**Stationary Greeter Robot — Project Charter & Requirements (v0.2, Standalone)**

Status: Draft for review | Owner: Stephen Perelgut | Date: 2025-10-15

**1. Executive Summary**

Design and deliver a desktop, non-mobile ‘greeter’ device for reception areas that detects when a visitor approaches, greets them politely, optionally recognizes enrolled individuals by name (opt-in with consent), and enables a rapid handoff to a human operator via a companion application. The device prioritizes reliable approach detection, clear audio I/O, privacy-by-design data handling, and simple operator controls.

**2. Objectives & Success Criteria**

Objectives:

* Provide a friendly, consistent greeting experience at reception desks and lobby counters.
* Detect human presence and approach in a 1–2 m ‘greeting zone’ directly in front of the device.
* Offer personalized greetings for enrolled/consented individuals by name.
* Enable operator handoff with live view and push-to-talk using a companion app.
* Operate primarily on-device for privacy and low latency.

Measurable Success Criteria (MVP):

* Approach detection: ≥98% detection of humans entering the greeting zone; ≤1 false trigger per hour.
* Person detection: ≥95% recall in typical lobby lighting; ≤1 spurious greet per hour.
* Recognition (opt-in): ≥95% top-1 accuracy for enrolled users with ≥2 enrollment images per person.
* Latency: detect→greet < 500 ms; app handoff < 1.0 s from operator action.
* Privacy: Consent captured and stored; one-click deletion verified; no default cloud uploads.

**3. Scope**

In Scope (MVP):

* Fixed desktop device with camera, microphone array, speaker, status LEDs, and optional small display.
* Approach/presence sensing using camera (RGB/depth) and an auxiliary sensor (ToF or mmWave) for robustness.
* On-device person detection and optional face recognition (enabled only after consent).
* Companion application (BLE and/or secure Wi‑Fi) supporting live view, push-to-talk, greeting/handoff controls, and enrollment.
* Local storage of consent records, embeddings, and visitor logs with export for audit/deletion.

Out of Scope (MVP):

* Any mobility or navigation features.
* Security enforcement (e.g., door controls).
* Sensitive attribute inference (emotion, age, gender, etc.).
* Continuous cloud streaming or third‑party identity management integrations.

**4. Stakeholders & RACI (Draft)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Role | Name/Org | Responsibility | RACI | Notes |
| Project Sponsor | Stephen Perelgut | Vision, approvals, demo success | A | Sets priorities; signs off MVP |
| Tech Lead (Edge/Perception) | TBD | Approach sensing, detection, recognition | R | Latency & accuracy targets |
| App Lead (Flutter) | TBD | BLE/Wi‑Fi app, UI, consent/enrollment | R | Handoff & logs |
| Privacy Officer | TBD | Policy, signage, audits | C | PIPEDA alignment |
| QA | TBD | Test plans, acceptance | C/R | Runs demo-readiness tests |

**5. User Stories**

* As a visitor (unknown), I receive a clear, polite greeting when I step up to the desk.
* As an enrolled visitor (known), I am greeted by name and offered quick assistance options.
* As a receptionist, I can see a live view and use push‑to‑talk to assist the visitor hands‑free.
* As an administrator, I can capture consent, enroll an individual, and delete their data quickly.
* As a facilities/privacy lead, I have signage and logs available to demonstrate compliance.

**6. Non‑Functional Requirements**

* Reliability: Operates for an 8‑hour desk shift without reboot; automatic recovery after power loss.
* Privacy: On‑device inference by default; encrypted storage; no default cloud connectivity.
* Accessibility: Clear speech; adjustable volume; visual status cues; optional on‑screen captions.
* Maintainability: Modular services; configuration via YAML/JSON; exportable logs; local OTA update option.
* Security: Pairing approval; local admin PIN; signed builds; change/audit logs.

**7. System Overview**

An edge compute module (Linux) runs perception (approach sensing, person detection, optional face embeddings), greeting policy/dialogue, audio I/O, and a BLE/Wi‑Fi service for the companion application. Sensors include an RGB/depth camera and an auxiliary presence sensor (ToF or mmWave) for low‑latency wake and reduced false positives. Data (consent, embeddings, logs) is stored locally with administrative export tools.

Text Diagram:

[Aux Presence (ToF/mmWave)] [RGB/Depth Camera] [Mic Array] → [Edge Compute (Services)] → [Speaker / LED / (Optional Display)]  
 ↓  
 [BLE / Secure Wi‑Fi Service]  
 ↓  
 [Companion App (Flutter)]

**8. Hardware Requirements (Categories & Suggested Parts)**

* Compute: Raspberry Pi 5 (+ optional Edge TPU) or NVIDIA Jetson Orin Nano (for additional vision headroom).
* Vision: 1080p RGB camera and compact depth solution (e.g., ToF module or RealSense D435).
* Presence: Short‑range ToF or mmWave radar (e.g., VL53L1X / IWR6843‑class) to define a greeting zone.
* Audio: 2‑mic array; small class‑D amplifier + 3–5 W speaker; optional echo cancellation module.
* User Interface: Status LED bar/light ring; optional 7–10" display for captions/menus/policy QR code.
* Power: Single AC adapter with internal DC rails; optional UPS HAT for graceful shutdown.
* Enclosure: Desk‑safe, tamper‑resistant, cable‑managed; tilt‑adjustable camera head.

**9. Software Requirements (MVP)**

* OS/Runtime: Ubuntu 22.04 LTS; lightweight ROS2 or minimal micro‑services (gRPC/REST).
* Perception: Person detector (YOLO/MediaPipe) + tracker; face embeddings for recognition (ArcFace/FaceNet‑style).
* Approach Logic: Sensor fusion (presence + camera) with hysteresis and region‑of‑interest masking.
* Speech: On‑device ASR (Whisper small/Vosk) and TTS (local engine or pre‑recorded prompts).
* Companion App: Flutter over BLE/Wi‑Fi; live view (low‑FPS MJPEG/RTSP); push‑to‑talk; enroll/consent; logs view/export.
* Data: SQLite with encrypted columns or FS‑level encryption; backup/export tooling (CSV/JSON/PDF).

**10. Data Governance & Privacy (Draft)**

* Consent‑first enrollment with a clear, limited purpose: personalized greetings only.
* Prominent signage near the desk; QR code to policy, contact, and deletion request form.
* Minimal retention: store embeddings and consent records; avoid retaining raw images unless required for short‑term QA with expiry.
* Right to access/deletion: Admin UI lookup → immediate deletion; actions logged for auditability.
* Security: Encryption at rest; admin PIN; pairing approval; periodic privacy review checklist.

**11. Safety & Ergonomics**

* Stable, non‑mobile enclosure with non‑slip feet; guarded openings; strain‑relieved cabling.
* Camera tilt restricted to public interaction area; privacy masks to exclude non‑public zones.
* Acoustic limits to avoid startling; visual pre‑cue before audio playback.
* Thermal management to keep exterior surfaces safe to touch during continuous operation.

**12. Operational Scenarios**

1. A visitor steps into the greeting zone → device detects presence → polite greeting → offer options (talk to human / information).
2. An enrolled visitor enters the zone → recognition → ‘Welcome back, <Name>’ → offer assistance menu or operator handoff.
3. Enrollment flow: operator requests consent → capture name + 2–3 images → store embeddings and consent log.
4. Operator handoff: companion app connects → live view and push‑to‑talk → operator converses and records a brief note.

**13. MVP Delivery Plan (5–7 Weeks)**

* Phase 0 (Week 1): Charter finalization, privacy & signage draft, acceptance tests.
* Phase 1 (Weeks 2–3): Hardware bring‑up; presence sensing + person detection; generic greeting; app live view/push‑to‑talk.
* Phase 2 (Weeks 4–5): Enroll/consent; name greeting; operator handoff; logs & exports.
* Phase 3 (Weeks 6–7): Hardening; optional captioning; demo scripts; policy doc.

**14. Key Risks & Mitigations**

* False triggers from passersby: Auxiliary sensor + camera gating + ROI masking + hysteresis.
* Backlighting or lighting shifts: Auto‑exposure/HDR; optional IR assist in low light.
* High ambient noise: Prioritize push‑to‑talk; AGC/noise suppression; optional captioning.
* Privacy concerns: Clear signage; simple opt‑out and deletion; default local processing only.
* Enterprise network constraints: BLE‑only mode; offline operation; admin USB export.

**15. Acceptance Criteria (Go/No‑Go)**

* Approach detection and greeting succeed for ≥20 consecutive visitor events with ≤1 false greet.
* Two enrolled users recognized by name at ≥95% accuracy across lighting variants.
* Companion app handoff latency ≤1.0 s; audio round‑trip intelligible to both parties.
* Consent signage displayed; enrollment + deletion demonstrated; logs exported.
* Device operates for an 8‑hour shift without crash; recovers from power cycle within 20 seconds.

**16. Assumptions & Constraints**

* Indoor, front‑desk placement with stable power and moderate lighting.
* Institutional privacy policies allow consent‑based recognition; a ‘no‑recognition’ mode is available.
* Network access may be limited; BLE‑only operation is acceptable for MVP.
* Component availability may require substitutions with spec‑equivalent parts.

**17. Deliverables**

* Stationary Greeter prototype with approach detection, greeting, and operator handoff.
* Companion app test builds (desktop/mobile) with enrollment and logs.
* Documentation set: setup guide, operator guide, privacy policy, signage PDF.
* Test report including metrics and acceptance run logs.

**18. Glossary (Select)**

* BLE: Bluetooth Low Energy, used for short‑range connectivity to the companion app.
* Embedding: Vector representation of a face used for recognition (not a photo).
* ToF: Time‑of‑Flight sensor for distance/presence measurement.

— End of v0.2 (Standalone) —