

FaceAttend

IT Personnel Technical Manual

Para sa mga IT Staff kag System Administrator
DILG Region XII – General Santos City

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PARA KANI

Ini nga dokumento para lang sa IT staff kag authorized system administrator sang DILG Region XII. Ang sulod sini may technical details, passwords, configuration values, kag system architecture nga dapat confidential. Indi ini igwa sa regular employees.

1. Ano ang FaceAttend? – System Overview

Ang FaceAttend isa ka web-based attendance management system nga naggamit sang face recognition para awtomatiko nga ma-record ang Time-In kag Time-Out sang employees. Built siya using ASP.NET MVC 5 running on .NET Framework 4.8, with SQL Server Express as database, deployed sa IIS (Internet Information Services).

Duha ang pangunahon nga zone sang system:

- Kiosk Zone – ang public-facing screen nga makita sang employees. No login required. Face scan lang ang gamiton.
- Admin Zone – ang protected management panel para sa HR kag IT staff. Accessible via PIN.

1.1 AI Components

Nagagamit ang FaceAttend sang duha ka AI engine:

AI Engine	Ginagamit Para Sa	File Location
DlibDotNet / FaceRecognitionDotNet	Face detection kag 128-dimensional face encoding (ang "fingerprint" sang face)	App_Data/models/dlib/
ONNX Runtime (MiniFASNet)	Liveness detection – nagacheck kung real person ka ukon photo/video lang	App_Data/models/liveness/minifasnet.onnx

2. Folder Structure kag File Locations

Importante nga mahibal-an mo kung asan ang bawat importante nga file sa project. Ini ang kumpleto nga folder map:

Folder / File	Ano ang Sulod / Ginabuhat
App_Data/models/dlib/	Dlib model files (.dat). Required para magtrabaho ang face detection. Indi delete.
App_Data/models/liveness/	minifasnet.onnx – ang liveness detection model. Kritikal kaayo ini.

App_Data/tmp/	Temporary upload folder para sa scanned images. Auto-cleaned after each scan. Dapat writable sang IIS application pool user.
Areas/Admin/	Ang buong Admin panel: Controllers, Models, Views. Diri gapuyo ang tanan nga admin features.
Controllers/KioskController.cs	Heart sang kiosk. Handles face scan pipeline, GPS/office resolve, liveness check, kag attendance recording.
Controllers/BiometricsController.cs	Face enrollment endpoint. Called during admin enrollment wizard.
Services/Biometrics/	DlibBiometrics.cs, OnnxLiveness.cs, EmployeeFaceIndex.cs, VisitorFaceIndex.cs, BallTreeIndex.cs, ImagePreprocessor.cs, SecureFileUpload.cs
Services/AttendanceService.cs	Records attendance with SERIALIZABLE transaction to prevent race conditions (duplicate scan protection).
Services/SystemConfigService.cs	Key-value config store with MemoryCache. Reads settings from database. Cache TTL: 300 seconds.
Filters/	AdminAuthorizeAttribute.cs (PIN auth), RateLimitAttribute.cs (rate limiter), SecurityHeadersAttribute.cs (HTTP security headers)
Scripts/kiosk.js	Main kiosk UI engine (~1000+ lines). Handles camera, MediaPipe BlazeFace (client-side detection), GPS, office resolve, scan submission, visitor modal.
Scripts/admin-enroll.js	Face enrollment wizard. Handles live capture (320ms interval) kag file upload mode.
Web.config	Tanan nga app settings, IIS URL rewrite rules, security config, connection string, kag machineKey (MUST CHANGE BEFORE PRODUCTION).

3. Database – SQL Server Schema

Ang FaceAttend nagagamit sang SQL Server Express (Entity Framework 6, Database-First approach). Ang connection string naa sa Web.config.

3.1 Main Tables

Table	Primary Purpose	Key Columns
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Employees	Master record sang bawat enrolled employee	Id, EmployeeId, FirstName, LastName, OfficeId, FaceEncodingBase64, FaceEncodingsJson, IsActive
AttendanceLogs	Immutable record sang bawat scan event	Id, EmployeeId, Timestamp, EventType (IN/OUT), LivenessScore, FaceDistance, GPSLatitude, GPSTime, NeedsReview
Offices	Physical office locations with GPS geofence	Id, Code, Name, Type, Latitude, Longitude, RadiusMeters, IsActive
Visitors	Known visitor profiles with face data	Id, Name, FaceEncodingBase64, VisitCount, IsActive
VisitorLogs	Per-visit audit record	Id, VisitorId (nullable), OfficeId, Timestamp, Purpose, Source (KIOSK or KIOSK_ANON)
SystemConfiguration	Runtime-configurable key-value settings	Key, Value, DataType, Description, ModifiedDate

3.2 Importante nga Note bahin sa FaceEncodingsJson

Ang Employees table may duha ka face data columns:

- FaceEncodingBase64 – ang original single-vector column. Always present.
- FaceEncodingsJson – bag-o nga column para sa multi-encoding (up to 5 vectors per employee). Ginaininsert via raw SQL.

BANTAY

Kung ang FaceEncodingsJson column wala pa sa imo database (older schema), ang system gracefully falls back sa FaceEncodingBase64. Para ma-add ini, run mo ini sa SQL Server: ALTER TABLE Employees ADD FaceEncodingsJson NVARCHAR(MAX) NULL;

4. System Configuration – Tanan nga Settings

Ang FaceAttend may duha ka lebel sang configuration: Web.config (static, requires app restart) kag SystemConfiguration table (dynamic, no restart needed, editable via Admin > Settings).

4.1 Kritikal nga Web.config Keys

Key	Default	Description
Kiosk:RequireGpsAllDevices	true	Kung true, required ang GPS sa tanan nga devices (desktop + mobile). Kung false, desktop kiosks skip GPS kag gamiton ang fallback office.
Biometrics:LivenessModelPath	~/App_Data/models/liveness/minifasnet.onnx	Path sa ONNX liveness model. Indi baguha kung wala ka nagbago sang model file.
Admin:AllowedIpRanges	(blank)	CIDR notation para sa IP allowlist sang admin access. Blank means allow all IPs. Sa production, i-restrict ini sa office network lang.
Admin:PinHash	(hashed PIN)	Ang hashed value sang admin PIN. Para mabago, gamiton ang admin Settings page.
Admin:SessionMinutes	30	Pila ka minuto before mag-expire ang admin session. 30 minutes ang default.
Security:HstsEnabled	false	I-set sa true kung naay valid SSL certificate ang server. Wala HTTPS, indi i-enable ini.
Kiosk:VisitorScanTtlSeconds	180	Pila ka segundo valid ang visitor scan cache item. Kung mag-expire, mag-scan liwat ang visitor.

KRITIKAL

Ang machineKey sa Web.config PLACEHOLDER lang ang value. DAPAT PALITAN ini bag-o i-deploy sa production server. Kung wala mabago, vulnerable sa session forgery attacks ang system.

4.2 Runtime Settings (Admin > Settings)

Ini nga settings ma-change without restarting ang app. Nakastore sila sa SystemConfiguration table.

Biometrics Settings

Setting Key	Recommended	Explanation
Biometrics:DlibTolerance	0.60	Face distance threshold. Lower number = stricter match. 0.60 is good balance. Ayaw ibaba sang mas mubos sa 0.50 (damo false rejections).

Biometrics:LivenessThreshold	0.75	Minimum liveness score para ma-accept ang scan. 0.75 is standard. Kung damo false fails, baba sa 0.65.
Biometrics:Liveness:RealIndex	1	KRITIKAL: Ang index sang "real" class sa model output. Para sa MiniFASNet = 1. Kung 0 ang value, photos makaagi, real faces mafail.
Biometrics:Liveness:Normalize	imagenet	Pixel normalization mode. MiniFASNet requires imagenet. Indi baguha kung ini ang imo model.
Biometrics:Liveness:ChannelOrder	BGR	Channel order sa tensor input. MiniFASNet trained with OpenCV (BGR). Indi baguha.
Biometrics:FaceMatchTunerEnabled	false	Adaptive tolerance tuning based on image brightness kag face size. Enable lang kung gusto mo experimental feature.
Biometrics:BallTreeThreshold	50	Pila ka enrolled employees before mag-switch sa BallTree index ($O \log n$) from linear scan ($O n$). Sa 50+ employees, auto-enables.

Location / GPS Settings

Setting Key	Recommended	Explanation
Location:GPSAccuracyRequired	2000 (laptop) 50 (phone)	Maximum allowed GPS accuracy value in meters. Laptop WiFi GPS reports 300-1500m. Phone GPS reports 3-20m. I-set depende sa device type mo.
Location:GPSRadiusDefault	500	Default geofence radius kung ang office record may RadiusMeters = 0. Para sa laptop kiosk, 500-1000m ang safe.
Kiosk:FallbackOfficeId	(your office ID)	Ang office ID nga gamiton kung ang kiosk desktop kag wala GPS. Set this to your primary office. Indi set sa 0 sa production.

5. Face Scan Pipeline – Detailed Flow

Importante nga mabalo-an mo ang exact steps para maayos mo ang issues sang scanning. Ini ang buong pipeline sa `KioskController.ScanAttendanceCore()`:

1. Client (kiosk.js) nagcapture sang camera frame bilang JPEG blob gamit ang MediaPipe BlazeFace (client-side detection) ukon legacy server-side detect.
2. POST to /Kiosk/ScanAttendance ukon /Kiosk/Attend (NextGen mode).
3. RateLimit check – max 10 requests per minute para sa ScanAttendance. Kung maabot, HTTP 429.
4. GPS / Office Resolution – kung may lat/lon coordinates, ginatawag ang PickOffice() nga naggamit sang Haversine formula para makita kung aling office ang pinaka-malapit. Kung wala coords kag desktop device, gamiton ang GetFallbackOffice().
5. SecureFileUpload.SaveTemp() – ang uploaded image ginastore sa App_Data/tmp/ gamit ang server-generated UUID filename (hindi ang client filename – security measure).
6. ImagePreprocessor.PreprocessForDetection() – kung ang image mas dako sa MaxImageDimension (default 1280px), ginadownscale para mas mabilis ang Dlib processing.
7. DlibBiometrics.TryDetectSingleFaceFromFile() – dapat exactly 1 face. Kung 0 or 2+, rejected.
8. OnnxLiveness.ScoreFromFile() – crops face region (CropScale factor), resizes sa InputSize (128px), normalizes sa imagenet mode, nagrun ang MiniFASNet ONNX inference. Output: probability nga real person ka.
9. Liveness threshold check – kung score < LivenessThreshold, rejected with LIVENESS_FAIL error.
10. DlibBiometrics.TryEncodeFromFileWithLocation() – generates 128-dimensional face vector (ang unique "fingerprint" sang face).
11. EmployeeFaceIndex.FindNearest() – nagsearch sa in-memory face index gamit ang BallTree (O log n) ukon linear scan. Returns ang best matching employee ID kag distance.
12. Kung distance > tolerance: VISITOR FLOW. Nagsearch liwat sa VisitorFaceIndex. Kung nakit-an, known visitor. Kung wala, bag-o nga visitor (nagtrigger sang visitor modal sa client).
13. Kung distance <= tolerance: EMPLOYEE FLOW. AttendanceService.Record() – SERIALIZABLE transaction nagiinsert sang AttendanceLog row. EventType auto-determined (IN kung first scan today, OUT kung second, etc.).
14. SecureFileUpload.TryDelete() – temporary file deleted.
15. JSON response returned sa client.

5.1 Importante nga Edge Cases

Situation	Ano ang Manabo / Solusyon
distance = Infinity sa JSON	Nanabo kung wala enrolled employees ukon visitors sa database. Ang double.PositiveInfinity invalid JSON. FIX: I-serialize as null. Check ang KioskController line nga: distance = bestVisitorDist.

Liveness always 0.14 or below	Wrong Normalize o ChannelOrder settings. Para sa MiniFASNet: Normalize = imagenet, ChannelOrder = BGR, RealIndex = 1.
Liveness always 1.00 (photos pass)	RealIndex wrong. Dapat 1 para sa MiniFASNet. Kung 0, nagabasa ka sang fake class probability.
GPS shows wrong city (Cotabato)	Fallback office alphabetically sorted. I-set ang Kiosk:FallbackOfficeId sa correct office ID. Check din ang office coordinates sa database.
"GPS signal too weak" sa laptop	Laptop WiFi GPS reports high accuracy values (300-1500m). I-set ang Location:GPSAccuracyRequired = 2000 kag office radius = 1000m.
ENCODING_FAIL error	Dlib models wala naloaded. Verify nga ang App_Data/models/dlib/ may complete .dat files. Check Application Event Log para sa startup errors.
GATE_BUSY liveness error	ONNX session busy (concurrent requests). Increase Biometrics:Liveness:GateWaitMs from 300 to 500 sa Settings.
CIRCUIT_OPEN liveness error	Ang liveness circuit breaker naopen (3 consecutive failures). Restart ang app pool para ma-reset. Then investigate ang model path kag ONNX compatibility.
TOO_SOON error	Normal behavior. Employee nag-scan liwat within MinGapSeconds (default: 180 seconds = 3 minutes). Not an error.

6. Deployment kag IIS Setup

Ini ang step-by-step para ma-deploy ang FaceAttend sa bag-o nga server ukon kung mag-migrate ka.

6.1 Requirements

- Windows Server 2016 / 2019 / 2022 ukon Windows 10/11 (for kiosk use)
- .NET Framework 4.8 (check Control Panel > Programs > Turn Windows features on/off)
- IIS with ASP.NET role enabled
- SQL Server Express 2019 o mas bag-o (free, downloadable sa Microsoft website)
- Visual C++ Redistributable 2019 (required by Dlib)
- Minimum 4GB RAM, 2 CPU cores. Recommended: 8GB RAM.
- Camera (USB webcam o built-in)

6.2 Installation Steps

16. Install .NET Framework 4.8 kung wala pa.
17. Install SQL Server Express. I-note ang server name (example: .\SQLEXPRESS).
18. Publish ang FaceAttend solution from Visual Studio: Right-click project > Publish > Folder. I-deploy sa ang output folder (example: C:\inetpub\wwwroot\FaceAttend\).
19. Sa IIS Manager, mag-create sang bag-o nga site ukon application. I-point sa folder mo.
20. I-set ang Application Pool sa .NET CLR Version 4.0, Integrated pipeline mode.
21. I-grant sang "Modify" permission ang app pool identity (example: IIS APPPOOL\FaceAttend) sa App_Data folder kag subfolder niya.
22. I-update ang connection string sa Web.config: Data Source=.\SQLEXPRESS;Initial Catalog=FaceAttendDB;Integrated Security=True
23. Run ang database migrations / SQL script para ma-create ang tables.
24. I-copy ang Dlib model files sa App_Data/models/dlib/. I-copy ang minifasnet.onnx sa App_Data/models/liveness/.
25. IMPORTANT: Baguha ang machineKey sa Web.config. Gamiton ang IIS Manager > Machine Key generator para mag-generate sang valid key.
26. Browse to <http://localhost/FaceAttend/> para ma-verify ang installation.

6.3 Checking If System Is Working

After deployment, check ini sa Admin Dashboard:

- LivenessModelLoaded: true – kung false, ang ONNX model wala makita. Check ang file path.
- DlibModelsLoaded: true – kung false, Dlib models missing ukon corrupted.
- DatabaseHealthy: true – kung false, check ang connection string kag kung running ang SQL Server service.

7. Admin Panel – Kumpleto nga Feature Guide

Ang Admin panel accessible via Ctrl + Shift + Space sa kiosk screen. Pag-enter sang PIN, maabot mo ang Dashboard.

7.1 Dashboard

Quick health overview. Nagashow sang today's statistics: total enrolled employees, Time-In/Out counts, pending reviews, kag system model health status. Kung may DatabaseHealthy: false, mibang check agad ang SQL Server.

7.2 Employees

Full CRUD para sa employee records. Key flows:

- Create: mag-fill sang form, save, then click "Enroll Face" para i-start ang biometric enrollment.
- Enroll: Camera turns on. System nagcollect sang 5 good frames (liveness-passed, single face detected). Ang best face vector nagsave sa FaceEncodingBase64, all 5 nagssave sa FaceEncodingsJson.
- Edit: Pwede mag-update sang details. Importante: kung mag-transfer sang employee sa different office, update ang OfficeId niya.
- Deactivate: Uncheck lang ang Active checkbox. Record preserved pero hindi makagscan sa kiosk.
- Re-Enroll: Gamiton kung nagbago ang appearance sang employee (bag-o nga salamin, timbang change, etc.).

DUPLICATE FACE CHECK

Before ma-save ang enrollment, nagacheck ang system kung ang bag-o nga face vector matches na sa existing employee sa database. Kung may match, FACE_ALREADY_ENROLLED error ang ibabalik. This prevents duplicate registrations.

7.3 Attendance Logs

Filtered, paginated view sang tanan nga attendance records. Filter options:

- Date range (from / to)
- Office
- Employee name ukon Employee ID
- Event type (IN ukon OUT)
- "Needs Review" flag

Bawat record nagashow sang: LivenessScore, FaceDistance, MatchThreshold, GPSAccuracy, LocationVerified flag, ClientIP, UserAgent, NeedsReview status, kag Notes.

Ang "Needs Review" flag nagatrigger kung:

- Face distance \geq (tolerance * NearMatchRatio, default 0.90) – close match pero uncertain
- Liveness score $<$ (threshold + LivenessMargin, default 0.03) – barely passed
- GPS accuracy \geq (required - GPSAccuracyMargin, default 10m) – barely passed accuracy

Para mark as reviewed: I-click ang record, then "Mark Reviewed" button, add short note.

7.4 Summary Report

Per-employee, per-day summary nga nagacompute sang net work hours. Logic:

- First IN of the day = Time-In
- Last OUT of the day = Time-Out
- Net hours = (Time-Out minus Time-In) minus 1 hour (lunch deduction)
- Late flag: kung Time-In > 08:00 AM
- Early out flag: kung Time-Out < 17:00 PM

BANTAY

Ang report limited sa 31 days per query. Mas matagal, i-export as CSV kag analyze sa Excel.

7.5 Offices

CRUD para sa office locations. Bawat office may Leaflet.js interactive map para easy placement sang GPS pin.

Important fields:

- Latitude / Longitude: Ang center sang geofence. Dapat exact location sang building.
- RadiusMeters: Ang radius sang allowed scanning area. Para sa laptop kiosk: 1000m. Para sa phone kiosk: 200-500m.
- Type: REGION, PROVINCE, ukon HUC. Para sa DILG Region XII structure.
- Code: Short code para sa reports (example: R12-GENSAN, R12-GSC, R12-RO).

BANTAY

Ang "Use My Location" button sa office form nagagamit sang browser geolocation. Sa laptop, IP-based GPS ini kag often nagapoint sa wrong city (like Cotabato instead of GenSan). Always manually verify ang coordinates sa Leaflet map after clicking this button.

7.6 Visitors

Management sang visitor profiles kag visit logs.

- Index: list sang tanan nga visitor profiles, searchable by name.
- Create/Edit: manual creation sang visitor profile without face enrollment.
- Enroll: face enrollment para sa visitor (same BiometricsController pipeline as employee).
- Logs: tanan nga visit records, filterable by date/office/name. May "Known Only" toggle para makita lang ang enrolled visitors.
- Purge Logs: delete old visitor logs based sa configured retention period (default: 5 years).

7.7 Settings

Tanan nga runtime-configurable settings. Organized sa sections: Biometrics, Advanced Liveness, Location, Kiosk, Attendance, Review Queue, Visitors, Performance.

KRITIKAL

KRITIKAL nga settings na DAPAT tama ang value: RealIndex (dapat 1), Normalize (dapat imagenet), ChannelOrder (dapat BGR). Kung wrong ini, ang liveness check broken. Photos makaabot, real faces mafail.

8. Common IT Tasks – Step-by-Step

8.1 Paano Mag-Change sang Admin PIN

27. Log in sa Admin panel.
28. Go to Settings.
29. Find "Admin PIN" field.
30. Enter ang bag-o nga PIN (numeric, minimum 4 digits).
31. Click Save. Ang bag-o nga PIN hashed agad kag stored sa Web.config.

NOTE

Ang PIN stored as hashed value sa Web.config (PinHash key). Wala plain text nga stored. Kung nakalimtan mo ang PIN, can be reset by editing Web.config directly kag setting a new hash.

8.2 Paano Mag-Add sang Bag-o nga Office

32. Admin > Offices > Create Office.
33. Fill in: Name (UPPERCASE), Code (short, example: R12-GENSAN), Type (HUC/PROVINCE/REGION).
34. I-drag ang pin sa mapa sa exact location sang building.
35. I-set ang Radius: 1000 para sa laptop kiosk, 300-500 para sa phone kiosk.
36. Fill in Province ukon HUC City depende sa Type.
37. Check ang Active checkbox.
38. Save.
39. Go to Settings > Fallback Office kag i-update kung ini ang primary kiosk office.

8.3 Paano Mag-Troubleshoot sang "Not in Allowed Area" Error

40. Check ang office record sa Admin > Offices. Verify ang Latitude kag Longitude. Para sa GenSan: 6.1164, 125.1716.
41. Check ang RadiusMeters. Kung 100, i-increase sa 1000 para sa laptop kiosk.
42. Check ang Settings > Location > GPS Accuracy Required. Dapat 2000 para sa laptop.
43. Check ang Settings > Location > Fallback Office. Dapat naka-set sa correct office ID.
44. Sa browser DevTools (F12 > Console) sa kiosk page, hanapin ang resolveOffice network call. Check ang response JSON para makita ang actual reason (GPS_ACCURACY, NO_OFFICE_NEARBY, etc.).

8.4 Paano Mag-Enroll sang Bag-o nga Employee

45. Admin > Employees > Create Employee. Fill in all fields. Save.
46. Click "Enroll Face" sa employee sa list.
47. Camera turns on. Ipaatubang ang employee sa camera.
48. System nagcollect sang 5 good frames. Hold still.
49. "Enrollment complete" message = success. Makagscan na siya sa kiosk.

BANTAY

Kung "FACE_ALREADY_ENROLLED" ang error, may ibang employee na nga may same face. Check ang existing employee records ukon contact ang employee para i-verify.

8.5 Paano Mag-Check sang System Health

50. Login sa Admin. Dashboard ang nauna.
 51. Check ang status indicators: LivenessModelLoaded, DlibModelsLoaded, DatabaseHealthy.
 52. Kung may false, check ang Windows Event Viewer > Application Log para sa detailed error messages.
 53. Check kung running ang SQL Server service (Services.msc > SQL Server (SQLEXPRESS)).
 54. Check kung ang App_Data/tmp/ folder writable sang IIS app pool user.
 55. Sa Settings page, ang model configuration visible. Cross-check ang values.
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9. Security Architecture

Ang FaceAttend may multiple security layers. Importante nga mabalo-an mo ini para maintain ang security sang system.

9.1 Authentication

- Admin access: Session-based PIN auth. Session timeout: 30 minutes (configurable).
- Unlock cookie: MachineKey-protected, IP-bound, nonce, one-time use, expires in 30-600 seconds.
- Session rotation: Session ID rotated after PIN verification para mabawasan ang session fixation risk.
- IP allowlist: Admin:AllowedIpRanges CIDR notation. Blank = allow all (insecure for production).
- Emergency bypass: App_Data/emergency_bypass.txt – kung present, nagbypass ang IP check. DELETE this file after emergency.

9.2 Rate Limiting

Token-bucket rate limiter per IP address:

Endpoint	Limit	Purpose
/Kiosk/DetectFace	180/min	Cheap face detection, frequent calls
/Kiosk/ScanFrame	120/min	Liveness-only scan
/Kiosk/ScanAttendance	10/min	Full attendance pipeline, expensive
/Kiosk/Attend	20/min	NextGen mode attendance
/Kiosk/UnlockPin	5/min	Brute-force PIN attack protection
/Kiosk/SubmitVisitor	30/min	Visitor registration

9.3 File Upload Security

Ang SecureFileUpload service nagahandle sang tanan nga image uploads:

- Server-generated UUID filename – ang client filename completely ignored (prevents path traversal).
- Files confined sa App_Data/tmp/ – wala pwede malusot sa labas sang this folder.
- Size limit enforced before kag after save (default: 10MB max).
- Auto-delete after processing via TryDelete().

9.4 HTTPS / SSL Recommendation

Ang FaceAttend designed para magtrabaho sa HTTPS. Para sa production:

56. Install SSL certificate (Let's Encrypt free, ukon commercial cert).
57. Configure IIS HTTPS binding sa port 443.
58. Set Security:HstsEnabled = true sa Web.config.
59. Add URL rewrite rule para i-redirect HTTP to HTTPS.

BANTAY

Kung wala HTTPS, ang browser geolocation API wala gumaganap (GPS disabled). Ang kiosk magashow "GPS needs HTTPS" error. HTTPS required para sa GPS features.

10. Performance kag Optimization

10.1 In-Memory Face Index

Ang EmployeeFaceIndex kag VisitorFaceIndex nagamaintain sang in-memory snapshot sang tanan nga face vectors. This avoids querying the database on every scan.

- Index auto-refreshes kung mag-enroll ukon mag-deactivate sang employee (Invalidate() called).
- BallTree index nabuuild kung enrolled employees \geq BallTreeThreshold (default 50). $O(\log n)$ search.
- Kung less than 50 employees, linear scan $O(n)$ – still fast enough.
- Index rebuilt on app pool restart.

10.2 SystemConfigService Cache

Ang settings gikan sa SystemConfiguration table cached sa MemoryCache with 300-second TTL. Meaning after mag-save ka sa Settings page, updated ang values within 5 minutes sa lahat nga server threads. Cache cleared immediately on Upsert.

10.3 OnnxLiveness Gate Lock

Ang ONNX inference serialized (one at a time) via gate lock. This is because ONNX InferenceSession not guaranteed thread-safe. GateWaitMs (default 300ms) nagadetermine kung pila ka oras mag-wait ang concurrent request.

Para sa single-kiosk deployment: Fine as-is.

Para sa multi-kiosk: Consider increasing GateWaitMs ukon implementing separate ONNX session per request (higher memory but better concurrency).

11. Para sa Future Improvements

Ini ang mga improvements nga magiging helpful kung gusto mo i-extend ang system:

11.1 Database Migration (JSON to SQL Server)

Ang current system naga-use sang SQL Server pero ang FaceEncodingsJson column naa as NVARCHAR(MAX) JSON string. For large deployments (500+ employees), consider migrating to a proper vector table:

```
CREATE TABLE FaceVectors (Id INT IDENTITY PK, EmployeeId INT FK, VectorData  
VARBINARY(MAX), SlotIndex INT);
```

11.2 Multi-Kiosk Support

Currently, ang ONNX session kag face index naggamit sang static singletons. Para sa multi-kiosk setup:

- Ang bawat kiosk dapat mag-point sa same server (centralized).
- Ang EmployeeFaceIndex kag VisitorFaceIndex shared across all requests (already designed for this).
- Ang ONNX gate lock ang bottleneck. Consider increasing GateWaitMs.

11.3 Flexi Schedule Reporting

Ang current Summary Report nagacompute sang net hours pero wala nagaflag kung ang flexi employee nakaabot sang required 8 hours. Enhancement: add "Hours Deficit" column para sa flexi employees sa Summary Report.

11.4 Offline Mode

Ang current design requires live server connection. Para sa disaster recovery, consider adding offline queue (local SQLite) sa kiosk device para ma-store ang scans kung wala network, then sync later.

12. Quick Reference – Troubleshooting Cheat Sheet

Error / Symptom	Most Likely Cause	Quick Fix
Kiosk shows "Cotabato" as office	Fallback office alphabetically sorted	Settings > Fallback Office > set correct office
GPS signal too weak	Laptop WiFi GPS, accuracy 300-1500m	GPS Accuracy Required = 2000, Office Radius = 1000m
Liveness always 0.14 (real faces fail)	Wrong Normalize / ChannelOrder	Set Normalize = imagenet, ChannelOrder = BGR, RealIndex = 1
Photos pass liveness at 1.00	RealIndex = 0 (reading fake class)	Set RealIndex = 1
Visitor modal not opening (system error)	Infinity serialized as invalid JSON	Fix KioskController: distance = double.IsInfinity(bestVisitorDist) ? (double?)null : bestVisitorDist
Camera detects back of person / wall	Low detection thresholds in kiosk.js	Set CFG.mp.detectMinConf = 0.75, acceptMinScore = 0.80
ENCODING_FAIL on every scan	Dlib models missing	Verify App_Data/models/dlib/ has all .dat files. Check Event Log.
CIRCUIT_OPEN liveness error	3 consecutive ONNX failures	Restart IIS app pool. Then check model path kag ONNX version compatibility.
Admin login not working	Wrong PIN, session expired, IP blocked	Check Web.config PinHash. Verify Admin:AllowedIpRanges. Try from a different browser.
"Step away" message after successful scan	requireFaceGone flag in old code	Remove requireFaceGone logic from armPostScanHold() kag main loop in kiosk.js (already fixed in latest version).