

AD-LIB: Automated Library System



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Abstract Automation is increasing rapidly, and intelligence in applications emerges as a new form of automation. The impact of automation is observed in the software, hardware, and machine layer. Due to automation, human intervention is reduced in a number of areas such as manufacturing, transport, utilities, defense, facilities, operations and lately, information technology. With this view in mind, we have developed library system for renewal and submission of books. To develop this system, we have used a microcontroller, a barcode scanner, and conveyor. First, we developed graphical user interface with MATLAB and then with LabVIEW for this system. Developed library system allows students to renew and submit in 24/7 basis.

Keywords Graphical user interface · Virtual instrument · Acquisition · Database · Barcode · Library management

1 Introduction

Robotization and innovation have turned out to be an aid for digital operations. It has made the human to work simpler. The developed system demonstrates the understudy subtitles, the book of the week; it additionally demonstrates the visual history of the understudy; it makes a database of the restoration and accommodation and furthermore contains a criticism area. The procedure begins with client entering one of a kind ID given to every client. When the client enters a substantial ID, the drove on the GUI turns green. On the off chance that the client enters an invalid ID, the drove will turn red. On the off chance that the ID entered is substantial, the photograph of the client will be shown alongside his/her different details shown,

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which are name, sexual orientation, degree, stream, year, age, and the name of the last book issued by him/her.

Once signed in, one can look over the numerous activities given and the one he wishes to do. He can check his issual history, present the book, re-establish the book, check the book of the week, or look for any book. On the off chance that the client taps on the issual history catch, he can check the quantity of books which he directly has issued on his name. The issual history demonstrates the quantities of books he has issued. It demonstrates all the book subtitles that are the Book ID, Title of the book, Publication Company, Name of the Author, Genre, and its time of distributing, ISBN no. also, the book version for each issued book. The following choice is present in the book.

On the off chance that the client needs to restore the book they obtained, they should examine the standardized tag given on the book by holding it under the constant standardized tag scanner. Once examined, they should press the submit catch. At the point when the catch is squeezed, the transport line framework turns on, and the belt activates. The book goes to the opposite side and falls into a book holding holder. On the off chance that the client re-establishes the book, they should filter the book by holding it under the standardized tag scanner. When the book is examined snap on the re-establish catch. The date will be reached out by a week or the quantity of days indicated by the library as per its framework. The book of the week catch will show the image of the book of the present week. This book changes each week and should be refreshed by the curator physically.

Usually, librarian has to enter data manually in the system, and then give it back to the user while returning or re-issuing a book. During examination, there are long queues while returning of books. To overcome this problem, we developed library system where submission and re-issual of books are done automatically. The portal is a model of a system which can be introduced in libraries to automize the procedures with the goal that less time is taken for the accommodation and re-issual of books. The developed system primarily consists of three parts, viz. the GUI screen, the conveyor line, and the barcode identification scanner. It comprises of sensors and LEDs to show what activities are going on. With the help of sensor, barcode scanner gets activated. Every user will be issued a unique ID and password to sign in. After user signs in, detailed information about his library transactions will be displayed. The user may choose to either submit or renew the particular book. This procedure will along these lines lessen the time taken for the entire accommodation process. Likewise, supervision is not required for the task of these portals.

2 Related Work

Using pick and place robotic arm, the library management system is developed [1]. Anita et al. created robotization in library for transporting of books in faster manner [2]. Mobile robotics is introduced as a motivating platform in courses with the help of combination of LEGO NXT mobile robots with LabVIEW [3, 4]. By the

use of an RGBD sensor, the pose of a known object is detected in the shelf using visual data [5]. Rahul Pol et al. designed and developed a low cost superior four degrees of freedom (DoF) robot ARM [6]. Modern database-driven Web applications are developed by ISIS family member [7]. Author [8] investigated the problems encountered during automation in two Nigerian university libraries. The significant improvement in service and use of library facilities are observed with the help of proposed library information system [9]. The mechanical and technical issues and problems were investigated while designing line follower robot [10]. In the paper [11], the library inventory management system (LIMS) is demonstrated using line following robot (LFR). Based on National Instruments LabVIEW controlled PXI RF hardware, Pavel and Rao [12] developed a UHF radio frequency identification tag test and measurement system.

2.1 Motivation and Scope

In the present scenario, the reader has to physically come to the library specifically to submit or renew the book; the librarian will then manually scan the barcode on the book. Once the computer receives the code on the screen, then the librarian will search for the excel sheet belonging to the SAP ID of the student. Since the information has to be typed by the librarian inside the excel sheet, there is a margin for the human error, as well as it is time-consuming since the supervisor has to check for the librarian's mistakes at the end of the day. Since all students get free from their lectures about the same time, there is a heavy rush, and the staff is under pressure to complete the process as soon as possible, which may lead to further errors. Due to long queue, it is very difficult for physically disabled user.

2.2 Salient Contribution

The idea of automated library is yet to be implemented in India. AD-LIB is an integration of microcontroller, Barcode Scanner, National Instruments LabVIEW.

- Strong acrylic sheet covering to withstand the shocks and simple encasing of the framework inside the wall.
- Black conveyor belt for easy scanning of the barcodes placed on the books.
- Secured Logging via a password-based GUI 24/7 without fail.
- Accessing and printing the database through Microsoft Excel Sheet. Arrangement of enrollment of new user at portal and additionally at the organizational work area.
- Unique barcode assigned to every book and each student. The barcodes are useful in calling out the functions from the spreadsheet database.

- National Instruments LabVIEW GUI for cost sparing and easy to understand user-friendly interactive system, LabVIEW is utilized for interfacing barcode scanner with the GUI.
- National Instruments VISA tool is used to establish the connection between Arduino and the GUI.

3 Methodology

Automation and technology have proven to be a boon for us. It has made human work easier. The portal which we have made aims at reducing the workload on the library staff by automating the renewal and submission process. Figure 1 shows the flow chart of the whole process of renewal and submission of books. It also has additional features, viz. It shows the student details, the book of the week, it also shows the issual history of the student, and it creates a database of the renewal and submission and also contains a feedback section. The process starts with the user entering the unique ID given to each user. Once the user enters a valid ID, the led on the GUI turns green. If the user enters an invalid ID, the led will turn red. If the ID entered is valid, the photo of the user will be displayed along with his/her other details which are name, gender, degree, stream, year, age, and the name of the last book issued by him/her. Once logged in, one can choose from the many actions given, the one he wishes to do. He can check his issual history, submit the book, renew the book, check the book of the week, or search for any book. If the user clicks on the issual history button, he can check the number of books which he presently has issued on his name. The issual history shows the numbers of books he has issued. It shows all the book details that are the Book ID, Title of the book, Publication Company, Name of the Author, Genre, its year of publishing, ISBN no., and the book edition for each issued book. The next option is submit the book.

If the user wants to return the book they borrowed, they will have to scan the barcode given on the book by keeping it under the continuous barcode scanner. Once scanned, they will have to press the submit button. When the button is pressed, the conveyor belt system turns on and the belt actuates. The book goes to the other side and falls into a book holding container. For renewal, user will have to scan the book by barcode scanner. After the successful scan, click on the renew button. The date will be extended by a week or the number of days specified by the library according to its system. The book of the week button will display the picture of the book of the current week. This book changes every week and needs to be updated by the librarian manually.

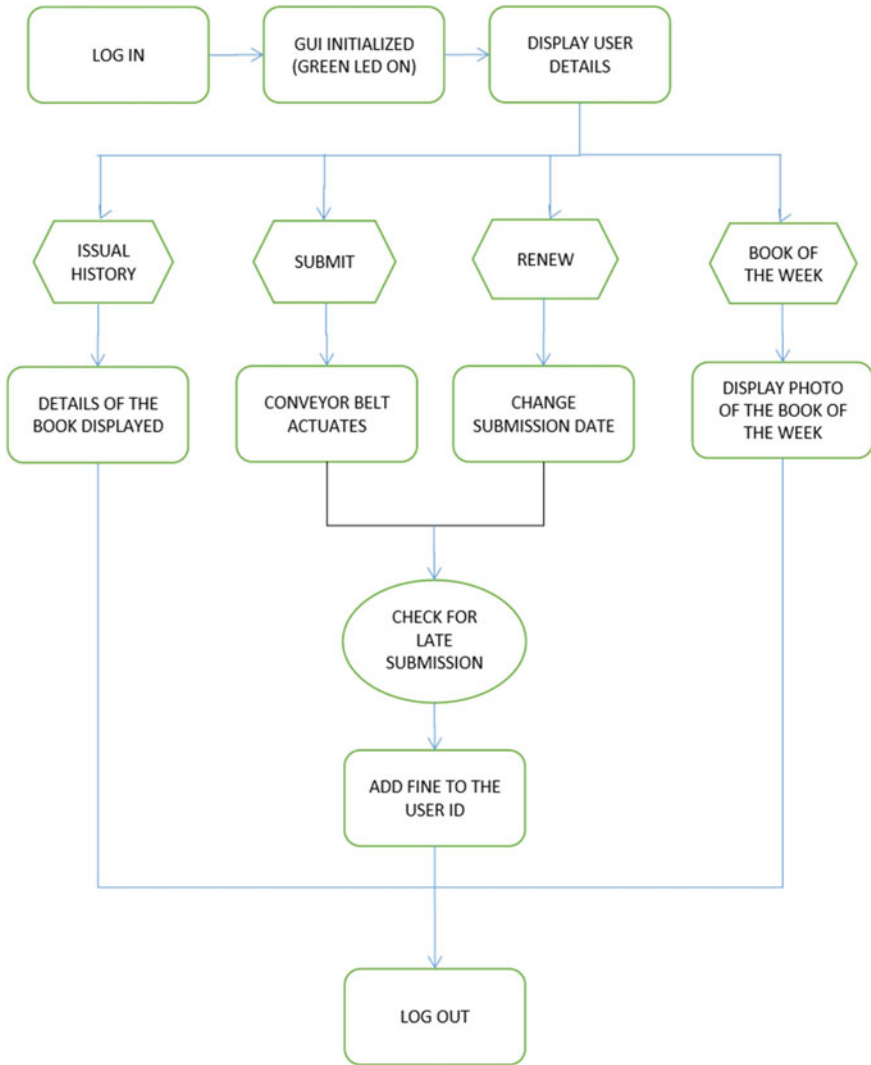


Fig. 1 Flowchart of AD-LIB

4 Softwares

The main purpose of AD-LIB is to carry out the library operations as desired by the user, so we require an intermediate platform that would take the inputs from the end-user, which in our case would be students, and these inputs would give specific commands to the controller. A Graphic User Interface (GUI) functions as the median platform, which has been designed and programmed to perform the

functional requirements. The inputs given by the user would be captured via an event structure, initialized during mouse click.

A GUI has been the Centralized Unit of the System; it comes in handy while interfacing microcontroller, barcode scanner, database (spreadsheets), Arduino UNO so that the user can trace back the problem or the run-time errors when the system breaks down. The GUI build up was initially started on MATLAB, but later, it was shifted to LabVIEW as the LabVIEW programming has a specific architecture in the form of state machines. We found the MATLAB programming a little sturdy and rectifying error consumed lot of time.

LabVIEW comes as an alternative for Supervisory Control and Data Acquisition (SCADA), so getting hands on experience on LabVIEW for future aspects was a good start for any Mechatronics Engineer. Whereas, having a little knowledge of MATLAB programming made us aware of the application development protocols. Overall, all the interfacing with the different components made us aware of the real-time working of the subsystems from a single centralized unit that supervises the decision and control of the modules attached to it.

4.1 MATLAB Guide

As we can see in Fig. 2, the initial GUI contained combinations of Push Buttons, a Header Text Box, and an ACTIVE X control developed by the Adobe Reader. You can likewise code the format and conduct of your application total utilizing MATLAB capacities.

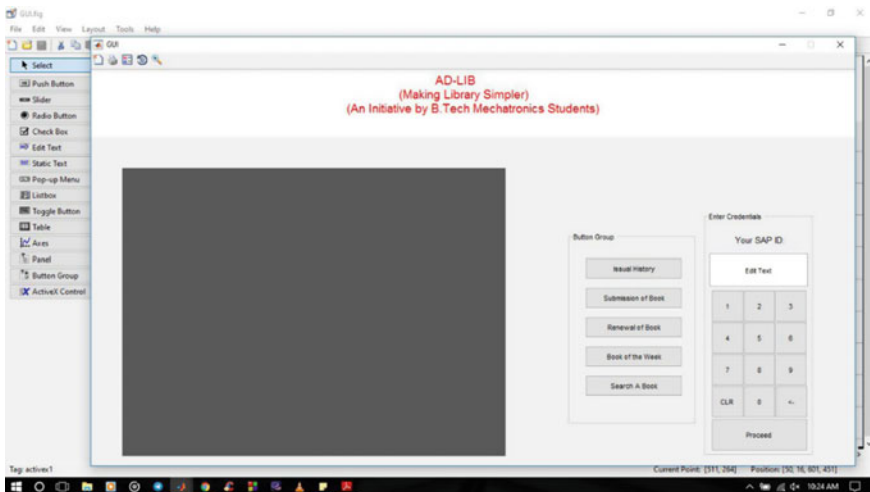


Fig. 2 Initial MATLAB GUIDE screen

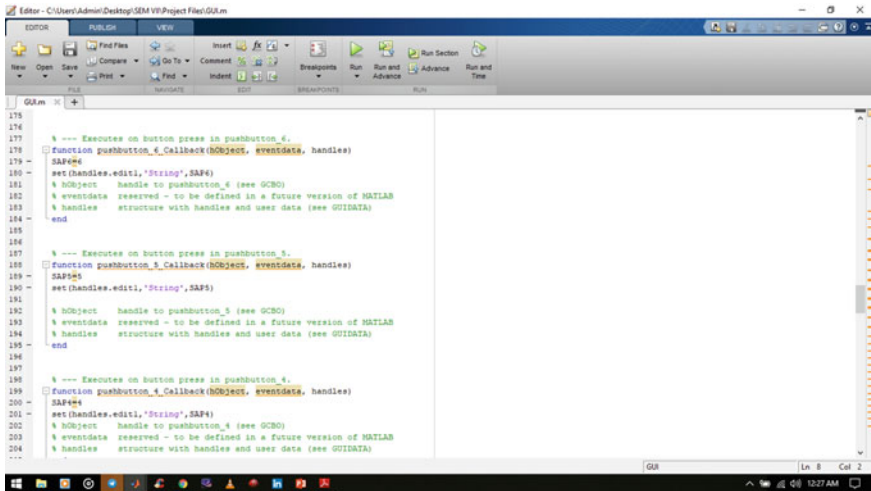


Fig. 3 MATLAB GUI algorithm

In this approach, you make a customary figure and place intuitive parts in that figure automatically. These applications bolster similar kinds of designs and intelligent parts that GUIDE underpins, and also selected boards. Utilize this way to deal with manufacture complex applications with numerous reliant parts that can show any kind of plot.

Every time there is a mouse click event on any one of the push buttons placed on the GUI screen, it generates a variable value assigned to the function named as event data. Therefore, upon a clicking, an event is called out of particular function name to which the push button has been added. An insight of the working algorithm has been shown in Fig. 3. If a user clicks on push button 4, a function named push button 4 call-back function is called, and its event data is then transferred to the edit text (set(handles.edit1, String, SAP4)) window above to show which push button has been pressed. Radio Buttons, Navigation Panel, and User Feedback had been added to the final GUI on MATLAB GUIDE as shown in Fig. 4.

4.2 National Instruments LabVIEW

LabVIEW structures are called virtual instruments in light of the fact that their appearance and activity mimic physical instruments, for example, oscilloscopes and multimeters. LabVIEW contains an extensive arrangement of devices for securing, breaking down, showing, and putting away information and also devices to enable you to investigate code you compose.

In LabVIEW, you fabricate a VI, or front panel, with controls and markers. Controls are handles, push buttons, dials, and other information systems. Pointers are

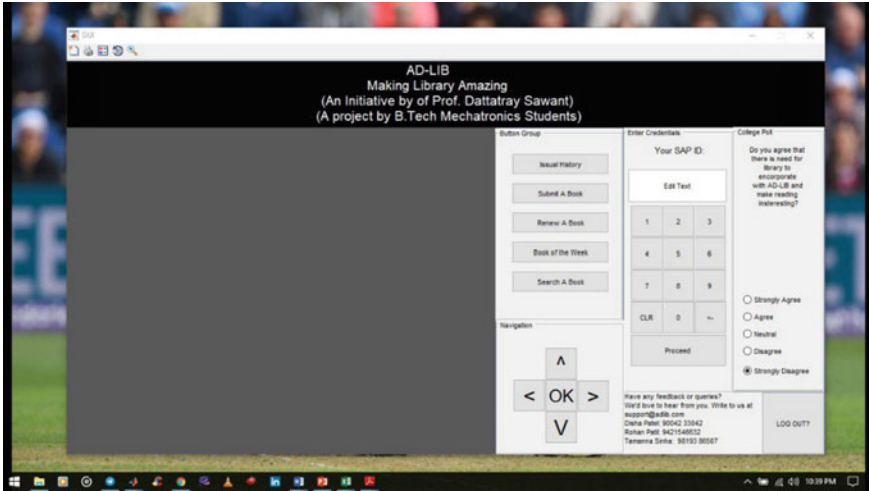


Fig. 4 Final MATLAB GUI

charts, LEDs, and other yield shows. After you construct the front pane as shown in Fig. 5, you include code utilizing VIs and structures to control the front panel objects. The square chart contains this code.

One advantage of LabVIEW over other advancement situations is the broad help for getting to instrumentation equipment. Drivers for a wide range of sorts of instruments such as ARDUINO, Barcode Scanners, DAQs, Motors, and LEDs are accessible for consideration. These present themselves as graphical hubs.

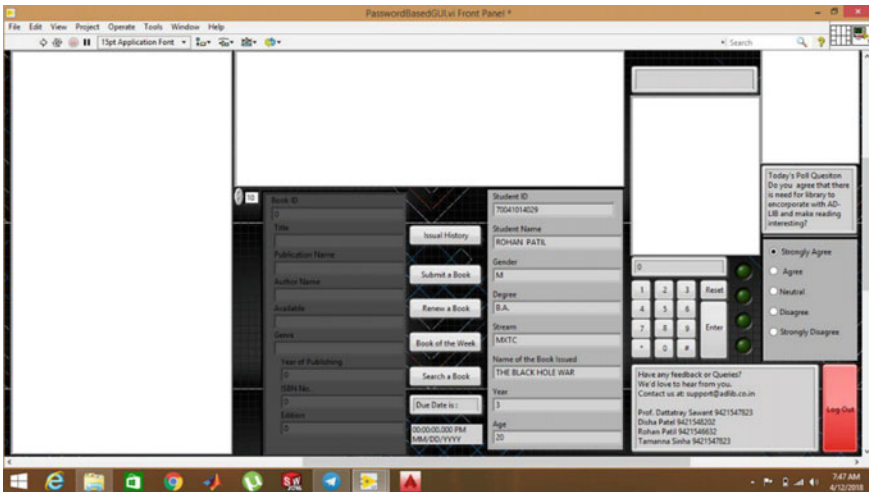


Fig. 5 Front panel of AD-IB screen in LabVIEW

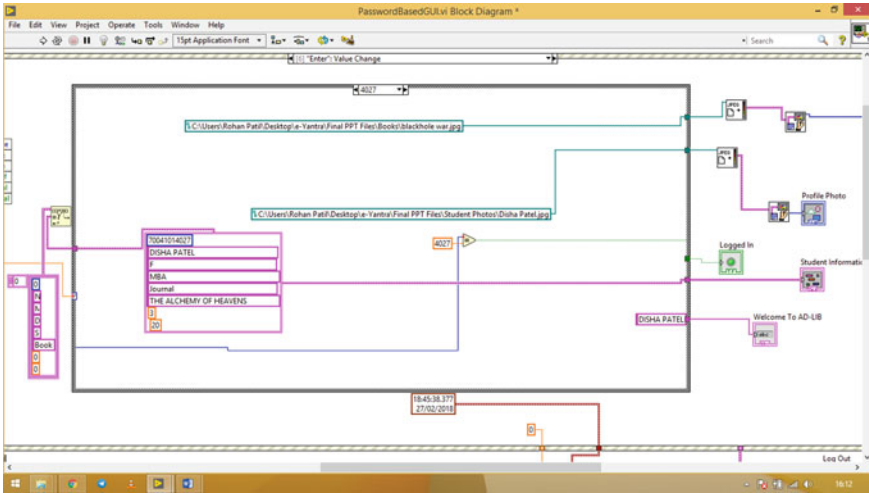


Fig. 6 Block diagram of the GUI in LabVIEW

Once we had created the front panel, we moved on to developing logic of the block diagram as shown in Fig. 6 which consists of the control of the front panel objects. The square outline contains this graphical source code. The terminals provide the information to the control after execution of the VI. The block diagram shows up as symbol or feed information to be written in the database (spreadsheet).

Terminals are passage and communication ports that trade data between the front board and block diagram. Upon initializing the inputs or providing events in the form of mouse clicks, the GUI performs tasks when a VI runs. The use of event structures monitors the execution of functions, .jpeg image reading, writing data to the excel sheets, and a communication channel between Arduino UNO and Front Panel Push Button (Submit a Book) in content-based programming architecture as shown in Fig. 7.

Combination of push buttons and clusters are graphical portrayals in the silver squares, and case structures give selective content-based programming decision to the Front Panel. The output of the clusters purely depends upon the unique passwords of the students and the information saved in the case structures.

Whenever a transaction occurs through the GUI, its information is saved in the excel sheets with the help of the write to measurement file function palettes; the librarian can send a command to print the monthly data as per the administration requirements. This eliminates the data discrepancies and human error during data logging, and thus AD-LIB becomes more reliable and accurate in such scenario.

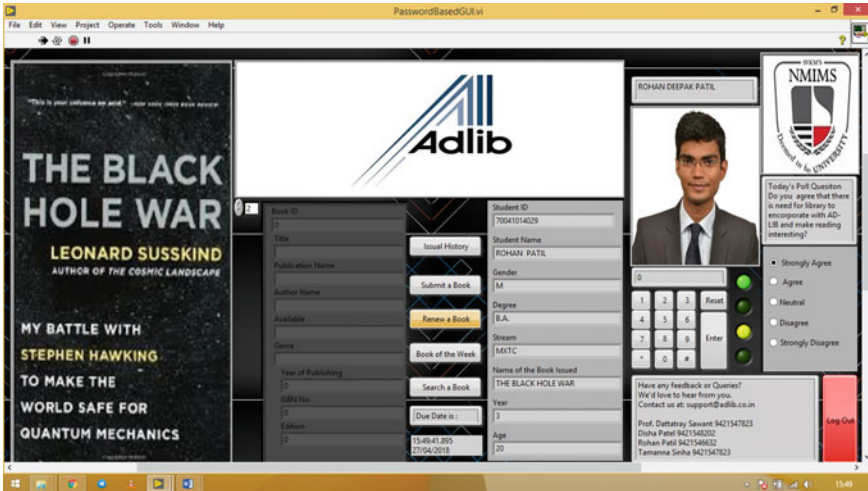


Fig. 7 Final AD-LIB GUI screen in LabVIEW environment

5 Testing

Initially, testing was done in two parts. The conveyor and the GUI were both tested separately. The conveyor was first controlled using PIC microcontroller. There were two sensors attached at the start and the end on the conveyor to sense when the book is kept. When the book was placed, it would get sensed by the sensor, and a red led on the sensor circuit would glow to show that the book has been placed, the conveyor would then actuate in clockwise direction. When the book would reach the sensor 2 it would sense, a red LED on the circuit would glow indicating that the book has passed; this would give the microcontroller instruction that the book has passed and the conveyor has to be stopped.

There were times when the conveyor did not stop even after the book passed from the sensor and fell in the basket. This was because there was a problem in the range of the sensor. The range was adjusted by the POT given on the IR sensor circuit. The conveyor could also be moved counter clockwise by reversing the connections to the microcontroller. There were two switches which were used to start or stop the conveyor manually when the sensor did not pick up the signal accurately. When we bought the barcode scanner (INTEX IN-101), the logic was to have a sensor which gives command to the scanner to actuate the scanning, but at the later part of the stage we realized that the sensor is getting lot of the disturbances from the surrounding and continuous change in the direction of rotation of the motor to pick up the barcode would be difficult task, so the discontinuous scanner was converted to the continuous mode through the barcode command, given in the manual of the INTEX IN-101.

6 Conclusion

There is very little automation in India's library system and a lot of scope to increase the library system efficiency and improve the data-keeping methods. This paper surely helps them in understanding the microcontrollers, actuation system, HMIs, Bio-Metric systems, and data logging to improve their knowledge. The developed system provides effective management of library as well as reduces human intervention. The GUI build up was initially started on MATLAB, but later it was shifted to LabVIEW as the LabVIEW programming has a specific architecture in the form of state machines. We found that LabVIEW software shortens the design cycle and simplifies the design process as compared to MATLAB. Finally, since the complete project will be built in India and will be used for Indian people, the project meets the Make in India Initiative.

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