Design an IoT Integrated Asset Tracking Application to Secure, Enable Real Time Control and Improve Digital Customer Experience in Glided Financing

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ABSTRACT

Gold being one of the precious metals is considered as a highly liquid asset and ensures providing better economic advantage compared to other assets. Most of the banks provide loans in pledge of the customers gold as a collateral. The gold that is stored in banks is sometimes subjected to manipulation by employees or customers but unless verified this issue is discovered at a later point subjecting the individuals to legal actions. The renewal of the existing gold loan process requires the presence of the customer in bank to fill and sign the documents. The preference is provided on a first come first serve basis and the customer needs to wait until the banking procedures are completed. This similar process is done even for retrieving gold from the bank. The objective is to design an application integrated with IoT to ensure a transparency of the asset details and improve customer experience by adopting digital methods during new asset pledge, renewal, and return.

Keywords: IoT - Internet of Things, RBIA - Risk-based internal audit, RFID - Radio-Frequency Identification, AI - Artificial Intelligence, SAP - Systems, Applications, and Products in Data Processing, GPS - Global Positioning System, LoRaWAN - Long Range Wide Area Network, Wi-Fi - Wireless Fidelity, BLE - Bluetooth Low Energy, AES - Advanced Encryption Standard

INTRODUCTION

Gold has been prized for centuries as a store of value, a form of currency and a symbol of wealth. It can help diversify your portfolio by providing steady returns and stable value despite market fluctuations. In fact, many investors turn to gold to protect their wealth during economic uncertainty. But there's another good reason to invest in gold that many overlook: its liquidity. Gold is one of the most liquid investments available, meaning you can quickly and easily convert it to cash when you need it. Liquidity refers to how easily and quickly you can sell an asset for cash at its current market value. For example, money in a bank account is highly liquid because you can withdraw it anytime. Real estate is illiquid because it can take a long time to list, accept an offer and close the deal. Gold has been universally accepted as a form of currency for thousands of years. It's also an investable asset and is used in products from jewelry to electronics. It's valuable in every country, making it easy to buy and sell globally. Because of this, while the price of gold may fluctuate in the short term, there are always buyers in the market for it. Therefore, if you want to convert your gold to cash, you shouldn't have any trouble doing so. Gold is an asset you can hold in your hand. This gives investors a sense of security compared to cash assets (which can quickly become devalued) and stocks (which exist abstractly as shares or symbols on a screen).Whether you hold physical gold like coins and bars or stocks backed by the precious metal, this tangibility makes gold reliably valuable and, therefore, a stabilizing element in any portfolio. There is only a finite amount of gold in the world, and once we've mined it all, we can't mine anymore. This relative scarcity keeps gold prices steady compared to assets like cash, which governments can print more of at any time and is highly dependent on market forces. It also means gold is always in demand, which makes it easy to sell when you want to cash out your investment.[1] In the dynamic and ever-changing world of financial services, glided financing shines as a beacon of opportunity for individuals seeking to unlock the value of their gold assets. This unique avenue empowers individuals to harness the intrinsic worth of their gold possessions to access vital funds through collateralization. This form

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of financing has gained traction due to its simplicity and accessibility. Lenders accept a variety of gold items, including jewelry, as collateral for these loans. When individuals opt for glided financing, they offer their gold assets as security to the lender. The value of the loan is determined based on the purity and weight of the gold pledged. The gold is securely stored in RBI-approved lockers to ensure its safety throughout the loan tenure. [2] Recently large numbers of frauds across the banking industry have been reported due to non-observance of the laid down procedure while processing gold loan. Many times, frauds happen because the branches are dependent on the assayer for the complete process of the gold loans. This case study is developed to understand the importance of various guidelines with respect to empanelment of assayer, safety and operational guideline on sanctioning of gold loan. This will help the branches to follow the preventive vigilance guidelines issued by the bank from time to time while processing gold loan to avoid occurrence of frauds and to improve the health of the Bank's credit portfolio. In the reappraisal report it was mentioned that one packet was found to be of lesser weight due to the missing of one item of gold ornaments vis-à-vis the appraisal memo. While checking a few more packets were also found loss of weight due to the difference in the number of articles. Based on the suspicion Branch got re-assayed entire portfolio. It was found that 68 gold articles totaling 1750 grams in 53 packets are found missing. It was a huge shock for everyone in the branch. Regional Office reported the matter to Head Office and investigation process started. On further investigation it was found that at the end of the day, all those jewels that were pledged, which are in the custody of the Assayer are rechecked by the officers. After the rechecking, the officer handover the jewels to the assayer for sealing with wax by the assayer and the sealed packets will be handed over to the branch officer to be kept in the safe custody. During the process of fixing the wax, the assayer use to remove 1 or 2 jewel articles from the packets. The absence of officers during the sealing of packets, have given the assayer an opportunity to remove the jewel from the packet. The assayer use to keep the note of jewels which he has taken off from the packets along with the customer details in his dairy. And also he use to prepare 2 vouchers of Jewel items and hand over one copy to customer and keep a copy with him for future reference. The assayer use to pledge some of the stolen jewel articles with the same branch and reported that around 20 loan accounts amounting to Rs. 50.00 Lacs have been opened, based on the security of missing jewels. The borrowers in these loans were introduced by the assayer. Whenever customers used to come for release of jewels, he would manage the customer without the knowledge of the branch officials and amicably settle the issues without the intervention or the knowledge of the branch officials. The assayer also uses to take personnel interest on reverification process and kept a keen watch on the reappraisal and re-verification process by the bank. After reverification process is over the branch officials has handed over the unsealed packets to him for packing and waxing of jewel packets. Utilizing the opportunity, the assayer utilizes the time of absence of officers during the sealing of packets, after the process of re appraisal, removes the articles from the packets. This was done with the knowledge that the interval for next reappraisal is 3 months, and the same packets are not taken at a large. The branch was having only one assayer as per preventive vigilance guidelines branch has failed to engage minimum two assayer whom to be changed on rotational basis. The branch was fully dependent on the assayer for the complete process of the gold loans. The branch officials have failed to control on movement of jewelry. Weighing and verification of gold ornaments must be done by assayer at the branch premises in the presence of Branch Manager / Officer. The branch officials have failed to verify the weight of jewels and number of items in the packet after waxing of jewel packets by assayer and taken possession of jewels from assayer without verification. Jewel loans were sanctioned to the borrowers introduced by assayer without following proper guidelines. Additional discreet enquiry desired in new cases of jewel loan sanction to ensure ownership of the ornaments offering for pledge to avail loan facility was not carried out. The branch officials were absent during the sealing of packets by the assayer. The branch officials had to ensure that immediately after pledge of ornaments& verification by officer, the jewel loan bag should be transferred to the safe after the details are entered. Gold packets after appraisal & sealing were not kept in safe custody immediately but left with the assayer for keeping in safe custody in the evening only. Branch has failed to ensure that if for any reason the jewels are handed back to the pledger/assayer, they should be appraised once again before accepting them for keeping in safe custody. On the instruction of the assayer in the guise of the closure of jewel loan accounts jewel packets were taken out from the safe custody. The branch has failed to check the credibility of every existing appraiser at branches periodically and ensures to examine the desirability of retaining them periodically by the Branch Manager. During re-assaying process of the pledged jewelry in the Gold Loan accounts at each quarter and during RBIA inspection the re-assaying to be carried out involving officials and assayer of another branch. The branch has involved his branch assayer also during reassaying which he could

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be able to conceal the fraud done by him. During the regular re appraisal internal audit, the verifying officer were not vigilant and could not notice the manipulation of the assayer of showing the same jewel already reappraised (during earlier verification) packets again and again for verification purpose.[3] Officials discovered a scam at Bank of India's Khairatabad branch involving Rs 4.4 crore in loans against fake gold ornaments. Employees, an authorized gold evaluator, and customers collaborated to commit the fraud. The issue came to light when a suspicious colleague revalued the pledged ornaments, revealing the scheme. [4] India's banking sector is growing rapidly, necessitating more efficient and accurate audit processes. Traditional bank audits involve manual data processing, extensive documentation, and subjective decision-making, leading to potential errors and delays. AI and Excel can address these challenges by automating data validation, improving report accuracy, and reducing audit times. The AI-powered system demonstrated a 40% improvement in report accuracy, enhancing audit quality and compliance.[5] Tribhovandas Bhimji Zaveri Limited (TBZ) is among India's largest jewellery brand. The 155-year-old brand has adopted the digital path. The company uses a hybrid cloud solution that primarily hinges on Oracle Cloud. The jewellery retailer is also embedding small IoT devices (similar to barcode/RFID tags) in high-value jewellery to understand whether they have been tried, how many times they've been tried, or sold or unsold.[6] The SAP Architecture Center offers a place that provides solution reference architectures, helping businesses adopt SAP solutions to turn data into valuable business insights. Every software architecture is unique, built to deliver the specific outcomes of your industry, line of business, or country of operation. As such, you will identify areas where this repository can be enhanced with new or updated reference architecture content. [7] Mermaid is a JavaScript-based diagramming and charting tool that renders Markdown-inspired text definitions to create and modify diagrams dynamically. With Mermaid, you can create various types of diagrams using simple text-based descriptions.[8]

Problem Description

The conventional gold loan process in banks relies heavily on manual verification and paperwork, making it vulnerable to asset manipulation and operational inefficiencies. Customers are required to be physically present for loan renewal and gold retrieval, leading to long waiting times, inconvenience, and a lack of transparency in asset tracking. These challenges not only affect customer satisfaction but also pose legal risks due to potential unauthorized handling of collateral. There is a critical need for a technology-driven solution that integrates IoT to digitally monitor gold assets, streamline banking procedures, and ensure secure, transparent, and user-friendly handling of gold loans throughout their lifecycle—from pledge to renewal and return.

Proposed Architecture

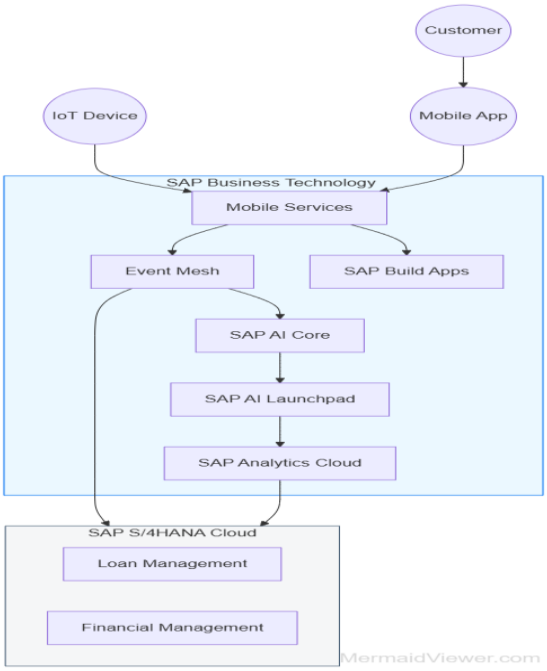

Fig 3.1 Architectural Design

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The architecture supports end-to-end digital transformation. It leverages AI, analytics, and event-driven design for smarter decisions. It's built on a cloud-first, modular approach, allowing scalability and flexibility. This architecture diagram illustrates how various components within the SAP ecosystem work together to enable intelligent, cloud-based business operations. Summarized below is a breakdown of each layer and interaction:

Customer Interaction Layer

Customer interacts with the system through:

IoT Devices – Smart device that collect real-time data.

Mobile Apps – User-facing applications for input, monitoring, or control.

These interfaces are the entry points for data into the SAP system.

SAP Business Technology Platform (BTP)

This is the central integration and processing hub. It receives data from IoT devices and mobile apps and enables various services:

Mobile Services – Manages mobile app connectivity, authentication, and data sync.

Event Mesh – Facilitates real-time event-driven communication between services.

SAP Build Apps – Low-code/no-code tools for building custom applications.

SAP AI Core & AI Launchpad – Hosts and manages AI models for intelligent automation and decision-making.

SAP Analytics Cloud – Provides dashboards, reporting, and predictive analytics.

This layer transforms raw data into actionable insights and intelligent workflows.

SAP S/4HANA Cloud

This is the enterprise resource planning backbone where core business processes are executed:

Loan Management – Handles financial products, customer loans, and related workflows.

Financial Management – Manages accounting, budgeting, and financial reporting.

These modules consume processed data from the BTP to drive business decisions and operations.

Data Flow & Integration

Arrows in the diagram show how data flows:

From Customer interfaces → into SAP BTP → then into S/4HANA Cloud. This flow enables real-time, intelligent, and automated business processes.

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Core features of the Smart IoT device:

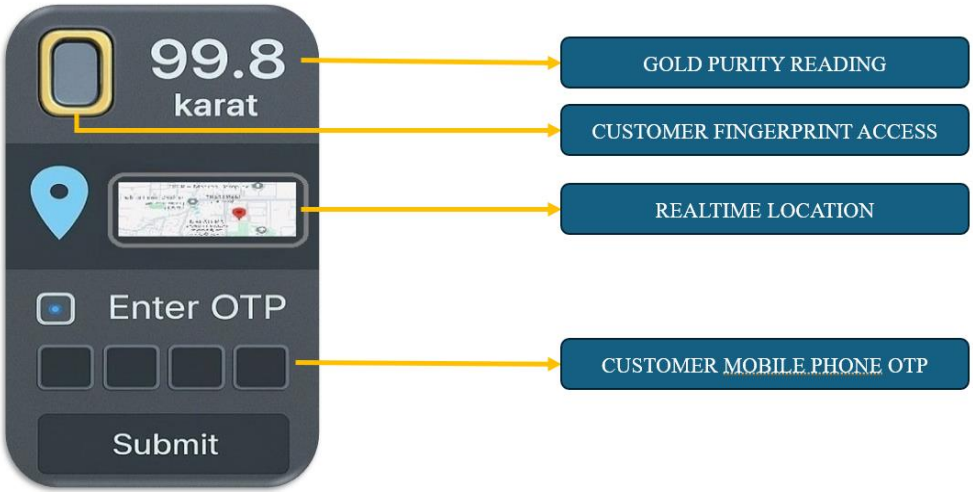

Fig 3.2 Smart IoT device

1. Gold Purity Sensor

Technology: Uses XRF (X-ray fluorescence) or ultrasonic resonance to measure karat level (example 22K, 24K).

2. Biometric Locking

Fingerprint Sensor: Capacitive sensor embedded into the jewellery clasp or surface.

OTP Verification:

Dual authentication via mobile app (OTP sent to registered number/email).

Fail-Safe: If fingerprint fails, OTP-only mode activates with time-limited access.

3. Location Tracker

GPS + LoRaWAN/Bluetooth: Real-time tracking with geofencing alerts.

Anti-theft Mode: Sends alert if jewellery is moved outside a safe zone.

Last known location: Stored in cloud for recovery assistance.

4. Connectivity

IoT Protocols: Wi-Fi, BLE 5.0, and optional NB-IoT for low-power wide-area tracking.

5. App Integration: Android/iOS app for control, alerts, and purity logs.

Cloud Sync: Data stored securely for insurance and resale verification.

6. Security & Tamper Protection

Tamper Detection: Vibration and pressure sensors trigger alerts if forced removal is attempted.

Self-Locking Mechanism: Auto-locks if unauthorized access is detected.

Encrypted Communication: AES-256 encryption between device and app.

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7. Power & Build

Battery: Rechargeable Li-ion micro-cell (3–5 days standby). Charging: Magnetic contact charging or kinetic energy harvesting.

8. Material: Medical-grade biocompatible casing (gold-plated titanium or ceramic).

Empirical Customer Onboarding:

A customer walks into a bank to pledge gold jewellery for a loan or renewal. The jewellery is tagged with an IoT device (example - RFID or NFC sensor) that tracks its location and integrity. The customer downloads a mobile app provided by the bank if registering the first time.

End-to-End Workflow:

Customer registers via mobile app and pledges gold.

IoT device tags the jewellery and streams data to SAP BTP.

AI audits the asset for authenticity and valuation.

Event Mesh triggers alerts for suspicious activity or renewal deadlines.

Analytics Cloud generates reports for customer and bank officials.

S/4HANA Cloud updates loan and financial records automatically.

CONCLUSION

This paper proposes an IoT-integrated asset tracking application that offers a transformative solution for Glided Financing to enable renewal decisions, real time location alert, stopping counterfeit and corrupt valuations mechanisms providing a hassle free, touchless and eco-friendly digital customer experience. It secures assets, empowers users with real-time control, and delivers a superior digital experience. This architecture can serve as a blueprint for fintech's aiming to modernize asset management and customer engagement. Further tweaking the IoT device can enable scalability across other industries.

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