

System for Material Real-Time Tracking (SMART)

A Compelling Solution for Infrastructure Companies



mSpace Technologies Limited

H.No. 2-2-1118/A, Flat-302, Sreemanrajals Residency,

Tilak Nagar, New Nallakunta,

HYDERABAD – 500 044

Telangana, INDIA

Tel.: +91-9246084979

+91-40-40192803

www.mspacetech.com

E-Mail: info@mspacetech.in

Copyright © **System for Material Real-Time Tracking (SMART)**. All rights reserved

This document contains proprietary information of **mSpace Technologies Limited**; it is provided under a license agreement containing restrictions on use and is protected by copyright, patent, and other intellectual and industrial property laws.

Except as may be expressly permitted in your license agreement for the Product, no part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language in any form by any means without the written permission of **mSpace Technologies Limited**.

Table of Contents

1.	Introduction	1
2.	The Solution	2
3.	Technical Architecture	4
	3.1. Android Client Application	5
	3.2. Server Side Web Application	7
4.	Compelling Benefits	10
	About mSpace Technologies Limited	11

1. Introduction

All infrastructure companies deal with and use very large quantities of construction materials that need to be transported to the site from their nearest camps through trucks. These trucks move in and out of each such geographically dispersed camps where loading and unloading of materials takes place whose value typically runs into several lakhs of rupees.

A major challenge for such infrastructure companies is that they are unable to reliably track and account for each one of these trucks, the volume of which can vary anywhere from a few hundreds to thousands on a daily basis. As a result, huge amount of material loss takes place that cannot be accounted for despite their current process and efforts put in place to track and account for all such material. Workers often take advantage of loopholes and lapses in these processes and gain personally by resorting to thefts, pilferages and adulterations of such materials. For example, some trucks were found to have hidden rocks that illegitimately add to the weight of the material when weighed at the weigh-bridge. In some cases workers even connive with each other and steal material, sometimes a whole truck, causing huge losses to their parent companies.

2. The Solution

mSpace's Material Tracking System is conceptualized, designed and developed to reliably track, monitor and analyze material movement in and out of infrastructure camps through trucks. It is a smart IT based mobility solution designed to capture in almost real time, each and every "transaction" – an incoming or outgoing truck and its details. The overall process flow for data capture is as depicted in Figure 1.

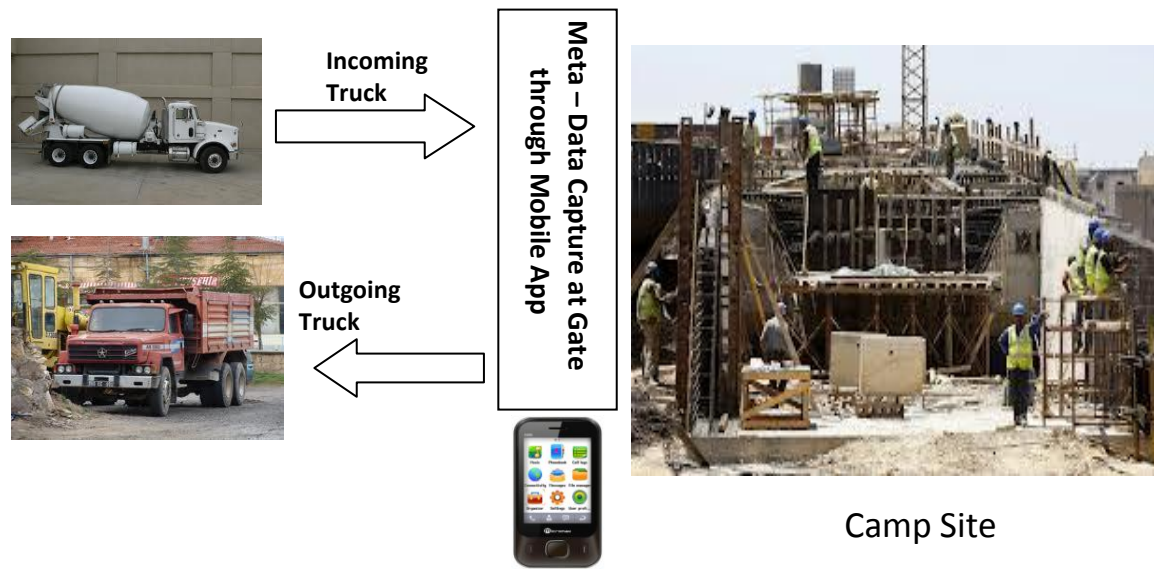


Figure.1: Meta-data capture for incoming and outgoing trucks through mobile application, comprising of a single transaction.

Key data elements that can be captured through the mobile device application at the gate of any camp are Material related details such as Bitumen, Cement, Steel, Fuel, Sand and others along with their photograph, Vehicle details – its source and chainage along with the photograph of registration number and the material document number and its photo.

The data captured by the mobile application is then saved locally in the device's external microSD card. Whenever the device is connected to the internet through Wi-Fi, GPRS or 2G, it is then uploaded to a centralized server through a web service and stored in a database. This raw data is then used to generate several reports that can provide valuable information and insights into the efficiency of daily operations. Some of these reports that can be generated are listed in Table 1.

Table 1. Reports supported by the Web Server Application

S. No.	Report Type	Report Description
1	Basic Transaction Reports	<p>Report for dashboard giving last transaction date and transaction count per camp for all camps</p> <p>List of all Gate Transactions</p> <p>List of all Weigh-Bridge transactions</p> <p>List of all ERP transactions</p>
2	Analysis Reports	<p>Report for vehicles in camp-to-camp trip taking beyond a given time duration</p> <p>Report for supplier-vehicles visiting multiple camps</p> <p>Report for supplier-vehicles visiting any camp(s) multiple times</p> <p>Report for non-supplier vehicles trips taking time beyond a given time duration</p> <p>Report for supplier vehicles remaining in a camp beyond a given time duration</p> <p>Report for summarizing all material received within a given period</p>
3	Link and Trace Reports	<p>Report linking Weigh-Bridge transactions with Gate transactions</p> <p>Report linking Incoming Gate transactions with matched Weigh-Bridge Transactions</p> <p>Report linking Outgoing Gate transactions with matched Weigh-Bridge transactions</p> <p>Report indicating suppliers avoiding weigh-bridge after entry</p>

3. Technical Architecture

The solution comprises of a client and server application. The client is an Android application that runs on a mobile device and is used to capture the data at each camp site. Multiple mobile devices can be used to capture data from each camp as well. The server application runs on cloud, captures the uploaded data and stores it in a database. Reports are then generated from this centralized data repository. The overall data process flow is as depicted in Figure 2.

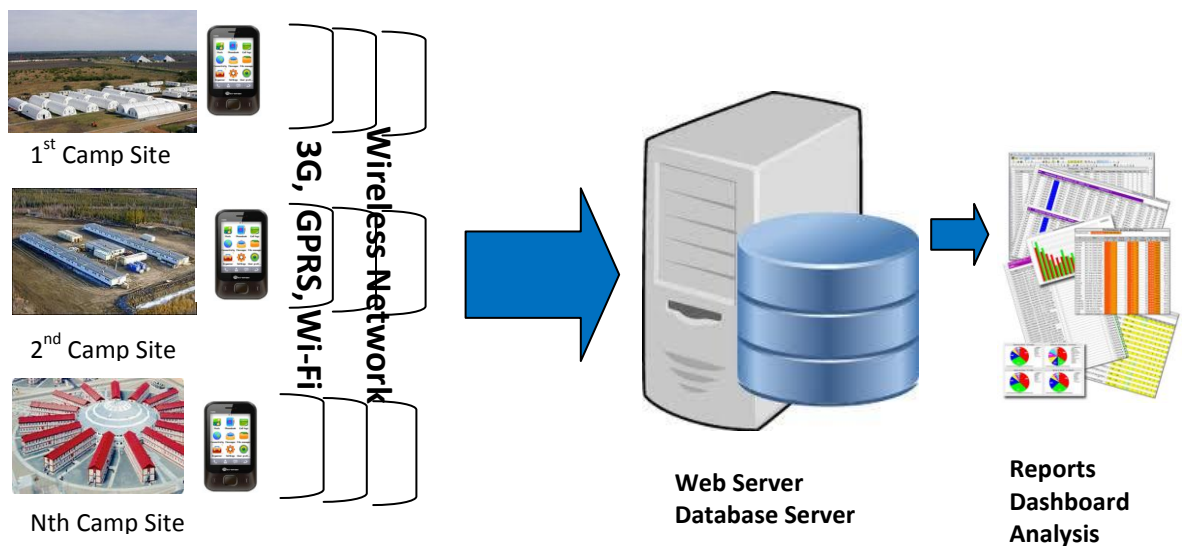


Figure.2: Data Flow Diagram

The client mobile application is designed for ease of use and data entry is done through drop-down selections and easy navigation with data validations. Thus the data for each transaction including capturing three photographs can be completed in about 40-50 seconds.

The data is uploaded to the server through a web service and is then inserted into the database in structured tables. The photographs are stored on the server hard disk. The weigh bridge data can also be uploaded to the server and stored in the database through administrator login ID for reconciliation with the Gate transaction. Further, this near real-time data can also be compared with ERP data. These reports can be exported into Excel and PDF files for archival and presentation purposes. Every report is also searchable dynamically through text search in the grid control. This flexible grid view allows users to sort/search/paginate on any data type column.

3.1. Android Client Application

The Android client application consists of the following screens for capturing the Incoming and the outgoing trucks which carry various materials such as Bitumen, Steel, Cement, Aggregate, Fuel, Sand and others. The first screen is a login screen wherein the user needs to enter his/her login details for authentication. Only authorized users are allowed to capture data and upload the same into the cloud server application. The login screen is as shown in Figure 3.



Figure.3: Login Screen of the Android Mobile Application

Users in the Android mobile application are managed by a local administrator user whose credentials are pre-loaded into the application. The admin user can manage (Create/Edit/Delete) additional users of the application but cannot capture or upload the data for any transactions. Non-admin users can also retrieve their passwords if it is forgotten.

After successful login, the second screen is as shown in Figure 4.



Figure.4: User welcome screen that displays user details and the camp ID.

In this welcome screen user details along with the last login data time and the camp ID that this user is assigned to are displayed. The user then has to select one of “Incoming” or “Outgoing” buttons depending on the truck status for which the data is about to be captured.

If the user selects “incoming” button the following incoming screen is displayed.



Figure.5: “Incoming” screen options.

As shown in Figure 5, all types of materials for which the meta data has to be captured are displayed as easily readable and intuitive icons along with text. User needs to only tap the appropriate icon. Then the corresponding screen of meta-data details of the material to be captured, for example Bitumen, is as shown in Figure 6.

The figure displays two sequential screenshots of a mobile application interface titled "Incoming - Bitumen".

The left screenshot, taken at 8:18 AM, shows the form with the following fields and values:

- Bitumen Grade: VG 30
- Starting Point: Supplier
- Registration Number: AP11FG, 2351
- Material Quantity (Kg/Lt): 2500

The right screenshot, taken at 8:19 AM, shows the same form with a "Save Form Data" button at the bottom. The values in the fields are identical to the first screenshot.

Figure.6: "Incoming" screen for Bitumen selection

Material (here Bitumen), Vehicle and Document details can be captured by the user by easily entering the appropriate data in the fields. The data fields and the controls vary depending on the type of material details to be captured. Vehicle details include the registration number, its source and destination details. In addition, photographs of the Material, Vehicle and the Document also can be captured using the photo feature of mobile phone device.

The screen for "Outgoing" is very similar to the "Incoming" screen shown above.

After the user enters all the relevant data in the screen, data is saved upon clicking the button "Save Form Data". The date and time of the truck arrival or departure at the gate is automatically captured by the system when the form data is saved. All such captured data is then sent to the centralized server application where the meta-data is stored in a database and the photographs with Latitude and longitude details along with Camp id and date time stamp are stored in the local server folder for viewing and reports generation through the server side application.

3.2. Server Side Web Application

The server side web application can be used by managers, executives and team leads for monitoring, analyzing and generation of reports from all transaction data across all camps located at various parts of the country. This application can be hosted on a public cloud server and can be accessed through internet using any one of the popular browsers. The following are the functionalities of this server side application:

1. Log-in screen: Only authorized users all allowed access into the system as shown in Figure 6.



2. Dashboard: Authorized users can instantly get to know the activity in the last 24 hours across all camps in this dashboard. The following is a screenshot of the dashboard.

CAMPID	CAMPNAME	LASTTXNDATE	INTXNCOUNT	OUTXNCOUNT
CTG-NMDC	CTG-NMDC	Feb 28 2013 8:01PM	0	0
CTG-YARD	CTG-YARD	-N/A-	0	0
HO	Head-Office	-N/A-	0	0
UP-196	UP-Batching Plant	Feb 28 2013 10:04PM	0	0
UP-204	UP-Badshah Bagh	Apr 16 2013 4:06PM	0	0
UP-22	UP-Mandola	Apr 16 2013 7:02PM	0	0
UP-66	UP-Baoli	Feb 28 2013 7:06PM	0	0
WB-139	WB-139	Feb 28 2013 11:48PM	0	0
WB-165	WB-165	Feb 28 2013 10:59PM	0	0
WB-183	WB-183	Apr 17 2013 10:23AM	0	0

3. Viewing all transactions data from various camps spread across the country (or anywhere in the world).

The screenshot shows the ABC Infra web application interface. At the top, there is a header with the logo 'ABC Infra', user information 'Hello admin, Last login: 01 May 2013', and links for 'Change Password' and 'Logout'. Below the header is a navigation sidebar with options: Dashboard, Transaction Reports (selected), Gate Analysis Reports, Vehicle Reports, Link & Trace Reports, and Admin. The main content area displays 'ABC Infra Gate Transactions Report- This site will contain the various reports based on ABC Infra Gate Application, Weighbridge Application and Stores Data.' There are two filter panels: 'Gate Transactions within Date Range' with 'From: 01/02/2013' and 'To: 21/02/2013', and 'Gate Transactions within Preset Range' with radio buttons for 'Yesterday', 'Last Week', and 'Last Month'. Below these is a table titled 'ABC Infra Gate Transactions Report for WB-139' with columns: Date-Time, User, In/Out, From, To, Material, Type/Grade, Vehicle, Quantity, and Photos. The table contains five rows of transaction data.

Date-Time	User	In/Out	From	To	Material	Type/Grade	Vehicle	Quantity	Photos
20 Feb 2013 - 00:02:00	vittal	In	Chainage - 118.000	WB-139	Empty	Empty	WB51A4626	32334.00	View Photos
20 Feb 2013 - 00:04:00	vittal	In	Chainage - 118.000	WB-139	Empty	Empty	TN45AW4916	17949.00	View Photos
20 Feb 2013 - 00:16:00	vittal	In	Chainage - 118.000	WB-139	Empty	Empty	WB51A4581	33778.00	View Photos
20 Feb 2013 - 00:19:00	vittal	Out	WB-139	Chainage - 118.000	Aggregate / Mix	Aggregate - GSB	WB51A4626	33821.00	View Photos
20 Feb 2013 - 00:24:00	vittal	In	Chainage - 118.000	WB-139	Empty	Empty	WB51A4635	33306.00	View Photos

A sample image of the vehicle Data time stamp is as shown below:



4. Compelling Benefits

The Mobile application is designed for ease of use, user-friendliness and is very intuitive with relevant graphic images and screen navigation with menu options, access control permissions and automatic uploading whenever connectivity is available. It is designed for minimal human intervention and ensures that accurate and relevant data is captured as fast as possible.

- All photographs can be watermarked with Latitude and Longitude along with camp ID and Date-time stamp for easy identification.
- Centralized dashboard allows corporate executives and team leads to monitor and analyze data on a daily basis through internet anywhere, anytime.
- The overall solution is highly scalable and can handle capture from multiple devices and is designed to work even in low-connectivity remote areas through offline and online support.
- Instant alerts through SMS and e-mail can also be provided to take immediate actions on transactions that are suspicious and abnormal

Comprehensive reports not only allow the executive management to track and monitor the material movement across all camps through intuitive dashboard, but also help them identify discrepancies and abnormal activity almost immediately. Alerts can also be configured and activated to take instant action on any abnormal activity. These reports are most valuable in detecting any kind of loss and can save crores of rupees for the Company.

About mSpace Technologies Limited

mSpace Technologies Limited is founded by former IIT and IIM graduates with over 80 man years of experience in the IT space. We provide Mobile Business Advantage to businesses across verticals (Infrastructure, Logistics, Utilities etc) by providing the following quality services:

- Business Consultancy
- Mobile Strategy - Solution conceptualization
- Design and Build Mobile Applications and end to end solutions
- Managed Solution Design Expertise - Hosting and Maintenance

These solutions are aimed at tracking and optimizing any business process or activity spread across various geographies thereby allowing near real-time monitoring of operations. This results in not only major savings in time, material and management but can also be used to significantly optimize operations through analysis of the data collected.

- Telephone: +91-40-40192803 / 09246084979
- E-Mail: info@mspacetech.in