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Smart Barcode Authentication System Using Python

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Abstract - *The authentication program is one of the crucial steps in any kind of system where various people or products are present. To make their values checked, to make them authenticated we use a lot of technologies nowadays. Barcode is one of these technologies used for authentication purposes. Barcode contains some encoded value of any real-world entity by which we can authenticate them and take them into our use as per our requirement. In this research, we have understood how barcodes work and how they can be used in most of the authentication systems where it is not in use till today. Authentication using barcodes is not only a security technique but also a system where we can use automation and artificial intelligence. So, we are looking forward to taking steps in developing more in this field to create some value for our society.*

Key Words: Barcode, Authentication, Artificial Intelligence, QR-Code, Scanner, Reader, Security, Database, Python Programming.

1. INTRODUCTION

In this modern world where we are adopting automation and technologies day by day, doing monetary transactions using secure technologies, making all kinds of information in digital storage provided by the government, etc. There are plenty of good sides to where we are blessed for having these kinds of modern technologies with us but there are people who are not so positive about all these. Cheaters and scammers are everywhere and trying to steal the data of people which are available online. So, security comes on the most-priority list in the modern world which we need to take care of. Barcode technology is one of these security systems by which we can prove the authenticity of real-world entities. This technology is now widely used but there are some drawbacks and future scopes also. In this paper, we are highlighting these and discussing future scopes we can have about the same.

1.1 What Is Barcode:

The Barcode was invented by two Drexel University students Norman Joseph Woodland and Bernard Silver in the year of 1948. In the year of 1952, the project was patented in the US. Barcode is a collection of black and white parallel vertical bars and these bars are made from the data we want to store in the form of a collection of bars.

1.2 Barcode In Security:

A barcode is a visual representation of encoded data from any kind of real-world entity. After encoding data taken from an entity, it is represented in a form of a series of bars of different dimensions and placed at different distances from each other. A real entity cannot be expressed digitally, so by encoding the features of that particular entity we try to make it unique to identify. In this world, all humans and also all living beings have their unique biological or chemical identities from their physical perspective. By encoding data from an entity we try to do the same with real entities but in a digital way. It helps to authenticate any single entity by its unique identity and also helps to look forward to security.

1.3 What We Have In Mind:

In daily life, there are various uses for Barcodes that we can see. There are barcodes on every product on their branding labels. Manufacturers use barcodes to authenticate their products. In some cases, we can see barcodes in shipment boxes also. As many things are getting authenticated using barcodes, then why can't we authenticate human identity using barcodes in temporary situations like in traveling tickets, entering any concert using a unique identity, and various authentication-based entries like these? In this research, we are going to discuss those opportunities we can have in the future and their pros as well as cons also.

2. Present Technologies And Usage:

2.1 A barcode is an image consisting of a series of black and white parallel vertical bars. Barcodes are made from the physical data given to the machine about any physical entity and converting them into digital form and representing them into a collection of bars as a barcode image. A barcode can be read using barcode scanners. The Barcode scanner reads the combinations of black and white bars and then the machine decodes them into meaningful data which is later checked for matching with the data available previously. If the data matches, the related thing or product is authenticated, else the product is either not enlisted or not the correct one.

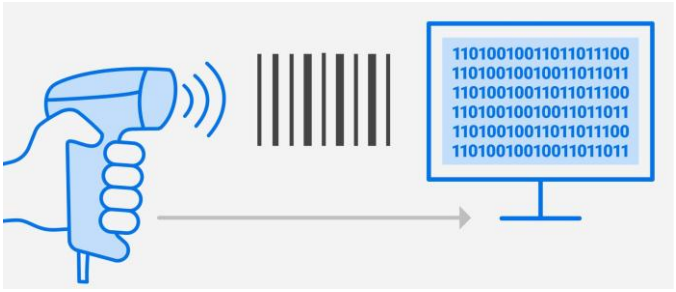

Fig -1: Barcode reading and decoding

2.2 Barcodes are also used in product warehouses to make a count of goods that need to be dispatched or the ones which are received. Barcode scanner authentications are also done for these purposes.

Fig -2: Reading barcodes from products

2.3 Most barcodes are used in retail stores to authenticate products, track package details of delivery services, and also in inventory management.

3. Usage Statistics:

As per the data collected in the year 2021, total barcode scans from global users are 6,825,842 which is an increase of 433% from its previous data. The database of QR TIGER says the usage of the barcode(1D and 2D) in the first quarter of the year 2022 is as below: From the values of countries all over the world, we created the pie chart of barcode usage in the first quarter of 2022. We have taken into consideration 10 countries which are the USA, India, France, United Kingdom, Canada, Saudi Arabia, Colombia, Malaysia, Singapore, and Mexico.

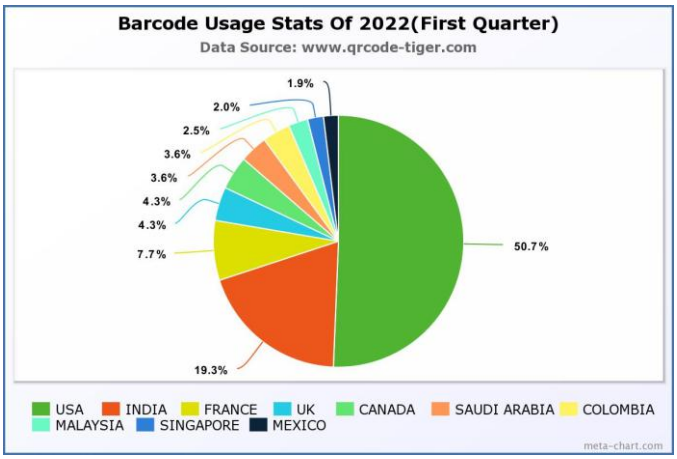

Chart 1: Usage data chart

4. What We Are Trying And How:

4.1 What: India is a country with a human count of 1.4 billion approximately. People who work in some fields, big and small businesses, schools, colleges, and transport systems every day face a huge amount of traffic. As there are lots of large services going on, in every situation they need count and authentication of unique entities to make things right as per the quantities and the quality of outcomes.

4.1.1 Railways: In India, the average number of people who travel in Mumbai local trains is approximately equal to 7.58 million. The number is more than the total population of New Zealand. Not only the west, but India also has south and eastern section where the numbers are more or less similar. So, maintaining this much crowd is not an easy task. When it comes to the authentication of passengers, there are ticket checkers who check tickets manually. But most of the time, lots of people travel without even paying a single penny. When ticket checkers suspect them and check them, then only they have to pay a fine otherwise there is no restriction of traveling without having a ticket. If we can introduce a barcode entry facility for entering the station premises with an alarm sound detection, it can be profitable.

4.1.2 Building And Concert Entries: In India, there are many historical places, temples, museums, and many places that people visit every day and people have to pay money to enter these places. In such places where we need to pay and enter, most of the places we see use manually operated booking systems and paper tickets. The manual process is more time taking and also more prone to error. If we try to implement a barcode-based system for payments and tickets, the authentications can be done more easily, accurately, and in less time.

4.1.3 Student Security: In schools and colleges every day lots of students come and most of them are underaged. It is very much necessary for organizations to take responsibility for their student's security. Sometimes people get so busy in their professional life nowadays that they cannot pick up and drop their children at their schools so most of the time they take help from cars. To secure every student with their unique identity from the pull car to the school premises we can take the benefits of barcodes as digital visual unique identity cards.

4.2 How: In typical barcodes and barcode readers have some periodic processes to authenticate them. First, we have to locate the barcode in the product and then either we need to place the barcode in front of the barcode reader or the reader needs to place it in front of the barcode. In this process, it only scans one barcode at a time and anyhow we have to do it physically. Instead of using that system, we are trying to automate the whole system using python programming language where we can generate unique barcodes for every single entity and scan them together to authenticate using a single camera. In existing processes of barcode scanning, we use a light source, a lens, and a light source by which the data is read, and one by one we can authenticate each entity at a time but by using a camera we can authenticate every product which is coming to the camera vision. It is going to make the process faster and the chances of error will be reduced.

4.2.1 Using Python In Authentication: Python is one of the most well-known programming languages in the field of automation and artificial intelligence. But in our scenario, the practical use is not that deep because the system is for temporary authentication. Only for tracking records, the use of AI is not at all necessary but by using predetermined libraries like 'OpenCV', 'Pyzbar' and many others of these, the barcode generation and reading through the vision of a camera gets easy and robust.

4.2.2 Using Camera As A Scanner: Instead of using a barcode scanner, if we use a camera as a barcode scanner, the span or vision of the scanner becomes much wider. In this case, we can read more than one barcode at a time and the process takes less time. Using programming algorithms we can also automate the system and implement other technologies and devices like digital message boards, and buzzer alarms. We can also use IoT devices with the basic concepts to make things more improved and we are looking forward to it and developing more about the concept.

Fig - 3: Camera as a barcode scanner

5. Future Scopes:

5.1 We have CCTV Surveillance cameras everywhere so we can use these cameras as barcode(1D AND 2D) scanners and authenticate products delivered to our doorstep from inside of our homes.

5.2 We can have an automated authentication system for cultural functions and parties where we try to ensure that only invited people can take entry.

5.3 Even in product authentication, day-by-day 2D barcodes or QR codes are taking the place of 1D barcodes as 2D barcodes are more secure as they contain more encoded details about the product that can help to signify the product specification in a better way. Also in terms of security, the 2D barcode is very much reliable.

5.4 Nowadays everyone has a smartphone and the phone has a barcode or QR code scanner application that reads the barcode data, decodes it, and shows it in the output window. So using these applications we can encode everything that we want to show to the person only who is interested to see or know about the topic. Instead of printing or showing unnecessary links or pages, we can provide the 2D barcode to the user. If he or she has an interest in the title of that, they can scan it from their mobile phone and see the content. It will also improve user experience. We can use this concept in places like blogs, restaurant menus, product offers, advertisements, and much more in publicly available content.

6. Advantages We Can Have:

6.1 Initially Barcodes and QR Codes are faster ways of authentication. With the implementation of programming and a camera as a scanner, it gets faster.

6.2 Barcode authentication is an efficient and secure way of authentication but the application of python makes it more secure and error-free because we can use exception-handling techniques.

6.3 Camera vision is wider and more advanced so it is easy to authenticate barcodes and QR codes. Here we can authenticate more than one barcode at a time.

6.4 Interfacing with various devices and technologies we can make more efficient and value-giving authentication systems.

7. Disadvantages We Should Improve:

7.1 In products where barcodes are printed, if the section is somehow scratched or damaged, the barcode gets damaged. In this kind of case, the information links are also destroyed with the barcode and there is no other way to retrieve it.

7.2 In 1D barcodes, the information about expiry date or ingredient list, etc. cannot be encoded so 1D barcodes are getting replaced by 2D barcodes.

7.3 For very small businesses, it is very much expensive technology to use. For authentication purposes, they can use normal barcode scanning techniques but the system we are thinking about will be much more costly for them.

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