Proof of Concept (POC)

Biometric Access System for MTA Services

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Author Note,

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The Pilot Run

The purpose of this project was primarily to improve ease of use & connectivity of daily riders. To this effect, we propose that the biometric system should be implemented as a stage by stage pilot project. For maximum effectiveness the new system must be implemented along the non-local subway line. The choice of this line will depend on the insights provided by MTA and, if required, third party analysts, who will identify where the most progressive and tech-savvy people travel.

The next step identifies the stations which will serve as the first point of implementation. The stations that serve this line alone, will have a greater number of biometric turnstiles and a single MetroCard turnstile. The stations which allow transfers will have fewer biometric turnstiles and more MetroCard turnstiles. This is to encourage the passenger along that given line to adopt the new system without disrupting the daily commute of passengers who are transferring from other lines.

As adoption improves at the stations that facilitate transfers, the system can be implemented to service stations along other lines until the entire network comes under the new biometric system.

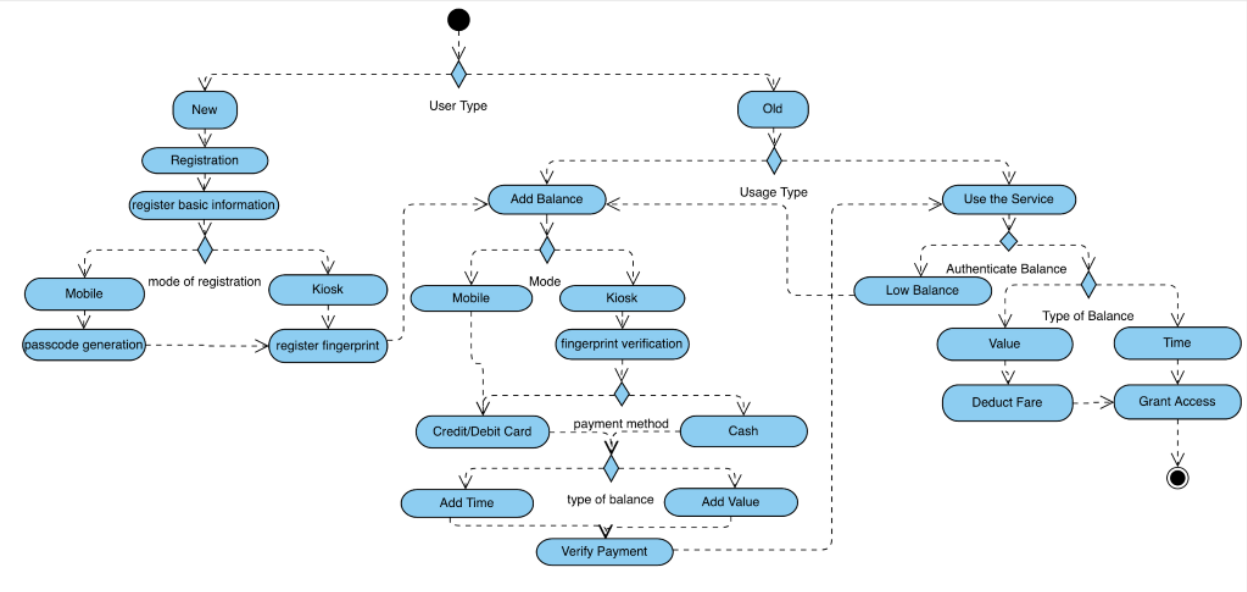

Figure 1. Process Flow Diagram

Success Measures

The primary benefit after introducing biometric in place of MetroCard will be the reduction of plastic waste. Every year MTA prints 160 million MetroCard (MetroCard: MTA, n.d.). The weight of a single card is around 2 grams so the total weight of 160 million cards will be approximately 320 ton (How much does a Metrocard weigh, 2013). So, if this biometric project gets implemented 100% by 2021, then we can see a reduction of 320 tons in terms of plastic use, by the end of 2022.

Another benefit of this project will be the reduction in number of crimes across New York city. In 2017, the total number of crimes per year in N (How much does a Metrocard weigh, 2013)ew York City were 1943 (*NYPD CompStat 2.0*. 2018). In majority of the cases, criminals use public transport to run away from the crime location. So, we are hoping a reduction of 20% in annual crime rate from 2022 onwards.

After this new access system, MTA will be able to see an increase in annual revenue by $55 million. This is the amount which MTA is losing every year because of fare evasion. Additionally, MTA will be able to see an increase of $10 million in annual revenue because of not producing the MetroCards (MetroCard: MTA, n.d.).

From the last two years, the NYC subway riders count is falling. In 2017 the total ridership count was down by 2% as compared to 2015 (Fitzsimmons, 2018). The numbers are falling because MTA services are getting less reliable and people are moving towards other alternatives such as Uber and Lyft. It is very contradictory that the number of populations of New York city is increasing year on year, but the number of subway riders is decreasing. The main purpose of this biometric project is to improve the ease of use for the riders. As a success measure, we can see an increase of 2% in total ridership count from 2022 onwards.

These success metrics will work as goals for MTA to be achieved by December 2022. The above-mentioned numbers are the minimum requirements which will certify this project as a successful initiative. Anything that is above these numbers will further strengthen the case.

Longevity (Technology Obsolescence)

Every software, database and corresponding infrastructure that a business installs in its processes has a definite lifecycle. Technology obsolescence is an event that is inevitable and a must for innovation. The MTA has dealt with obsolescence before, be it for new trains, tracks and access infrastructure. The passenger access system alone has seen multiple updates when features and convenience didn't conform with the times. For example, the transition from using coins to a standardized token was necessary when the MTA increased its base fare and their turnstiles were unable to recognize different types of currency coins.

Some of the pain-points or issues that technology obsolescence brings with it, but aren't limited to, increasing customer inconvenience, lack of support from employees and third-party vendors, and eventual reduction in overall ridership. The introduction of the MetroCard was a revolution for its time, bringing improved accessibility and passenger convenience with it. However, like any other process implementation, it has increasingly shown its drawbacks and vulnerabilities for a few years now.

Other public transport authorities have attempted modernizing their access systems by implementing smart cards, multi-purpose debit cards and NFC tap cards while some still efficiently serve their customers with versions of the token system. But the sheer volume of passengers that the MTA services everyday requires a more robust and secure solution. Such smart-card systems, apart from the disadvantages they possess for still being card-based, are inherently more vulnerable to security breaches. This becomes a critical pain-point for passengers who use smart cards that double up as a debit/credit card.

Biometric technology has seen major improvements in the past decade. It has become the standard for secure verification on personal devices like laptops and smartphones. The secure

and reliable nature of biometric systems makes it an ideal candidate for large, distributed systems as well. While biometric technology doesn't guarantee perfect security, it does offer a big improvement over possession and knowledge-based authentication like device specific access and passwords as well as ease-of-use and convenience when compared to multi-factor authentication systems.

It seems unlikely that biometric verification techniques and technologies will become redundant in the foreseeable future. Alternatives like smart cards and multi-factor authentication processes are re-iterations of old and redundant technology as well as time-consuming processes, which no passenger will accept as a cost to use public transport. Therefore, biometrics will face very little competition from other access methods. However, the accuracy and flexibility of biometric systems is improving every day. We are already seeing device manufacturers move from fingerprint technology to advanced facial recognition methods. As this technology becomes more accessible, costs will reduce, and acceptance will steadily rise among users. The base of this biometric access system like server, supporting software, encryption algorithms and underlying infrastructure is thus the most crucial aspect of this system. It makes the system ready for the next biometric access technology which can be implemented without affecting the underlying systems that the passenger does not interact with. The fingerprint scanning method is currently the most accepted and cost-effective method for access, and we expect this access method to be relevant for at least a decade post its implementation. For the purpose of longevity, it can be treated as the first stage of a larger, truly contact-less access system in the MTA.

Use Cases

The proposed biometric system can be understood by following three use cases:

1. Registration System

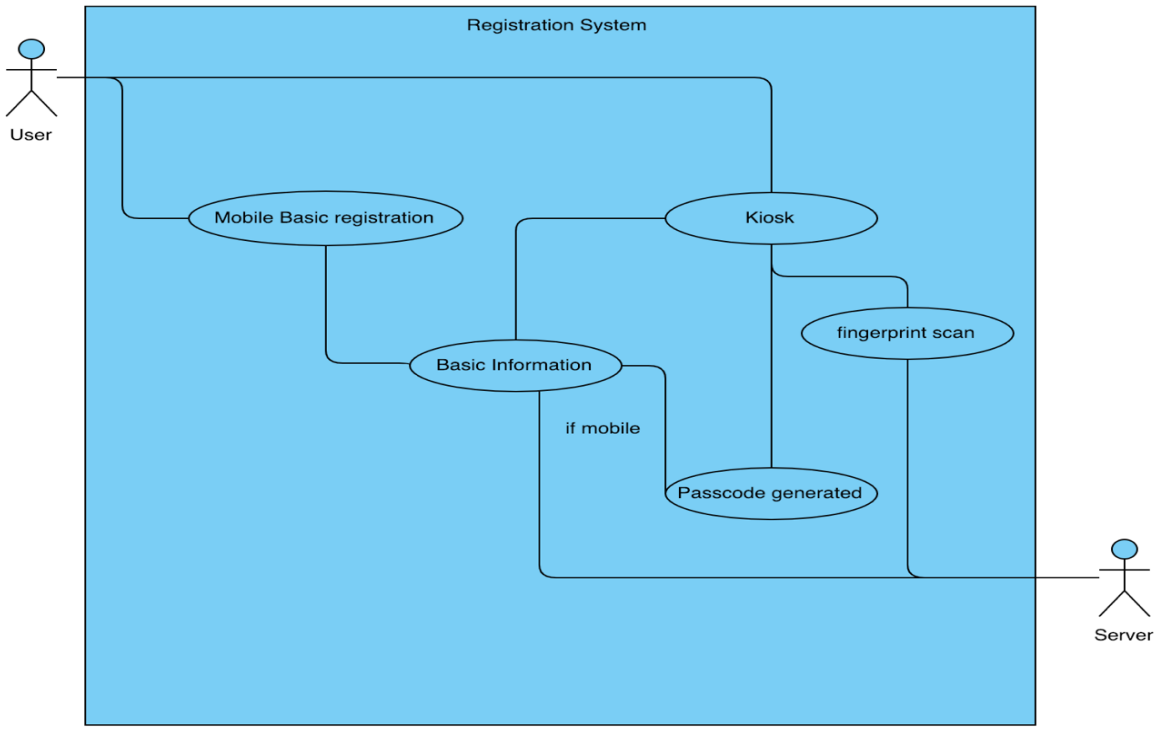

Figure 2. Registration System UML Diagram

As shown above in figure 2, a user can register in two ways – through Smart phone and at Kiosk. The first step is to provide basic user information for account creation. If the user uses a smart phone application for registration, then a passcode will be generated and using that passcode on the kiosk the user can register its fingerprint. Otherwise, if the user uses Kiosk directly for registration, then it can register fingerprint directly without the need to generate a passcode. All of this information is stored by the server into the database.

2. Authentication System

Just as the traditional method, user account balance needs to be verified for authentication and access to the service. The difference is instead of swiping a card the user will scan its finger at the turnstile. The scanner will generate a unique code which will verify the user balance and information from the database, thus accepting or denying the access accordingly.

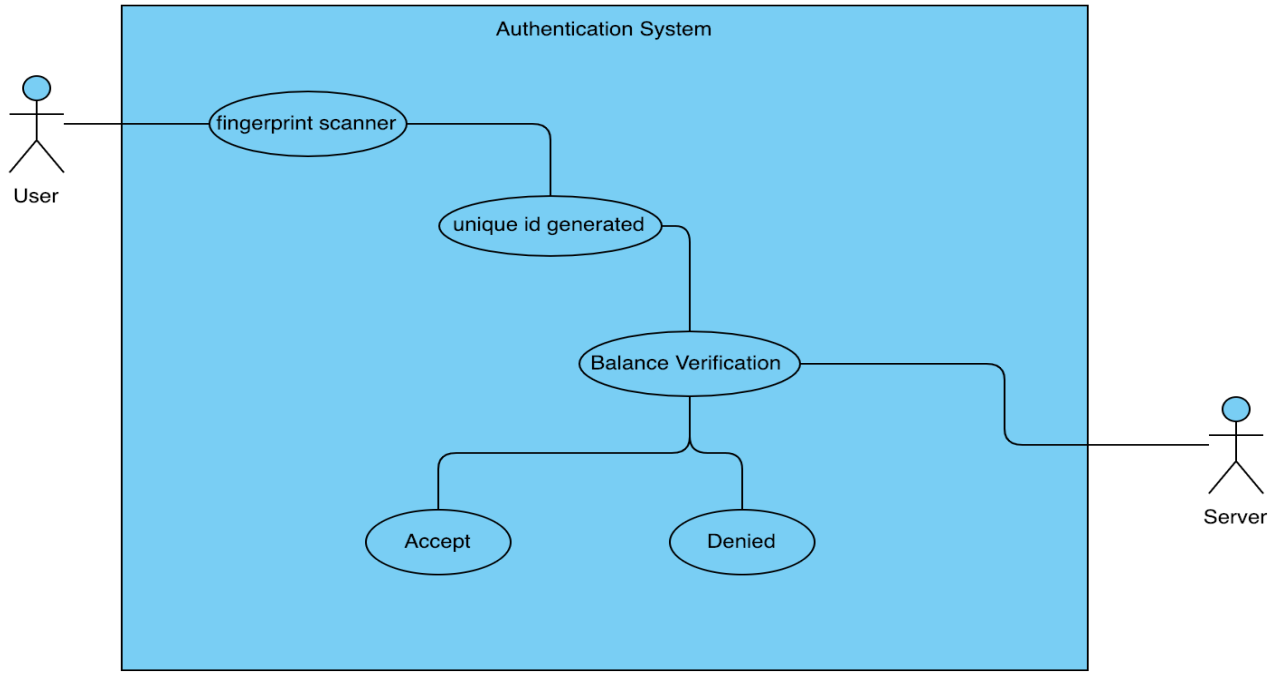

Figure 3. Authentication System UML Diagram

3. Payment System

To get an access to the subway or bus, the rider needs balance in his/her account. Recharging an account can be carried out by either smart phones or Kiosk. Using the smart phone, the payment methods can be Credit or Debit cards while using the Kiosk it can be Credit or Debit Cards or Cash. Kiosk being a public device needs fingerprint verification to access the account for recharging.

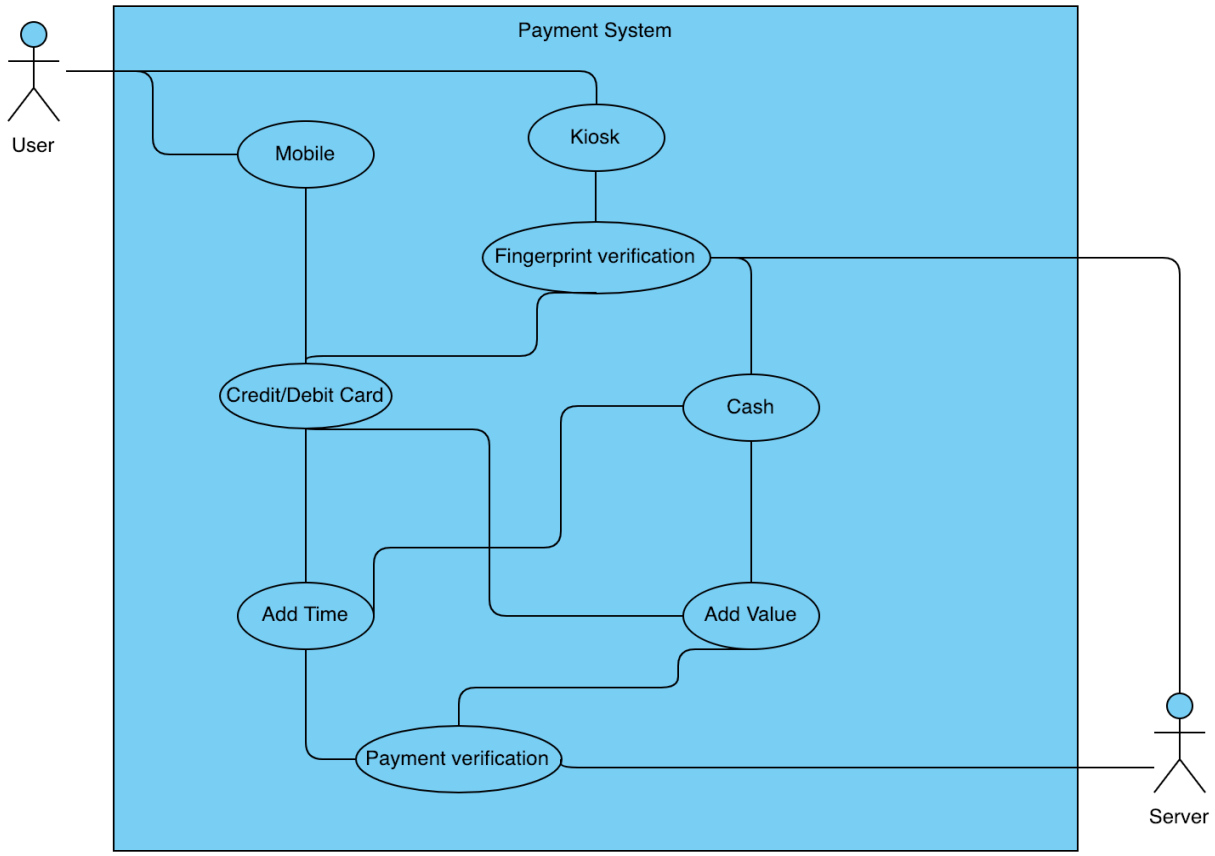

Figure 4. Payment System UML Diagram

Resources

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