# INTELLIGENT BASED AUTOMATED STORE AND RETRIEVAL SYSTEM WITH RADIO FREQUENCY FOR INDUSTRIAL APPLICATIONS

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***Abstract*- This project proposes a means of intelligence for an RF based automated storage and retrieval system (ASRS). Main objective of this project is to provide intelligence in the existing Warehouse Management System (WMS), which is a non-intelligent machine and mainly used for storing and retrieving of raw products in manufacturing unit. This project aims by implementing intelligence in ASRS control along with RF module. ASRS having Programmable Logic Controller, which controls and coordinates the movement and performance of ASRS. Intelligence with ASRS is provided for storing or retrieving appropriate amount of load according to the input from users. Hence the construction and cost of the system is huge, the implementation is simulated using SCADA.**

**Keywords - RF module, Warehouse Management System, intelligence, PLC.**

## I.INTRODUCTION

Since automation plays a lead role in day to day era, centralized control in modern construction management to identify and quickly collect the materials for reliable operation which has been detailed by Javad Majrouhi Sadroud [1]. In dynamic industrial environment collection of finished products is done by automated guided vehicle, so coordination and collision avoidance among them which is detailed by Roberto Olmi [2].

Since industries have a dynamic floor, AGV path selection and guidance may be difficult, so path planning and localization is proposed [3]. Research on AGVS proved to be like a robot, which can be reprogrammed and perform sophisticated logistics operation in dynamic industrial environment [4].

In manual operation, operator has to move the forklift of automated industrial warehouse vehicle to shift the load, but external and internal sensors were developed with forklift in order to automate the system [5]. Even in the rough industrial floors, the automated gain vehicle should be robust enough to travel, so that the performance requirement can be met. To track the position of vehicle they can be monitored using several sensors or by simple CCD cameras [6].

To avoid obstacles while moving the vehicle in industries, the robot can be programmed for dynamic environment [7]. In dynamic manufacturing units, the manual on-board collection of materials being automated by using the radio frequency in which the RFID is used for warehouse management [8][9].

In modern manufacturing enterprise, auto warehouse with Automated Storage and Retrieval System (ASRS) of Material Handling System (MHS) plays an important role by shifting the products and materials in this dynamically competitive world [10]. It allows the load to be shifted quickly, safely and precisely within a warehouse environment and thus rapid configuration to the right storage. The control of ASRS can be man-aboard or remote control. In man aboard physical interaction with ASRS is needed to shift the loads in or out. But in remote controlled ASRS, the system controller is a standalone PC. The software resident on PC will take care of bin/part number. According to the instruction from operator the ASRS store/retrieve the load.

PLC technology is rapidly evolving and it plays an increased role in the automated industrial warehouse environment [11]. An ASRS is proposed for automatic shifting of loads from specific storage locations which is supported with number of computer techniques. ASRS is used in the places where large volume of loads needs to be shifted. The storage density is important due to the limited availability of space in production environment. The expensive damages to the load and also to the human can be avoided by centralized control of ASRS [12]. So the ASRS is enhanced with RFID reader in asrs and RFID tags [13] in the racks where control can be coordinated from PC.

Existing system of ASRS use the concepts where the materials stored in a heighten racks and storage of items handled manually by a crane system. The material is stored in standard size bins, crates or pallets,

which are stacked into high rise racks, with multiple levels. The length of the rack is 100 -150 meters and height is 8 -15m. ASRS have the aisles, in each aisle there is a stacker crane which picks up the load from a station and stores in a location by operators physical interaction and also take the load out from the racks [14]. That is they can place or retrieve loads. To support ASRS with accurate vertical alignment the track and ceiling guided with rails or channels. A pickup and delivery station is a simple elevated structure to board the material of load. They are designed to transfer, rotate or heighten loads if required. Practically the human operator of the ASRS is provided the cabin in stacker crane, where operator does all the tasks. Person has to sit in the cabin and manually operate the crane. A well trained person for operating the crane is allotted and whenever any load to be moved in or out, operator has to move the crane at required height, length, left, right. The operation and physical verification of operating conditions must be checked regularly. All safety measures for the manual operations are made with care.

## II.PROPOSED IDEA

This project aims to develop the functionality of remote control for ASRS by RF module such that it stores or retrieves according to the input at the user end. In remote controlled ASRS, software is stored in the PC and communicated with the ASRS through wired LAN. After verifying the available database in the system controller, the command has to ply over the wired LAN means to the PLC and as per the commands received by the PLC, control actions have to be performed, and the database has updated continuously. The flexibility of ASRS is enhanced using RF module. ASRS has RF module and racks in WMS having the RFID tags.

The exact quantity of input can be selected by the operator using commands in the system. Intelligence in ASRS is provided to store or retrieve the exact amount of material through selection. Instead of aisle, ASRS is developed with arm for picking or dropping the parts/items like bolts, pipes, screws etc.

### *A. ASRS Description*

ASRS is a computerized and used for handling the material which is at a height. The system performs the automated store operation. The system offers effective utilization of space, since the floor space is costly in industrial environment. Minimum man power, due to computerized store/retrieval operation. Control to the ASRS from pc is provided through wired LAN. The software of ASRS can handle the material management systems and also management information systems (MIS) for effective monitoring and control.

They are divided into four major parts high rise storage racks, crane, storage bins and controllers. Fig.1 represents the block diagram of ASRS.

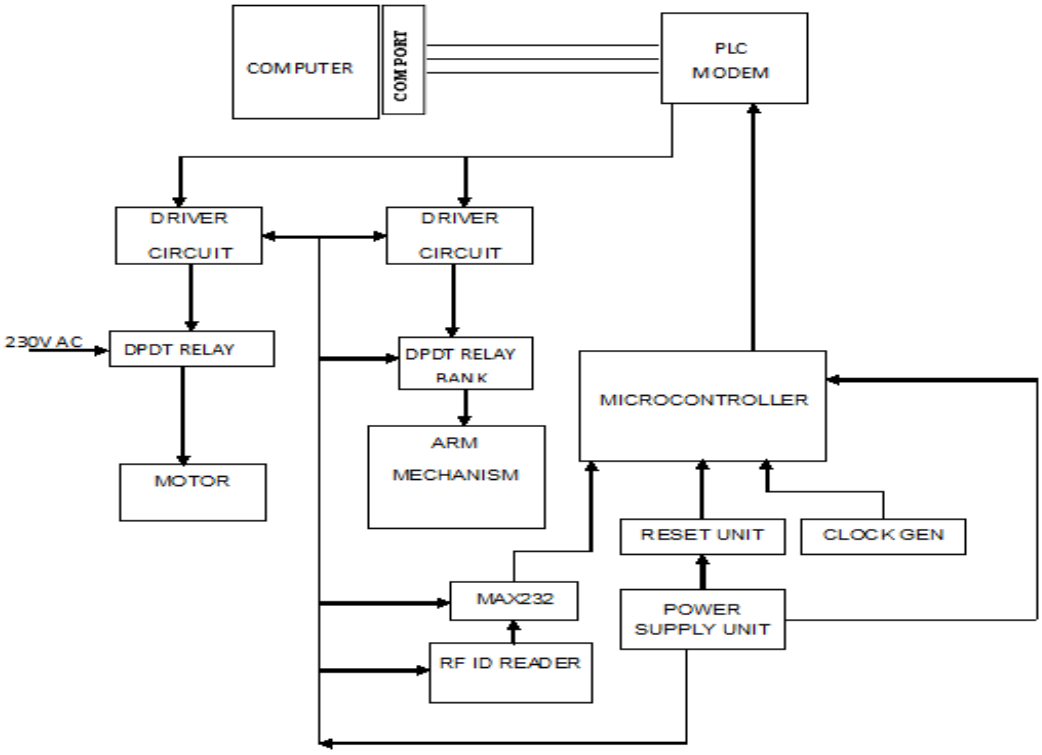


Fig .1.Block diagram of ASRS

*1) High Rise Storage Racks*:

For effective utilization of vertical space, generally the materials are stored in high columns. The racks are designed in these columns, where they are made up of steels and can be installed quickly. Two rails for moving ASRS over the racks, in bottom and top. Bottom fixed with respect to storage racks and top rail for movement between two rows. RFID tags are positioned in front of every rack.

*2) Crane:*

This is a twin column structure, handles store/retrieval operations. The fork which extends left/right side or for dropping material into bin. For emergencies, in case the automation is failed operator can manually operate from the cabin.

*3) Storage Bins:*

Containers used for store/ retrieval in ASRS. The material or raw products like bolts, pipes etc will be dropped are taken out from these bins. So the bins should be of dust free and correct dimensions are used. RFID readers are fixed in the front end of the bins.

*4) Controllers*:

PLC and Microcontroller:

Practically to replace the human operator on the stacker crane and the entire task the operator would do, is automated by micro PLC. It is programmed to execute commands received from system controller, by moving the stacker crane for the desired operations, and giving a feedback to the PC based system controller. The stacker carne controller is connected to several sensors and limit switches to get the physical inputs. The output goes to the operator's panel for activation of limit switches. The sequencing of operations like inputs from sensors and limit switches are programmed in the PLC. And also the driver and relay operations for rotate, elevate, stretch of arm developed in ASRS also programmed in PLC.

According to the command from microcontroller the PLC make arm for ASRS to respond. Microcontroller is used as another support for ASRS.

*B. RFID*:

RFID module is connected with microcontroller. It operates under low frequency of 125 kHz. RFID tags are fixed at the front end of the rack. The product or part id is stored in the memory of microcontroller. Once the operation of ASRS is started the search for material begins. RFID reader reads all the digit codes of tags and once it is matched, it sends the identity for further processing to microcontroller. When code is matched and product is found, then according to the instruction from operator the material is shifted. Here passive type of RFID is used, when the reader is brought in contact with the tag of 6 cm the coil is influenced by magnetic field and becomes active.

*C. PC:*

PC along with memory, UPS, interface modules and cards are provided with reliable environment. The system software having menus for operator interactions with number of selection choices are displayed in windows screen e.g. bin number, column left/right, stop, store or retrieval. In memory all the product id and their quantity are stored. So the database is updated regularly. For user convenient software maintains the database of e-bin. A sample window representing various menus to operate ASRS through computer is shown below in Fig.2.

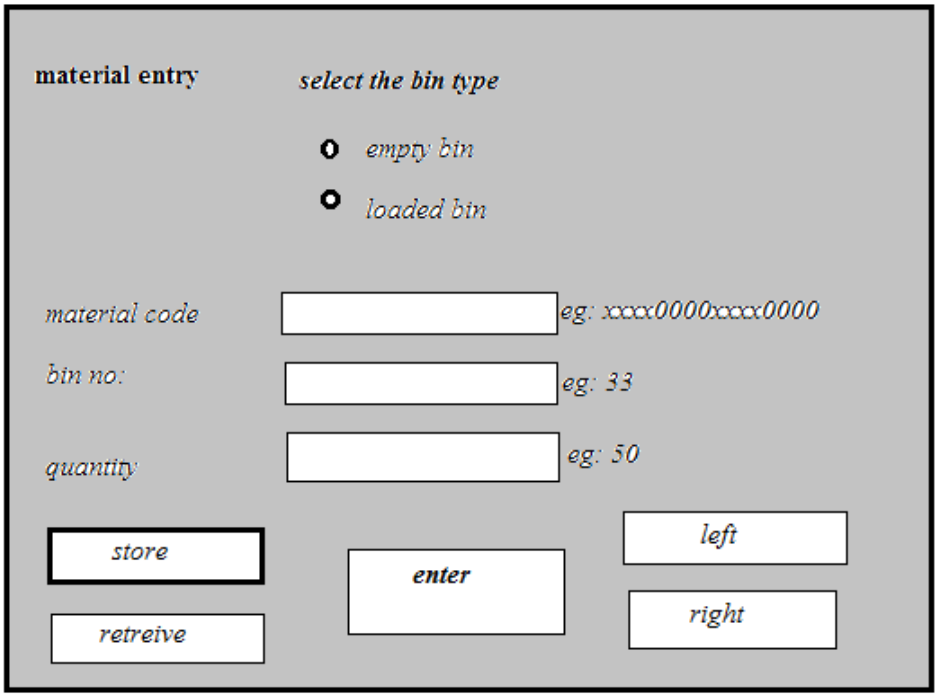


Fig 2: menus on windows screen

## III.SOFTWARE DECRIPTION AND SIMULATION RESULTS

SCADA is used for performing the simulation of this system. The PLC ladder logic is used in implementing this result and this is done in RSview32. The Fig.3 & 4 represents existing ASRS in which box of product is shifted. In this proposed system arm is developed in ASRS for picking each product. The simulation result for existing and proposed system is shown in the below figures. Two racks on the left side and right side, where the ASRS moves according to the operators intentions. Product id and quantity can be entered in the menu space provided in the screen. When the product id is entered the particular rack indicates green light. Once pressing the start button on screen or enter in keyboard ASRS will move to the particular rack and when RFID tag matches with the RFID reader, ASRS also indicated with green light. Green indication on ASRS indicates the RFID when id is “matched” and red indicates “not matched”. So according to user’s option ASRS will store or retrieve the material from particular rack.

### *A. Simulation result for existing system:*

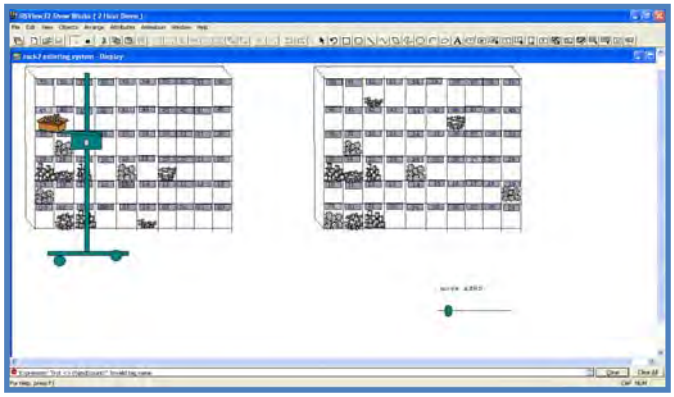

Fig .3.Retrieving a box of material from the rack number 49.

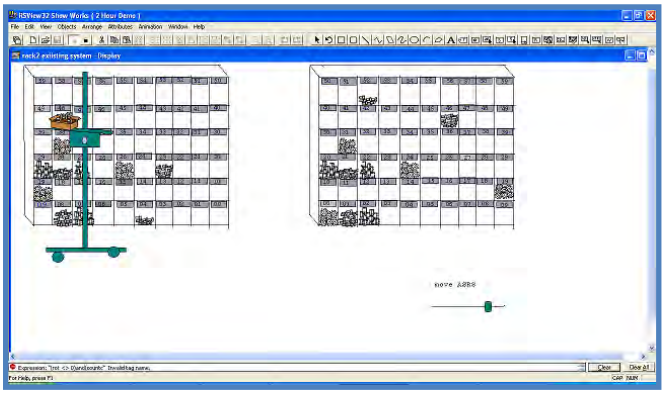

Fig .4. After retreiving the material , ASRS is ready to move.

*B. Simulation result for proposed system:*

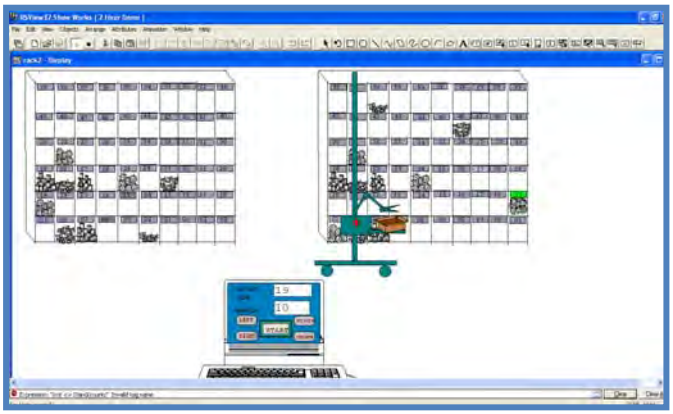

Fig .5. Enter the rack id, quantity and press start option, ASRS moves to the rack 19.

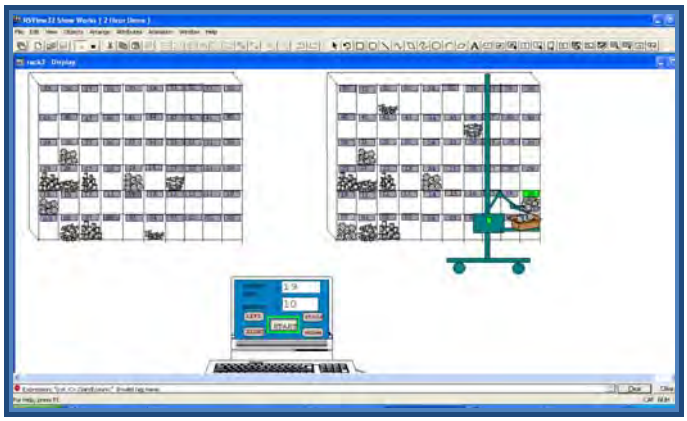

Fig 6.The RFID is matched by indicating green in asrs and retrieves 10 products from the rack.

## IV.RESULTS AND DISCUSSION

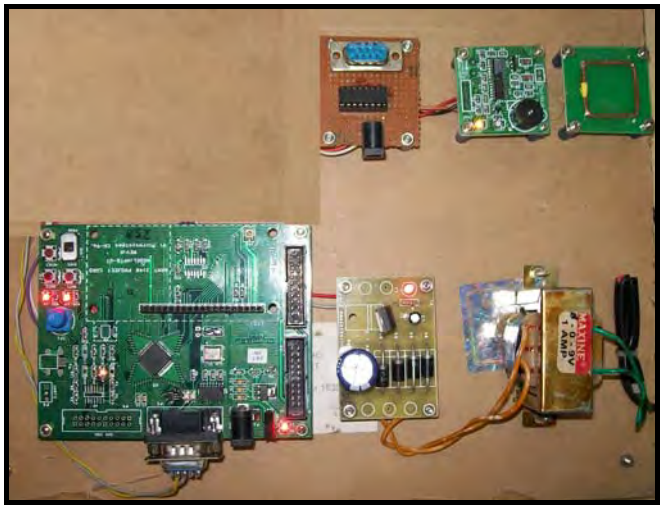

Fig.7.Hardware setup of LPC2148 connected with RFID and power supply .

The processor used is arm 7 LPC2148, RFID is connected with processor so that they can read the datas and transmit them to the processor for further processing through serial port connection as shown in the above figure. Power supply is provided to this circuit through step-down transformer.

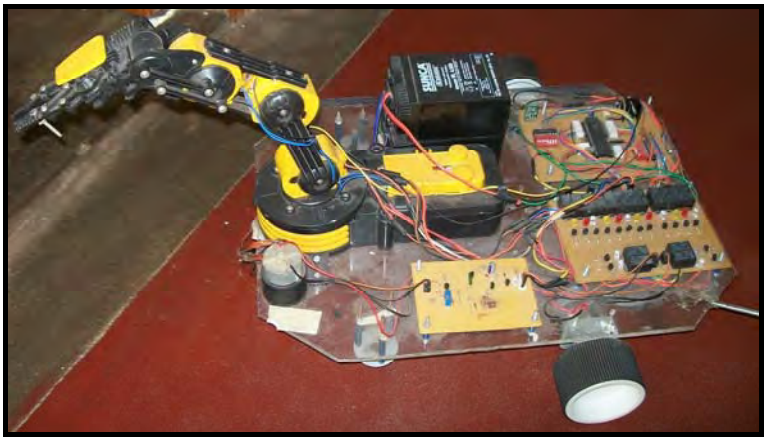

Fig.8. Arm developed for ASRS

Arm developed for ASRS, connected with the relay circuit so they can rotate, heighten and move their fork type arm to pick each material from the rack as shown in the above figure.

## V.CONCLUSION

The proposed system provides the industrial and manufacturing environment with automated operation. So that production can be increased with decreasing the time of selecting an appropriate material. Also the accuracy of the material and expensive damages can be avoided. Hence the system is expected to provide flexibility and secure environment. The usage of intensive cabling can be avoided. The system will increase the profit due to saving of more time.

In future the system can be enhanced with complete centralization of control through GPS, so that there is no need of human operator. Hence all the operations can be performed by robots and after collecting the material they automatically load them in a vehicle and send them to appropriate place inside the industry.

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