9. Perangkat Lunak Jaringan Kendali PARKING

Perangkat lunak jaringan kendali PARKING terdiri dari:

* **PLC Program**: Logika kontrol utama (Structured Text/ladder) untuk mengatur urutan operasi, safety, dan fault handling pada sistem parkir.
* **HMI/SCADA**: Antarmuka operator berbasis software (misal: Python Tkinter, WinCC, Wonderware) untuk monitoring status slot parkir, alarm, dan kontrol manual barrier gate.
* **Komunikasi**: Protokol komunikasi industri (Modbus, Ethernet/IP) untuk pertukaran data antara PLC, HMI, dan perangkat lain.
* **Simulasi**: Program simulasi (misal: Python) untuk pengujian logika dan visualisasi proses sebelum implementasi fisik.
* **Data Logging**: Fitur pencatatan data kendaraan, waktu masuk/keluar, dan status slot untuk analisis dan troubleshooting.

9.1 Lampiran: Control System Plan and I/O Table

9.1.1 Control Philosophy

* The system is fully automated with manual override for all barrier gates and display.
* Main control logic is based on vehicle detection, slot status, and access validation.
* Alarms are generated for abnormal conditions (slot full, barrier error, sensor failure, etc.).
* All critical parameters are monitored and logged.
* Local HMI/SCADA for operator interface; remote monitoring optional.
* **Architecture Update:** The system now uses a modular process and control architecture, with clear separation of sensors, logic, and actuators as shown in the updated flowcharts. PLC/SCADA or software logic group handles all process decisions and actuator commands.

9.1.2 Main Control Logic

* **Vehicle Detection**: Sensor triggers when a vehicle enters or exits, updating slot status and display.
* **Barrier Gate**: Opens if slot available and access valid, closes after vehicle passes or on error.
* **Display Update**: Real-time update of slot availability and system status.
* **Alarms**: Any abnormal sensor reading or device error triggers alarm and can stop relevant equipment.
* **Architecture Update:** Logic is now explicitly mapped from sensors to logic functions to actuators, as per the new flowcharts. All sensor values are routed to a central logic group (PLC or software), which then controls actuators.

9.1.3 I/O Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tag/Name | Type | Description | Location | PLC Variable | HMI Display |
| SENSOR-01 | DI | Sensor Kendaraan Masuk | Pintu Masuk | SENSOR\_01 | masuk |
| SENSOR-02 | DI | Sensor Kendaraan Keluar | Pintu Keluar | SENSOR\_02 | keluar |
| SLOT-01 ... SLOT-N | DI | Sensor Slot Parkir | Setiap Slot | SLOT\_01 ... N | slot |
| BARRIER-IN | DO | Barrier Gate Masuk Start/Stop | Pintu Masuk | BARRIER\_IN | barrier-in |
| BARRIER-OUT | DO | Barrier Gate Keluar Start/Stop | Pintu Keluar | BARRIER\_OUT | barrier-out |
| DISPLAY | DO | Display Digital Update | Area Parkir | DISPLAY | display |
| ALARM | DO | Alarm Aktif/Nonaktif | Panel Kontrol | ALARM | alarm |