

MAP INTERFACE FOR IOWA DEPARTMENT OF TRANSPORTATION'S ACCESS-ALAS

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ABSTRACT

This paper discusses the limitations of Iowa Department of Transportation's (DOT) Access-Accident Location and Analysis System (ALAS) and also explains the working of the map interface, a software program designed to overcome these limitations. The paper also includes discussion on other crash analysis systems designed and/or deployed in other states. All features/capabilities of the map interface are explained and some of them are compared to those of Access-ALAS to focus on the enhanced performance of map interface.

INTRODUCTION

State departments of transportation, insurance agencies and transportation consultants do crash analyses to evaluate roadway safety. Various software programs are used by these agencies to perform crash analyses. The Iowa Department of Transportation (DOT) uses Geographic Information Systems (GIS)- Accident Location and Analysis System (ALAS) and Access-ALAS to perform system-wide crash analyses. ALAS is used to retrieve accident data and generate customized reports that are used to improve engineering (highway design), safety and enforcement in transportation. This paper focuses on enhancing the capabilities of Access-ALAS and improving access to the data for crash analysis by designing a map interface. The map interface will ease the process of selecting crashes by providing a user-friendly Graphical User Interface (GUI). A GUI helps the safety analyst perform crash analysis faster and thereby the analyst can spend more time in giving better solutions to transportation problems and making the transportation system safer. Therefore, enhancing Access-ALAS with a map interface will have an indirect impact on transportation safety.

The main purpose of a crash analysis is to improve safety by identifying crash patterns and mitigating the crash severity or/and reducing the number of crashes by adopting suitable countermeasures. The effectiveness of these countermeasures in improving safety depends upon the accuracy of the crash analysis. The accuracy of the results of crash analysis depends upon the nature (spatial or textual) and accuracy of crash data input into the crash analysis system. Therefore, crash data have a considerable effect on roadway safety. Figure 1 shows the relationship between crash data and roadway safety.

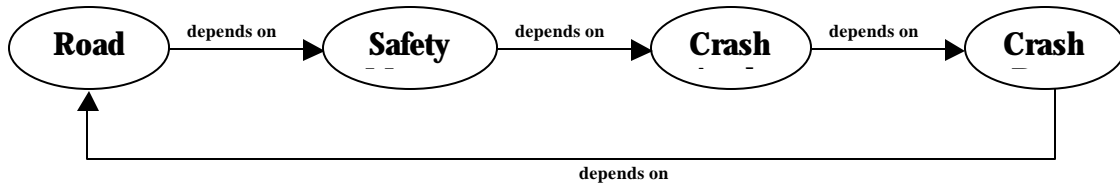


FIGURE 1 Graphical Representation of the Relationship between Roadway Safety and Crash Data

Crash data can be in spatial or textual form. If spatial data are used, the analyst will have a choice to select specific crashes and decide whether the crash is intersection-related or access-related or curve-related and so on. On the other hand if textual data are used, the safety analyst has to use some criteria such as an intersection ID to query crash data and the results will be based upon the data entered into the crash table. Therefore, spatial data allows the analyst greater discretion during the crash selection process whereas textual data limits analyst’s choice to discrete ranges of attribute values.

OTHER CRASH ANALYSIS SYSTEMS

Analogous to the Iowa Department of Transportation’s Access-ALAS, Washington State DOT has developed a Collision Records System (CRS) that helps the local agencies improve traffic safety on their street systems. CRS stores the collision data in a Microsoft Access database. Microsoft Access helps in generating specialized reports such as location report, high collision location report and corridor report (1).

The Kentucky State police uses CRASH, the primary goal of which was to design and implement a single, uniform, cost-effective system to accurately capture, analyze, and report traffic collision data. Kentucky State Police, federal and local law enforcement agencies throughout the Commonwealth, use the CRASH System (2).

The state of Alabama stores and manages detailed information about vehicle crashes including the estimated location where a crash occurred. Crash locations are estimated and hand recorded by highway patrol officers at the scene of a crash. These locations are typically placed at identifiable points along the roadway, such as mileposts and intersections (3).

Iowa DOT’s TraCS software can provide crash data to the safety analysts as quickly as eight hours from the time of crash occurrence (4). This helps in getting the most recent crash data. Automated collision database and reporting system developed for Nashville, Tennessee will make possible the near real-time entry and analysis of

collision records. This system will allow for enhanced manipulation of collision data, thereby increasing time efficiency and improving the overall level of analytical capability (5).

PROBLEM DEFINITION

Access-ALAS uses node numbers to run crash-location queries. Nodes include intersections and points on roadways with significant change in alignment. A unique number is assigned to each one of these nodes. When new roads are added to the existing road network, new node numbers representing the new intersections are added to the system, thereby making the node-numbering system non-uniform.

The Access-ALAS user requires node maps to perform crash analysis. The user has to manually read these node maps to determine the node numbers for the intersections, which can make the crash data retrieval process time-consuming.

As most of the Access-ALAS queries are based on nodes, and thereby node numbers, the analyst does not have a chance to select crashes between any two points on the roadway except between those points with designated node numbers.

APPLICATION OF MAP INTERFACE

The queries in the map interface are based on real world x-y coordinates unlike the existing Access-ALAS system and therefore, unlike Access-ALAS, the map interface does not inherit the limitations of a node-based system. The safety analyst can select crashes based on different criteria using the map interface software program. The most commonly used criteria featured in the map interface are as follows.

1. County-wide crashes
2. City-wide crashes
3. Crashes in a user-selected area (a rectangular area)
4. Crashes along a road between any two points
5. Crashes between intersections with intersection names as the input
6. Any selected crash

In the existing system, the user has to enter the node numbers to analyze crashes on either a particular roadway or between intersections. Figure 2 shows a node-input screen to analyze crashes between two pre-defined nodes. The node number 1 is for the intersection of Hyland Avenue and Lincoln Way, and node number 2 is for the

intersection of Hayward Avenue and Lincoln Way. These node number values are obtained from the node maps provided by Iowa DOT.

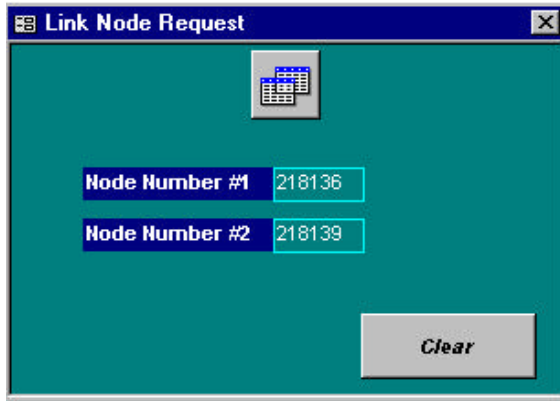


FIGURE 2 A Node-Entry Screen in the Existing Version of Access-ALAS

Determining node numbers for all the intersections required to be queried is a time-consuming process. The map interface allows the user to select crashes from a map that consists of roads with road names, crashes, county boundaries, county names and other features such as rivers and railroads. With the map interface, the user can perform the same query mentioned above with just two mouse clicks. This not only saves the analyst's time but also gives him a chance to spend time in doing more analysis. Figure 3 shows a map interface screen with crashes between the intersection of Hyland Avenue and Lincoln Way, and intersection of Hayward Avenue and Lincoln Way selected.

One of the other features of map interface lets the user select crashes in a particular area by drawing a rectangle around the crashes. Figure 4 illustrates the area-wide selection of crashes.

Care is taken to protect the functionality of Access-ALAS, thereby providing the user a choice to select either the traditional node-based system or the map interface. In future, the crashes will not be referenced using node numbers any more.

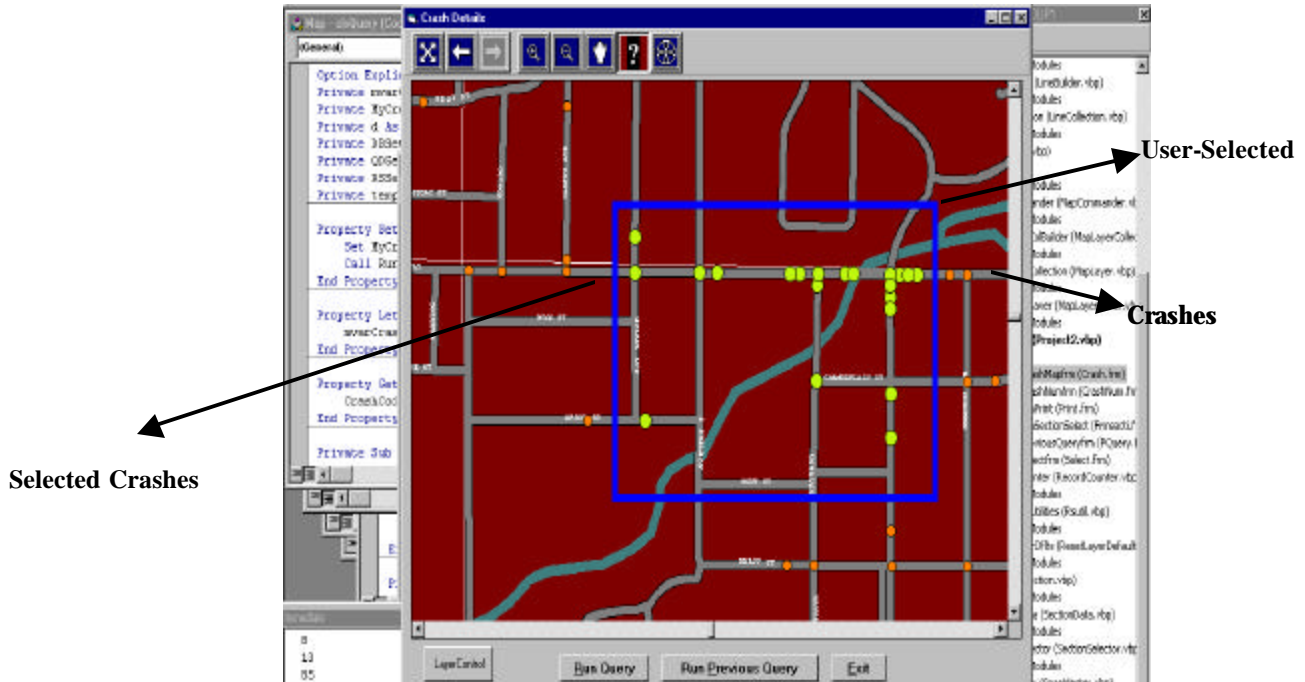


FIGURE 3 Map Interface Crash Selection Screen

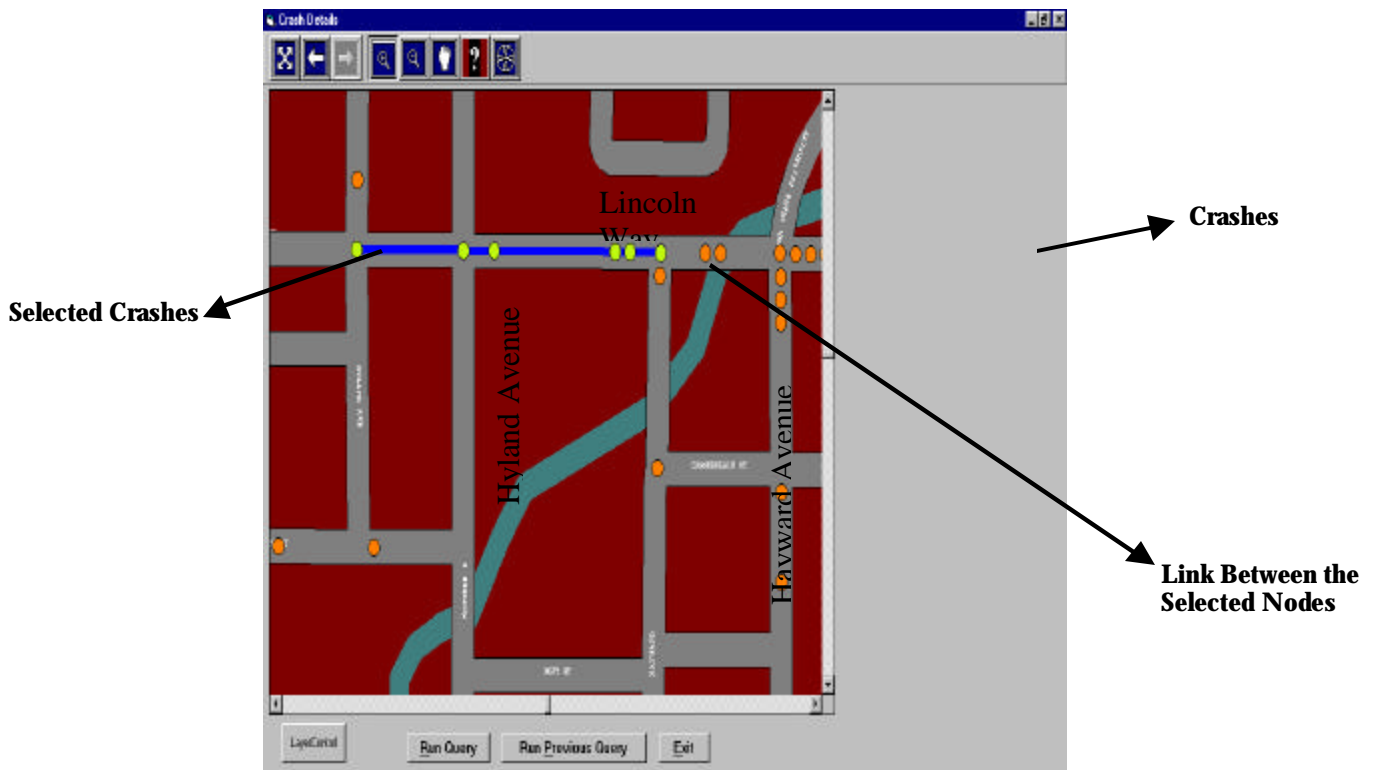


FIGURE 4 Area-Wide Crash Selection Using Map Interface

SOFTWARE DESIGN AND DEVELOPMENT

A model showing how the map interface works has been developed. The model shows every detail of the internal workings of the map interface, thereby providing the possibility to easily modify the system in future. For example, if a crash is to be selected on a map, the system needs input from the user. The input can be a crash number, a segment on a roadway or a polygon on the map. The system takes the input, processes it and generates the output, which in this case is a crash/set of crashes. Every detail of how the system works and the logic involved is documented using the Unified Modeling Language (UML). UML is a language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system (6). Figure 5 shows a high level view of user interaction with the map interface.

The code required to build the map interface is written in Microsoft Visual Basic 6.0 and MapObjects 2.0. Visual Basic is a high-level programming language and supports all windows-based computers.

This program is in development stages and will be provided to users next year. An Access-ALAS user survey will be done in November 2000 to determine whether map interface features everything the user needs and the software program will be modified accordingly.

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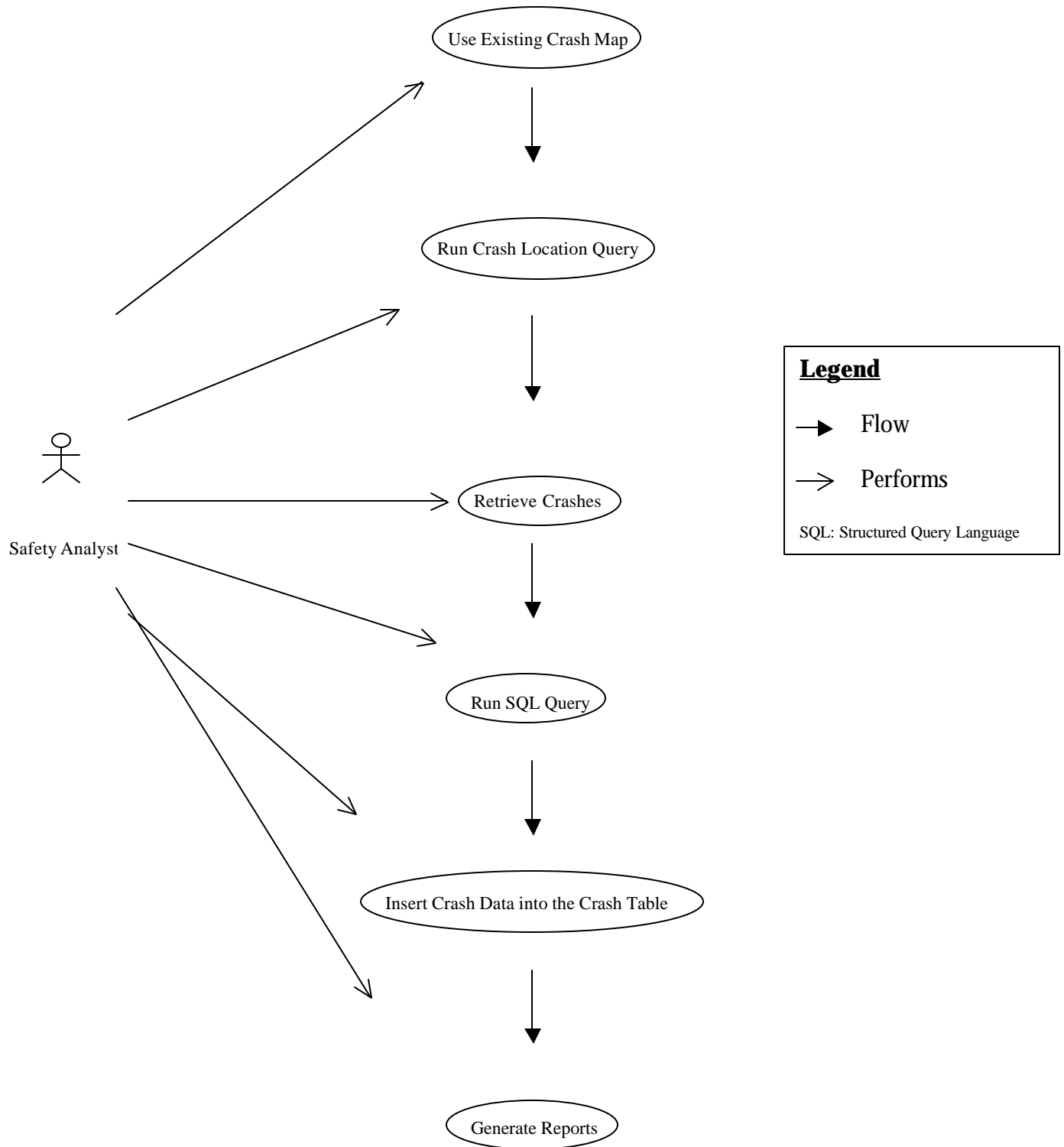


FIGURE 5 Working of Access-ALAS Map Interface