Automatic book vending machine

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Ab*stract*—The usage of is Books inevitable and its demand is increasing steadily particularly in the places such as educational institutions, government offices, etc. At the same time, time is a precious thing that one does not want to waste in any way. In stationary shops it is quite difficult to buy Books during rush time period and the counting of the Books depending on the requirement would cause further time delay and there is a chance for the error in the manual counting of Books. To avoid these problems, this project titled "Automatic Book Vending Machine" is proposed to deliver the books to the public by using the sensors and Raspberry Pi based on the Mechatronics principles. It will be cheap and economic for the bulk production and it will be very useful for the college and school students. Here it is designed to deliver books by self-scanning system. It will help us to save more time and manual work will be nullified.

***Keywords*—Working, Hardware Requirements, Model of Book Vending Machine.**

I. INTRODUCTION

In earlier days it was easy to handle the library by a single person, but as the number of people visiting the library increased it started difficult to have control on the records of issued books. As the years passed by and new technologies started emerging in the market, many great people thought of developing a book vending machine and finally in year 1883 by Percival Everitt in London**.**

Automatic book vending machine is a top consideration for colleges as it will reduce the man power that is required in the manually working library. As for now in the colleges students have to visit every time to the library show their identity cards, make an entry in the register and then the books are issued to the student by the librarian. But after implementing this system the student has to just register them self by scanning their identity card, select the books and the books will be issued to the student directly. There is no need to keep any record manually so there is no any harm of data loss. The id of the books that are issued to the students will automatically store in the database server which reduces the manual work.

The Automatic book vending machine requires a camera that will work as a scanner and will scan the identity card. Once the identity card is registered the list of books will be displayed on the LCD screen from which the students can select maximum of 2 books at a time. After the selection of books at the time of checkout the ID of the selected books will be sent to the raspberry pi and with the help of stepper motors the slot will be opened of the particular books according to the ID of the books. At the same time the ID of the books will also store in the database server and will "issued" status will be shown.Automatic vending machine decentralised book distribution system that provides computer controls storage, dispensing and tracking of books have been recommended as one potential mechanism to improve availability and less human interference in the system and this machine are widely used in many libraries and book stores.

Automatic book vending machine enhances the availability of the book to the borrower and facilizes the linearly administration of the book by increasing their accessibility on library.

II.METHODOLOGY

A. Block diagram

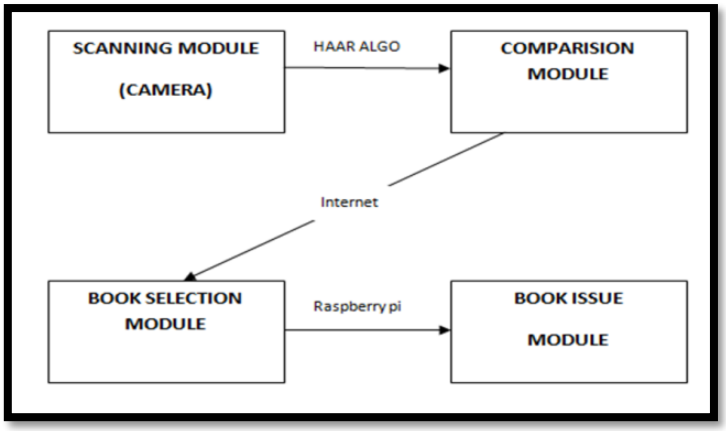

Fig.1 Block diagram of book vending machine

The system architecture of project where the camera will work as a scanner and will capture the identity card of student. The copy of the identity card that is already stored in the database will be compared with the current captured identity card using HAAR Algorithm. Then the student will get a list of books on a LCD screen. Student can select maximum 2 books at a time. After the selection of books, the request will be processed and the books will be issued to that particular student.

There are four modules are given as following:

- Scanning module
- Comparison module
- Book selection module
- Book issue module

a. Scanning module

Here we will scan the identity card of the student. Scanning will be done by using camera which will be placed near LCD screen. The camera will capture the photo of identity card and it will pass that photo to the next module i.e. Comparison Module.

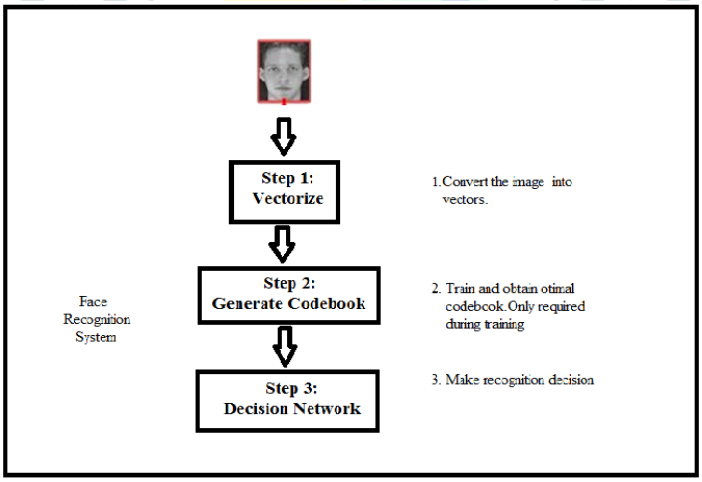

Fig.2 scanning process of image

Python language we need to create identity card detection system. We are able to create this by saving identity card in the system by using python and then we will scan the identity card by using camera. After matching face with the saved card data we will give the permission based on the detection. After matching identity card we will go ahead and open the new section for selecting the books available in the database for that we will using Tinker bell based UI part for the python based UI system. Here after selecting book we will go ahead to open the selected books motor. For that we will connecting the switch with the motor.

b. Comparison module-

Once the photo of identity card is captured by the camera, it will be sent to the comparison module (DATABASE) where by using HAAR Algorithm the comparison will be done to ensure whether the scanned copy of identity card is already registered or not. If the identity card is already registered then the books list will be shown on the LCD screen and if the identity card is not registered then first it will register the ID card and then the LCD Screen will show the entire books list.

c. Book selection module-

Once the registered identity card is approved then the LCD screen will show the entire books list. There will be maximum of 10 books in the list. Student can select max of 2 books that are displayed on the LCD screen.

d. Book issue module-

As the student selects 2 books from the given list and proceeds to checkout, the raspberry pi will get the request and will fetch the ID from the server. Those books whose ID are selected will trigger the GPIO Port which will start the servo motor and the books will be issued to the student and the entry of issued books will be done on the backend server automatically.

A. Component Description-

1. Hardware description

1.1 Raspberry pi 3B+ model:

Raspberry pi small size computer which having its Raspbian OS. It's able to do multiple function simultaneously. It has 1.4 GHz quad core ARM cortex A-53 and RAM 1 GB.[1] It required power up to5V, 2.5 amp which is negligible with respect to PC.[1]

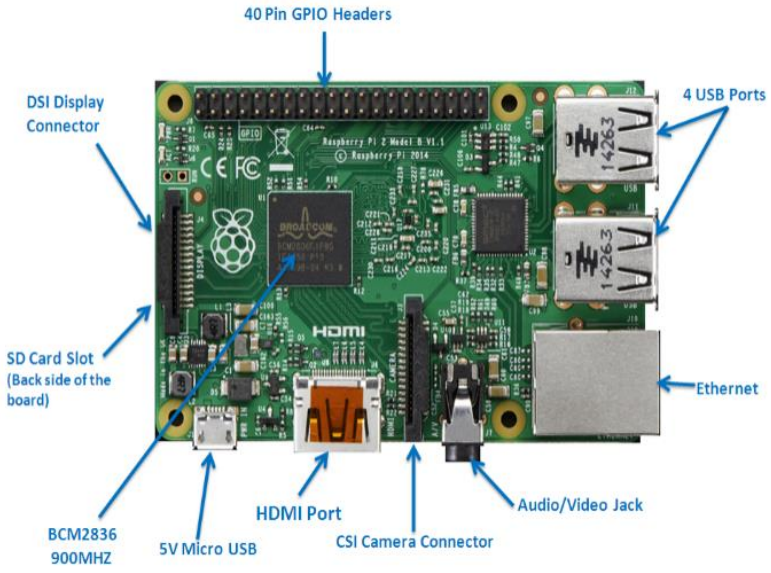

Fig.3 Raspberry Pi model

1.2 HDMI Cable:

The Raspberry Pi has an HDMI port which you can connect directly to a monitor or TV with an HDMI cable. This is the easiest solution; some modern monitors and TVs have HDMI ports, some do not, but there are other options.

1.3 12v variable power supply:

A regulated power supply is an embedded circuit; it converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into DC. Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits.

1.4 Pi-camera:

Camera used in this project having 8MP resolution with fixed lens. It is capable to capture picture 3280x2464 pixel size.[2]

Fig.4 Pi Camera

1.5 Arduino board:

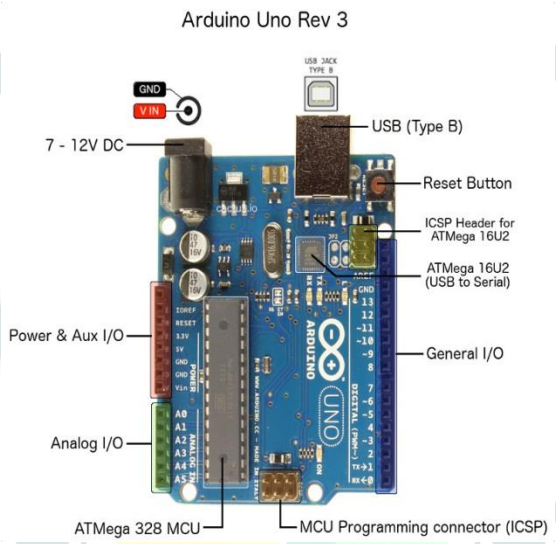

Fig.5 Arduino Uno R3 board

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline package(DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Arduino Uno R3 Microcontroller. The Arduino Uno R3 is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The Raspberry Pi is 40 times faster than an Arduino when it comes to clock speed. The Raspberry Pi an independent computer that can run an actual operating system in Linux. It can multitask, support two USB ports, and connect wirelessly to the Internet.

1.6 Servo motor:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It requires a relatively sophisticated controller.

1.7 LCD display:

LCD Display connected with the help of HDMI cable to the raspberry pi to accept the user books entry which book user wants. All that data handle by the IOT and update the database on the server.

2.Software description:

2.1 Raspbian OS:-

Of all the operating systems Arch, Risc OS, Plan 9 or Raspbian available for Raspberry Pi, is afree operating system based on Debian (LINUX)Raspbian comes out on top as being the most user-friendly, best-looking, has the best range of default software's and optimized for the Raspberry Pi hardware [8].

2.2 Python:-

Python is a widely used general-purpose, high-level programming language []. Its syntax allows the programmers to express concepts in fewer lines of code when compared with other languages like C, C++or java.

2.3 GPIO Python Library:-

The Raspberry Pi GPIO Python library allows you to easily configure and read-write the input/output pins on the Pi's GPIO header within a Python script. This package is not shipped along with Raspbian.

2.4 OPEN CV:-

It (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. It has over 2500optimized algorithms, including both a set of classical algorithms and the state of the art algorithms in Computer Vision, which can be used for image processing, detection and face recognition, object identification, classification actions, traces, and other functions. This library allows these features be implemented on computers with relative ease, provide a simple computer vision infrastructure to prototype quickly sophisticated applications.
The library is used extensively by companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota, and startups area as Applied Minds, Video Surf. It is also used by many research groups and government.

III. FUTURE WORK

The work could be enhanced by improving the algorithm by adding advanced machine learning to it. Multi layered processors can be used for fast processing.

IV.CONCLUSION

The automatic book vending machine is technically flexible to the students. It is based on Raspberry pi. It gives availability of the book all the time and also in rural areas it is very helpful and gives ease access. As well as economical as compared to vending machines available in market. And can be easily modified for future expansion.

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