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SPRING AI

GENERATIVE ARTIFICIAL INTELLIGENCE CON JAVA

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Corso base per Venis S.p.A, Venezia, Italia

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SETUP PROGETTO SPRING AI

- ➔ Inizializzare un progetto Spring con le seguenti caratteristiche:
 - ➔ Maven come *build tool*
 - ➔ Spring Boot alla versione più recente **non SNAPSHOT**
 - ➔ Linguaggio Java 21
 - ➔ Group **it.venis.ai.spring**
 - ➔ Artifact **demo**
 - ➔ jar packaging
 - ➔ Spring Web e OpenAI come dipendenze

- 1 Inizializzare un nuovo progetto Spring AI
- 2 Verifica JRE per progetto
- 3 Esecuzione del progetto

- 1 Da IDE (VSCode)
- 2 Da Spring Initializr

PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VS CODE)

1 Installare le estensioni VSC necessarie

The screenshot shows the Visual Studio Code interface with the 'Marketplace' tab selected. A search bar at the top contains the query 'Extension: Extension Pack for Java'. Below the search bar, the 'Extension Pack for Java' by Microsoft is displayed, showing a rating of 4.5 stars and 37,832 reviews. An 'Install' button is visible. The main content area displays seven extensions included in the pack, each with its name, developer, description, and an 'Install' button:

- Language Support for Java™ by Red Hat
- Debugger for Java
- Test Runner for Java
- Maven for Java
- Gradle for Java
- Project Manager for Java

On the right side of the screen, there are sections for 'Marketplace' and 'Categories'. The 'Marketplace' section shows details for the extension: Identifier: vscjava.vscode-java-pack, Version: 0.29.2, Published: 2017-09-27, Last Released: 2025-08-18. The 'Categories' section lists Programming Languages, Snippets, Linters, Debuggers, and Formatters under the 'Extension Packs' category.

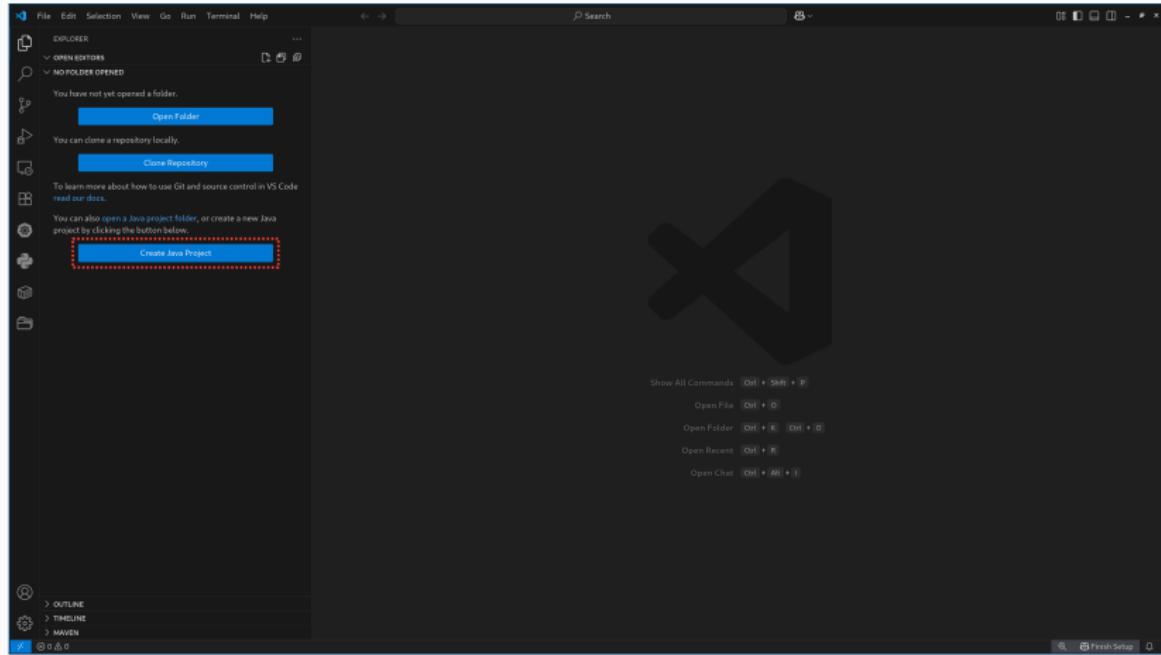
1 Installare le estensioni VSC necessarie

The screenshot shows the VS Code Marketplace interface. The main search bar at the top contains the text "Extension: Spring Boot Extension Pack". Below the search bar, the "Spring Boot Extension Pack" by VMware is displayed. It has a green gear icon, a rating of 4.5 stars from 21 reviews, and 3,563,390 installs. A blue "Install" button with a checkmark and the text "Auto Update" are present. A note below says, "This extension is recommended based on the files you recently opened." On the left sidebar, there are icons for file operations like Open, Save, Find, and others. The right sidebar contains sections for "Marketplace" (Identifier: v mware.vscode-boot-dev-pack, Version: 0.2.2, Published: 2017-11-28, Last Released: 2025-01-28), "Categories" (Programming Languages, Linters, Extension Packs), and "Resources" (Marketplace, Issues, Repository, License, VMware). The main content area displays the "VS Code Spring Boot Application Development Extension Pack" page, which includes sections for "Spring Boot" and "Spring Initializr Java", each with their own descriptions and links.

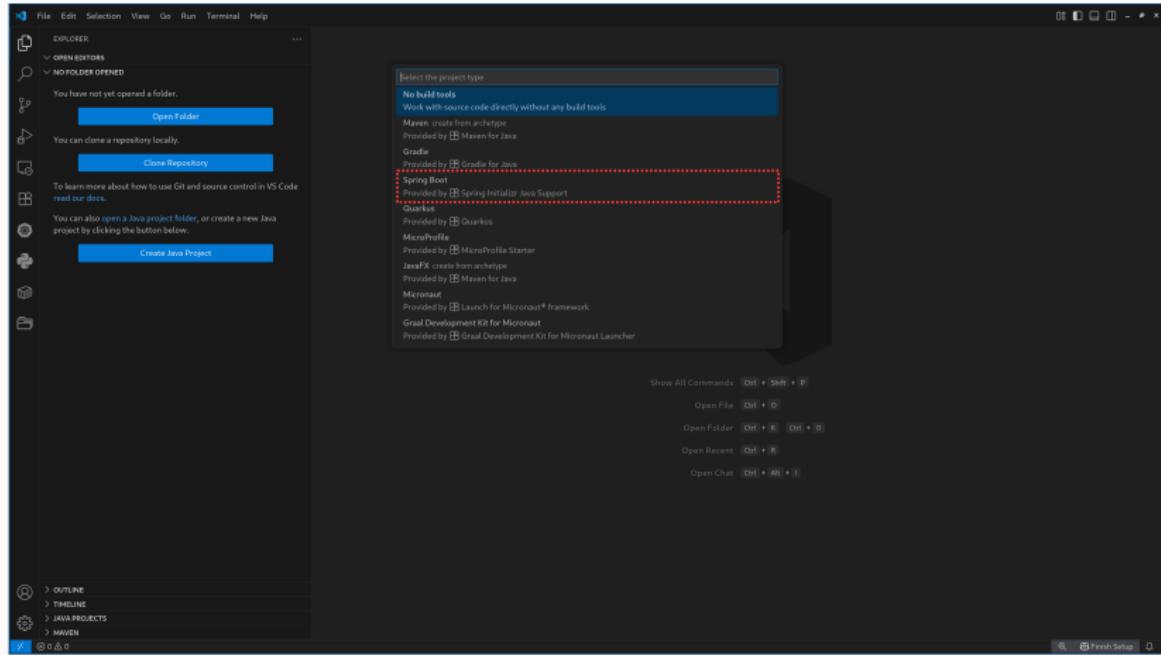
PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VS CODE)

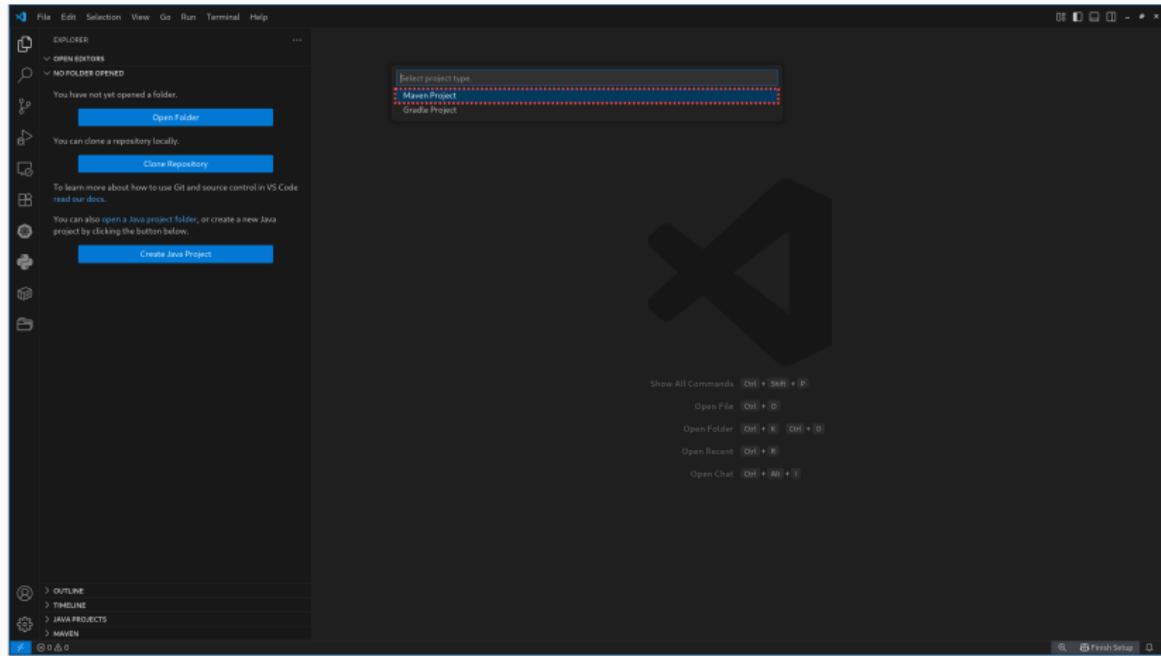
2 Aprire una nuova finestra VSC e selezionare Create Java Project



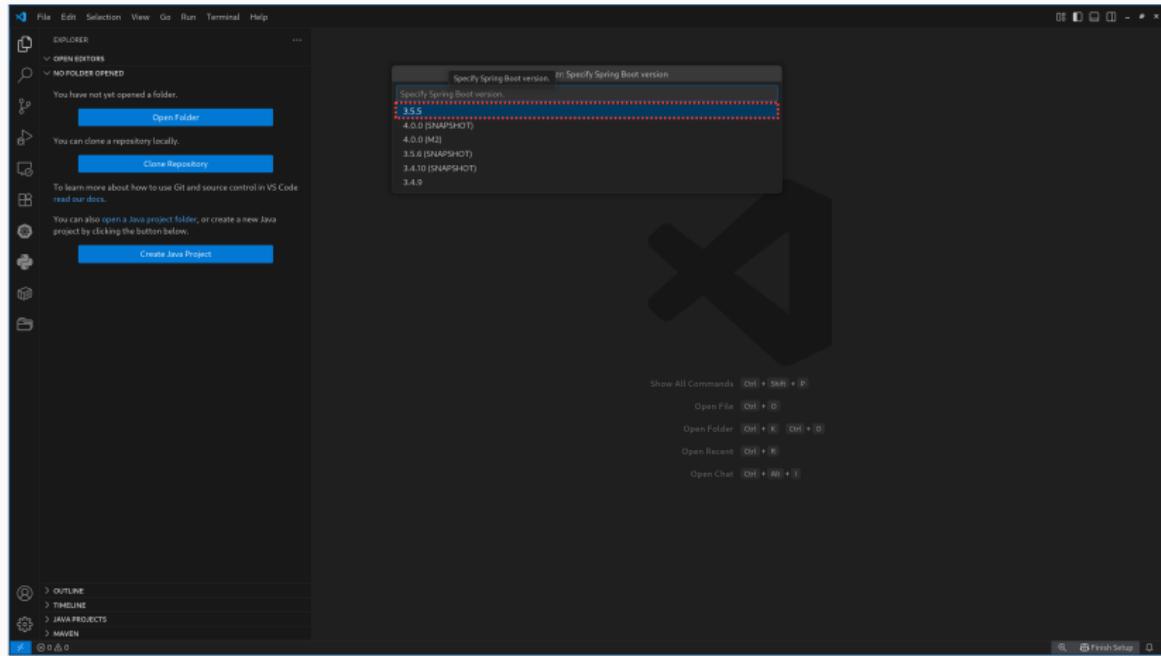
3 Selezionare Spring Boot come tipo di progetto (NON Maven)



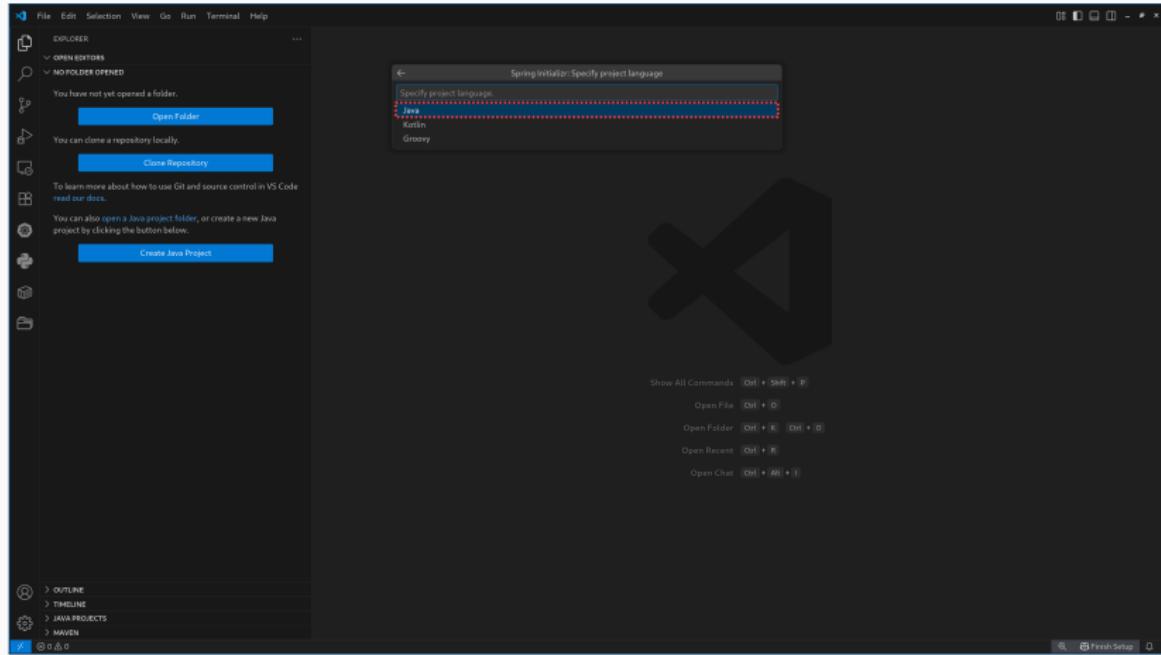
4 Selezionare Maven project come tipo di progetto



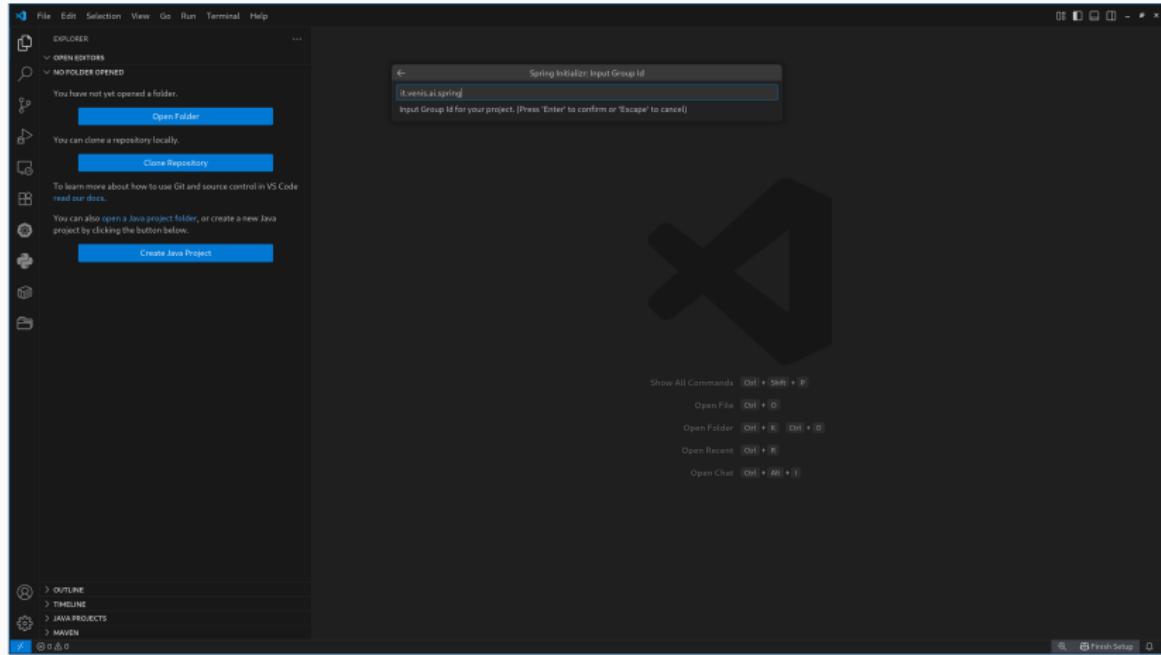
5 Selezionare la versione di Boot per il progetto



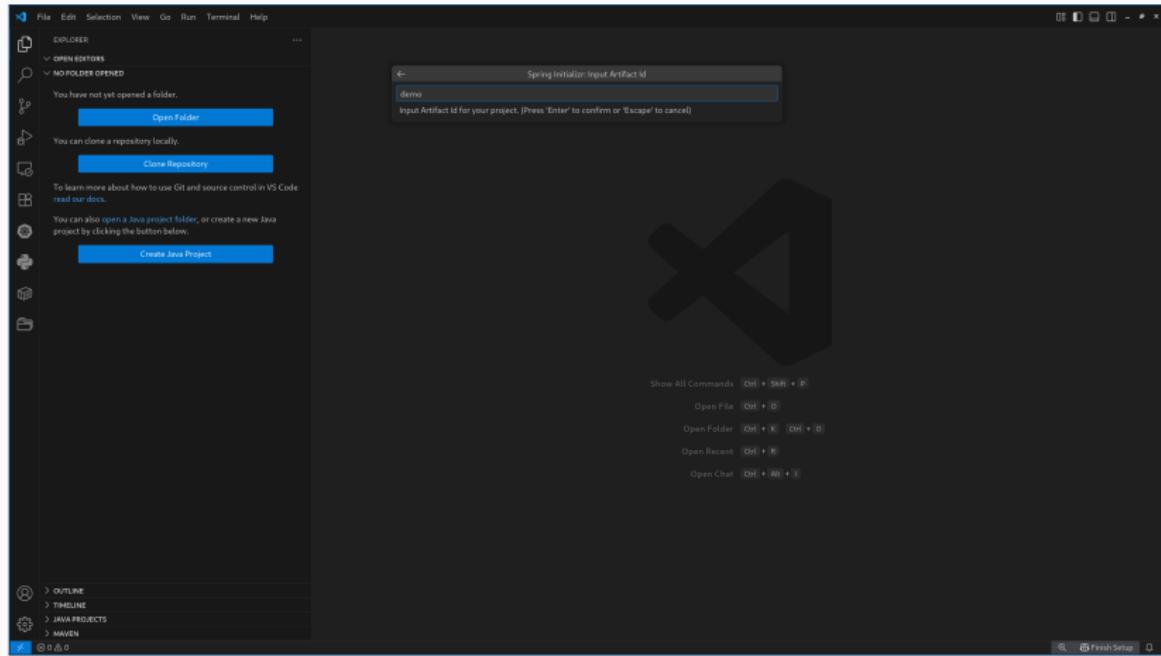
6 Selezionare Java come linguaggio di progetto



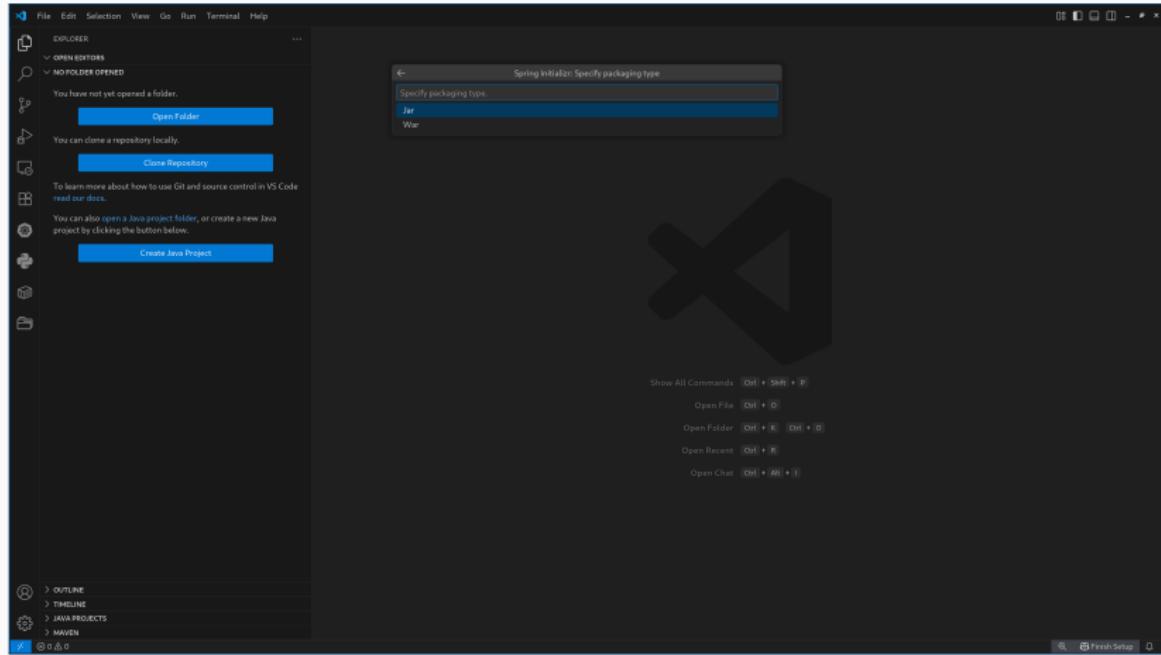
7 Definire il Group ID di riferimento del progetto



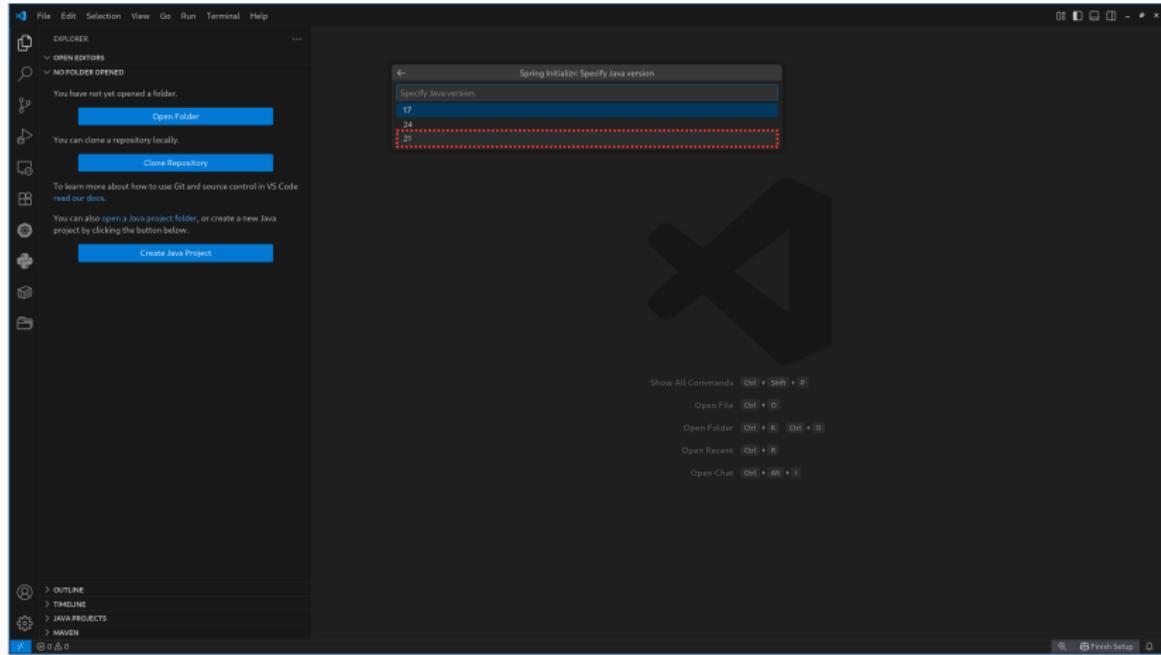
8 Definire l'Artifact ID di riferimento del progetto



9 Definire la tipologia di *packaging* del progetto



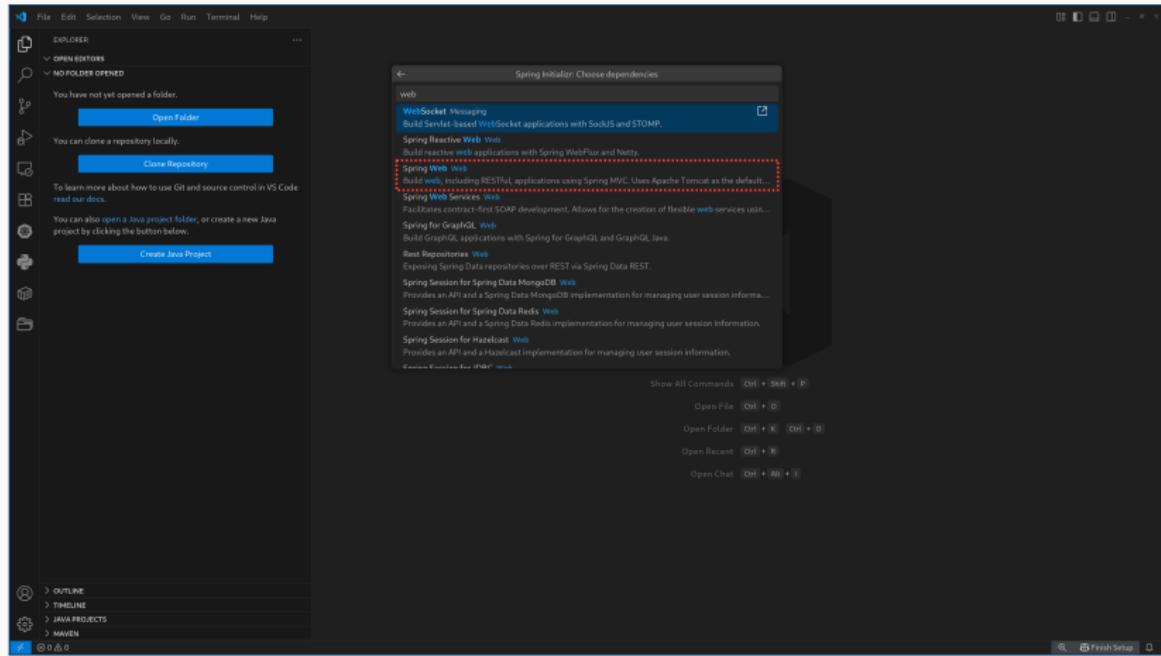
10 Selezionare la versione di Java di riferimento



PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VSCode)

11 Selezionare come prima dipendenza di progetto Spring Web

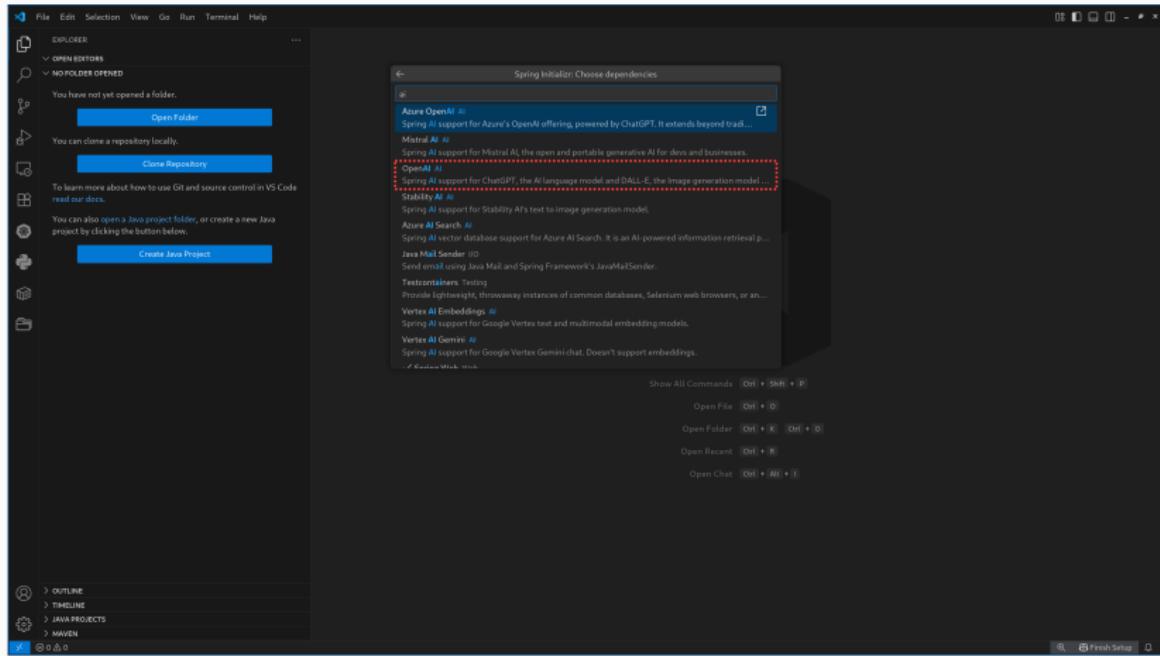


PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VSCode)

12

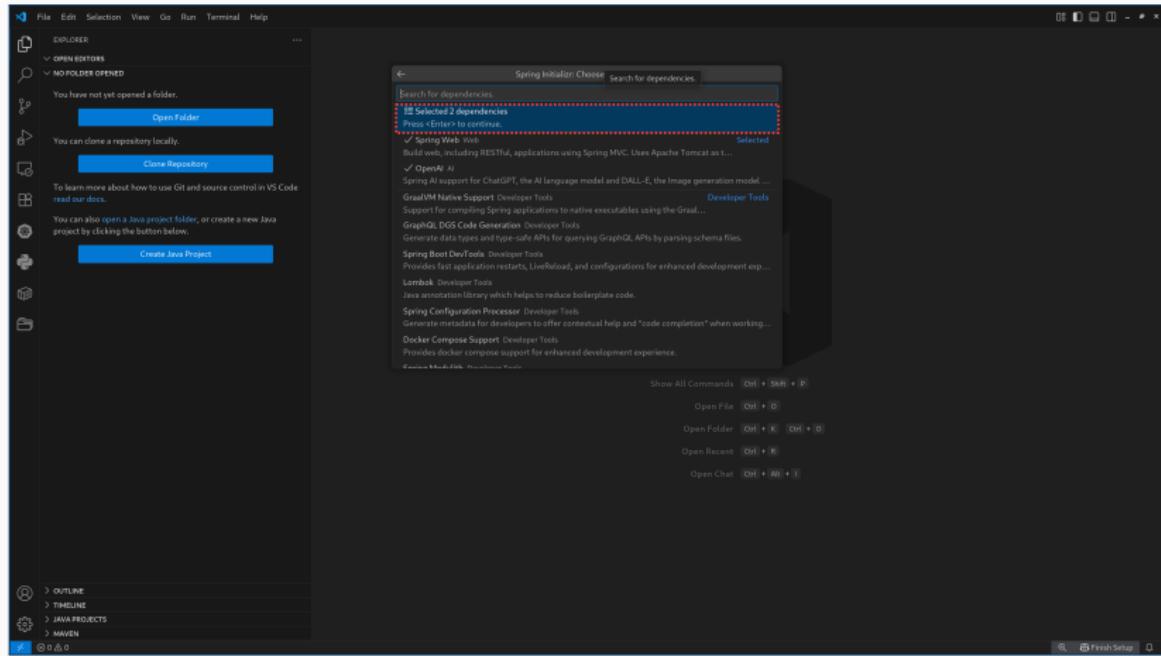
Selezionare come seconda dipendenza di progetto OpenAI



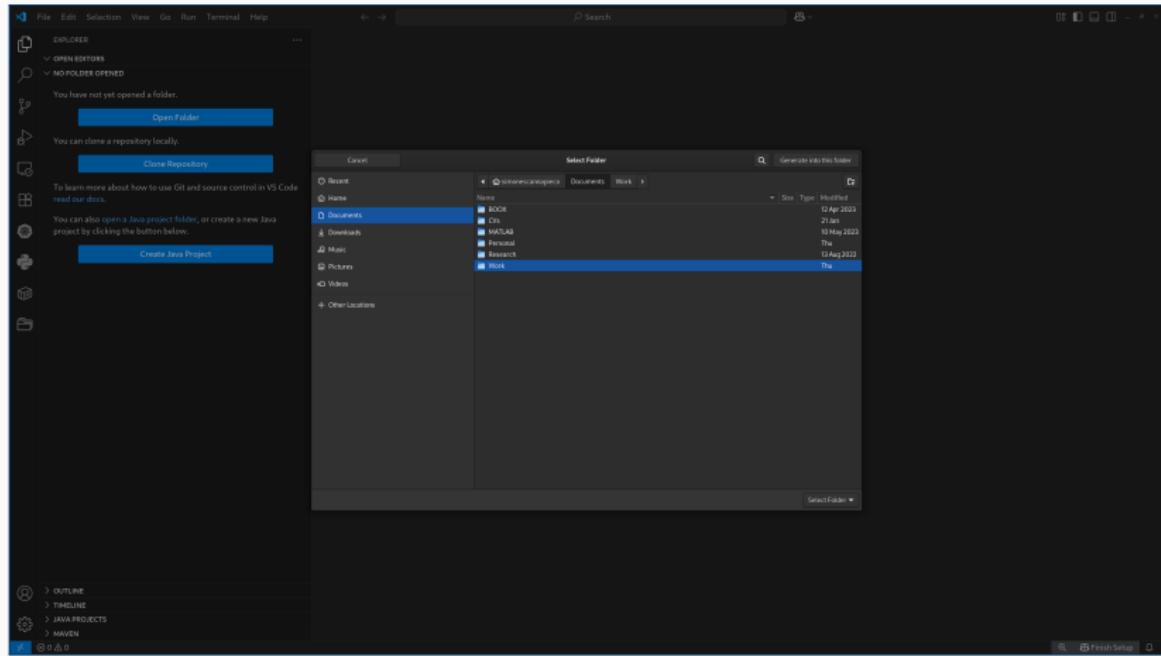
PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VSCode)

13 Continuare la creazione del progetto premendo Enter



14 Navigare nel FS e selezionare la cartella padre del progetto

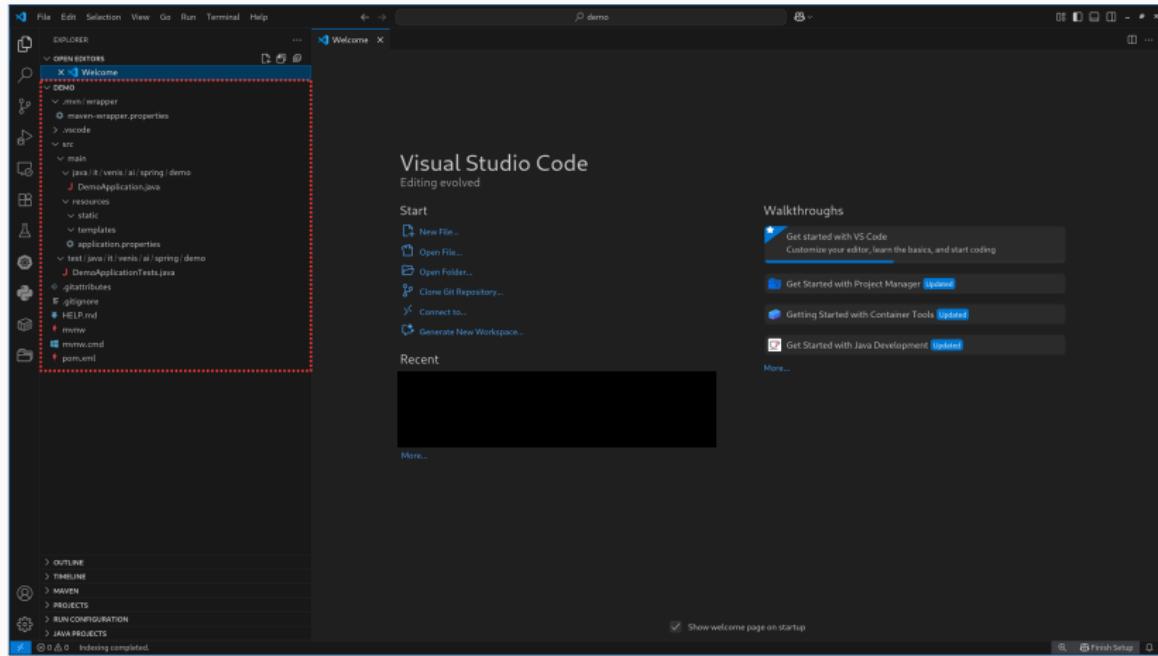


PROGETTO SPRING AI

INIZIALIZZAZIONE DA IDE (VS CODE)

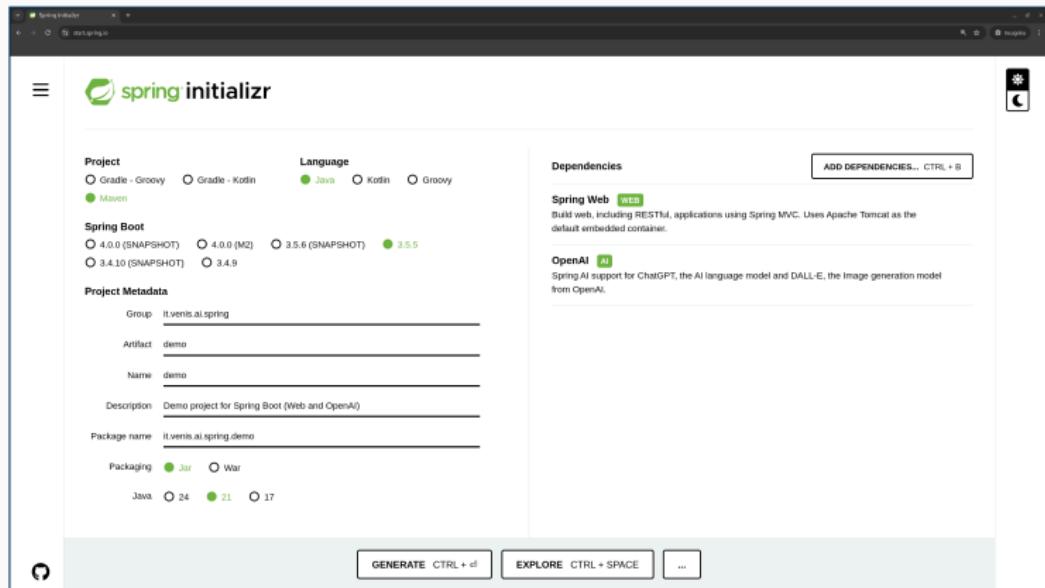
15

Verificare i file di progetto nel pannello Explorer (CTRL + SHIFT + E)



PROGETTO SPRING

INIZIALIZZAZIONE DA SPRING INITIALizr

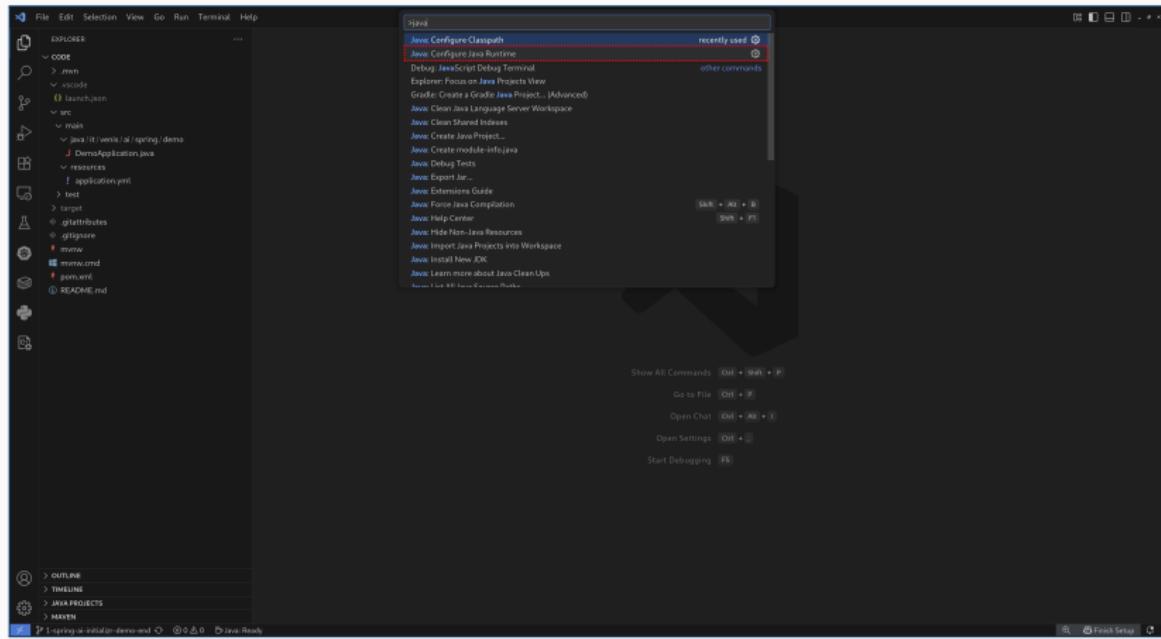


The screenshot shows the Spring Initializr interface. In the Project section, Maven is selected. Language Java is selected. In the Spring Boot section, version 3.5.0 (Snapshot) is selected. In the Project Metadata section, Group is set to it.venis.ai.spring, Artifact to demo, and Name to demo. Description is Demo project for Spring Boot (Web and OpenAI). Package name is it.venis.ai.spring.demo. Packaging is set to Jar. Java version 21 is selected. Under Dependencies, Spring Web and OpenAI are listed. Buttons at the bottom include GENERATE (CTRL + d), EXPLORE (CTRL + SPACE), and a three-dot menu.

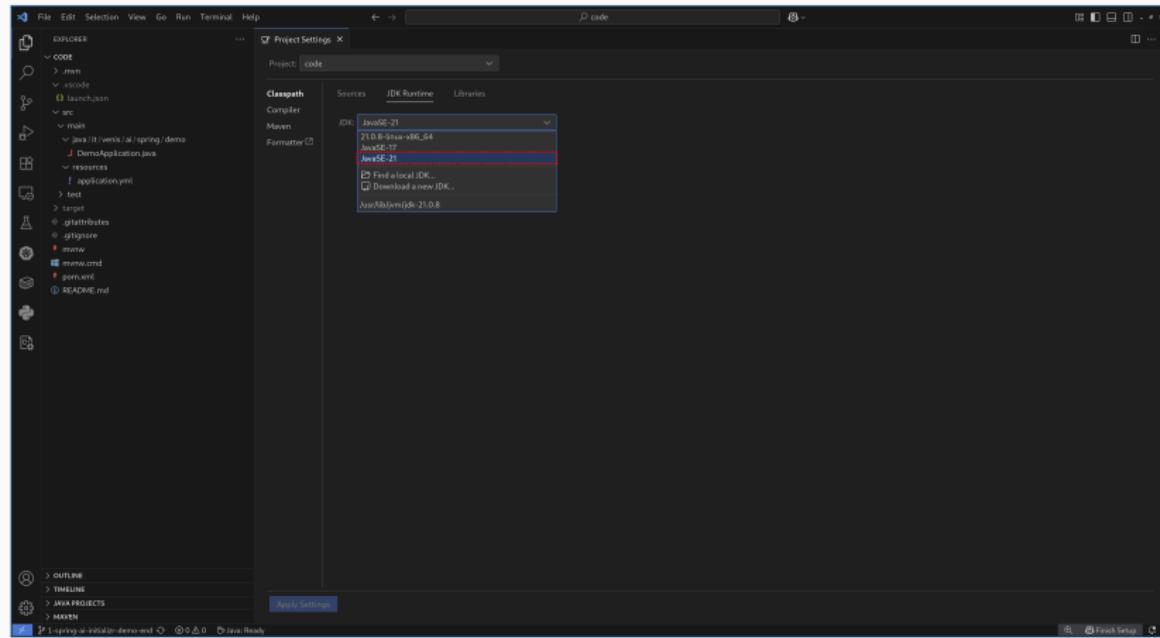
Portale ufficiale

<https://start.spring.io/>

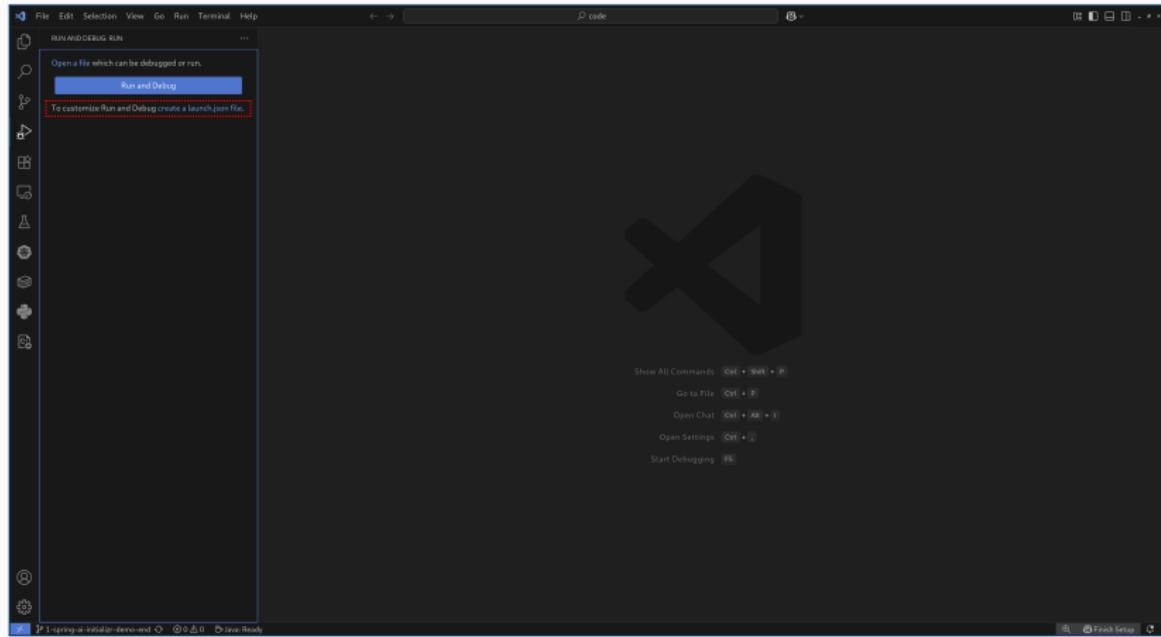
1 Dal pannello dei comandi (CTRL + SHIFT + P), Java: Configure Java Runtime



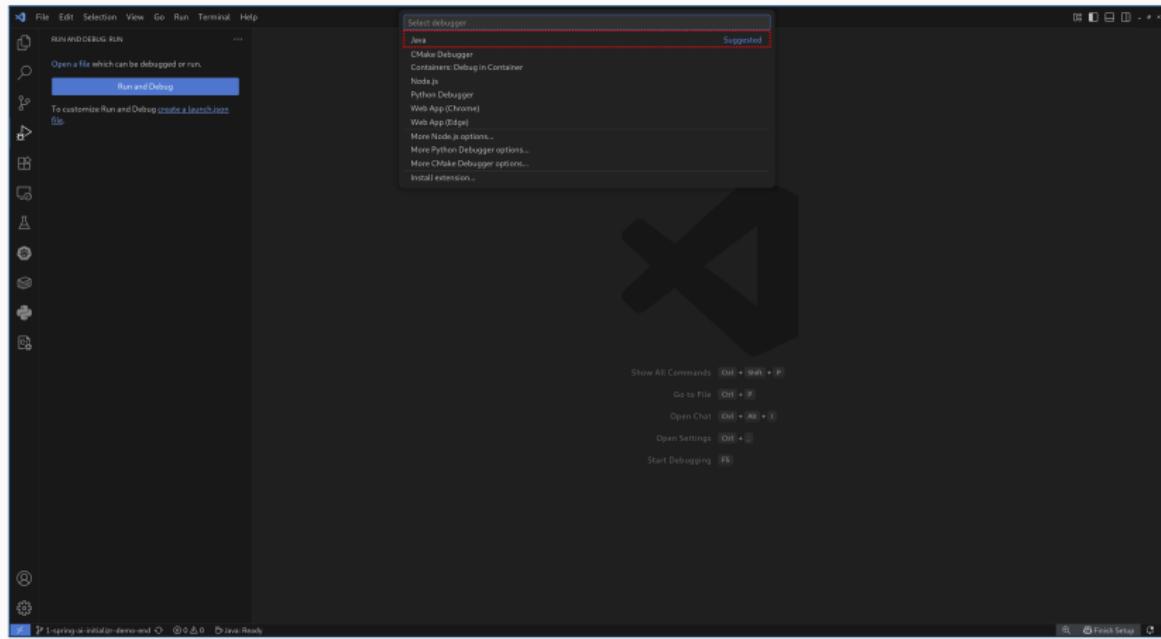
2 Selezionare la JDK 21 precedentemente installata



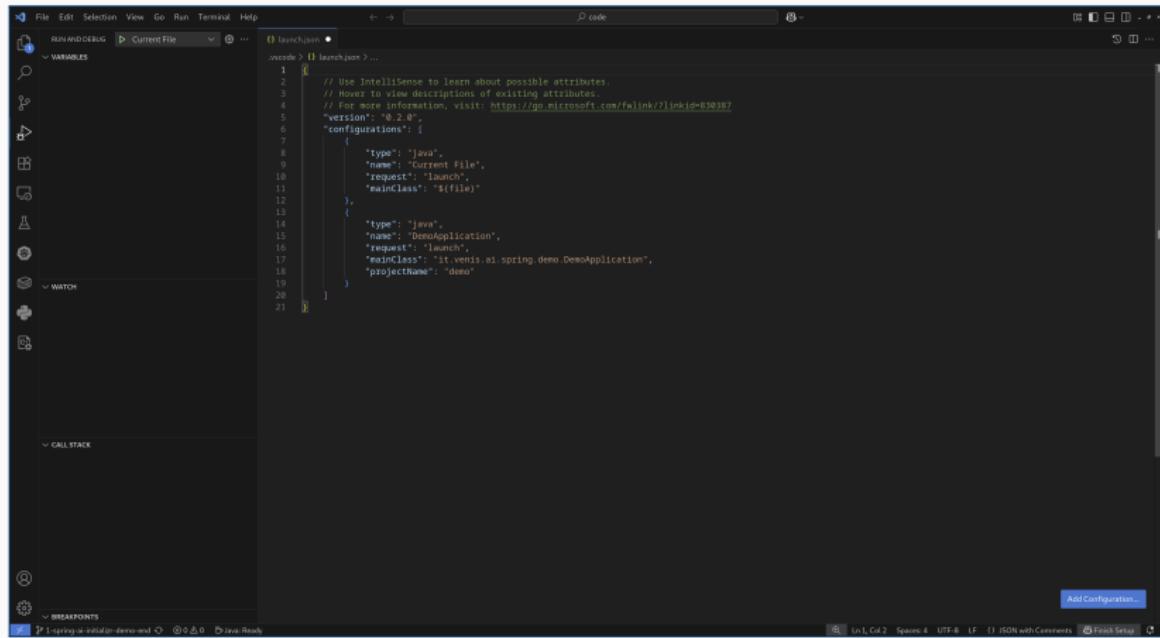
- 1 Dal pannello di debug (**CTRL + SHIFT + D**), creare un nuovo file `launch.json`



2 Selezionare Java come tipologia di esecuzione/debug



3 Verificare la presenza delle due configurazioni di base

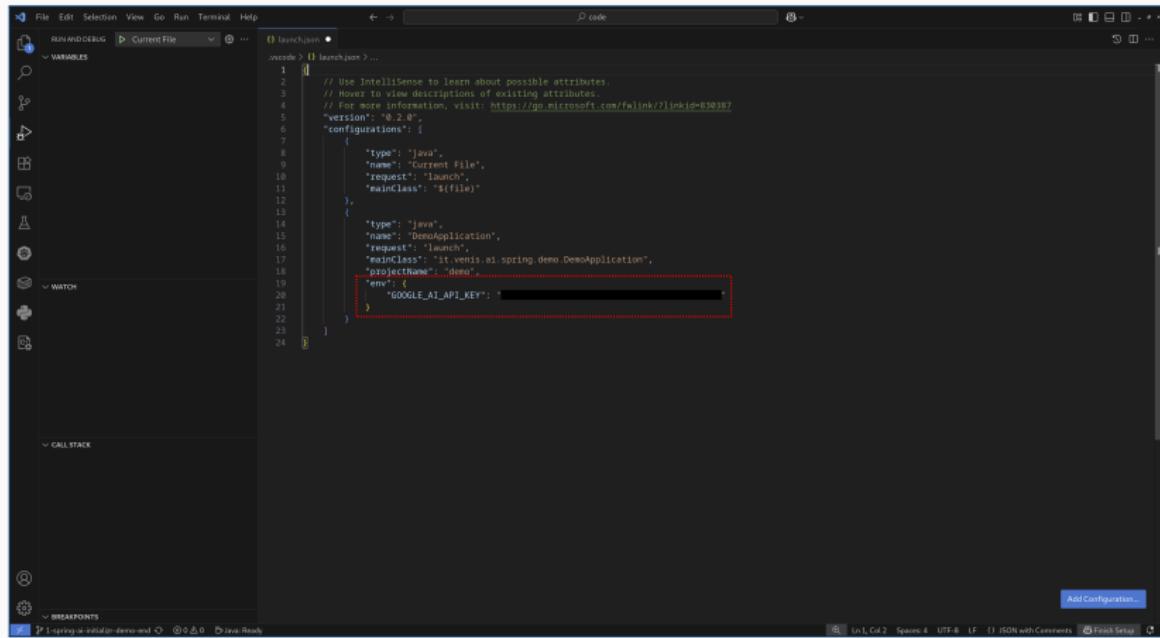


The screenshot shows the VS Code interface with the "RUN AND DEBUG" tab selected. On the left, the "VARIABLES" and "WATCH" toolbars are visible. The main editor area displays the contents of the `launch.json` file:

```
version: "0.2.0"
"configurations": [
    {
        "type": "java",
        "name": "Current File",
        "request": "launch",
        "mainClass": "${file}"
    },
    {
        "type": "java",
        "name": "DemoApplication",
        "request": "launch",
        "mainClass": "it.venis.ai.spring.demo.DemoApplication",
        "projectName": "demo"
    }
]
```

At the bottom right of the editor, there is a button labeled "Add Configuration". The status bar at the bottom shows the file path `src/main/java/it/venis/ai/spring/demo/DemoApplication.java`, line count `18`, and character count `1080`.

4 Aggiungere metadati se necessario (es. variabili di ambiente)



The screenshot shows the VS Code interface with the 'RUN AND DEBUG' tab selected. The left sidebar displays the 'VARIABLES' and 'WATCH' sections. The main editor area contains the 'launch.json' configuration file:

```
1 // Use IntelliSense to learn about possible attributes.
2 // Hover to view descriptions of existing attributes.
3 // For more information, visit: https://go.microsoft.com/fwlink/?linkid=830387
4 {
5     "version": "0.2.0",
6     "configurations": [
7         {
8             "type": "java",
9             "name": "Current File",
10            "request": "launch",
11            "mainClass": "${file}"
12        },
13        {
14            "type": "java",
15            "name": "DemoApplication",
16            "request": "launch",
17            "mainClass": "it.venis.ai.spring.demo.DemoApplication",
18            "projectName": "demo",
19            "env": {
20                "GOOGLE_AI_API_KEY": "████████████████████████████████████████"
21            }
22        }
23    ]
24 }
```

A red dotted rectangle highlights the 'env' object in the second configuration block, specifically the 'GOOGLE_AI_API_KEY' key. The bottom right corner of the editor has a 'Finish Setup' button.

1 Eseguendo il progetto, dovremmo ottenere una eccezione!

The screenshot shows a Java IDE interface with a terminal window open. The terminal output is as follows:

```
File Edit Selection View Go Run Terminal Help
RUN AND DE... DemoApp.java ...
application.yml X
src/main/resources/application.yml
1 spring:
2   application:
3     name: demo
4

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

t]
2025-09-02T10:43:17.128+02:00 INFO 122580 --- [demo] (main) o.apache.catalina.core.StandardEngine : Starting Servlet engine
: Apache Tomcat/10.1.44
2025-09-02T10:43:17.155+02:00 INFO 122580 --- [demo] (main) o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring embedded WebApplicationContext
2025-09-02T10:43:17.156+02:00 INFO 122580 --- [demo] (main) w.s.c.ServletWebServerApplicationContext : Root WebApplicationContext
ext initialization completed in 622 ms
2025-09-02T10:43:42+02:00 WARN 122580 --- [demo] (main) ConfigServletWebServerApplicationContext : Exception encountered during context initialization - cancelling refresh attempt: org.springframework.beans.factory.BeanCreationException: Error creating bean with name 'openAiAudioSpeechModel' defined in class path resource [org/springframework/framework/a/i/model/openai/autoload/configure/OpenAIAudioSpeechAutoConfiguration.class]: Failed to instantiate [org.springframework.ai.openai.OpenAIAudioSpeechModel]: Factory method 'openAIAudioSpeechModel' threw exception with message: OpenAI API key must be set. Use the connection property: spring.ai.openai.api-key or spring.ai.openai.speech.api-key property
2025-09-02T10:43:17.429+02:00 INFO 122580 --- [demo] (main) o.apache.catalina.core.StandardService : Stopping service [Tomcat]
t]
2025-09-02T10:43:17.440+02:00 INFO 122580 --- [demo] (main) .s.b.a.l.ConditionEvaluationReportLogger :
ERROR starting ApplicationContext. To resolve the condition evaluation report re-run your application with 'debug' enabled.
2025-09-02T10:43:17.452+02:00 ERROR 122580 --- [demo] (main) o.s.boot.SpringApplication : Application run failed
org.springframework.beans.factory.BeanCreationException: Error creating bean with name 'openAIAudioSpeechModel' defined in class path resource [org/springframework/framework/a/i/model/openai/autoload/configure/OpenAIAudioSpeechAutoConfiguration.class]: Failed to instantiate [org.springframework.ai.openai.OpenAIAudioSpeechModel]: Factory method 'openAIAudioSpeechModel' threw exception with message: OpenAI API key must be set. Use the connection property: spring.ai.openai.api-key or spring.ai.openai.speech.api-key property
at org.springframework.beans.factory.support.ConstructorResolver.resolveConstructors(ConstructorResolver.java:657) ~[spring-beans-6.2.10.j
xr6.2.10]
at org.springframework.beans.factory.support.ConstructorResolver.instantiateUsingFactoryMethod(ConstructorResolver.java:645) ~[sprin
ing-beans-6.2.10.jar:6.2.10]
at org.springframework.beans.factory.support.AbstractAutowireCapableBeanFactory.instantiateUsingFactoryMethod(AbstractAutowireCapa
Simone Scannapieco 1-spring-ai-initial-demo-and ... 0 0 0 DemoApplication.java ... Java Ready 0 Since Scannapieco (3 days ago) 0 Unl. Cola 0 Spazio 2 UTP-S LP (...) Spring Boot Properties Yardi 0 Final Setup 0
```

A red box highlights the error message in the terminal output:

Exception encountered during context initialization - cancelling refresh attempt: org.springframework.beans.factory.BeanCreationException: Error creating bean with name 'openAIAudioSpeechModel' defined in class path resource [org/springframework/framework/a/i/model/openai/autoload/configure/OpenAIAudioSpeechAutoConfiguration.class]: Failed to instantiate [org.springframework.ai.openai.OpenAIAudioSpeechModel]: Factory method 'openAIAudioSpeechModel' threw exception with message: OpenAI API key must be set. Use the connection property: spring.ai.openai.api-key or spring.ai.openai.speech.api-key property

2 Definiamo la chiave richiesta da Spring AI (spring.ai.openai.api-key)

The screenshot shows a Java IDE interface with the following details:

- IDE Layout:** The left sidebar includes "RUN AND DE...", "DemoApp", "VARIABLES", "WATCH", and "CALL STACK". The right sidebar includes "bash" and "Debug DemoApplication".
- application.yml Content:**

```
spring:
  application:
    name: demo
  openai:
    api-key: ${GOOGLE_AI_API_KEY}
```

A red dashed box highlights the line `api-key: ${GOOGLE_AI_API_KEY}`.
- Terminal Log Output:**

```
t]
2025-09-02T10:43:17.128+02:00 INFO 122500 --- [demo] (           main) o.apache.catalina.core.StandardEngine : Starting Servlet engine
[Apache Tomcat/10.1.44]
2025-09-02T10:43:17.155+02:00 INFO 122500 --- [demo] (           main) o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring embedded WebApplicationContext
2025-09-02T10:43:17.156+02:00 INFO 122500 --- [demo] (           main) w.s.c.ServletWebServerApplicationContext : Root WebApplicationContext initialized completed in 622 ms
2025-09-02T10:43:17.427+02:00 WARN 122500 --- [demo] (           main) ConfigServletWebServerApplicationContext : Exception encountered during context initialization - cancelling refresh attempt: org.springframework.beans.factory.BeanCreationException: Error creating bean with name 'openaiAudioSpeechModel' defined in class path resource [org/springframework/framework/a/i/model/openai/autoconfigure/OpenAIAudioSpeechAutoConfiguration.class]: Failed to instantiate [org.springframework.ai.openai.OpenAIAudioSpeechModel]: Factory method 'openAIAudioSpeechModel' threw exception with message: OpenAI API key must be set. Use the connection property: spring.ai.openai.api-key or spring.ai.openai.api-key property.
2025-09-02T10:43:17.429+02:00 INFO 122500 --- [demo] (           main) o.apache.catalina.core.StandardService : Stopping service [Tomcat]
t]
2025-09-02T10:43:17.440+02:00 INFO 122500 --- [demo] (           main) .s.b.a.l.ConditionEvaluationReportLogger :
ERROR starting ApplicationContext. To display the condition evaluation report re-run your application with --debug enabled.
2025-09-02T10:43:17.452+02:00 ERROR 122500 --- [demo] (           main) o.s.boot.SpringApplication :
Application run failed
org.springframework.beans.factory.BeanCreationException: Error creating bean with name 'openaiAudioSpeechModel' defined in class path resource [org/springframework/framework/a/i/model/openai/autoconfigure/OpenAIAudioSpeechAutoConfiguration.class]: Failed to instantiate [org.springframework.ai.openai.OpenAIAudioSpeechModel]: Factory method 'openAIAudioSpeechModel' threw exception with message: OpenAI API key must be set. Use the connection property: spring.ai.openai.api-key or spring.ai.openai.api-key property.
at org.springframework.beans.factory.support.ConstructorResolver.instantiate(ConstructorResolver.java:657) ~[spring-beans-6.2.10.j
sr.6.2.10]
at org.springframework.beans.factory.support.ConstructorResolver.instantiateUsingFactoryMethod(ConstructorResolver.java:645) ~[spr
ing-beans-6.2.10.jar:6.2.10]
at org.springframework.beans.factory.support.AbstractAutowireCapableBeanFactory.instantiateUsingFactoryMethod(AbstractAutowireCapa
...

```

3 Ora non dovremmo ottenere eccezioni!

The screenshot shows a Java IDE interface with the following details:

- IDE Layout:** The left sidebar contains "RUN AND DE...", "DemoApp", "VARIABLES", and "WATCH". The bottom-left sidebar includes "STACKTRACE", "BREAKPOINTS", and checkboxes for "Uncaught Exceptions" and "Caught Exceptions".
- Terminal Tab:** Shows the command "gradle bootRun" being run, with the output:

```
gradle bootRun
Starting build
Configuration on demand is available. To trigger it, use 'gradle -d' or the '--refresh-dependencies' option.
:compileJava
:processResources
:classes
:bootRun
Starting Tomcat server in port 8080
```
- Output Tab:** Displays the log from the "gradle bootRun" command, including:

```
2025-09-02T10:48:24.985+02:00 [INFO] [128913] --- [demo] [main] i.venis.ai.spring.demo.DemoApplication : Starting DemoApplication
2025-09-02T10:48:25.594+02:00 [INFO] [128913] --- [demo] [main] i.venis.ai.spring.demo.DemoApplication : code/target/classes started
2025-09-02T10:48:25.622+02:00 [INFO] [128913] --- [demo] [main] o.apache.catalina.core.StandardService : No active profile set, falling back to default profile: "default"
2025-09-02T10:48:25.655+02:00 [INFO] [128913] --- [demo] [main] o.s.b.w.embedded.tomcat.TomcatWebServer : Tomcat initialized with port 8080 (http)
2025-09-02T10:48:25.593+02:00 [INFO] [128913] --- [demo] [main] o.apache.catalina.core.StandardEngine : Starting service [Tomca
2025-09-02T10:48:25.594+02:00 [INFO] [128913] --- [demo] [main] o.apache.catalina.core.StandardEngine : Starting Servlet engine
2025-09-02T10:48:25.622+02:00 [INFO] [128913] --- [demo] [main] o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring em
2025-09-02T10:48:25.622+02:00 [INFO] [128913] --- [demo] [main] w.s.c.WebApplicationConte : Root WebApplicationContext
2025-09-02T10:48:25.622+02:00 [INFO] [128913] --- [demo] [main] o.s.b.w.embedded.tomcat.TomcatWebServer : Tomcat started on port
2025-09-02T10:48:25.622+02:00 [INFO] [128913] --- [demo] [main] i.venis.ai.spring.demo.DemoApplication : Started DemoApplication
```
- PROBLEMS Tab:** Shows a single error: "The project 'DemoApp' is not a valid Java project." with a link to "https://www.jetbrains.com/help/idea/project-and-module-model.html#java-project".
- OUTPUT Tab:** Shows the log from the "gradle bootRun" command.
- DEBUG CONSOLE Tab:** Shows the log from the "gradle bootRun" command.
- TERMINAL Tab:** Shows the command "gradle bootRun".
- PORTS Tab:** Shows the port 8080 is in use by "Tomcat".
- Bash Terminal:** Shows the command "gradle bootRun" being run.
- Debug Session:** Shows "Debug DemoApplication".

<https://github.com/simonescannapieco/spring-ai-base-dgroove-venis-code.git>

Branch: 1-spring-ai-initializr