

Automatic Book Sorting Machine

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Abstract--This paper describes automatic book sorting machine techniques for the performance enhancement of existing library systems in India. The book placement mechanism is used to sort the books under RFID Cards. The prototype system uses a RFID Card to sort the books according to the arranged departmental boxes. Every department has its own departmental assigned RFID Cards which are placed inside the book. The conveyor belt is fixed with RFID Card detector/reader which identifies the departmental books by which the departmental assigned actuator is operated to push the books to departmental boxes. Earlier the books were sorted with the help of manually to perform the sorting task. Earlier book sorting machines were used identify the different books on a conveyor belt so man used to pick it and place in a place where it has to be kept, but ours machine used to sort the books and collect it in a separate bins in a specified departments.

I. INTRODUCTION

Libraries consist of several books, but with increase in education branches and researches, millions of books are being added to modern libraries. Manual sorting is a time consuming and tedious process for humans. This often results in incorrect placement of books on shelves. Consequently, people find it difficult to locate the books. Thus an efficient and automatic book sorting system is required to segregate books in a short period of time. Each book has its own identity in the form of call number or accession number. In the present library system, the books are sorted based on these numbers into different categories. This concept is used as a basis for the design of this project. Instead of the card containing call or accession number, the RFID card is used. The RFID card is specific for the books of specific department. The books to be sorted are made to move on the conveyer belt. The conveyer belt has three actuators to push the book to the containers of three different departments. The fourth department book will move straight till the end of the belt and is collected by the container. Thus books of four different departments will be segregated by the system.

II. LITERATURE REVIEW

1. Paper titled “Automatic Book Placement and Searching Technique for Performance Enhancement of Library Management System” International Journal of Computer Theory and Engineering, Vol. 2, No. 4, August, 2010.

This paper describes a book placement and book searching method for performance enhancement of existing library

systems. The book placement mechanism is used to ensure the placement of book inside the shelf according to assigned code to facilitate manual searching.

2. Paper titled “Model design and simulation of automatic sorting machine using proximity sensor” International Journal on Engineering Science and Technology, Volume 19, Issue 3, September 2016, Pages 1452–1456.

3. This research designed and developed an automated sorting object of a conveyor belt. The developed automated sorting machine is able to incorporate flexibility and separate species of non-ferrous metal objects and at the same time move objects automatically to the basket as defined by the regulation of the Programmable Logic Controllers (PLC) with a capacitive proximity sensor to detect a value range of objects. Paper titled “The RFID Technology and Its Current Applications” in proceedings of The Modern Information Technology in the Innovation Processes of the Industrial Enterprises, 2006, pp.29-36.

The paper gives an overview of the current state of the art in the radio frequency identification (RFID) technology. Aside from a brief introduction to the principles of the technology, a survey is given on major classes of RFID tags and readers, commonly used frequencies and identifier systems, current and envisaged fields of application, as well as advantages, concerns and limitations of use.

4. Paper titled “RFID Based Intelligent Books Shelving System,” presented at the Annual RFID Eurasia Conference and Exhibition, Istanbul Sep 5,6-2007 In this paper RFID based intelligent shelving system has been proposed to provide an efficient mechanism of books management monitoring through wireless communication between the RFID reader and the books is presented. the performance of RFID reader motion and tags data management such as retrieving information, matching with database, sorting out the order and displaying the status of books locations are discussed. A prototype consisting of monitoring PC with embedded controller, two dc motors with drivers, RFID reader and aluminium frame stick on rack have been developed. The design and development of RFID-Based books shelving system for automatic sorting of misplaced books in library is presented in this paper. The operation of this system relies on appropriate control strategy for smooth motion of RFID to capture (acquire) books data at appropriate speed. Software which displays the status of the books locations has also been developed.

III. MECHANICAL SYSTEM DESIGN

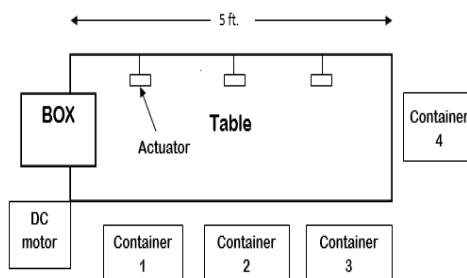


Figure 2.1 Top view of the system

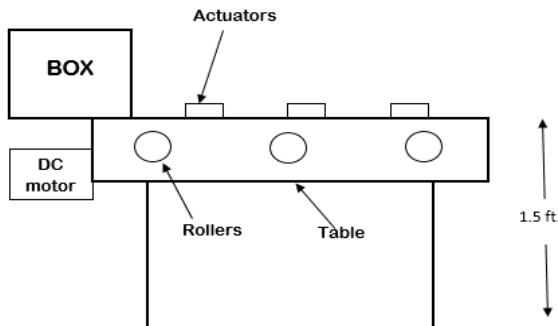


Figure 2.2 Side view of the system

A. Actuators

A linear actuator that creates motion in a straight line. This actuators typically convert rotary motion into linear displacement via screws or gears to which the knob or handle is attached.

Rack and pinion gears are used to convert rotation into linear motion. The flat, toothed part is the rack and the gear is the pinion.

B. Ball bearing

A ball bearings is a rolling-element which is used for maintain separation between the bearing races. Here the ball bearing used to generate rotational motion needed for the conveyor belt.

C. Conveyor belt

A conveyor belt is the system used for carrying books in this mechanism. In this belt conveyor system we use two or more pulleys, with an endless loop of carrying medium, the conveyor belt that rotates about them.

The belt is made of one or more layers. Many belts in general material handling have two layers. An inner layer of material to provide linear strength, shape called a carcass and an outer layer called the cover.

IV. ELECTRICAL SYSTEM DESIGN

A. IR Sensor

It is the combination of IR LED with photodiode. IR Sensors works by using a specific light sensor, to detect a select light wavelength in the Infra-Red (IR) spectrum. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which can be

detected using a threshold. The transmitter part is infrared LED which transmits continues IR rays received by IR receiver.

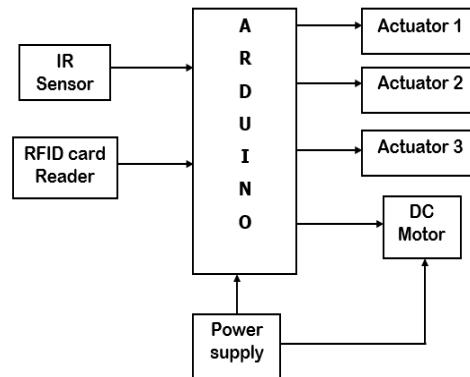


Figure 2.6 Block diagram of electronic system

B. RFID card

Radio-frequency identification (RFID) use electromagnetic field to identify automatically and track tags attached to books. The tags in the books contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response.

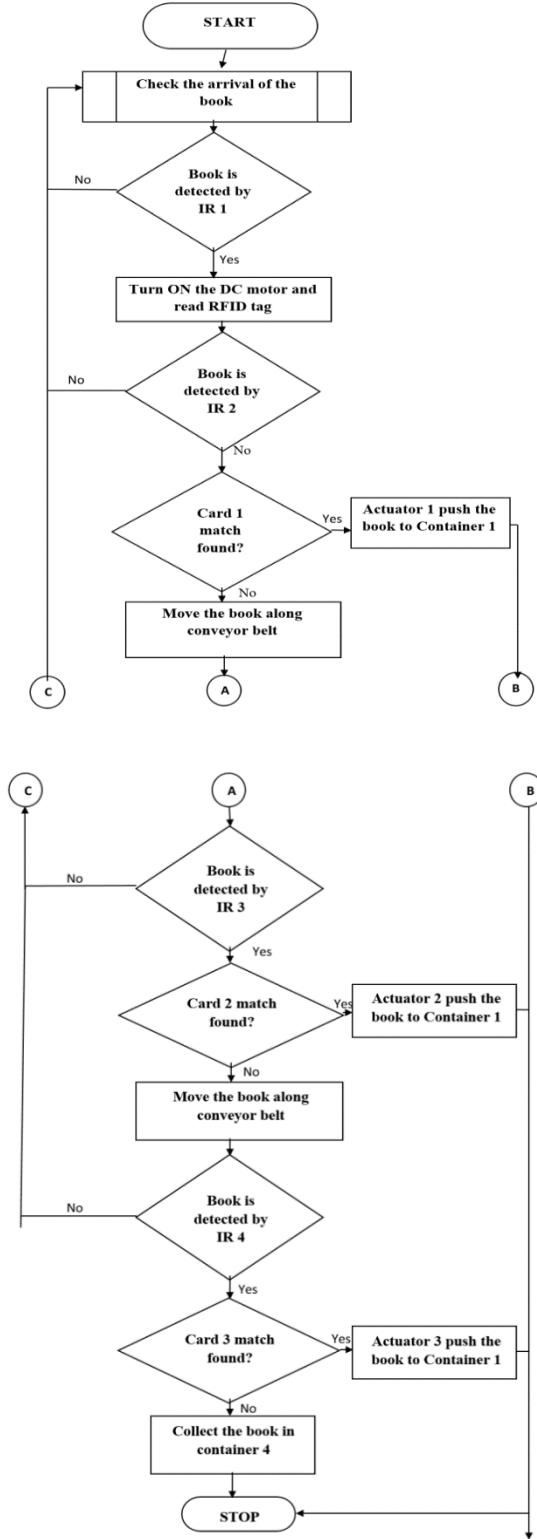
C. DC Motor

A DC motor is an electrical device used to convert electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. A coil of wire with a current running through it generates an electromagnetic field aligned with the centre of the coil. The direction and magnitude of the magnetic field produced by the coil can be changed with the direction and magnitude of the current flowing through it.

D. Arduino Microcontroller

It controls the position of stepper motor and servo motor with help of program. It is an open source prototyping platform based on easy to use hardware and software. They have digital and analog input/output pins that can interface into various expansion boards and other circuits and an Atmel 8, 16 or 32-bit AVR microcontroller with complementary components that helps in programming and incorporation into other circuits. Arduino programs are written in any programming language with a compiler that produces binary machine code. Here we are using Arduino Uno for controlling process.

V. FLOWCHART OF SYSTEM



VI. CONCLUSION

In this paper work, design of book sorting system is presented. This system uses RFID tag to read and identify the different department of the books that are to be sorted. The sorting algorithm is developed using the Arduino open source. The linear actuators are used to push the books to

their respective container. The book is checked by the IR sensor that is places at the one end of the table. The conveyor belt is used to move the books and it is operated with the rollers driven by the DC motor.

The books are sorted into four different departments. Each books were sorted correctly into the designated compartment with minimum sorting time. The system was prone to minimum error as RFID cards were used as the book identity. The maintenance cost of the system is low as it uses simple mechanisms for sorting and separating the books.

This work minimizes the manpower requirement in the library as the system effectively sorts the books in a very short duration of time. As a result, the maintenance cost of the library reduces. Also the libraries become more sophisticated and error free.

The present system focuses on the sorting mechanism. However, a more sophisticated system can be built with book sorting and placement mechanisms.

FUTURE WORK

The present system extracts the name of the book and searches the database for its class and location. However, the location of the book can also be found from the standard tag pasted on the side of the book. Also the class of the book can be determined by utilizing test categorization techniques based on neural networks. The system can then work without library database. Beside book storing system, book retrieval system can also be automated with the help of motion sensors and digital cameras to facilitate the library uses.

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