

# South Carolina Intelligent Highway Alert System (IHAS)

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**Abstract**—Motorists are provided with the ability to have traffic updates, weather updates, and Amber alerts all on one screen inside one’s vehicle. This was possible by creating a database that would contain the update/alert (put in by an operator via a webpage) along with Visual C++ coding that can read the information from the database via query language through Wi-Fi (IEEE 802.11). Simultaneously, the C++ is running a loop that uses the access point’s (wireless router’s) IP address to determine location and direction of a motorist. The updates/alerts are constantly renewed and easy to read while driving down the road. For a motorist to know traffic, weather, and Amber alerts constantly would allow for one to avoid backed up traffic, to pull over or take another route before hitting a flooded section of road, and for everyone with this system to know about a missing child; including the vehicle/abductor’s description. Ultimately, the technology can help save motorists, traffic flow, and find kidnapped children faster.

## I. NOMENCLATURE

HTML- Hypertext Markup Language  
 IP-Internet Protocol  
 SCDOT- South Carolina Department of Transportation  
 SCIHAS- South Carolina Intelligent Highway Alert System  
 SQL-Server Query Language  
 PHP- Originally Personal Home Page, now Hypertext Processor  
 WAMP- Windows, Apache, MySQL, and PHP

## II. INTRODUCTION

The SCIHAS was conceived initially as a method to transmit information to motorists in an efficient, timely, and convenient manner. The process involved designing and creating a website and database, a method in which to transfer the information over a medium, and a way to display the data once it was received. Initial research indicated that wireless internet (802.11 g) or just Wi-Fi was the easiest and most practical medium in which to transmit data. The final design scheme

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The funding for the IHAS was provided by the Citadel Electrical Engineering department.

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settled on separated the IHAS into 3 distinct categories: A website and database for information to entered and stored; wireless routers to be used as repeaters; and an in car unit which ran a program to detect the repeaters and display all data pertinent to that repeater’s IP address.

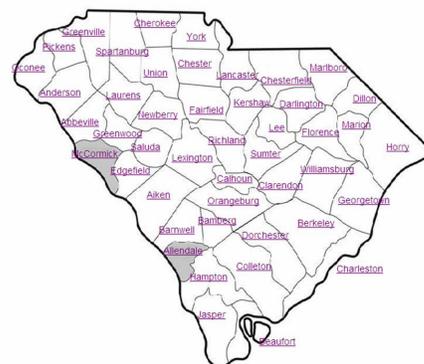
The design requirements for the IHAS were minimum including: low power consumption, clear and accurate display of messages with direction included, access to a wireless network, and a user-friendly access point to update the database.

## III. WEBSITE AND DATABASE DESIGN

### A. Website

The website was conceived out of the necessity of an access point for operator. The website was written in HTML and PHP. HTML was chosen because it was needed in order to display the web page on the Internet. PHP was chosen primarily because of its ease of use to design a web page. The PHP was embedded in the HTML code for the web application of the database. After the website was designed, the page was loaded onto the Internet using WAMP Server. WAMP is a form of mini-server that can run almost any Windows operating system. The Apache component allowed for the website to be loaded onto the Citadel’s local network.

### Intelligent Highway Alert System



Press [Here](#) to Send State Wide Alerts

Fig1: IHAS main page screenshot.

The SCIHAS website consisted of several web pages. The first page was map of the state that enabled the operator to

select the county to send updates. The county was selected by clicking the county's name which acted as a link to the next page. The next broke the county down further, by displaying highways and interstates, as well as the area covered by each repeater. From there the operator chose a specific location by selecting a repeater from a drop-down box. The drop-down box contained the names of each repeater located within that specific county. Although the repeaters appeared to have names on the web page, the routers' static IP addresses had been programmed in to PHP script. The updates themselves were typed into textboxes named "Amber," "Weather," and "Traffic." Once the messages were typed into the user clicked a "Submit" button to send the updates to the SQL database. The PHP code was programmed to echo "The form was successfully added to your database."

### South Carolina Intelligent Highway Alert System

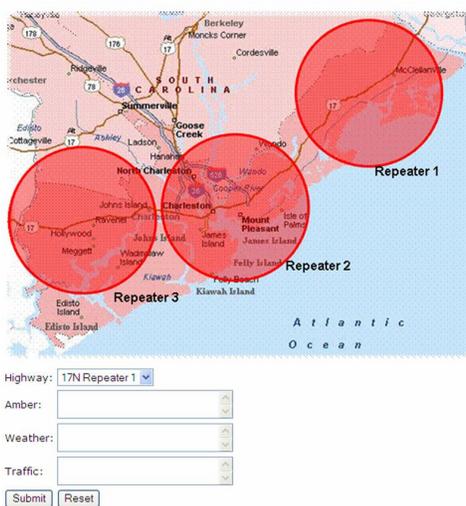


Fig2: Charleston County Alert screenshot.

### B. Database

The database was written using MySQL because of its compatibility with PHP. MySQL is a database manager that keeps track of data in a highly organized way. The database was named "scihas" and contained a table named "repeater." The table contained 5 fields names "Highway," "Amber," "Weather," "Traffic," and a timestamp named "Date/Time." The database was actually created using phpMyAdmin, which provided a graphic interface for the database. The "Highway" field contained the IP address of the updated router. The "Amber," "Weather," "Traffic" fields contained the information entered from the website. The timestamp was added as a reference point so that the most recent update would be accessed.

## IV. HARDWARE DESIGN

### A. Repeaters/ Routers

Linksys 802.11g wireless routers were selected as the repeaters for the project. Linksys routers were chosen for their reliability and signal quality over such other routers as NETGEAR and D-Link. The routers were set up to relay

information from the database on an encrypted wireless path. For testing purposes the routers were placed well apart from each other on the Citadel campus in several locations. The wireless routers were connected to the Internet via CAT-5 Ethernet cables.



Fig3: WRT54GS Wireless Router used for testing.

### B. Server Housing

The server housing for the local host was a PC installed in a central control location. The PC was a Gateway and was chosen because it was a preexisting piece of hardware that suited the requirements of the project design. The server also had access to the Internet which allowed it to interface with the IHAS website.

### C. Receiver (In-Car Unit)

The unit that received the updates via the internet was a laptop. The laptop was chosen over other technology such as PDAs or LCD screens. The laptop was readily available for programming, and more versatile than the other possibilities. The laptop was programmed with a Visual C++ routine that detected the network, connected to said network, and displayed information for the router's area.

## V. SOFTWARE DESIGN

### A. Server Code

The most important parts of the query code were the libraries and header files. These were needed to request and receive information. The database was set up previously so that the information could be queried. Constants, such as the password, user name, host, and database name were set in the top of the code. For remote connection, as this project used, the host had to have an IP address when working in tandem with the MySQL database. A privilege was set up to allow the user to remotely connect to the database. The privileges were granted based off the IP address of the user, which necessitated the need for static IP addresses for the IHAS Repeater Network. Further constants were set up for the MySQL functions. Examples of these function included MySQL (connection), My\_Result (results from query), and My\_Row (Display data and information in rows). Connection

to the database was initialized by using MySQL\_init. This was then followed by MySQL\_real\_connect command which was set equal to the MySQL constant used earlier. The MySQL\_real\_connect command required the following: (&mysql (constant), host, username, password, database, port #, NULL, NULL). This code allowed the user to connect to the IHAS network using static IP addresses. In order to detect connection errors, an “if statement” was used. If the connection equaled NULL, there was an error. To display this error, the code was paused by system (“pause”) and exited using the “return 1” command. Once a successful connection was made, C++ query code was used to display information to the user. The query command that was used was MySQL\_query. Further code was also needed so that the information could be displayed in a clear and easy-to-read format. Once that was completed, the data was displayed in clear, orderly rows. MySQLclose\_command closed the program, as well as disconnected from the database, and exited the program using the “return 0: command.

### B. Receiver Code

This end of the software was responsible for determining the motorists’ location. It was also responsible for querying and displaying all relevant information to the motorist.

It utilized functions from Windows Socket Application Programming Interface in order to determine the static IP address of the router. Once an initial connection was made, the program compared the determined IP address with a list of known IP addresses. Each address in the list referred to a single location. Once a match had been found, the program established a connection to the SCIHAS server and queried the server for information relevant to the router’s location. The information was then displayed to the motorist on the in-car unit. An additional message displayed the router’s name and that it was connected to the SCIHAS. From here the program entered a loop. The program continuously determined the IP address of the repeater. It also continuously retrieved and displayed data from the server. When the motorist entered a “dead space” zone, the program froze the last retrieved information from the server, but continued to find IP addresses. A “dead space” zone was a purposefully created area where no connection could be made. After a new repeated had been found, and been connected to, the direction was able to be determined. Direction was determined by the order and locations in which previous repeaters were connected. The process then resumed where the program ran in a continuous loop to determine IP addresses and query those IP addresses. All information related to the IP addresses was again displayed, along with direction and the necessary updates.

### C. Security

Only an operator with a security clearance was allowed to operate the system at the server end. The pages of the IHAS website were secured with passwords and all transmissions were encrypted before being sent.

## VI. APPENDIX

Below is a sample of the query code used in the IHAS program:

```
#include "stdafx.h"
#include <iostream>
#include <windows.h>
#include <mysql.h>
#include <sqltypes.h>
#include <sqlext.h>
#pragma comment(lib, "C:\\Program Files\\MySQL\\MySQL
Server 6.0\\lib\\opt\\libmysql.lib")
using namespace std;
//declaring constants
#define host "155.225.212.205"
#define username "Trooper"
#define password "password"
#define database "scihhas"
unsigned int i;
MYSQL *connection, mysql;
MYSQL_RES *result;
MYSQL_ROW row;
int query_state;

int main()
{
    //Connecting to the Database
    mysql_init(&mysql);
    connection =
mysql_real_connect(&mysql,host,username,password,database
,3306,NULL,0);
    if (connection == NULL)
    {
        cout << mysql_error(&mysql) << endl;
        system("pause");
        return 1;
    }
    //Displaying Database Information via a MySql Query.
    mysql_query(connection,"SELECT Highway, Amber,
Weather, Traffic FROM repeater WHERE Highway='17NR3'
ORDER BY datetime DESC");

    result = mysql_store_result(connection);
    row = mysql_fetch_row(result);
    cout << "Most Current Alert: ";printf(row[0] != NULL ?
row[0] : "NULL");
    cout << endl;
    cout << "AMBER: ";printf(row[1] != NULL ? row[1] :
"NULL");
    cout << endl;
    cout << "WEATHER: ";printf(row[2] != NULL ? row[2] :
"NULL");
    cout << endl;
    cout << "TRAFFIC: ";printf(row[3] != NULL ? row[3] :
"NULL");
    cout << endl;
    mysql_close(connection);
    return 0;
}
```

## VII. ACKNOWLEDGMENT

The authors gratefully acknowledge the contributions of Dr. Jason Skinner, Assistant Professor of Electrical Engineering at The Citadel, Super Troopers team faculty advisor; Dr. Johnston Peeples, Department Head of Electrical Engineering at The Citadel; and Mr. Charles Lehman for his technical advice in the creation of the IHAS website.

## VIII. REFERENCE

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## IX. BIOGRAPHIES



Matthew Besnard was born in New Orleans, Louisiana on December 18, 1986. Upon graduation from The Citadel with a Bachelor of Science Degree in Electrical Engineering, he plans to work as an engineer. He has plans to

pursue a Masters of Engineering Management after a few years in industry. As a member of the Corps of Cadets at The Citadel, he has served as Lima Company Academic Officer overseeing approximately one hundred cadets.



Franklin B. Culick was born in Kingstree, South Carolina on March 12, 1987. Upon graduation from The Citadel with a Bachelors Degree in Electrical Engineering, he will be commissioned in the United States Air Force as a 2<sup>nd</sup> Lieutenant. He has been

assigned to Laughlin AFB in Del Rio, Texas for pilot training. He plans to get a Masters in Engineering Management on a later date. As a member of the Corps of Cadet at the Citadel, he served as Lima Company Commander in charge of approximately one hundred cadets.



Alexander S. R. Grimes was born in Manhattan, New York on June 30, 1987. Upon graduation from The Citadel with a Bachelors Degree in Electrical Engineering, he will be working for Raytheon Missile Systems in Tucson, Arizona. He plans to get a Masters in Communications

Engineering after working in the industry. As a member of the Corps of Cadet at the Citadel, he served as the Citadel ice hockey team captain for two years.



David N. Huffman was born in Aiken, South Carolina on November 12, 1986. Upon graduation from The Citadel with a Bachelors Degree in Electrical Engineering, he will be working at SPAWAR located in Charleston, South Carolina. He has plans to

pursue a Masters of Engineering Management after a few years in industry. As a member of the Corps of Cadet at the Citadel, he served as India Company Senior private leadership, which is the voice that really governs The Citadel.