Library Automation System Using RFID Tags

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Abstract—**The design and implementation of a self-service library management system utilizing radio frequency identification are presented in this study (RFID). Radio frequency technology and micro processor technology are combined in RFID. It is intended to take the role of barcode sin library applications in order to enable self-check-in and check-out as well as many other applications, as well as to manage library resources morequickly and efficiently. The use case diagram, which this article pioneers, explains the system's over all purpose and its component parts and enables intelligent management from book reception to book circulation.**

I. INTRODUCTION

Newtechnologyisbeingadoptedbylibrarieseverywhereto enhance customer service and speed up the check-in/check-outandinventoryprocedures.Onemethodforcreatingamore time-effective and safe library management system isradiofrequencyidentification(RFID).Theradiofrequencyand microchip-based technology known as RFID (radio frequencyidentification, sorting, and detection) can be used to track,identify, sort, and detect library holdings. It can be used tocreateaself-servicesystemthatenablesuserstoindependently check out and check in things, allowing libraries toinventory and monitor resources more effectively.The initialrequestforRFIDtechnologycamefromBritishmilitaryfor cesduring World War Two, who used a primitive translation tocompare friendly and opposing aircraft.In the old age 1973,For welcome inactive state and write tag, Mario W. Carullawasallowedapatent.Asaresultofthisfinding,RFIDtags accompanying entrenched circuits and thought are nowsecondhandinarangeofcivilianuses.RFIDscienceisimme diately used in supply chain administration, athenaeums,andmanydifferentfields.RFIDtechnologyhasstart edtoreinstate the barcoding method in book repositories. In 1991,RFIDwasfirstusedinalibraryattheUniversityofGuelphin Canada. However, allure use in athenaeums has happenedrestricted, with just 3000 athenaeums utilising the electronicsin 2012. When distinguished from barcodes, RFID electronicsprovides a secure and effective system administration means.Thereisnownosystemworkingthattracksundergraduate habit or streamlines the check-in and check-out procedure.Furthermore,skilledisnostockorder,andasaconsequ encenocurrent inventory record. This restricts scholars from utilizingthemoneycausefindingnoveltyandwinningrulingclas sexaminedontimeisdisputing.Thereserveadministrationmeth od proposed in this paper solves these concerns and constitutes a structure namely two together, efficient for graduatesand adept for the area. Students can use bureaucracy to lookfor belongings, check their chance, and check ruling class outwithoutdifficulty.

II. RELATED WORK INTRODUCTION

RFID Technology Using RFID (Radio Frequency Identification)isatypeofwirelesscommunicationthatoperatesi nthe high-frequency region of electromagnetic frequencies byusing electromagnetic or electrostatic coupling. The workingprinciple behind RFID structure is as follows: the reader sendsan electromagnetic wave energy at a specific frequency to theelectronic tag, the electronic tag is in the RF signal detectionarea,theinducedcurrentreceivesenergy,thelabelissen tthe necessary information by the reader through a wirelesschannel, the reader has a receiver to receive the signal sent bythe electronic tag, and the reader reads the information. Thelabel is made up of a chip and a coupling piece, each of whichis encrypted with certain electronic data.The research entailedintegratingtheRFIDtechnologyandcreatingaGraphica lUserInterface (GUI) at the host PC. The project's objective is todevelop an automated library shelf management system thatwillassistlibrariansinmoreefficientlymaintainingtheshelv esand finding any misplaced books on the shelves. MicrosoftVisual Basic.Net was used to construct the interface for thesystem. The exact data for the book must be entered into thedatabase using the GUI. After that, an RFID tag with a ShelfID was created and set up. This code was then utilised by thesystem to scan the selected shelf for any lost books. RFIDtechnology and an online concept are combined to develop aninternet-based application for managing libraries. The entireprocedurethattakesplacewithinthelibraryutilisestheRFI Dreader Motorola 10 MC9090. This suitable reader can readtags with any type of frequency, including low, high, and ultrahigh. Each user and each book receives an RFID Tag 107 witha unique EPC (Electronic Product Code) that is produced inconnectionwiththedatabaseforfurtherinformation.[3]

III. SYSTEM SPECIFICATIONS

A. Interface Requirements

- Front-end: HTML, CSS, JavaScript.

- Back-end: Python, Google Cloud, google sheets, drive API which helped us access sheets using python

B. SoftwareRequirements

- VSCode-IDEwhereeeverythingwasperformed.

- Python-UsedasaScriptingLanguage.

- Anaconda - Aims to simplify package management anddeployment.

- gspread-ToopensthecurrentsheetorcreatesanewGoogle Sheet file, read/write the records, in addition, todowithoutadoubtformatting.

- GoogleSheets-Thatactaslocaldatabasestorage.

- ArduinoIDE-Forconnectinghardwarecomponentswiththesoftwarepart.

C. HardwareRequirements

RFID Tags, RFID Reader, NodeMCU, Jumper Wire, RFIDRC522,Breadboard.

D. NonFunctionalRequirements

While the update occurs in real-time, the Database must becorrectly connected to the project. ensuring that the databasequeries are written correctly to avoid breaking any limitationswhile updating. The system must function flawlessly with alargenumberofbooksandusers.Answerstoinformationrequestsmustdisplayonthescreenwithin5seconds.Toavoidillegal access, distinct users must use unique login credentialsthataresafe(givenbyourtags).Theprogrammewill makeuseofasafedatabase.Apartfortheirpersonalinformation anda small amount of additional information, normal users canonly view material; they cannot update it. The system willhave many user categories, and each user will have accessrestrictions.[6]

IV. LIBRARY MANAGEMENT SYSTEM BASED ON RFID

A. Features of Our System

1) *Security:* Library login: To prevent the students from using the model in an abusive manner, we only restrict the editing access to Library personnel only.

2) *Privacy:* All members can access and read data but only Librarians can have access to make changes. Non-members cannot access the data thus keeping the data of members secure.

B.Architecture

1) *Microservices Architecture:* Microservices are an archi-tectural style that structures the application as a collection ofservices.[7]

- Pros:

ImprovedfaultisolationEaseofunderstandingSmallerandfasterdeployments

- Cons:

CommunicationbetweenservicesiscomplexDebugging problemscanbeharder
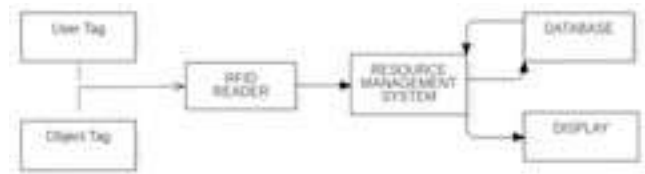

Fig.1.OverallSystemArchitecture

The block diagram of proposed Library using RFID is shown in Figure 2
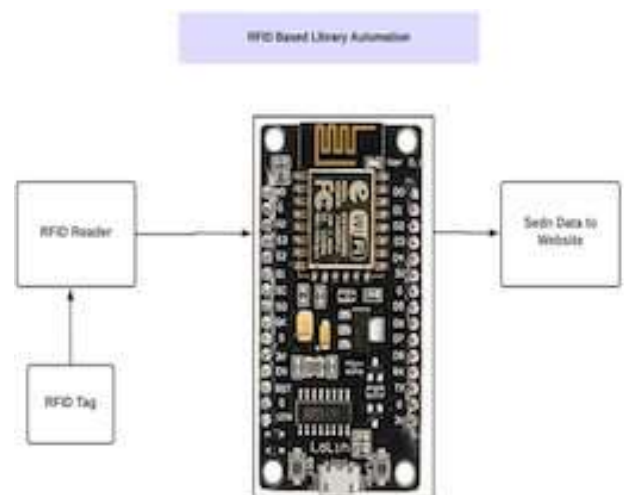

Fig.2.Workingdiagram

Fig.3.RFIDArchitecture

EachPersonwillbeprovidedwithanRFIDchipwhichwill contain the person's information. Each book will alsohave an RFID attached to it which will contain the book'sinformation.Tobeginwith,theusermustberegisteredand thisisdonewiththehelpofalibrarian.Datafromboththeperson's RFIDtagandfromthebookwouldbescannedby the RFID reader, which sends/receives with the microcontroller.The main computer receives the output data from themicrocontroller once it has processed the data obtained and isready to store it in a database. All the changes get reflected inthe master database which is the google sheet in this case.[5]Each member and book will have unique rfid card.The systemwillbeabletoreadinformationfromtags.[4]Theprocessi sasfollows.

- Useridisprovidedafterregistration.

- passwordvalidationoccurs

- systemchecksfortheauthorizationlevel

- Registernewuserfeaturecanbeperformedbythelibrarian

- Search book feature is also available wherein a particularbook can be searched and if the book isn't available, allthebooksaredisplayed.

- Finefeatureaddsfineonperdaysystemwhichstartsafter10d ays.

C. *AbbreviationsandAcronyms*

- RFID:-RadioFrequencyIdentification

- IDE:-Integrateddevelopmentenvironment.

- COMPort:-CommunicationPort.

- HTML:-HypertextMarkupLanguage.

- NodeMCU:-NodeMicro-ControllerUnit.

D. *ResultsandDiscussions*

Multipleliteraturepapersweretakenintoconsiderationwhi chpavedthewayforthisproject.

- After the implementation we could see book details beingavailable,studentsbeingabletoregisterusingrfidtags.

- Email- Verificationwassenttostudentsregisteringforthefirsttime.

- Student/Teacherwasabletoviewallthedetailsregardingthe booksavailable.

- Adminportalhadalltheaccessibilityalongsidewithregistra tionofnewusers.

- RFIDplayedanimportantroleasitwasanecessitytoscanthe usertagandthenthebooktagtoregister.

- Adminwasabletosendmailregardingthefine,duedate.

- Highsecurity,betterperformancewasensuredwiththetagsu sage.

- Ithelpedincreatinganautomatedandasmartlibrarysystem.

TEST SCENARIO	OUTCOME	SOLUTION(if applicable)
User Exist	Taken library portal	N.A.
User Doesn't Exist	Shows "user not found"	• Admin has to register • User gets rfid tag
Book Available	• visible during search • can checkout	N.A.
Book not Available	• during search all available books are displayed	• Admin can add the book if it gets available using rfid tag
Fine functionality 1)working	After 10 days each day will add up 5 rupees as penalty	N.A.
Fine functionality 2)Not working	After 10 days each day will add up 5 rupees as penalty	• Admin can access the google sheet where the issuing date is stored and calculate fine.
Checkout (RFID working)	checking out is just one click on the book id	N.A.
CheckOut (RFID not working)	can't checkout by using one-click option	• Admin can delete the record from the google sheet which automatically updates the portal
Sending Notification	Admin can send e-mail to users by just clicking on their respective mail id	• email is stored in the sheet
If website crashes	Shows Error	• we have a backup using google clouds and google sheet

Fig.4.ResultTable

E. *Conclusion*

High security performance, more privacy, improved per-formance, ease of use, and intelligent administration are allbenefitsofRFIDtechnology.

- Traditional library management issues including manuallabour, extensive time commitment, security flaws, andothersareresolved.

- RFID readers and RFID tags should be of good quality,toyieldbestperformance.

- The modern and intelligent library is represented by themanagement system for library administration that wasbuiltwithRFID.

- The only focus of this study was to develop an RFID-based library management system, including the generalform and the hardware and software environment. Thesystemadministrationwasdesignedwiththegoalofincr easingthelibrary'soveralleffectiveness.

F. *Futurework*

- Providingmisplacementofbooksinformation.

- Anti-Theftfunctionalitycouldbeaddedwhichwouldbe of a very lesser cost when compared to the currentmechanismthatisbeingused.

REFERENCES

[1] Dhanabalan, S. S., Sitharthan, R., Madurakavi, K., Thirumurugan, A., Rajesh, M., Avaninathan, S. R., & Carrasco, M. F. (2022). Flexible compact system for wearable health monitoring

applications.Computers and Electrical Engineering, 102, 108130.

[2] M.S.Cunningham,"AcasestudyintotheimplementationofRFID atthe Pilkington Library Loughborough University," Unpublished Master'sdissertation,2018.

[3] Prabhat Pandey, and K.D. Mahajan, "ApplicationofRFIDTechnologyinLibrariesandRoleofLibrarian", 2011.

[4] Pazhani. A, A. J., Gunasekaran, P., Shanmuganathan, V., Lim, S., Madasamy, K., Manoharan, R., &Verma, A. (2022).Peer–Peer Communication Using Novel Slice Handover Algorithm for 5G Wireless Networks.Journal of Sensor and Actuator Networks, 11(4), 82.

[5] China Chang Ji Wen,The University Library Management System Based on Radio FrequencyIdentification Jin Feng Zhang College of Information and TechnologyJilin Agricultural University Changchun Architecture and Civil Engineering CollegeChangchunp. 130118,2017.

[6] Nyoman Karna, Donny Pratama,and Muhammad Ramzani, "Self Service System for Library Automation : Case Study,"TelkomUniversity Open Library 2019.

[7] UseofRFIDTechnologyinLibraries:aNewApproachtoCircula-tion, Tracking, Inventorying, and Security of Library Materials ; Syedmd.Shahid,UniversityofJammu,2005