Automated Systems for Road Safety control in a Developing World

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Abstract

The problems associated with road travel in developing nations have generated serious concern to researchers and road management agencies. The number of accidents recorded each year in every developing nation is scaring. This research has been conducted and a critical analysis on road safety reveals many problems facing the control of road traffic. An Automated system was finally designed and developed for road safety control. This Automated system is believed to have the capacity to minimize or eliminate the problems identified in this study on traffic control in a developing world.

Key words: drivers, traffic situation information, accident causation, FRSC

Introduction

An examination of Road Traffic Accidents (RTAs) by age and sex of drivers has shown that victims are predominantly young adult males within age range of 26-30 years. The causes of RTA were multi factorial and were attributed to: recklessness and negligence of the driver (61.3%), mechanical defects in vehicle (8.4%), careless crossing of the road by pedestrians (12.7%), bad road and other less important causes accounted for (17.6%).

A further Analysis of the condition of drivers involved in RTA has shown that the use of drugs such as alcohol, kolanut and Indian hemp at time of accident were important factors in the occurrence of RTA (although the use was often denied). Over 12 % of RTAs were under influence of caffeine in kola nut, 7.74% alcohol, and 1.62 Indian hemp. The role of poor sight in accident causation has also been well documented. With the high rate of road mishaps and road congestion, there lies a great vacuum of Communication Bridge between the daily road users and the Federal Road Safety Corps (FRSC). There is an urgent need therefore to fill this gap.

The inability for fast, efficient and accurate decision making through provision of adequate traffic situation information to road users (motorist and cyclists alike) has led to loss of lives. The FRSC is not rendering a 24hours/7days satisfactory service, while the road is in constant use and traffic situation at late hours are not properly coordinated. The unavailability of a functional Database is an obstacle to an effective communication. The objective of this paper is to design and develop a Decision Support System (DSS), for the Federal Road Safety Corps, Awka State Chapter. The DSS system [1][2][3], when deployed, implemented and commissioned will be capable of assisting the Commission in decision making, on road accidents and traffic offenders.

The DSS system [4] will be capable of

registering new road users, and send instant Short Message Service (SMS), to users demanding for enquires on alternative route, among others; subsequently providing faster solution on Road Congestion and Maintenance. This study will develop and implement a Decision Support System, which will be capable of assisting the Federal Road Safety Corps in decision making, with respect to road usage, alternative route and road congestion, for road users.

Background Studies

A Decision Support System (DSS) is any tool used to improve the process of decision making in complex systems, particularly where information is uncertain or incomplete. There are a number of approaches to DSS systems, each of which assist the process in different ways. DSS is an old term that now applies collectively to a number of 'new' systems such as OLAP (On Line Analytical Processing), EIS, ESS, expert systems and more [4]. A DSS can range from a system to answer simple queries that allow a subsequent decision to be made, to a system that provides detailed querying across a spectrum of related datasets. More complicated systems directly 'answer' questions as opposed to providing static information on high level 'what-if' scenario modeling. These latter systems are more important in a DSS and are its prime application area. They encompass systems where knowledge or answers are sought in systems with incomplete or very complex data. A DSS [1][18] provides decisions based on rules or algorithms derived from an understanding of the business or application domain. DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions. Typical information that a decision support application gather and present may include:

i. inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
ii. comparative sales figures between one period and the next,
iii. Projected revenue figures based on product sales assumptions.

There are several ways to classify DSS applications. Not every DSS fits neatly into one of the categories, but may be a mix of two or more architectures. DSS are classified into the following six frameworks: *Text-oriented DSS, Database-oriented DSS, Spreadsheet-oriented DSS, Solver-oriented DSS, Rule-oriented DSS*, and *Compound DSS*. According to Power, D. J. [13] , a Decision Support System (DSS) is a collection of integrated software applications and hardware that form the backbone of an organization's decision making process. Companies across all industries rely on decision support tools, techniques, and models to help them assess and resolve everyday business questions. The decision support system is data-driven, as the entire process feeds off of the collection and availability of data to analyze. Business Intelligence (BI) reporting tools, processes, and methodologies are key components to any decision support system and provide end users with rich reporting, monitoring, and data analysis. Decision support systems have become critical and ubiquitous across all types of business. [14]. In today's global marketplace, it is imperative that companies respond quickly to market changes. Companies with comprehensive decision support systems [5][6][7] have a significant competitive advantage.

Materials and Methods

A compound DSS is the most popular classification for a DSS. It is a hybrid system that includes two or more of the five basic structures. The support given by DSS can be separated into three distinct, interrelated categories: *Personal Support, Group Support, and Organizational Support.* DSS components may be classified as: [22] [23] [24] [26]

i. Inputs: Factors, numbers, and characteristics to analyze
ii. User Knowledge and Expertise: Inputs requiring manual analysis by the user
iii. Outputs: Transformed data from which DSS "decisions" are generated
iv. Decisions: Results generated by the DSS based on user criteria

DSSs which perform selected cognitive decision-making functions based on artificial intelligence or intelligent agent technologies are called *Intelligent Decision Support Systems* (IDSS). The nascent field of Decision engineering treats the decision itself as an engineered object, and applies engineering principles such as Design and Quality assurance to an explicit representation of the elements that make up a decision. Disturbed by the unpleasant trends in the nation's road traffic system often resulting to an upsurge in road traffic crashes, the Federal Government initiated a search for a credible and effective response to this challenge. In February 1988, the Federal Government created the Federal Road Safety Corps through Decree No. 45 of 1988 as amended by Decree 35 of 1992 referred to in the statute books as the FRSC Act cap 141 Laws of the Federation (2010). Top-down is a programming style, the mainstay of traditional procedural languages, in which design begins by specifying complex pieces and then dividing them into successively smaller pieces. The technique for writing a program using top–down methods is to write a main procedure that names all the major functions it will need. Later, the programming team looks at the requirements of each of those functions and the process is repeated. These

of Nigeria (LFN), passed by the National Assembly as Federal Road Safety Corps (establishment) Act 2007. The critical mandate of the Commission was accident prevention and loss reduction on all public roads across the country.

System Design and Implementation

The main menu of the new system, from which desired modules and sub-modules can be invoked from, serves as the control centre of the new system. The main menu for the system is illustrated with the use of the Top – down program architecture.

Database Specification

The Structured Systems Analysis and Design Methodology (SSADM) coupled with a database specification are the arrangement or pattern of collection of related data or information stored for some vital reasons. A database is a compulsory component of every Decision Support System. A DSS can contain various database Tables, which also contains various fields and linked together by a similar field. In the design of the new DSS system, the Database Management System (DBMS) to hold data is the "Microsoft *Access 2007 edition*". This database will have the functionality and capability of holding processed data in the entire DSS.

High Level Model of Proposed System

The High Level model adopted for the proposed system is the top-down design, which is basically a decomposition process which focuses on the flow of control in the structure of the program, coming from top-to-bottom, as posited by Goldstein, E.B.

compartmentalized sub-routines eventually will perform actions so simple they can be easily and concisely coded [20].

Top-down approaches emphasize planning and a complete understanding of the system. It is inherent that no coding can begin until a sufficient level of detail has been reached in the design of at least some part of the system. Top-down approaches are implemented by attaching the stubs in place of the module. Modern software design approaches usually combine both top-down and bottom-up approaches. Although an understanding of the complete system is usually considered necessary for good design.

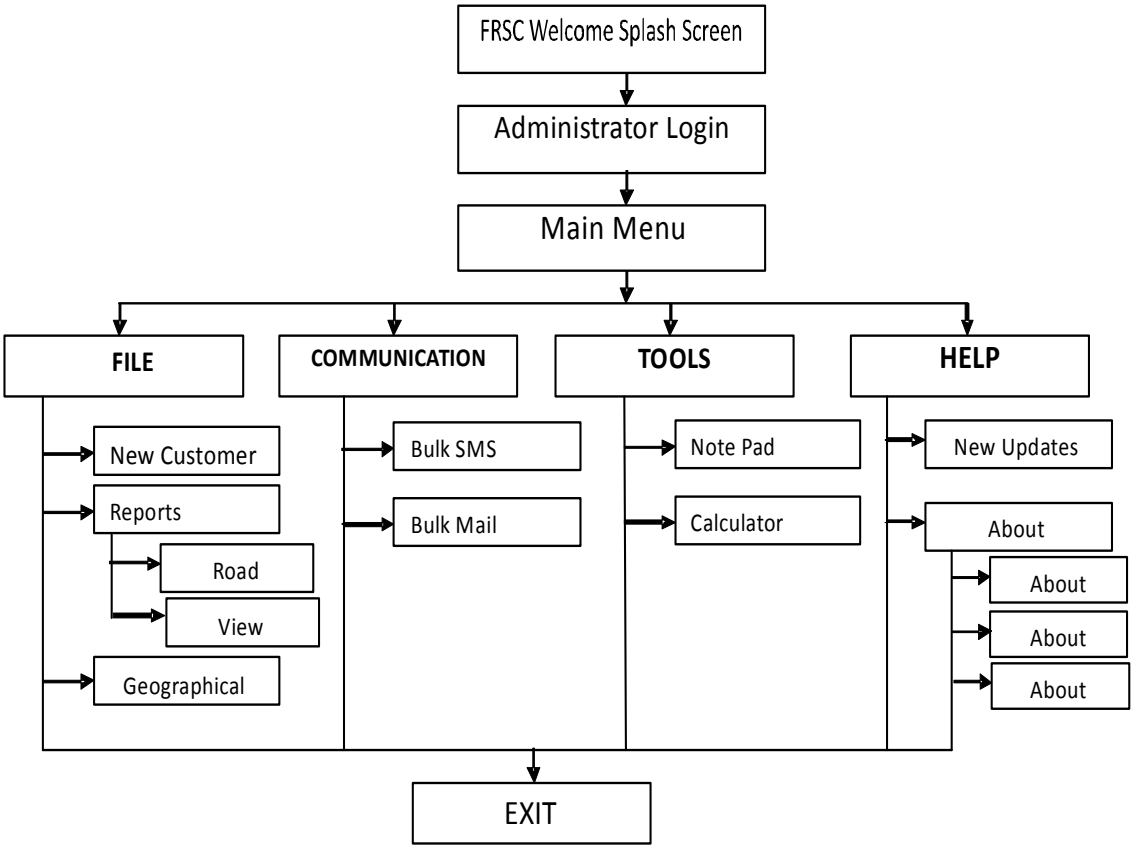

Fig. 1: Main Menu (Control Centre) of the DSS

PROGRAM FLOWCHARTS

A program flowchart is a pictured representation of logic/instruction flow in an entire program

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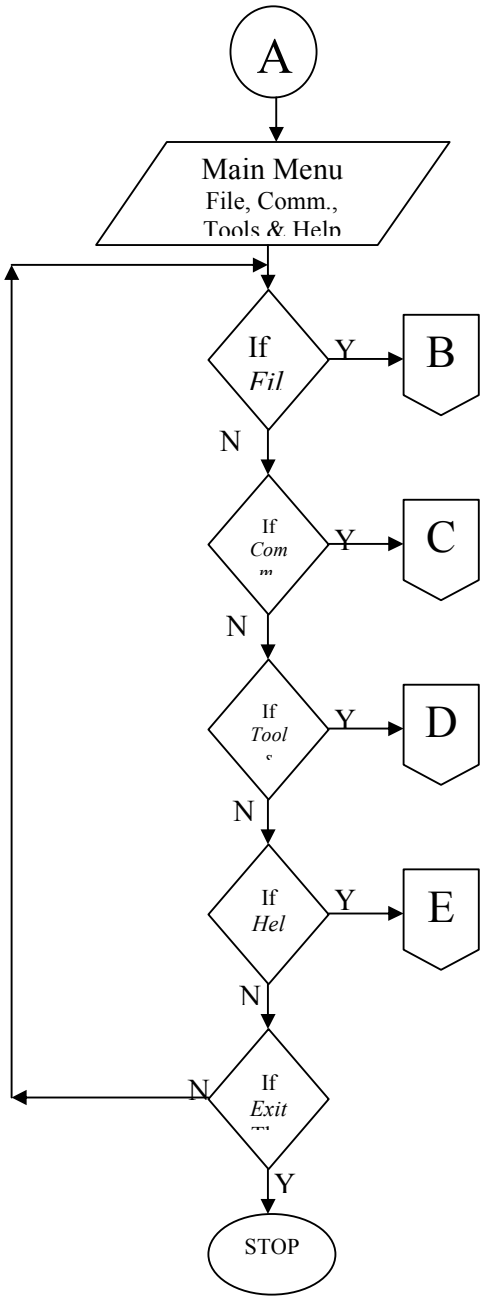


Fig. 2: Administrator Login Page Administrator Login Page

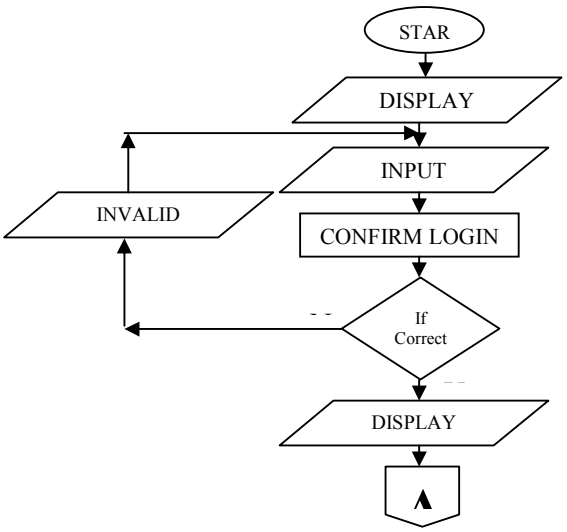


Fig. 2: Program Flowchart for Administrator Login Page

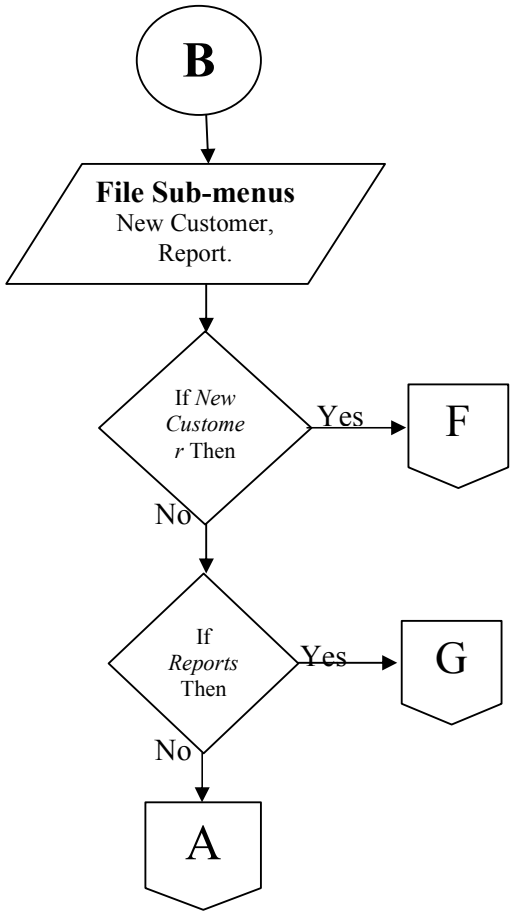
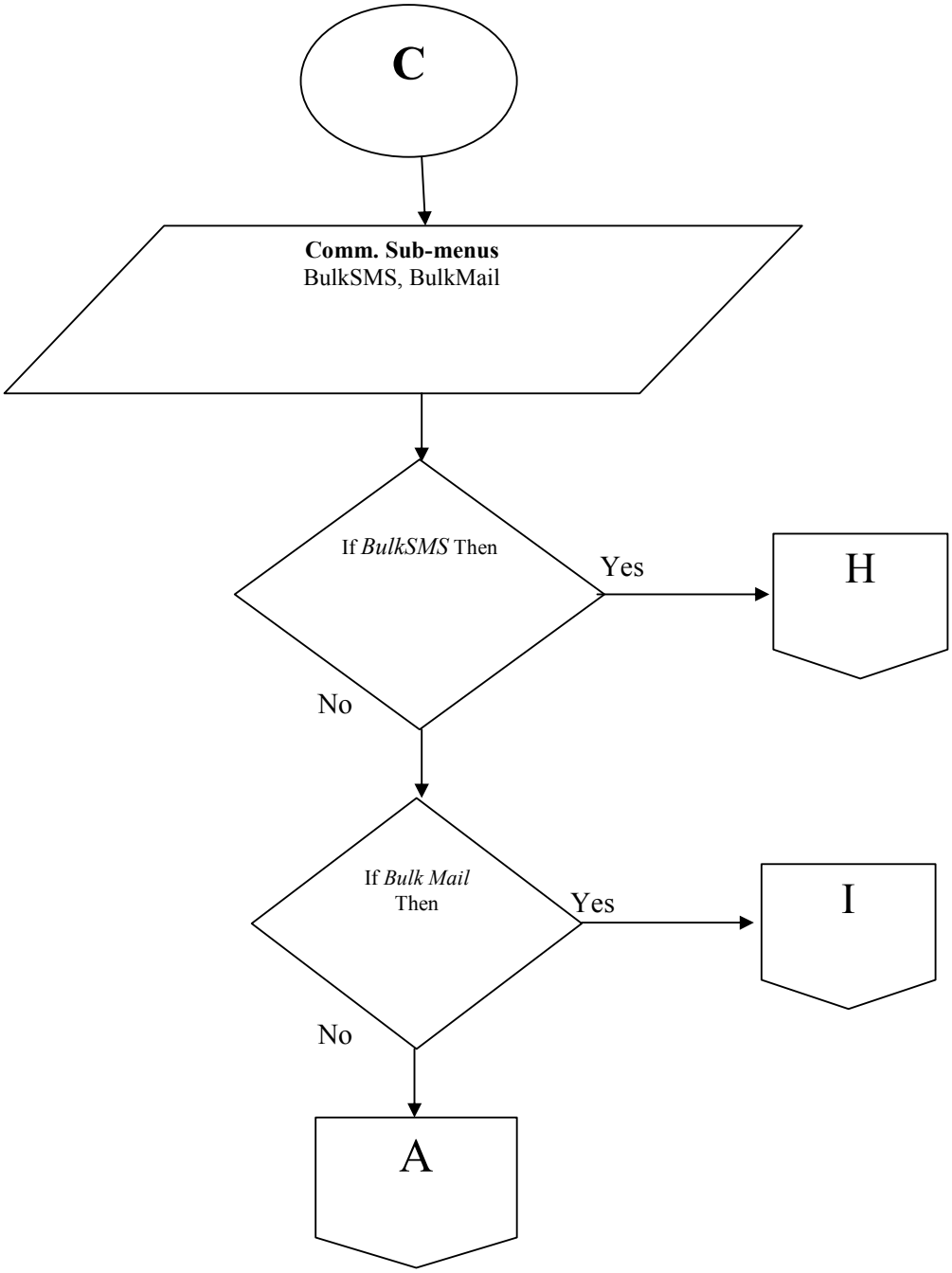


Fig. 3: New customer sub-menu



Figs. 5 Program Flowchart for *Communication Sub-menu*

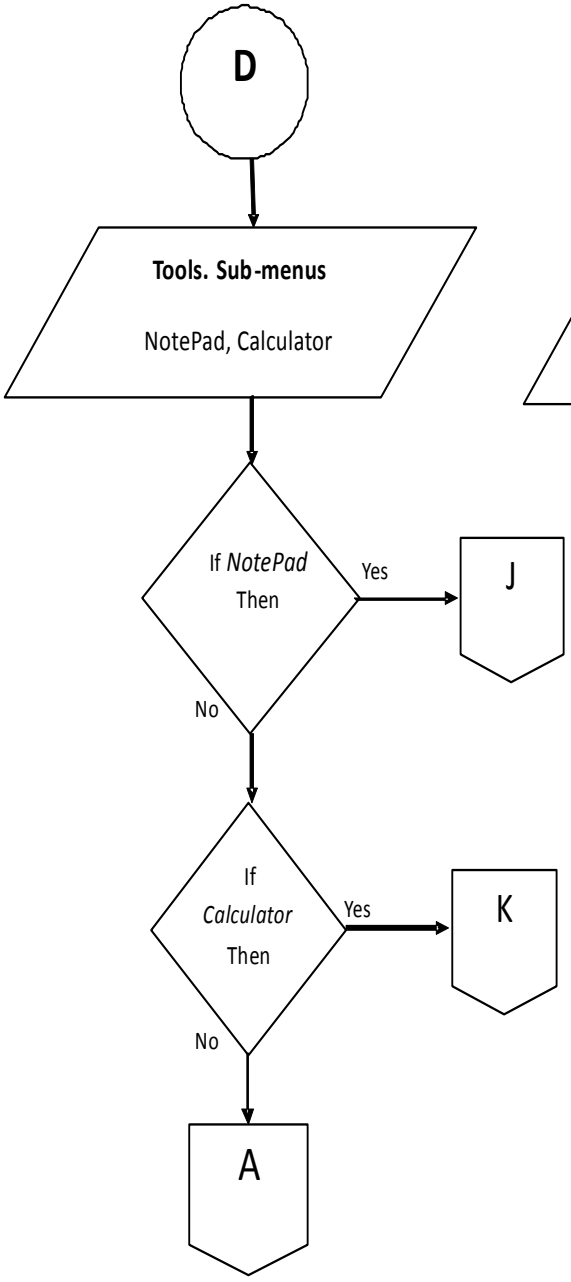


Fig. 6: Program Flowchart for *Tools Sub-menu*

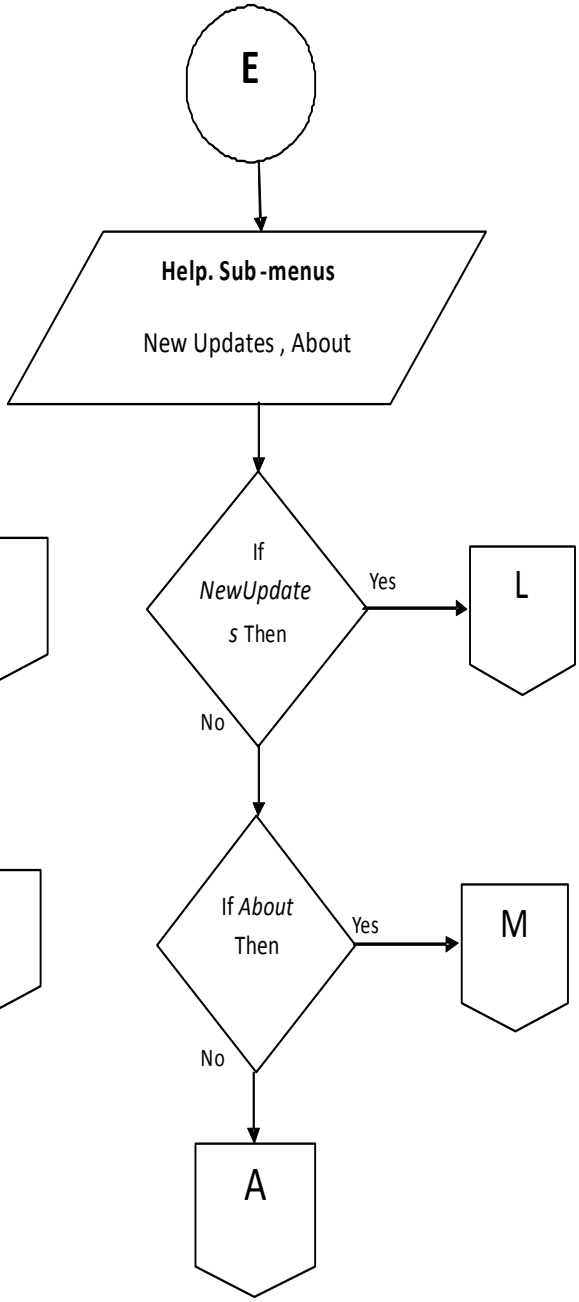


Fig. 7: Program Flowchart for *Help Sub-menu*

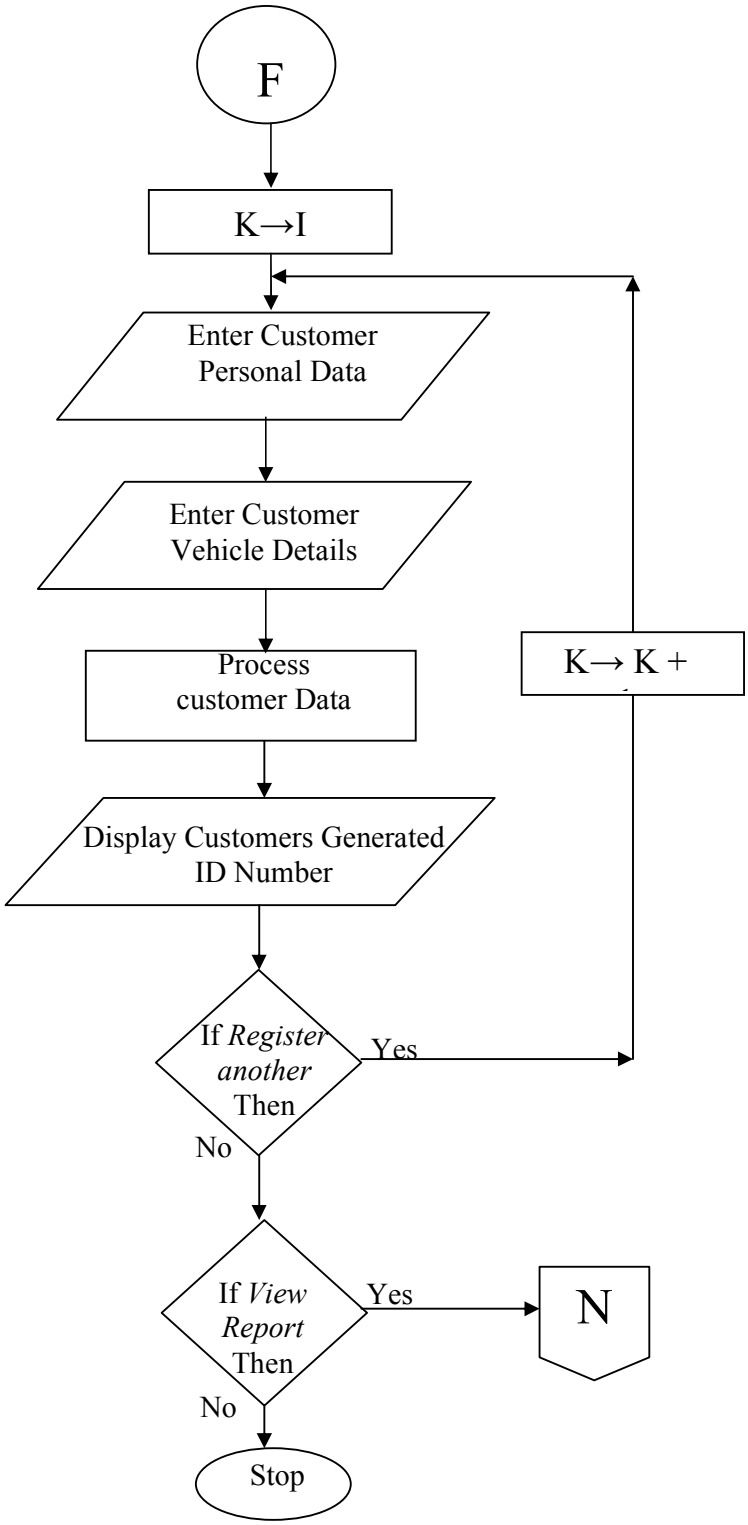


Fig. 8: Program Flowchart for *Help Sub-menu*

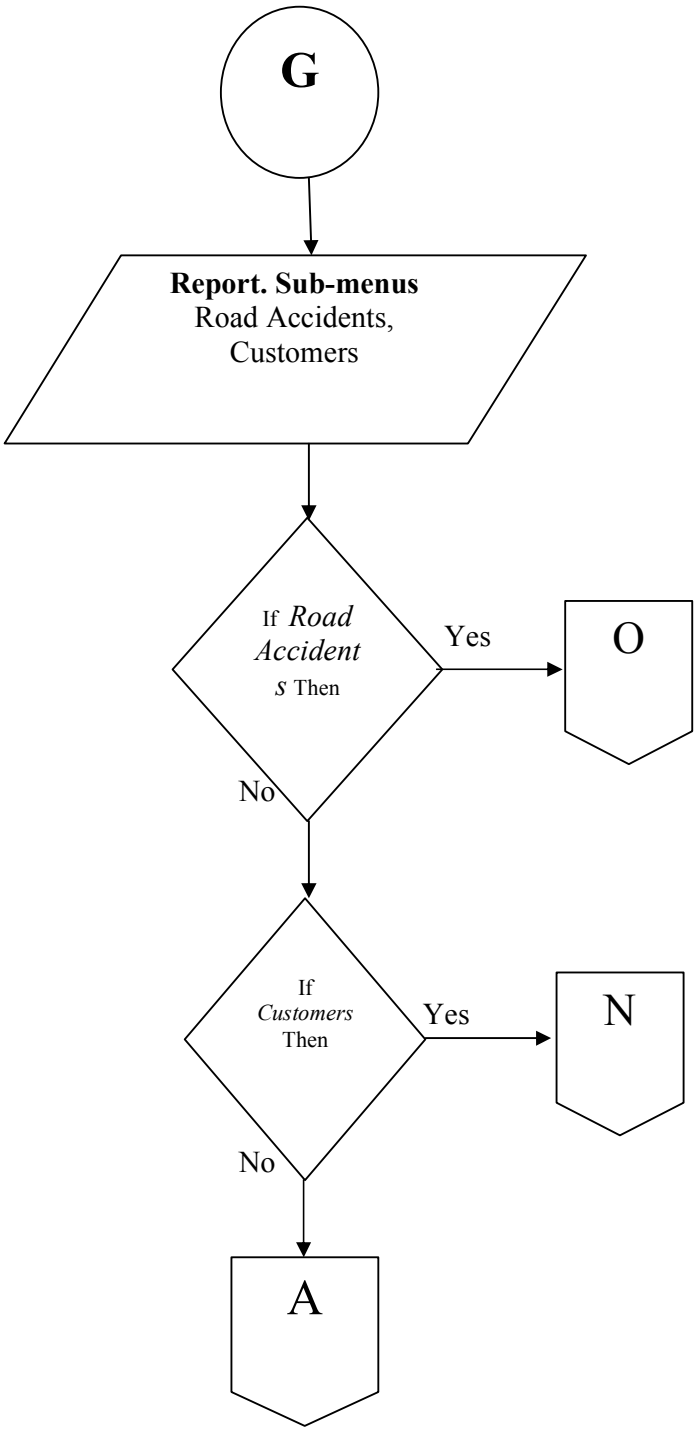


Fig. 9: Program Flowchart for *Report Sub-menu*

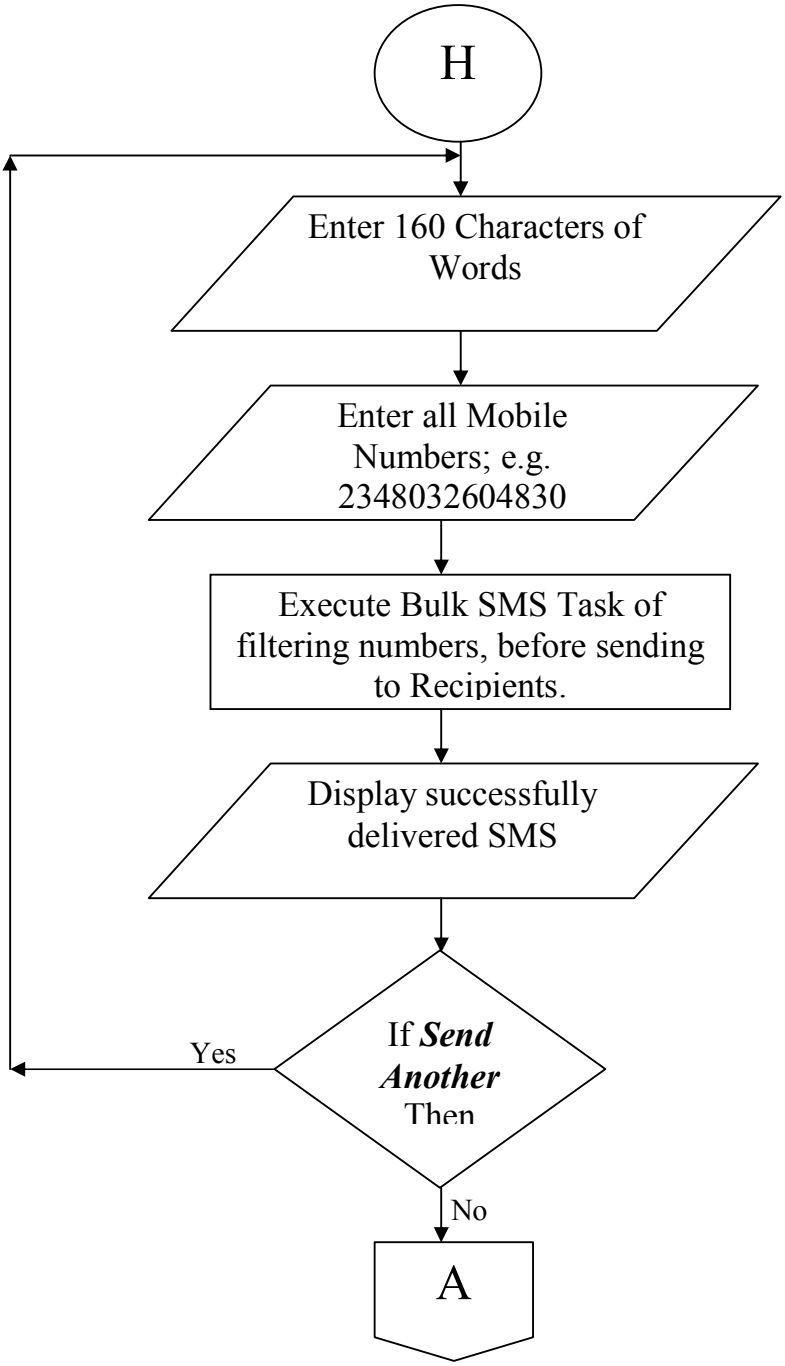


Fig. 10: Program Flowchart for *BulkSMS*

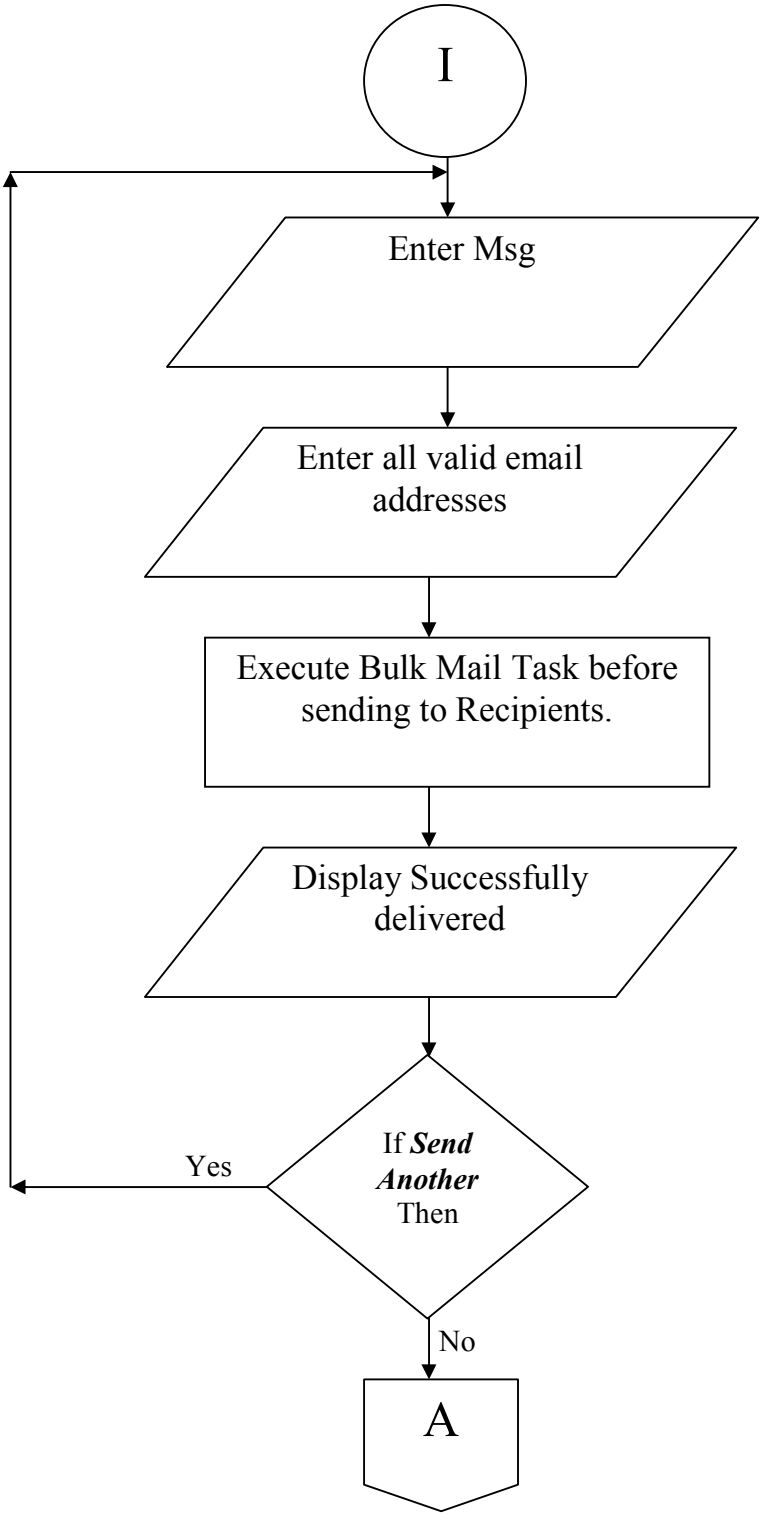


Fig. 11: Program Flowchart for *System Notepad*

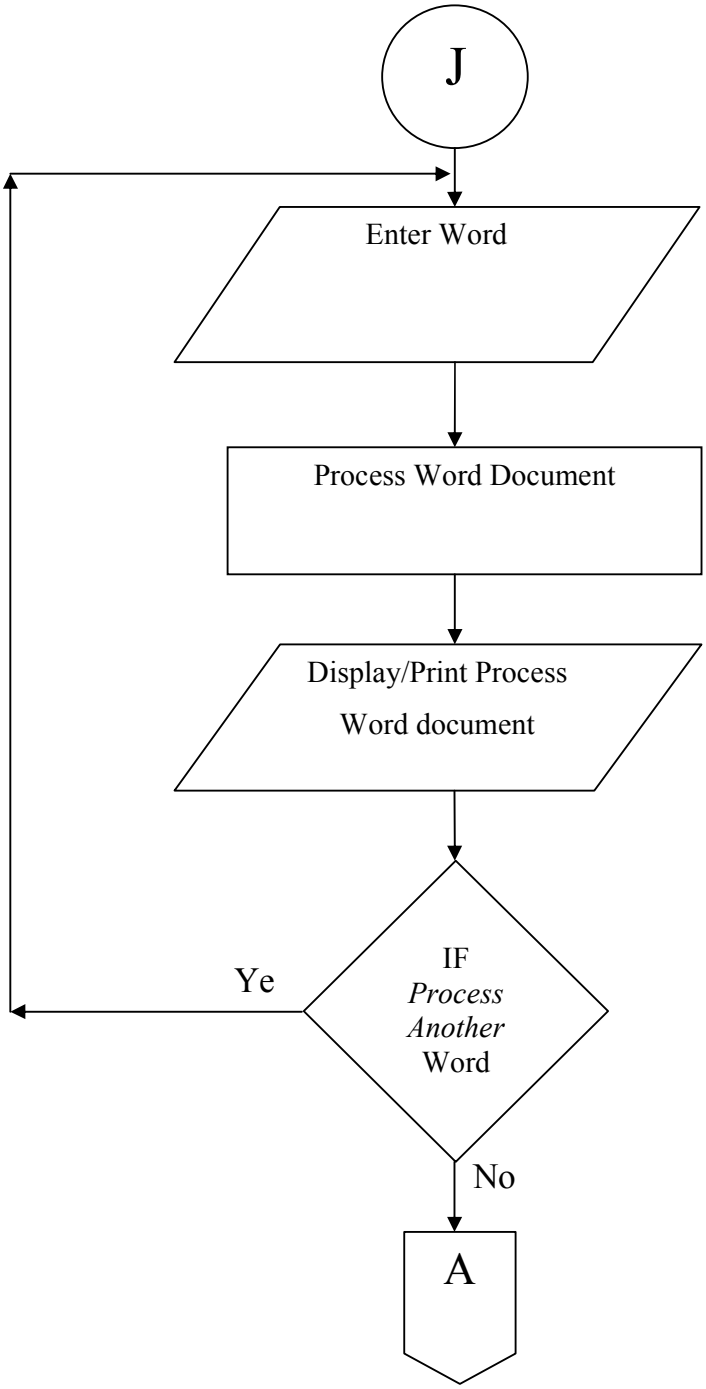


Fig. 12: Program Flowchart for *Bulk Mail*

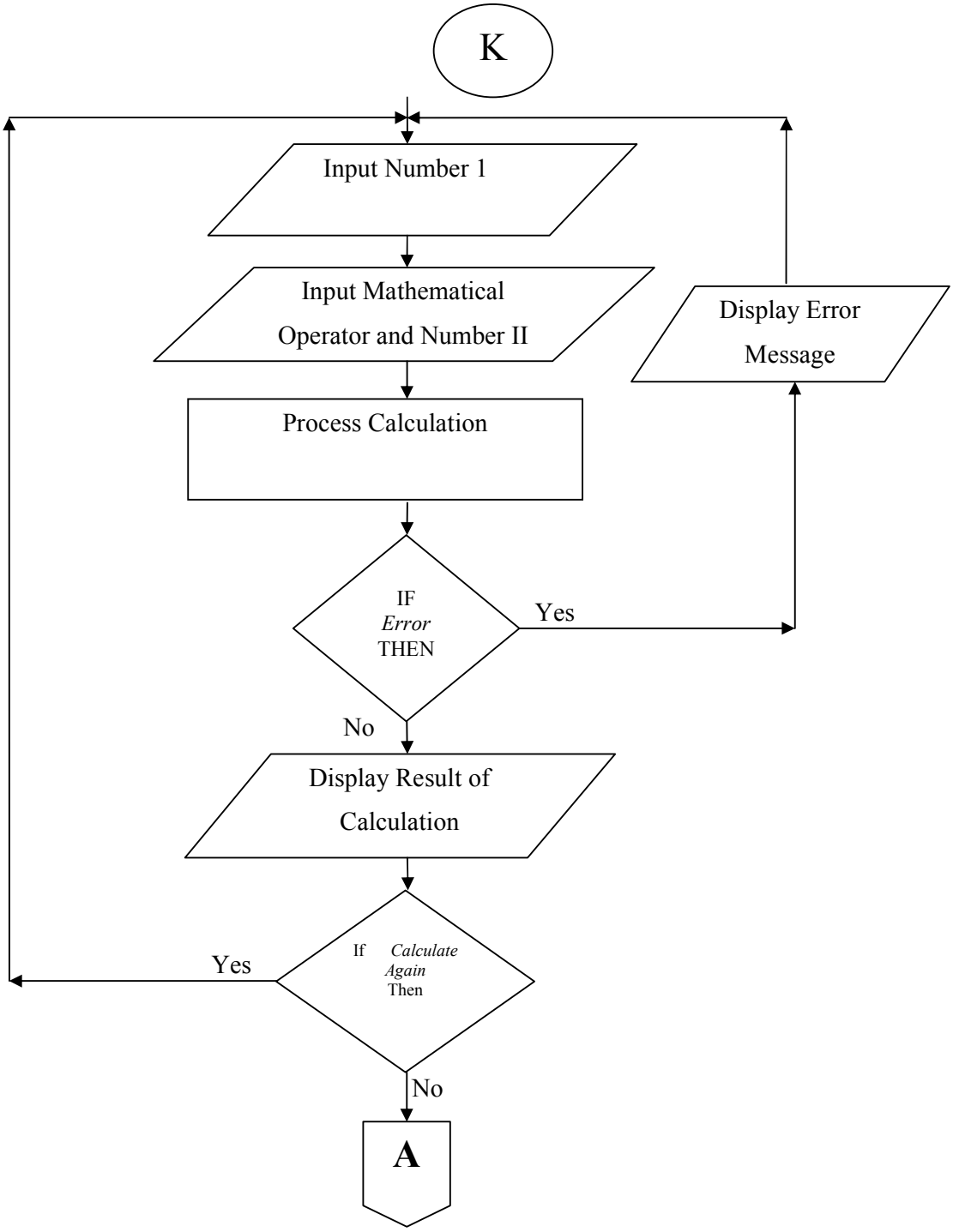


Fig. 13: Program Flowchart for *System Calculator*

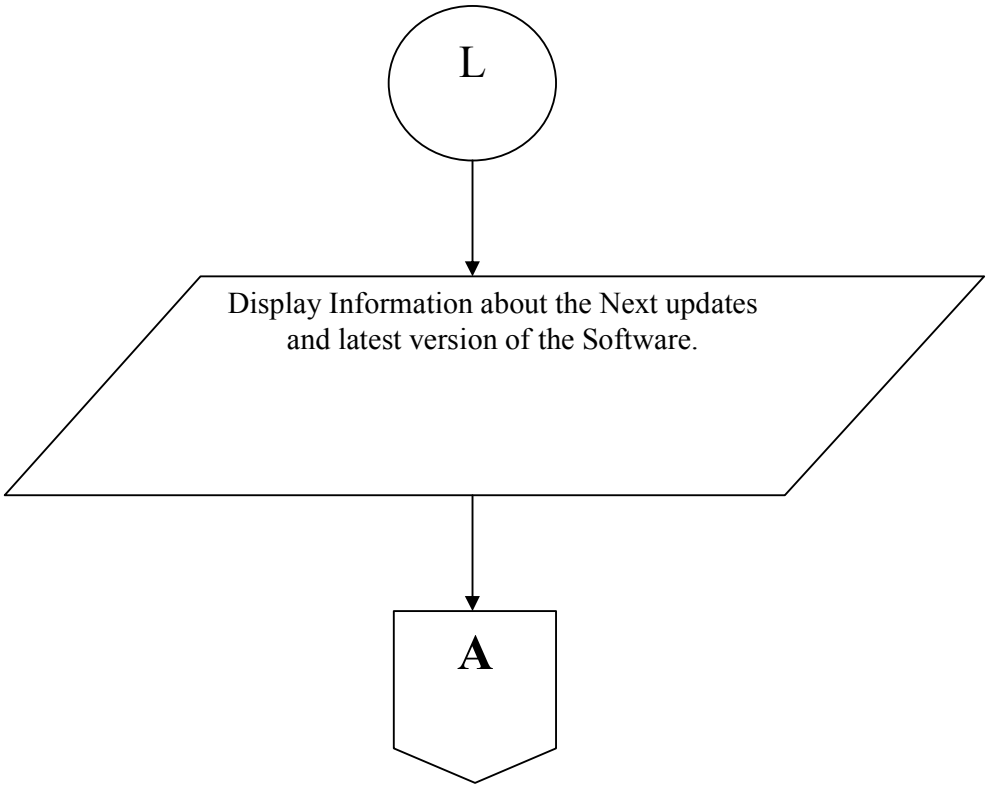


Fig. 14: Program Flowchart for *Latest Software Updates*

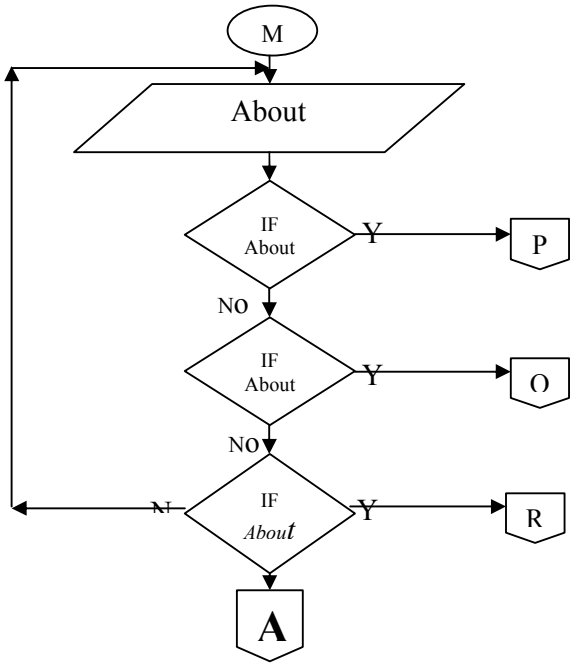


Fig. 15 Program Flowchart for *Report - Customers*

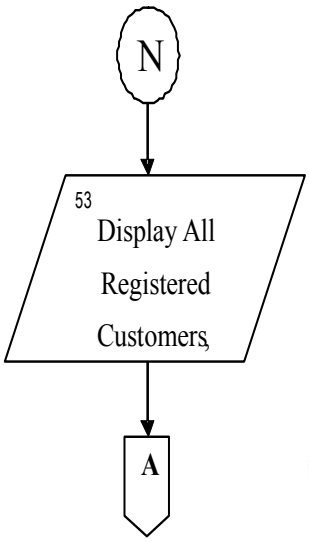
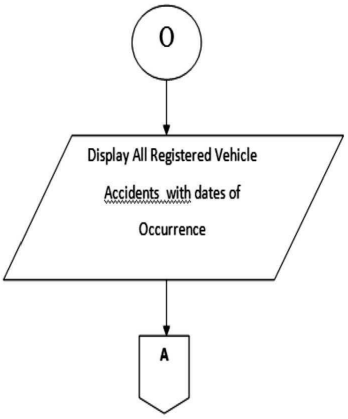


Fig. 16: Customer display with vehicle details



Program Flowchart for *Report –Vehicle Accidents*

Fig. 17

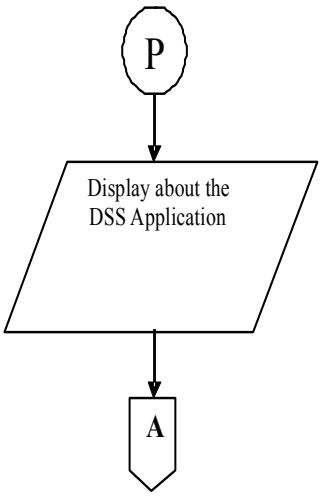


Fig. 18 Program Flowchart for *\Report –Vehicle Accidents*

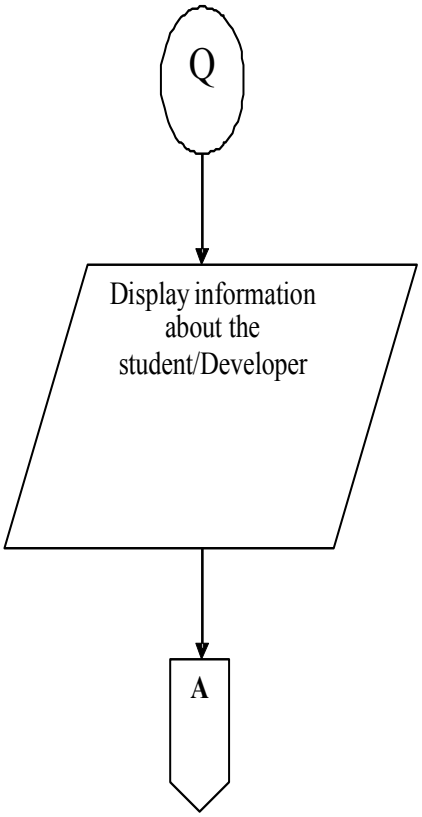


Fig. 19: DSS Application

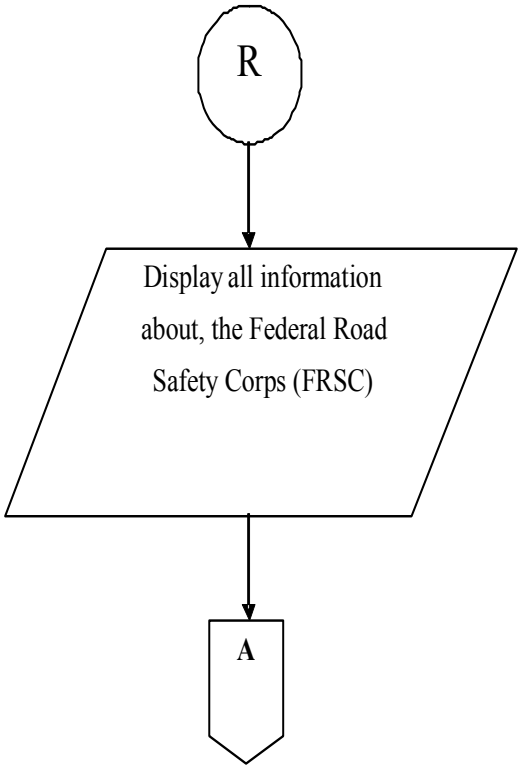


Fig. 20: Customer display with vehicle details

Results and Discussions

This research work has been directed at providing an efficient and reliable road decongestion and road maintenance Decision Support System for the Federal Road Safety Corps (FRSC). The basic reason for the development of Decision Support System (DSS) for Road Safety is to create a database system that will help the Road Safety Corps by providing it with quicker and more analyzed information for effective decision making on road safety on Nigerian Roads.

One should also note that Decision Support System (DSS) [15] is not only used in road safety issues, the system is also used in many other fields and technologies that need decision making activities to enhance their operations and or corporate decision processes.

The Output Samples:

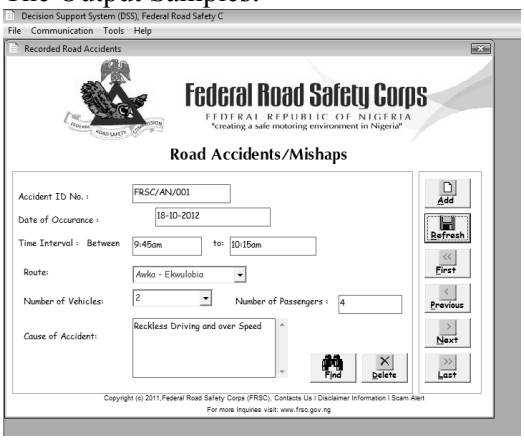


Fig. 21 Road Accient Data entry screen

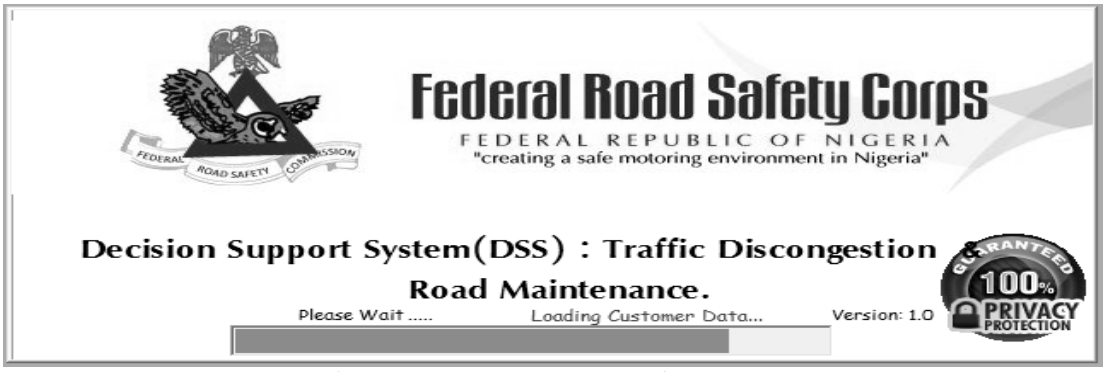


Fig. 22: Output Page I : Welcome Screen

Fig. 23: Output Page II: Administrator Login

Summary, Conclusion And Recommendations:

We have succeeded in designing and developing a DSS system to support the operations of FRSC. Road traffic accidents were most commonly attributed to mechanical faults. Regular maintenance of official vehicles is therefore advocated and would ensure that they are kept in good condition. Use of drugs while driving should be discouraged among drivers to prevent RTA. Drivers should be discouraged from keeping part time jobs so as to ensure that they have adequate rest and are not over worked.

Drivers should be relocated to administrative jobs or other sectors as the drivers begin to age. Drivers should have periodic eye tests to prevent accidents from visual impairment.

It is recommended that the FRSC adopt and deploy this software as it is likely to improve her daily operations and performance.

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