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A fully automated Librarian Robot

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Abstract: With growth in technology, follows a substantial rise in technological knowledge, and this gives rise to better products, and more sources to gain the necessary skills from. Modern day technology involves simplification of human lives, which has caused the rise of several gadgets around us. Today, modern libraries employ the usage of robots, to carry out the fundamental tasks of a human librarian, thereby saving time, effort and costs. The largest libraries do more than just store books and newspapers on their shelves. When a library collection contains millions of documents, it needs complex and highly sophisticated logistical systems in order to serve its readers' requests. It needs library robots

In many libraries, amazing automated transportation and robotic retrieval systems are behind every book you receive from your librarian. Peek far behind the walls of the familiar reading rooms into the seemingly endless rows of stainless steel shelves, data centres, and intelligent servants that deliver humankind's collective knowledge.

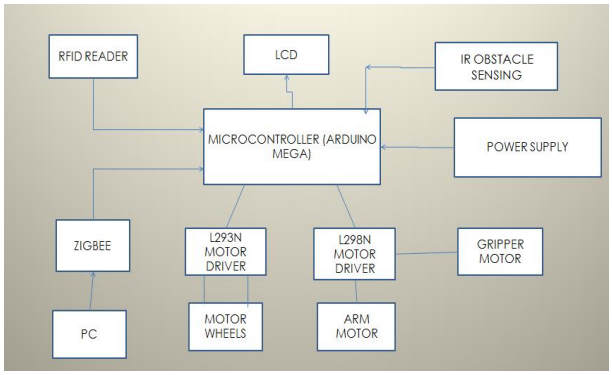
In our paper, we aim to develop such a low-cost solution for a simple robot that employs an optimized algorithm for accurate book selection.

Keywords: Automated robots, Robotics,

I. INTRODUCTION

To automate the process of book searching, and picking, we use a robot with an arm, with some degrees of freedom. The robot is capable of moving on its own, travelling to the target shelf while avoiding obstacles, and picking up the desired book. It will then do an about turn, and come back to the starting point, and release the book. We employ the usage of RFID tags for identification and location. The books are placed in the corresponding racks, with RFID tags attached to them, in sorted, or unsorted manner. The RFID is remembered in the database. An RFID reader, placed in the robot arm, is used to detect, and select the books. The IR obstacle sensor placed over the arm detects the book, and then the gripper will close the jaws, to grasp the book. The robotic arm is then retracted back, after which, the robot turns around, and comes back to the starting location.

II. BLOCK DIAGRAM



III. COMPONENTS

A. Stepper Motors

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence, the motor will rotate, one step at a time.With a

computer controlled stepping you can achieve very precise positioning and/or speed control. For this reason, stepper motors are the motor of choice for many precision motion control applications.

Positioning – Since steppers move in precise repeatable steps, they excel in applications requiring precise positioning such as 3D printers, Camera platforms and X,Y Plotters. Some disk drives also use stepper motors to position the read/write head.

Speed Control – Precise increments of movement also allow for excellent control of rotational speed for process automation and robotics.

Low Speed Torque - Normal DC motors don't have very much torque at low speeds. A Stepper motor has maximum torque at low speeds, so they are a good choice for applications requiring low speed with high precision.

B. DC Motors

A DC motor converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors periodically change the direction of current flow in part of the motor.

A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.A simple DC motor has a stationary set of magnets in the stator and an armature with windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. In large motors there can be several parallel current paths. The ends of the wire winding are connected to a commutator, that allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes.

C. Radio Frequency Identification

Technology that uses radio waves to automatically identify individual items. The objective of any RFID system is to carry data in suitable transponders, to retrieve data, by machine readable means, at a suitable time and place.

The RFID tag can contain identifying information such as a book's title or material type, without having to be pointed to a separate. The information is read by an RFID reader, which replaces the standard barcode reader commonly found at a library's circulation desk.

Each paper thin tag contains an engraved antenna and a microchip with a capacity of at least 64 bits. These are three types of tags 'read only', 'WORM', and 'read/write'. Tags are read only if the identification is encoded at the time of manufacture and not rewritable 'WORM' (write once read many) tags are programmed by the using organization, but without the ability to rewrite them later 'Read/Write tags' which are chosen by most libraries, can have information changed or added.

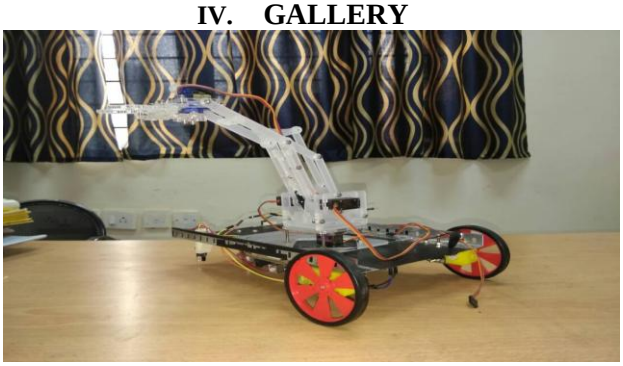
D. Line Follower Robot

Line follower is an autonomous robot which follows either black line in white area or white line in black area.Robot must be able to detect particular line and keep following It.It uses two IR sensors. Using the digital values from the IR sensors the respective motors are rotated. The sensors detect the colour of the track and follow the black path. Line follower is used to move the robot in the library. It is more convenient, cost effective, & is automated. It is considered an easy way of transportation. Other means of transportation such as an automated or a remote controlled bot would again need human intervention.

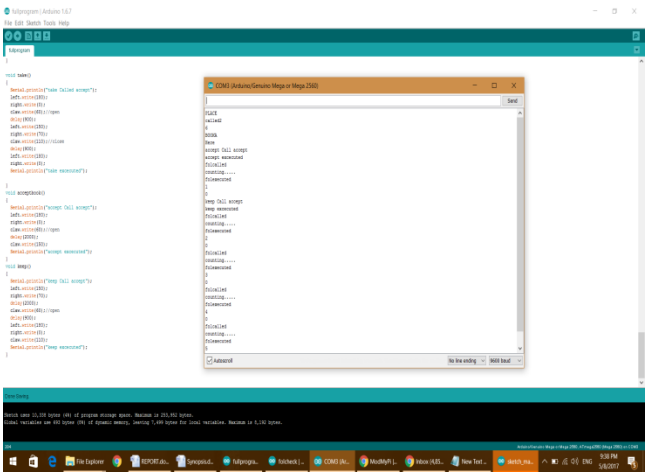
E. Robotic Arm

The robotic arm is used to lift books from the shelves and can also be used to place them back on the shelf.The arm consists of servo motors inculcated at suitable joints. A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The end effector, or robotic hand, can be designed to perform any desired task such as welding, gripping, spinning etc., depending on the application. It contains 4 servo motors. The motor at the base enables the arm to make a 360 degree turn about its standing axis. The two lateral motors enable the arm to move back and forth, and up and down. The frontmost motor is used to operate the gripper jaw. Precisely programmable means to pick up and deliver objects. Durable, light and reliable. Low cost, used widely in robotic systems, from space programmes to mass manufacturing.

IV. GALLERY



V. OUTPUT IMAGE



VI. CONCLUSION

The aim of the paper is to simplify a librarian's job, and also to prevent mishandling, and loss of books, and precious journals.

To automate the searching process, we use an electronically controlled mechanical arm, to search, and grip the books.

The same principle can be extended to supermarkets, household cupboards and warehouses, to acquire materials through automated robotic mechanisms.

We use such systems to reduce time, effort and money spent by companies.

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