HRMS Biometric Attendance ETL System

Role: System Developer & Architect
Domain: Workforce Analytics / Data Engineering
Environment: 24×7 Television Broadcasting Organization
Organization: Ekushey Television Limited (Bangladesh)
Designed by: Ariful Islam Emon (Deputy Manager, IT)

Project Overview

Designed and implemented an end-to-end ETL pipeline to capture, process, and analyze employee attendance data from biometric fingerprint devices. The system ensures accurate attendance evaluation across non-standard work cycles in a continuous operations environment.

Key Contributions

- Developed a real-time data ingestion pipeline to extract attendance logs from biometric fingerprint terminals into a structured application database.

- Implemented automated data validation to remove null, invalid, and duplicate records, ensuring high data integrity for downstream processing.

- Engineered transformation logic to map attendance events to employee rosters and compute attendance status (on-time, late, extremely late, absent).

- Designed time-window inference logic to correctly determine employee working days in a 24×7 operational model, supporting shifts that span across calendar days.

- Built rule-based attendance classification aligned with departmental scheduling policies.

- Enabled automated report generation for HR and department management to support operational monitoring and workforce compliance.
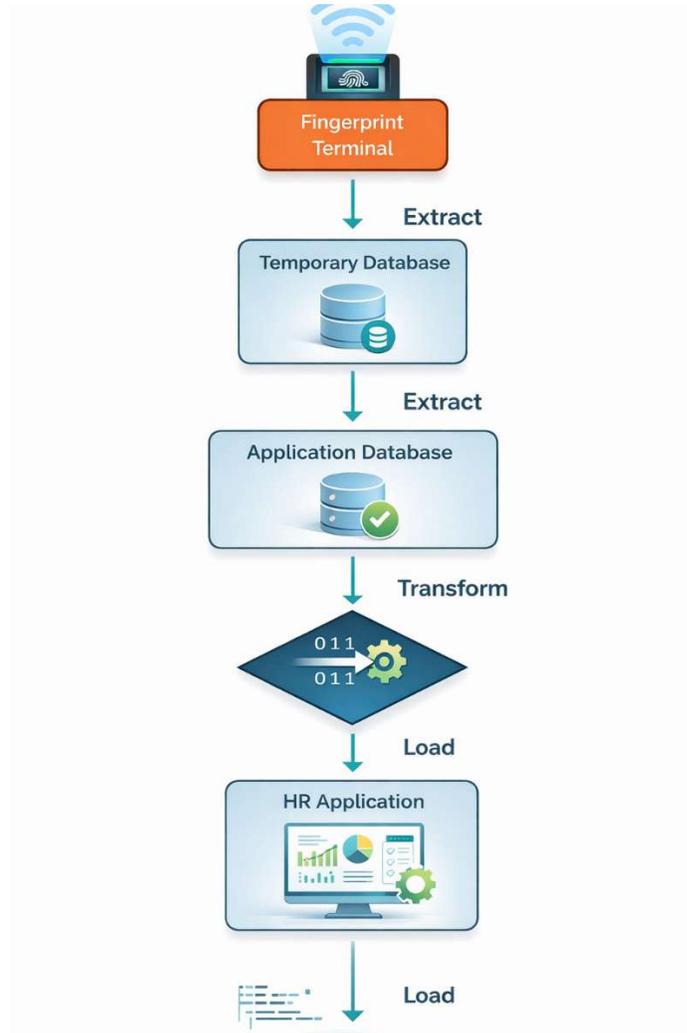
Technical Highlights

- Real-time data extraction from biometric access control systems

- Data cleansing and validation pipeline design

- Rule-based transformation and classification engine

- Time-series event processing for shift-based workforce modeling

- Relational database integration for structured storage

- Automated reporting for HR decision support

Impact

- Improved attendance data accuracy and consistency across departments

- Reduced manual attendance reconciliation efforts

- Enabled reliable shift-based workforce tracking in a 24×7 production environment

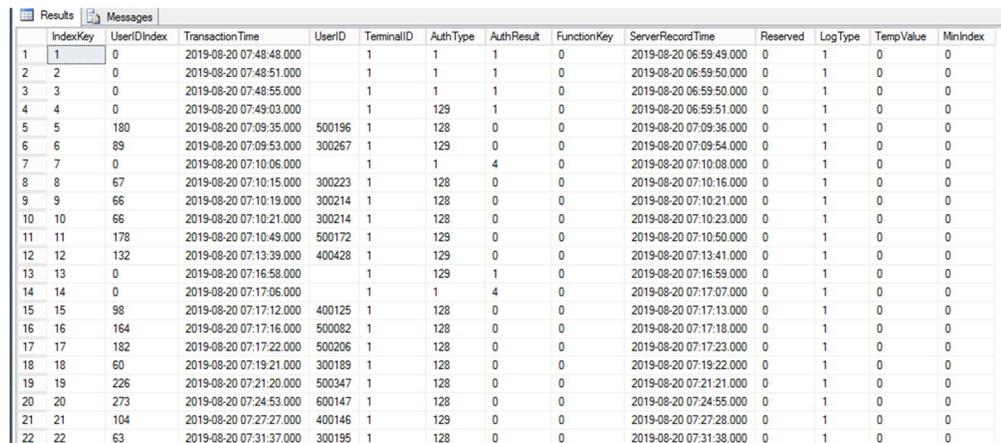- Established a scalable foundation for HR analytics and reporting

Workflow

ETL Process for Employee Attendance Management in a Television Channel HRMS

This ETL (Extract, Transform, Load) process supports the employee attendance module of a Human Resource Management System (HRMS) used by a television broadcasting organization operating on a 24×7 schedule.

Extract

Employee attendance is captured through biometric fingerprint terminals deployed across the organization. Each authentication event is recorded in real time and stored in a temporary repository in raw format. From this raw dataset, the application extracts the required structured fields, including Employee ID, attendance date, attendance time, and terminal identifier.

Figure 1: Raw biometric data

During extraction, data quality checks are applied to ensure reliability and consistency. Records containing null values, invalid timestamps, or duplicate entries are identified and filtered. The validated and structured attendance records are then stored in the application database to prepare them for downstream processing.

	LogIndex	Remarks	LogDate	LogTime	EmpID	EmpName	Designation	DeptName	NodeID	AuthType	AuthResu
182	3091233	Biometric logIndex: 735	2019-08-21 00:00:00.000	11:37:12	300223	Sergeant (Retd.) Md. Zakir...	Assistant Manager (Ad...	HRA	1	128	0
183	3091234	Biometric logIndex: 736	2019-08-21 00:00:00.000	11:51:50	300232	Roksana Begum Raisa	Sr. Executive, HR	HR	1	128	0
184	3091235	Biometric logIndex: 737	2019-08-21 00:00:00.000	11:55:58	500350	Md. Atiqur Rahman	Video Editor	BOE	1	129	0
185	3091236	Biometric logIndex: 738	2019-08-21 00:00:00.000	11:58:16	600132	Mohammed Anamul Huq	Executive, Press	PGM	1	129	0
186	3091237	Biometric logIndex: 739	2019-08-21 00:00:00.000	11:58:19	500036	Md. Hanif	Manager, Presentation	BOE	1	128	0
187	3091238	Biometric logIndex: 740	2019-08-21 00:00:00.000	12:04:17	800053	Yash Ahmed	Assistant Manager, SM	SM	1	128	0
188	3091239	Biometric logIndex: 741	2019-08-21 00:00:00.000	12:10:30	400371	Rafiqul Islam	News Room Editor	NCA	1	128	0
189	3091240	Biometric logIndex: 742	2019-08-21 00:00:00.000	12:14:36	300227	Md. Suzat Ali	Assistant Manager,Gen...	MGT	1	128	0
190	3091241	Biometric logIndex: 743	2019-08-21 00:00:00.000	12:14:41	300235	Md. Abdur Rahman Babul	Office Assistant	HRA	1	128	0
191	3091242	Biometric logIndex: 744	2019-08-21 00:00:00.000	12:15:03	500410	Monirul Alam Chowdhury	Cameraman	BOE	1	128	0
192	3091243	Biometric logIndex: 745	2019-08-21 00:00:00.000	12:15:17	400441	Mohammad Imam Hasan	Sports Reporter	NCA	1	129	0
193	3091244	Biometric logIndex: 746	2019-08-21 00:00:00.000	12:17:31	600114	Asaduzzaman	Assistant Producer, PGM	PGM	1	128	0
194	3091245	Biometric logIndex: 747	2019-08-21 00:00:00.000	12:22:17	500353	Mst. Nargis	Library Assistant, Trainee	BOE	1	128	0
195	3091246	Biometric logIndex: 748	2019-08-21 00:00:00.000	12:25:33	700029	Md. Abubakar Fezlay Rabbi	AGM, Graphics & Art Di...	GRP	1	128	0
196	3091247	Biometric logIndex: 749	2019-08-21 00:00:00.000	12:30:26	110030	Md. Nazmush Shahadat	Reporter	ETV - O...	1	128	0

Figure 2: Clean and partially transformed data

Transform

The transformation phase begins by linking attendance records with employee master data and assigned work schedules maintained in the HRMS. Based on predefined departmental rosters, the system evaluates attendance status, categorizing records into operational classifications such as on-time, late, extremely late, or absent.

Given the organization's continuous 24-hour operations, an employee's working day is not restricted to the conventional calendar day (12:00 a.m. to 11:59 p.m.). Instead, work cycles may span non-standard intervals, such as 6:00 a.m. to 5:59 a.m. the following day or 10:00 p.m. to 9:59 p.m. the next day. The transformation logic is designed to accurately determine an employee's effective working day by analyzing attendance timestamps in conjunction with schedule definitions.

EmpID	500402	Name						Designation	Executive, IT				Dept.	BOE		Sub Dept.	IT			Status	Probation	DOJ	1/7/2016
In	6:01	6:01	12:35	6:01	CL	CL	CL		15:54	12:40	13:51	9:26	6:00	9:22	6:00	18:43	DayOff	9:46	8:33	6:01	6:01	16:32	17:27	10:19	13:32	7:22	6:01	7:53	18:03	15:16	Septemb
Out	5:50	15:20	5:55	15:46						22:15			6:02	16:39	5:48	5:51			5:57	5:55	5:49	5:50	5:56	19:21		5:57		5:54	5:51		RT: 208
WH	23:49	9:19	17:20	9:45						9:35			0:02	7:17	23:48	11:08			21:24	23:54	23:48	13:18	12:29	9:02		22:35		22:01	11:48		TWH: 272 Lv: 3 [+24] OV: 88
ST			D/O						ExLt	GH-D/						ExLt			ExLt	ExLt	D/O							ExLt	ExLt		

Figure 3: Transformed data

In cases where roster data is incomplete or unavailable, the system intelligently infers the working cycle using attendance patterns, ensuring continuity of attendance evaluation. The processed and enriched attendance data, including computed status indicators, is stored in the application database as transformed data.

Load

In the final stage, the HRMS loads the transformed attendance data into reporting and analytics modules. The system generates operational and managerial reports tailored to departmental requirements, supporting workforce monitoring, compliance tracking, and administrative decision-making.

Figure 4: Load transformed data from application database

Through this structured ETL workflow, the HRMS ensures accurate capture, validation, and interpretation of attendance information, enabling reliable workforce management in a continuous broadcasting environment.