

Design of Mobile Applications for Remote Monitoring Equipment

Ondrej Krejcar^{1,2}

¹ Department of Measurement and Control, Faculty of Electrical Engineering and Computer Science,
VSB Technical University of Ostrava, Ostrava-Poruba, Czech Republic,

ondrej.krejcar@remoteworld.net

² Department of Information Technologies, Faculty of Informatics and Management, University of Hradec
Kralove, Hradec Kralove, Czech Republic, ondrej.krejcar@asjournal.eu

Abstract. This project consists in developing applications for mobile phones that allows users to query using the touch screen to check the status of remote devices. Current status of the remote visualization device is arranged on the display, thereby increasing user comfort when operating the remote device (currently designed for GSM communicator GD-06 Allegro), instead of the traditional communication via SMS. Applications for mobile devices is designed for .NET Compact Framework and is designed for Windows Mobile. This application is created in Visual Studio 2008 from Microsoft.

Keywords: remote device, visualization, mobile phone, GSM communicator

1. Introduction

The project aims to tackle a remote communication device GD-06 Allegro, which the user is located in a remote location and via SMS, MMS or GPRS communication he enters control commands (such as current temperature, relay to run heating, etc.). The user did not have to code a complicated issue into a "text messages" application is created [1] that all operations carried out alone.

It also works in real time and serves as an interface between the device and controlled by who controls it. Although the GSM communicator works without modifications, the user must still issue an SMS, or connect via the internet and it takes time and deteriorate the quality of work. It is therefore necessary to create applications that use different operations performed work for the user.

According to materials, we decided to communicate with a GD-06 Allegro SMS [2]. The communicator can also communicate via MMS or GPRS data connection. Applications in pressing for the establishment of the state can send pre-worded text in the case. In the subsequent inbound message with some information it can retrieve and display the contents of your phone so that the user does not have anything else open and it was all literally at your fingertips. GSM Communicator works on the principle of commands that can be arbitrarily redefined. In this particular case in the library. Net Compact Framework [3], [4], through the Microsoft Visual Studio 2008.

From the available literature [5] it is clear that the data will go to independent data required time, but on the contrary, they will go almost to the nearest minute. Time in the communicator is synchronized after each arrival of any message. It does not matter what it is, because time is given everywhere. When power failure occurs for a longer period of time and communicator loses the power supply is turned on again after any request from the user to reset the time. The application is designed to be the most intuitive (so when you start to understand what and how the user can do). In the menu, where you can just check off a requirement, unless you collected more data values, but only some. For incoming data, the phone will not bother with the other opening. The acquired data is displayed directly on screen or in any format, even see as far as possible.

The current through the selected interface connection via SMS is the cheapest way, but the application can be adapted to other interfaces (MMS, GPRS), depending on user requirements or the requirements of data sent. When it was necessary to send files (pictures), it would be preferable in this case, select GPRS data, which is paid for forwarded data, regardless of how long the transmission takes. MMS is in this direction too expensive to send a few characters that can be inscribed within a single SMS.

2. Problem definition

GSM Communicator GD-06 Allegro has the basic equipment temperature sensor connector connects hands-free, power connector, input and output terminals (P1-P6). Input and output terminals for connection control devices and measuring the output values.

One solution is the control of GSM communicator via SMS Manager [6], which is designed for desktop computer (PC) or laptop. This application works by connecting the phone via a serial connection to the computer. The application is not suitable for use for two reasons. The first problem is the free availability of this version, making the beginning of the message you type your ad text. The second drawback is the need to use the computer instead of a mobile phone, allowing the user must be at the computer, which in itself is installed.

For a user who uses Skype [7] and has a paid account, there are applications VisualGSM [8]. This application works on Skype. User to send commands to the GSM terminal is just a PC, through which verifies and enters data. Fail, however, for mobile monitoring. The user must have a Skype account and paid to him. VisualGSM program is also difficult to install and adjust.

As for the program easier to communicate via SMS is possible to use the program Send SMS [9]. Using Visual Studio 2008 C #, this application simply programmed. For use in communicating with the GSM module is required for an application program components for data processing. This application is purely for sending SMS. SMS functionality works via a GSM module or mobile phone.

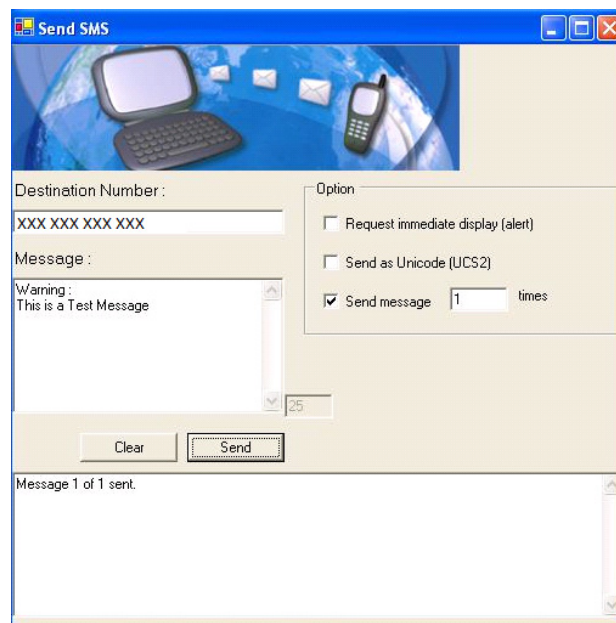


Fig. 1: Sample Program Send SMS

The best option for remote monitoring devices have been developed within the thesis of George Seagull [1], which uses the communication over the Internet. It is designed for PDAs and PCs. The computer version has more features and faster to communicate with remote devices. The mobile application runs slower due to slower performance graphics and connectivity to the Internet. For the most part, this program also cannot be used because there are many components and set of management processes. Some functions cannot be applied to control commands for the GSM module.

Using components of the proposals was made possible with the application of detection for the temperature, which is located GSM communicator GD-06 Allegro. Control terminals in the rear view of the

communicator with intermediate values. The preparation was the primary communications solutions via SMS and basic operational status inquiries to the device. In the first phase to establish proper communication and testing program has not yet been resolved imaging values in an aesthetic environment, but only as text in the box. The processing of graphics in the program was addressed in the final stage of formation of the program. Under the options program, which addresses a small part of the replacement application for remote monitoring of equipment function is used, which allows sending and receiving data. The first two options does not solve the problem. There are no alternative uses for mobile phones. The third option, which is the easiest way is processed, the use of SMS from your computer instead of the phone.

How to simplify the application of remote communication devices were used directly in the program. When you start the user sees the checkbox by which you define what information you want to find, or processes to be run. After pressing the button (button), download data"to send an SMS in the prescribed form pursuant to set the user. Received data is graphically presented, the user is displayed on the display as a popup. Another possible application is to store incoming data and then re-display. In the lower part of the program is running Button bar. The button bar is, and the menu"Exit". The menu offers the user will find: Information on the application author, change language and other features that are explained in the following chapter. Simplifying the application supports the length of battery life [10]. With the simplification of processes and merge multiple functions into a single processor is not burdened with many mobile phones, and consequently has a consumption.



Fig. 2: Basic design (left), View menu (middle) and new designed application (right)

3. New solution

Application for operation of GSM communicator GD-06 Allegro has been designed on the principle of sending an SMS via the GSM network. The first phase of the program was designed to test the functionality and SMS sending and receiving. Use the "Download data" is sent an SMS with a predefined code form. The actual button to download the SMS does not send data. To send must be washed at least one checkbox is checked (temperature). By checking one or more of the checkboxes in the menu defined SMS message to be carried out only one act that should be implemented. Features of the application code for creating and sending an SMS, a new class that is called the button "Download Data". Smsgsend class responds to the values of checkboxů. According to "false" or "True" to checkboxích smsgsend class defines the form to send an SMS. When pressing the SMS is sent and the application waits for a response. The advent of SMS responses from the GSM communicator GD-06 Allegro, on the display data from a GSM communicator. In the "Menu" was designed with several items. The item "About Me" profile data hiding applications to communicate with a remote device. When you press the menu pops up MessageBox in which information about the author. In Figure 2 the OSD menu and its submenus. We offer two language options, English and Czech. When

clicking on the menu as a button, the application is translated into the language. When the Czech and, of course, again does not translate into Czech. This function is not very complicated. It was programmed in a simple manner. It works by rewriting the text according to a defined pattern. For use in a large amount of text labels would not be appropriate.

```
private void menuItem7_Click(object sender,EventArgs)
{
    button_stahni.Text = "Data download";
    checkBox_stav.Text = "System status";
    checkBox_teplota.Text = "Temperature";
    menuItem4.Text = "Language";
}
```

Applications without smssend class is unnecessary. The main feature is just sending and receiving SMS code. Button, download data, it starts a wave of orders. The class smssend using checkboxes is created with the SMS and the technical parameters of the transmission of the main application class. Main Street application then sends a predefined SMS GSM communicator GD-06 Allegro. The reply SMS and retroactive application with a popup window displays the values on the device. Part code to set the text size and protected against overshoot and subsequent collapse of. [11]

```
public bool SendSMS(string CellNumber, string SMSMessage)
{
    string MyMessage = null;
    //Check if Message Length <= 160
    if (SMSMessage.Length <= 160)
        MyMessage = SMSMessage;
    else
        MyMessage = SMSMessage.Substring(0, 160);
    if (IsOpen == true)
    {
        SMSPort.WriteLine("AT+CMGS=" + CellNumber + "r");
        _ContSMS = false;
        SMSPort.WriteLine(MyMessage + system.Environment.NewLine + (char)(26));
        _Continue = false;
        if (Sending != null)
            Sending(false);
    }
    return false;
}
```

Sending SMS in accordance with the instructions prescribed by the code to the GSM communicator GD-06 Allegro [5] was written in class smssend, which is called when the button is pressed. With the proper functionality of the phone are a few tasks done in a few seconds. Application does not load the phone so much and thus are reduced demands on energy consumption. [10]

4. Implementation

This application must be downloaded to your PDA or other mobile device, which is Windows Mobile. When you start with a simple graphical user interface that addresses the basic instructions for controlling the GSM communicator GD-06 Allegro. In the upper part of the program button is used to send control code via SMS. Under the button for sending SMS messages are placed checkboxes for each function. Features on the findings of the device (time, status of the terminals) to determine the temperature and the heating is switched on and off. In the bottom menu buttons are located, and Exit. When you click on menu items to expand. The author, language, Help. Under the language of choice from English and Czech. When you select an item, the

application will be translated into the chosen language. Usage is ideal for English speaking people. When you press Menu, and Help opens new Form (Window) in, which is how to handle application and how the application works. The help window can be closed either by a cross in the upper right corner or the OK button! In the bottom left corner of the button bar. When the button is clicked The author opens MessageBox with information about who made up the application.

5. Conclusions

On this project we have tried and successfully verify how to work with communications by SMS. Furthermore, we also discovered many new opportunities and we would like to continue in this field and to develop his skills. By using our developed components developers can continue to develop in a form that will be graphically in a higher level. We learned even more to simplify the source code, so that their writing was even much more least time-consuming.

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7. References

- [1] O. Krejcar, J. Cajka, User Adaptation Improvement Using a Software Components for Mobile Control Systems in .NET Compact Framework, In *Proceedings of International Conference On Networking and Information Technology, ICNIT 2010*, 11. – 13. June 2010, Manila, Philippines, pp. 545-549.
- [2] R.Y. He, G.L. Zhao, C.W. Chang, H. Me, X. Qin, Z. Qin, A PK-SIM card based end-to-end security framework for SMS, *COMPUTER STANDARDS & INTERFACES, Volume 31, Issue 4*, pp. 629-641, 2009
- [3] O. Krejcar, Problem Solving of Low Data Throughput on Mobile Devices by Artefacts Prebuffering. *EURASIP Journal on Wireless Communications and Networking*, 2009, Article ID 802523, 8 pages. Hindawi publishing corp., New York, USA, DOI 10.1155/2009/802523
- [4] M. Augustynek, M. Penhaker, D. Korpas, Controlling Peacemakers by Accelerometers. In 2010 The 2nd International Conference on Telecom Technology and Applications, ICTTA 2010. March 19-21, 2010, Bali Island, Indonesia, Volume2, 2010, p. 161–163. ISBN 978-0-7695-3982-9, DOI: 10.1109/ICCEA.2010.288
- [5] O. Krejcar, R. Frischer, Non Destructive Defects Detection by Performance Spectral Density Analysis, *Journal Sensors*, MDPI Basel, Vol. 11, No. 3., pp. 2334-2346. (2011)
- [6] O. Krejcar, R. Frischer, Detection of Internal Defects of Material on the Basis of Performance Spectral Density Analysis, *Journal of Vibroengineering*, 2010 – Vol. 12, No. 4 - P. 541-551.
- [7] P. Tucnik, Optimization of Automated Trading System's Interaction with Market Environment, 9th International Conference on Business Informatics Research, Univ. Rostock, Rostock, Germany, Lecture Notes in Business Information Processing, 2010, Vol. 64, pp. 55-61
- [8] P. Mikulecky, Remarks on Ubiquitous Intelligent Supportive Spaces, 15th American Conference on Applied Mathematics/International Conference on Computational and Information Science, Univ Houston, Houston, TX, 2009, pp. 523-528, ISBN: 978-960-474-071-0
- [9] J. Pindor, M. Penhaker, M. Augustynek, D. Korpas, Detection of ECG Significant Waves for Biventricular Pacing Treatment. In 2010 The 2nd International Conference on Telecom Technology and Applications, ICTTA 2010. March 19-21, 2010, Bali Island, Indonesia, Volume 2, 2010, p. 164–167. DOI: 10.1109/ICCEA.2010.186
- [10] W. Haerick, T. Wauters, C. Develder, F. De Turck, B. Dhoedt, *ANNALS OF TELECOMMUNICATIONS*, Volume 65, Issue 7-8, pp. 419-432, 2010, DOI: 10.1007/s12243-010-0168-0

- [11] P. Brida, J. Machaj, J. Duha, A Novel Optimizing Algorithm for DV based Positioning Methods in ad hoc Networks, *Electronics and Electrical Engineering*. 2010. – No. 1(97). – P. 33–38.