

A Review on Manipulation Techniques for Book Detection

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Abstract - While searching the book in library, the location as well as book's size, color, and textures are unknown. Therefore it is a big challenge for the autonomous book detection and grasping. Various approaches have been used for manipulation of book in library; optical character recognition, RFID tags, barcodes for decrease the influences and book detection algorithm which should be grasped, based positioning strategy to achieve a high success rate of grasping. It would support a handicapped person to work and to perform all manipulative tasks.

Keywords - *Book detection, Optical character recognition, RFID tags, barcodes.*

1. Introduction

To the best of our knowledge there exist up to now only few systems for book detection. In [4], the user has been asked to look a specific book in a shelf and when it is found, the book is delivered to the user as soon as possible. As compared to other advanced capabilities, the system integrates automatic object recognition, force feedback and visually guided grasping. Finally, they are encouraged to follow working in this way to obtain the complete prototype. This systems use easy identifiable markers or codes on each book or optical character recognition for book localization on a book shelf in a library.

In [5] each book is equipped with a RFID tag and the book size is stored previously in a database. After detection of the tag all book information is accessible and used for book grasping. In this paper, the books can put on the proper slot in the bookshelf using the ambient intelligence and the book information. It provides the information structured space where the physical space and the virtual space are connected with each other.

It consist of the robot localization method and the bookshelf information system based on the ambient intelligence realized by the RFID technology. After that, the librarian robot system is introduced, which consists of the mobile platform which can localize itself and navigate using the ambient RFID tags and the manipulator which can recognize and manipulate books, under the floor even

if there are high bookshelves. Then propose the classification and integration method of the information from various ambient sensors is applied, which enables the proposed robot to complete given missions successfully.

In [6] a similar approach is presented, which uses bar codes on the books instead of the RFID tags. The robot is initially equipped with a database system of book locations and a global map of the off-site shelving facility. At first, the robot is parked at the docking station waiting for an item request. After receiving a request, the robot will autonomously run along a known path to the book location and retrieve the requested item from the shelf. Each item is assumed to be stored in a specific designed case, and arranged side-by-side with a small gap between cases.

In the work from Tomizawa [7], a system uses a mobile robot as a teleoperated tool for accessing and manipulating remote objects. Compared to other approaches, the work presented here does not depend on any identifier label or priory knowledge and is able to detect and grasp arbitrary books of different color and size. For the retro catalogization, the books with the same color and size are often delivered from magazine. This means, that old books will be added to the on-line database of the library.

2. Book Manipulation Techniques

In [4], an autonomous solution for the robotics librarian is proposed. The aim of this, the required book is retrieve by any user, and bringing that book to the user, whether it was founded in the corresponding bookshelves. The approach used in this research is, robot navigation strategies; user interfaces based on voice commands; or visually guided grasping modules. In particular, this paper is focused on the computer vision and grasping module.

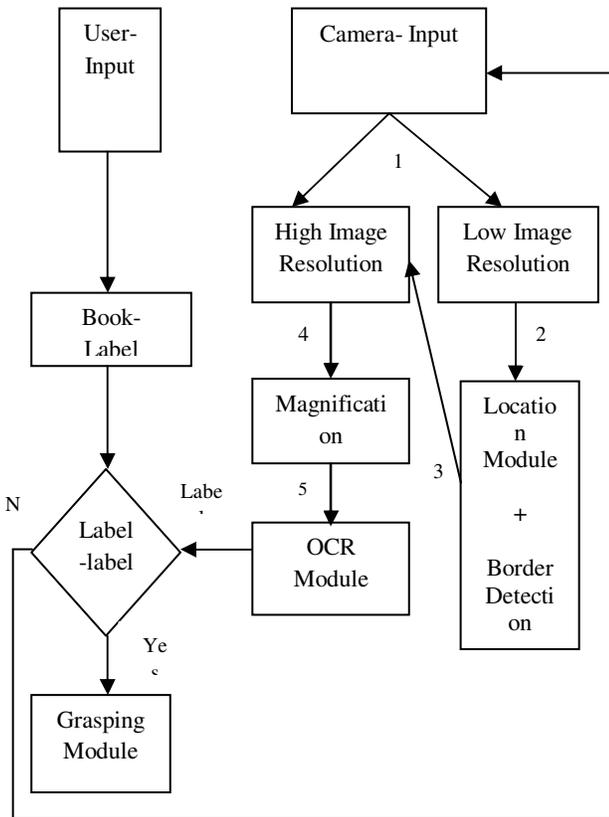


Fig.1 Locate and Identify the label of a book, before grasping

In [5], the system composed of a mobile manipulator which has ubiquitous functions to manipulate books, books which has an RFID tag, the intelligent floor system which provides the current robot position using the passive RFID tags implanted under the floor, and the middleware which connects the whole system seamlessly. In this, the RFID technologies applied to the librarian robot system and designed and implemented the information structured environment named u-RT space.

In [6], an ultrasonic ranging system and an infrared sensor system are employed in order to improve the navigation system of the robot. A barcode scanner is used to ensure the precision of book picking.

2.1 Manipulator Arm System:

A specific manipulator arm system is designed to retrieve books from the bookshelves and carry them to the scanning stations.

2.2 Locomotion Device:

This device is responsible for the gross motion of the robot.

2.3 Navigation System:

In its operation, the library robot will follow paths based on a global map.

In the research [7], human has to specify deliberate behaviors such as choosing a book. Robot has to perform autonomously unconscious tasks such as opening the book and turning its pages.

In order to read a book located in a remote place,

- (1) moving toward the bookshelf.
- (2) choosing the book and
- (3) perusing

These are the 3 main steps that must be performed.

2.4 Movement toward the Bookshelf:

This describes the robot motion method toward the bookshelf. The user does not need to know arrangement of the bookshelf in a library. The robot is given in advance the map of the library where it is. When an operator gives the title of a book or its category, the robot has to move by generating a route autonomously and avoiding obstacles.

2.5 Extraction and return operation:

This presents the book selection method and its picking out operation from the bookshelf.

2.6 Perusal:

Functions required for perusal are “opening a book and turning over pages” and “capturing an image and showing it to the user.” Book opening-closing and page turning’s equipments are developed independently and equip the robot. Using a high resolution camera image is captured, and the picture is transmitted to the user via LAN.

3. Conclusion

In this paper, the performance and efficiency of the algorithm will be improved; meanwhile these assumptions are relaxed towards a more realistic scenario. The information structured environment named the u-RT space is introduced, and presented the librarian robot system which can communicate with the u-RT space, which consists of the ubiquitous mobile manipulator, the intelligent bookshelf, the intelligent floor system, ambient localization sensor, and the middleware which connects the whole system seamlessly. To make the dependable robotic system, the UML analysis was carried out. A field test will be conducted at the off-site shelving facility in the future. A remote book browsing system was built in order

to use a robot as an access media including physical interaction in a remote place. As compared to existing system the proposed system uses the Bayesian algorithm for reading a barcodes that models the shape and appearance of barcodes, allowing for geometric distortions and image noise, and exploiting the redundant information contained in the parity digit.

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