

# System Requirements Specification (SRS)

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## NanoRiego

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## 1. Object & Scope

This System Requirements Specification (SRS) defines the technical and operational characteristics of the NanoRiego irrigation control platform. It captures both the system-level and component-level requirements necessary to fulfill the functionality described in the User Requirements Specification (URS). The SRS acts as a contractual agreement between stakeholders and the development team, serving as a definitive reference for system architecture, implementation, integration, and validation.

## 2. System Overview

NanoRiego is a modular, embedded system for local irrigation automation, consisting of:

- **NanoRiegoPCB:** Custom PCB integrating microcontroller, RTC, relay interface, and Bluetooth communication.
- **NanoRiegoPIO:** Embedded software managing irrigation logic, timing, and hardware actuation.
- **NanoRiegoAPP:** Android application offering real-time user interface and remote operation.

The controller receives user inputs from the mobile interface via Bluetooth and executes real-time irrigation schedules accordingly, while preserving system state during power interruptions.

### 2.1 Hardware Overview

Component	Function	Source	Estimated Cost
NanoRiegoPCB	Central PCB	Custom (MikeMakes)	~10€
Arduino Nano	Microcontroller	Amazon/AliExpress	2€–8€
HC-05	Bluetooth module	Amazon/AliExpress	3€–11€
DS1307 RTC	Real-Time Clock	Amazon/AliExpress	2€–6€
4-Relay Module	Actuation interface	Amazon/AliExpress	2€–8€

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## 3. System Requirements

### 3.1 Functional Requirements

- **SYS-FR1:** The system shall control up to three solenoid valves for water distribution.
- **SYS-FR2:** The system shall operate one hydraulic pump in tandem with active irrigation zones.
- **SYS-FR3:** The system shall accept scheduling instructions from the mobile app. Schedule include start time, duration per zone and active days of the week.
- **SYS-FR4:** The system shall execute scheduled events based on the internal RTC.
- **SYS-FR5:** The system shall allow manual zone activation via the mobile app.
- **SYS-FR6:** The system shall store schedule and configuration data persistently.
- **SYS-FR7:** The mobile app shall enable time/date synchronization and Bluetooth pairing.
- **SYS-FR8:** The controller shall return current system state upon request.

### 3.2 Interface Requirements

- **SYS-IR1:** Relay output lines shall switch up to 10A @ 250VAC / 30VDC.
- **SYS-IR2:** HC-05 module shall operate at 3.3V logic and communicate at 9600 baud.
- **SYS-IR3:** DS1307 RTC shall communicate via I2C and operate from 5V with backup battery.

### 3.3 Hardware Requirements

- **SYS-HR1:** The main PCB shall accommodate Arduino Nano, HC-05, DS1307, and relay module via pin headers.
- **SYS-HR2:** The system shall use a 2-resistor voltage divider to adapt 5V TX to 3.3V RX for HC-05.
- **SYS-HR3:** All components shall share a common ground or use isolated grounds when necessary.
- **SYS-HR4:** The pump circuit shall be protected using a DIN-rated auxiliary relay.

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### 3.4 Software Requirements

- **SYS-SR1:** Firmware shall implement a state machine to handle scheduling, manual override, and error states.
- **SYS-SR2:** Bluetooth parser shall support pairing, command execution, and exception handling.
- **SYS-SR3:** Mobile app shall be developed using Android Studio and be compatible with Android 7.0+.
- **SYS-SR4:** EEPROM memory shall be logically mapped for efficient and reliable data retention.

### 3.5 Performance Requirements

- **SYS-PR1:** System boot time shall not exceed 3 seconds.
- **SYS-PR2:** Bluetooth reconnection shall occur within 5 seconds.
- **SYS-PR3:** User input delay shall be under 500 ms.
- **SYS-PR4:** Time sync error shall remain within  $\pm 2$  seconds.

### 3.6 Reliability and Safety Requirements

- **SYS-RS1:** System shall prevent activation of more than one valve at a time.
- **SYS-RS2:** Pump shall never be active without an open valve.
- **SYS-RS3:** System shall ignore malformed Bluetooth commands.
- **SYS-RS4:** UI shall clearly indicate system status and connection health.
- **SYS-RS5:** Relay modules shall not exceed their rated electrical loads.

### 3.7 Human-Machine Interface

- The application shall present two UI panels:
  - **SYS-HMI1:** Control dashboard (zone status, timers, manual override, schedule)
  - **SYS-HMI2:** Configuration page (automatic sync and bluetooth settings)
- **SYS-HMI2:** All control widgets shall reflect real-time state and enforce logical constraints based on connection status.

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## 8. Appendix and References

- Refer to URS Document (v1.0, April 2025)
- GitHub Repository: [github.com/MikeMakes/nanoRiego](https://github.com/MikeMakes/nanoRiego)
- Bluetooth Module Datasheet (HC-05)
- RTC Module Datasheet (DS1307)

*Revisions to this SRS may be issued upon design iteration or stakeholder feedback.*