

# Object-Oriented Database Connectivity for Hand Held Devices

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## ABSTRACT

Due to the lack of representation of an object-oriented database on hand-held devices, the present work describes an approach to send the information in the form of an object-oriented database on hand-held devices. A smart phone is selected as a hand-held device and connectivity between the object-oriented databases has been established by the use of the object-oriented programming language C#.Net. For modeling purpose, Unified Modeling Language (UML) is used to specify a UML Class Model and Sequence diagram. A concept of star schema is also used to represent the object-oriented database.

**Keywords:** UML; Object Orientation; Class Diagram; Sequence Diagram; SQL Server; Star Schema and C#.Net

## 1. Introduction

UML is a powerful and graphical modeling language that is used to design the large and complex software systems. In the current scenario, the object-oriented approach is widely used by software professionals for the development purpose because of more flexibility towards the reusability of code and maintenance of the code in comparison of the structured design methodology. Let us first describe some of the important references related to UML. Booch [1] has described object-oriented analysis and design with various kind of applications along with various type of diagrams used for the stable software designs. Lieberherr, *et al.* [2] presented an objective sense of style for object-oriented programming. By lots of efforts of Gready, Object Management Group (OMG) [3] has released the version of UML in the year of 1997. The detailed description of UML is given by Selic and Rambaugh [4] they described the modeling of complex real-time system. Blaha and Premerlani [5] has presented an object-oriented modeling and designing approach for database applications. Rambaugh *et al.* [6] developed "The Unified Modeling Language Guide" for the user which provides help to operate UML. Blaha and Rambaugh [7] also described object-oriented modeling and design with UML. Berrabah *et al.* [8] has defined a new tool that checks the coherence of the constraints on UML diagrams. Haji Ali *et al.* [9] developed an assessment system through UML class diagram using the notation extraction. Prashanth and Chandrashekar [10] have pre-

sented a new approach to detect faulty violations in UML state chart models. Palanippa and Ling [11] have described the several web-based case tools for automated rendering of UML model.

In addition to above, UML is also used to describe the software and hardware architecture problems. Saxena *et al.* [12-20] have proposed UML models for protocol establishing the mutual exclusion under distributed environment; for protection of domain based system by design of data cubes; for design of embedded database through the UML and further they developed a prototype for embedded database management system using C++ programming language. They also developed a UML models for the Patient Registration System with three dimensional data cubes; for instruction pipeline for the evaluation of performance of the instructions of software programs; for performance estimation of Karnaugh map with efficient new object-oriented algorithm. UML is also used by the authors for presentation and performance of various kinds of network topologies for distributed computer system. Recently, they developed UML model for performance evaluation of multithreaded programs on dual core processor. On the basis of UML design, performance of multithreaded programs written in JAVA and C# has been computed. Maier G., *et al* [21] has casted a first look on mobile hand-held device with usage from a network perspective. Wu *et al.* [22] proposed a mobile system based application for content of Wikipedia. Kushwaha and Sharma [23] have presented data mining services where are able to support decision

makers in strategic planning for the enhancement of small handheld devices. Peng *et al.* [24] also proposed a novel Markov Random Fields (MRF) based binarization algorithm segment foreground text from document images captured using hand-held devices (such as cell-phone or digital camera). Morshed *et al.* [25] have presented an approach to identify the security and privacy related risks and threats of the mass users as well as corporate users, for the wireless hand-held devices and they have integrated with the clouds. Caban-Martinez *et al.* [26] has discussed the experience, advantages and disadvantages of touch screen handheld devices for the collection of field data from a largely underserved worker population. Martin-Dorta *et al.* [27] have attempted to harness the opportunities for mobility and the new user interfaces that handheld touch screen devices offer, in a non-formal learning context, with a view to developing spatial ability. Gember *et al.* [28] have stated the differences in the content and flow characteristics of handheld versus non-handheld traffic.

In the current scenario, many object-oriented languages are available for software development out of which C# is a well known object-oriented programming language and supports several object-oriented concepts. Software professional are shifting their old structured based software into the object-oriented based software. Further desktop computing is shifting towards the hand held device computing. Therefore; in the present work, C# is used to develop an application for connectivity of object-oriented database for hand-held device like smart phone. In the work, a real domain of the Life Insurance Corporation (LIC) of India is considered to develop the object-oriented database connectivity for said device. For the design purpose, UML is used to construct a UML class model and sequences of activities are also presented through UML sequence model. An Application is developed for connectivity of object-oriented database for said device and generated by the use of SQL Server 2008. The star schema is also designed for database with three major fields. For testing purpose, some queries have been performed to justify the performance of designed object-oriented database.

## 2. UML Model for Object-Oriented Database Connectivity

### 2.1. UML Class Diagram

The UML class diagram shows the structural behavior of the system, in which attributes and operations are designed for the complete software project. Different properties like association, aggregation, inheritances in the form of sub classes are also designed in the UML class diagram. In the present work, a complete process of depositing the premium of issued policy plan using mobile

system is explained through UML class model which contains the major classes like as Customer, Mobile\_System, Main\_Branch, Plan, LIC\_Branch\_N and Bank represented in **Figure 1**.

The Main\_Branch class has multiple associations with all the classes and single association with every Branch class of LIC *i.e.* LIC\_Branch\_N. The Plan class has a multiple associations with Customer class, and single association with the Main\_Branch class. The Main\_Branch class sends information on the Customer's Mobile\_System regarding Premium due of the issued plan for depositing the due amount. In Customer class, the customers interact with this information through the Mobile\_System Class and go to the policy issuing branch through LIC\_Branch\_1, LIC\_Branch\_2, and LIC\_Branch\_N for depositing the premium amount. After deposited the premium amount, the next premium due date is generated by the system through the software provided at the Main\_Branch. The premium amount of the policy is auto deducted by the Main\_Branch through the Bank which is linked to the every LIC's Branch. The Customer's data is uploaded online through the same software and also stored in the LIC's database. The details and the status of the premium of the policy can be viewed by fetching the database on the mobile system.

### 2.2. UML Sequence Diagram

The UML sequence diagram shows the dynamic behavior of the system. For the above, a UML sequence diagram is also designed and represented in **Figure 2**. From the figure, it is seen that Customer deposits the premium amount of the issued Policy in the LIC branch of India. The sequence diagram shows the complete process of depositing premium amount of an issued Policy. The five main objects are represented at the top of diagram. The communication line between two objects is shown by arrows along with communication message. The vertical line shows the life line of the object. The Main\_Branch sends information about premium due to the Customer through the Mobile\_System and the object Customer interacts with the information regarding premium due, then customer goes to the policy issuing branch and deposits the premium amount. After deposit the premium amount, the branch deposits the premium money into the Bank then the Main\_Branch auto deducts the premium money. The main purpose of this diagram is to represent whether the system of sending information about premium due on the Mobile\_System is working properly or not.

## 3. Object-Oriented Database Connectivity

### 3.1. Design of Star Schema

For designing the database, the business integration de-

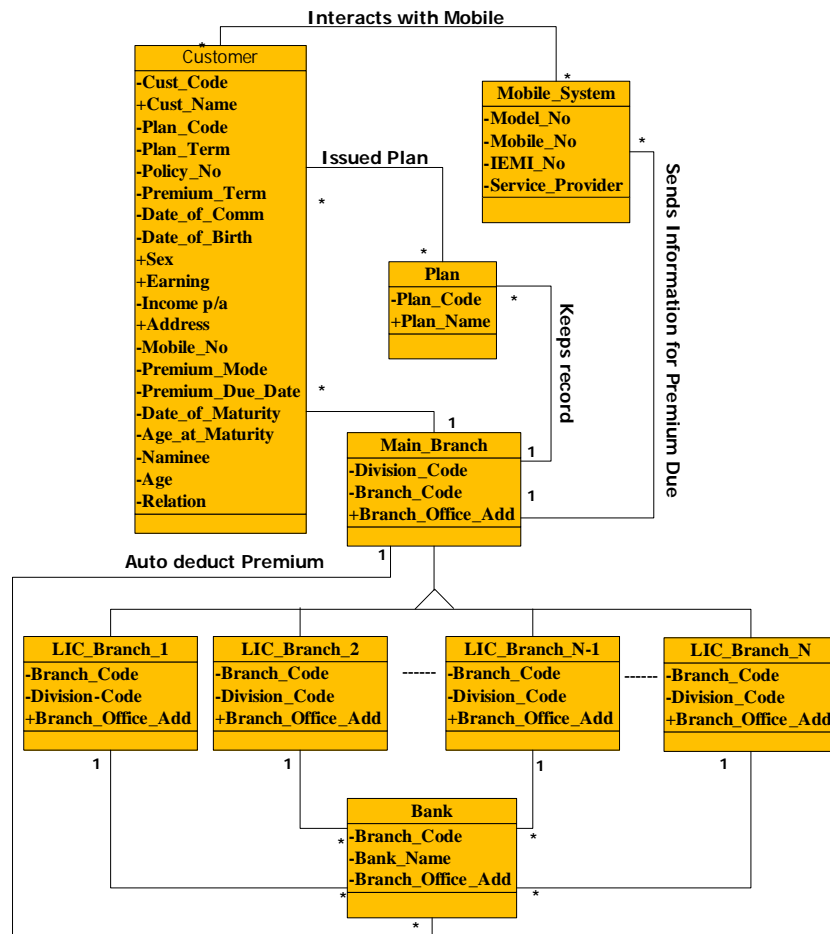


Figure 1. A UML class model.

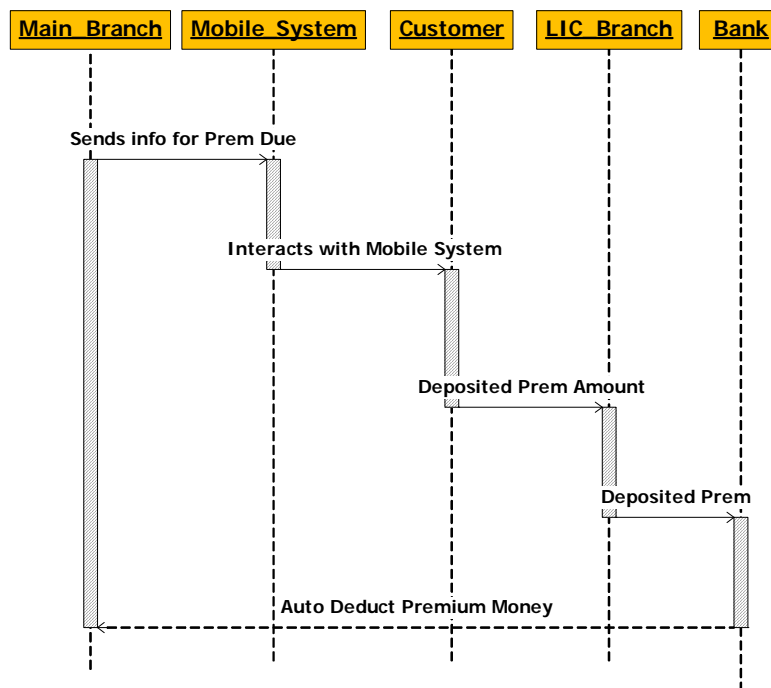


Figure 2. A UML sequence diagram.

velopment services of SQL Server 2008 are used and a star schema is generated as shown in Figure 3 for connectivity of database. By the use of star schema, several database tables are generated and linked with one of the main table, which contains the primary key attributes of other tables.

### 3.2. A Sample Object-Oriented Database

For designing the database, authors have used the SQL Server 2008 and a database table is designed according to the attributes of customer table as shown as the output of *Sample Query 1*. It contains three major fields like Cust\_Name (for customer name), Date\_of\_Commt (for date of commencement of policy) and Prem\_Due\_Date (for premium due date) of the issued policy plan. The purpose of this table is to take a look of customer name whose premium of issued policy is due. On the basis of this table, sample queries have been performed and corresponding results are given below:

*Sample Query 1:*

Select Cust\_Name, Date\_of\_Commt;  
Prem\_Due\_Date from tblCustomers;

The output of the above query is as follow:

Cust_Name	Date_of_Commt	Prem_Due_Date
1	Maya Devi	2010-07-28
2	Kaushlendra Sengar	2010-07-28
3	Pankaj Sivastava	2010-07-28
4	Sajeev Kumar	2010-06-28
5	Sirajuddeen Khan	2010-07-28
6	Amit Kumar Singh	2010-06-28
7	Siddhant Thakur	2011-01-28
8	Uendra Kumar	2011-02-15
9	Shridhar	2011-02-15
10	DhanDevi	2010-12-28
11	Ram Avtar	2011-02-15
12	Mahesh Prasad	2011-02-14
13	Rumila	2011-01-28
14	Ram Das	2011-02-15
15	Dhamendra Mishra	2011-01-28
16	Dori lal	2011-02-15
17	Islam Ali	2011-01-28
18	Mithlesh Kumar	2011-02-15
19	Nitesh Kumar	2011-02-15
20	Tavhid	2011-02-15
21	Saiyyada Khatoon	2011-02-15

*Sample Query 2:*

select Cust\_Name, Sum\_Assured, Prem\_Amount from

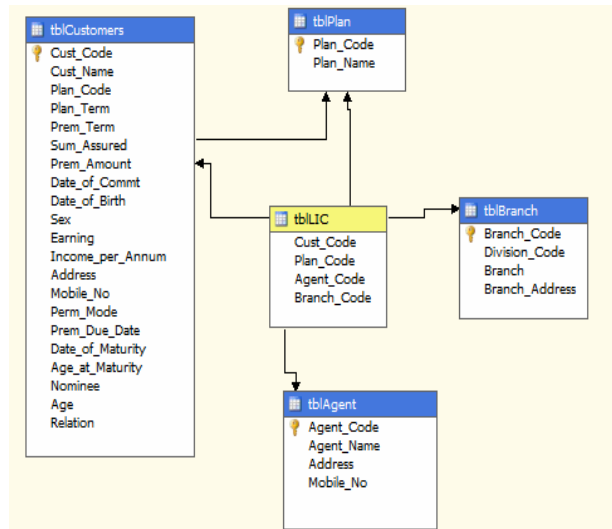


Figure 3. A sample of star schema.

tblCustomers where Cust\_Code = 'C10009';  
The output of the above query is given as:

Cust_Name	Sum_Assured	Prem_Amount
1	Shridhar	100000
		549

*Sample Query 3:*

Select Prem\_Due\_Date, Prem\_Amount from tblCustomers where Sex = 'Male';

The output of the above query is given as:

Prem_Due_Date	Prem_Amount
1	2010-10-27
2	2010-10-27
3	2011-06-27
4	2010-10-27
5	2011-06-27
6	2011-04-27
7	2011-03-14
8	2011-03-14
9	2011-07-14
10	2011-08-13
11	2012-02-14
12	2011-07-27
13	2012-02-14
14	2011-07-27
15	2011-05-14
16	2011-08-14
17	2011-05-14
18	2011-12-27
19	2011-08-14

## 4. Representation of Database Connectivity on Mobile Devices

For implementation of above concept, authors have used

the Visual Studio 2008 and using C#.Net, a window form is designed as shown in **Figure 4**. This diagram shows how to connect a mobile system with Personal Computer (PC) and sends an information regarding premium due on the customer's mobile system. The purpose of this application is to inform to the customers about their premium due of issued policy by the LIC of India through their mobile system.

The connectivity code segment for above application is given below:

```
private void btnsend_Click(object sender, EventArgs e)
{
    try
    {
        //command for Connection to the database
        if(DL.Con.State== ConnectionState.Open)
        {
            //command for Sending the message
            SqlCommand cmd = new SqlCommand();
            cmd.Connection = DL.Con;
            string SQLInsert = "INSERT INTO" + "tbloutbox
            phoneNO,Message,Delivery)" + "VALUES" + "(" + " +
            txtPhoneNo.Text + "," + txtMessage.Text + "," + 'send'";
            cmd.CommandText = SQLInsert;
            cmd.ExecuteNonQuery();
            SMS.SendSMS(txtPhoneNo.Text, txtMessage.Text);
            MessageBox.Show("Message Sent Successfully",
            "Santosh Kumar");
        }
        //command for Disconnect from the database
        DL.Con.Close();
    }
    catch (Exception ex)
    {
        MessageBox.Show(ex.Message);
    }
}
```

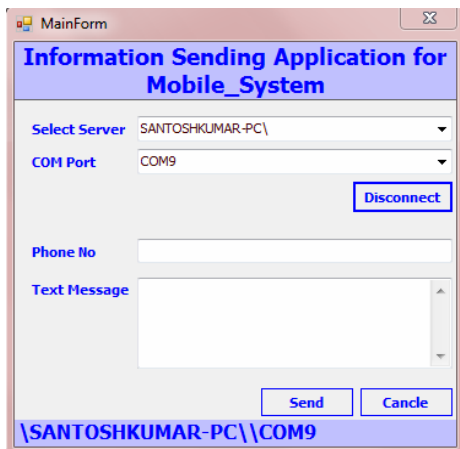


Figure 4. Windows application for mobile.

The **Figure 5** shows the information which is sent successfully on the destination mobile device and **Figure 6** shows the information which is reached at the destination mobile system.

## 5. Concluding Remarks

From the above work, it is concluded that UML is powerful modeling language for the development of the real models and it is also observed from the literature that UML is not much used for representation of the object-oriented database, therefore there is a need to construct more UML models for the software which are already running on the structured databases as object ori-

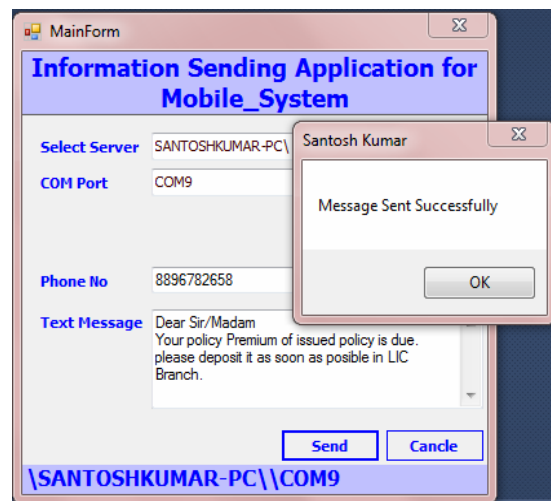


Figure 5. Message sent to destination.

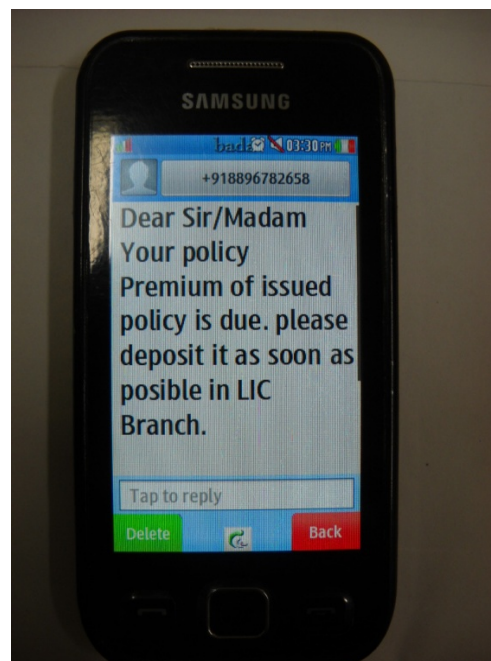


Figure 6. Display on mobile device.

entation supports large amount of databases with flexible reusability property. In the asian/developing countries, there is a large scope for implementation of above approach to display the desired information from large databases on the mobile devices like pocket computer/mobile system, etc.

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