

# **A web-based employee time tracking system: enhancing operational efficiency in the workplace**

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## **Abstract**

*Originally, the only way to confirm employee presence at work involved physical supervision and signing of sheets on arrival. People could report to work late and therefore, they could not render their services effectively thus leading to loss of time and low productivity. Also, such scenarios create thriving grounds for ghost workers in organizations, which lead to increased wage bills for companies and frustrations to human resource managers. As a result, there is lack of accountability among workers in areas of time management and work productivity to determine the compensation due. Unfortunately, there is lack of appropriate mechanisms to monitor employee punctuality and their movements in-and-out of the workplace. Apparently, in this era of modern technology, automated systems can be used to solve the aforementioned issues amicably. The proposed system will facilitate tracking of employees reporting and departure in real time via scanning their staff ID using barcode scanner technology. The project will use prototyping software development methodology whereby PHP, MySQL, HTML and NOTEPAD ++ tools will be used.*

**Keywords:** Web based system, Employee management systems, Tracking Systems, Barcode Technology

## **Background**

Time is of essence in an organization and so are the employees. On the other hand, monitoring of employees' movement in and out of the organization is important to know who an employee is and who is not so as to handle them accordingly. With each having an allocated duty, it is possible to identify ghost workers within the organization.

However, employees' still do demand for pay at the end of every month or rather go on strikes when this is delayed or when in need of salary hike. It is important to be awarded for hard earned sweat, that is proper accomplishment of duties and provision of the services required by the individual company. It is also not appropriate to pay somebody who does not exist but recognized in the pay roll for no apparent duty performed according to [18].

There are increased costs incurred due to payment of ghost workers who defraud and hinder growth of organizations. Apparently, time has changed and so has technology. In physical signing of sheets, there is a large gap since anyone can sign into the organization as an employee with possession of fake ID's. After hacking into the victim organization, it is even more easy to be fixed into the organization's database as an employee but with no apparent

duty but for the sake of a pay at the end of the month. Moreover, it is inaccurate since even without being physically present when clocking in to work, one can still be signed in by a fellow employee.

This deters productivity since services cannot be rendered effectively since one may choose to come for work late or not appear at all since he/she was already signed in. According to [15], an automated system should be used to monitor employees as they report to work. This assists employers to identify ghost workers whereby salaries will be paid to genuine workers to allow productivity and compensation of staff thus efficient management.

The system will stop the issue of ghost workers as every current employee of the organization will be required to swipe their cards (organization identification card) through a barcode scanner on arrival and departure from work. The organization identification card will be issued on the admission date as it will have already been stored in the organizations database as legit right after one has been approved qualified to work for the organization. The system will also help the employer keep track of the employees according to [20], in terms of keeping track and working schedule with effect of how they clock in and out of work.

The project is related to use of biometrics for identification of employees-a perfect tool for establishing accountability that is being adopted by governments today around the world to curb the issue of ghost workers.

Success of this project will facilitate close range checks on employees at workplaces to ensure accountability in time management and other company resources. More importantly, the new system will help organizations to improve employee productivity and maintain company wage bill at the optimum. The aim of this project is to facilitate employee monitoring in the workplace to ensure accountability and eliminate the problem ghost workers.

## **Literature Review**

### ***Overview***

This chapter aims to review employee time management systems and ghost workers concerns in the workplace, as well as previous studies that have been done with regards to employee tracking. Also, problems facing this sector will be investigated, particularly the challenges.

### ***Current Situation***

Many organizations' have struggled to curb the challenges of employee accountability including the elimination of ghost workers. To address this issue, the use of biometrics has been put in place in most organizations' project implementation.

This technology works in such a way that once you arrive at work, you slide your fingers, mainly the index finger to a fingerprint scanner which is able to detect who is entering or leaving. Moreover, there is also physical signing in whenever one arrives at work and while

leaving. The system implies mostly to the person's working in various offices in the organization.

According to [22], 'companies with a wide range of employees working at different times and for different rates, face a further challenge that is the burden of accuracy on the employee that eats up time which could have been used productively. The error rate in some cases is so high that it creates great chaos for the entire security system. It could happen due to weather, physical condition, age and other issues.

### ***Challenges of Biometric Systems***

There are a number of limitations in the use of this system such that biometric machines are less accurate, and mistakes happen. Usually, biometric devices make two types of errors, False Acceptance Rate (FAR) and False Rejection Rate (FRR). When the device accepts an unauthorized person, its known as FAR and when it rejects an authorized person its known as FRR according to [5].

Some biometric devices take more than the accepted time and long queues of workers' form waiting to be enrolled especially in large companies. In such cases, people get hard time while scanning the biometric device every day. It is tedious for a person to go through a biometric verification system before entering into school, office or other places every day.

That not being the only limitation, it is expensive to maintain the system. Regular updates on the system need to be done so as to enable accurate data flow. It is a highly technical and complex system that makes up the whole process. Also, according to [7], a non-techy person will be flopping when trying to understand the system. Companies hire highly experienced and skilled programmers to develop the system, so it requires programmers to manage the system which significantly increases costs. Another problem with the current fingerprint recognition systems is that they require a large amount of computational resources, especially when operating in the identification mode which has some drawbacks.

According to [2], biometric system has some complexity in obtaining high-quality images of images of finger patterns. This are dirt issues, cuts, tear and wear that can easily affect the ridges and minutiae of fingertip. According to [12], 'Labour is the organization's most valuable asset yet it is also the most controllable expense. However, many organizations still rely on manual, semi-automated or disparate systems to track employee time and attendance. A time clock solution that simply tracks employee punches is the first step but not the final destination towards reducing payroll inflation and manual errors.

### ***Existing solutions***

Among solutions to the identified problem has been the use of fingerprint scanner. One uses the fingerprint scanner to clock in to work without any time records being made. However, this results to unaccountability of time and hours worked and thus even lateness to work is tolerated. According to [5], some people aren't fortunate enough to be able to participate in the enrolment process due to loss or damaged body parts such as fingers or eyes. In this type

of cases, a fingerprint/ Iris recognition device recognition would be embarrassing and simply offensive. Such people will surely experience a hard time to come along with others in the system. Physical sheets have also been put in place to sign in employees manually. In turn, this leaves space for unauthorized persons to have access into the organization hence creating room for ghost workers.

The limitations identified above form gaps that make organizations' fail to perform their duties efficiently and with maximum professionalism. The gap arising from this is that there is creation of room for employees to come to work late especially during system maintenance. There are various types of biometric modalities. Some of them are contact based like fingerprint and palm vein scanner; some are contactless like iris and face recognition, etc. According to [8], in contact-based modalities, a biometric device is used a zillion times by enormous amount of people.

Everyone is actually sharing their germs on fingers with each other via the device. You never know what you are taking with you after placing your finger on the device hence making it unhygienic. You wouldn't have any option to change the system.

According to [19], "Biometrics" implies "life measurement" however the term is associated with the utilization of unique physiological characteristics to distinguish an individual. It's a new way to verify individuals' authenticity. Biometrics utilizes biological characteristics or behavioural features to recognize an individual.

In real sense, a biometric system is a pattern identification system that uses various patterns such as iris patterns, retina design and biological characteristics like fingerprints, facial geometry, voice recognition and hand recognition and so forth. Biometric recognition system provides possibility to verify one's identity simply by determining "who these people are" instead of "what these people possess or may be remembered" according to [16]. The very fact that makes it really interesting is that the various security codes like the security passwords and the PIN number could be interchanged among people unlike physical traits.

The principle use of Biometric security is to change the existing password system. There are numerous pros and cons of using biometric technology. In the case of fingerprint scanning, the scanner scans only one section of a persons' finger and it may be susceptible to error. Nonetheless, fingerprints aren't private since we all leave fingerprints almost everywhere. Once the fingerprints are stolen, they are stolen for lifetime and hence there is no way to get back to a secure situation according to [10]

According to [17], there are biometric authentication systems based on a chip card reader integrating a biometric sensor (for example a fingerprint sensor) and a specialized processor. According to this known technique, the reference print (or reference image) of the authorized user is stored in the chip of the card and the verification is carried out in the terminal, using the data of this chip card. When the reference print stored in the card agrees with the print to be compared (of the user to be authenticated) captured by the sensor, the card is unlocked and, for example, then authorizes secure electronic transactions.

However, a disadvantage of such a system is the fact that the step of verification (wherein the reference signature is compared with the signature to be input in order to authenticate a user)

is implemented in the chip card reader according to BiometricToday, (2015). Consequently, the signatures associated with the prints must be stored at least momentarily in the reader. They can therefore be hacked, altered and/or re-used (“replayed”) fraudulently using the reader by an ill-intentioned user.

### ***My Project Gap Stamp***

According to [9], ‘Barcode technology has become so widespread that many consumers take it for granted. The technology continues to offer numerous benefits in a wide array of businesses. With only some basic printing equipment and a readily available barcode scanner, businesses can use barcode technology to improve accuracy, speed and efficiency without significant expense’. The proposed project is set to solve and seal the gap left or rather take in place instead of the biometric system. According to [11], barcodes are used to recover engine systems without failure. A system that is not affected by climatic chemicals, does not fail due to one’s age or sickness (in terms of deformity) and it is accurate in capturing data in terms of arrival and leave at work, time spent on breaks, able to identify when one is on leave and it does still calculate the salaries and allowances depending on the working discipline achieved by each of the employee in the organization come the end of the month.

Each organization is time bound to the working of their employees and thus must see to it that the most significant acts, that is, arrival to work, leaving work place and deductions or proper allocation of salaries and allowances is properly officiated and accurate according to [21]. This is a task that the proposed system will handle. In its place, bar codes will solve it best other than having a system where an employee must use fingerprint. The only thing required is to have the organizations pass ID that will have an individual’s name, department of work and details a bar code that will be scanned through a bar code scanner to verify the information on the ID as rational according to [1] about the effectiveness of scan artists in barcode usage. It is a faster way of login in to work without any clogging of data in the system. Barcodes can also be used when one is sick without any milestones.

Once one is successful on arrival to work, the time from arrival to the first break will be calculated and subsequently till the end of the day when one departs. Depending on the lateness of arrival and return to work after breaks, the system will be able to calculate and effect this before salaries are disbursed at the end of the month.

Also before leaving work, one is required to scan their ID through the barcode scanner in order to be allowed to exit the premises and furthermore for a time stamp of departure from work since the main aim is to keep track of employees’ time stamps so that there is no late arrival or early dispensation from work. This will be a form of projecting remedial use of barcodes according to [3]. In line with that, overtime will also be recorded and effected on one’s work frame and in turn directed to the Human Resource manager.

### **System design and construction.**

## Use case Diagram

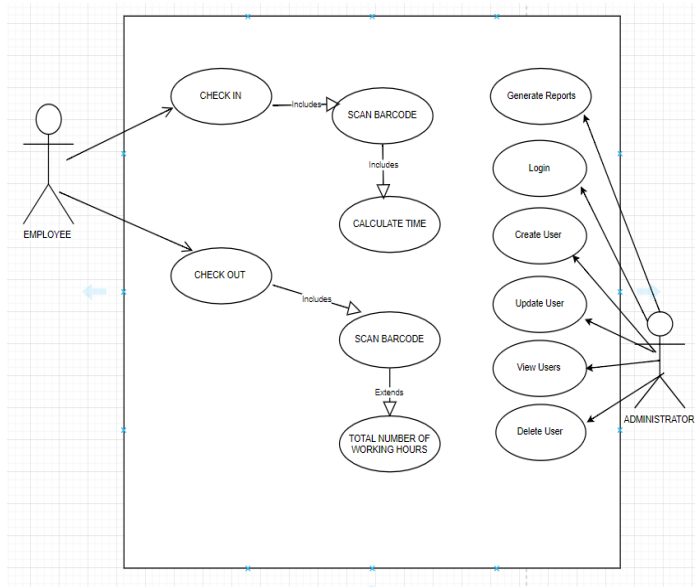


Figure 1. Use Case Diagram

The use cases are UML (Unified Modeling Language) diagrams used during the analysis phase of project to identify and partition the system, their main functionality is to separate the actors and the use cases. Actors represent roles that could be played by users of the system. These users could be humans' other computers, pieces of hardware, or even other software systems. The only criterion is that they must be external to the part of the system being partitioned into use cases.

They, actors, must supply incentives to the part of the system and receive outputs from it. For instance, a registered user pre-condition, the user clocks in, in main success. The scenario is that the user has provided personal information that is barcoded and detailed in the organizations' ID. This is the department of work and the organizations' ID number. The second description comes to the administrator's login so as to view users' activities.

Actors registered, the user pre-condition, who is the administrator is logged in, in main success. In this scenario, the administrator has logged in and selects to view, update, retrieve, generate overall reports or delete users according to either new employee joining the organization or apprising the Identification Cards to verify existence in the systems database.

Post condition- the user clocks out in main success and the system now calculates total number of working hours. If the user does not produce an Identification Card or scans an Identification Card that is not registered to the systems database, THEN: prompt "user cannot clock out".

## Sequence Diagram

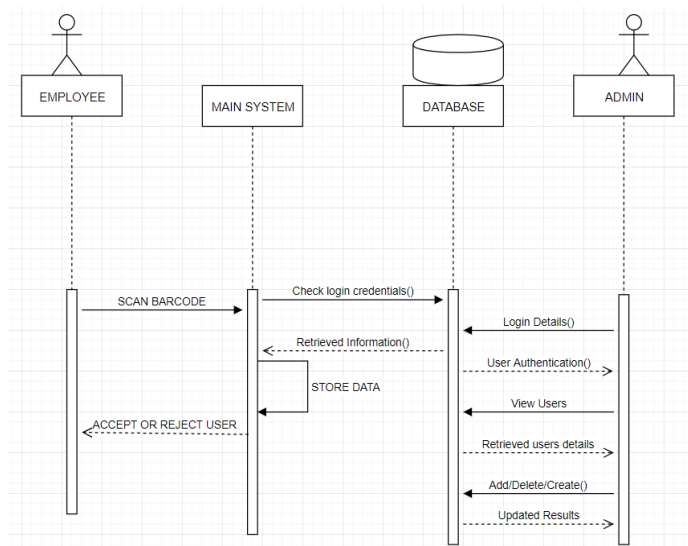


Figure 2. Sequence Diagram

The sequence diagram is a diagram that graphically depicts how objects interact with each other via sending and reception of messages in the execution of a use case or operation. In web application for this case, for detection of risks clocking in and out of work, once the login message is sent, the application validates the user credentials and either accepts or rejects the login.

The administrator then enters their login credentials and is able to view users and their activities. The administrator also can add or delete users, generate reports according to how employees clock in and out. They can also retrieve user details in case of logon failure and update them so that the system can recognize all the employees.

## Flow Chart

The supervisor is in charge of activating the system so that one can be able to sign in with the use of their barcodes. Opening of the clock means that the system was shut down and this is important because data is saved, and the machine is able to cool off so that the systems do not overwork or overheat after leading to data loss.

Scanning of the badge when entering place of work to allow access of the employee.

Supervisor response to exceptions means failure to be able to access the workplace either due to badge unrecognition by the scanner, damaged badge or new entrance of an employee is all solved by the supervisor.

The supervisor closes the clock to give the system a break so that it can process data and so that it can also cool down.

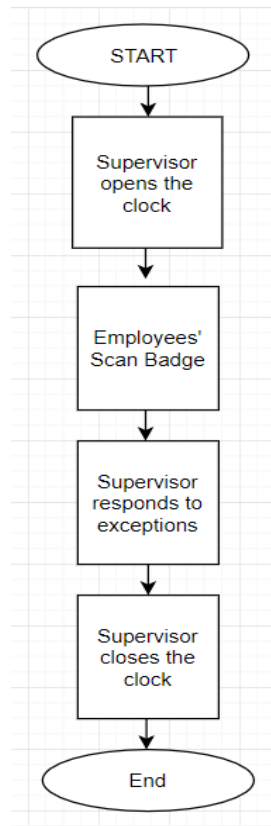


Figure 3. Flow Chart

**System Architecture**

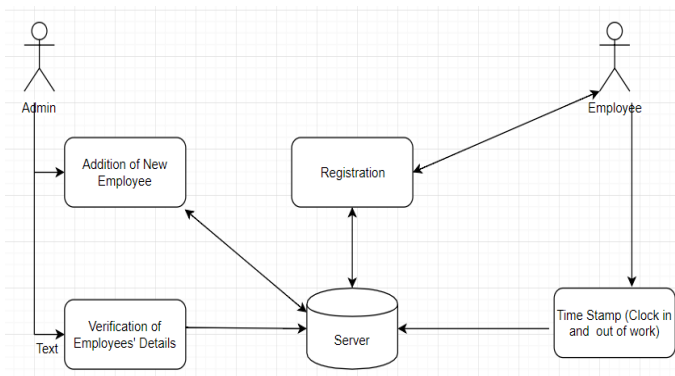


Figure 4. System Architecture

An employee registers so that they are part of the system. Before that, the administrator adds them to the system as new employees and gives them an identification badge number so as to show existence in the firm.



The administrator then verifies their existence in the organization's server after they have registered themselves so that their time stamps can now be approved. The employee then can be able to clock in and out of work since all their details have been verified by the administrator and can now have access as part of the organization's team.

### **System development methodology**

In the case of this project, software prototyping methodology will be used. This methodology enables the development of a system based on the currently known requirements but can change progressively as he/she gains better understanding of the requirements. Also, there is acquisition of knowledge on the system development. Subsequently, errors can be easily detected as difficult functions can be recognized. This methodology has got a disadvantage of making complex scopes. Therefore, to ensure user-friendliness and quality, prototyping is used according to [13].

### ***System Specification***

The biometrics system is currently being enacted to take care of the problem of work attendance by employees. It involves placement of a body part, either the hand or in some cases, the eye (pupil scanning). The system intends to take care of the problem affecting the biometric system that is being currently implemented. This issue will be solved where scanning of barcodes takes less time and is used in most places like supermarkets with a lot of efficiency. According to [8], the purchase of fingerprint scanner is expensive and requires high maintenance and this is out of question when dealing with barcode scanners as they are not costly.

PHP – the importance of using PHP as a programming language is because it's much more compatible with My SQL, which is a source language. It is also safe and secure and not too many codes are required.

MySQL – this will be my database. The reason for using it is that it provides a high performance, that is a unique storage engine architecture. It can meet the most demanding performance expectations of any system.

HTML – this is the base language that CSS, JavaScript and PHP plug into. It provides the content that CSS styles, JavaScript enhances and PHP links to a database (to simplify their function).

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