RFID BASED WASTE MANAGEMENT & VEHICLE TRACKING SYSTEM
Due to large scale of Waste Management Processes, it's cumbersome and tedious to keep track of total weight of Waste disposed by Vehicles manually as well as includes discrepancies when it comes to accuracy and reliability. The measure challenges are to Prevention & control of the misuse of manual system, vehicle movement of garbage from one location to another location, Induction of transparency and accountability in operations.
RFID Waste Management & Vehicle Reorganization/tracking is a state-of-the-art system that is built using Radio Frequency Identification (RFID) technology in a combination to provide monitoring, tracking and visibility into the internal as well as external operations of the waste management cycle.
How RFID Works?

1. Reader broadcasts signal through antenna.
2. Tag receives signal and gets charged.
3. The Charged tag sends identifying response back to the reader.
4. Antenna reads the data and sends to reader.
5. Reader sends data/info to computer for processing.
6. Computer sends event based data to be stored on tag.
Components of **RFID based WM & VTS Tracking System**

- **Tagged Vehicle.**
- **RFID Reader Installed at Transfer Station.**
- **Transfer Station Desktop Application Installed at Workstation at Transfer Station** (with RFID Local Databases).
- **Main Server (with Central Database).**
- **Web based Server Application (accessible over internet from anywhere).**
**Project Scenario:**

**Dataflow from RFID devices to Transfer station database:**

- **Pre-stored unique vehicle id on the RFID tags** (mounted on garbage vehicles) is sent to the RFID reader as the vehicle reaches the weighbridge.
- **RFID reader receives the unique vehicle id and sends it to the workstation over Ethernet connection.**
- **Workstation routes the RFID data to the Transfer Station Application running on the workstation.**
- **Transfer Station Application saves the data in a local RFID database created on the workstation.**
**Data Flow from Transfer station database to Central database:**

- **Transfer Station Application connects to the Main server over the internet (via USB data-card).**
- **Transfer Station Application pulls the data stored in the local RFID database.**
- **Transfer Station Application pushes this data to the Main server.**
- **Web Based Application running on the Main server saves this data to the central database.**
**Project Scenario:**

**Data Flow from Central Database to Web browser:**

- **User connects to the Main server having a static IP, through a web browser.**
- **Web based application user interface is made available to the user.**
- **User can create and retrieve data to and from the central database, depending on his/her access rights.**
Need and Benefits:
Relevant Tasks:

- Automatically record weight, incoming and outgoing time of Municipal Corporation & Agency Vehicles.
- Automated process to transfer daily data to a Central location connected to the Internet.
- Automated process to apply data coming from transfer station to centralized server.
- Reports will be generated from collected data from Transfer Station. Reports will be based on data collected using vehicle ID.
The desktop application software at the Transfer Station will record at least following information:

- Date of operation.
- Registration number of the Truck supplying Municipal Waste.
- Tare and Total weight of the truck.
- Time of entry and Exit of the truck.
- Net weight of the Municipal solid waste.
- Zone/Circle/Ward from which Municipal solid waste has been collected.
**Functionalities:**

**Allow Authorized Vehicles only:** Process and System will be implemented to only allow registered vehicles. Entry of unauthorized vehicles will be stopped at the main entrance. Provision will be provided to add or logically delete a vehicle from the database of authorized vehicles. Complete record of who added, when added and when deleted will be maintained in a System. Vehicles coming in to the site may not carry waste. Separate category will be created for such vehicles to record incoming and exiting times. System will flag if a vehicle given temporary gate pass is weighed at the weigh bridge.

**Time of Entry Recorded:** Time of each Entry in to Transfer Station will be recorded at the instance of first weight of the vehicle. Recording will be done in a format that will leave trace in case the date and time stamp is changed. When time of Entry is being recorded, the System will also record the vehicle number as well as whether the truck belongs to a vendor, Municipal Corporation or Agency or any other type of Vehicles.

**Record Time of Exit:** Exit time of each vehicle will be recorded at the instance of second weight of the vehicle, Since RFID reader is not being installed at the exit gate for the pilot implementation.
**Truck weight:** Weigh Bridge will record the weight of the loaded vehicle. Weight record will also contain other information such as date and time stamp of when the vehicle was weighed and vehicle number.

**Empty Weight of the Truck:** System will record the weight of the empty truck. When the trucks leave Transfer Station, they will weigh to ensure that the truck is emptied. Everyday there will be a report run to ensure that the empty weight of the vehicle is close to what is in records. Municipal Corporation and Agency vehicles coming to the Transfer Station will also be weighed to prove that the trucks were empty when they came in to the facility.

**Store Data Locally:** System will store data locally at local server.

**Fault Tolerance:** In case system is not able to perform, manual process will be well defined.

**Record Zone:** System will record the zone (e.g. NORTH, SOUTH, EAST and WEST) from where waste was picked up by the deposited vehicle. This set up will be done in advance.
**Traceability:** Due to some catastrophic failure, if the system is not fully operational and data is being captured manually, any entry done after the fact will be recorded in the system. Any records created manually will be recorded. In these cases, the system will record who at site recorded the data not just who entered it in the system.
Transfer Station Reports:

Waste Weight Report: System will provide a report to show amount of waste deposited in a given timeframe. Relevant fields such as Net Weight, Date and timestamp will to be displayed. This report can be further filtered by
- Date of deposit.
- Municipal Corporation Vendor(Agency)/Municipal Corporation Vehicle
- Vehicle
- Zone/Circle/Ward from where the waste is being brought in User will be able to group the report by above fields.

Traffic: This report will display the number of vehicles that are coming in each Transfer Station. This report will group it by the type of vehicles such as Municipal Corporation, Agency, and Temporary etc. This report can be created for a time period.

Traffic by Hour: For a given time frame, System will display the number of vehicles that are depositing waste by hour of the day. This report will tell the times when more manpower may be needed. This report will ONLY include incoming vehicles from Municipal Corporation and Municipal Corporation Vendors (Agency).
**Screen-Shots Of Web Application:**

![Software Solutions](image1)

**WMS Web Application Screen-Shot:**

![Login Form](image2)
MS Web Application Screen-Shot:

**Dashboard:**

- Welcome to the RFID Waste Management System:
  - RFID Waste Management System is a system that uses Global Positioning System (GPS) and Radio Frequency Identification (RFID) technologies in combination to provide monitoring and visibility into the internal as well as external operations of the waste management cycle.

- Administration:
  - The administration module is designed to be used by the administration level system users. It allows the users to access any module of the system through their management level access rights. The administrators can define system access rights to other users. It also allows to define business logic and lifecycles of the RFID system.

- Transfer Station:
  - The transfer station module allows the system to view reports with consolidated data from the RFID and GPS system. Reports like incoming and outgoing traffic statistics, while prices are brought in and claimed out by individual vehicles etc., with each report filtered by a number of parameters makes it useful for the management level intensive statistics.

- YES:
  - The GPS vehicle tracking system allows the system users to monitor and track the movement of individual vehicles on Google maps. Users can observe the vehicle’s past and current positions and movements, speed, direction of movement etc., or view the maps. It also allows to generate reports with business intelligence that provides visibility into the management operations as well as at higher levels.

- Change Password:
  - Old Password:
  - New Password:
  - Re-Enter New Password:

**Change**
### Transfer Station > Synchronize Status:

![RFID Waste Management System](image)

#### Reports
- Synchronize Status
- Traffic
- Traffic by Hour
- Waste Weight

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Transfer Station > Traffic:

WMS Web Application Screen-Shot:
WMS Web Application Screen-Shot:

Transfer Station> Traffic:
WMS Web Application Screen-Shot:

Transfer Station>
Waste Weight:
THANK YOU

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