FORM 2

THE PATENT ACT 1970

(39 OF 1970)

&

THE PATENT RULES, 2003

COMPLETE SPECIFICATION

(SEE SECTION 10)

1. TITLE OF THE INVENTION

RFID-BASED INTELLIGENT CHECKLIST MANAGEMENT SYSTEM WITH MACHINE LEARNING–DRIVEN REMINDER LOGIC

2. APPLICANT (S)

NAME	**VELLORE INSTITUTE OF TECHNOLOGY**
NATIONALITY	**INDIAN**
ADDRESS	**VELLORE INSTITUTE OF TECHNOLOGY** **NEAR KATPADI ROAD,** **VELLORE, TAMIL NADU, INDIA – 632014**

3. PREAMBLE TO THE DESCRIPTION

THE FOLLOWING SPECIFICATION PARTICULARLY DESCRIBES THE INVENTION AND THE MANNER IN WHICH IT IS TO BE PERFORMED.

4. DESCRIPTION

RFID-BASED INTELLIGENT CHECKLIST MANAGEMENT SYSTEM WITH MACHINE LEARNING–DRIVEN REMINDER LOGIC

TECHNICAL FIELD

[0001] Embodiments of the present invention relate to systems and methods for automated item tracking and checklist management using Radio Frequency Identification (RFID) technologies. Embodiments are also related to intelligent reminder systems that employ machine learning models to identify missing items, predict checklist completion patterns, and generate context-aware alerts. Embodiments are further related to cloud-integrated IoT systems capable of synchronizing RFID scan data, historical user activity, and checklist entries for real-time monitoring. Embodiments are additionally related to multi-item management across different categories such as “Office,” “Home,” and “Gym,” where each category includes predefined or user-customized items associated with RFID tags. Embodiments are particularly related to intelligent decision-making frameworks that analyse checklist deviations, missing tag scans, or inconsistent user patterns and provide adaptive reminders to ensure that essential items are carried before leaving a location.

BACKGROUND OF THE INVENTION

[0002] RFID technologies have long been used in domains such as inventory management, warehouse logistics, access control, and asset tracking, largely because of their ability to identify tagged objects without physical contact or line-of-sight scanning. Despite the

maturity of RFID in industrial settings, its adaptation for everyday personal item management remains limited, particularly for individuals who must routinely carry multiple essential items across different contexts. People often depend on belongings like wallets, keys, access cards, notebooks, personal accessories, work materials, and gym equipment, and forgetting even a single item can cause inconvenience, delays, or significant disruption. Existing personal checklist applications rely entirely on manual ticking and require the user to remember to update the checklist, without validating whether the physical item is present. This lack of object-level verification creates a major gap between the user's assumption of readiness and the actual set of items they have packed.

[0003] Some consumer solutions attempt to address this problem using Bluetooth trackers or proximity-based devices; however, these systems are inherently limited when multiple items must be tracked across multiple bags or categories such as "Office," "Home," or "Gym." Items often shift between bags, and Bluetooth-based trackers typically depend on pairing with a smartphone, suffer from battery constraints, and cannot reliably differentiate between categories or detect whether an item is inside a particular bag. RFID smart-bag concepts exist, but they are not designed for dynamic category switching, nor do they incorporate intelligence capable of learning typical item patterns or providing adaptive reminders.

[0004] Prior art relevant to this space exhibits several deficiencies. A first category includes standard checklist applications that allow item listing but provide no sensing or

verification, relying entirely on user memory. A second category consists of warehouse-style RFID inventory systems that are not optimized for personal mobility, multi-bag scenarios, or real-time reminders. A third category describes Bluetooth trackers that alert only when an item is physically distant from the phone, offering no insight into whether the item should belong to the selected checklist at a given time. A fourth category includes smart luggage systems that can detect the presence of objects inside a suitcase but do not incorporate machine learning to classify missing items or adapt reminders based on user usage history. A fifth category includes IoT-based reminder applications relying on timers, geofencing, or simple notifications without verifying whether required items have been physically detected through RFID scans.

[0005] These fragmented approaches lack adaptability, intelligence, and real-world object verification. They do not integrate RFID scanning with category-specific checklists, nor do they incorporate machine learning models to identify normal usage patterns, detect anomalies, or predict which items are typically grouped together. Without learning-based personalization, existing systems cannot determine whether a missed item is critical or whether the user commonly omits it under certain circumstances. Furthermore, current solutions do not synchronize historical scan data with cloud storage to allow long-term behavioural analysis or multi-device integration. Based on the foregoing, a need therefore exists for an improved RFID-based intelligent checklist management system with machine-learning-driven reminder logic that verifies actual item presence, learns user behaviour over time, synchronizes with

cloud-based storage, supports multiple categories, and generates accurate, context-aware reminders to ensure reliable and frictionless readiness before leaving a location.

SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide an RFID-based intelligent checklist management system capable of verifying whether specific items have been physically detected before the user leaves a location. This object is achieved through the integration of RFID tags attached to individual items and an RFID reader module capable of identifying which items are present within a bag or defined region. By replacing manual checklist ticking with automatic tag detection, the system eliminates dependency on user memory and ensures that critical items are never unintentionally left behind.

[0007] Another object of the invention is to offer adaptive, machine-learning-driven reminder logic that analyses the user's historical behaviour and identifies patterns across multiple categories, such as Office, Home, and Gym. By learning which items the user typically carries together and how frequently certain items are used, the system aims to provide reminders that are not only accurate but also personalized. This allows the reminder module to reduce irrelevant notifications while highlighting items that are contextually important for the selected category.

[0008] A further object of the invention is to integrate cloud-based data synchronization so that checklist information, scanned items, missed item instances, and behavioural patterns can be securely stored and accessed across devices. This facilitates long-term learning, multi-

device consistency, and the ability to review past item usage or frequently forgotten objects. Cloud synchronization also enables the system to train its machine learning models on aggregated historical data, thereby improving its predictive capability and refining its reminder accuracy over time.

[0009] Another object of the invention is to organize items into multiple predefined or user-configurable categories, each containing a specific set of essential items associated with RFID tags. Through this multi-category structure, the system enables the user to switch between different activity contexts, such as transitioning from Home to Office or Office to Gym, without manually altering checklists. The RFID detection and ML logic adjust automatically based on category selection, ensuring that reminders are context-appropriate.

[0010] A final object of the invention is to provide a unified, IoT-enabled operational framework that integrates RFID scanning, data processing, category selection, machine learning analysis, and reminder generation into a single automated workflow. Through this cohesive structure, the system aims to improve user readiness, reduce checklist errors, and minimize the risk of forgotten items by ensuring that every essential object is verified, analyzed, and monitored through an intelligent and adaptive reminder mechanism.

[0011] The present invention provides an RFID-based intelligent checklist management system that automates the process of verifying item presence and generating adaptive reminders using machine learning. The system eliminates the limitations of manual checklist applications by introducing RFID-tagged items that can be automatically detected

through an RFID reader module integrated into the user's bag or environment. By linking each item to an RFID tag, the system ensures that checklist data reflects real-time physical item presence rather than user assumptions or manual inputs. This enables the system to accurately detect missing objects and alert the user before leaving a location.

[0012] The invention incorporates a machine-learning-driven reminder mechanism that analyses item usage history, category-wise behaviour, and patterns in checklist completion. The ML model identifies which items are frequently forgotten, which items typically appear together, and how user behaviour varies across categories such as Office, Home, and Gym. These behavioural insights allow the reminder module to deliver personalized and context-aware notifications. Instead of issuing generic alerts, the system prioritizes items based on learned significance, thereby reducing unnecessary notifications while improving reliability.

[0013] The system architecture integrates RFID detection with cloud-based data storage to support long-term behavioural learning. Each scan event, detected item, missing item, and category selection is stored in the cloud, enabling the ML engine to continuously refine its predictions. This ensures that over time, the system becomes increasingly accurate in identifying unusual checklist deviations or predicting items that the user is likely to require. The cloud integration further supports multi-device synchronization, allowing the user to access checklist status and behaviour insights from any connected device.

[0014] Checklist items are organized into multiple predefined or user-generated categories, each containing essential objects relevant to specific daily contexts. When the user

selects a category, the system automatically loads the associated checklist and evaluates whether required items have been scanned. This category-based intelligence allows seamless transitions between home and work environments without manual reconfiguration. The RFID reader module instantly detects whether each item belonging to the selected category is present, and the ML module evaluates whether the absence corresponds to a genuine error or a behaviourally consistent omission.

[0015] Collectively, the invention provides a unified IoT-Machine Learning framework that maintains real-time item verification, intelligently adapts to user habits, and generates timely reminders to minimize forgotten essentials. By combining RFID-based sensing, cloud-enabled data aggregation, multi-category organization, and ML-based predictive analysis, the system establishes a highly personalized and automated solution that reliably enhances everyday user readiness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 illustrates the system architecture of the RFID-based intelligent checklist management system, depicting the arrangement and interaction between RFID-tagged items, the RFID reader module, the data processing components, and the cloud-based storage that supports machine-learning-driven reminder generation. The figure shows how item detection, checklist evaluation, and behavioural analysis modules operate within a unified framework.

[0017] FIG. 2 illustrates the functional workflow of the system, including RFID tag scanning, checklist comparison, identification of missing or unmatched items, and activation

of the reminder logic. The figure represents the sequential operations performed by the system to analyse detected items, classify deviations from expected behaviour, and generate adaptive alerts based on machine-learning-assisted decision-making.

DETAILED DESCRIPTION

[0018] The present invention provides an RFID-based intelligent checklist management system designed to automate the verification of essential items and deliver adaptive reminders based on user behaviour and historical scanning patterns. The system eliminates the traditional dependence on manual checklists by introducing automated RFID tag detection combined with machine-learning-driven decision logic. The invention enables the user to ensure that every essential item is physically present before leaving a location. As illustrated in FIG. 1, the architecture comprises RFID tags attached to individual items, an RFID reader module capable of scanning and identifying these tags, a processing unit that evaluates detected tags against one or more active checklists, a cloud storage layer that maintains historical usage records, and a machine learning engine that analyses long-term behavioural trends to refine future reminders. The coordinated operation of these components transforms static checklist management into a dynamic, intelligent, and self-learning system.

[0019] Each item that forms part of the user's routine, such as office supplies, home accessories, or gym essentials, is assigned a unique RFID tag. When the user scans their bag or designated area using the RFID reader, the reader captures the RFID identifiers and forwards the data to the system's processing module. The processing unit maintains predefined or user-

defined categories such as Office, Home, and Gym, each containing a recognized set of required items. As the scan is performed, the system identifies the detected items and performs a direct, real-time comparison against the expected items for the active category. This enables precise item-level verification rather than relying on user memory or subjective assessment. When an item from the checklist is not detected by the RFID scanner, the system identifies this as a deviation and begins processing the conditions required to generate an alert.

[0020] As illustrated in FIG. 2, the operational workflow begins with user category selection, RFID scanning, and checklist loading. The system then proceeds into a detection and comparison stage, where it identifies missing items, evaluates the severity of the deviation, and determines whether a reminder should be issued. The evaluation is not limited to immediate item presence; it also incorporates behavioural intelligence through machine learning. The system references historical behaviour stored in the cloud to determine whether the missing item represents an atypical omission or a pattern that aligns with past behaviour. For example, if the user frequently omits an item from the Office category and historical scans confirm that it is rarely carried, the system may adjust the reminder priority or suppress the alert entirely. Conversely, if the system identifies that a frequently carried item is missing, it raises a high-priority alert, ensuring the user receives timely and relevant notifications.

[0021] A key aspect of the invention is its ability to learn and evolve over time. Each RFID scan—whether complete, partial, or missing items—is recorded and stored securely in the cloud. This includes information such as which items were detected, which items were

missing, the category selected, and the user's eventual action. Over repeated use, the system builds a comprehensive behavioural profile for each category and each item. The machine learning model uses this accumulated data to identify trends such as frequently forgotten items, commonly grouped item sets, or evolving usage patterns. This continuous learning enables the system to provide more accurate, personalized reminders rather than relying solely on static rule-based logic. The incorporation of cloud-based storage ensures that the user's preferences and behavioural insights remain consistent even if they switch devices or access the system from multiple locations.

[0022] The system also supports seamless category transitioning without requiring manual reconfiguration. When the user changes from one activity context to another, for instance, from Home to Office, the system automatically loads the appropriate checklist and adjusts its detection expectations accordingly. The RFID reader then scans the items currently present, and the processing unit matches them against the newly activated checklist. This dynamic behaviour ensures that the user is always guided according to the correct context. The system's ability to instantly adapt its requirements prevents confusion that may arise from overlapping or outdated checklists. As the user transitions between categories, the machine learning model continues to evaluate whether the combination of detected and missing items aligns with the user's habitual behaviour or constitutes a significant deviation requiring immediate notification.

[0023] The invention also provides enhanced reliability by utilizing physical RFID tag detection rather than estimated or proximity-based solutions. Unlike Bluetooth trackers or manual checklist apps, the RFID-based approach verifies actual physical presence, eliminating false assumptions. The RFID reader captures data even when items are inside bags, concealed, or rearranged, ensuring accurate detection regardless of orientation. The processing unit uses this verified data to produce definitive checklist evaluations, and the system is able to respond with an appropriate level of urgency. Through the integration of RFID sensing, category-specific checklists, cloud-supported behavioural analysis, and adaptive machine learning, the invention forms a robust, unified, and intelligent checklist management ecosystem. By combining the structural design shown in FIG. 1 with the sequential operations depicted in FIG. 2, the system delivers a comprehensive solution that automates item verification, reduces checklist errors, and enhances personal readiness in daily activities..

5. CLAIMS

I/We Claim:

1. An RFID-based intelligent checklist management system comprising a plurality of RFID tags affixed to user items, an RFID reader configured to detect the RFID tags, a processing unit configured to compare detected tags with a checklist associated with a selected category, a cloud storage component configured to store historical detection patterns, and a machine learning engine configured to analyse the historical patterns to generate adaptive reminders when one or more expected items are not detected.

2. The system as claimed in Claim 1, wherein the RFID reader is configured to scan items in real time and transmit detected tag identifiers to the processing unit for comparison with the checklist.

3. The system as claimed in Claim 1, wherein the checklist comprises predefined or user-defined categories including a set of required items associated with corresponding RFID tags.

4. The system as claimed in Claim 1, wherein the processing unit is configured to identify deviations by determining whether one or more required items are missing from the detected RFID tags.

5. The system as claimed in Claim 1, wherein the machine learning engine is configured to analyse user-specific historical data to determine habitual item usage patterns and adjust reminder priorities accordingly.

6. The system as claimed in Claim 1, wherein the machine learning engine is configured to suppress reminders for items that are historically omitted and enhance reminders for items that are frequently carried.

7. The system as claimed in Claim 1, wherein the cloud storage component is configured to store item detection events, category selections, instances of missing items, and user behavioural trends for long-term analysis.

8. The system as claimed in Claim 1, wherein the processing unit is configured to activate a reminder when the comparison identifies item absence that exceeds a machine-learning-determined significance threshold.

9. The system as claimed in Claim 1, wherein the reminder is generated based on both immediate RFID detection results and behaviour-driven predictions produced by the machine learning engine.

10. The system as claimed in Claim 1, wherein the coordinated operation of RFID detection, category-based checklist comparison, cloud data storage, behavioural analysis, and machine-learning-driven reminder generation forms an autonomous and adaptive item-verification framework.

6. SIGNATURE WITH DATE

7. ABSTRACT

RFID-Based Intelligent Checklist Management System with Machine Learning–Driven Reminder Logic. The invention relates to an RFID-based intelligent checklist management system that automates the verification of essential items and generates adaptive reminders based on user behaviour. The system includes RFID tags affixed to individual items, an RFID reader configured to detect the tags, a processing unit that compares detected items with a checklist associated with a selected category, and a cloud-connected machine learning engine that analyses historical usage patterns. When the RFID scan identifies missing items, the system evaluates the deviation using real-time detection results and behaviour-derived insights to determine whether a reminder should be issued. The machine learning component refines reminder priorities by learning which items are frequently carried or commonly omitted, thereby reducing unnecessary alerts and enhancing contextual accuracy. Through integrated RFID detection, category-wise comparison, historical trend analysis, and adaptive reminder generation, the system provides a personalized and reliable item-verification framework. **[FIG. 1]**

DRAWINGS

TOTAL SHEETS: 02
SHEET NO.: 01

1/2

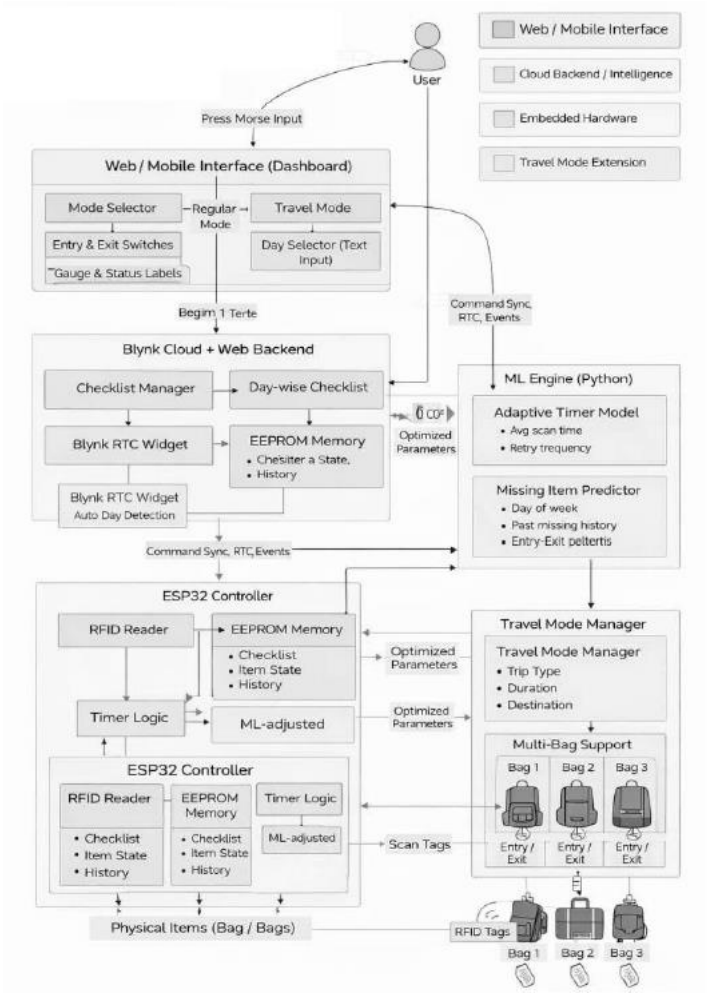


FIG. 1

K S Hariprasad
Patent Agent IN-PA3636

TOTAL SHEETS: 02
SHEET NO.: 02

2/2



FIG. 2

K S Hariprasad
Patent Agent IN-PA3636