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Ahmed Abdulghaffar Algadi

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AUTO SMART TEXT AND E-MAIL NOTIFICATION SYSTEM

(ASTENS)

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A Project

Presented to the

Faculty of

California State University,

San Bernardino

---

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Computer Science

---

by

Ahmed Abdulghaffar Algadi

September 2012

AUTO SMART TEXT AND E-MAIL NOTIFICATION SYSTEM

(ASTENS)

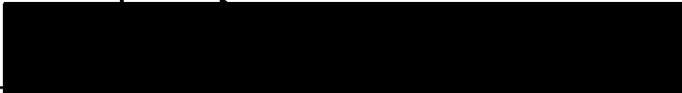
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A Project  
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San Bernardino

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by  
Ahmed Abdulghaffar Algadi  
September 2012

Approved by:

  
Dr. Haiyan Qiao, advisor,  
Computer Science and Engineering

8/30/2012  
Date

  
Dr. Ernesto Gomez

  
Dr. Kerstin Voigt

## ABSTRACT

ASTENS (Auto Smart Text and E-mail Notification System) is a communication tool that was developed for universities/schools purposes. ASTENS uses text messages and email technologies to provide easy, fast, and convenient ways of communication between the instructors and their students.

ASTENS provides two types of communication: class notifications and grade notifications. First, the class notifications allow an instructor to communicate with students registered in his/her class by using his/her cell phone or email. These notifications could be any message related to the class (e.g. notes, reminder, announcement, etc.) and every student will be notified via text message and email. Second, the grade notifications will be sent automatically to all the students subscribed to ASTENS grade notifications via text message and email once the instructor posts or updates the students' grades. ASTENS will automatically evaluate the students' progress in their classes and notify them if their performance dropped dramatically and/or if their grades fall below the class average.



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CHAPTER ONE  
INTRODUCTION

Statement of the Problem

In higher education the communication between the faculty members and their students is mainly limited to the classroom. This limitation is because the students might only meet once or twice a week with their instructors, and they might not meet at all if a student has registered in an online course. In the age of technology, text message and email technologies can be used to expedite and improve the communication dramatically.

Background of SMS and E-mail

Nowadays, using the Short Message Service (SMS) and Electronic mail (E-mail) is a part of our daily life for communication. These technologies became very useful and powerful communication tools in different entities such as companies, banks, universities, schools etc.

SMS technology has been introduced in the past few decades, and the first SMS text message was sent in December 1992 [1, 3]. SMS is the transmission of a short text message to and from mobile, phone, fax, or IP address

using communication protocols. SMS uses a standardized phone protocol defined as Global System for Mobile Communication (GSM) which allows sending text messages up to 160 characters to and from GSM mobile [1].

The first email was sent successfully from one computer to another in summer of 1971 by Ray Tomlinson through ARPANET [13]. The email is a store-and-forward model, is the transition of messages from one sender to one or more recipients across the internet [14, 15].

#### Purpose

The purpose of Auto Smart Text and E-mail Notification System (ASTENS) project is to provide the California State University San Bernardino and other universities with a new easy, fast, and convenient way of communication between the faculty members and their students.

Also, with increased usage of the Internet and cell phones, SMS text messages and email technologies have become the number one tool of communication in our daily life. Therefore, the faculty members and the students are accustomed to the use of these technologies without the need of learning a new tool.

## Definitions and Abbreviations

The definitions and the abbreviations used in this document are described in the following table.

Table 1. Definitions and Abbreviations

ASTENS	Auto Smart Text and Email Notification System
CSUSB	California State University San Bernardino
SMS	Short Message Service
GSM	Global System for Mobile Communication
GPRS	General packet radio service
mCore	Combined knowledge of SMS with .NET technologies.
POP3	Post Office Protocol 3
SMTP	Simple Mail Transfer Protocol
OOP	Object Oriented Programming
IMAP	Internet Message Access Protocol, an Internet standard protocol for E-mail retrieval.
AT Command	Attention, instructions control the modem.
ETSI	European Telecommunications Standards Institute
WAP	Wireless Application Protocol
WFA	Windows Form Application
GPA	Grade Point Average
.NET Framework	Software developed by Microsoft that runs on Microsoft Windows and has large libraries and provides language interoperability across several programming languages.
MySQL	My Structured Query Language, an open source relational

	database that runs as a server and provides multi-user access to a number of databases.
IP address	Internet Protocol Address, a numerical label assigned to every device that participates in a network.
TCP/IP	Transmission Control Protocol/Internet Protocol, a communication protocol used to connect hosts on the Internet.

## CHAPTER TWO

### PROBLEM DESCRIPTION AND REVIEW

#### Introduction

Universities and schools around the world are seeking new technologies to use in order to provide high quality service to the faculty members and students. There are a number of universities and schools that have started to use SMS and email technologies for fast and convenient communication between faculty members and students due to the wide application of the mobile devices among students, and email users.

The SMS notification programs have provided many services to companies, banks, factories, universities and schools; however, the SMS notification programs do not offer sufficient services to universities. The following services should be offered to universities.

- Class Notifications: regarding class delay, class cancellation, change room/building etc.
- Course Notifications: regarding assigning home work, inform about quiz etc.

- Grades Notifications: regarding home work grades, midterm grade, final grade etc.
- GPA retrieval.
- University/School Notifications: regarding holidays, campus closure or/and emergencies etc.
- Student Notifications: regarding registration fees and/or registration deadline etc.

#### Review

Since SMS and email technologies are the fastest and easiest way to communicate, most of the companies, banks, universities, and even families use these technologies as their primary communication method.

For instance, banks are using SMS technology to notify their customers about variety of matters, usually these notifications are related to the account activity, irregular account activity, balance, etc.

Some clothing companies are using email technology to communicate with their regular customers about new arrival products, special offers, discount coupons, etc.

Some universities and schools are using both SMS and email technologies to communicate with their faculty

members, staff, and students. They usually use these technologies for emergency notification purpose, instead of teaching purpose or daily communications.

### Scope

Auto Smart Text and E-mail Notification System (ASTENS) uses SMS and email technologies to provide an improved communication and notification system with the least amount of time and work. Since the ASTENS was developed for universities and schools, instructors will have the ability to communicate with their students using their cell phones and/or their emails without the need to know each student's contact information.

The intended users for ASTENS include administrators, instructors, and students. The different users have different functionalities. Furthermore, the design of ASTENS allows extension, and in the future new functionalities can be added under the current framework.

## Significance

The SMS notification system is usually not free and an additional financial burden will be added to universities. The SMS gateway would cost between \$829 and \$96848 [2], not mentioning the whole notification system. In addition, these types of systems can also cost the faculty and students who do not have an unlimited text plan on their mobile devices.

Auto Smart Text and Email Notification System (ASTENS) offers the similar, and even more features, than existing programs that use the SMS for communication. ASTENS has an email notification feature that has been added to the SMS text messages notification. For instance, instructors who do not have an unlimited data/text plan, or do not like to use their mobile phone can send messages using email and that will significantly save the faculty members the cost of using the text messages, and make using the system easier.

The ASTENS's primary task is for the teaching purposes. Using ASTENS at CSUSB will improve the communication between the faculty members and the students and make the communication more efficient. The faculty members will be able to communicate with their students

anywhere and anytime whenever they have Internet access or a mobile device.

The benefits of using ASTENS are listed as follows.

- Faculty members
  - Will be able to cancel, or delay their classes easily due to emergency,
  - Will be able to send any note to their students regarding test date, home work, home work due date, review session etc., and
  - Will not be disturbed during class/office hours by students with the frequent asked questions such as students' grades, home work due date etc. since the students will receive a text message and an email whenever class announcements are made or grades are updated.
  
- Students
  - Will save time for not waiting outside their instructor's office to ask about home work due dates, grades, test, etc.,
  - Will not have to leave his/her classes, or to come to the university to meet their instructors

during his/her office hours to ask about home work due dates, grades, test, etc.

- The international students who are taking Open University courses and therefore cannot access MyCoyote account at CSUSB will be able to check their course grades through ASTENS.

Without ASTENS the instructor will have to save all the students' cell phone numbers and emails and put them in groups in order to send messages and/or emails to the students. It results to the following problems.

1. Instructors have to have a smart phone.
2. Instructors have to have at least one group of students' cell phone numbers and emails for each class they teach.
3. Instructors have to redo all these groups every quarter.
4. Instructors will have to spend a large amount of time grouping these phone numbers and emails.
5. Instructors' cell phone messages are sent to the students' cell phones only, and the instructors' emails are sent to the students' emailboxes only.

ASTENS will resolve the problems listed above with the following features.

1. Instructors do not need to have a smart phone to use ASTENS system.
2. Instructors do not need to save any student number nor email; the student contact information is kept in the server, not on the phone.
3. Instructors' messages and/or emails will be sent to students' cell phones and emails. Students will get the message through both cell phone and email. Even without a cell phone, the student will still get the message via an mailbox.

## CHAPTER THREE

### METHODOLOGIES

#### Related Technologies

The following are the technologies that have been used in ASTENS.

#### Retrieving E-mails Using POP 3

Post Office Protocol 3 (POP 3) is an application-layer internet protocol used to retrieve emails from a remote server over a TCP/IP connection. POP 3 is a client/server protocol. As soon as the email gets downloaded using POP 3, the email will be deleted from the server. [4, 5]

#### Sending E-mails Using SMTP

Simple Mail Transfer Protocol (SMTP) is an application-layer internet protocol used to send emails between servers over a TCP/IP connection. SMTP is usually used with POP 3 or IMAP protocols to retrieve emails because SMTP ability is limited to queue emails at retrieving end. [6, 7, 8]

#### Retrieving and Sending SMS Using mCore

mCore .NET SMS Library is a powerful class library and it is a combined knowledge of SMS with .NET technologies. The mCore .NET SMS Library allows developers to send and

receive SMS text messages with .NET Applications, and it can be used with any ETSI 07.05 compliant GSM modem. [9]

#### GSM Modem

In ASTENS a Samba-75 modem - Falcom is being used with a valid SIM card. mCore has been designed to work with any ETSI GSM 07.05 compatible GSM modem, and with any GSM modem with suitable serial/USB data cable or Infrared port that supports AT commands. [10]

The modem commands are called AT commands because every single command line starts with "at" or "AT". AT commands are supported by GSM/GPRS modems and cell phones. [11, 12]

#### Programming Language

ASTENS project has been written and developed with Visual C# (C Sharp) .NET language using Windows Form Application (WFA).

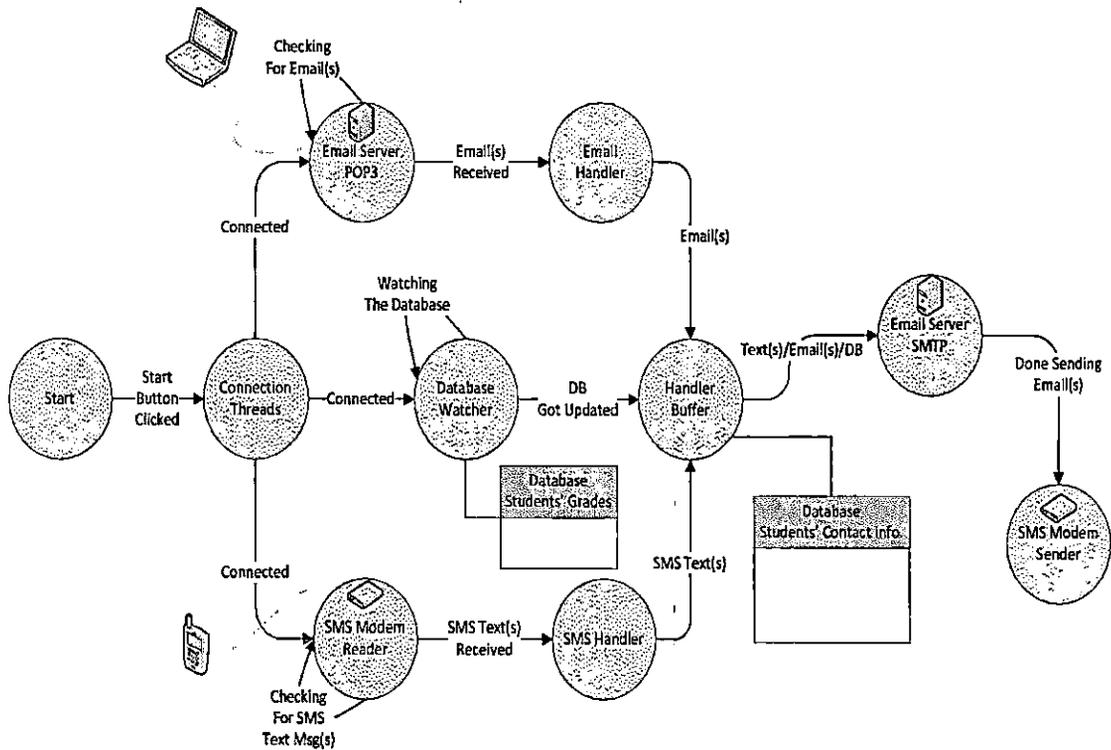


Figure 1. The Basic Mechanism of ASTENS

### Object Oriented Design

ASTENS uses an OOP language that allows the developer to exploit the features of OOP. The object design is the description of the primary classes and methods. Figure 2 shows the UML Class Diagram of ASTENS.

#### Smart Text Class

This class is the main class of ASTENS. It connects the project to the GSM modem and to the email server. The main methods include the following.

- `Auto_Smart_Text_Connection_Handler()` - This method establishes threads that connect ASTENS to the GSM modem and the email server.
- `Disconnect_from_ASTENS()` - This method disconnects ASTENS from the GSM modem and from the email server.

### SMS Class

This class controls and handles the incoming SMS text messages and the outgoing SMS text messages and emails. It checks the table that holds the students' grades for any update.

The main methods include the following.

- `Connect_TO_ASTENS()` - This method connects ASTENS to the GSM modem and verifies the mCore licenses. It connects ASTENS to the email server and establishes threads to download the incoming email(s) from the server.
- `Start_checking_the_GSM_modem_and_students_grades()` - This method establishes threads to receive the incoming SMS text message(s) and check whether or not the students' grades have been posted and/or updated.
- `Read_SMS()` - This method reads the incoming SMS text message(s).

- `Send_SMS()` - This method sends SMS class notifications to the students.
- `Send_SMS_Grades()` - This method sends the grades to the students via SMS text.
- `Send_Emails()` - This method sends class notifications email to the students.
- `Send_Emails_Grades()` - This method sends the grades to the students via email.
- `verify_the_SMS_Sender()` - This method verifies the sender of the SMS.
- `verify_the_instructors_SMS_Format()` - This method checks the format of the text message if it has wrong format, a notification text will be sent to the instructor to inform him/her.
- `verify_the_instructors_SMS_authorization()` - This method checks whether or not the instructors have the authority to send a notification text.
- `Not_an_instructor()` - This method handles the students' SMS text message(s).

### POP3 Class

This class controls and handles the incoming email(s).

The main methods include the following.

- `First_Email()` - This method downloads, reads, and deletes the email(s) from the server.
- `verify_the_Email_sender()` - This method checks whether or not the sender is authorized to send a notification email.
- `verify_the_Email_authorization()` - This method checks whether or not the instructors have the authority to send a notification email.

#### New Instructor Record Class

This class allows the administrator to add a new instructor's record to ASTENS system.

#### New Student Record Class

This class allows the administrator to add a new student's record to ASTENS system.

#### Update Instructor Record Class

This class allows the instructors to update their own information.

The main methods include the following.

- `Retrieve_Cell_and_Email()` - This method retrieves the instructors' contact information from the database.
- `Retrieve_Courses_Filling_the_comboBox()` - This method retrieves the courses that the instructors teach.

### Update Student Record Class

This class allows the administrator to update the student's record.

The main methods include the following.

- Add\_button\_Click() - This method adds the selected course to the student's record.
- DGV\_CellContentClick() - This method deletes the selected course from the student's record.

### Student Record Deletion Class

This class allows the administrator to permanently delete the students' record from ASTENS system.

### Grading Scale Class

This class allows the instructors to set the grading scale for their courses.

### Post Students Grades Class

This class allows the instructor to post the students' grades.

### MySQL DataBase Connection Class

This class connects ASTENS to MySQL database and handles all the communication between ASTENS and the MySQL database.



## Databases Schema and Structural Design

MySQL database is used in ASTENS to store the courses' details, and students' and instructors' contact information. Some of ASTENS database tables will be created automatically whenever the instructors set their courses' grading scale, and it will be dropped whenever the courses' grading scale get reset. MySQL tables entity relationship shown in Figure 3.

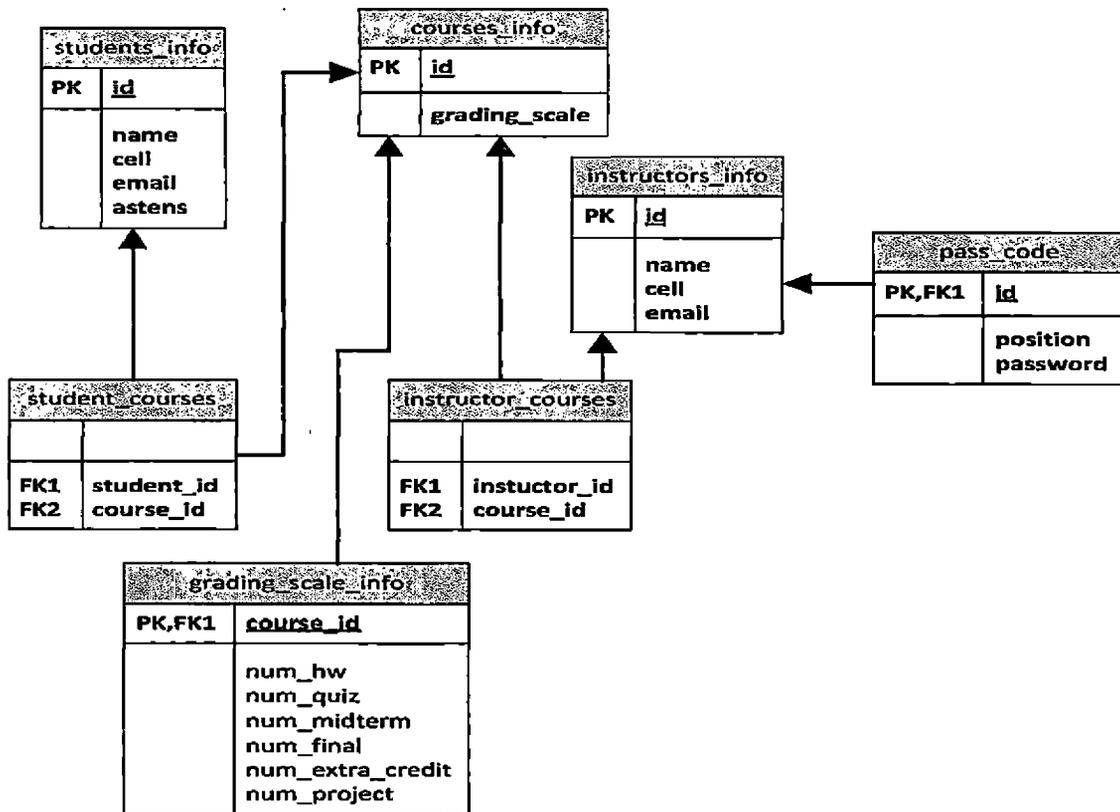


Figure 3. ASTENS Database - Entity Relationship

### Students Info Table

The Student Info Table contains the students' contact information and ASTENS's subscription field. Students have the ability subscribe or unsubscribe to ASTENS grade notifications.

MySQL statement used to create this table is listed as follows.

```
CREATE TABLE students_info (  
id varchar (10), PRIMARY KEY (id), name varchar (30),  
cell varchar (10), email varchar (30), astens varchar (1));
```

Table 2. Students Info - Structural Design

Field	Type	Null	Key	Default	Extra
id	varchar(10)	NO	PRI	NULL	
name	varchar(30)	NO		NULL	
cell	varchar(10)	NO		NULL	
email	varchar(30)	NO		NULL	
astens	varchar(1)	NO		NULL	

### Instructors Info Table

The Instructor Info Table contains the instructors' contact information. The instructor has the ability to

update his/her contact information. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE instructors_info (  
id varchar (10), PRIMARY KEY (id), name varchar (30),  
cell varchar (10), email varchar (30));
```

Table 3. Instructors Info - Structural Design

Field	Type	Null	Key	Default	Extra
id	varchar(10)	NO	PRI	NULL	
name	varchar(30)	NO		NULL	
cell	varchar(10)	NO		NULL	
email	varchar(30)	NO		NULL	

### Courses Info Table

The Courses Info Table contains the university course titles and shows whether or not the course's grading scale has been set. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE courses_info (  
id varchar (9), PRIMARY KEY (id),  
grading_scale varchar (1));
```

Table 4. Courses Info - Structural Design

Field	Type	Null	Key	Default	Extra
id	varchar(9)	NO	PRI	NULL	
grading_scale	varchar(1)	NO		NULL	

Pass Code Table

The Pass Code Table contains the administrators' and the instructors' login passwords. The id references the instructors\_info table. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE pass_code (
id varchar (9), PRIMARY KEY (id),
FOREIGN KEY (id) REFERENCES instructors_info (id) ON UPDATE
CASCADE ON DELETE CASCADE,
position varchar (9), password varchar (16));
```

Table 5. Pass Code - Structural Design

Field	Type	Null	Key	Default	Extra
position	varchar(9)	NO		NULL	
id	varchar(9)	NO	PRI,FK1	NULL	
password	varchar(16)	NO		NULL	

### Instructor Courses Table

The Instructor Courses Table contains the course(s) that the instructors teach. This table will be checked to verify whether or not the instructors have the authority to send SMS and/or email notification for a specific class. The instructor\_id references the instructors\_info table, while the course\_id references the courses\_info table. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE instructor_courses (  
instructor_id varchar (9), FOREIGN KEY (instructor_id)  
REFERENCES instructors_info (id) ON UPDATE CASCADE ON  
DELETE CASCADE, course_id varchar (9),  
FOREIGN KEY (course_id) REFERENCES courses_info (id) ON  
UPDATE CASCADE ON DELETE CASCADE;
```

Table 6. Instructor Courses - Structural Design

Field	Type	Null	Key	Default	Extra
instructor_id	varchar(9)	NO	FK1	NULL	
course_id	varchar(9)	NO	FK2	NULL	

### Student Courses Table

The Student Courses Table contains the courses that the students' are registered for. The student\_id references the students\_info table, while the course\_id references the courses\_info table. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE student_courses (  
student_id varchar (9), FOREIGN KEY (student_id) REFERENCES  
students_info (id) ON UPDATE CASCADE ON DELETE CASCADE,  
course_id varchar (9),  
FOREIGN KEY (course_id) REFERENCES courses_info (id) ON  
UPDATE CASCADE ON DELETE CASCADE;
```

Table 7. Student Courses - Structural Design

Field	Type	Null	Key	Default	Extra
student_id	varchar(9)	NO	FK1	NULL	
course_id	varchar(9)	NO	FK2	NULL	

### Grading Scale Info Table

The Grading Scale Info Table contains the details of the courses' grading scale. MySQL statement used to create this table is listed as follows.

```
CREATE TABLE grading_scale_info (  

```

```

course_id varchar (6), PRIMARY KEY (course_id),
num_hw varchar (6), num_quiz varchar (6),
num_midterm varchar (6), num_final varchar (6),
num_extra_credit varchar (6), num_project varchar (6));

```

Table 8. Grading Scale Info - Structural Design

Field	Type	Null	Key	Default	Extra
course_id	varchar(6)	NO	PRI	NULL	
num_hw	varchar(6)	YES		NULL	
num_quiz	varchar(6)	YES		NULL	
num_midterm	varchar(6)	YES		NULL	
num_final	varchar(6)	YES		NULL	
num_extra_credit	varchar(6)	YES		NULL	
num_project	varchar(6)	YES		NULL	

### CourseID Grades Table

The CourseID Grades Table is one of the flexible tables and is an auto-generated table. This table holds the students' grades for a certain class. For example, the table could be CSE600\_grades, CSE610\_grades, or CSExxx\_grades. The number of each assignment might vary from one class to another. A class could have none or more home works, quizzes, midterms, finals, projects, and/or extra credits.

Note: (Hw)\* means none or more home works.

Table 9. CID Grades - Structural Design

Field	Type	Null	Key	Default	Extra
student_id	varchar(9)	YES	PRI	NULL	
hw1	varchar(5)	YES		NULL	
hw1_txt	varchar(1)	YES		NULL	
...	...	...		...	
midterm1	varchar(5)	YES		NULL	
midterm1_txt	varchar(1)	YES		NULL	

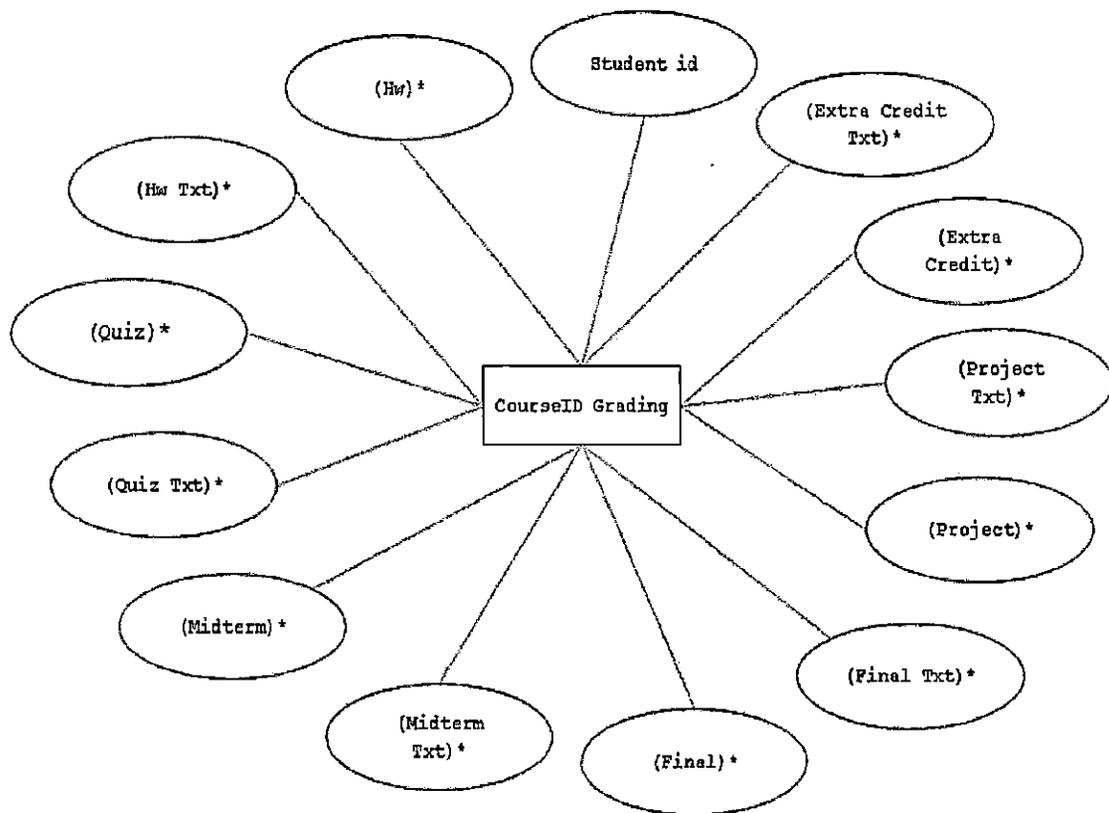


Figure 4. CourseID Grades - Entity Diagram

### CourseID Grading Scale Table

The CourseID Grading Scale Table is one of the flexible tables and is an auto-generated table. This table holds the assignments' full grades and the assignments' percentage for a certain class. For example, the table could be CSE600\_grading\_scale, CSE610\_grading\_scale, or CSExxx\_grading\_scale. The number of each assignment might vary from one class to another. A class could have none or

more home works, quizzes, midterms, finals, projects,  
and/or extra credits.

Note: (Hw)\* means none or more home works.

Table 10. CID Grading Scale - Structural Design

Field	Type	Null	Key	Default	Extra
hw1	varchar(5)	YES		NULL	
hw2	varchar(5)	YES		NULL	
...	...	...		...	
quiz1	varchar(5)	YES		NULL	
quiz_percentage	varchar(5)	YES		NULL	
...	...	...		...	
final1	varchar(5)	YES		NULL	
final_percentage	varchar(5)	YES		NULL	

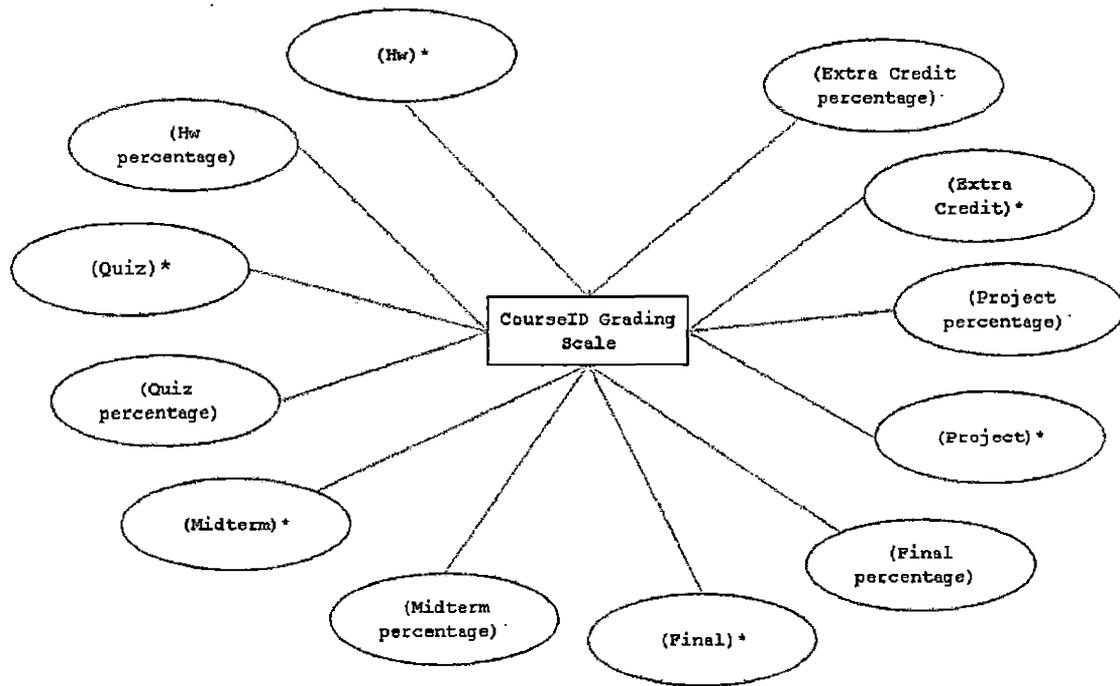


Figure 5. CourseID Grading Scale - Entity Diagram

CHAPTER FOUR  
SOFTWARE DESIGN AND IMPLEMENTATION

Product Users

The users of ASTENS are administrators, instructors, and students. The following figure shows the actions available to the users.

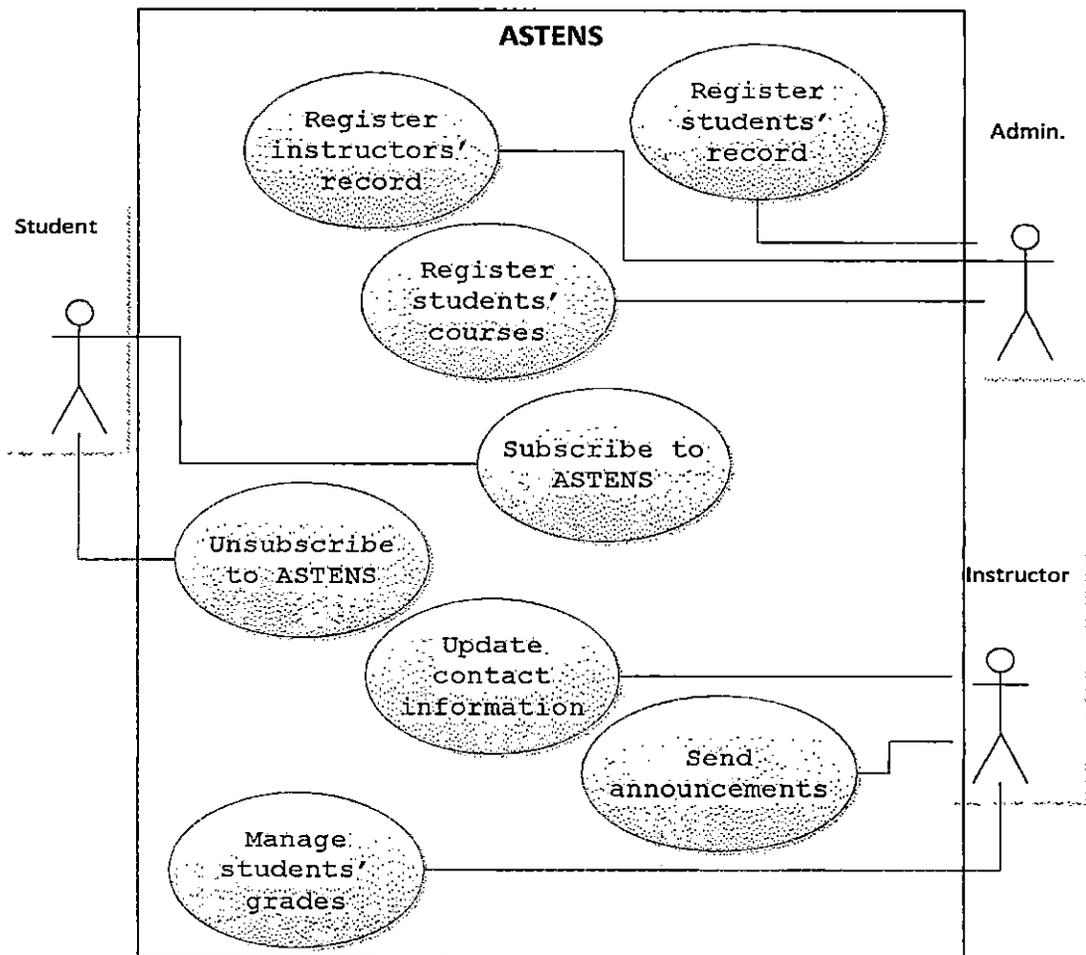


Figure 6. ASTENS Users - Use Case Diagram

## Users Characteristic

ASTENS provides a variety of services to its users, but the services are limited to some of the users. The following figure shows the system functions available to the administrator.

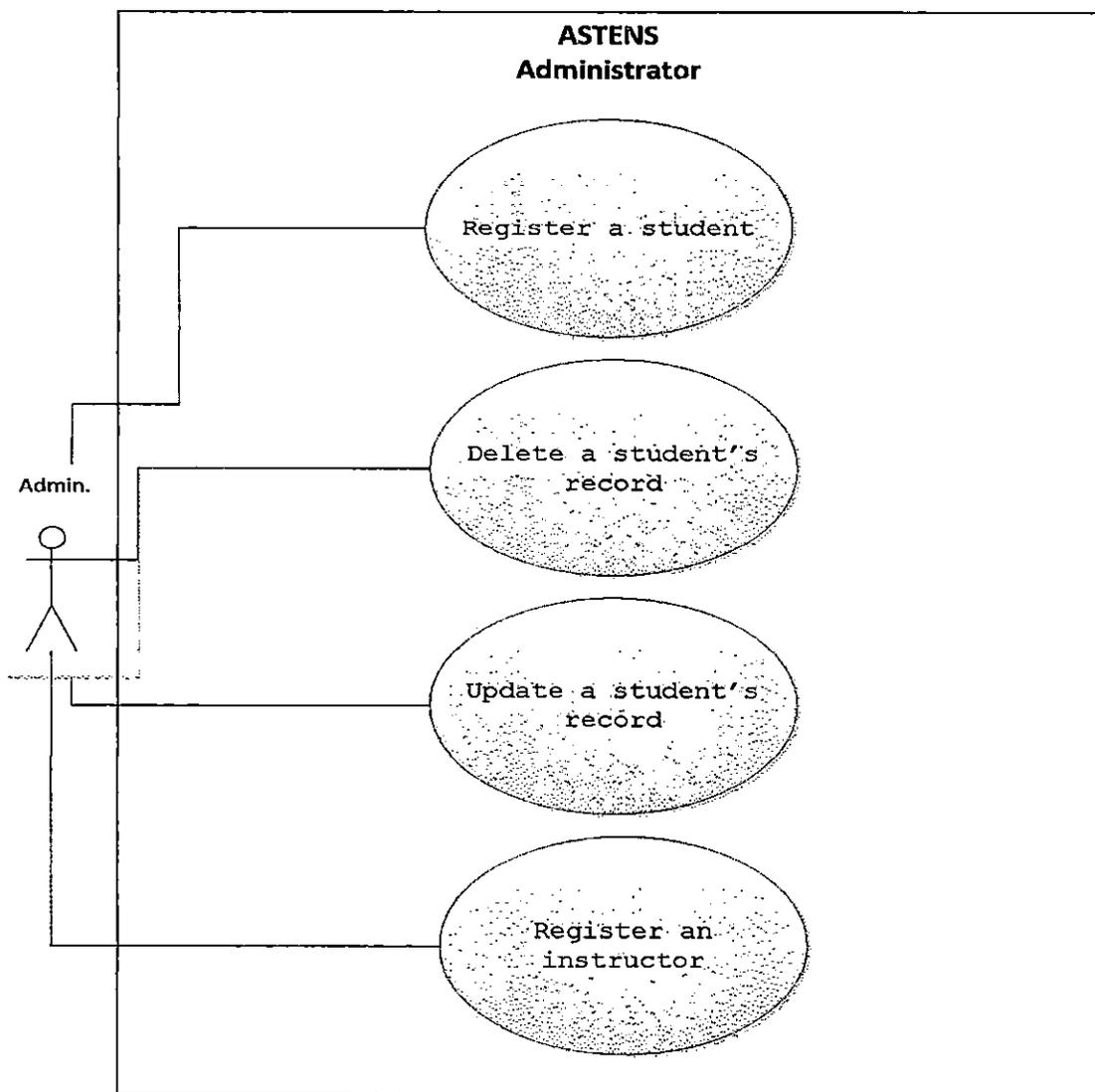


Figure 7. Administrator - Use Case Diagram

Instructors are provided with a number of interfaces that give them the ability to interact with the system. The following figure shows the system and the network functions available to the instructor.

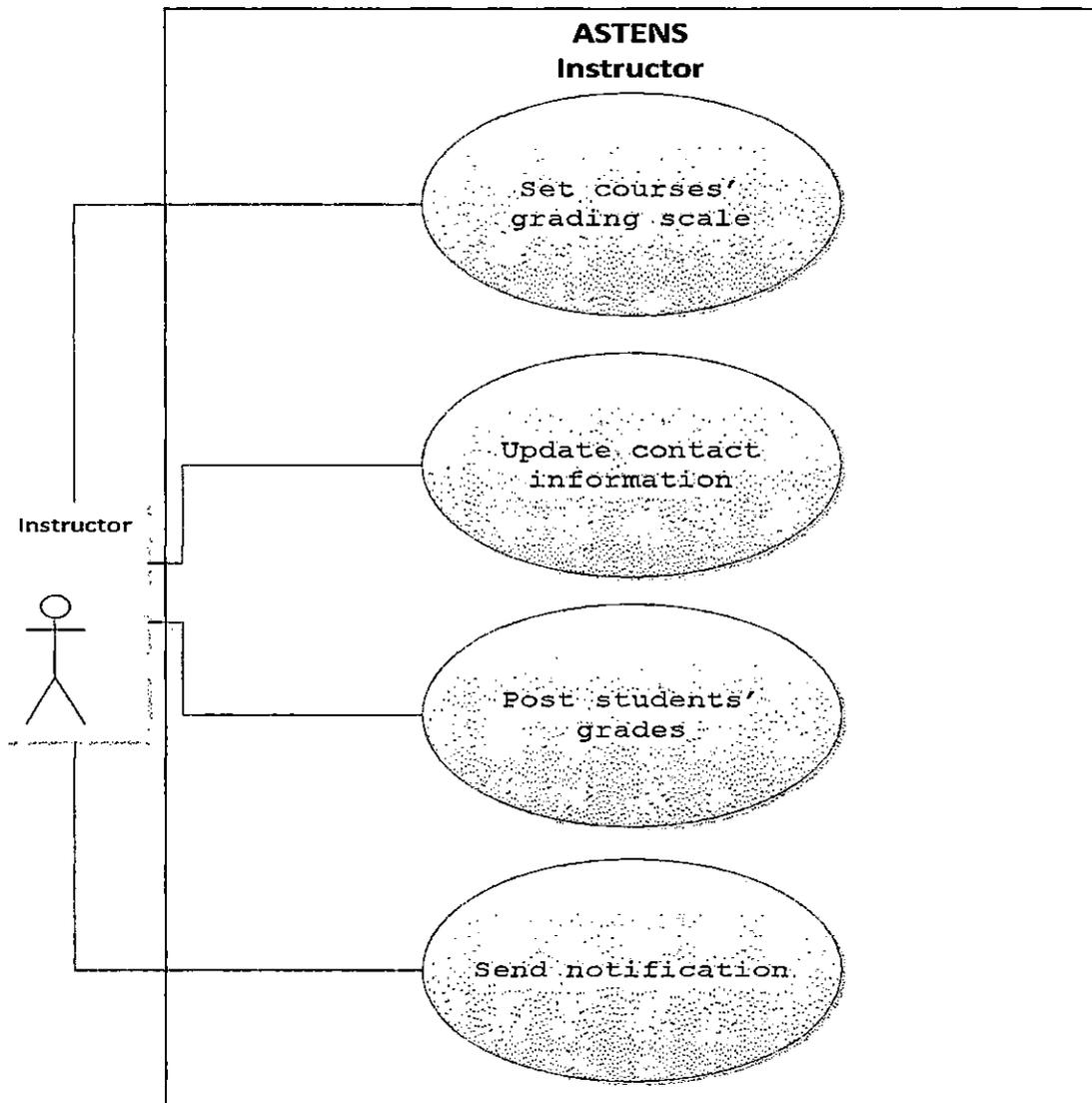


Figure 8. Instructor - Use Case Diagram

Students will receive the class notifications as a default feature once they enroll in the class. In order for the students to receive the grade notifications they will have to subscribe to ASTENS grade notifications. The following figure shows the network functions available to the students.

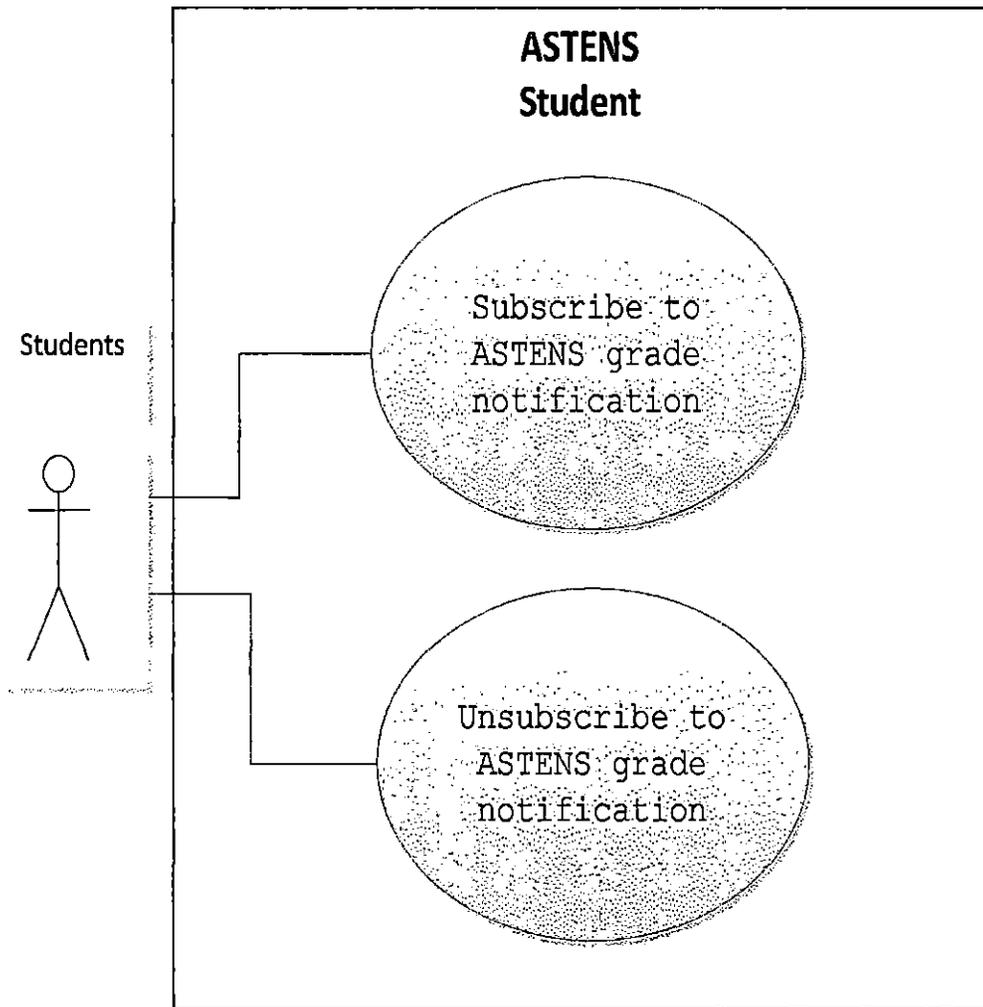


Figure 9. Student - Use Case Diagram

## Users Interfaces

ASTENS could be accessed via system interface as shown in Figure 10 and network interface (i.e. a cell phone or an email). As mentioned earlier, the users are administrators, instructors, and students. Some of these users have access to both system and network interfaces, while others might have only one of them.

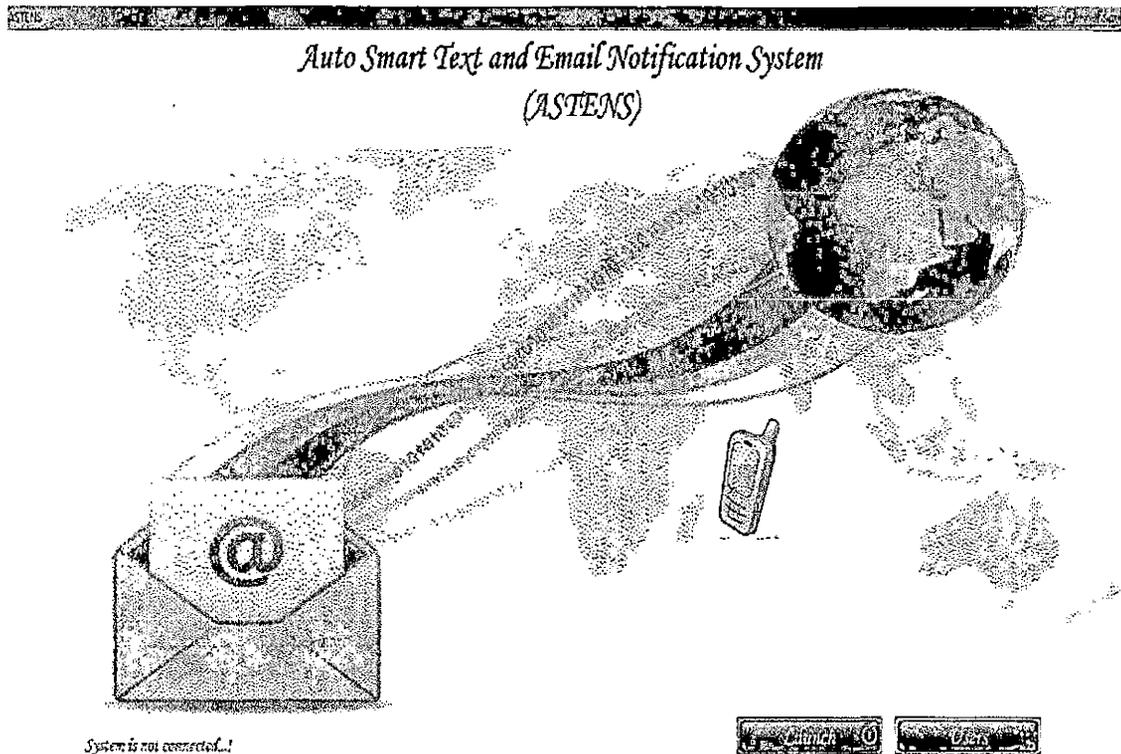


Figure 10. ASTENS Primary Interface

Both administrators and instructors will have to click on the User button in order to login into ASTENS.

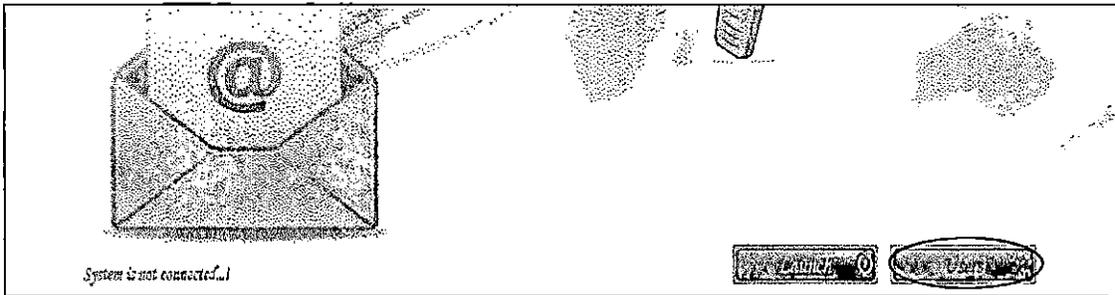


Figure 11. Users Button - Primary Interface

### Administrator Interfaces

The administrator has no network interfaces, but has system interfaces. The system interfaces available to the administrator are listed as follows.

- Login into the system.

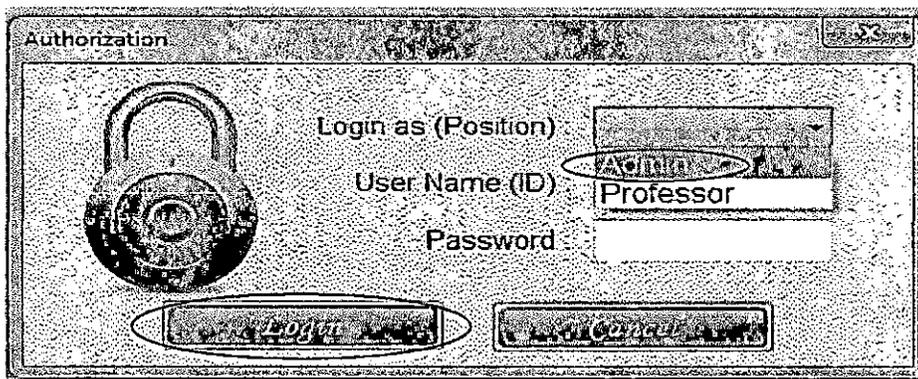


Figure 12. ASTENS Login Interface

- Administrator's primary interface contains the following options (circled).

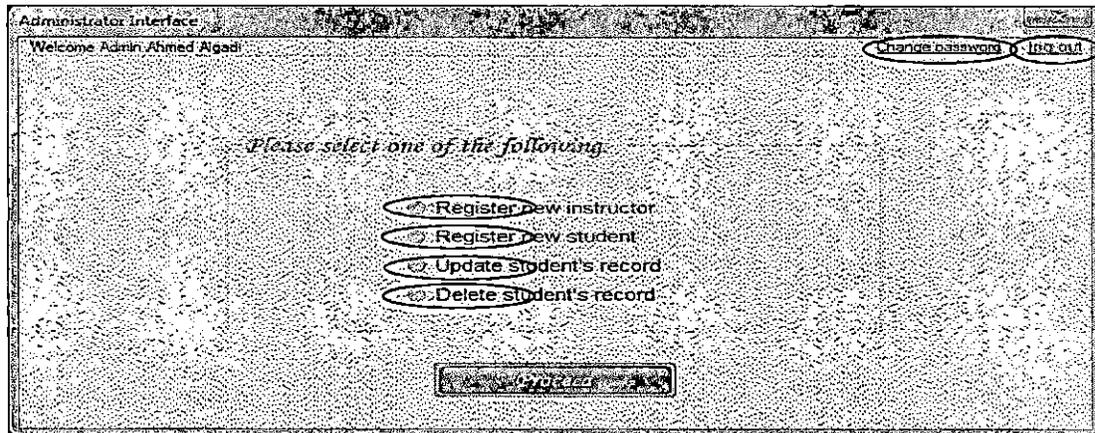


Figure 13. Admin - Primary Interface

- Change password option.

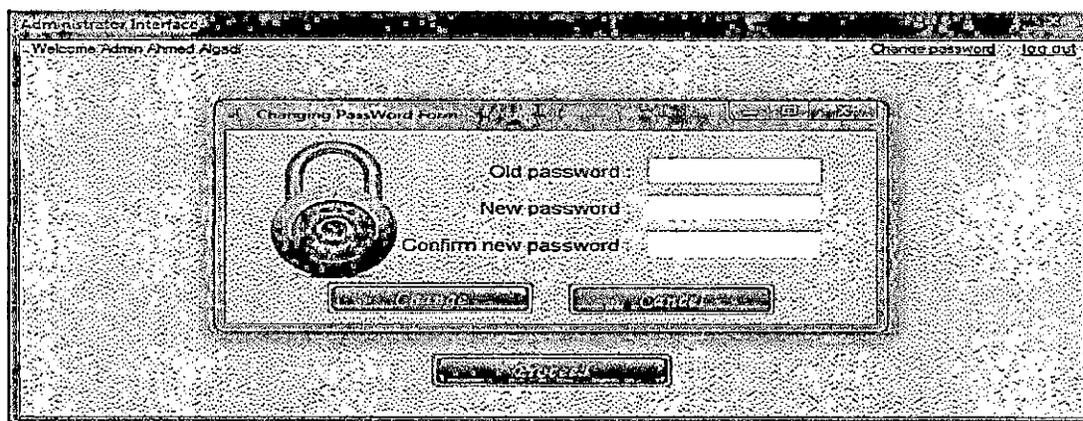


Figure 14. Admin - Changing Password Interface

- Register new instructor option. The administrators will be able to register new instructors to the system, enter the instructors' contact information, choose a position, and set a temporary password.

New Instructor Record

### New Instructor Record Form

*Instructor's Information*

\* Note: all the following fields are required:

ID (9 digits):

Full Name:

Cell phone (10 digits):

E-mail:

Position:

Create temporary password:

Confirm password:

Figure 15. Admin - Instructor Record Interface

- Register new student option. The administrators will be able to register new students to the system, enter the students' contact information, and choose an option of subscription to ASTENS (circled). The administrator could upload an existing students' information file using the Browse button (circled).

New Record

## New Student Record Form

### Student's Information

Note: all the following fields are required.

Upload (.txt or .csv) file:

ID:

Name (first,last):

Cell phone:

E-mail:

Subscribe in ASTENS:

Figure 16. Admin - Student Record Interface

- Update student's record option. The administrators will be able to register and/or drop the students' course(s) using the Classes Registration (circled) as shown in Figure 17, and update the students' contact information.

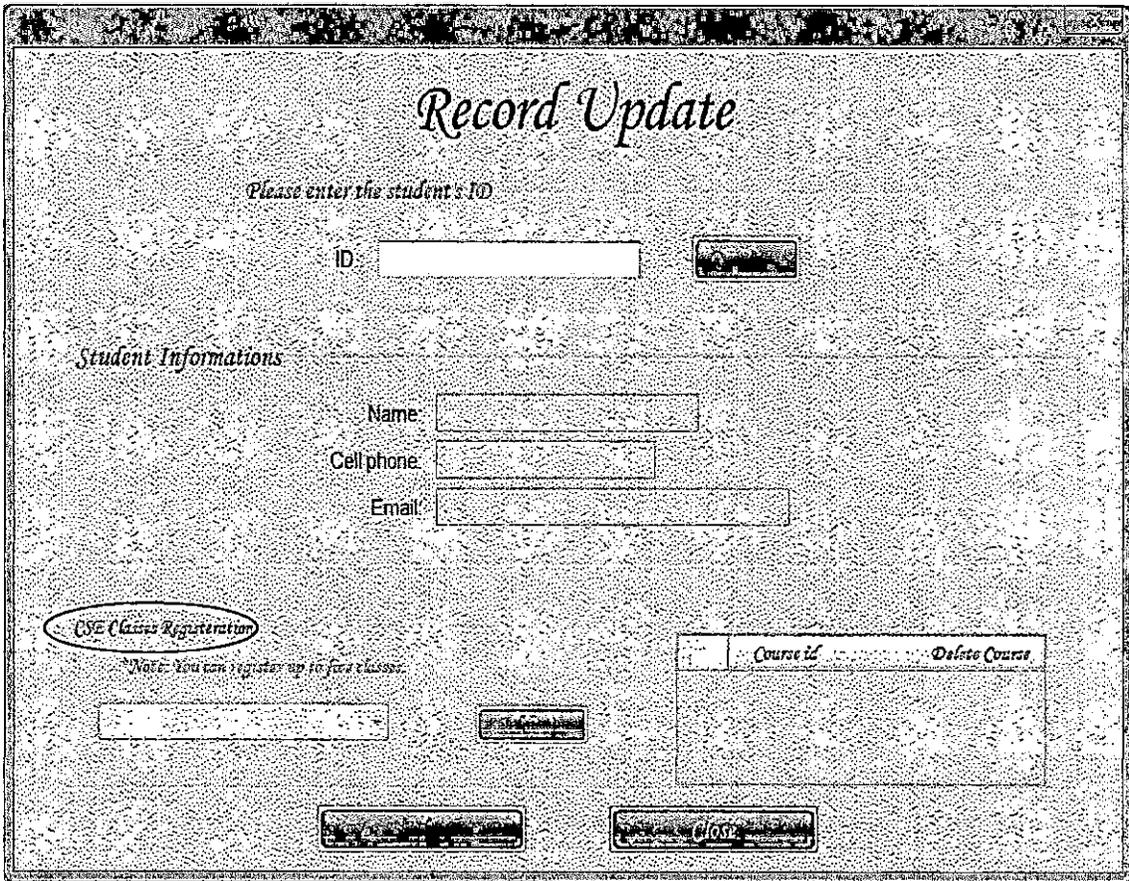


Figure 17. Admin - Updating Record Interface

- Delete student's record option. Once a student's record gets deleted, everything related to that student will be permanently deleted from the system.

Records

## Students' Recored Deletion Form

Student's ID:

*Student's Information*

Name:

Cell phone:

Email:

Figure 18. Admin - Deletion Record Interface

### Instructor Interfaces

Instructors have both system interfaces and network interfaces. The system interfaces available to the instructor are listed as follows.

- Login into the system as professor as shown in Figure 12.
- Instructor's primary interface contains the following options (circled).

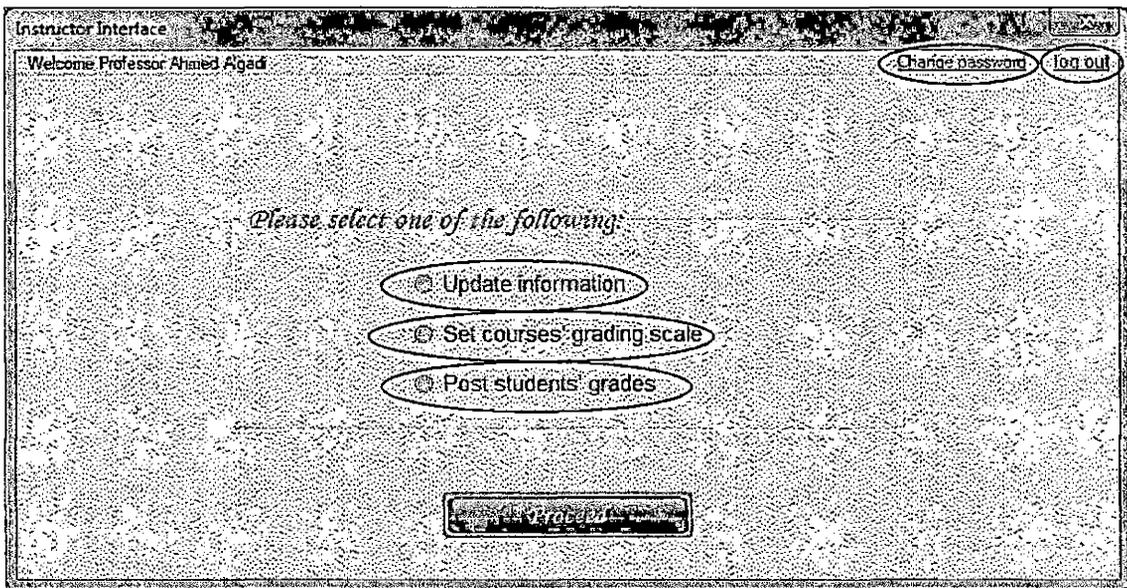


Figure 19. Inst - Primary Interface

- Change password option.

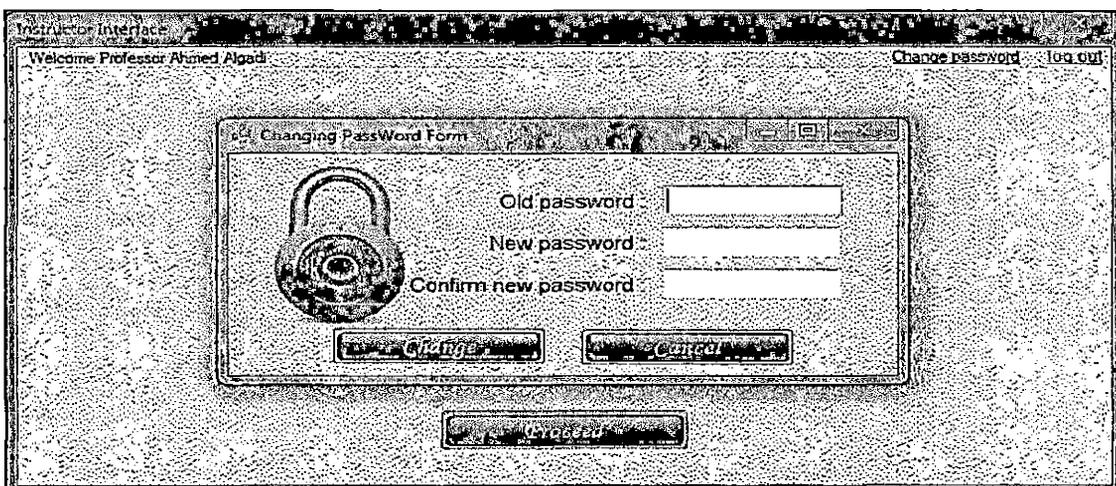


Figure 20. Inst - Changing Password Interface

- Update information option. Instructors will be able to update their own contact information and select the course(s) they will teach. The instructor's information will be retrieved automatically once they choose this option as shown in Figure 21.

*Information Update*

*Ahmed Alqadi*

ID:

*Edit the field(s) that you want to update*

Cell phone:

Email: a

*Courses Registration*

<i>Course id</i>	<i>Delete Course</i>
CSE600	<input type="button" value="Delete"/>
CSE610	<input type="button" value="Delete"/>
CSE690	<input type="button" value="Delete"/>

Figure 21. Inst - Updating Information Interface

- Set courses' grading scale option.

Course's Grading Scale

## Grading Scale

Choose a course:

CSE600

CSE610

CSE690

Number of assignment(s):

Percentage:

Assignment	#	Full Grade

Figure 22. Courses' Grading Scale Interface (1)

Course's Grading Scale

# Grading Scale

Choose a course:

Select an assignment:

Number of assignment(s):

Percentage:  
 %

Assignment	#	Full Grade	Remove
Homework	1	100	Remove
Midterm	1	70	Remove
Final	1	200	Remove

Figure 23. Courses' Grading Scale Interface (2)

- Post student's option. Once the instructors post the grades, their student will receive his/her grades in the form of a text message and an email.

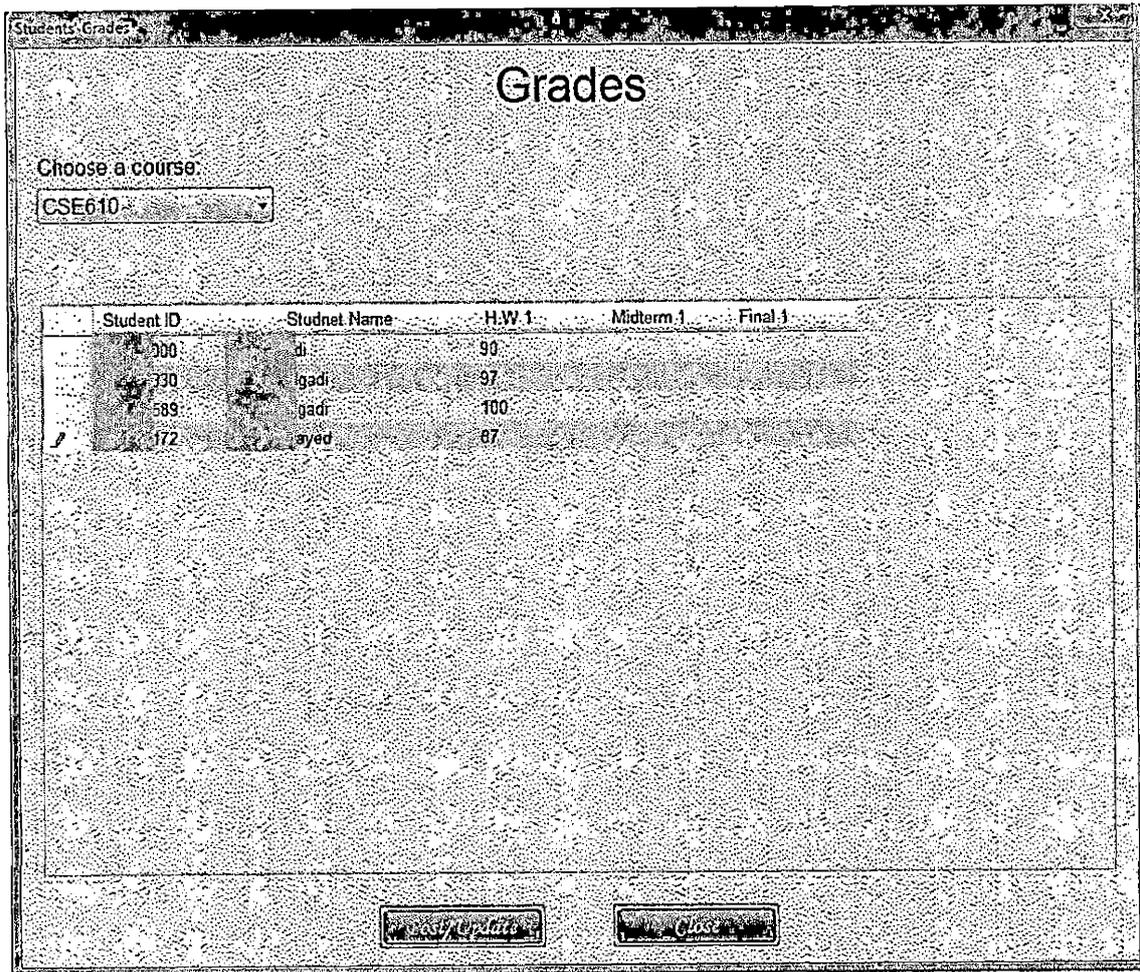


Figure 24. Inst - Posting Grades Interface

In order for the instructors to access the network interfaces via email, they will have to use a special syntax such as the following examples.

- To: ASTENS designated email address.
- From: Instructor's registered email address.
- Subject: The course title i.e. (CSE610).
- Body: The instructor's message.

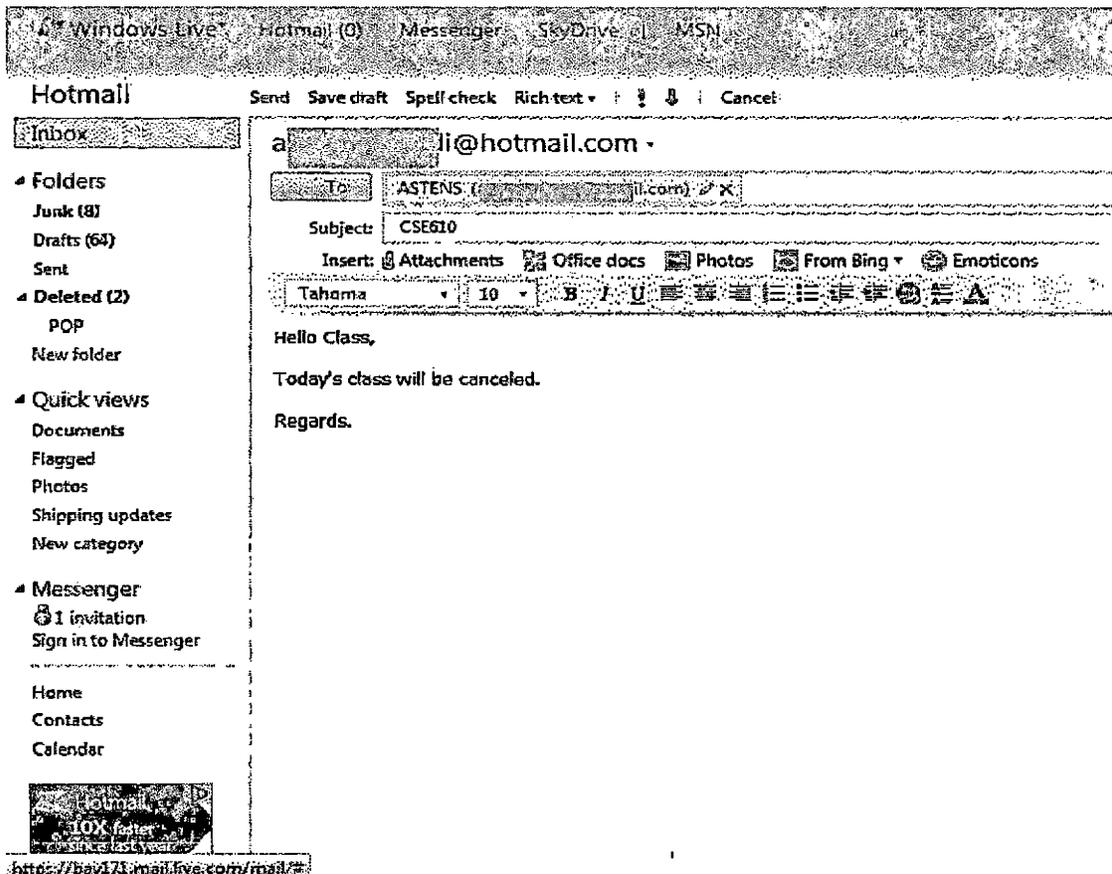


Figure 25. Inst - E-mail Body Syntax

The following figure shows the instructor's SMS text message format.

- To: ASTENS designated SIM number.
- Body: The first line is the course title.



Figure 26. Inst - SMS Text Message Syntax

## Student Interfaces

Students have no system interface, but they have a network interface. The students can only subscribe or unsubscribe to ASTENS grades notifications service. Student will be identified by their cell phones numbers. The students' SMS text message syntax is as follows.

- To: ASTENS designated SIM number.
- Body: subscribe or unsubscribe.

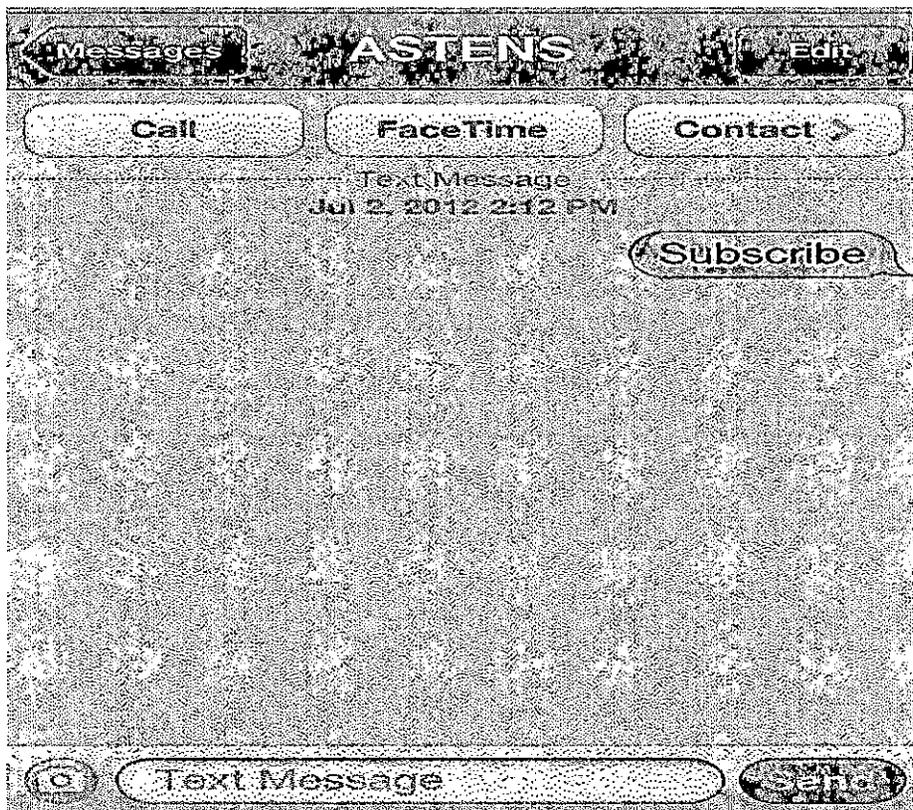


Figure 27. Student - SMS Text Message Syntax (1)

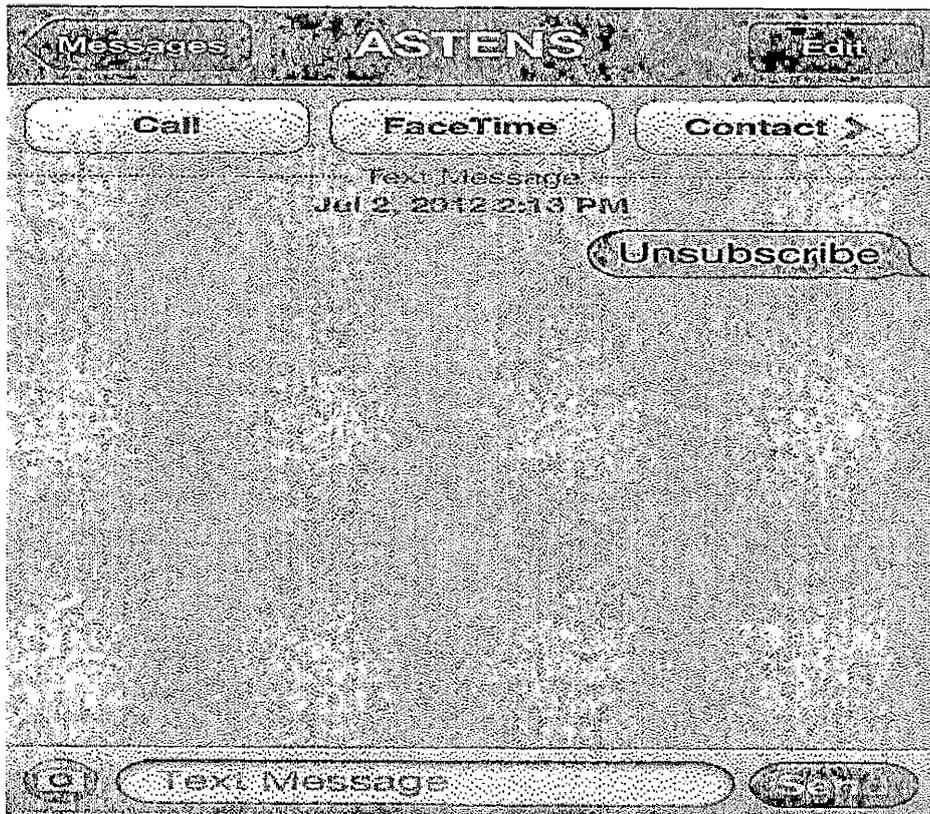


Figure 28. Student - SMS Text Message Syntax (2)

## Product Testing

Testing the product is an important step to verify whether or not the product meets the expected results.

### Unit Testing

Functional and structural tests have been applied to a specific part of the code.

Table 11. The Result of Unit Testing

Interface	Test	Result
ASTENS	Connect to GSM modem. Connect to E-mail Server. Users' button works properly. Error messages work as expected.	Pass
GSM Modem	Read the incoming text messages. Send text messages. Error messages work as expected.	Pass
E-mail Server	Read the incoming emails. Send emails. Error messages work as expected.	Pass
Instructor Interface	All forms are accessible. All buttons work properly. All links work properly. Error messages work as expected.	Pass

Instructor Interface	All forms are accessible. All buttons work properly. All links work properly. Error messages work as expected.	Pass
Register new instructor form	All buttons work properly. Position comboBox works. Setting password works. Error messages work as expected.	Pass
Register new student form	Save/close button works properly. ASTENS comboBox works. Browse button works properly. Upload button works properly. Error messages work as expected.	Pass
Delete students form	All buttons work properly. Error messages work as expected.	Pass
Update students form	All buttons work properly. Courses comboBox works. Error messages work as expected.	Pass
Update instructors form	All buttons work properly. Courses comboBox works. Error messages work as expected.	Pass

Set courses' grading scale	<p>Courses' comboBox works properly.</p> <p>Assignments' comboBox works properly.</p> <p>Error messages work as expected.</p> <p>All buttons work properly.</p>	Pass
Post students' grades	<p>Courses comboBox works properly.</p> <p>Error messages work as expected.</p> <p>All buttons work properly.</p>	Pass
Login	<p>Position comboBox works.</p> <p>All buttons work properly.</p> <p>Error messages work as expected.</p>	pass
Change password	<p>New password set successfully.</p> <p>All buttons work properly.</p> <p>Error messages work as expected.</p>	Pass

## System Testing

The goal of this system testing is to evaluate the system's compliance with the specified requirements. System testing is a complete and integrated system testing.

Table 12. The Result of System Testing

System	Test	Result
Administrator	Only authenticated users can access. Register new instructors and students. Update students' record.	Pass
Instructor	Only authenticated users can access. Set the courses' grading scale. Post the students' grades. Send SMS and email notifications.	Pass
Student	Subscribe/Unsubscribe to ASTENS via SMS.	Pass

## CHAPTER FIVE

### CONCLUSION AND FUTURE WORK

#### Conclusion

ASTENS began as an idea that uses the SMS and email communication technologies to provide us a fast way of communication to our university. This idea has been successfully developed as a communication tool for universities/schools.

ASTENS provides two types of communications: class notifications and grade notifications. First, the class notifications allow the instructors to communicate with their students via SMS text message and/or email. Second, the grade notifications are auto messages that will be sent to all the students who are subscribed to ASTENS grade notifications once the instructor posts the students' grades.

#### Future Work

ASTENS is expected to have a bright future because it uses our daily communication methods. The SMS and email technologies are available to everyone because of the vast spread of smart phones and other smart devices. The future

work will provide the users with better access to the system.

The services that can be added for administrators are summarized as follows.

- Using emails, administrators will be able to update students' contact information.
- Using emails, administrators will be able to add a new instructor record to the system.
- Using cell phones, administrators will be able to delete students' record.

The services that can be added to instructors are summarized as follows.

- Using cell phones and/or emails, instructors will be able to update their own contact information.
- Using cell phones and/or emails, instructors will be able to send notification to a specific student or a group of students.

The services that can be added to students are summarized as follows.

- Using cell phones, students will be able to retrieve their grades.

- Using emails, students will be able to retrieve their instructors' office hours.
- Using cell phones and/or emails, students can make an appointment with their instructors.
- Using cell phones and/or emails, student can retrieve the assignments' due dates.

## REFERENCES

- [1] WIKIPEDIA, "Text messaging," 24 July 2012. [Online]. Available: [http://en.wikipedia.org/wiki/Text\\_messaging](http://en.wikipedia.org/wiki/Text_messaging).
- [2] Ozeki Informatic Ltd., "SMS Gateway Standard licenses," 2000 - 2012. [Online]. Available: <http://www.ozekisms.com/index.php?owpn=242>.
- [3] Want to know it?, "Who Invented Text Messaging," 2012. [Online]. Available: <http://wanttoknowit.com/who-invented-text-messaging/>.
- [4] M. Rouse, "POP3 (Post Office Protocol 3)," TechTarget, March 2007. [Online]. Available: <http://searchexchange.techtarget.com/definition/POP3> .
- [5] WEBOPEDIA, "POP," QuinStreet Inc., 2012. [Online]. Available: <http://www.webopedia.com/TERM/P/POP2.html>.
- [6] M. Rouse and J. Mathew, "SMTP (Simple Mail Transfer Protocol)," TechTarget, September 2005. [Online]. Available: <http://searchexchange.techtarget.com/definition/SMTP>.
- [7] WEBOPEDIA, "SMTP," QuinStreet Inc. , 2012. [Online]. Available: <http://www.webopedia.com/TERM/S/SMTP.html>.
- [8] Microsoft Support, "SMTP: Definition of SMTP,"

Microsoft, 30 October 2006. [Online]. Available:

<http://support.microsoft.com/kb/87022>.

[9] Logix mobile, "mCore™ .NET SMS Library 1.2," IG Logix Softech Pvt. Ltd., [Online]. Available:

<http://www.logixmobile.com/index.asp> .

[10] Logix mobile, "Supported GSM Modems & Phones," IG Logix Softech Pvt. Ltd., [Online]. Available:

[http://www.logixmobile.com/products/mcorelib/gsm\\_modem.asp](http://www.logixmobile.com/products/mcorelib/gsm_modem.asp).

[11] Developers' Home, "Introduction to AT Commands," 2004 - 2011. [Online]. Available:

<http://www.developershome.com/sms/atCommandsIntro.asp>.

[12] PCTEL, "AT Command Guide," June 2000. [Online].

Available: <http://linmodems.technion.ac.il/pctel-linux/Pctel.ATCommand.Guide.6.23.00.pdf>.

[13] R. Tomlinson, "The First Network Email," [Online].

Available:

<http://openmap.bbn.com/~tomlinso/ray/firstemailframe.html>.

[14] H. Tschabitscher, "What Email is and How It Works,"

About.com, [Online]. Available:

[http://email.about.com/cs/beginningemail/a/email\\_basics.htm](http://email.about.com/cs/beginningemail/a/email_basics.htm)

.

[15] WEBOPEDIA, "e-mail," QuinStreet Inc. , 2012. [Online].  
Available: [http://www.webopedia.com/TERM/E/e\\_mail.htm](http://www.webopedia.com/TERM/E/e_mail.htm) .

[16] WIKIPEDIA, "MySQL," 9 August 2012. [Online].  
Available: <http://en.wikipedia.org/wiki/MySQL>.

[17] WIKIPEDIA, "IP address," 16 July 2012. [Online].  
Available: [http://en.wikipedia.org/wiki/IP\\_address](http://en.wikipedia.org/wiki/IP_address).

[18] P. Huber, "Standard for ARPA Internet Text," 2006.  
[Online]. Available: <http://rfc.net/rfc822.html>.

[19] P. Huber, "MIME Standard, Internet Message Bodies,"  
2006. [Online]. Available: <http://rfc.net/rfc2045.html>.

[20] P. Huber, "MIME Standard, Media Types," 2006.  
[Online]. Available: <http://rfc.net/rfc2046.html>.

[21] P. Huber, "QuotedPrintable Class from ASP emporium,"  
2006. [Online]. Available:  
<http://www.aspemporium.com/classes.aspx?cid=6>.

[22] P. Huber, "MIME Standard, E-mail Encapsulation of HTML  
(MHTML)," 2006. [Online]. Available:  
<http://rfc.net/rfc2110.html>.

[23] P. Huber, "MIME Standard, Multipart/Related Content-  
type," 2006. [Online]. Available:  
<http://rfc.net/rfc2112.html>.

[24] P. Huber, "MIME Encapsulation of Aggregate Documents," 2006. [Online]. Available: <http://rfc.net/rfc2557.html>.

[25] P. Huber, "POP3 Email Client (.NET 2.0)," 5 August 2006. [Online]. Available: <http://www.codeproject.com/csharp/Pop3MailClient.asp>.

[26] A. Kurniawan, "Retrieve Mail From a POP3 Server Using C#," 19 Jan 2002. [Online]. Available: <http://www.codeproject.com/Articles/1733/Retrieve-Mail-From-a-POP3-Server-Using-C>.