

School-Based Assessment

Information and Communication Technology

THEME PARK SYSTEM

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1. Objectives

1.1 Background

The theme park aims to provide visitors with different kinds of entertainments together with well services. In order to improve the quality of the services and increase their competitiveness in the market, the management company plans to develop a system for the theme park which mainly focus on serving the visitors and improve the efficiency of data management of the theme park.

1.2 Problems and situations facing

There are several problems that the theme park is facing, including data management, information distribution, and high operation cost. The system aims to solve these problems.

- Data are stored at different databases and server
- Much human resources are wasted in the process of the information booklet production (About one-fourth of staff hired)
- The paper booklet is the only way for visitors to obtain the information of the theme park and it will be insufficient in peak hours
- High cost on printing and paper in the booklet production

1.3 Requirements of the intended users

The system aims to satisfy the intended users' requirements listed in the functional requirement of the system requirements specification.

Managers

- Reduce the number of staff required and the operation cost of information distribution
- Setup a centralized database to increase the efficiency on data management
- Utilize the use of facilities to increase the park's capacity

Visitors	<ul style="list-style-type: none"> • Obtain information of the park easily and conveniently (Map, Time table of events, Recommendations etc.) • All information are gathered in one system • Receive help immediately when in need
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Table 1 Requirements of the intended users

1.4 Difficulties when implementing the system

There are several difficulties when the system is being implemented. In the current process of system development, errors and problems will be located and possible solutions will be provided.

Data collection	<ul style="list-style-type: none"> • No centralized database is available in the park. Data have to be collected from different locations • Different time intervals of departments for data collection and analysis
	Possible solutions <ul style="list-style-type: none"> • Set up a centralized database • Set up a client-server network to monitor the operation of departments
Introduce to intended users	<ul style="list-style-type: none"> • Staff may not know how to operate the system • Visitors may not know the existence of the system or how to use the system
	Possible solutions <ul style="list-style-type: none"> • Provide training to staff • Upload an introduction video of the system to the theme park's website and play the video at the entrance of the park

Table 2 Difficulties when implementing the system and possible solutions

2. Analysis

2.1 Studies about visitors

A research has been conducted recently to find out the behavior of visitors, including their schedule and queries. The problem will be solved by the system.

Schedule	<ul style="list-style-type: none"> • Time crushing of planned events • Information obtained is always outdated
Queries	<ul style="list-style-type: none"> • Where should we obtain different information • When will the event begin • How long do we have to wait for the facility

Table 3 Studies about visitors

2.2 Problems to be solved by the system

- Part of staff can be freed and distributed to other positions to perform other tasks
- Latest information can be obtained at any time
- Users can obtain all information in a same location
- Better organization and management of data
- Reduce the operational cost in information distribution

2.3 Limitations of the system

- Visitors without suitable electronic devices are not able to access to the system
- High network transmission speed is required for the servers
- Paper booklets are still required for visitors without suitable electronic devices
- The system cannot totally replace the original information distribution system.
The operation cost will be higher since there are two systems running together

2.4 System Requirements

Hardware

Personal digital assistant (PDA)	<ul style="list-style-type: none"> • Main device for users to use the system • High portability which favors the use of the system in the theme park
Workstation	<ul style="list-style-type: none"> • For manual data entry • System maintenance or modification
Mainframe computer	<ul style="list-style-type: none"> • Centralized database • System server
Router / Access point	<ul style="list-style-type: none"> • Provide a wireless network inside the park • Users can access to the system through Wi-Fi connection

Table 4 Hardware required

Software

Operating system for database server	<ul style="list-style-type: none"> • Essential software for operation • Able to support multi-users and multi-tasking software
Monitoring system	<ul style="list-style-type: none"> • Monitor the performance of the system • System maintenance
App software	<ul style="list-style-type: none"> • For users to access to the system • Provide an interface for data input and output processes

Table 5 Software required

2.5 Comparisons

2.5.1 Hardware

Computer

- Mainframe computer
 - Run with tailored operating system
 - More than one CPU
 - Require RAM with large storage capacity
 - Large physical size (Up to the size of a room)
 - Used for handling large amount of transactions
 - Extremely high installation and operation cost
- Workstation
 - Desktop computer with relatively higher performance
 - Multi-tasking
 - Suitable for data entry and system maintenance
 - Not portable
 - Extendable
- Personal digital assistant (PDA)
 - Handheld device
 - Mainly uses touchscreen for input
 - Embedded with wireless network interface card
 - Nearly all PDAs are able to connect to the network
 - Portable

	Mainframe Computer	Workstation	PDA
Advantages	<ul style="list-style-type: none"> - High computational power - Able to handle large amount of data flow at the same time - Large storage capacity - High stability and security 	<ul style="list-style-type: none"> - High extendibility - Durable - Suitable for large amount of data entry 	<ul style="list-style-type: none"> - High portability - Popular among end-users - Able to connect to the network
Disadvantages	<ul style="list-style-type: none"> - Extremely high power consumption - Large physical size 	<ul style="list-style-type: none"> - High power consumption - Not portable 	<ul style="list-style-type: none"> - Relatively lower computational power - Short battery life
Application	<ul style="list-style-type: none"> - Database - File server 	<ul style="list-style-type: none"> - System maintenance - Manual data entry 	<ul style="list-style-type: none"> - Running the system software

Table 6 Comparison between computers

Mainframe computer has a high computational power which can handle large amount of transactions and it will be used as the file server of the system. It will also be used as the database of the system as it has a large storage capacity.

Workstation has a relatively higher computational power than other personal computers which can be used for manual data entry and system maintenance. Since it is better for data input, it will be used for testing the logic of the system in the current stage as the main focus of the current stage is to locate and debug as many errors as possible to minimize the total cost of system development.

PDA has a high portability which favors the use of the system in the park and it will be used as the media to access to the system. User can access to the system through a wireless network which will be set up in the next phases. Since PDA is popular among user, no extra devices are required for them to access to the system.

2.5.2 Software

Programming Language

- Pascal
 - Procedural programming language
 - Easy to learn and use
 - Easy to locate errors and debug
 - Able to deal with different calculations
 - Able to obtain information from text files

- C++
 - Object-oriented programming language
 - Having imperative, object-oriented and generic programming features

- Java
 - Object-oriented programming language
 - Portable (Cross platform)
 - Wide usage including games, built-in functions of electronic device

- Visual basic
 - Easy to learn and use
 - GUI
 - Many built-in functions like buttons

	Pascal	C++	Java	Visual basic
Speed of execution	Fast	Fastest	Normal	Normal
Complexity	Simple	Normal	Complex	Simple
Debug	Easy	Hard	Easy	Easy
File size	Small	Small	Normal	Normal
Object-oriented	No	Yes	Yes	No

Table 7 Comparison between programming languages

Java has the advantage of high portability which means the system written in java can be ran on different platforms. It is also an object-oriented programming language which will be easier to implement a large scale of program.

However, Pascal is chosen as it has the advantage of easy to use, manage and debug, which is good for the current process of developing the system. It is able to work on calculations and organization, and having a low file size.

Moreover, the main focus of the current stage is to design and test the system logic, which is better to use a programming language (Pascal) which is easier to be modified or define bugs. After the system logic is developed, it can be implemented to a higher level programming language to develop the whole system in the next processes.

Network

- Peer-to-peer network
 - Easy to set up
 - Can be set up with even two computers only
 - No special requirements on the performance of the computer
 - Low set up cost
 - Slow Data transmission speed

- Client/server network
 - A central server has to be set up
 - Function well even there are lots of computers connected to the network
 - High network security
 - All data are stored in the database
 - Resources including hardware and software can be accessed by users once they are authorized

	Peer-to-peer network	Client/server network
Cost	Low	High
Number of workstations	A few	Many
Network security	Low	High
Central server	No	Yes
Network loading limit	Low	High

Table 7 Comparison between programming languages

Client/server network is chosen as it can provide a server to centralize all data. This provides a better data management and it can provide an access control function to prevent unauthorized users from obtaining restricted information.

Internet connection

- Wi-Fi
 - Limited coverage
 - Popular internet connection method
 - High data transmission speed
 - Can be set up by an organization
 - Easy to modify
- 3G
 - Designed for mobile phones
 - High usage cost
 - Able to connect to the internet at any time and place as long as the area is covered by the mobile phone network
 - Provided by ISP
- WAP
 - Designed for handheld wireless devices
 - Low data transmission speed (Range from 10 to 153 Kbps)
 - High cost
- Dial-up connection
 - Using dial-up modem and telephone line
 - Very cheap to set up
 - Provided by ISP

	Wi-Fi	3G	WAP	Dial-up Connection
Cost	Depends on the scale	High	High	Low
Data transfer speed	Very high	high	low	Very low
Security	Low	Normal	Normal	High
Coverage	Small	Large	Small	Large

Table 8 Comparison between network connections

As the performance of the network connection will directly affect the efficiency of the system, the network should be stable, having a fast data transmission speed and a large coverage.

3G provides a very large coverage of network and an acceptable data transmission speed. However, it cannot be modified easily as it is provided by ISP. The cost will also be very high if the data usage is high.

Therefore, Wi-Fi is chosen as it has a very high data transmission speed and it can be modified easily as it can be set up by the park. The coverage can also be enlarged by connecting more access points or routers to the network. And the cost is relatively lower as it is not charged based on data usage.

Database

- Text file
 - Easy to use
 - Pre-installed in most devices
 - Store text only
- Microsoft access
 - GUI
 - Supported by VBA
 - Can be integrated with other Microsoft Office software
- Oracle Database
 - Object-relational database management system
 - Portable
- MySQL
 - Cross platform
 - Open-source
 - Easy to use

	Text file	Microsoft Access	Oracle Database	MySQL
Function	Very Few	Many	Many	Some
File size	Small	Normal	Normal	Normal
Portability	High	Normal	High	High
Data format support	Very Few	Many	Many	Many

Table 9 Comparison between databases

As the current stage of system design is to develop the system logic, only text file is required as it is less complicated and very easy to debug or modify. It is also suitable for program testing as it is easy to use.

Microsoft Access will be implemented in the next phases as it can be integrated with other Microsoft Office software which favors data management.

3. System flow chart

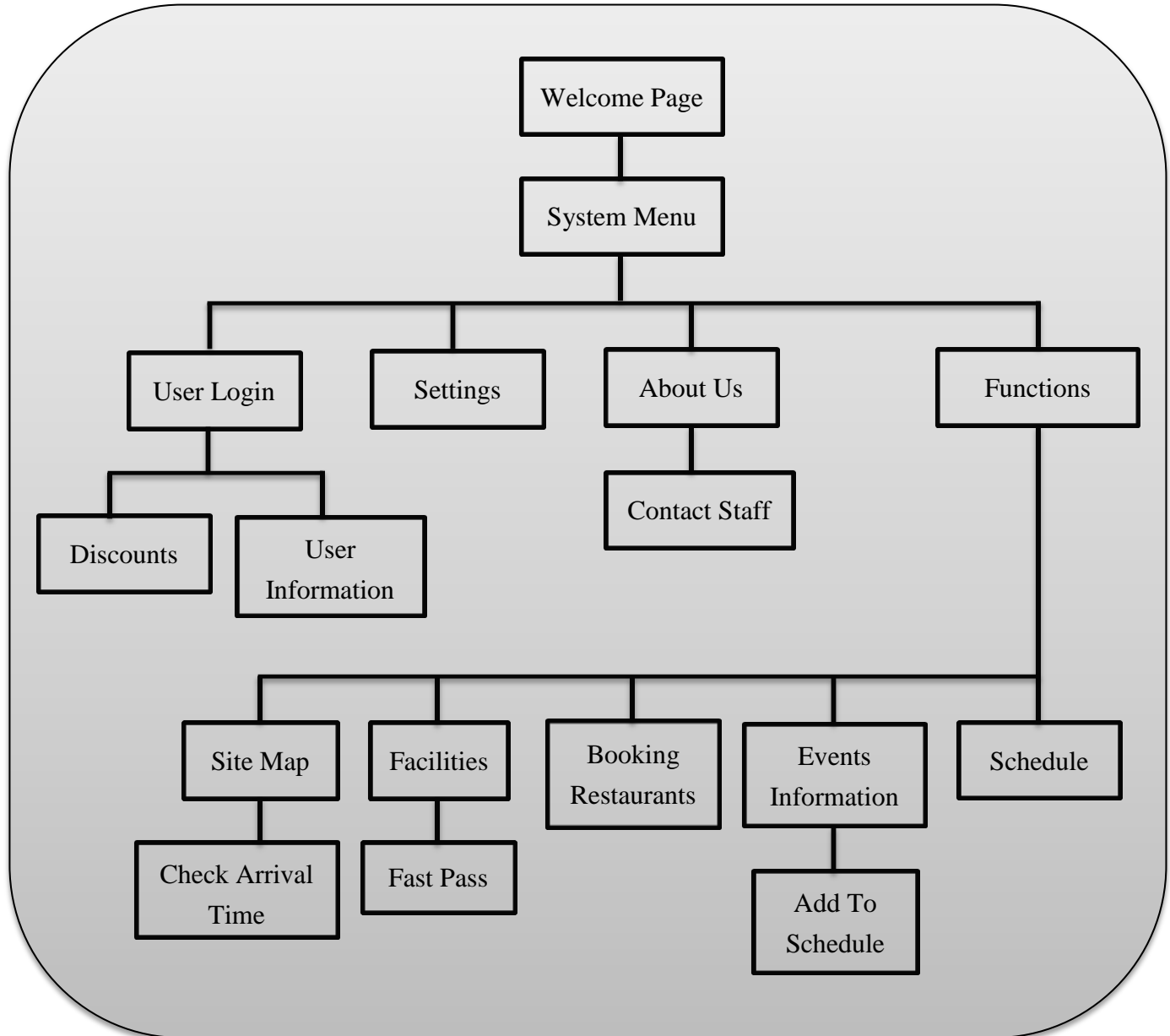


Chart 1 System overview

4. Functions Details

4.1 User Login

User can login to the system in this function. They can save their settings and records made in the system and restore the data back when they login again.

To reduce the work load of the system, registration of account will be available when user has entered the park and the process will be completed when they receive their own ticket. When user has login to the system, they can obtain the discount offered by the park. They can also change their name and password of their account in user settings.

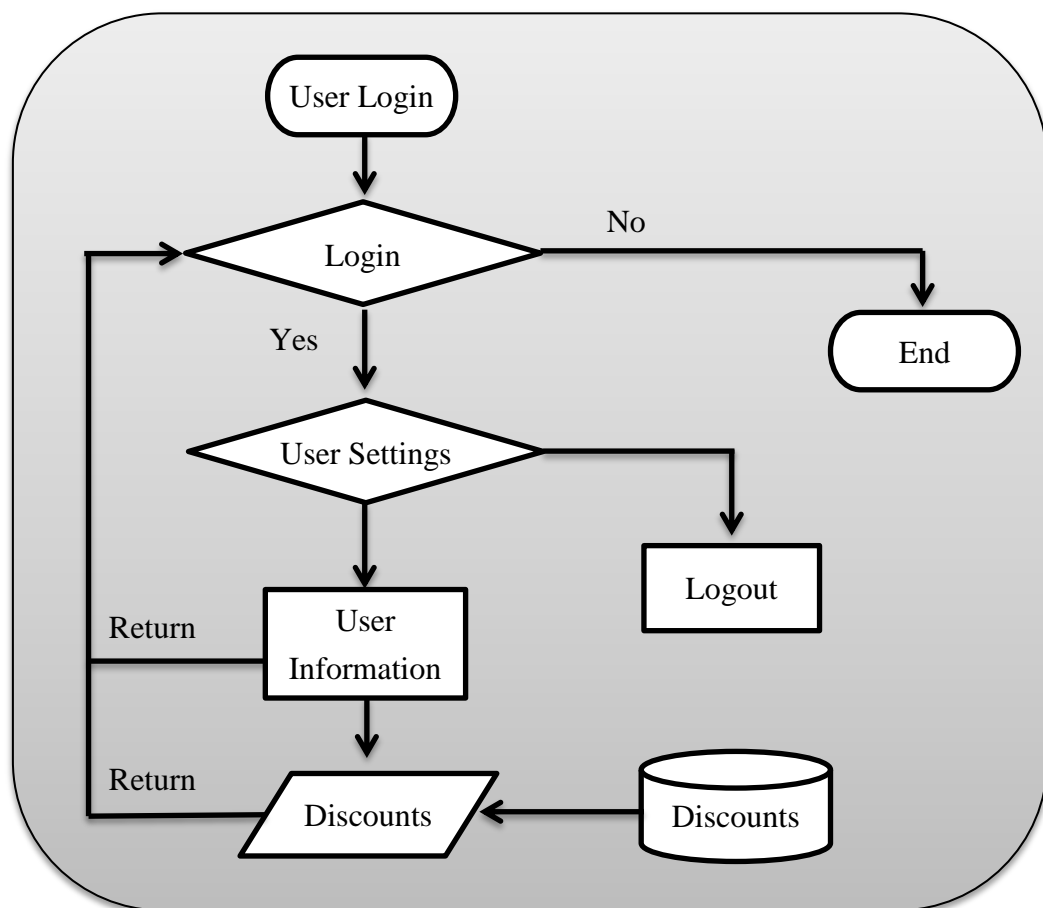


Chart 2 User Login

4.2 Site Map

Site Map function includes the map of the whole theme park and checks the current position of the user. It allows users to plan and check for their route conveniently.

In this function, users can also check for the estimated arrival time from their current position to the designated location. The system will check with the current situation of the park with GPS and calculate the arrival time automatically. Since a real-time system is applied, the data will be collected when a request is made. The calculated arrival time will be highly reliable and accurate.

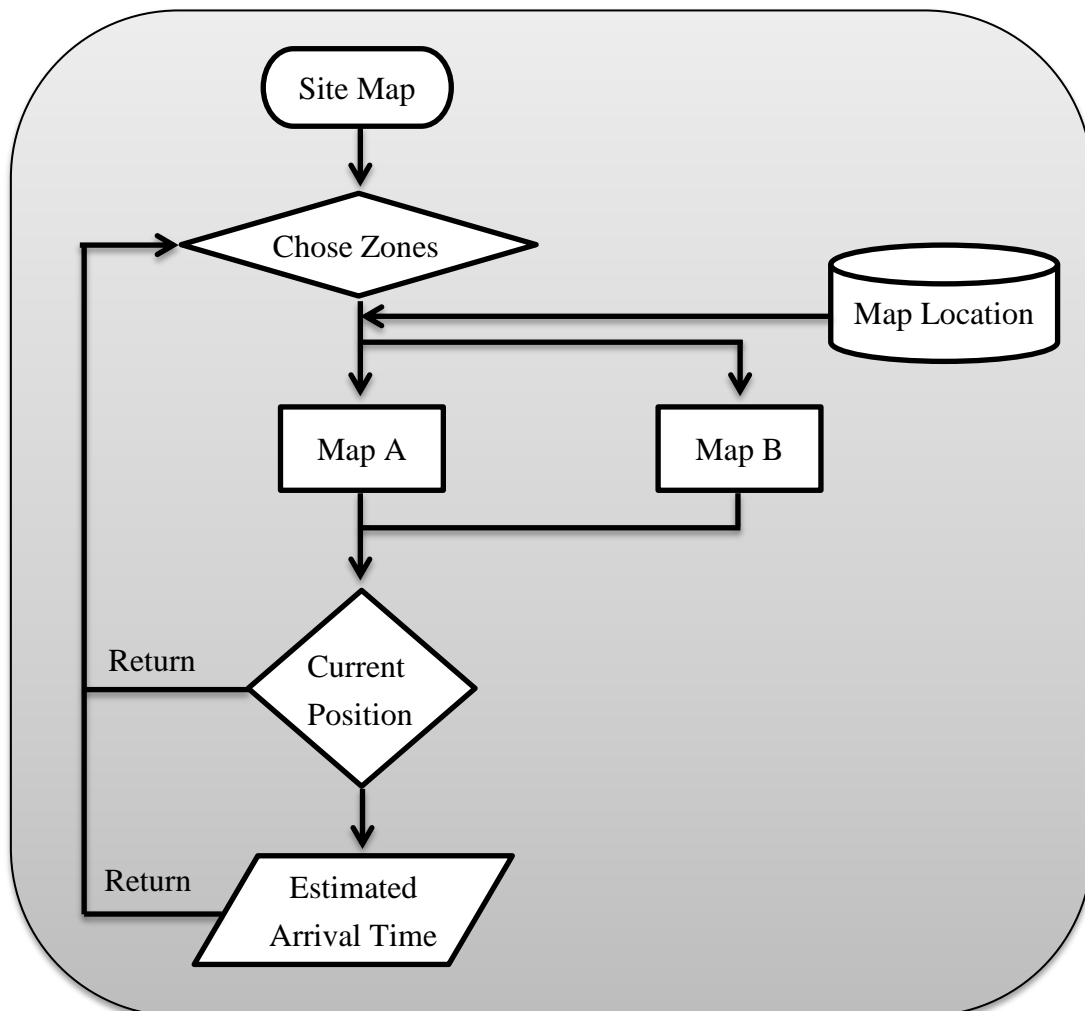


Chart 3 Site Map

4.3 Facilities

Facilities function allows users to check the available facilities and events. It provides users with useful information which helps to make a better planning.

Users can chose to receive a fast pass for different facilities to reduce the time wasted in queuing. A fast pass allows users to queue up for a facility online which they don't have to wait outside the facility. It can help users to have a better time management and prevent the park from being too crowded.

Users can also check for the remaining seats of each event which allows users to make a better planning on their schedule.

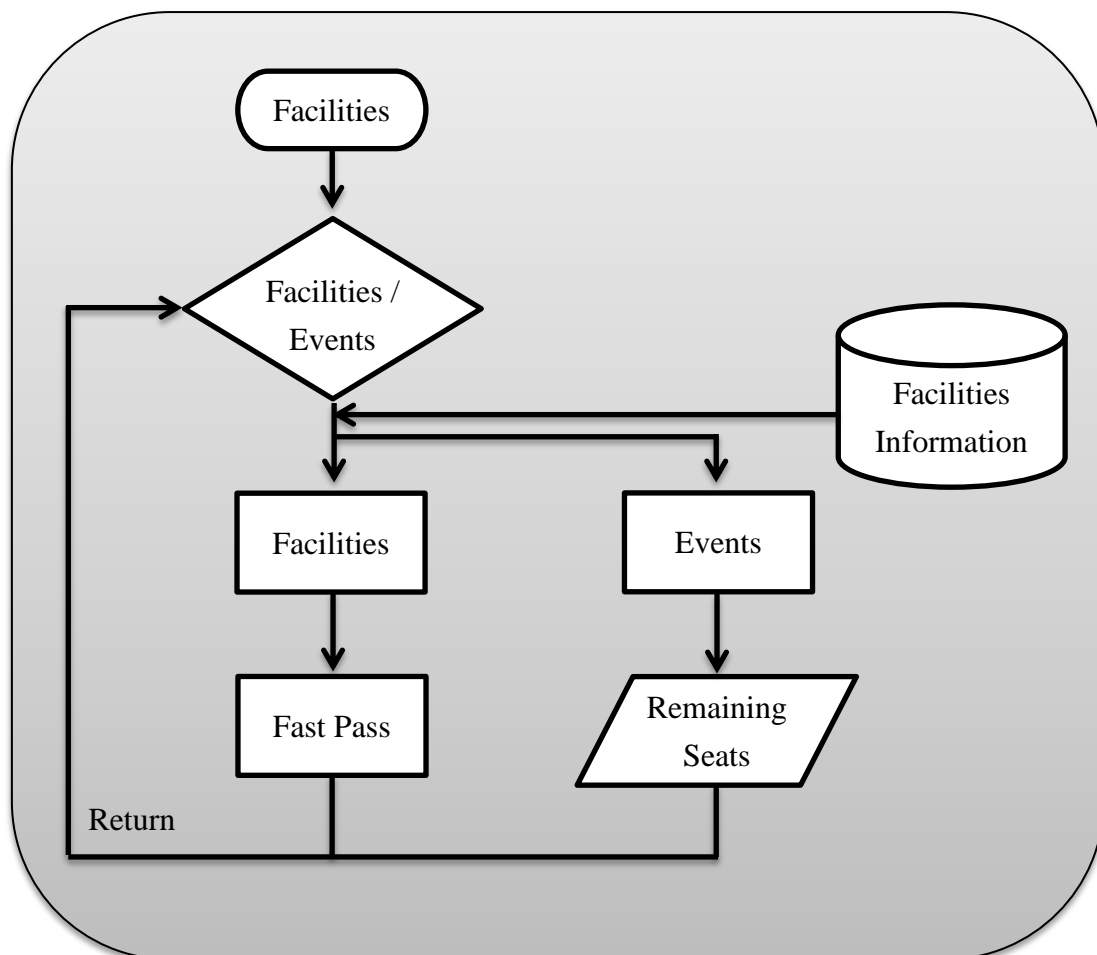


Chart 4 Facilities

4.4 Restaurants

Restaurants function provides the information of all the restaurants inside the park. It allows users to know all the available restaurants they can chose in the park.

Users can also book the restaurants in the system. The system will check with the availability of the restaurant to see if the request should be allowed. The result will be shown within a few seconds.

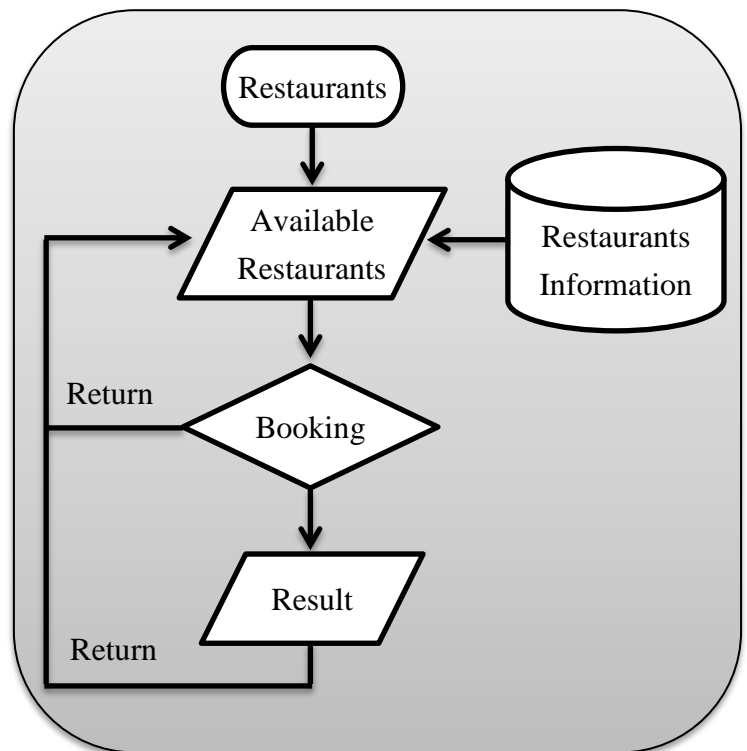


Chart 5 Restaurants

4.5 Events Information

Events Information function provides information about the events to be held today. Users can know about the details of the events held on today.

Users can also add the events to the schedule to prevent missing the events. They can check and modify their schedule in the schedule function.

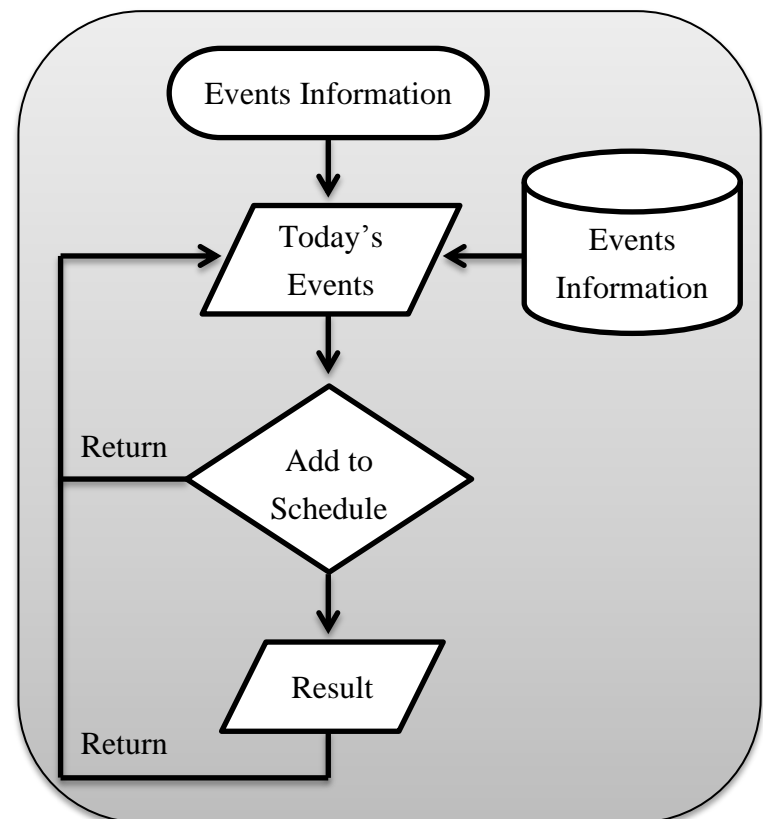


Chart 6 Events Information

5. System Features

‘Readme’ Text File

Since the right of privacy is a fundamental human right, to ensure that users have read and understand the terms listed in the ‘readme’ text file including privacy policies and terms of use, users have to modify the text file after they have read before they can use the system.

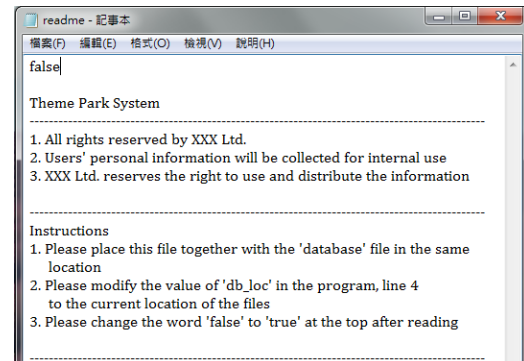


Figure 1 'Readme' text file

This protects the personal information of users and their privacy as they understand what will be collected by the system and how their personal information will be used.

The system cannot be accessed until the instructions are completed and followed properly.

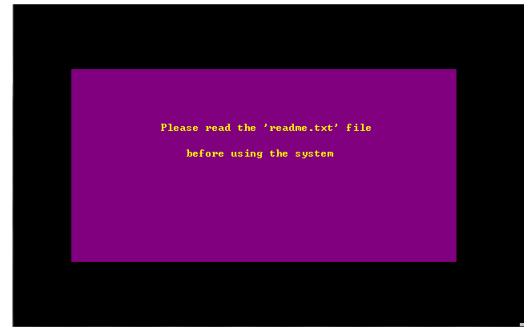


Figure 2 System access refused

Graphical User Interface

The system has adopted a graphical user interface (GUI) which provides a clear and easy-to-use interface for users. Comparing to other interfaces such as command line interface, users are not required to recite lengthy commands to control the system. This improves the efficiency of controlling.

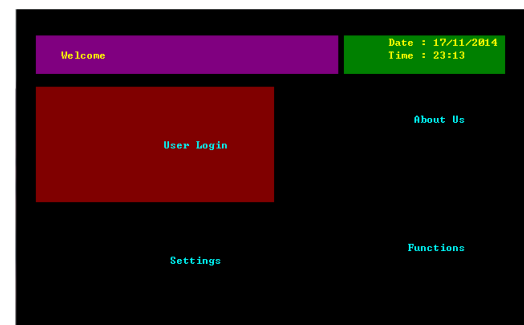


Figure 3 System menu interface

A pre-designed layout allows programmers to design the actual system more conveniently and efficiently in the next phases as a sample layout has been designed and completed already. Time for developing the system can be generally reduced.

Security Measures

Privacy is one of the major concerns of the system. Apart from keeping all the personal information properly, the system also protects users' privacy during input process.

In the login page, when users have inputted their user name and password, and verified the inputted information, the password will be hided and covered by '*' a few seconds later.

This prevents the personal information from being lost to unauthorized people due to peeking. As the system will be used in the park where users will be surrounded by many people, the probability of peeking is extremely high. This feature greatly reduces the chance of losing personal information.

Verification Code

When users have incorrectly inputted their user name or password for more than two times, users also have to input a verification code when they login.

After the system has been developed in the next phases, the text will be intentionally distorted to help fight automated spam programs. Since there are uncountable many malicious software and programs among the internet, some of them may attack the system by generating tons of useless data. The system will be overloaded if there are too many data flow at one time. An intentionally distorted verification code can block automated spam programs from attacking the system as nearly all character recognizing program cannot identify those intentionally distorted text. This helps to maintain the normal condition and performance of the system.

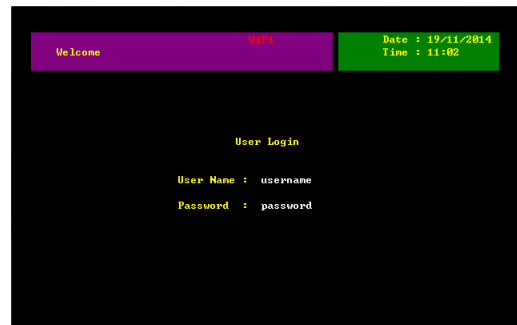


Figure 4 Login page

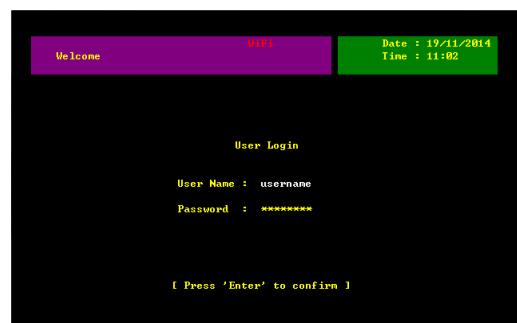


Figure 5 Password has been covered by '*'



Figure 6 Login with verification code

Double Data Entry

To prevent undesirable input error, double data entry is implemented. Users have to input their new password twice when they are changing their password.

During data input process, errors are likely to occur, especially transposition error. Users may not notice that they have inputted their new password incorrectly and they not be able to access to the system again. Double data entry greatly reduces the chance of occurrence of input errors.

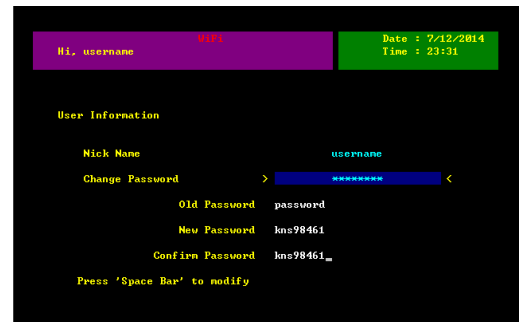


Figure 7 Double data entry for changing password

Pop-up Windows

Latest and important information should be always provided to user. In order to prevent user from missing the notice, a pop-up window containing the information will be shown up and the system will not continue until user have responded to it. When users have done something wrongly, a pop-up window will appear and warn users. This reminds users about what they should do.

The system also asks users to confirm their option through a pop-up window. This prevents users from any careless mistakes when they are making a choice.

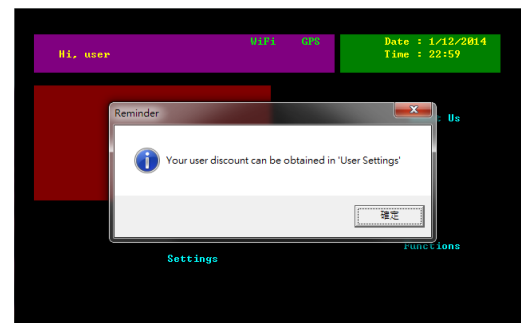


Figure 8 Pop-up window of discount

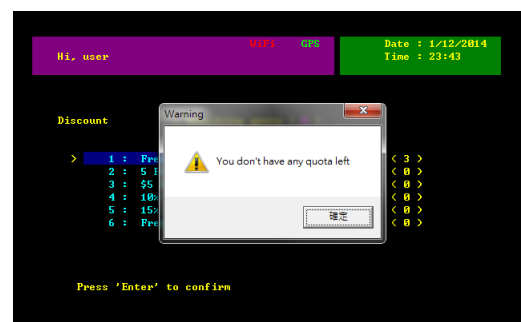


Figure 9 Pop-up window of warning

Online Support

User can obtain online support from the system. There are always some unexpected problems happened and user may not know how to solve the problem.

Since user may not be able to contact our staff through phone call. The system provides a platform for them to communicate with our staff to solve their problems or queries. Since a real-time system is implemented, user can receive responses just a few seconds later.

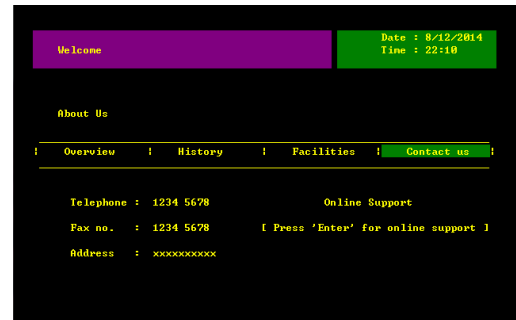


Figure 10 Online support

Searching

User may find it inconvenient to search for information from a list. It will waste a lot of time to look up for the information when the list contains many data.

The system provides a searching function for users to search for an event conveniently if they know the name of the event. This greatly improves the user experience when they are using the system.

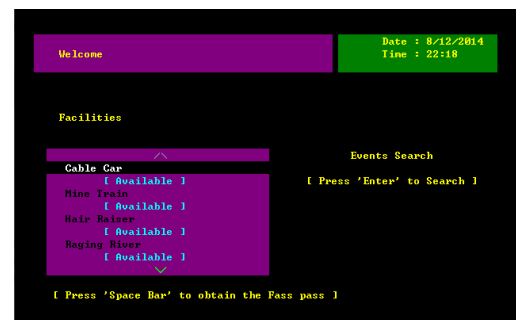


Figure 11 Events searching

Schedule

Users can record the event to their own schedule in the system. An alarm will be set automatically to remind users of the events recorded.

Since users may not check the time frequently and they may miss the event. This function can prevent this from happening.

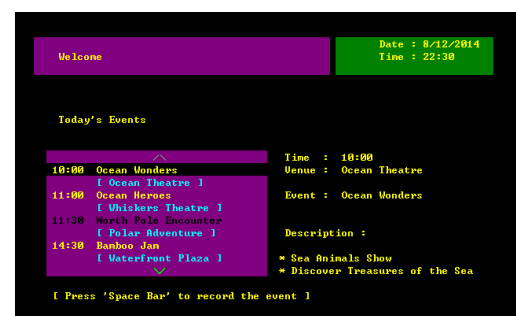


Figure 12 Schedule

6. Program

```

{menuLayout_login}
if (pre_menuX = 1) and (pre_menuY = 1) then textbackground(16);
if (ch_menuX = 1) and (ch_menuY = 1) then textbackground(12);

if ((ch_menuX = 1) and (ch_menuY = 1)) or ((pre_menuX = 1) and (pre_menuY = 1)) then
begin
  for i := 1 to 9 do
  begin
    GoToXY(4, 6 + i);
    write(' ':37);
    end;

    GoToXY(24, 11);
    if logn then write('User Login')
    else write('User Settings');
end;

```

Figure 13 Program: Main menu

In the above program, two conditions are set for displaying the menu. Only the parts required will be changed to display the option made by users. Besides showing a clear interface, the efficiency of the system will be considered too. Setting two conditions can reduce unnecessary operations of the system.

Variable	Application
pre_menuX, pre_menuY	The coordinates of the box chosen previously by the user
ch_menuX, ch_menuY	The coordinates of the box chosen now by the user

```

Procedure events;
Type event = record
    time, name, location, des_1, des_2 : string;
end;
Const no_event = 7;
Var key_events, opt, i : integer;
    upper : 1..(no_event - 3);
    lower : 4..no_event;
    rept : boolean;
    ch_event : array[1..no_event] of event;
Begin
    key := 0;
    key_events := 0;
    opt := 1;
    upper := 1;
    lower := 4;
    rept := false;

    reset(db_event);

    for i := 1 to no_event do
        with ch_event[i] do
            begin
                readln(db_event, time);
                readln(db_event, name);
                readln(db_event, location);
                readln(db_event, des_1);
                readln(db_event, des_2);
            end;
        end;
    end;
end;

```

Figure 14 Program: Array and Record

In the above program, array and record are used together to store the data read from text file. It acts like a database which provides a better data management.

Variable	Application
time, name, location, des_1, des_2	Fields of a record
ch_event	Store all the records

7. Testing and Evaluation

After the system is implemented, it should be tested to ensure that there are no errors and performs properly as expected. Since mistakes may occur at any stages of the System Development Life Circle, the system may not be able to complete all required tasks or fail to match with the user requirements. In order to make sure that the system is correctly designed and functions well, three tests have to be done, including unit test, system test and acceptance test, and conducted by programmers, test team and users respectively.

7.1 Unit Test

Unit test refers to testing individual modules to remove syntax and logic errors. It aims to identify and fix as many errors as possible before they are integrated into large units as errors will be much more difficult to locate and fix for a larger system unit.

Test on Function: Login

Test Case	Input / Action	Expected Outcome	Actual Outcome	Result
Check if the system will reject invalid login	Blank	Login rejected	Login rejected	Success
Check if the verification code shown up after the second invalid login	Input two invalid login	The verification code shown up	The verification code shown up	Success
Check if the verification code functions properly ('dkeys' shown)	'dkeys'	Login rejected	Login rejected	Success
Check if username contains space will be rejected	' user'	Login rejected	Valid login	Fail

An error occurred during data verification, username contains spaces cannot be detected as invalid. This error can be fixed by checking the presence of space in the inputted username. Any username contains spaces detected will be treated as invalid.

Test on Function: Map (Error-free)

Test Case	Input / Action	Expected Outcome	Actual Outcome	Result
Check if the system can obtain data of maps from the database	Enter map function	Map information are shown correctly	Map information are shown correctly	Success
Check if the 'My Position' function works when GPS is turned on	Turn on GPS	Users' current position is shown in the map	Users' current position is shown in the map	Success
Check if the estimated arrival time is shown soon after a request is made	Request for the estimated time	The estimated arrival time is shown	The estimated arrival time is shown	Success

Test on Function: Facilities (Error-free)

Test Case	Input / Action	Expected Outcome	Actual Outcome	Result
Check if the facilities and events are shown correctly	Enter facilities function	All information are shown correctly	All information are shown correctly	Success
Check if the search function works properly	'Ocean Wonders'	Event 'Ocean Wonders' is shown	Event 'Ocean Wonders' is shown	Success

Test on Function: Schedule (Error-free)

Test Case	Input / Action	Expected Outcome	Actual Outcome	Result
Check if all the recorded events are shown	Record an event	The event is shown in schedule	The event is shown in schedule	Success
Check if the schedule can be reset	Press 'Delete'	Schedule is reset	Schedule is reset	Success

7.2 System Test

System test checks the integration of the modules as a complete system. It aims to find out whether the system works according to the user requirements. In this early stage of system development, the system test only focus on error location. While volume tests, storage test and performance time test will be conducted in the next phases.

System Test	Result
Different functions can be entered by pressing arrow keys and enter	True
Wi-Fi or GPS logo is shown at status bar after turned on	True
Wi-Fi or GPS turned on in settings is recognized by other functions	True
Discount and user settings are available after login	True
Each function is correctly linked to databases	True
Press esc to return to menu at different pages	True

7.3 Acceptance Test

Acceptance test allows users to determine whether the system meet the user requirements. It can check whether the system is developed properly based on the objectives and accepted by users. However, the main focus of the current stage is to test the logic of the program and fix syntax errors. Acceptance test is not suitable and useful at the current stage. It will not be conducted at the current stage.

7.4 Evaluation

After conducting the above two tests, the performance of the system is acceptable. The logic of the program works well and the functions can satisfy all requirements listed in the user requirements.

However, some errors are located during unit test which indicates that part of the system is not functioning well to meet with the expected results. Possible solutions are listed out and they are fixed soon after they have been located.

On the other hand, there are rooms of improvement in the system. Other than achieving all user requirements, user-friendliness should also be considered. Users communicate with the system through the user interface of the system. It should be designed in an easy-to-use and clear manner. The design of the system interface should be the major concern at the next phases.

8. Conclusion and Discussion

After the testing and evaluation of the system, the result shows that the system has been developed correctly and functions well.

Most of the function works and they are well-cooperated with each unit in the system, which means the effectiveness and efficiency of the system are ensured. Since a low level programming language (Dev-Pascal) is used in the current stage, it is easier to check the logic of the system as it is a procedural programming language. Every detail of the logical steps are typed and shown clearly. Locating errors and debug are simpler to achieve.

Moreover, the system can be further simplified and achieve a higher efficiency with a higher level of programming language applied in the next phases as they are declarative or object-oriented programming language. Programmer can focus on 'what' to solve instead of 'how' to solve. With the designed logic at this stage, time and cost of developing the system can be significantly reduced.

In the next stages, the major focus and concern will be shifted to data collection and hardware settings. Since the logical and interface of the system have been designed, they can be copied and applied during the software development. When building up a centralized database, it is very important to connect different servers and network to the database properly as this will directly affect the performance of the whole system. The connection between the text file and the system designed can be used as a reference in the next phases as it has been checked and proved to be functioning properly.

Through the current process, a general concept and the data flow of the system are designed and visualized. This helps to improve the efficiency of the whole system development process and reduces the cost incurred during system development. This ensures the importance of the current process.

9. Gantt Chart

2013-2014	12	01	02	03	04	05	06	07	08	09	10	11	12
Understand the background													
Understand the problems facing													
Collect user requirements													
Researches													
Begin system designing													
Begin program designing													
Estimate possible problems													
Program testing and debug													
Evaluate the program													
Generate report and conclusion													
Suggestions for the next process													

10. References

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book 1 – 3, elective D2

Wikipedia

<http://en.wikipedia.org/>