System and Software Architecture Description (SSAD)

Tipsure.com

Team# 09

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Version History

Date	Author	Version	Changes made	Rationale
10/10/14	AB, TT	1.0	• Changes to original template for Instructional ICM-Sw v1.0, included system context diagram, use case diagrams, artifacts diagrams, and details of expected flow of actions for system capabilities	• Initial SSAD document, based on client requirements, negotiated win conditions, and explaining proposed system architecture
10/15/14	TT	1.1	• Changes to previous version to incorporate UML standards in use-case diagram, system context diagram	• General readability and easy understanding of diagrams, UML standards have been enforced
10/20/14	AB, TT	2.0	• Added sections for Technology dependent and independent design, architectural styles, patterns and framework	• Complete documentation of proposed system, and rational for selection of choices for architectural style and technology dependence
12/01/14	TT	2.1	• Changes to previous diagrams to depict relevant architecture changes, such as location of Add Business feature changed	• Encompass the essence of component and sequence diagrams, and cover more details of the architecture, new changes and decisions

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1. Introduction

1.1 Purpose of the SSAD

The purpose of the SSAD is to document the results of the object-oriented analysis and design (OOA&D) of the Tipsure.com system being developed. The SSAD will be used by the builder (programmer) as reference to the system architecture. The Tipsure.com system being developed should be faithful to the architecture specified in the SSAD. Furthermore, the SSAD is used by the maintainer and clients to help understand the structure of the system once the proposed system is delivered.

1.2 Status of the SSAD

This is the third version of the SSAD document, and follows the guidelines of ICSM EPG for system architecture plan. Version 2.0 was an initial draft from the Electronic Guide with basic understanding of system flow and design in place for the Tipsure.com project. Version 2.1 considered project details of various actors in the system and their roles, and interaction with the system and with each other. With better understanding of customer requirements and priorities in Win-Win negotiations, the architecture has been refined to incorporate them consistently in version 2.2. The current version gives clear and well defined idea of what are the interfaces to the system, who are the actors, and how they use the interfaces in the Tipsure.com project.

2. System Analysis

2.1 System Analysis Overview

The primary purpose of Tipsure Project is to offer suggestions on who, when and how much to tip at any business in the world. It is a web based database project delivered on a mobile platform. This project aims at reducing the confusion many business travelers encounter and strives to provide accurate information and simplify the changing atmosphere of tipping expectations in the US and global markets.

In this system, there are primarily two users: Customers and Business Owners: the first group of users benefit by having the confusion and awkwardness of who to tip, how much is appropriate by finding the closest Tipsure business with the help of search and nearby options and the second group benefits by providing a smoother transaction to their client and providing accurate information on who, when, how much to tip. Further the facility of adding comments, leaving feedback and calculating the tip with the help of a tip calculator is also provided.

2.1.1 System Context

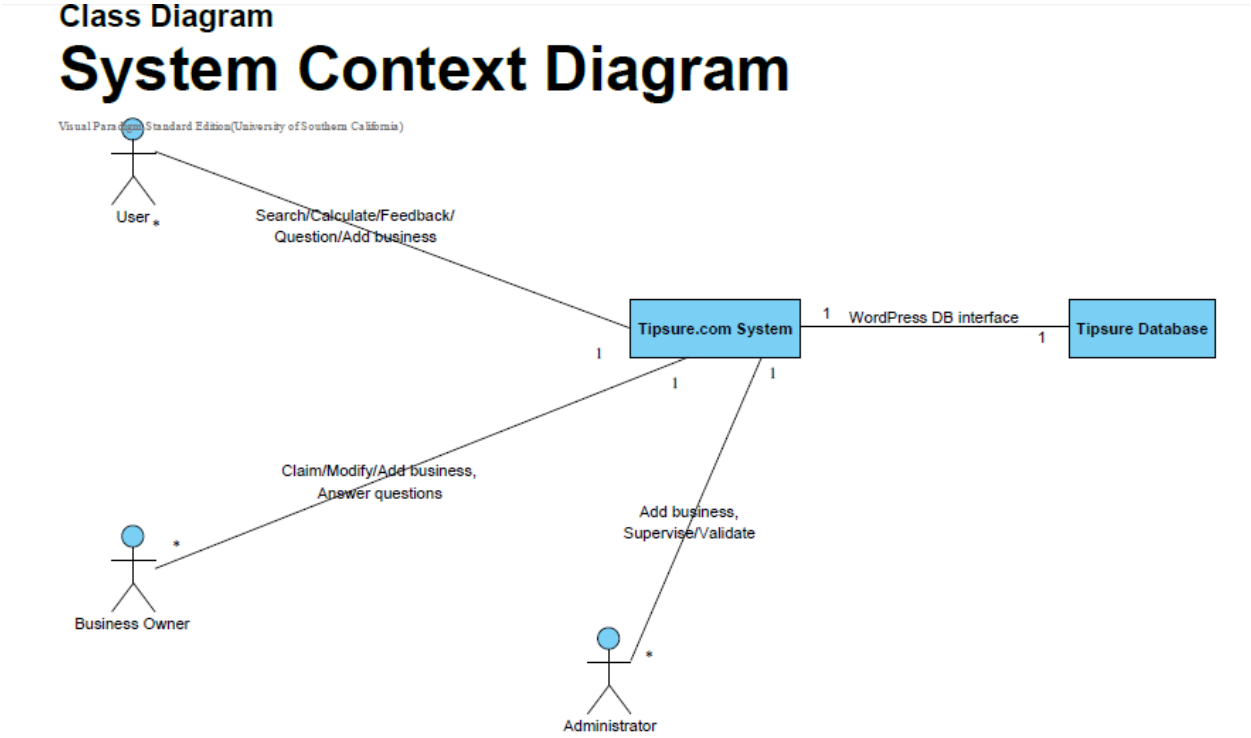

Figure 1: System Context Diagram

Table 1: Actors Summary

Actor	Description	Responsibilities
User	End users of Tipsure.com project.	Access tipping information, provide feedback about businesses, their tipping practices, ask question to admin, use travel guides provided by Tipsure.com
Business Owner	Validated owner of business in Tipsure.com's database.	Claim their businesses from the website, provide accurate business information, including tipping practices, respond to customer queries.
Administrator	Owners and maintainers of the project.	Authenticate claims of owners, answer customer questions sent via website, filter comments and feedback.
Tipsure.com System	WordPress and PHP system that handles all user requests.	Handle user request, send certain requests such as adding new business, claiming a business, to the Administrator.
Tipsure Database	Separate system storing all Tipsure.com information, and responding to SQL queries.	Maintain business information, owners' information, and maintain integrity of data, respond to SQL queries and provide appropriate information.

2.1.2 Artifacts & Information

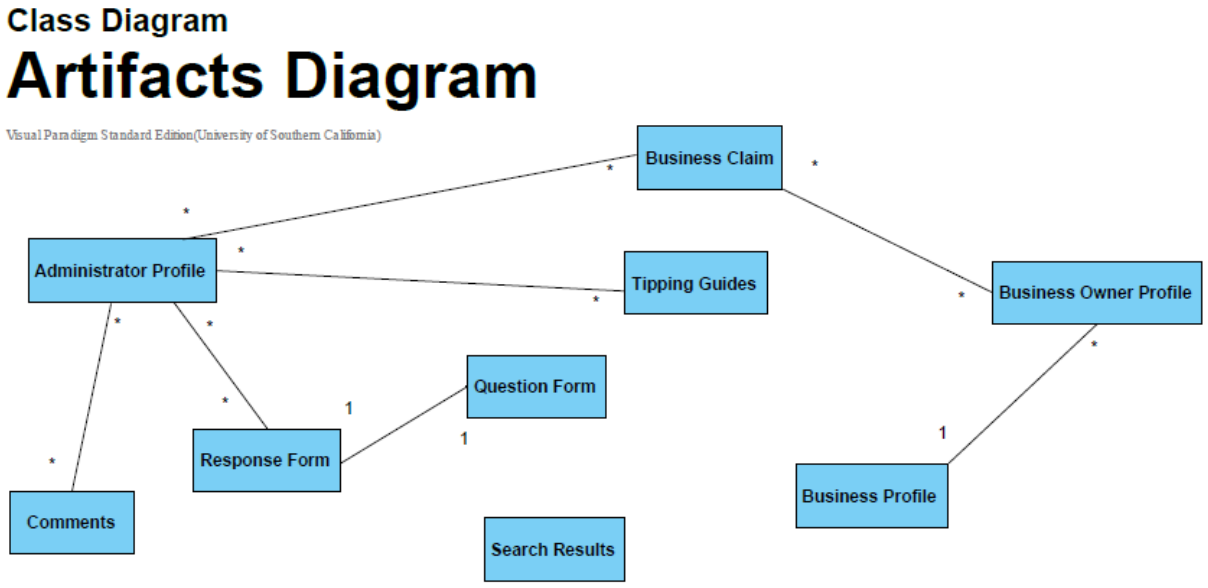

Figure 2: Artifacts and Information Diagram

Table 2: Artifacts and Information Summary

Artifact	Purpose
ATF1: Search Results	Contains all relevant query results of businesses searched for, based on Tipsure ID, location or business type.
ATF2: Tipping Guides	Available for online and offline reference of tipping practices in specific countries, for specific businesses.
ATF3: Administrator Profile	Relevant information of administrator and maintainers, restricted within the system, external users cannot see it.
ATF4: Question Form	User can ask any tipping related or business related question using this form, to the administrator and client.
ATF5: Response Form	Client/administrator replies to user questions submitted using ATF6, in a Response Form, and will be sent to the user.
ATF6: Comments	Users, including business owners, can comment on a business' tipping practices and on business in general, using Comments section for each business, which will be sent over for approval to administrator.
ATF7: Business Profile	Relevant information (contact information, location, and owner) for a particular business, added when a business is verified.
ATF8: Business Owner Profile	Relevant information of a business owner, including contact information, added when an owner is verified.
ATF9: Business Claim	Contains information as to who claims to be the owner of a particular business, and verification process details.

2.1.3 Behavior

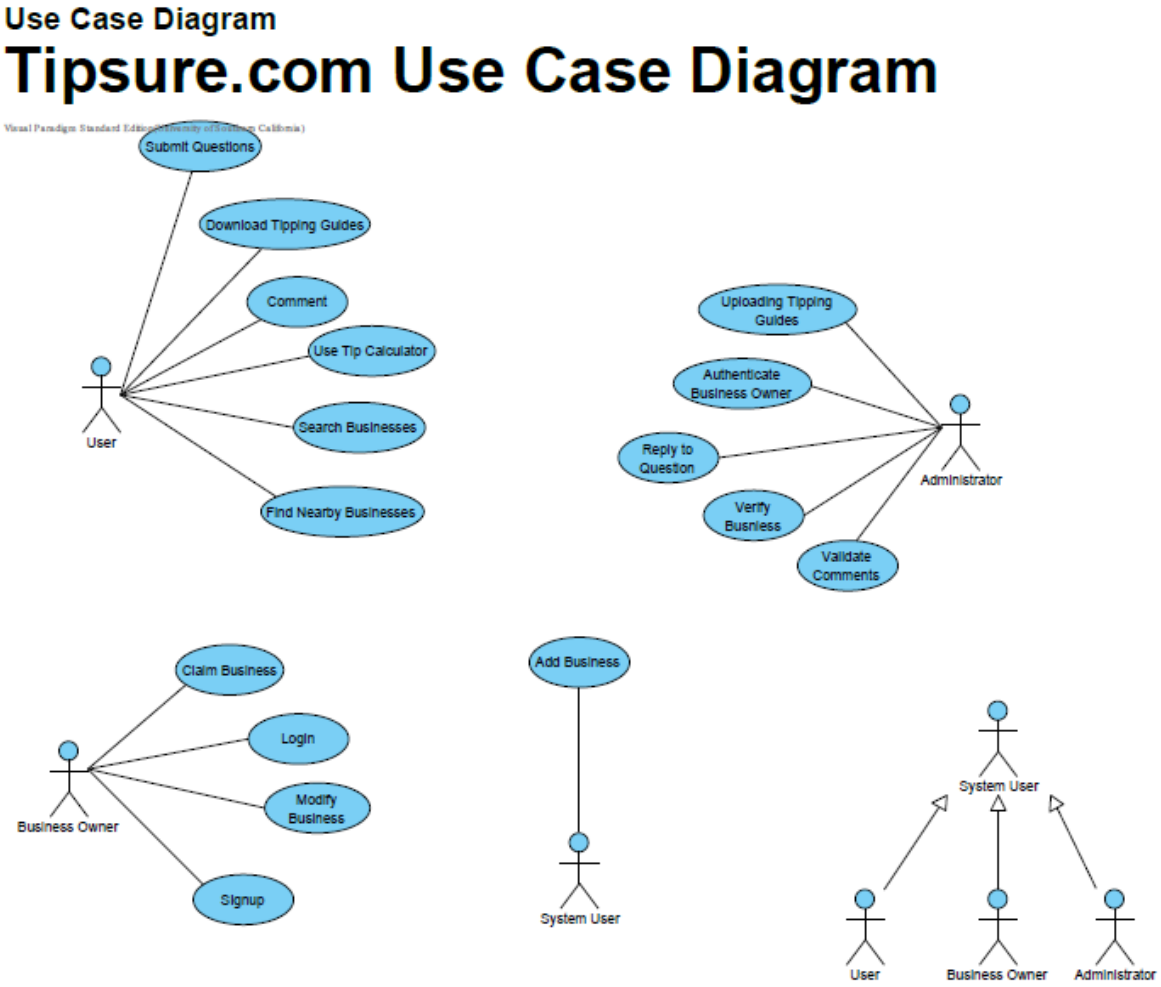

Figure 3: Process Diagram

2.1.3.1 Search Business

2.1.3.1.1 Search based on Tipsure ID/location/business category

Table 3: Process Description for Search

Identifier	UC-1 Search Business
Purpose	Find a specific business, based on Tipsure ID, or multiple businesses based on geo-location.
Requirements	WC_3167: number of businesses on map WC_3166: readable search results on map WC_3138: search via all categories
Development	None

Risks	
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	If business exists, it will be shown on the device. If the search gives multiple listings, they will be shown in a scrollable list, and on the map.

Table 4: Typical Course of Action: Search

Seq#	Actor's Action	System's Response
1	User opens up the application on the mobile device	
2		Server renders the home page of the web application
3	User selects one of the options: Tipsure ID or Business Name. User types in input field, and presses search button	
4		Application queries database, fetches relevant data, sends back to device.
5	User may select one of the multiple businesses listed, and get corresponding information.	

Table 5: Alternate Course of Action: Search

Seq#	Actor's Action	System's Response
1-3	Same actions as above.	
4		Application queries database, if no relevant data found, show message "No Results found", allows to go back to search
5	Clicks Search again hyperlink.	
6		Redirect to home page where search feature is present in the application.

2.1.3.1.2 Add New Business

Table 6: Process Description: New Business Addition

Identifier	UC-2 Add a New Business
Purpose	Any user, including a business owner can add a new business

	listing
Requirements	WC_3147: add a business WC_3154: assign Tipsure IDs
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	If business is verified by the administrator, it is added as a Tipsure listing.

Table 7: Typical Course of Action: New Business Addition

Seq#	Actor's Action	System's Response
1	User goes to the Add a Business feature of mobile application	
2		Application renders the Add a Business page
3	User inputs all relevant information of the business, clicks Add button	
4		Listing information received by system, sent to admin for verification.
5		Admin verifies listing successfully
6		Listing added as a Tipsure business, business profile created.

Table 8: Alternate Course of Action: New Business Addition

Seq#	Actor's Action	System's Response
1-4	Same actions as above.	
5	Admin fails to verify listing	
6		Listing discarded from the Tipsure.com system.

2.1.3.1.3 Business Owner Registration

Table 9: Process Description: Owner Registration

Identifier	UC-3 Business Owner Registration
Purpose	A business owner can register in Tipsure system, so as to be qualified for claiming their businesses.
Requirements	WC_3148: claim business
Development	None

Risks	
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	If owner is authentic, they will be added in the Tipsure system, otherwise their registration request will not be considered.

Table 10: Typical Course of Action: Owner Registration

Seq#	Actor's Action	System's Response
1	User goes to the register feature of mobile application	
2		Application renders the register page
3	User types in relevant information, and presses register button	
4		User information received by system, sent to admin for verification.
5	Admin/client verifies user successfully	
6		User added as a registered user, user profile created.

Table 11: Alternate Course of Action: Owner Registration

Seq#	Actor's Action	System's Response
1-4	Same actions as above.	
5	Admin/client fails to verify user	
6		User request discarded from the Tipsure.com system.

2.1.3.1.4 Business Claim

Table 12: Process Description: Business Claim

Identifier	UC-4 Business Claim
Purpose	A business owner can register in Tipsure system, so as to be qualified for claiming their businesses.
Requirements	WC_3148: claim business
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application.

	User on the mobile device is able to access Tipsure.com. UC-3: Claim request from Registered user.
Post-conditions	If owner's request is authentic, listing will be added into owner's profile, business profile will show owner in the Tipsure system, otherwise their claim request will not be considered.

Table 13: Typical Course of Action: Business Claim

Seq#	Actor's Action	System's Response
1	User goes to the claim feature of mobile application	
2		Application renders the claim page
3	User types in relevant information, and presses claim button	
4		User information received by system, sent to admin for verification.
5	Admin verifies the claim successfully.	
6		Listing added for the registered owner, owner profile and business profile modified, owner given access to modify business profile.

Table 14: Alternate Course of Action: Business Claim

Seq#	Actor's Action	System's Response
1-4	Same actions as above.	
5	Admin verifies and finds listing bogus.	
6		Verification Failure, then user claim request discarded from the Tipsure.com system.

2.1.3.1.5 Tipping Guides

Table 15: Process Description: Tipping Guides (Download)

Identifier	UC-5 Travel Tipping Guides
Purpose	User can download Tipping Guides when travelling to other countries, for offline reference. Guides are also available for online reference.
Requirements	WC_3142: review tipping guides WC_3156: create/update tipping guides

	WC_3157: download travel tipping guides
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	Travel Tipping Guides, if downloaded on device, can be used for offline reference.

Table 16: Typical Course of Action: Tipping Guides (Download)

Seq#	Actor's Action	System's Response
1	User goes to the Travel tipping Guides feature of mobile application	
2		Application renders the Tipping Guide page
3	User searches for relevant information online, or downloads Guides for offline reference.	
4		If download request comes from user, system provides Guides as pdf documents.

2.1.3.1.6 Calculate how much to tip using Tip Calculator

Table 17: Process Description: Tip Calculator

Identifier	UC-6 Use Tip Calculator
Purpose	User can use Tip Calculator feature to obtain precise amount of tip, based on the bill amount.
Requirements	WC_3144: tip calculator
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	Accurate tip amount calculated and shown to the user.

Table 18: Typical Course of Action: Tip Calculator

Seq#	Actor's Action	System's Response

1	User goes to the Tip Calculator feature of mobile application	
2		Application renders the Tip Calculator page
3	User types in bill amount, and presses appropriate tip percentage button	
4		Appropriate calculations done by the tool, result rendered on device.

2.1.3.1.7 Ask Question, Client responses

Table 19: Process Description: User Questions & Responses

Identifier	UC-7 User Question Submission, Client response
Purpose	User submits any tipping or business related question, client responds to queries, by recording responses on separate pages, and sending links to those pages to user.
Requirements	WC_3143: submit question
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com. Client able to access Ask-a-Question module.
Post-conditions	User submits question, client creates response, in a separate webpage on website, emails user with link to that page. If question already answered in another page, that page's request is sent.

Table 20: Typical Course of Action: User Questions & Responses

Seq#	Actor's Action	System's Response
1	User goes to the Ask-a-Question feature of mobile application	
2		Application renders Ask-a-Question form
3	User types in contact information, and their questions, presses send button.	
4		User information received by system, sent to admin/client for response.
5	Client/admin responds by creating new webpage, writing	

	response there, and sending link to the new page to user, or if question already answered on another page, that page's link is sent.	

2.1.3.1.8 User Comments and Moderation by administrator

Table 21: Process Description: User Comments & Moderation

Identifier	UC-8 User comments
Purpose	User can post comments regarding business and tipping practices for businesses, which will be moderated by administrator, filtering out inappropriate comments. Method of moderation will be decided by client.
Requirements	WC_3151: verify comments
Development Risks	None
Pre-conditions	System Database is properly initialized and is interacting with the application. User on the mobile device is able to access Tipsure.com.
Post-conditions	Valid comments will be posted on Tipsure.com webpage for that business, invalid or inappropriate comments will be removed by administrator.

Table 22: Typical Course of Action: User Comments & Moderation

Seq#	Actor's Action	System's Response
1	User goes to the comment section of a business in mobile application	
2		Application renders the business' comments section along with business information
3	User types in their comment, and presses comment button	
4		User comments received by system, sent to admin for approval.
5	User approves or flags it as inappropriate.	
6		If approved, then user comments added to business' page, else comments removed.

2.1.4 Modes of Operation

The Tipsure.com project, as we envision implementing it, will operate only in one mode, the functional mode, so nothing further is said about modes of operation for this specific project. In the functional mode, administrator will have complete access to all modules, and will filter comments, verify businesses, approve business owner claims. The project works on a hosting platform and uses WordPress plugins, hence in case of system backups and restore, the platform according to Level of Service Agreement, will handle backups and restore. The client has their own database for the project, separate from the hosting platform, and database exception handling and restores will be handled by the client and the DBMS for their database.

2.2 System Analysis Rationale

Based on our analysis of the system, following are facts that seem to be less obvious, and may be misunderstood or reason of confusion:

1. Search Results: User search queries using location-based search for Tipsure businesses, will fetch data (tipping information, if Tipsure business) and address of businesses located in vicinity of current user location, and show fixed number of results as query response, not constrained by the distance between businesses and user location.

2. Add Business Module: Administrator verifies a business addition request by any user, and adds it as a Tipsure business listing, if verification is successful. Process of verification is decided by client.

3. Claim Business Feature: Registered user can file a claim of owning a business, so as to control business information for that particular listing. Administrator verifies a business claim request, and adds the Tipsure business listing owner, if verification is successful. Process of verification is decided by client.

4. Tipping Guides: These, as the client and team envision it, are compilation of tipping practices of specific countries, and specific businesses in those countries. Tipping Guides will be available to be viewed online, and will be available for downloading as pdf document, for offline use.

5. Comments Validation: Administrator will verify and filter comments on tipping information, in order to remove spam comments, and business employees' self-praising comments.

3. Technology-Independent Model

3.1 Design Overview

3.1.1 System Structure

The Technology-independent model for this project does not add value. The client already had a hosting and development platform, which are siteground.com and WordPress respectively. All the development for the mobile application development was done primarily using PHP for scripting, leveraging templates of WordPress and HTML and CSS for geo-location, styling and layout design. As is evident, most of the application architecture is to make use of existing database, and platform.

Most of the components within the mobile web application are also interfaced with current system, for instance upon request from the web app, business pages from main server are rendered. Addition of new business adds new entry to the existing database. Thus, there seems to be little advantage of designing a technology independent model for this project.

4. Technology-Specific System Design

4.1 Design Overview

4.1.1 System Structure

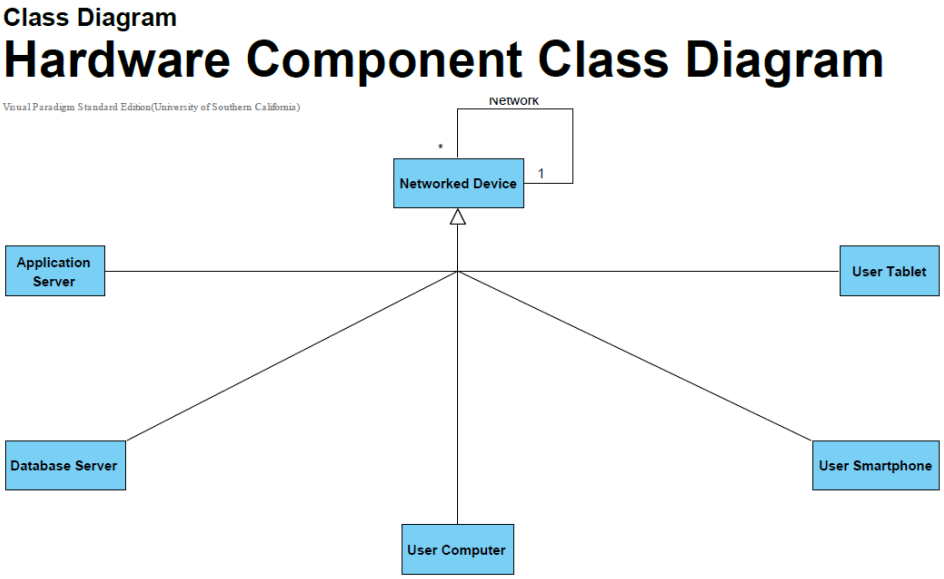

Figure 4: Hardware Component Class Diagram

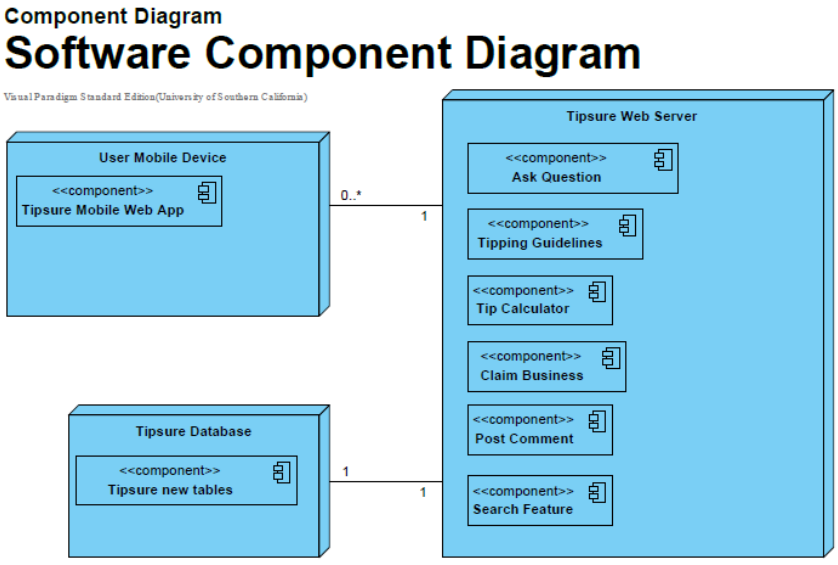

Figure 5: Software Component Class Diagram

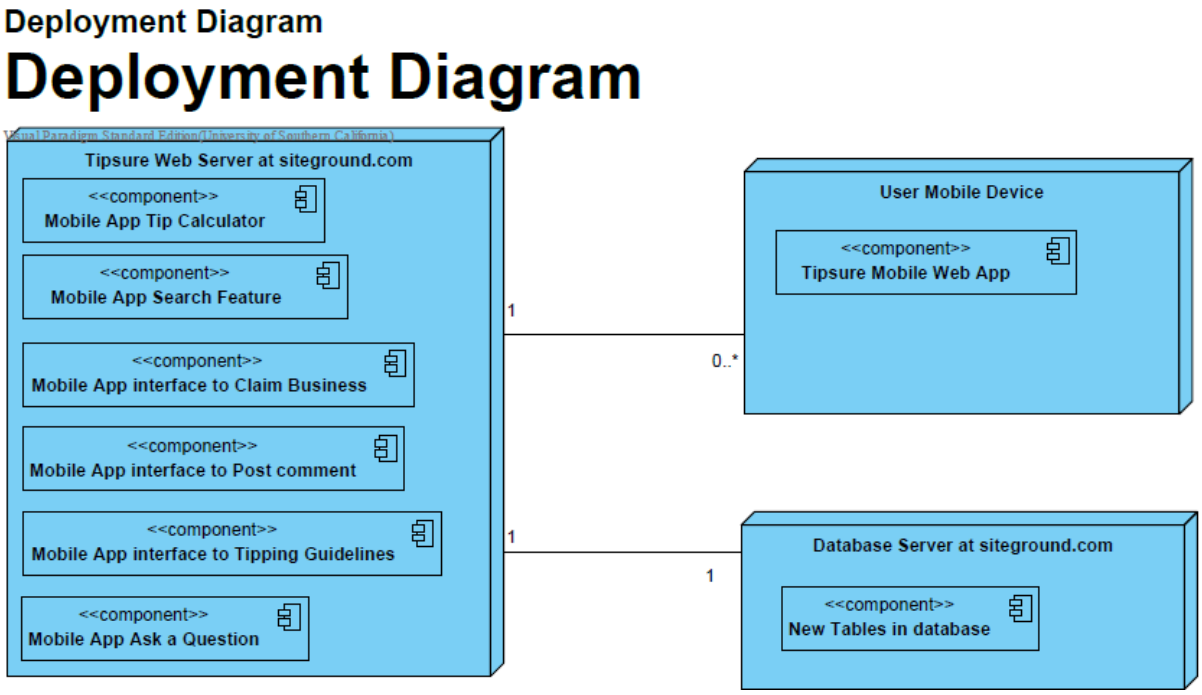

Figure 6: Deployment Diagram

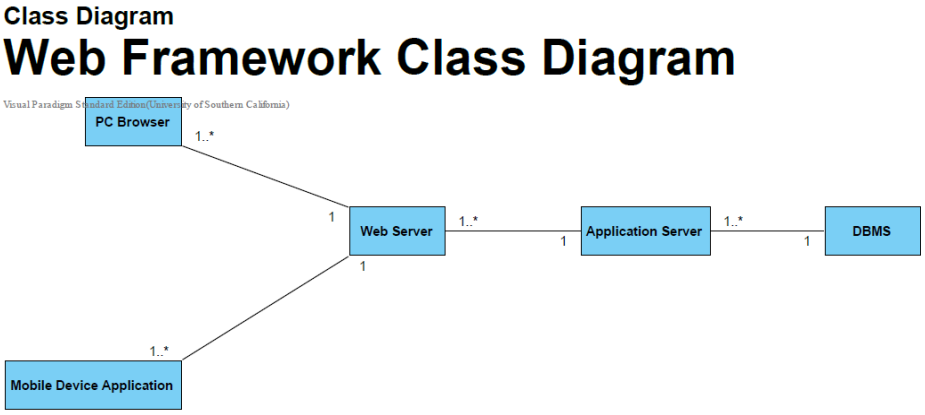

Figure 7: Web Framework Component Diagram

Table 23: Hardware Component Description

Hardware Component	Description
Networked Device	The device which is interconnected through network links.
User tablet	The end device through which user would be communicating with Tipsure.com.
User Smartphone	The end device through which user would be

	communicating with Tipsure.com. Also one of the requirements for the mobile application.
User Computer	The end device through which user would be communicating with Tipsure.com. The website would be accessible through PC or desktop computer.
Database Server	It is the back end: Tipsure database storing information about whom, when and how to tip.
Application Server	Application Server interacts directly with Tipsure database.

Table 24: Software Component Description

Software Component	Description
Mobile App Tip Calculator	This component will calculate 5%, 10%, 15%, 20%, or 25% tip for a given amount
Mobile App Search Feature	This component will search efficiently using new tables in the database
Mobile App interface to Claim Business	This component provides an interface to access the same Business Claim module as the actual website, but with a simpler form for easier viewing on mobile devices
Mobile App interface to Post Comments	This component provides an interface to comments module, which is linked to each business through original WordPress themes
Mobile App interface to Tipping Guidelines	This component provides a way to access same tipping guidelines that are available via Tipsure.com website
Mobile App Ask a Question	This component gives a way to easily ask any tipping question to the administrator, and the response will be manually sent via email
Tipsure Mobile Web App	This application will be installed on user devices, that will access the mobile site templates and provide features agreed in win conditions
New tables in database	These are created with indices as appropriate for faster access to information, in order to give quicker access to Tipsure businesses

Table 25: Web Framework Component Description

Web Framework Component	Description
PC Browser	PC Browser is the web browser through which end users can access Tipsure website.
Web Server	Web Server is the server which receives all HTTP requests and sends HTTP responses.
Application Server	Application Server interacts directly with Tipsure database.
DBMS	It is the back end: Tipsure database storing information about

	whom, when and how to tip.
Mobile Device Application	The final outcome of the project i.e. migration to mobile platform which would provide users e seamless experience.

4.1.2 Design Classes

4.1.2.1 Class Diagram for the Application

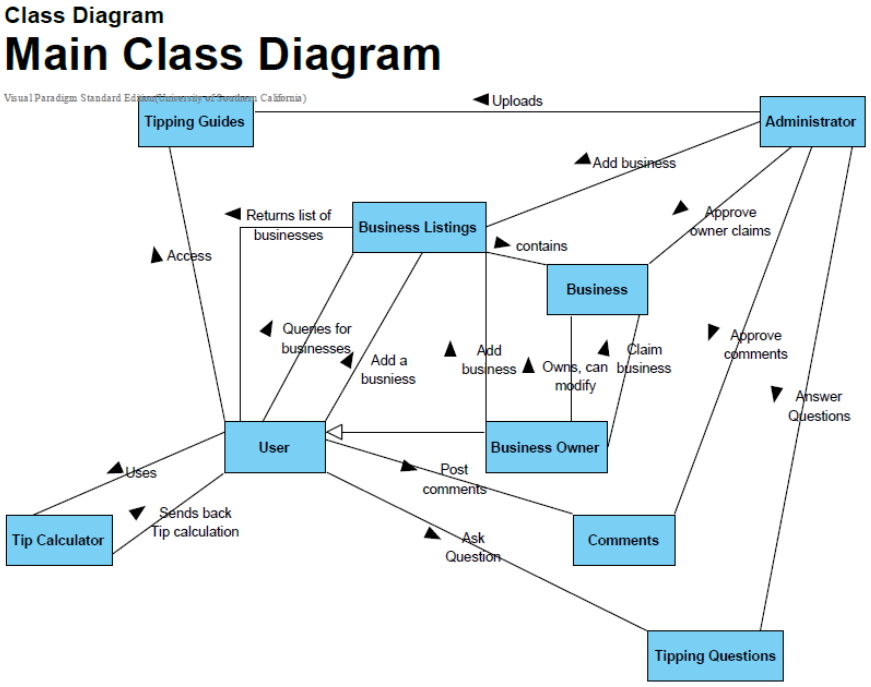

Figure 8: Class Diagram

Table 26: Class Diagram Description

Class	Type	Description
Tipping Guidelines	Boundary	Will be uploaded by administrator, accessed by user
Business Listings	Controller	Will answer user queries for business searches, return businesses
Administrator	Controller	Will moderate/control, verify/validate claims, comments, etc
Business	Entity	Has all information related to a business, including contact info, owner name, location
Business Owner	Controller	Can also be a user, owns business(es), can modify owned business
User	Entity	End user, who queries businesses to get tipping information, guides, nearby businesses

Tip Calculator	Boundary	Calculates certain percent of tips on given amount
Comments	Boundary	Business comments that are validated by administrator
Tipping Questions	Boundary	Asked by user, replied to by administrator, by putting response on separate web page and sending link to the page back to user

4.1.3 Process Realization

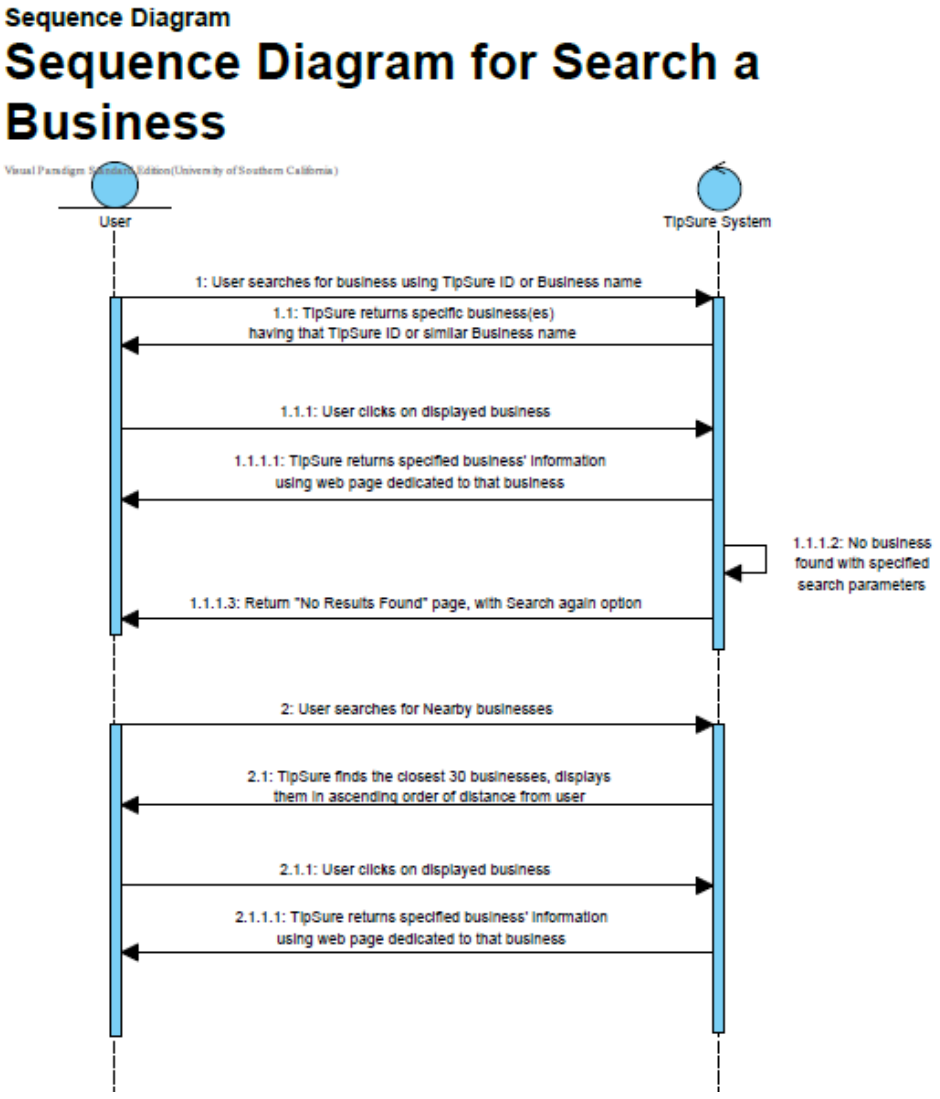

Figure 9: Process Realization: Sequence Diagram for Search Category

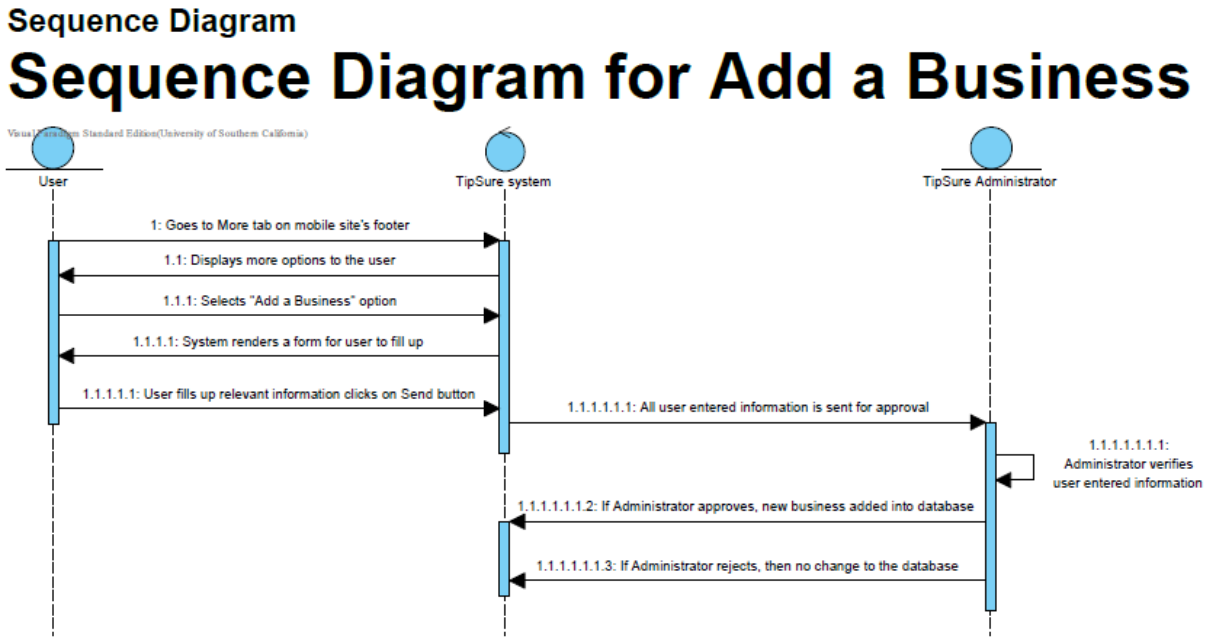

Figure 10: Process Realization: Sequence Diagram for Add Business

4.2 Design Rationale

For Tipsure.com project we decided to adopt a 3-tiered architecture as our application is a web based application and the best suited approach for such app that also wants a flexible design, is 3-tier architecture.

The following list shows the 3-tiers (commonly called "layers") of the architecture and the specific components in each tier.

- User Interface Layer
  - User Interface component for mobile devices
- Business Logic Layer
  - Searching, querying, and various other features supporting components
- Database Management Layer
  - DBMS

The client wants to extend the existing database to mobile application that is being developed in this project, and hence the best scalable and flexible alternative is to have 3-tier architecture. One more benefit is that later changes into the system and architecture are easier to incorporate in a 3-tier system.

5. Architecture Styles, Patterns, and Frameworks

Table 15 shows the architecture styles, patterns and frameworks used in this design.

Table 15: Architectural Styles, Patterns, & Framework

Name	Description	Benefits, Costs, and Limitations
3-Tier Architecture	The 3-tier architecture separates the application into 3 different layers: user interface, logic, and domain and data access. This means that the model disassociates the data controller and access from the user interface. The communication between the visual and data components is done via the logic, or the controllers.	The use of this architecture allows for increased abstraction between the layers of components. This allows for the user interface and logic to be independent of each other satisfying the client's requirement. The 3-tier architecture also allows for single model to have multiple views meaning that the control and the UI mechanisms are flexible and adaptive for future changes. However, adopting this architecture may increase complexity as well as the size of the application due to the separation of data, process, visualization, and display components.