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Applied Research Document

For the individual project
of Semester 3, ICT
Software Engineering

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Class
S3-CB02

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1. Introduction

This research is conducted to gather all the information needed for developing the individual project for semester 3.

The project, Evento, consists in creating a platform for managing events and allows purchasing tickets.

Problem definition

Organizers should be able to create events and manage them. Clients should be able to buy tickets to the events available and receive the details of the tickets purchased.

2. Hypothesis

Building the platform requires:

The CRUD methods for events and accounts need to be implemented using the REST API. The tickets will then be sent to the clients using an external API that connects to Outlook. Another external system will be the payment one that will simulate a simple payment method.

3. Research methods

It is common in IT projects to have to develop new solutions, such as architectures, applications, or backend technologies.

Finding innovation and quality will be easier with research methods.

For my project I am going to use the Design Oriented Triangulation method framework because this way I can include practical research methods.



- Available product analysis
- Competitive analysis



- Interview
- Observation
- Survey
- Explore user requirements
- Task analysis



- Unit testing
- Usability testing
- Component testing
- Security testing



- Benchmark test
- Product review
- Ethical check
- Guideline conformity analysis



- Brainstorm
- Business case exploration
- Code review
- Requirements prioritization

3. Research methods

in practice

Question					
Q1 S1	Available product analysis Competitive analysis	Observation Explore user requirements Task analysis	Usability testing Component testing Security testing	Guideline conformity analysis	Requirements prioritization
Q1 S2	-	Task analysis	Unit testing Usability testing	Benchmark test Product review	Brainstorm Code review
Q2 S1	Available product analysis	Observation Task analysis	Usability testing Component testing Security testing	Ethical check	Business case exploration Code review
Q2 S2	-	Explore user requirements Task analysis	Security testing	Ethical check	Code review

Research question 1

What features are needed in order to create an efficient platform in order to ease the process of buying a ticket?

Subquestion 1

How can tickets be sent to the clients?

In order to send the tickets to the clients, I am going to generate QR codes that will be sent by e-mail to the clients.

QR codes are digital barcodes that can be read by digital devices. QR codes store information as a series of pixels arranged in a square grid.

Each ticket will consist of a QR code that will contain details about the event and the client.

After the purchase of a ticket, the QR code is sent to the e-mail address of the client.

a. Creating a QR code

QR code processing in Java is made easier with ZXing ("Zebra Crossing"). In my project, I will use the library's 'core' to create QR codes.

b. Send e-mails to the clients

The main reason that stood at the base of choosing an API for sending emails was the possibility of also sending attachments because the main purpose of the email will be to send the QR codes to the client.

In order to do that, I am going to use the JavaMail API.

This API allows sending attachments in the email by accessing the internal files or the database of the project.

After purchasing a ticket, this will be created and sent to the client from the company's address.

Subquestion 2

How can the seating system be created?

The seating system will look like in *image 1*, below. The seats can have one of 3 types of statuses:

- occupied
- selected
- N/A

The seats are going to be mapped by columns and rows (*image 2*) in order to help the algorithm that will give suggestions for a certain amount of tickets.

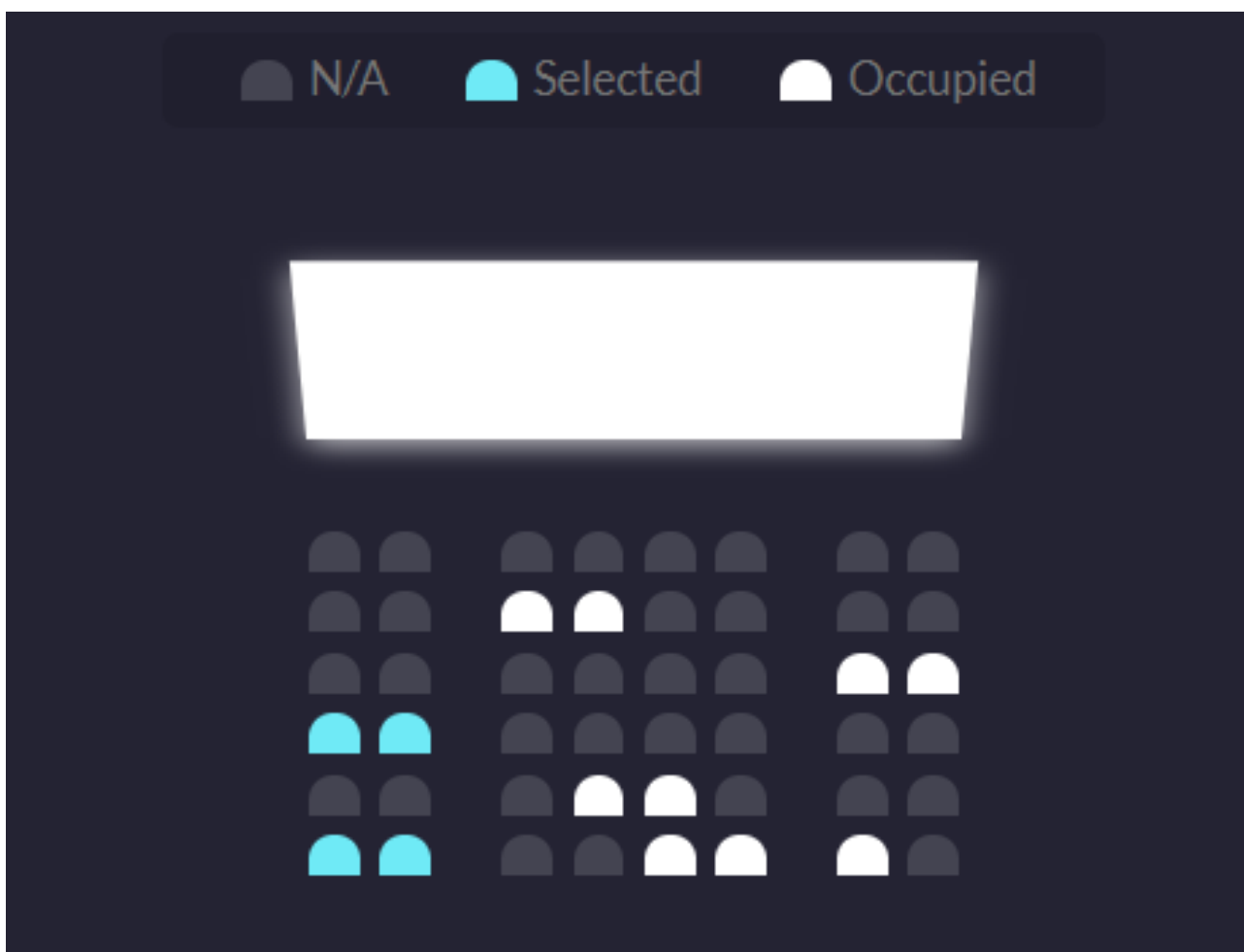


image 1

The seating suggestions logic will be built based on the fact that there are 3 "blocks" of seats, I will use a "snake-like" pattern. For example, if the customer wants 3 seats, the suggestions can be:

- 1a, 1b, 2a/b - in the first block
- 1c, 1d, 1e - in the second block
- 1g, 1h, 2 g/h - in the third block

However, if there are no related places left in the block, then the system will suggest seats that are nearby, for example, 1b and 1c.

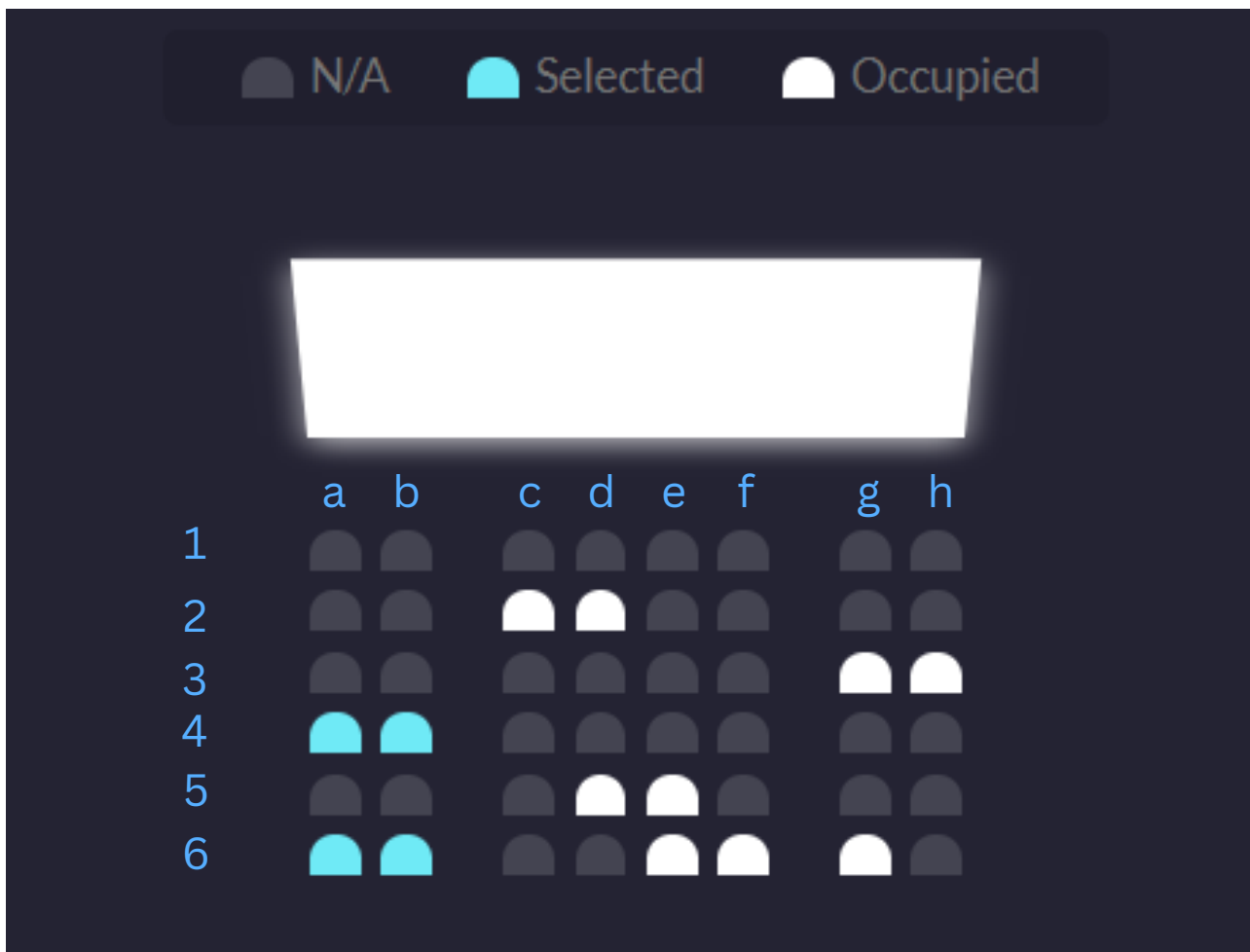


image 2

Research question 2

How can the application assure a safe payment environment?

Subquestion 1

What is the suitable payment API for my application?

In order to integrate the suitable payment API into the application, I needed to make my goals clear:

- simulation of an actual payment
- obtaining proof of the payments made (e.g. via tokens)
- integration possible with the coding environment and the programming languages used

After researching the available options, I chose a cloud-based service: Stripe. The main reasons why I choose this API for my project were:

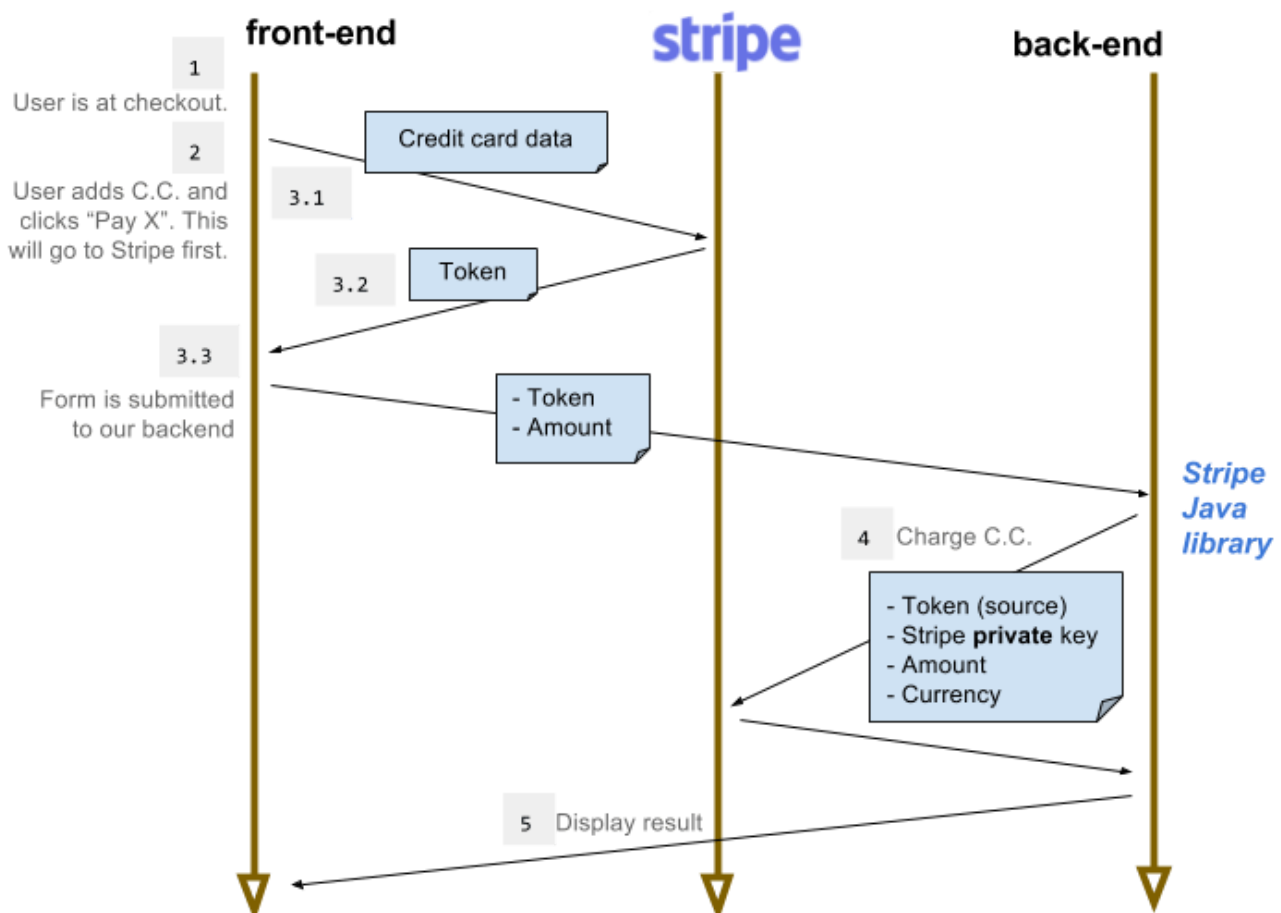
1. can be integrated using Java and JavaScript
2. has payment fraud prevention
3. PCI Compliance (Payment card industry (PCI) compliance ensures that credit card transactions in the payments industry are secure. Businesses follow payment card industry compliance standards to protect and secure credit card data provided by cardholders and transmitted during card processing.

Subquestion 2

Which data is sensitive in my application and how can this be secured?

The data which is sensitive and so it has to be secured is of course related to the card details. However, after making a payment, evidence of the purchase and its content should be created.

Stripe reduces the complexity of receiving payments by providing a layer of abstraction. Therefore, we do not need to deal with credit card details directly - instead, we deal with a token representing an authorization to charge.



Using our Spring Boot application and Stripe, we will charge the credit card in five simple steps:

1. A user clicks "Pay with Card" on the checkout page.
2. In the Stripe Checkout overlay dialogue, the user fills out the credit card information.
3. A user confirms with "Pay <amount>" which will:
 - Credit card information should be sent to Stripe
 - In the response, get a token that will be appended to the existing form
 - Send the form with the amount, public API key, email, and token to our backend
4. The token, amount and secret API key are sent to Stripe through our back end.
5. In the back end, the Stripe response is checked, and the user is given feedback about the operation.

PROTOTYPE: QR CODE

Strategy

1. Research
2. Test project: Create a QR code and show it
3. Implement the QR code in my project
4. Test and improve

Research

The grid arrangement of the black squares on a white background that an imaging device can read is called a QR code. The advantage of a QR code is that smartphones can scan it.

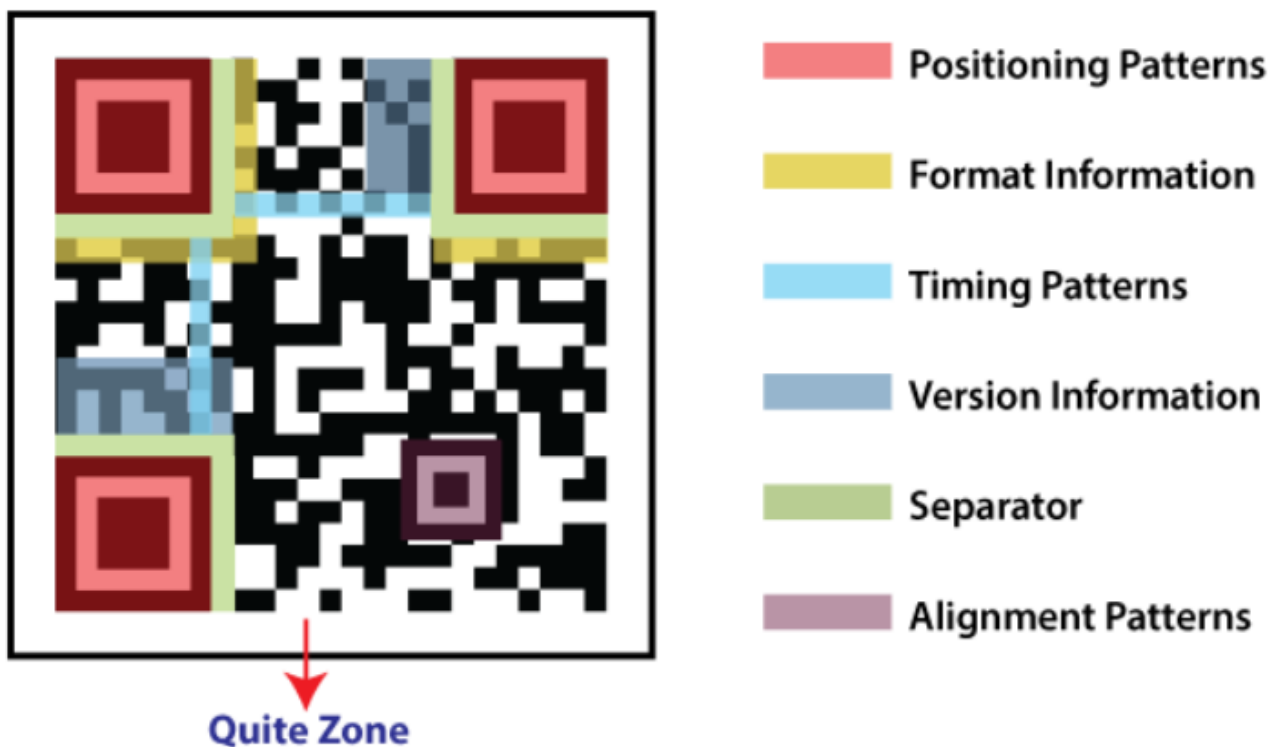
How does it work?

QR code is made up of modules (black and white squares) that contain the encoded data. Modules are arranged in the row and columns that are called Data Matrix. The Placing of data bits starts from the bottom right corner and moves in an upward direction and changes the position while reach at the top.

PROTOTYPE: QR CODE

QR code Components

There are the two primary components of QR code i.e. Function Patterns and Encoding Regions. These components further divided into small components. The following figure depicts the components of QR code.



PROTOTYPE: QR CODE

Components	Parts of Components	Description
	Quite Zone	It is the boundary of the QR code. The white space around the QR code represents the quiet zone.
Function Patterns	Positioning Patterns	It is also known as finder patterns or position markers. It finds the edges of the QR code.
	Timing Patterns	It helps the scanner to identify the position of rows and columns. The sixth row and column in the QR code are dedicated to the timing pattern.
	Separator	It separates data from the finder pattern.
	Alignment Patterns	It helps the scanner to identify the reference point for alignment.
Encoding Regions	Format Information	It helps the scanner to identify the types of content such as text, URL, etc. It contains data in two parts i.e. Level of Error Correction and masks pattern.
	Version Information	It helps the scanner to identify the version number of the QR code.
	Data Modules	It helps the scanner to decode the data entered by the creator.

PROTOTYPE: QR CODE

Generating a QR code in Java

To generate a QR code in Java, I needed to use a third-party library named ZXing (Zebra Crossing). It is a popular API that allows processing with a QR code. With the help of the library, I can easily generate and read the QR code by following these steps:

- Create a QR Code generator class that contains two static functions:

Generate QR Code Image

This function is used to generate the QR Code in image form and this will save the image in the specified path.

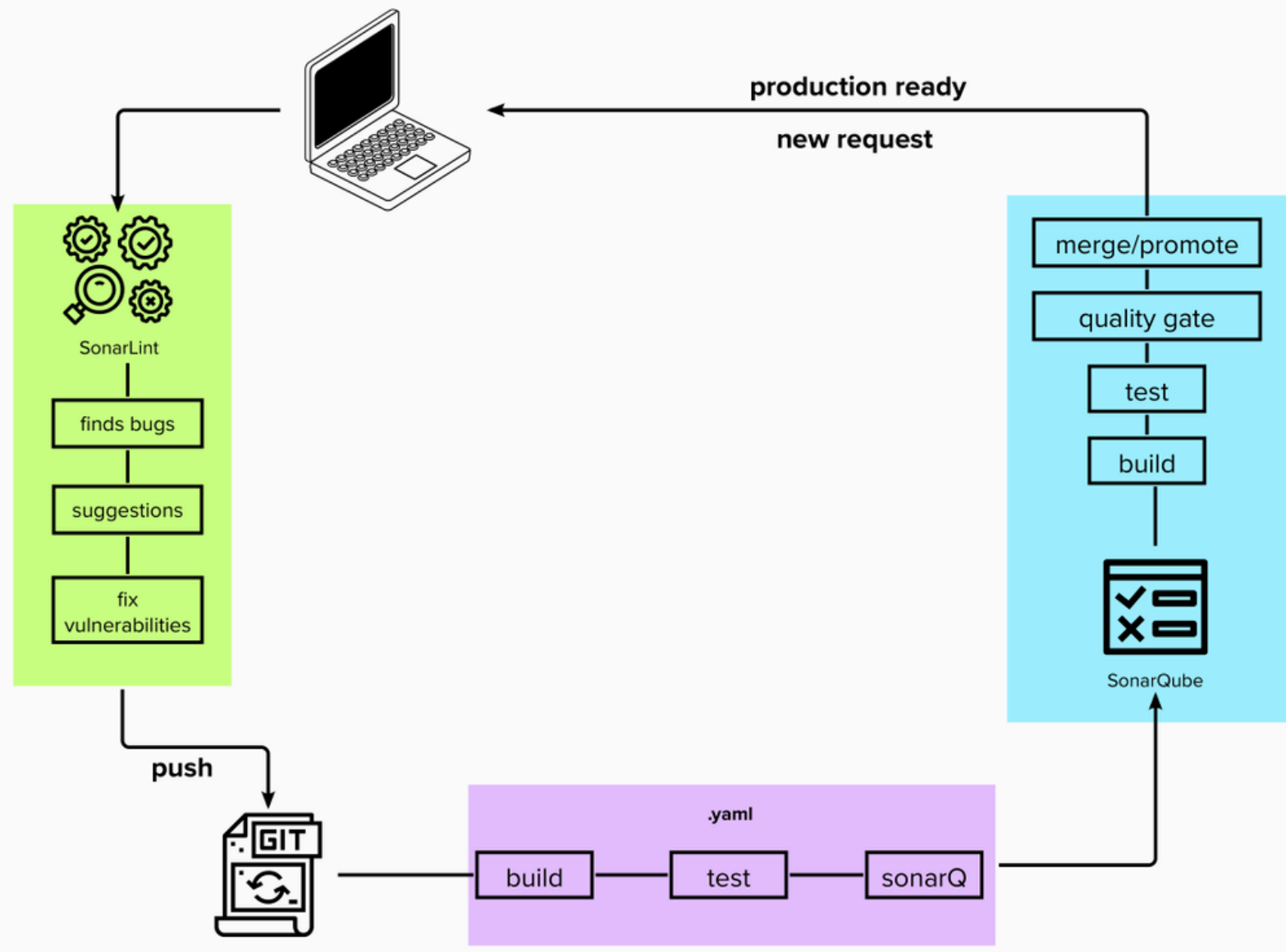
Generate QR Code ByteArray

This function will generate the QR Code in the form of a byte array.

- Create a Controller class

This class contains a method “getQRCode” with the GetMapping (“/”). This method will call the function that we have created in QRCodeGenerator class to get the Image or the Byte Array for the QR code.

CI SETUP



For my CI setup, I am using both SonarLint (the IDE extension) and SonarQube.

SonarLint catches issues right in the IDE while SonarQube analyzes pull requests and branches. The combination forms a continuous code quality analysis solution that keeps the codebase clean.

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