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RFID Application for Molten Iron Carriers (Ladles) in Steel Plant

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Abstract: ***As we transition into the 21st century and prepare for the future it becomes vital to protect the environment by reducing Visakhapatnam Steel Plant's carbon footprint and redistributing man power to more specialized roles. Centralized automation of logistics will enable an increase in efficiency and quality production of steel in VSP.***

Keywords: RFID, transponder, antenna, ladles

1. Introduction

Visakhapatnam Steel Plant (VSP), the first coastal based Steel Plant of India is located, 16 KM South West of city of Destiny i.e. Visakhapatnam, India. Bestowed with modem technologies, VSP has original installed capacity of 3 Million Tonnes per annum of Liquid Steel which is up-graded to 6.3 Million Tonnes per annum of steel. At VSP there is emphasis on total automation, seamless integration and efficient up gradation, which result in wide range of long and structural products to meet stringent demands of discerning customers within India and abroad. VSP products meet exalting International Quality Standards such as JIS, DIN, BIS, BS etc.

VSP has become the first integrated Steel Plant in the country to be certified to all the three international standards for quality (ISO-9001), for Environment Management (ISO-14001) & for Occupational Health & Safety (OHSAS-18001) now named as QSHE together. The certificate covers quality systems of all operational, maintenance, services units besides Purchase systems, Training and Marketing functions spreading over 4 Regional Marketing Offices, 20 branch offices and 22 stock yards located all over India.

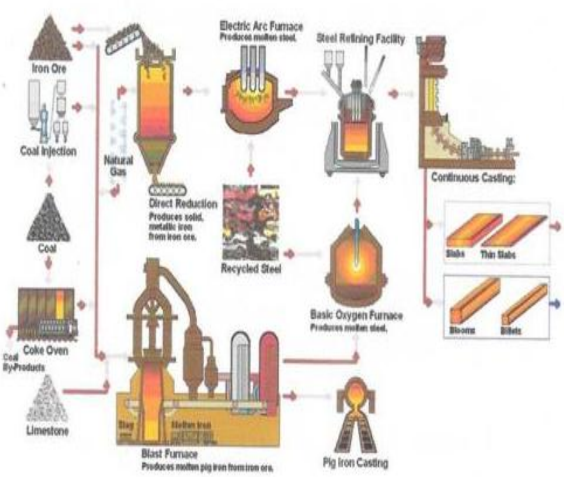
2. VSP Technology: State-of-the Art

- 7 meter tall Coke Oven Batteries with coke dry quenching
- Biggest Blast Furnaces in the Country
- Bell-less top charging system in Blast Furnace
- 100% slag granulation at the BF Cast House
- Suppressed combustion-LD gas recovery system
- 100% continuous casting of liquid steel.
- "Tempcore" and "Stelmor" cooling process in
- LMMM & WRM respectively
- Extensive waste heat recovery systems
- Comprehensive pollution control measures
- Operation power requirement of 380 to 400 MW is being met through Captive Power Plant. The capacity of the power plant is 515 MW.

3. Major Departments

- Raw Material Handling Plant (RMHP)
- Coke ovens & Coal Chemical Plant (CO&CCP)
- Sinter Plant (SP)
- Thermal Power Plant TPP)
- Blast Furnaces (BF)
- Air Separation Plant (ASP)
- Steel Melting Shop (SMS)
- Continuous casting Department (CCD)
- Light & Medium Merchant Mill (LMMM)
- Wire Rod Mill (WRM)
- Medium Merchant & Structural Mill (MMSM)

4. Rough Diagram of the Plant

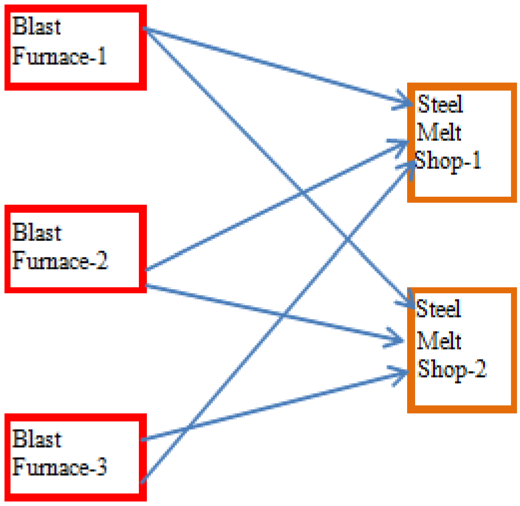


5. Paper being submitted and its idea

Presently VSP utilizes ladles (molten iron carriers) to transport molten iron from the three blast furnaces to the two Steel Melting Shops (SMS) which yields 6 crossing paths. Each path utilizes a diesel-powered engine to pull ladles driven by employees. In addition ladle movement is directed by employees for safe operation. With the imminent transition to where automation is compulsory and keeps up with demand, *it is proposed to use radiofrequency identification to control the ladles, powered on electric paths, from a centralized control station. This will minimize man power and diesel usage, thereby increasing productivity.* Radiofrequency identification allows usage of electromagnetic coupling to establish a system whereby the mainline computer system would have access to a reader, which can then be connected to an antenna. The reader will initiate signals via this antenna towards a transponder which will receive the signal. Here, the transponder will be active in nature and runs by the same electric grid that runs the ladles. The transponder will utilize this energy source to send back an appropriate response to the reader which will be picked up by the antenna. The reader sends the data from the transponder to the main computer system as acquisition for logging, subsequent data modification and processing. This trifold communication system is simple yet efficient as it uses less energy than passive RFID systems by necessitating three times less powerful signal sources for initiation of response signal from the transponder for the signal transmission to the reader's antenna. The setup will also allow five times the range than passive RFID and as such will suffice for the distance needed in the plant and allows thousand times larger read/write data for greatest data bandwidth with communication. The main computer system will thus be able to communicate with the ladles by instantaneously collecting position and velocity measurements of all ladles and initiate movement along tracks as needed. This system can improve safety significantly by removing the compounded scope of human error in the current system and enable a serious and thorough system of proofreading by a smaller group of well-trained workers in control center to reduce error and also increase efficiency. Each of the various combinations of paths will be accounted for the RFIDs receiving data from the main computer system to guide the ladles on non-colliding paths and in alternating patterns to maximize efficiency in getting molten ore to the SMS while drastically reducing diesel consumption and manpower and moving the steel plant towards a more automated structure.

6. Tentative figure of the idea

Represents cross-paths between Blast Furnaces and Steel Melt Shops on which RFID marked ladles move and be identified from central control room.



7. Other recommendations for future

To explore the possibilities of identifying the snap of conveyor belts well in advance to avoid heaping of materials and shut downs.