Database Application Development

Final Project – WPI Library

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1. Executive Summary

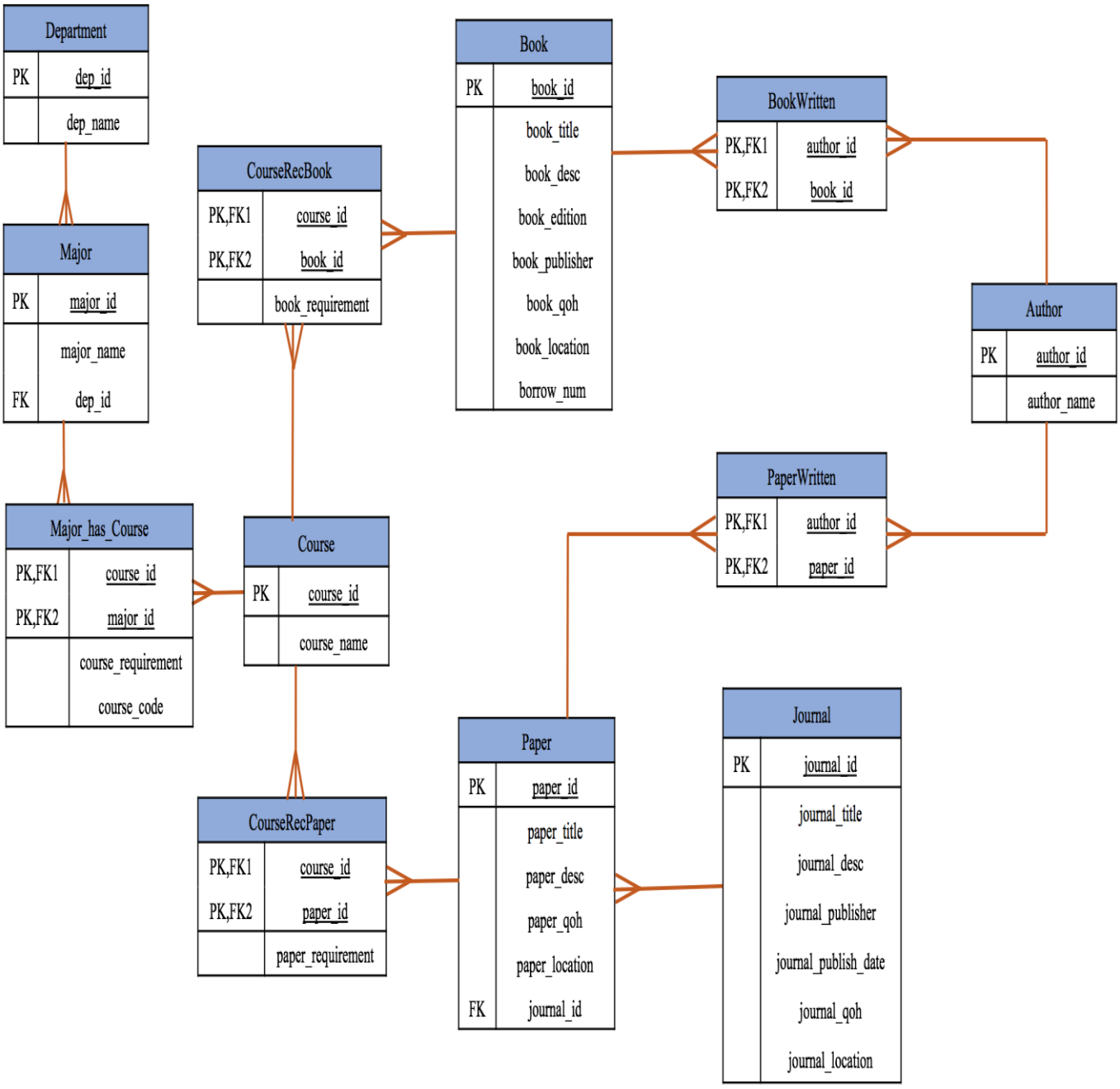
The Gordon Library of WPI provides thousands of books/dissertations/journals to WPI students. However, the current searching system at Gordon Library does not contain the functions of searching books and other academic materials by programs they are majoring or courses they are taking. Therefore, students at WPI always feel overwhelmed and confused when there are needs for them to find required books, papers or other materials based on their programs and courses. In addition to that, the Gordon library does not have an Android application that could provide all the functions for students to do the searching quickly on their phones. The project aims to provide an efficient solution for the problem.

The final project report presents how we came up with the idea and the inspiration of designing an Android application for WPI Library service, the methodology and tools that we utilized to design and develop the Application, and the development processes and all the required technical documentation for the application. Also, the final deliverable and demonstration will be attached to the final project report as an appendix to give the readers a image of how the Library service application would work, how the GUI user interfaces would be like, and the brief introductions of all the functions that the application possesses.

2. Business Problem Statement and Solution

The Gorden Library at WPI does not have the specialized Application for Students to search the needed books or material on their phones quickly. Also, students find it difficult to search the needed books and other academic materials by programs they are majoring in or courses they are taking in WPI's current library searching system. For the benefits of all the WPI communities, our team created a WPI Library Android Application to help with solving these problems.

3. Entity-Relationship Diagram



4. 3NF

Department (dep_id, dep_name)

Major (major_id, major_name, *dep_id*)

Major_has_Course (*course_id*, *major_id*, course_requirement, course_code)

Course (course_id, course_name)

CourseRecBook (*course_id*, *book_id*, book_requirement)

Book (book_id, book_title, book_desc, book_edition, book_publisher, book_qoh, book_location, borrow_num)

CourseRecPaper (*course_id*, *paper_id*, paper_requirement)

Paper (paper_id, *journal_id*, paper_title, paper_desc, paper_qoh, paper_location)

Journal (journal_id, journal_title, journal_desc, journal_publisher, journal_qoh, journal_publish_date, journal_location)

BookWritten (*author_id*, *book_id*)

PaperWritten (*author_id*, *paper_id*)

Author (author_id, author_name)

5. Data Dictionary

Table	Attribute	Content	Format	Key	Reason to Include
Department	Store department information to be searched				
	dep_id	Department ID	Varchar [5]	PK	General information of departments.
	dep_name	Department Name	Varchar [25]		
Major	Store major information to be searched				
	major_id	Major ID	Varchar [5]	PK	General information of majors
	major_name	Major Name	Varchar [25]		
	dep_id	Department ID	Varchar [5]	FK	Major belong to Department
Major_has_course	Store major and course relationship.				
	major_id	Major ID	Varchar [5]	PK/FK	Relationship between major and course; Search course by its major.
	course_id	Course ID	Varchar [5]	PK/FK	
	course_requirement	Whether course required for this major.	Varchar [10]		Course requirement for different majors.
	course_code	Course Brief Code	Varchar [10]		Brief Code description about the course.
Course	Store course information to be searched.				
	course_id	Course ID	Varchar [5]	PK	General information of Course
	course_name	Course Name	Varchar [20]		
CourseRecBook	Store course recommended books; which book is recommended by which course.				
	course_id	Course ID	Varchar [5]	PK/FK	Relationship between course and book; Search book after course.
	book_id	Book ID	Varchar [5]	PK/FK	
	book_requirement	Whether Book required for this course.	Varchar [10]		Book requirement for different Course.
Book	Store book information to be searched.				

	book_id	Book ID	Varchar [5]	PK	General information of the books and all this information will be shown when you search it.
	book_title	Name of the book	Varchar [50]		
	book_desc	Short description of the book	Varchar [70]		
	book_edition	Edition of the book	Varchar [10]		
	book_publisher	Publisher publish the book	Varchar [25]		
	book_qoh	Quantity of the book in library	INTEGER		
	book_location	Where is the book in library	Varchar [50]		
	borrow_num	How many times book have been borrowed	INTEGER		Use to show the most borrowed books.
CourseRecPaper	Store course recommended papers; which paper is recommended by which course.				
	course_id	Course ID	Varchar [5]	PK/FK	Relationship between course and paper; Search paper after course.
	paper_id	Paper ID	Varchar [5]	PK/FK	
	paper_requirement	Whether paper required for the course	Varchar [10]		Paper requirement for different Course.
Paper	Store paper information to be searched.				
	paper_id	Paper ID	Varchar [5]	PK	General information of the paper and all this information will be shown when you search it.
	paper_title	Paper Name	Varchar [50]		
	paper_desc	Short description of the paper	Varchar [70]		
	paper_qoh	Quantity of paper in the library	INTEGER		
	paper_location	Where is the book in the library	Varchar [50]		
	journal_id	Journal ID	INTEGER	FK	Paper published in journal.

Journal	Store journal information to be searched.				
	journal_id	Journal ID	Varchar [5]	PK	General information of the journal and all this information will be shown when you search it and by its paper.
	journal_title	Journal Name	Varchar [50]		
	journal_desc	Short description of the journal	Varchar [70]		
	journal_publish_date	When the journal published	DATE		
	journal_publisher	Publisher publish the journal	Varchar [25]		
	journal_qoh	Quantity of journal in the library	INTEGER		
	journal_location	Where is the journal in the library	Varchar [50]		
BookWritten	Store relations between books and authors.				
	author_id	Author ID	Varchar [5]	PK/FK	Relationship between authors and books; Several authors can write a same book.
	book_id	Book ID	Varchar [5]	PK/FK	
PaperWritten	Store relations between papers and authors.				
	author_id	Author ID	Varchar [5]	PK/FK	Relationship between authors and papers; Several authors can write a same paper.
	paper_id	Paper ID	Varchar [5]	PK/FK	
Author	Store information of authors.				
	author_id	Author ID	Varchar [5]	PK	General information of authors and will be shown when you search books or papers.
	author_name	Author Name	Varchar [50]		

6. Relationship Descriptions

1. Department : Major is 1:M :

   A department contains several majors, like Business Department have Finance and Marketing; A major can only be included in a department.

2. Major : Course is M:N :

   A major will provide many courses to students; A course will be needed for different major students; Course's requirement for different majors is different, some courses are required for this major but some are selected.

3. Course : Book is M:N :

   A course will recommend several books to its students; A same book can be recommended by different courses; Book's requirement for different courses is different, some books are required for this course but some are selected.

4. Course : Paper is M:N :

   A course will recommend several papers to its students; A same paper can be recommended by different courses; Paper's requirement for different courses is different, some papers are required for this course but some are selected.

5. Author : Book is M:N :

   A book can be written by several writer, so it will have several authors; An author can write many books;

6. Author : Paper is M:N :

   A paper can be written by several writer, so it will have several authors; An author can write many papers;

7. Journal : Paper is 1:M :

   Many papers will be published in a journal; A paper can only be published in one journal.

7. Spaces Estimates

Table	Row length (realistic)	# Row (real)	# (5 years)	Size Overall (realistic)	Size Overall (5 years)
Department	30	3	5	90	150
Major	35	37	44	1295	1540
Major_has_Course	30	370	528	11100	15840
Course	25	259	352	6475	8800
CourseRecBook	20	1295	1760	25900	35200
Book	214	10000	12000	2140000	2568000
CourseRecPaper	20	1036	1408	20720	28160
Paper	179	5000	6000	895000	1074000
Journal	206	2500	3000	515000	618000
BookWritten	10	20000	24000	200000	240000
PaperWritten	10	15000	18000	150000	180000
Author	55	12500	15000	687500	825000
Overall	**834**	**68000**	**82097**	**4653080**	**5594690**

Assumption:

1. There is a 1.2 increase in Majors, Books, Papers and Journals in 5 years.
2. A major has 7 required courses and 3 elective courses which comes from other majors. (realistic)
   A major has 8 required courses and 4 elective courses which comes from other majors. (5 years)
3. A course has 3 required books and 2 elective books (1 is overlap with other courses and 1 is special). (realistic and 5 years)
4. A course has 2 required papers and 2 elective papers (1 is overlap with other courses and 1 is special). (realistic and 5 years)
5. There will be 10000 books and 5000 papers in the library. (real)
6. In average, a book has 2 authors and a paper has 3 authors.

8. The output of Running Create Table commands

Create Department:

.dump Department

PRAGMA foreign_keys=OFF;

BEGIN TRANSACTION;

CREATE TABLE Department (dep_id VARCHAR[5] CONSTRAINT dep_id_pk PRIMARY KEY, dep_name VARCHAR[25] NOT NULL);

COMMIT;

Create Major:

.dump Major

PRAGMA foreign_keys=OFF;

BEGIN TRANSACTION;

CREATE TABLE Major (major_id VARCHAR[5] CONSTRAINT major_id_pk PRIMARY KEY, major_name VARCHAR[25] NOT NULL, dep_id VARCHAR[5], CONSTRAINT Major_dep_id_fk FOREIGN KEY(dep_id) REFERENCES Department(dep_id));

COMMIT;

Create Major_has_Course:

.dump Major_has_Course

PRAGMA foreign_keys=OFF;

BEGIN TRANSACTION;

CREATE TABLE Major_has_Course (major_id VARCHAR[5], course_id VARCHAR[5], course_requirement VARCHAR[10],course_code VARCHAR[10],

CONSTRAINT Major_has_Course_major_id_fk FOREIGN KEY(major_id) REFERENCES Major(major_id) ,

CONSTRAINT Major_has_Course_course_id_fk FOREIGN KEY(course_id) REFERENCES Course(course_id),

CONSTRAINT Major_has_Course_majorid_courseid_pk PRIMARY KEY(major_id, course_id));

COMMIT;

Create Course:

.dump Course

PRAGMA foreign_keys=OFF;

BEGIN TRANSACTION;

CREATE TABLE Course (course_id VARCHAR[5] CONSTRAINT course_id_pk PRIMARY KEY, course_name VARCHAR[20]);

COMMIT;

Create CourseRecBook:

```
.dump CourseRecBook
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE CourseRecBook (course_id VARCHAR[5], book_id VARCHAR[5], book_requirement VARCHAR[10],
 CONSTRAINT CourseRecBook_course_id_fk FOREIGN KEY(course_id) REFERENCES Course(course_id) ,
 CONSTRAINT CourseRecBook_book_id_fk FOREIGN KEY(book_id) REFERENCES Book(book_id),
CONSTRAINT CourseRecBook_courseid_bookid_pk PRIMARY KEY(course_id, book_id));
COMMIT;
```

Create CourseRecPaper:

```
.dump CourseRecPaper
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE CourseRecPaper ( course_id VARCHAR[5], paper_id VARCHAR[5], paper_requirement VARCHAR[10],
 CONSTRAINT CourseRecPaper_course_id_fk FOREIGN KEY(course_id) REFERENCES Course(course_id) ,
 CONSTRAINT CourseRecPaper_paper_id_fk FOREIGN KEY(paper_id) REFERENCES Paper(paper_id),
CONSTRAINT CourseRecPaper_courseid_paperid_pk PRIMARY KEY(course_id, paper_id));
COMMIT;
```

Create Book:

```
.dump Book
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE Book (book_id VARCHAR[5] CONSTRAINT book_id_pk PRIMARY KEY, book_title VARCHAR[50] NOT NULL,
book_desc VARCHAR[70], book_edition VARCHAR[10], book_publisher VARCHAR[25], book_qoh INTEGER, book_location
VARCHAR[50], borrow_num INTEGER);
COMMIT;
```

Create Paper:

```
.dump Paper
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE Paper (paper_id VARCHAR[5] CONSTRAINT paper_id_pk PRIMARY KEY, paper_title VARCHAR[50] NOT NULL,
paper_desc VARCHAR[70], paper_qoh INTEGER, paper_location VARCHAR[50], Journal_id INTEGER, CONSTRAINT
Paper_journal_id_fk FOREIGN KEY(journal_id) REFERENCES Journal(journal_id) );
COMMIT;
```

Create Journal:

```
.dump Journal
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE Journal (journal_id VARCHAR[5] CONSTRAINT journal_id_pk PRIMARY KEY, journal_title VARCHAR[50] NOT
NULL, journal_desc VARCHAR[70], journal_publish_date DATE, journal_publisher VARCHAR[25], journal_qoh INTEGER,
journal_location VARCHAR[50]);
COMMIT;
```

Create BookWritten:

```
.dump BookWritten
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE BookWritten ( author_id VARCHAR[5], book_id VARCHAR[5],
CONSTRAINT BookWritten_author_id_fk FOREIGN KEY(author_id) REFERENCES Author(author_id),
CONSTRAINT BookWritten_book_id_fk FOREIGN KEY(book_id) REFERENCES book(book_id),
CONSTRAINT BookWritten_authorid_bookid_pk PRIMARY KEY(author_id, book_id));
COMMIT;
```

Create PaperWritten:

```
.dump PaperWritten
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE PaperWritten ( author_id VARCHAR[5], paper_id VARCHAR[5],
CONSTRAINT PaperWritten_author_id_fk FOREIGN KEY(author_id) REFERENCES Author(author_id),
CONSTRAINT PaperWritten_paper_id_fk FOREIGN KEY(paper_id) REFERENCES Paper(paper_id),
CONSTRAINT PaperWritten_authorid_paperid_pk PRIMARY KEY(author_id, paper_id));
COMMIT;
```

Create Author:

```
.dump Author
PRAGMA foreign_keys=OFF;
BEGIN TRANSACTION;
CREATE TABLE Author ( author_id VARCHAR[5] CONSTRAINT journal_id_pk PRIMARY KEY, author_name VARCHAR[50] NOT
NULL);
COMMIT;
```

9. The output of Running Insert commands

1. SELECT * FROM Department;

dep_id|dep_name
D001|School of Business
D002|School of Engineering

2. SELECT * FROM Major;

major_id|major_name|dep_id
M001|Marketing|D001
M002|Management Information System|D001
M003|Computer Science|D002
M004|Data Science|D002

3. SELECT * FROM Major_has_Course;

major_id|course_id|course_requirement|course_code
M001|C005|required|MKT 500
M001|C006|required|MKT 568
M001|C007|selected|MKT 565
M001|C001|selected|MIS 571
M001|C003|selected|MIS 584
M002|C001|required|MIS 571
M002|C003|selected|MIS 584
M002|C004|selected|MIS 578
M002|C005|required|MIS 500
M002|C007|selected|MIS 565
M003|C002|required|CS 548
M003|C008|required|CS 539
M003|C009|selected|CS 585
M003|C011|selected|DS 504
M003|C001|selected|MIS 571
M004|C010|required|DS 501
M004|C011|selected|DS 504
M004|C012|required|DS 502
M004|C002|selected|DS 503
M004|C008|selected|CS 539
M004|C009|selected|DS 505

4. SELECT * FROM Course;

course_id|course_name
C001|Database Application Management
C002|Knowledge in Database and Data Mining
C003|Business Intelligence
C004|Telecommunications Management
C005|Marketing Management
C006|Data Mining Bus. Applications
C007|Digital Marketing
C008|Machine Learning
C009|Big Data Manamgement
C010|Introduction to Data Science
C011|Big Data Analysis
C012|Statistical Method for Data Science

5. SELECT * FROM CourseRecBook;

course_id|book_id|book_requirement
C001|B013|required
C001|B002|required

C001|B004|selected
C001|B012|selected
C002|B014|required
C002|B003|required
C002|B010|selected
C002|B002|selected
C003|B015|required
C003|B006|required
C003|B005|selected
C003|B003|selected
C004|B016|required
C004|B010|required
C004|B017|selected
C004|B013|selected
C005|B017|required
C005|B005|required
C005|B020|selected
C005|B002|selected
C006|B018|required
C006|B001|required
C006|B005|selected
C006|B007|selected
C007|B019|required
C007|B009|required
C007|B024|selected
C007|B022|selected
C008|B020|required
C008|B007|required
C008|B013|selected
C008|B009|selected
C009|B021|required
C009|B011|required
C009|B008|selected
C009|B022|selected
C010|B022|required
C010|B004|required
C010|B006|selected
C010|B014|selected
C011|B023|required
C011|B008|required
C011|B010|selected
C011|B004|selected
C012|B024|required
C012|B012|required
C012|B005|selected
C012|B018|selected

6. SELECT * FROM CourseRecPaper;

course_id|paper_id|paper_requirement
C001|P001|required
C002|P002|required
C003|P003|required
C004|P004|required
C005|P005|required
C006|P006|required
C007|P007|required
C008|P008|required
C009|P009|required
C010|P010|required
C011|P011|required
C012|P012|required
C001|P004|selected
C002|P003|selected
C003|P002|selected
C004|P001|selected
C005|P009|selected
C006|P010|selected
C007|P011|selected
C008|P012|selected
C009|P005|selected
C010|P006|selected
C011|P007|selected
C012|P008|selected

7. SELECT * FROM Book

book_id|book_title|book_desc|book_edition|book_publisher|book_qoh|book_location|borrow_num
B001|Introduction to Marketing|Giving a general image of marketing to readers and some fundamental conception of this area|14th|WPI|3|1st floor area D5|13

B002|Introduction to Management Information System|Giving a general image of Management Information System to readers and some fundamental conception of this area|12th|WPI|5|2nd floor area H5|25

B003|Introduction to Computer Science|Giving a general image of computer science to readers and some fundamental conception of this area|12th|WPI|4|1st floor area C2|15

B004|Introduction to Data Science|Giving a general image of data science to readers and some fundamental conception of this area|10th|WPI|5|1st floor area E11|43

B005|Further Learing of Marketing|Focus on professional aspects of marketing area based on fundamental knowledge, such as difficult market patterns|14th|NGA book publish|7|2nd floor area E23|12

B006|Further Learing of Management Information System|Focus on professional aspects of Information based on fundamental knowledge|12th|NGA book publish|6|1st floor area A2|13

B007|Further Learing of Computer Science|Focus on professional aspects of computer science based on fundamental knowledge, knowing how to write complex code and computer stucture|10th|NGA book publish|6|2nd floor area A3|10

B008|Further Learing of Data Science|Focus on professional aspects of data science based on fundamental knowledge, such as data mining(need statistical background)|15th|NGA book publish|6|2nd floor area B5|7

B009|Practical Tools for Marketing|Introduce and teach readers how to use different tools to solve marketing problem|10th|XYZ book publish|7|2nd floor area F15|20

B010|Practical Tools for Management Information System|Introduce and teach readers how to use different tools to solve information system problem|14th|XYZ book publish|4|3rd floor area H17|13

B011|Practical Tools for Computer Science|Introduce and teach readers how to use different tools to solve computer science problem|12th|XYZ book publish|6|2nd floor area E6|40

B012|Practical Tools for Data Science|Introduce and teach readers how to use different tools to solve data science problem|12th|XYZ book publish|5|1st floor area B4|36

B013|Learning Database System|Teach readers how to apply database to application|11th|ABC book publish|10|1st floor area D6|15

B014|Learning Data Mining|Learning data mining skills, like clustering and classification|11th|ABC book publish|7|2nd floor area C13|32

B015|Learning Business Intelligence|Teaching important concept and skills in business intelligence area|14th|ABC book publish|6|3rd floor area H5|22

B016|Learning Telecommunications Management|General concepts of telecommunication and how to use it. |16th|ABC book publish|9|1st floor area B10|17

B017|Learning Marketing Management|Skill for readers to improve their behavior in market|12th|DEF book publish|5|1st floor area E7|26

B018|Learning business with Data Mining|Apply data mining skills like clustering to business problem. |14th|DEF book publish|10|3rd floor area A13|20

B019|Learning Digital Marketing|Focus on digital aspect of marketing|15th|DEF book publish|14|2nd floor area A17|21

B020|Skills for Machine Learning|Provide a deeper understanding of data, skills for readers to learn data pattern using computer|10th|DEF book publish|7|1st floor area F4|18

B021|Skills for Big Data Management|Apply different management skills for big data|17th|ZXC book publish|4|1st floor area F10|31

B022|Skills for Data Science|Introduction of several useful tools for data science problem|12th|ZXC book publish|8|3rd floor area C5|33

B023|Learning Big Data Analysis|Learning how to analysis data with hugh amount|11th|ZXC book publish|3|1st floor area H1|25

B024|Learning Statistical Method|learning statistical skills, used in data analysis and data mining|10th|ZXC book publish|2|2nd floor area B6|19

B025|Fantasy World|Describing a fantasy world in where lives many special creatures|2010|Novel publish|4|3rd floor area N5|78

B026|Great Advanture|Introduction of several useful tools for data science problem|2012|Novel publish|8|3rd floor area N4|69

B027|Living in the New World|Learning how to analysis data with hugh amount|2010|Novel publish|5|3rd floor area N1|27

B028|Harry Potter|learning statistical skills, used in data analysis and data mining|2001|Novel publish|7|3rd floor area N1|101

B029|C++|Introduction to C++|2012|Computer publish|9|2nd floor area C19|105

B030|Java|Introduction to Java|2013|Computer publish|7|2nd floor area C12|93

8. SELECT * FROM Paper;

paper_id|paper_title|paper_desc|paper_qoh|paper_location|Journal_id

P001|Using special analysis for Database Application|Giving an example about how to solve practical problem in database application|5|2nd floor area P1|J002

P002|Using special analysis for Data Mining|Giving an example about how to solve practical problem in data mining|4|2nd floor area P2|J003

P003|Using special analysis for Business Intelligence|Giving an example about how to solve practical problem in business intelligence|2|2nd floor area P1|J002

P004|Using special analysis for Telecommunications Management|Giving an example about how to solve practical problem in telecommunications management|5|2nd floor area P3|J002

P005|Using special analysis for Marketing Management|Giving an example about how to solve practical problem in marketing management|3|2nd floor area P1|J001

P006|Using special analysis for Data Mining Bus. Applications|Giving an example about how to solve practical problem in business applications|4|2nd floor area P2|J001

P007|Using special analysis for Digital Marketing|Giving an example about how to solve practical problem in digital marketing|3|2nd floor area P4|J001

P008|Using special analysis for Machine Learning|Giving an example about how to solve practical problem in machine learning|4|2nd floor area P2|J003

P009|Using special analysis for Big Data Manamgement|Giving an example about how to solve practical problem in big data manamgement|5|2nd floor area P3|J003

P010|Using special analysis for Data Science|Giving an example about how to solve practical problem in data science|6|2nd floor area P4|J004

P011|Using special analysis for Big Data Analysis|Giving an example about how to solve practical problem in big data analysis|2|2nd floor area P2|J004

P012|Using special analysis for Statistics|Giving an example about how to solve practical problem in statistics|4|2nd floor area P2|J004

9. SELECT * FROM Journal;

journal_id|journal_title|journal_desc|journal_publish_date|journal_publisher|journal_qoh|journal_location

J001|Special Topic of Marketing|A collection of papers about topics in marketing area|2016-09|ABC journal publish|10|1st floor area H4

J002|Special Topic of Management Information System|A collection of papers about topics in Information System area|2014-05|ABC journal publish|5|1st floor area H5

J003|Special Topic of Computer Science|A collection of papers about topics in computer science area|2016-02|ABC journal publish|7|1st floor area H4

J004|Special Topic of Data Science|A collection of papers about topics in data science area|2017-06|ABC journal publish|7|1st floor area H3

10. SELECT * FROM BookWritten;

author_id|book_id
A001|B001
A002|B001
A003|B002
A004|B003
A005|B003
A006|B003
A007|B004
A008|B005
A009|B005
A010|B006
A011|B007
A012|B007
A013|B007
A014|B008
A015|B009
A016|B009
A017|B010
A018|B011
A019|B012
A020|B012
A021|B013
A022|B014
A023|B014
A024|B015
A025|B016
A026|B017
A027|B017
A028|B018
A029|B018
A030|B019
A015|B020
A004|B020
A002|B020
A026|B021
A022|B022
A002|B023
A005|B024
A014|B024
A017|B024
A031|B025
A032|B026
A033|B027
A034|B028

11. SELECT * FROM PaperWritten;

author_id|paper_id
A001|P001
A002|P001
A003|P002
A004|P003
A005|P003
A006|P003
A007|P004
A008|P005
A009|P005
A010|P006
A011|P007
A012|P007
A013|P007
A014|P008
A015|P009
A016|P009
A017|P010
A018|P011
A019|P012
A020|P012

12. SELECT * FROM Author;

author_id|author_name
A001|AJ
A002|HK
A003|VB
A004|FG
A005|JF
A006|WI
A007|QF
A008|EF
A009|BHT
A010|VDFB
A011|GE
A012|VBRE
A013|QR
A014|HTHY
A015|WVBT
A016|FTRB
A017|RF
A018|FRB
A019|EF
A020|FERV
A021|KMLG
A022|DFN
A023|ORK
A024|WOIQ
A025|FREN
A026|VTJH

A027|VHUEHJ	A030|VEB	A033|VDU
A028|IHREU	A031|SDF	A034|MDEI
A029|FREB	A032|VBFR	

10. Query Documentation

Query Descriptions	SQL Queries	Query Output
List the most borrowed 5 books	SELECT book_title FROM Book ORDER BY borrow_num DESC LIMIT 5;	C++ Harry Potter Java Fantasy World Great Adventure
List all the books from the Book Table	SELECT book_id, book_title FROM Book;	B001|Introduction to Marketing B002|Introduction to Management Information System B003|Introduction to Computer Science B004|Introduction to Data Science B005|Further Learning of Marketing B006|Further Learning of Management Information System B007|Further Learning of Computer Science B008|Further Learning of Data Science B009|Practical Tools for Marketing B010|Practical Tools for Management Information System B011|Practical Tools for Computer Science B012|Practical Tools for Data Science B013|Learning Database System B014|Learning Data Mining B015|Learning Business Intelligence B016|Learning Telecommunications Management B017|Learning Marketing Management B018|Learning business with Data Mining B019|Learning Digital Marketing

		B020|Skills for Machine Learning B021|Skills for Big Data Management B022|Skills for Data Science B023|Learning Big Data Analysis B024|Learning Statistical Method B025|Fantasy World B026|Great Adventure B027|Living in the New World B028|Harry Potter
List all the Papers from the Paper Table	SELECT Paper_id, Paper_title FROM Paper;	P001|Using special analysis for Database Application P002|Using special analysis for Data Mining P003|Using special analysis for Business Intelligence P004|Using special analysis for Telecommunications Management P005|Using special analysis for Marketing Management P006|Using special analysis for Data Mining Bus. Applications P007|Using special analysis for Digital Marketing P008|Using special analysis for Machine Learning P009|Using special analysis for Big Data Management P010|Using special analysis for Data Science P011|Using special analysis for Big Data Analysis P012|Using special analysis for Statistics
List all the Journals from	SELECT Journal_id, Journal_title FROM Journal;	J001|Special Topic of Marketing J002|Special Topic of Management

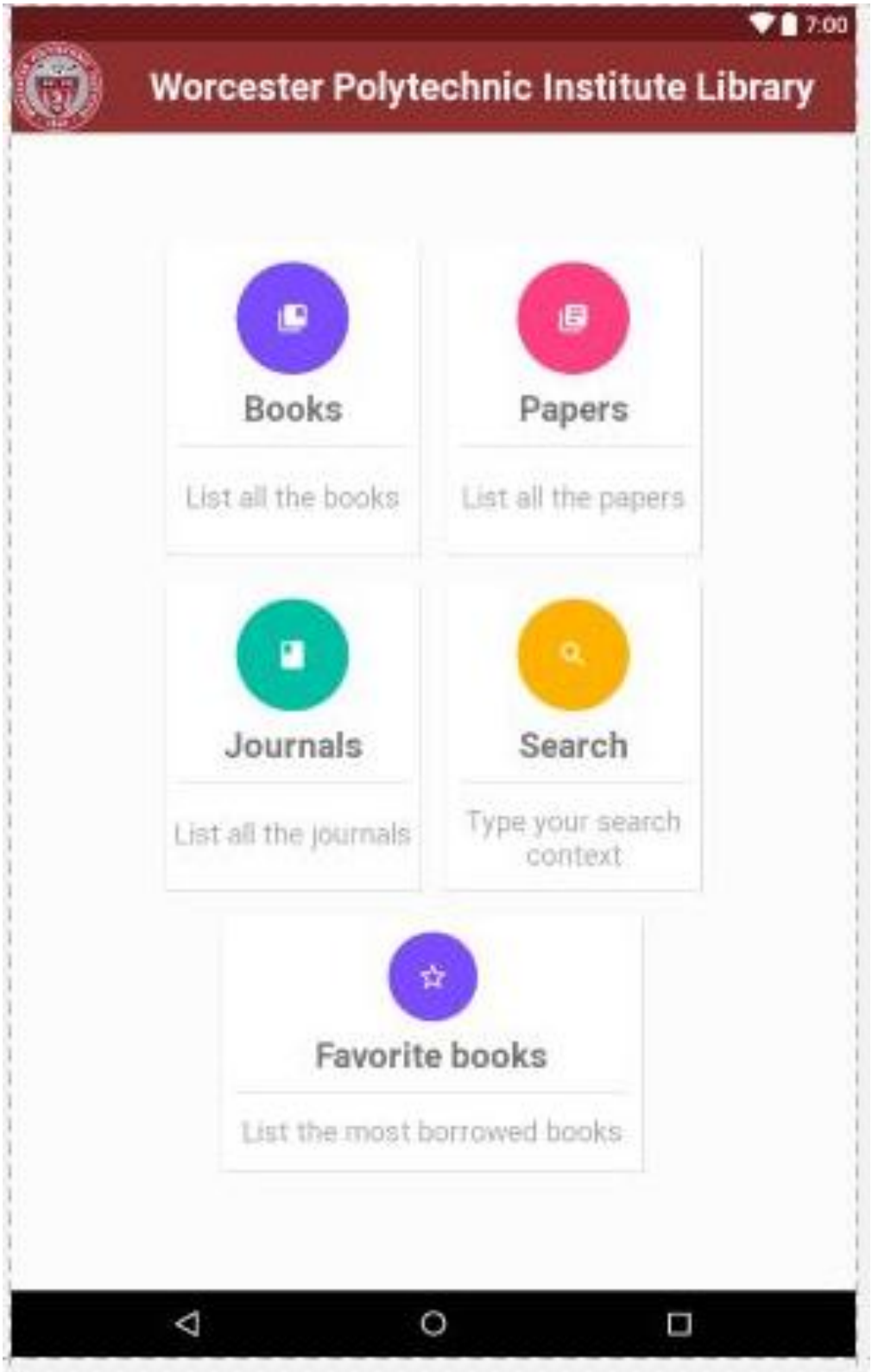
the Journal Table		Information System J003|Special Topic of Computer Science J004|Special Topic of Data Science
List all the Department by Department Name	SELECT dep_name FROM Department;	School of Business School of Engineering
List all the majors at the School of Business	SELECT major_name FROM Major, Department WHERE Major.dep_id = Department.dep_id AND dep_name = 'School of Business';	Marketing Management Information System
List all the required courses by Majors	SELECT course_name FROM Major, Major_has_Course, Course WHERE Major.major_id = Major_has_Course.major_id AND Major_has_Course.course_id = Course.course_id AND course_requirement = 'required' AND Major.major_id = 'M001';	Marketing Management Data Mining Bus. Applications
List all the elective courses by majors	SELECT course_name FROM Major, Major_has_Course, Course WHERE Major.major_id = Major_has_Course.major_id AND Major_has_Course.course_id = Course.course_id AND course_requirement = 'selected' AND Major.major_id = 'M001';	Database Application Management Business Intelligence Digital Marketing
List all the books by required courses	SELECT Book.book_id, Book.book_title FROM Book, CourseRecBook, Course WHERE Book.book_id = CourseRecBook.book_id AND CourseRecBook.course_id = Course.course_id	B002|Introduction to Management Information System B004|Introduction to Data Science B012|Practical Tools for Data Science

	AND Course.course_name = 'Database Application Management';	B013|Learning Database System
List all the books by elective courses	SELECT Book.book_id, Book.book_title FROM Book, CourseRecBook, Course WHERE Book.book_id = CourseRecBook.book_id AND CourseRecBook.course_id = Course.course_id AND Course.course_name = 'Database Application Management' AND book_requirement = 'required';	B013|Learning Database System B002|Introduction to Management Information System
Show the book detail	SELECT book_title, book_desc, book_edition, book_publisher, book_qoh, book_location FROM Book WHERE book_title = 'Introduction to Computer Science';	Introduction to Computer Science|Giving a general image of computer science to readers and some fundamental conception of this area|12th|WPI|4|1st floor area C2
List the author of the selected book	SELECT Author_name FROM Book, Author, BookWritten WHERE Book.book_id = BookWritten.book_id AND BookWritten.author_id = Author.author_id AND book_title = 'Introduction to Computer Science';	FG JF WI
List all the papers by course	SELECT Paper.paper_id, Paper.paper_title FROM Paper, CourseRecPaper, Course WHERE Paper.paper_id = CourseRecPaper.paper_id AND CourseRecPaper.course_id = Course.course_id AND Course.course_name = 'Database Application Management';	P001|Using special analysis for Database Application P004|Using special analysis for Telecommunications Management
List all the papers by required courses	SELECT Paper.paper_id, Paper.paper_title FROM Paper, CourseRecPaper, Course WHERE Paper.paper_id = CourseRecPaper.paper_id AND CourseRecPaper.course_id = Course.course_id	P001|Using special analysis for Database Application

	AND Course.course_name = 'Database Application Management' AND paper_requirement = 'required';	
List all the papers by elective courses	SELECT Paper.paper_id, Paper.paper_title FROM Paper, CourseRecPaper, Course WHERE Paper.paper_id = CourseRecPaper.paper_id AND CourseRecPaper.course_id = Course.course_id AND Course.course_name = 'Database Application Management' AND paper_requirement = 'selected';	P004|Using special analysis for Telecommunications Management
List the detail of the paper	SELECT paper_title, paper_desc, paper_qoh, paper_location FROM Paper WHERE paper_title = 'Using special analysis for Database Application';	Using special analysis for Database Application|Giving an example about how to solve practical problem in database application|5|2nd floor area P1
List the Author of the paper	SELECT Author_name FROM Paper, Author, PaperWritten WHERE Paper.paper_id = PaperWritten.paper_id AND PaperWritten.author_id = Author.author_id AND paper_title = 'Using special analysis for Database Application';	AJ HK
List all the journals by paper	SELECT Journal.journal_id, journal_title FROM Journal, Paper WHERE Journal.journal_id = Paper.journal_id AND paper_title = 'Using special analysis for Database Application';	J002|Special Topic of Management Information System

List all the journal detail	SELECT journal_title, journal_desc, Journal_publish_date, journal_publisher, journal_qoh, journal_location FROM Journal WHERE journal_title = 'Special Topic of Management Information System';	Special Topic of Management Information System|A collection of papers about topics in Information System area|2014-05|ABC journal publish|5|1st floor area H5

11. GUI Interfaces Design



Screen 1: This is the Main Page Screen for Navigating the WPI Library.

Screen 2: The Screen shows all the Department at WPI.

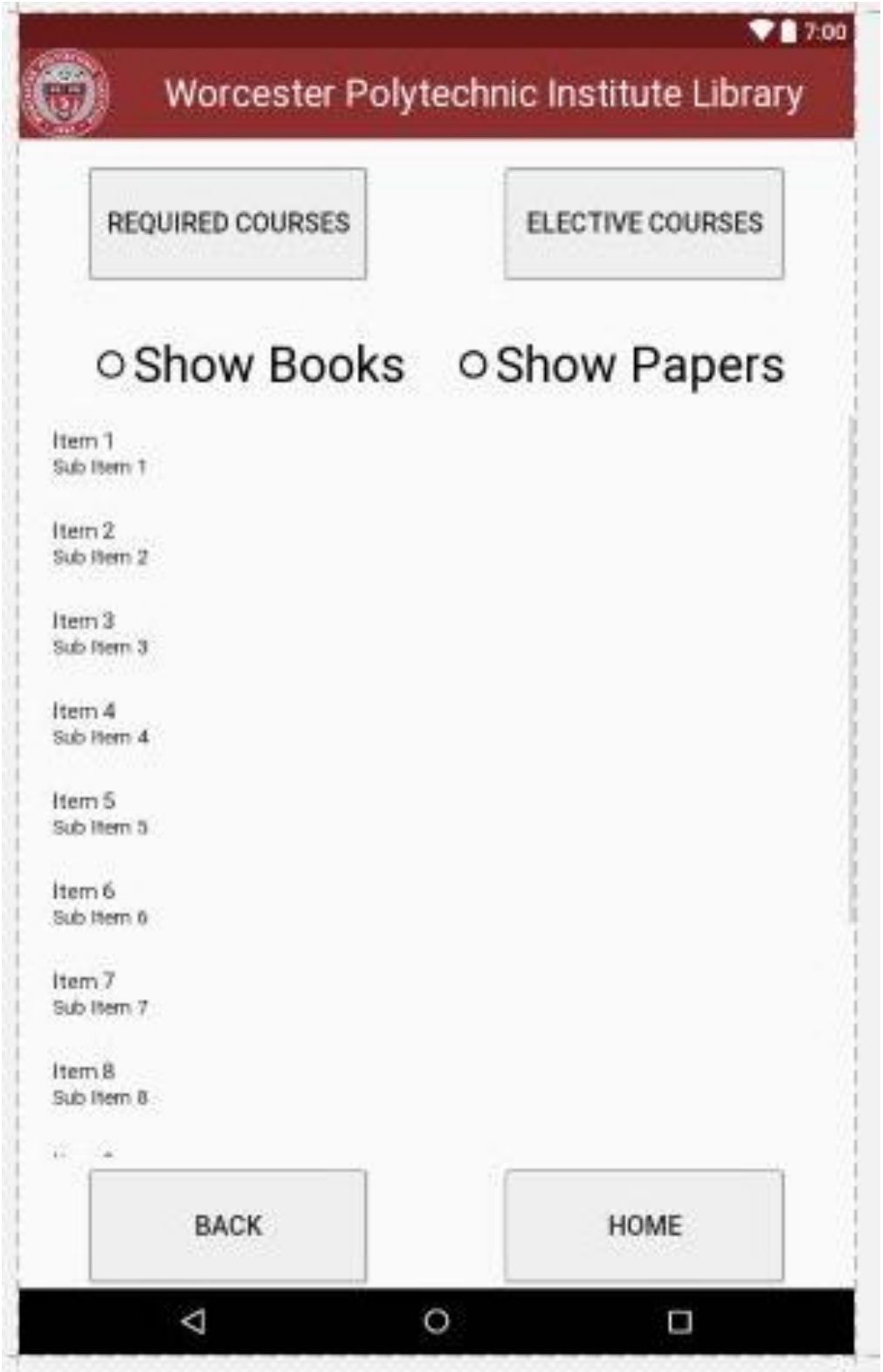
Screen 3: This Screen shows all the majors at School of Business.

Screen 4: This Screen shows all the majors at School of Engineering.

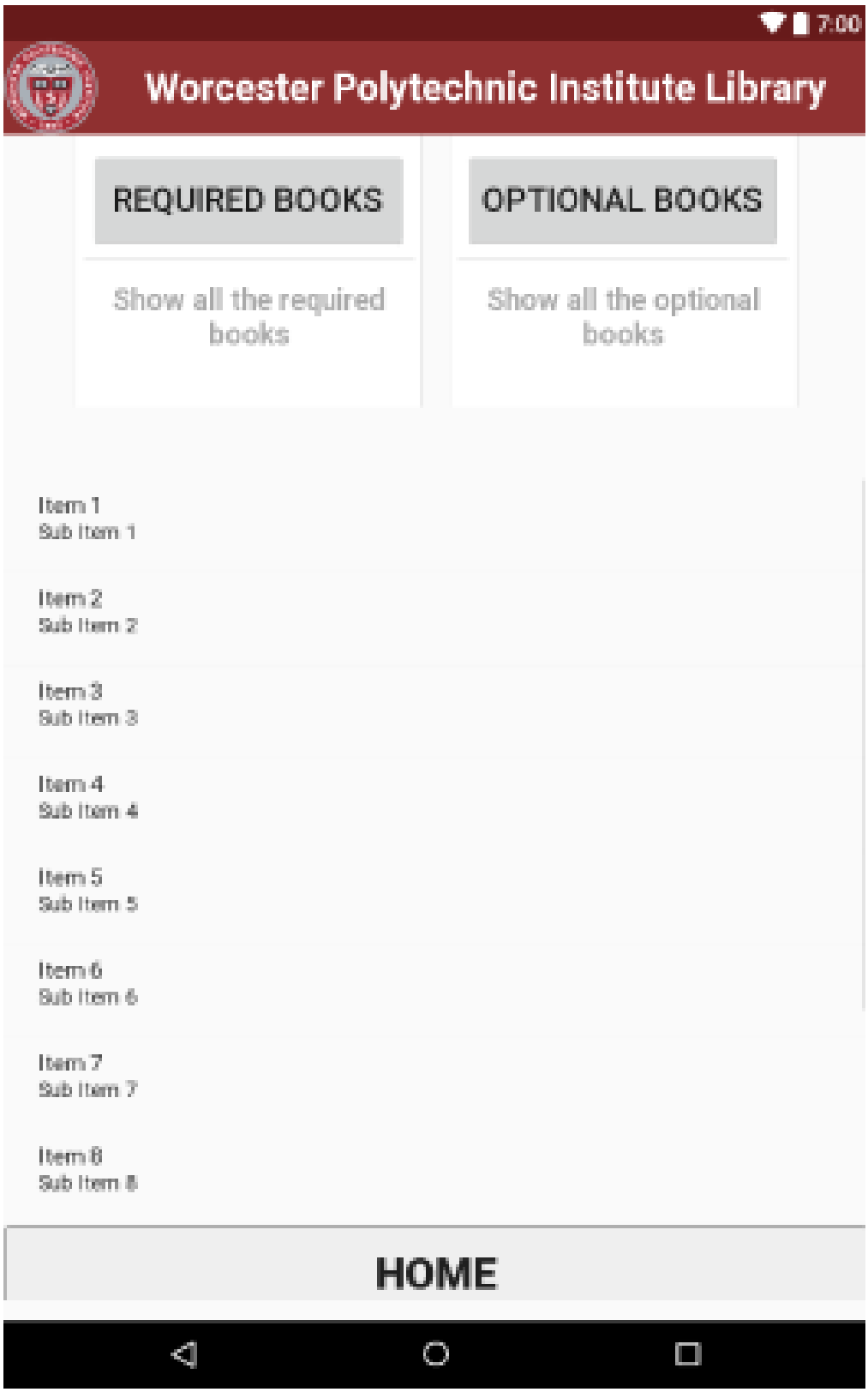
Screen 5: This Screen will show all the books at WPI Library.

Screen 6: This Screen will show all the papers at WPI Library.

Screen 7: This Screen will show all the Journals at WPI Library.

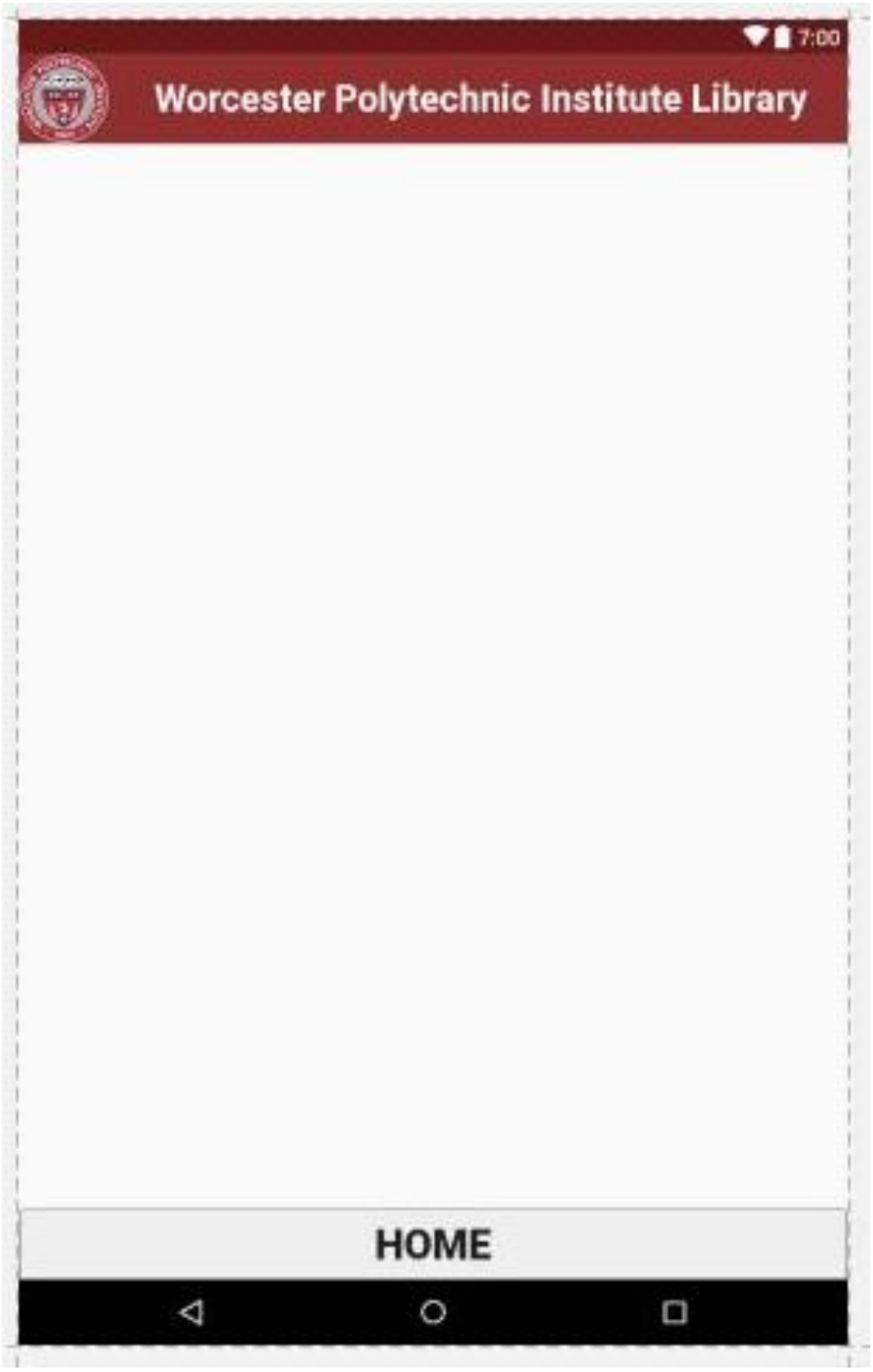


Screen 8: This Screen will show books or papers by choosing Required Courses or Elective Courses.



Screen 9: This screen will show all the required books or optional books based on the selected course.

Screen 10: This screen will show all the required papers or optional papers based on the selected course.



Screen 11: The Screen will show all the details for the searched books or papers.

12. Needed backup and security features

The data in our database are set to be connected with WPI library database. In case of losing the connection, we need to make backup of the library's data to ensure the data integrity. When the disconnection really happens, our application can recover data from our backup.

Meanwhile, we create new information for users, such as books for certain courses, thus we need to build up a full backup to automatically save overall data in our system. One thing we have to ensure is that the data in backup should always be the same with WPI library and the courses-books connection should be the same with real requirement under each course and major.

Since the information on our app are all face to the public, including what books/journals/papers in WPI Library and what books are required for courses. We are an information query platform without user login and personal information so we may not need to pay too much attention to security problems on our application. [1]

13. Potential data quality problems and proposed solutions

In assumptions of constructing the app, our database retrieve data from database in our library so when users searching books, journals or papers it will automatically extract data from library database. If the library database has some problems or the connection is failed suddenly, our app won't work. To keep our app operating as usual, we need to do better backup work.

Under this process, it is also possible that when our data fail to connect with the library, some new records are failed to update by staffs into the system. To reduce it happen, we need to ensure the connection is continuous and the range covers all data, which is especially important when data in library database system is updated and ours need to synchronize.

Same to the problem above, we also need to ensure updating data when required or optional books is changed for certain courses. In addition to ensure data updated from our part, we will also set up a feedback part for application: if some people no matter teachers or students who realize that the data is updated however our information on app don't change, they can report us through feedback part. After checking the authenticity, we will update our database. If users have other suggestions or needs, they can address in the feedback.[2]

14. Recommendations for further improvements

- Separate backup for our data

  In order to ensure that our application can always operate as usual, we would better have our separate backup instead directly using data from WPI library database. If the connection lose we can still run the application. In addition, we do have our self-created information about books assigning to courses, backup should also contain the relationships in.[3]

- Collect information from professors or schools before each semester begin

  Considering that each semester, the professor assigned to courses may change, and their required/elective books and papers may change too, we should better send survey to schools or professors to know whether they have changes. If content change, we will update our data.

- Connect professors information into database

  As describe above, different professor has different recommended books and each course may have several professors at different semester or even same semester. It's better to base on our current application, add professors into database and under each connection with professor and course, so that users can get real time and correct information.

- Add users login interface with plan of their personal courses arrangement

  To improve user experience, we would add student login function. Student can login into the application and add their scheduled courses and related books to the favorites. The favorites will remember the content for each user and each time user can directly jump into that interface to see information they need.

- Add feedback reporting function into application

  We can add feedback reporting function into our application so that students, professors or anyone can report us about any advices and errors. We will listen to advices, especially when there are errors happening. After checking with school's employee, we will take actions to update data, improve our design and functions.

15. Conclusions

- Benefit the whole WPI Community in the long run.

  Our Application will facilitate WPI Library's services in the long run, not only saving the student's time and energy to search needed material more efficiently, but also will play an indispensible role in the Faculties teaching and researching process.

- Keep improving all the functions and UI/UE design

  Our team will keep working on the improving all the functions of application based on our prototype, and improving the UI/UE design to make our application more user-friendly.

- Collaborating with WPI official to promote the application

  If we could get positive and great feedback from the students and faculties, we will collaborate with WPI official to promote our application among the whole WPI community and even among other universities in MA or New England Area.

- Keep developing IOS Application for iPhone users

  Our team will keep working on IOS Application development for the iPhone users to bring more benefits to a broader scope.

16. References.

[1] *How Secure is Android, Really?* Alan Henry, Retrieved from https://lifehacker.com/how-secure-is-android-really-1446328680

[2] *4 Ways to Solve Data Quality Issues*, Todd Hinton, Retrieved from https://www.redpointglobal.com/blog/4-ways-solve-data-quality-issues/

[3] *How to backup and restore app data with or without root*, Brittany McGhee, Retrieved from *https://www.androidpit.com/how-to-backup-and-restore-app-data-with-or-without-root*