

## MODERN LOGISTICS IN INDUSTRIAL MANUFACTURING

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***Abstract:** This work is part of a project on the potential contribution of electronics and information technologies to the logistics in industrial systems . By managing using RFID components and systems more effectively during use and in the transition technical, environmental and economic efficiency could be increased. This working paper provides a short overview of RFID technology and romanian S.I.M.I. concept . The principles of RFID technology are briefly explained and especially also our own applications realised with RFID passive and active technology.*

***Keywords:** RFID, SIMI, ReaderNet, tag, reader.*

### 1. INTRODUCTION.PRINCIPLES OF RFID

A typical RFID system will consist of a reader, a tag and some kind of data processing system to process the data read from the tag. The tag also is called transponder, an expression which is derived from TRANSMitter/resPONDER – in some cases "tag" is used for low-frequency (e.g. 125kHz), whereas "transponder" is used for high-frequency (e.g. 13.56MHz and 2.45GHz) "tags". [1]The complexity of the READER (or interrogator) can vary considerably, depending on the type of tag used and the function to be fulfilled. Basically a reader has radio circuitry to communicate with a tag, a microprocessor (to check and decode the data and implement a protocol), a memory (to store data) and an antenna/s which may or may not be enclosed in it.

### 2. MANUFACTURING ASSEMBLY

The potential applications for this technology are numerous. RFID technology offers inexpensive read-only tags, which are generally short range, or more expensive long range, read/write devices with large memory capacities. . For example, these tags are used in factories to track items through their production cycle. Given the short read range of these tags, the item typically travels on a conveyor bringing it in close proximity to the interrogator.

Short range systems are also used for personal identification and access control operations. The longer range tags are finding many applications in transportation, as these tags can be read at distances up to several hundred mms. They are being used to identify AGVs.

These longer range tag systems are also capable of being used in depots, factories, and warehouses to provide automated inventory of pieces with no human involvement. In addition to automatically identifying the pieces, these systems can locate pieces and direct a ATS system to the pallet very quickly.

For example the auto ID system increases flexibility and improves throughput in factories, significantly reducing the capital tied up in materials in the manufacturing processes(Fig.1). 2.45 GHz systems are characterised by directional reading, long reading range, high passage speed, good immunity to electromagnetic interference (EMI) and very high tolerance to dirt; they are still more expensive than low frequency RFID (125 kHz, 13,56 MHz) and optical systems (e.g. bar code systems).

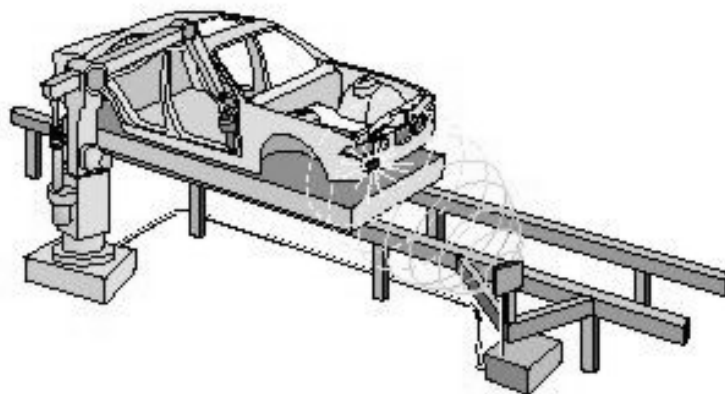


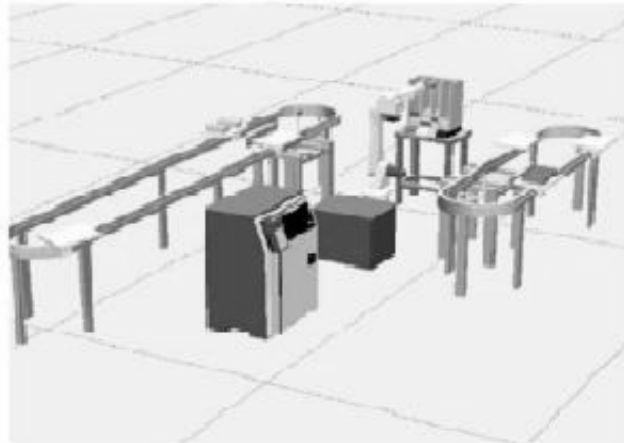
Fig. 1. Auto ID System

### 3. THE DEMONSTRATION LOGISTICS

The demonstration environment is intended to explore with increasing levels of complexity the potential benefits of RFID based data for management and logistics closed loop control. Although the demonstration environment will focus on manufacturing supply chain applications, it is emphasised that the demonstrator results are intended to map directly into other domains. RFID infrastructure (EPC, RFID systems, Savant interfacing system, PML) can be integrated into a closed loop control system (Fig.2.)

#### **4.SIMI CONCEPT**

SIMI is an integrated software and hardware system which is able to identify, locate and manage assets and personnel in a defined area using RFID technology; is able to connect access control, alarm and locking systems. The system offers simple practical, easy to use interface that allows you to control allocation, movement and security of any asset.



*Fig. 2. Visualisation of packing and storage system – operational view*

This can be anything from a laptop computer to expensive artworks. The system employs the latest Radio Frequency (RF) technology applying it in a simple form to pinpoint an event. Using miniature transmitters physically secured on an asset, it can recognise the current whereabouts, who owns or uses it and where in the building plant it is allowed to go and at what times. This allows the user to fully customise the system's entire operation. A unique transmitter 'tag' is installed onto or into a high value item and its details are programmed into a database together with all the details pertaining to the make, and other comparable model number, serial number, parts allocation and office allocation etc of the tagged asset(s). Even pictures of the parts manufactured or owner can be included.

#### **5.SIMI TAGGING SYSTEM**

Through the network of readers-ReaderNet, which are all allocated positions on a scale floor plan of the factory, any of the following transmissions states are relayed to the database. The types of data transmissions typically available in the system are:

- the part management transmission
- the security transmission
- the maintenance transmission

The sophisticated software modules TagARTIdent, TagARTMon analyses the received data and will, depending on the system set up & configuration, log the event, raise any appropriate alarm, or track the asset and display its zoned location on a pre defined map, among many other possible operations. This is done by active tags that each transmit a unique ID at a factory pre-set time interval. Multifunction readers, appropriately situated in the area where position monitoring has to be conducted, interpret signals transmitted by the tags. All tags interpreted by a specific reader are in fairly close proximity to the reader; enabling the position of the tags to be established within a zoned area. The security transmission (Anti-Tamper) is activated by any movement or attempted pilfering of the tagged asset. The transmitter is equipped with an anti-tamper feature. Any activation of these devices causes the transmitter to broadcast an alarm sequence, which is in turn transmitted through the readers and network to the database. Depending on the system set up and configuration, the software initiates various alarms on receipt of the transmission. The alarms can be set to require a response from the operator. Various alarm response modes and activation of other hardware can also be initiated, for example, CCTV camera shots or calls to an armed response security company. Through the receiver network it is possible to develop an audit / management trail of the item as it moves within the monitored area. Various comprehensive reports can be tailored and produced from this audit trail.

**6. THE SIMI HARDWARE STRUCTURE**

In the fig.3 is presented one of the possibility to design and realise the ReaderNet .  
 In the fig.4 is presented a real ReaderNet designed and installed by us in a romanian plant in two phases, the hardware being under the general control of SIMI

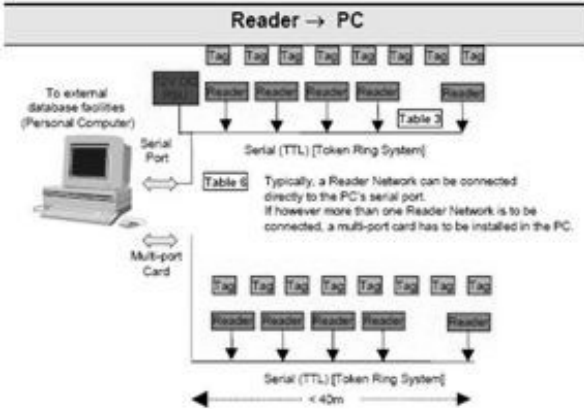


Fig.3. The ReaderNET concept

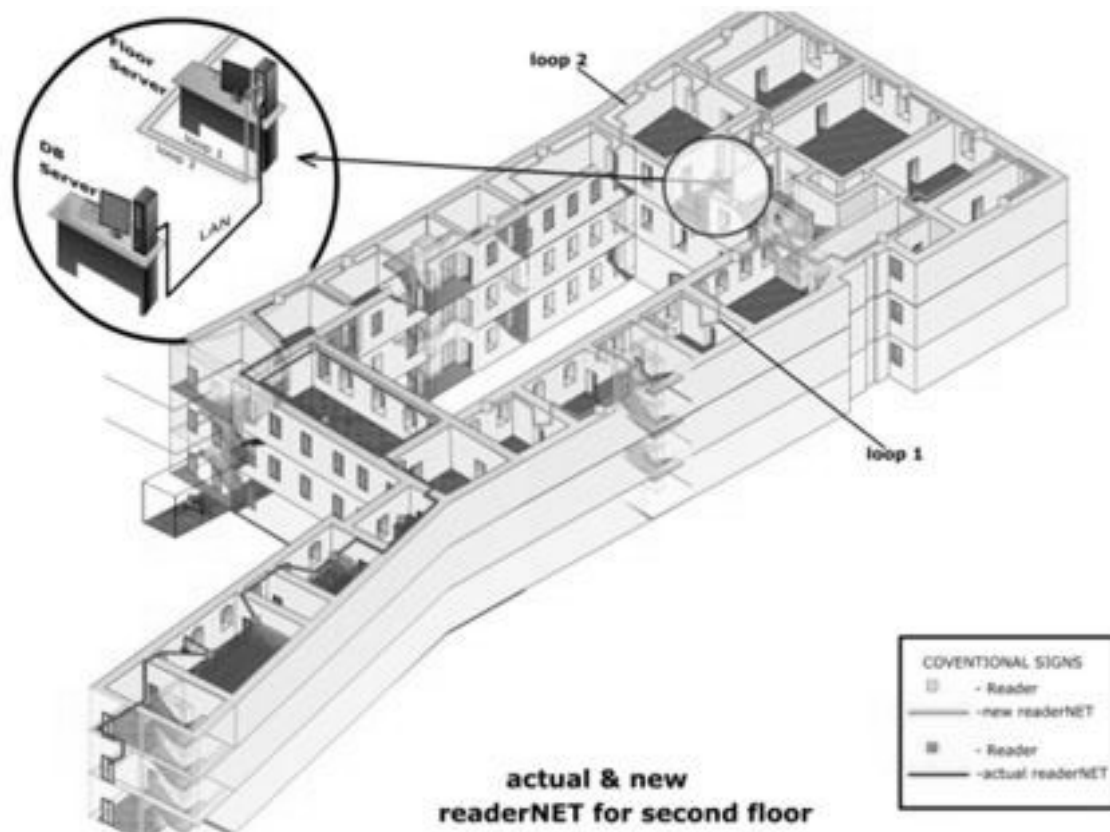


Fig.4. SIMI in an romanian plant

The Reader ( Fig.5) comprise the following functionality and properties[2]:

- RF Module (RF Receiver and Demodulator).
- Micro-controller
- LED indicators on the output connectors



Fig.5.Reader

The unit receives RF data on a frequency of 433.92MHz. Such data is demodulated, interpreted and validated by the microprocessor. If the data is valid, relevant data is output to in a serial format at a baud of 57 600 bps. Although the voltage levels are 5V TTL levels, it is compatible with all RS232 devices.

More than one reader can be connected on a ReaderNet. A token ring system is incorporated to prevent data from colliding on the data line and also to give every reader on the network its

own time frame to transmit data on the data line. Each reader in a reader-net is programmed with a unique ID (Reader Address). This device is externally powered (8.5Vdc 13.6Vdc). The unit regulates the power internally to 5Vdc. The PS100 Power Supply is recommended for use with the Reader. The device is aligned to receive RF at a frequency of 433.92MHz. The bandwidth is 20MHz.. Size 84mm x 40mm x 19mm. Input/Output Connections 2 x RJ45 Sockets.

## **5. GENERAL INFORMATION ABOUT SOFTWARE**

The application suite is comprised of three (3) software modules:

### *5.1 Readernet Server (Administrator Application)*

This application is the live link to the Readernet. There will be a physical connection between the Readernet and the Server PC, either via a COM Port or USB port. This application needs to be started with a Parameter indicating the COM Port to connect to, whether it is a Physical COM Port or a Logical one(as with USB). A sample start-up for the application is “TagArtident\_Readernet\_Server.exe <COM=1>” (indicating that the PC will be connect to the Readernet using COM1).

Other Start-up parameters include: <AUTO=Y> Sets the application to Auto-Start monitoring the Readernet <DELAY=n>, Sets the application to start monitoring the Readernet n seconds after it opens (this must be used in conjunction with <AUTO=Y> above). The Readernet Server is an application that needs to be installed on a SECURE Server PC.

### *5.2 Readernet Monitor (Administrator Application)*

This application is the Rules Monitor application. It monitors ALL activity detected by the Readernet Server and performs any operations specified by the user according to the rules specified.

The rules are set using the User Application, under the Group Rules Screen. Here the user can specify what activities can be monitored, (e.g. a tag entering a zone), and what actions to take.

This application also needs to be installed on a SECURE Server PC. It can be installed on the SAME PC as the Readernet Server, but this is NOT a requirement.

### *5.3 User Application*

The user application is the user’s interface to the SIMI. This application is used to do the following: add users and other tagable parts,tools,etc , monitor Violations in the System (i.e. broken rules), view tags in zones, report on Activity, set Rules and actions relating to users and assets.

Administrators, Operators, Security personnel, etc can use the User application. This application has built-in security that can be controlled by the permissions granted to each individual user. This application does NOT need to be installed on a Secure Server PC. The software application designed and installed by us for the Reader NET of the fig.no.4 is presented in the fig.6.



Fig.6 . *Graphic interface of SIMI*

SIMI can be customised to meet user's specific requirements. SIMI uses an open MS-SQL database and has the ability to call other programs allowing users to perform their own system integration; can be a completely wireless system, hard wired or a combination of the two RFID tags are assigned to people and parts,tools,devices so that they can be located in real time.

The moment that an asset is disturbed an alarm can be activated. The SmartTag system can track and trace up to 2.4 billion people and assets across an unlimited number of locations.

## 6.CONCLUSIONS

Features [3] of SIMI for improving logistics in manufacturing:

- it uses high and medium distance communication (50-100 m)
- it uses a non contact technology
- it is very difficult to fake
- it uses a lot of graphical interfaces for monitoring and for management
- it allows the identification and management of a great number of devices,parts,etc without a human operator
- it allows localization and identification of assets in large areas

- online localization of items
- history of movement and inventory of parts for any desired time interval
- detecting any movement in range of 1 mm of an item

## **REFERENCES**

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