannot be implement in a school system. The reason behind this limitation is because the system required a mobile phone which is prohibited for students to bring to the school.

1.5 Significant of Project

The key feature of this proposed system is that it instantly records attendance for user once the connection between the mobile and beacon are established. Thus, the time taken to record a single attendance can be shortened in a matter of time. Once the mobile phone user

enters the signal coverage of the Bluetooth beacon, the mobile phone can receive the broadcast content by using an app (Feasycom, 2022). The receiving device, such as a BLE-enabled smartphone, often acts as an intermediary device that uses the information from the beacon to do something with it (Mapsted, 2021). Hence, after the communication has been made, the attendance records will be saved in the database. Moreover, BLE beacon is compatible with any devices from different manufacturers and it uses 2.4GHz band to withstand against interferences during the communication with devices. Most Bluetooth beacons can reliably transmit up to approximately 30 meters without any physical obstructions (Mapsted, 2021). It can automatically send information to users in the coverage area, determine the location of the user, and then transmit corresponding information based on the location (HyxkioT, 2022). A beacon is estimated to last longer than expected although it relies on batteries for its power. Generally, lasting from about 18 to 24 months, while some may even last over 5 years (TimeTec, 2016). Thus, it is efficient to choose beacon since the cost for one beacon is affordable and suitable for its functionalities it provides.

1.6 Project Schedule

Project schedule is to obtain the time frame of the project development towards completion. In this section, Gantt Chart is used to obtain the details of the project details including the time frame and the schedule of each task. The Gantt Chart also serves as a guideline to determine the progression of each task and to avoid any task exceed its expected completion date.

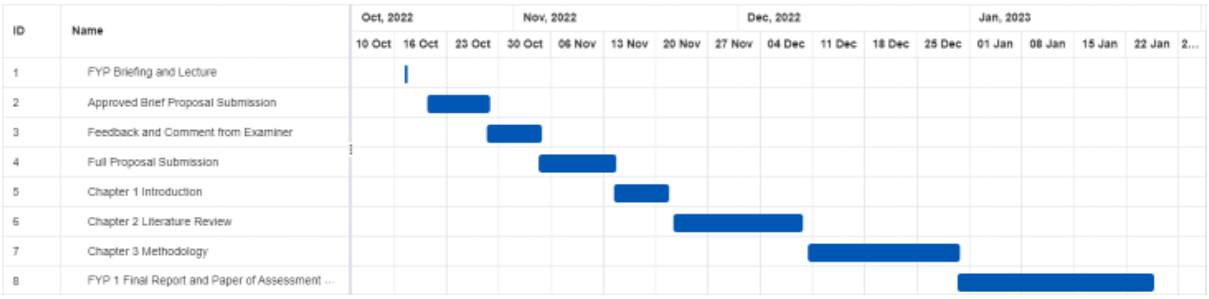

Figure 1-1 General overview of project schedule

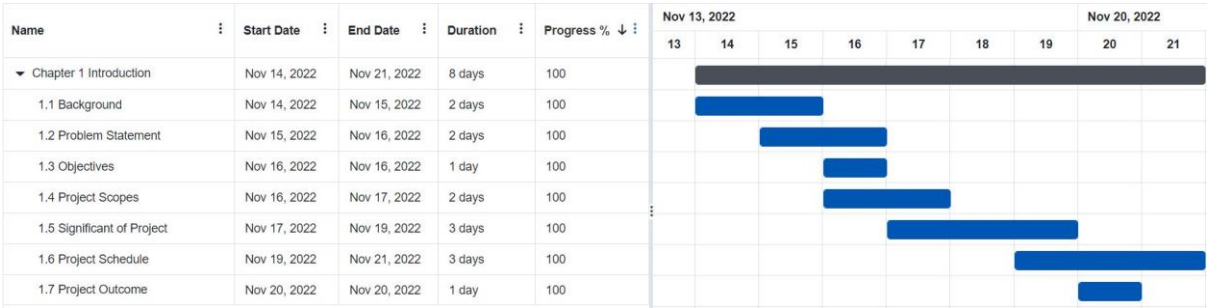

Figure 1-2 Schedule for chapter 1

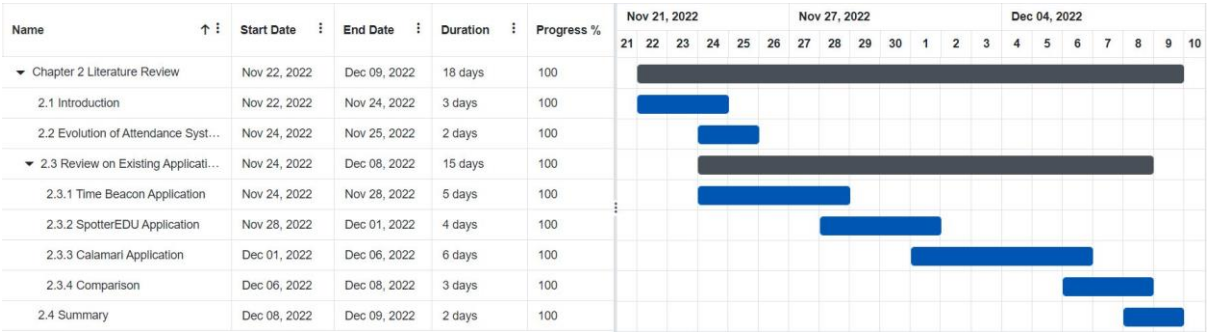

Figure 1-3 Schedule for chapter 2

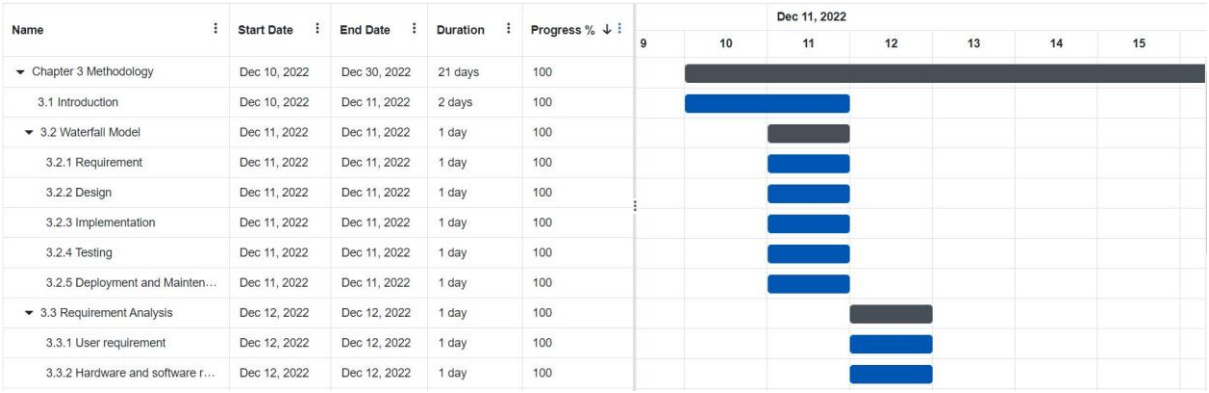

Figure 1-4 Schedule for chapter 3 part 1

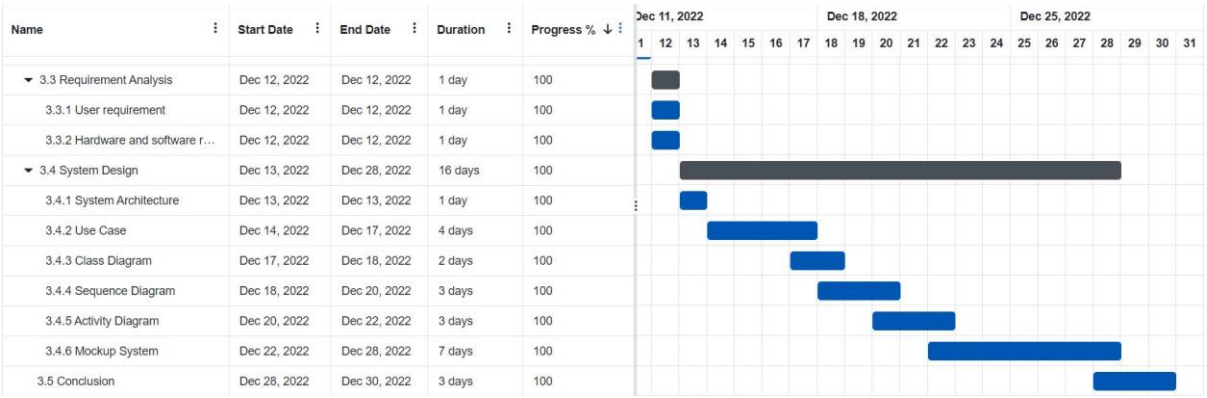

Figure 1-5 Schedule for chapter 3 part 2

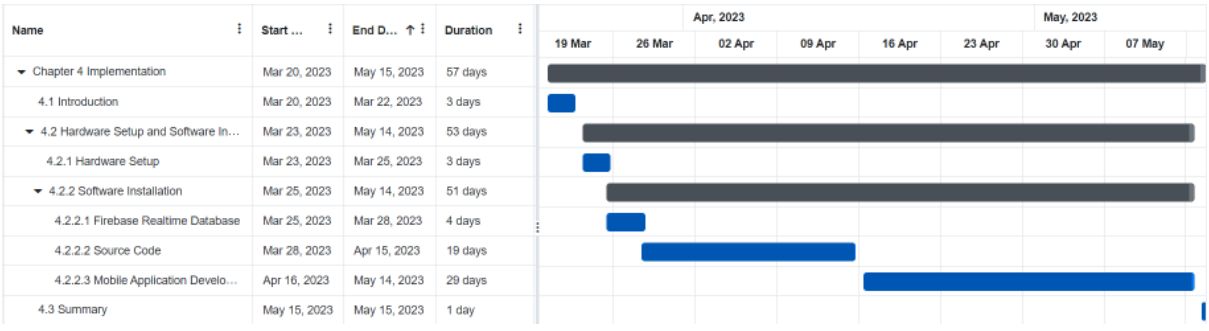

Figure 1-6 Schedule for chapter 4

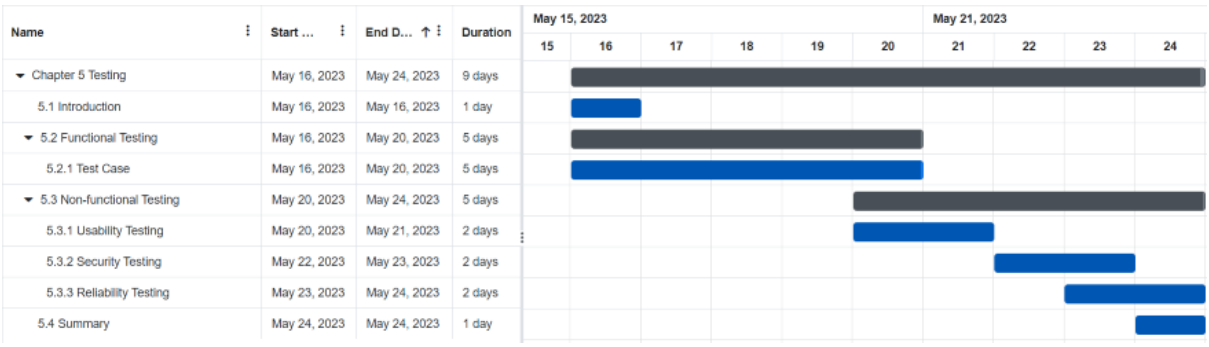

Figure 1-7 Schedule for chapter 5

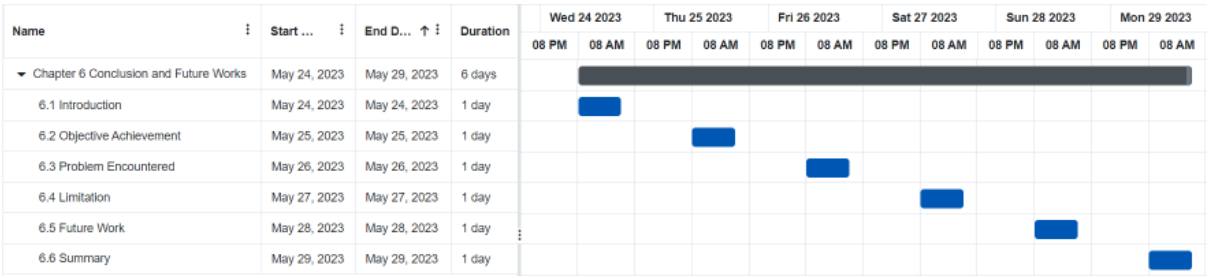

Figure 1-8 Schedule for chapter 6

1.7 Project Outcome

By the end of this project, the objectives are achieved whereby a mobile application is developed and installed in a mobile phone. A database is successfully created to store the attendance records. Next, a fully configured BLE beacon that able to detect any devices within its coverage area and able to send the information to the database. Last but not least, the list of attendance that the system has stored in the database are available to view.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

In this chapter, the history and evolution of attendance system will be described to show what are the types or methods that has been used in the past. Although the technologies are evolving, most of the methods are still widely used in certain organizations or activities until now. Next, the comparison of existing application or software will be described to identify the benefits that proposed system holds that current existing system does not provide.

2.2 Evolution of Attendance System

Attendance systems have evolved over time to become more efficient and accurate ways of tracking whether individuals are present at a specific location or event. In the past, attendance was often tracked manually using paper and pencil, with individuals marking their own names on a physical attendance sheet. This method was prone to errors and inaccuracies, as people could easily forget to mark their attendance or accidentally mark the wrong name. In the late 1800s, the first method used for recording attendance was called time card where it was designed for employee by inserting the time card to a machine. This mechanical employee time clock would stamp day and time information on a thick paper card, hence the name 'time card' (Redcort, 2011).

As technology has advanced, electronic attendance systems have become more common. These systems often use electronic devices, such as swipe cards or biometric scanners to track attendance quickly and accurately. These systems can be linked to databases or other computer systems, allowing for the easy tracking and analysis of attendance data.

One of the most recent developments in attendance tracking technology is the use of mobile devices and apps. Scanning qr-code in order to record individual attendance has developed and commonly used in higher level education. This allows individuals to quickly

and easily mark their attendance using their smartphones, eliminating the need for physical attendance sheets or specialized devices. This also allows for real-time tracking of attendance, making it easier to monitor and manage attendance in real-time.

Overall, the evolution of attendance systems has been driven by a desire for more efficient and accurate ways of tracking attendance. As technology has advanced, these systems have become increasingly sophisticated, making it easier for organizations to accurately track and manage attendance.

2.3 Review on Existing Applications

In this section, comparison between existing applications with proposed system will be described. The example of current existing applications that will be introduced and briefly explained in this section is the applications that is known as Time Beacon, SpotterEDU and Calamari. The comparison that will be described in this section will includes the brief introduction and the features that each application provides.

2.3.1 Time Beacon Application

Time Beacon is owned by TimeTec TA that allow users to scan nearby beacon for attendance clocking activities via BLE-enabled smartphones. The system stores and manages employees' profile and login information also provides administrator a full view of employees' attendance. The system is compatible with any iOS and Android devices and users can report and view attendance using mobile network and GPS locator.

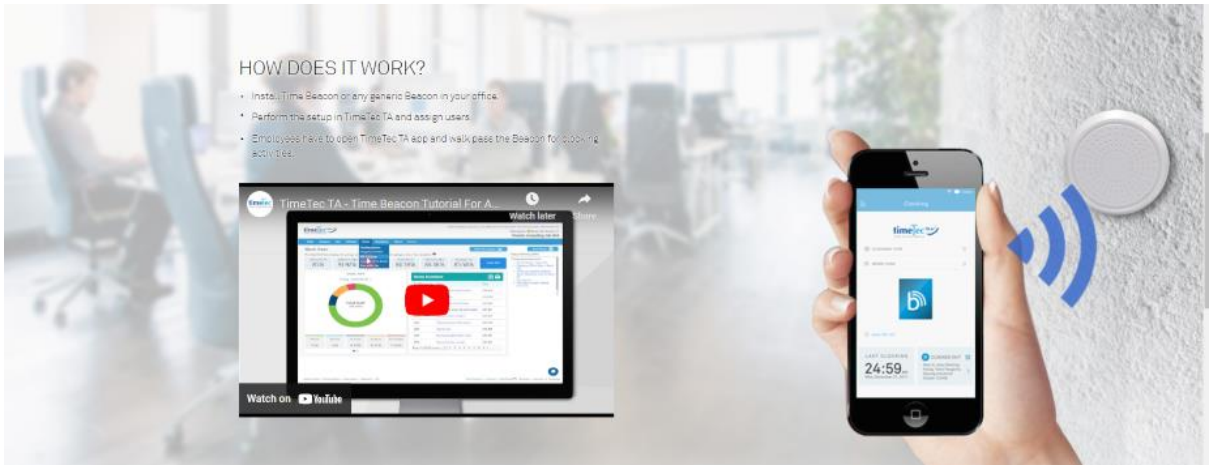

Figure 2-1 Time Beacon official website

2.3.2 SpotterEDU Application

SpotterEDU was developed in 2014 and over 30 schools currently using the services that the system provides. The application detects beacons to implement automated attendance monitoring. Mainly focusing on student-athletes' attendance that benefits both coaches and the students itself. The attendance system utilized iBeacon technology to keep track of students' movement within a classroom, providing continuous and non-invasive attendance.

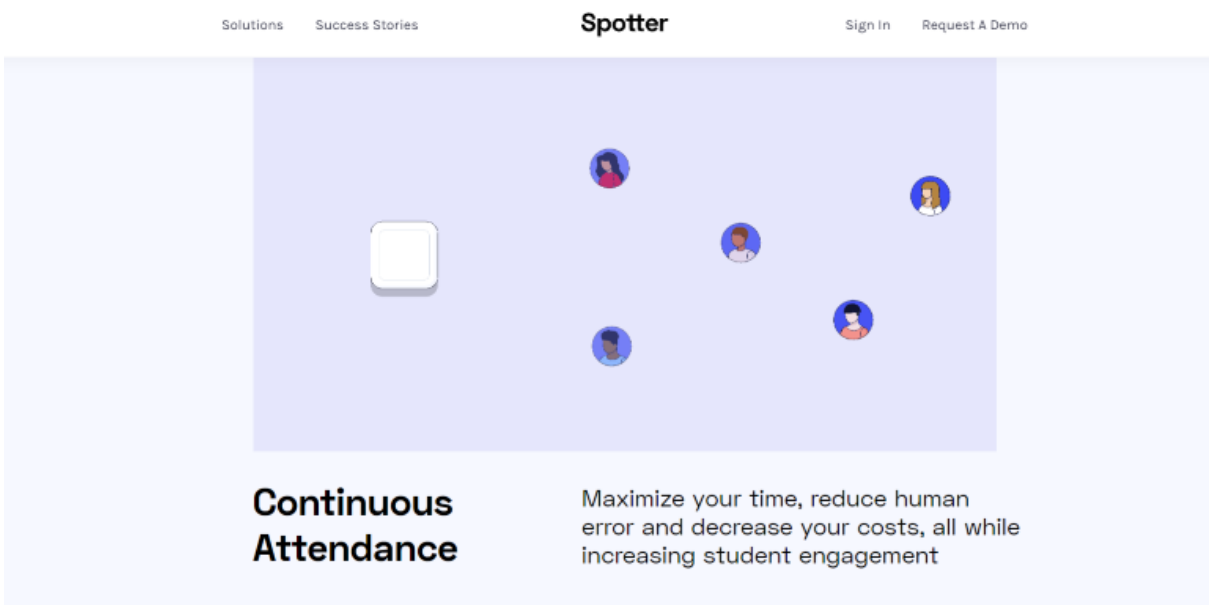

Figure 2-2 SpotterEDU official website