

# Wireless Database Searching Scheme Using GSM Modems

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**Abstract**—With the development of mobile communication technologies and the popularity of relating devices, GSM network based intelligent systems are being used more and more widely. Most of existing intelligent systems have been built on mobile platforms, but these systems don't provide any facility that can save our energy. Again, the work is not time efficient. But, today, this work needs to be performed from any corner of the world, since people can't afford to visit the field of action every time they want something to be done. In view of this, a wireless database searching scheme has been developed. With a GSM modem as hardware carrier, the system receives information from outsiders, searches in database and sends the result through short messages independently. Basically, it helps to transfer information between the organization (where the system has been implemented) and the external world. Furthermore, receiving any information from an authorized number can also update the database remotely using this system.

**Keywords**-Intelligent system; Wireless; Database searching; Authorized number.

## I. INTRODUCTION

Wireless data services and systems represent a rapidly growing and advancing segment of the communication industry. While the wireless data industry is becoming increasingly diverse and fragmented, one can identify a few mainstreams, which relate directly to users' requirement for data services [2, 4, 5, 6, 7, 10]. With the widespread deployment of wireless networks and the fast growing popularity of smart mobile devices, there has been an increasing interest in wireless data services from both industrial and academic communities in recent years. Point-to-point access employs a basic client-server model, where the server is responsible for processing a query and returning the result to the client via a dedicated point-to-point channel [3, 9]. For instance, in search of a book,

people must go to the library. But, lack of time makes it pretty difficult for a person to go to a library searching for a book, unaware of the fact if it is available or not, and also, if available, how many. It is time consuming because there may be a large queue at the counter. Even though, they can get the conformation via email or phone calls. But, this is not an independent process; it is dependent on the staff and also, it is not instantaneous, they must wait for reply. Therefore, how to improve the mobile information services' efficiency at low cost has become a research hotspot.

The advancement of mobile computing technologies in recent years has contributed to the growth of smart cities. Some thing is to be highlighted here: internet may be indispensable today, but still it is not that friendly for many of the users. On the other hand, nowadays, most of the users know to operate the mobile phones and write messages. For this simplicity, the Global System for Mobile communication (GSM) digital wireless network has been developed. It may be used to transmit data at rates of 9600 bits/s [11]. We can also use a symbian smart phone and install the wireless database viewer plus, but it is costly.

In order to overcome this problem, a wireless database searching scheme has been developed. From anywhere people can get the valuable information about any book in a library. SMS can be sent between users or to and from an application, which gives service development an extra flexibility and encourages innovation [1, 8]. Basically, it interacts between library and external world. It is low cost, user-friendly and convenient for secondary development.

This paper is organized as follows: In Section II, detailed design of the scheme has been presented. This is followed by its experimental results explained in Section III. Discussion is also given in Section IV. Conclusion and future work are given in Section V.

## II. DETAILED DESIGN

### A. Functional Module Designs

The main goal of this scheme is to get useful information about any book wirelessly from a server in the library. A block diagram of this scheme is given in Fig. 1.

The scheme is divided into seven functional modules, and each can provide a different interface and feature implementation.

A GSM module provides a standard serial interface, which has AT commands interface to communicate between a mobile platform and a Data Terminal Equipment (DTE). Therefore, we can use AT commands through serial port to control GSM modem and achieve its receiving and sending short messages.

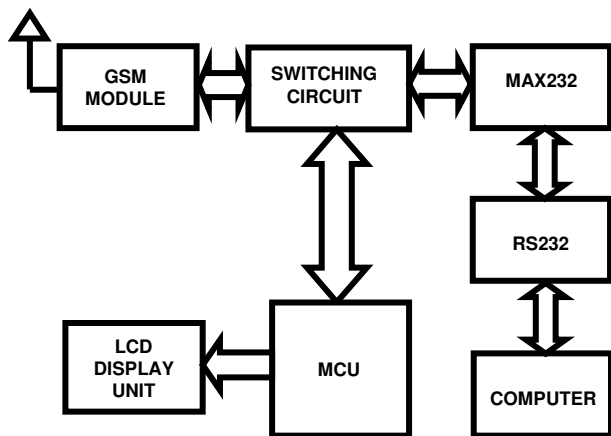


Figure 1. Block diagram of the system.

The switching circuit provides different role to maintain the communication between GSM module and Microcontroller unit (MCU) or MCU and server. Two control pins from MCU are connected to the switching circuit to control the switching functionalities.

MCU (basically ATMEGA32A [12]) is mainly responsible for coding, which controls the total flow of different modules to make other modules manage their own processes. It also maintains two control pins, which are responsible for communication between GSM module and computer. This module extracts the message content and sends to the computer via the switching circuit. Then the module receives result from computer and sends it back to the user through GSM module.

A Computer is used as a search engine, which includes database server and a java application. Database contains specifications of the items (here, books) and its current stock. The application receives query from MCU through RS232 serial port using DB9 female connector, searches in database and sends back the result to the MCU. MAX232 is used to communicate between MCU and RS232 serial port to convert from/to TTL voltage level to/from RS232 voltage levels.

LCD display unit is connected with MCU and shows the status of different data transferring stages.

### B. System Software Architecture Design

The System software architecture design includes mainly MCU functions and computer functions.

#### 1) MCU Functions

MCU functional diagram is shown in Fig. 2. MCU functions include message content, mobile no. and data & time extraction, check whether the message is received from an authorized mobile number.

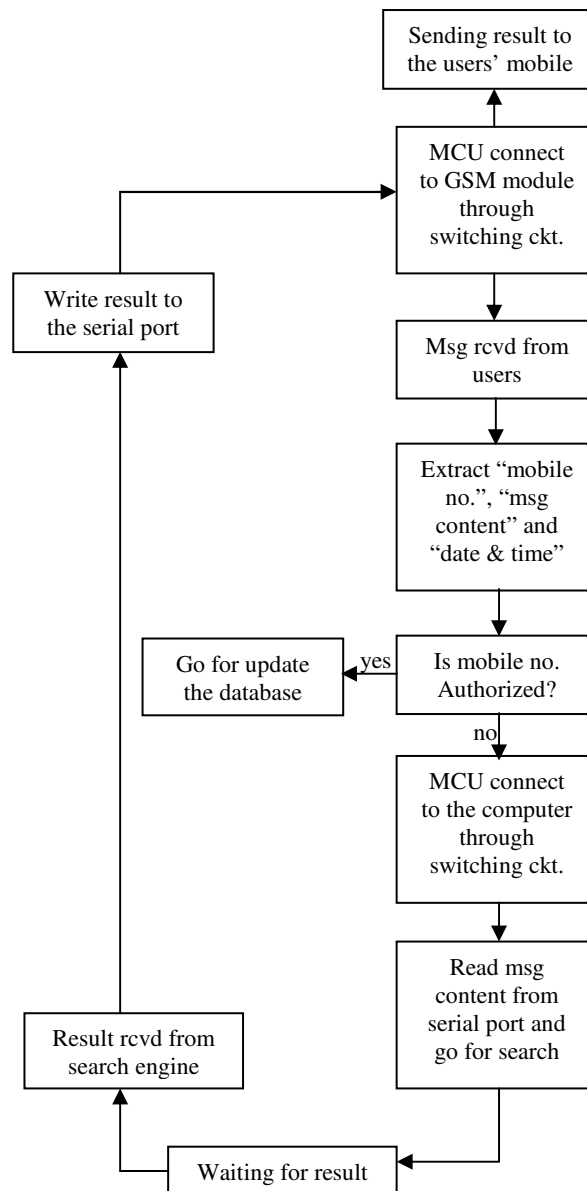


Figure 2. MCU functional diagram

If yes, then go for database updating; otherwise, go for database searching. In case of database searching, at first connects MCU to the computer through switching circuit, then sends the message content to the computer and waiting for the searching result. After receiving the result from the computer, system connects MCU to the GSM module and sends the result to the users' mobile through the GSM module. These functions have been implemented using C programming.

For debugging AVR software the AVR Studio 4 have been used as an Integrated Development Environment. The AVR Studio allows chip simulation and in-circuit emulation for the AVR family of microcontrollers. The AVR Studio uses a COF object file for simulation. This file is created with through the C compiler by selecting COF as the output file type.

## 2) Computer Functions

Computer functions include mainly database searching and updating. Making a database connection has been done already. After reading data through a serial port, searching is to be done and the results to be written to the serial port. These functions have been developed using Java programming.

Basically the JAVA application of the system is always in running condition, when data comes through the serial port, searching will be done by the application and send the result through serial port to the microcontroller. To run JAVA application some system requirements (like JDK 6 from Sun/Oracle and Eclipse IDE for Java Developers) have been installed. We have used RXTX Serial port Library to access serial port with Java. In our Java program we have implemented Serial-Port-Event-Listener and overrode the serial-Event method. Whenever data is coming in serial port, this method is automatically called. For designing the system, we have used Microsoft office access 2007.

## C. Operation Process

Using wireless database searching scheme any external user can search for a particular book automatically within a short time period from anywhere. They have to send a message containing the book description from their mobile phone and after some time, they will get information regarding status of that particular book.

Normally, GSM module is connected to the MCU through switching circuit. After receiving any message, MCU extracts mobile number, message content and date & time, and then displays all the data through LCD display unit. Then MCU is connected to the computer through switching circuit. A Java application is always in running

condition in the computer system. After reading the message content from the serial port, Java application will search in database and write the result to the serial port. After getting result, MCU will be connected to the GSM module and send back the result to the users' mobile. Using this scheme, authorized person can also update the database remotely.

## III. EXPERIMENTAL RESULTS

### A. Experimental setup

The experimental setup is shown in Fig. 3 and Fig. 4.

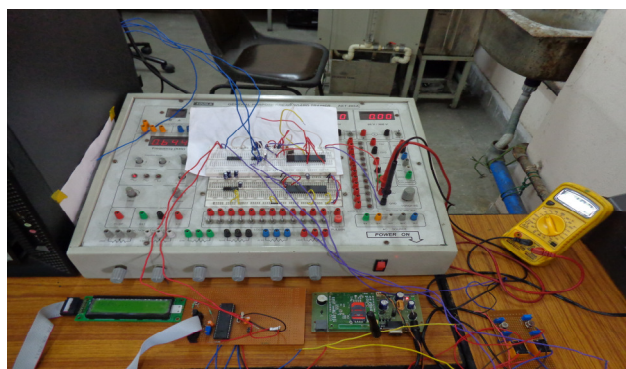


Figure 3. Front view of experimental setup

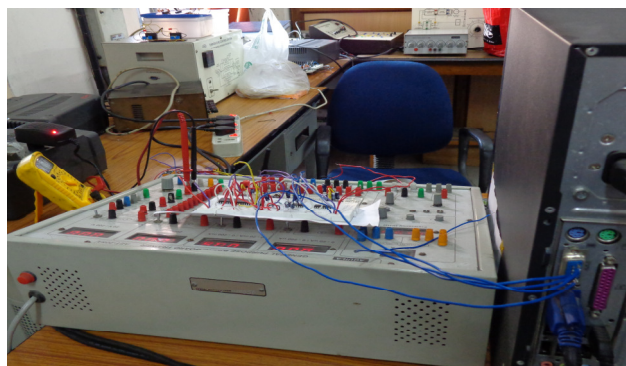


Figure 4. Back view of experimental setup

We have designed a Microsoft Access database as shown in Fig. 5. The book-Details is the Table name and there are some fields (such as title, author, accession-no, copyright, edition and volume). For testing the system, we have included two same title of aa, single title of bb and none title of cc.

After powered on the PC, we have to open Eclipse environment [13] and run that application as Java application as shown in Fig. 6.

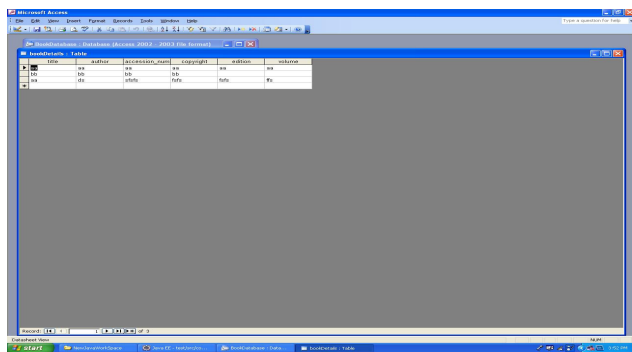


Figure 5. Microsoft Access database

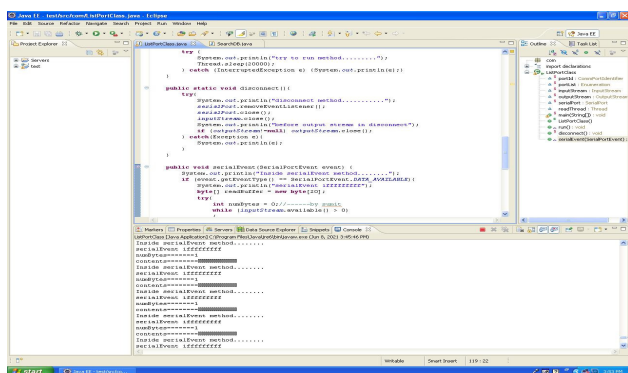


Figure 6. Running Java application

B. Steps for Results

After switching the system on, LCD initialization, baud rate and input-output pins are set up, that are a part of the primary settings. During this time, LCD module displays the message “INITIALIZING...” which is shown in Fig. 7. After completing these tasks, “READY.....” is exhibited, this is shown in Fig. 8. Fig. 9 shows the message content, which will be sent to the system. After receiving the message through GSM, the number from which the message has come, message content and message details (like date and time) will be shown in LCD module in Figs. 10 – 12. Then the content is sent to the computer and the status will be shown in Fig. 13. After that, the computer sends the response to the user mobile. The status and useful information received by mobile are shown in Figs. 14 – 15. Similarly, for different status, the computer sends different messages to the user mobile, which are shown in Figs. 16 and 17.

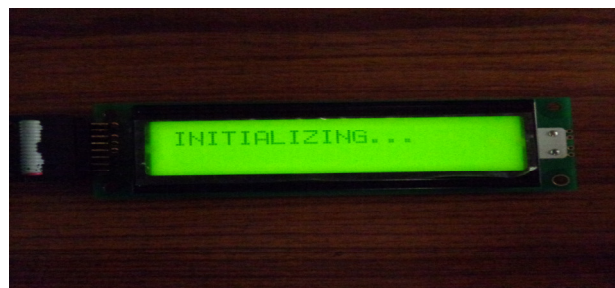


Figure 7. Display after powered on



Figure 8. Display after initializing

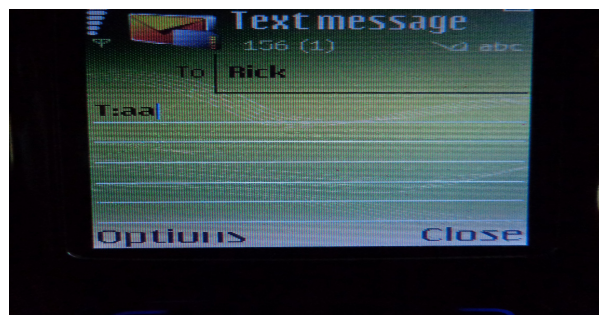


Figure 9. Searching for “aa”



Figure 10. Display the mobile no.



Figure 11. Display the msg content



Figure 12. Display date & time



Figure 13. Data sending to the PC

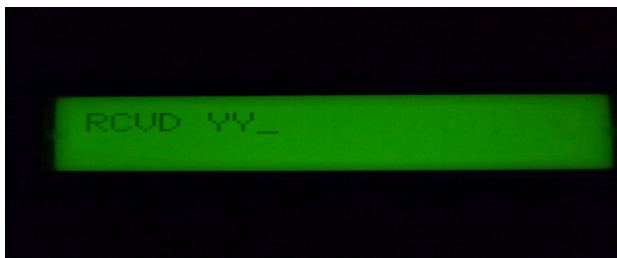


Figure 14. Data received from PC

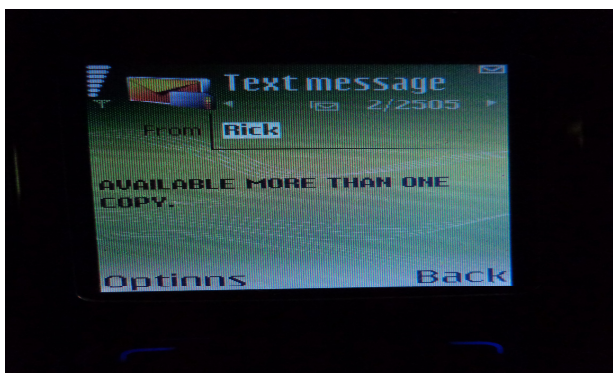


Figure 15. Msg received from the system

Similarly searching for T:bb, we have received “AVAILABLE ONLY ONE COPY”.

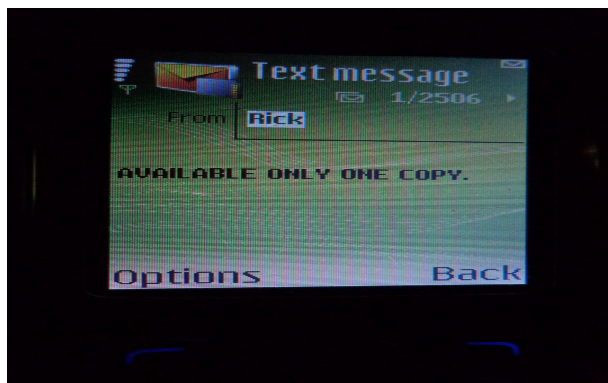


Figure 16. Msg received for “bb”

Searching for T:cc, we have received “CURRENTLY NOT AVAILABLE”.

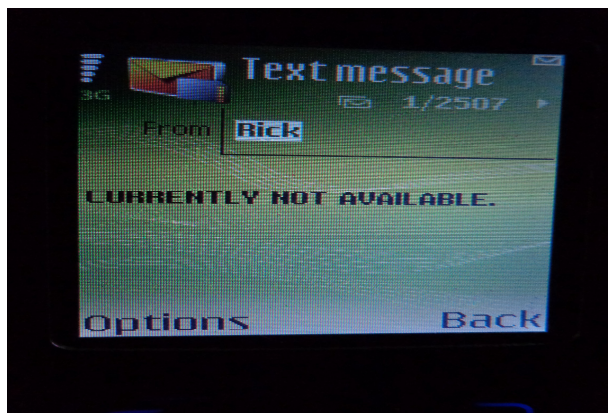


Figure 17. Msg received for “cc”

#### IV. DISCUSSION

The experimental flow chart is found to have quite good response with the library users’ queries from anywhere. The experimental results are found to have good repeatability. The GSM module of the receiver side finds the transmitter output and the useful information is sent back to the users according to their queries quite satisfactorily. The designed circuit saves energy and valuable time. Another advantage of this system is its individuality. It works automatically after receiving message without any involvement. The material cost of this system is not a big deal for a library and its design is very simple.

When the system is powered on, it should be properly started. Otherwise problem will occur. Character missing out may be occurred. Another thing is to be noticed that after every time powered-on the PC, the software application should be run manually. After that, no need to be taken care about the system.

The design has a good flexibility and can be implemented in different organizations regarding part-searching facility, medical stores, banking sectors and even government sectors. So, people can easily avoid the queue at the counters and save their valuable time and energy. Hence the developed automation system may be treated as low cost reliable and user friendly system.

## V. CONCLUSION AND FUTURE WORK

Nowadays, the database is more and more widely used, but the research combining it with message system is still limited. This Database system (DBS) is connected with mobile phone; hence the library user can get useful information rapidly. On the average, it only takes 1-2 minutes (depending upon size of the database and length of the title) to send a message, that is, the DBS has a higher efficiency of delivering the information. From the experimental study, a good reputability has been observed in the proposed system designing. Moreover, the experimental results remain unchanged. The GSM module finds the transmitter (users' mobile) output and the useful information is returned back to the users according to their queries quite satisfactorily. The designed circuit saves energy and valuable time. It works automatically without any involvement. The system can not only strengthen the independency and individuality of people, but also promote people's learning.

There are several scopes for improving on the work presented here. During searching functionality (from receiving message to transmitting message), if the GSM module is receiving any new message, the message will be wasted because at that time microcontroller is being connected to the computer. In future work, a queue can be implemented in the system which stores the new messages and after completion of the current cycle the next message will come from the queue. For "available only one copy" the book cannot be issued. In future work, a system can be implemented, using that we can get a soft-copy of required rare document like journal papers, reference book, etc. (after deposition of required amount of money in bank) through email independently within a short time period. We will study these in the near future.

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