Routine App Tutorial Stage 1: Initial Prototype (Monolithic) - Detailed Instructions

This document outlines the structure and implementation of the dev.algo.routine full-stack application. Specifically, this document is a tutorial on how to build the initial monolithic application.

1. Backend Setup

1.1 Set up Spring Boot project

Create an initial project

1. Configure from web https://start.spring.io/.
2. Specifically, use this predefined configuration using java 17 and maven, adding web, data-jpa, postgresql, security, and lombok dependencies.
3. Generate, download, unzip
4. Import the project in your IDEA Import: Project properties > Import module

1.2 Configure PostgreSQL database

Setting up a robust database is crucial for the application. Set up PostgreSQL, a powerful open-source relational database system.

1. Install PostgreSQL if not already installed
2. Create a new database named `routine_db`
3. Open the `src/main/resources/application.properties` and add the db connection details

```
# DB connection
spring.datasource.url=jdbc:postgresql://localhost:5432/routine_db
spring.datasource.driver-class-name=org.postgresql.Driver

spring.jpa.hibernate.ddl-auto=update
spring.jpa.properties.hibernate.dialect= org.hibernate.dialect.PostgreSQLDialect
spring.jpa.show-sql=true

# The following line is for using Spring Profiles
 spring.profiles.active=dev
```

4. Create a file `application-dev.properties` to store db user and password

```
spring.datasource.username=your_username
spring.datasource.password=your_password
```

NOTE

- You should gitignore the `dev.properties`.
- In a production environment, consider using environment variables or a secure vault for sensitive information.

1.3 Create JPA entities

Entities are the backbone of our data model. They represent the structure of our database tables in Java objects.

1. Create a new package `dev.algo.routine.backend.model`
2. Create `User.java`:

```java
@Data
@Entity
@Table(name = "users")
public class User {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private long id;

    @Column(nullable = false, unique = true)
    private String username;

    @Column(nullable = false)
    private String password;

    @Column(nullable = false, unique = true)
    private String email;
}
```

3. Create `Task.java`:

```java
@Data
@Entity
@Table(name = "tasks")
public class Task {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private long id;
    @Column(nullable = false)
    private String title;

    private String description;

    @Column(nullable = false)
    private LocalDateTime dueDate;

    @ManyToOne
    @JoinColumn(name = "user_id", nullable = false)
    private User user;

    private boolean complete;
}
```

NOTE Consider adding additional fields like `createdAt` and `updatedAt` for better tracking of records.

1.4 Implement repositories

Repositories provide an abstraction layer for database operations, allowing us to interact with our entities easily.

1. Create a new package `dev.algo.routine.backend.repository`
2. Create `UserRepository.java`:

```
public interface UserRepository extends JpaRepository<User, Long> {
    User findByUsername(String username);
}
```

3. Create `TaskRepository.java`:

```
public interface TaskRepository extends JpaRepository<Task, Long> {
    List<Task> findByUser(User user);
}
```

NOTE For more complex queries, consider using `@Query` annotations or `QueryDSL` for type-safe queries.

1.5 Create services

Services encapsulate our business logic, providing a clean separation between the web layer and data access layer.

1. Create a new package `dev.algo.routine.backend.service`
2. Create `UserService.java`:

```java
@Service
public class UserService {
    private static Logger logger = LoggerFactory.getLogger(UserService.class);

    private final UserRepository userRepository;
    private final PasswordEncoder passwordEncoder;

    public UserService(UserRepository userRepository, PasswordEncoder
passwordEncoder) {
        this.userRepository = userRepository;
        this.passwordEncoder = passwordEncoder;
    }

    public User createUser(User user) {
        // encode the password before saving
        user.setPassword(passwordEncoder.encode(user.getPassword()));
        return userRepository.save(user);
    }

    public User findByUsername(String username) {
        return userRepository.findByUsername(username);
    }
}
```

3. Create `TaskService.java`:

```java
@Service
public class TaskService {

    private final TaskRepository taskRepository;

    public TaskService(TaskRepository taskRepository) {
        this.taskRepository = taskRepository;
    }

    public Task createTask(Task task) {
        // Note: you might want to check the task is associated to an user,
        // or you might want to set a default deadline if the task does not have
one
        return taskRepository.save(task);
    }

    public List<Task> getTaskForUser(User user){
        return taskRepository.findByUser(user);
    }
    public Task updateTask(Task task) {
        return taskRepository.save(task);
    }

    public void deleteTask(Long taskId) {
        taskRepository.deleteById(taskId);
    }
}
```

NOTE Consider adding validation logic and error handling in these service methods for robustness.

1.6 Implement REST controllers

Controllers handle HTTP requests and responses, defining the API endpoints for our application.

1. Create a new package `dev.algo.routine.backend.controller`
2. Create `UserController.java`:

```java
@RestController
@RequestMapping("api/users")
public class UserController {

    private final UserService userService;

    public UserController(UserService userService) {
        this.userService = userService;
    }

    @PostMapping("/register")
    public ResponseEntity<User> registerUser(@RequestBody User user) {
        User createdUser = userService.createUser(user);
        return ResponseEntity.ok(createdUser);
    }
}
```

3. Create `TaskController.java`:

```java
@RestController
@RequestMapping("/api/tasks")
public class TaskController {

    private final TaskService taskService;
    private final UserService userService;

    public TaskController(TaskService taskService, UserService userService) {
        this.taskService = taskService;
        this.userService = userService;
    }

    @PostMapping
    public ResponseEntity<Task> createTask(@RequestBody Task task, Authentication
authentication) {
        // Get the authenticated user
        User user = userService.findByUsername(authentication.getName());
        task.setUser(user);
        Task createdTask = taskService.createTask(task);
        return ResponseEntity.ok(createdTask);
    }

    @GetMapping
    public ResponseEntity<List<Task>> getTasks(Authentication authentication) {
        User user = userService.findByUsername(authentication.getName());
        List<Task> tasks = taskService.getTaskForUser(user);
        return ResponseEntity.ok(tasks);
    }

    @PutMapping("/{taskId}")
    public ResponseEntity<Void> deleteTask(@PathVariable Long taskId) {
        taskService.deleteTask(taskId);
        return ResponseEntity.ok().build();
    }
}
```

NOTE Consider implementing pagination for the getTasks endpoint to handle large numbers of tasks efficiently.

1.7 Add Login Endpoint

Implement an `/api/auth/login` endpoint, which will allow login from the frontend

1. Create `AuthController.java`

```
@RestController
@RequestMapping("/api/auth")
public class AuthController {
    private static final Logger logger = LoggerFactory.getLogger(AuthController
.class);

    private AuthenticationManager authenticationManager;
    private UserService userService;

    public AuthController(AuthenticationManager authenticationManager, UserService
userService) {
        this.authenticationManager = authenticationManager;
        this.userService = userService;
    }

    @PostMapping("/login")
    public ResponseEntity<?> authenticateUser(@RequestBody LoginRequest
loginRequest) {
        logger.info("Login attempt for user: " + loginRequest.getUsername());
        try {
            Authentication authentication = authenticationManager.authenticate(
                new UsernamePasswordAuthenticationToken(
                    loginRequest.getUsername(),
                    loginRequest.getPassword()
                )
            );

            SecurityContextHolder.getContext().setAuthentication(authentication);

            User user = userService.findByUsername(loginRequest.getUsername());
            logger.info("User authenticated successfully: {}", user.getUsername());

            Map<String, String> response = new HashMap<>();
            response.put("token", "dummy-token");// Replace with JWT in production
            response.put("username", user.getUsername());

            return ResponseEntity.ok(response);
        } catch (AuthenticationException e) {
            logger.error("Authentication failed for user: " + loginRequest
.getUsername());
            return ResponseEntity.status(HttpStatus.UNAUTHORIZED)
                    .body("Invalid username or password");
        }
    }
}

@Data
class LoginRequest {
    private String username;
    private String password;
}
```

1.8 Implement basic Spring Security configuration

Security is crucial for any application. Here, we set up basic authentication and authorization rules.

1. Create a new package `dev.algo.routine.backend.config`
2. Create `SecurityConfig.java`:

```
@Configuration
@Profile({"dev", "test"})
@EnableWebSecurity
```

```
public class SecurityConfig {

    @Bean
    public SecurityFilterChain securityFilterChain(HttpSecurity http) throws
Exception {
        http
                .csrf(AbstractHttpConfigurer::disable) // Disable CSRF for
simplicity. Enable in production.
                .cors( cors -> cors.configurationSource(corsConfigurationSource()))
                .authorizeHttpRequests(auth -> auth
                        .requestMatchers("/api/users/register", "/api/auth/login")
.permitAll()
                        .requestMatchers("/api/tasks/**").authenticated()
                        .anyRequest().authenticated()
                )
                .httpBasic( httpBasic -> {}); // Use HTTP Basic Authentication
        return http.build();
    }

    @Bean
    public PasswordEncoder passwordEncoder() {
        return new BCryptPasswordEncoder();
    }

    @Bean
    public AuthenticationManager authenticationManager(AuthenticationConfiguration
authenticationConfiguration) throws Exception {
        return authenticationConfiguration.getAuthenticationManager();
    }

    @Bean
    public CorsConfigurationSource corsConfigurationSource() {
        CorsConfiguration configuration = new CorsConfiguration();
        configuration.setAllowedOrigins(Arrays.asList("http://localhost:3000"));//
allow origin: react dev server
        configuration.setAllowedMethods(Arrays.asList("GET", "POST", "PUT", "
DELETE", "OPTIONS"));
        configuration.setAllowedHeaders(Arrays.asList("Authorization", "Content-
Type"));
        configuration.setExposedHeaders(Arrays.asList("Authorization"));// headers
the browser can access
        configuration.setAllowCredentials(true);
        configuration.setMaxAge(3600L);// how long browser should cache CORS
configuration (seconds)
        UrlBasedCorsConfigurationSource source = new
UrlBasedCorsConfigurationSource();
        source.registerCorsConfiguration("/**", configuration); // CORS config
applied to all paths
        return source;
    }
}
```

3. Create `CustomUserDetailsService.java`:

```java
@Service
public class CustomUserDetailsService implements UserDetailsService {

    private final UserService userService;

    public CustomUserDetailsService(UserService userService) {
        this.userService = userService;
    }

    @Override
    public UserDetails loadUserByUsername(String username) throws
UsernameNotFoundException {
        User user = userService.findByUsername(username);
        if(user == null) {
            throw new UsernameNotFoundException("User not found with username: " +
username);
        }
        // Convert our custom User to Spring's UserDetails
        return org.springframework.security.core.userdetails.User
                .withUsername(user.getUsername())
                .password(user.getPassword())
                .roles("USER")
                .build();
    }
}
```

NOTE

- For production, consider implementing JWT (JSON Web Tokens) for stateless authentication and more granular authorization rules.
- SecurityConfig configures CORS, enable unauthenticated access to register and login endpoints, and authenticated access to tasks endpoints

1.9 Running the Backend

To run the application:

1. Ensure PostgreSQL is running and the database is created
2. Run the Spring Boot application
3. The API will be available at `http://localhost:8080`

```
mvn clean install -U
mvn spring-boot:run
```

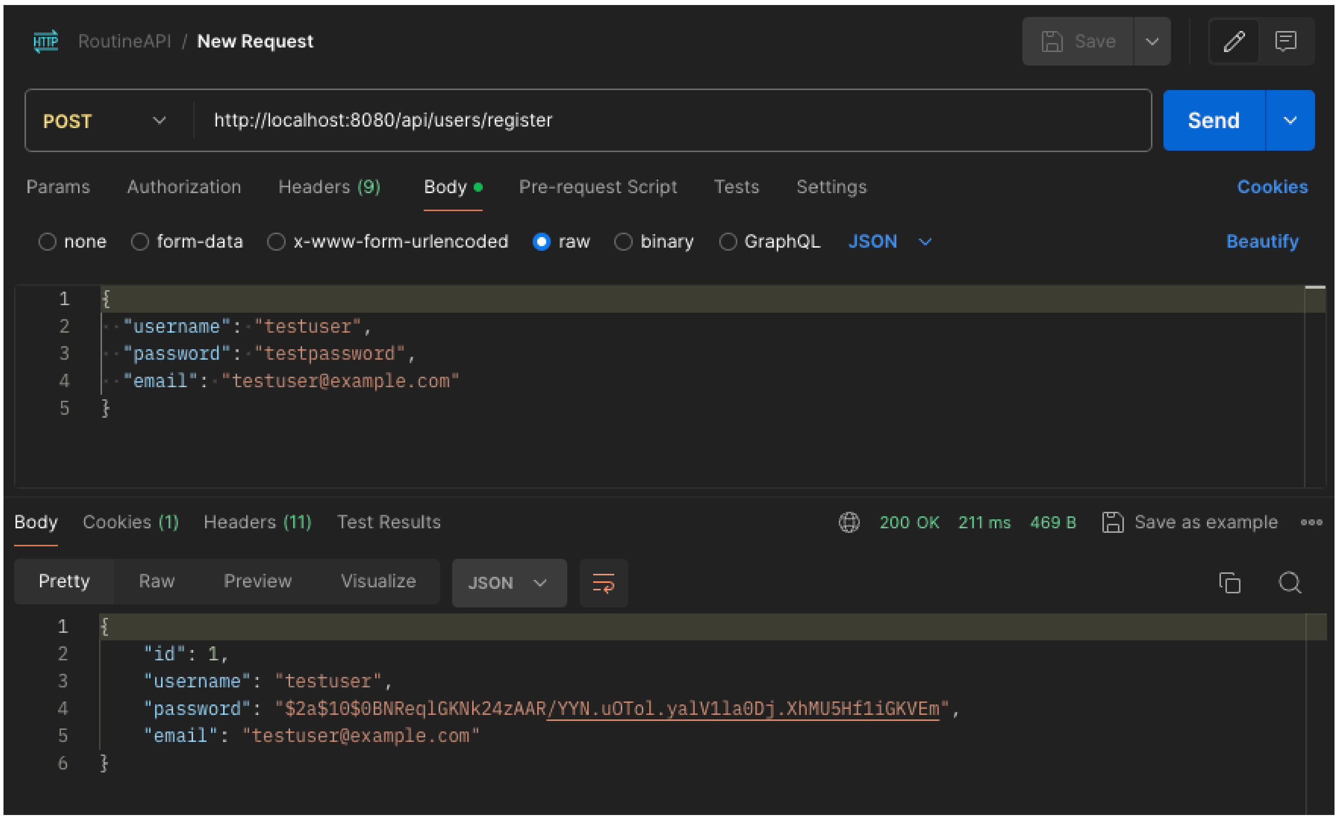
1.10 API Endpoints

When the backend is running, you can test the endpoints with a tool like Postman:

- POST `/api/users/register`: Register a new user
- POST `/api/tasks`: Create a new task
- GET `/api/tasks`: Get all tasks for the authenticated user
- PUT `/api/tasks/{id}`: Update a task
- DELETE `/api/tasks/{id}`: Delete a task

Example: Use Postman to send a POST request to http://localhost:8080/api/users/register with a JSON body like this:

```
{
  "username": "testuser",
  "password": "testpassword",
  "email": "testuser@example.com"
}
```



POST http://localhost:8080/api/users/register

Body: [✓ raw] JSON

```
{
  "username": "testuser",
  "password": "testpassword",
  "email": "testuser@example.com"
}
```

200 OK 211 ms 469 B

```
{
    "id": 1,
    "username": "testuser",
    "password": "$2a$10$0BNReqlGKNk24zAAR/YYN.uOTol.yalV1la0Dj.XhMU5Hf1iGKVEm",
    "email": "testuser@example.com"
}
```

If the user registration is successful, you should be able to use these credentials to log in at the browser prompt. So, access https://localhost8080 and login with testuser:testpassword

NOTE Remember to implement proper error handling, validation, and testing for a production-ready application.