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SMS Based Hardware Controlling System “A Ubiquitous Approach”

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Abstract

The goal of this paper intended to develop a compact SMS (Short Message Service) based automated hardware controlling system. This is a low cost and ubiquitous automated System. It can be divided into three major parts, namely (1) Hardware controlling device, (2) Server connected with a Wireless Modem and (3) SMS Receiver and Controller of the system. At first Hardware controlling device attached with a server. Server programmer will be started by user and continuously running in the server machine. A GSM (Global System for Mobile communication) interface also attached with our server. The user will send an SMS containing the information of hardware controlling. This SMS will be received at the GSM modem attached with the server, then processed by the server and related instruction will be generated for hardware controlling system attached with the server through parallel port. The instruction will be sent to different circuits, which are specially designed for specific events for example main power switch, door lock system attached to the emergency exit or water pump etc.

Keywords: Short Message Service (SMS), Radio Frequency (RF), AT Commands, ubiquitous access, Automation.

Introduction:

Now we are in a global world where all the people are very much familiar to use technology for their personal, official, academic as well as daily work. We must need to do all the works in respect of saving money, time and energy and also for the fortification of our assets and belongings in an effective and efficient way [3]. In our daily life we face various kinds of unexpected incidents. In the era of technology we can easily handle them technically. This is why we need an automated system that can take necessary initiatives of its own [5]. Our proposed system is one of that automated system can take necessary initiatives according to the instruction of a controlling person. The proper use of this user friendly system it would be quite helpful to overcome many unwanted incidents [10]. The objective is cost effective and user friendly SMS based hardware controlling system using cheap and highly available apparatus and materials.

Business Case:

The most widespread methods for HAS today are RS-232 hardware, IP-based device and radio frequency (RF) or Bluetooth technologies [7]. In our proposed system we have tried to overcome the high cost of controlling unit and difficult to handle. The most significant specialty of our proposed system is that all the apparatus and materials we used, are cheap and available. The system is also easy to install and maintain. So naturally the system will be cost effective and user friendly as well as pretty necessary too. If electronic components development is low cost, home automation migrated from being an industrial application to home automation [9].

Proposed System Architecture:

System Architecture (High level Design)

- **Hardware Controlling Device:**

Hardware that can control devices connected with it according to the instructions from server side. The incoming information to this device is decomposed into a serial bit sequence [6].

- **Server:**

A system that is requiring for runs software to manage the hardware controlling device and to send or receive SMS.

- **GSM Modem:**

This device is for sending and receiving data, SMS text messages, GPRS data over the GSM network.

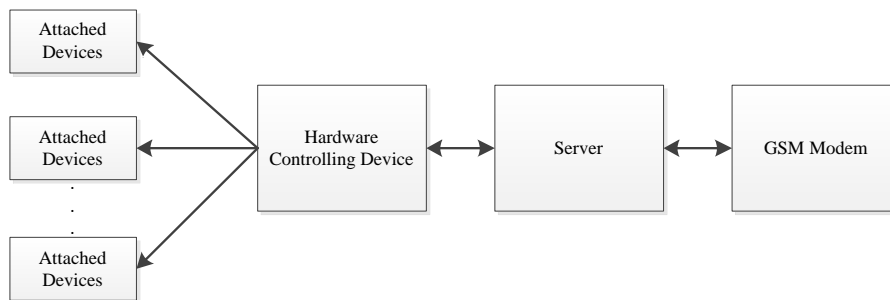


Fig. 1 System High level design

Software that will run in the server side gives status report to the user on demand and receives instructions from him through SMS using a GSM modem that would be attached to the server through USB or serial port. A hardware controlling device will be attached with the server through its parallel port. Server instructs the hardware devices attached with the hardware controlling devices according to the user's command. Instruction may be automatic or manual. Server will preserve important messages in its own database system.

- **Specific Requirements to Develop the System:**

Required Software:

- Operating environments: Microsoft Windows XP
- Java(TM) 2 SDK, Standard Edition Version 1.4.2

Required Development Tools:

- Netbeans-6.0
- Mysql-5

Required Hardware

- Server PC: 3 MB hard disk space, 256 MB system RAM, 2 GHz P4 CPU,
- Hardware Controlling Device
- GSM Modem

Testing Tools:

- Siemens M-25 Mobile
- JUnit

Software system Development:

SMS Lib:

SMSLib is an API library, which allows you to send and receive SMS messages via your GSM modem. You can use SMSLib either with a dedicated GSM modem or with a GSM phone that complies with some standard.

COMM API:

The Java Communications API is a Java extension that facilitates developing platform-independent communications applications for technologies such as fax, modems and robotic equipment. The Java Communications API (also known as javax.comm) provides applications access to RS-232 hardware or serial port.

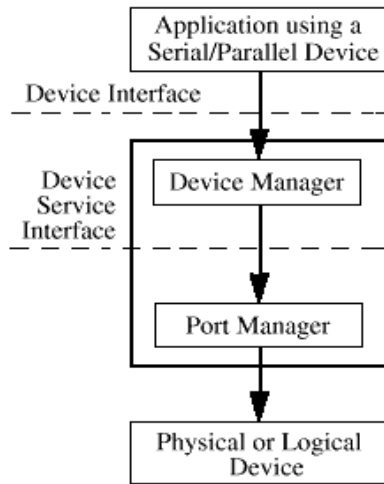


Fig. 2 COMM API

Hibernate:

Hibernate is an object-relational mapping library for the java language, providing a framework for mapping an object-oriented domain model to a traditional Relational database. Hibernate solves object-relational impedance mismatch problems by replacing direct persistence related database accesses with high-level object handling functions.

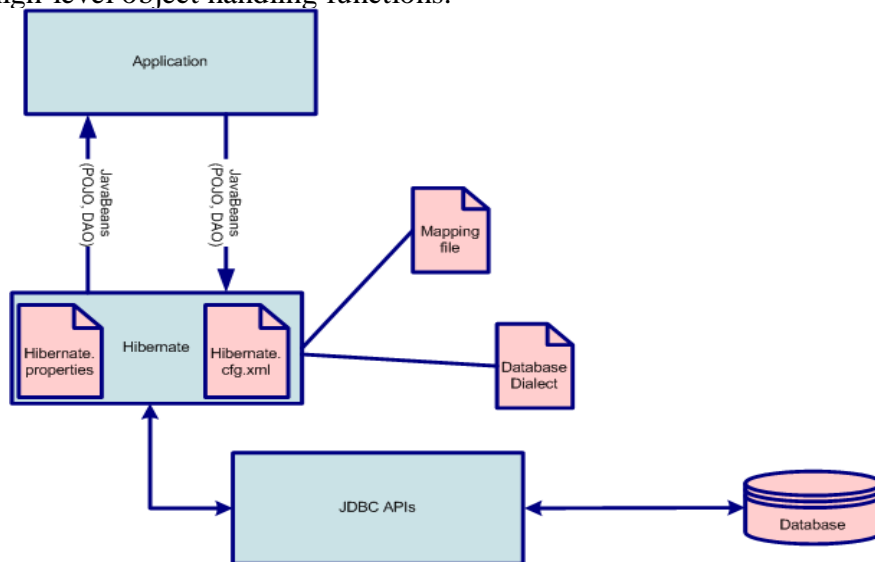


Fig. 3 Hibernate Architecture

Hibernate's primary feature is mapping from Java classes to database tables. Hibernate also provides data query and retrieval facilities. Hibernate generates the SQL calls and relieves the developer from manual result set handling and object conversion, keeping the application portable to all SQL databases, with database portability delivered at very little performance overhead. All you need to do is create an XML "mapping document" telling Hibernate the classes we want to be able to store in a database, and how they relate to the tables and columns in that database, and then we can ask it to fetch data as objects, or store objects as data for us. Compared to most of the alternatives,

it's almost magical. At runtime, Hibernate reads the mapping document and dynamically builds Java classes to manage the translation between the database and Java worlds.

AT command set:

When the modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of +++AT<ENTER>. To issue a disconnect sequence type +++ATH<ENTER>. This format complies with the Time Independent Escape Sequence.

SMSLib communicates with your GSM modem via the serial port. SMSLib uses the enhanced 3GPP AT command set (which is similar to the ancient Hayes AT command set) in order to control the modem. These commands are sending and received through the serial port.

So, the first thing to check is the ability to serially connect your GSM modem to your COMPUTER. Several of the dedicated GSM modems are connected via plain serial cables. Many other and most of the modern GSM phones are connected via Bluetooth, IrDA or USB cables. If you are using these connection layers, you should probably install the manufacturer drivers as well. These drivers create a virtual COM port (well outside the range of the standard COM ports, something like COM7 or COM40), which will allow you to connect to your phone serially.

Hardware Controlling Device:

In the COMPUTER there will be D-25 type of female connector having 25 pins and in the printer, there will be a 36-pin connector. Connecting cable will combine this connector using following convention. Pin structure of D-25 and connectors are explained bellow.

Computer places the data in the data pins, and then it makes the strobe low. When strobe goes low, printer understands that there is a valid data in data pins. Other pins are used to send controls to the printer and get status of the printer; you can understand them by the names assigned to the pins.

TABLE 1 Pin Numbers and signals

Pin No (D-Type 25)	SPP Signal	Direction In/out	Register.bit
1*	nStrobe	In/Out	Control.0
2	Data 0	In/Out	Data.0
3	Data 1	In/Out	Data.1
4	Data 2	In/Out	Data.2
5	Data 3	In/Out	Data.3
6	Data 4	In/Out	Data.4
7	Data 5	In/Out	Data.5
8	Data 6	In/Out	Data.6
9	Data 7	In/Out	Data.7
10	nAck	In	Status.7
11*	Busy	In	Status.6
12	Paper-Out / Paper-End	In	Status.5
13	Select	In	Status.4
14*	nAuto-Linefeed	In/Out	Control.1
15	nError / nFault	In	Status.3
16	nInitialize	In/Out	Control.2
17*	nSelect-Printer/ nSelect-In	In/Out	Control.3
18 – 25	Ground	Gnd	

Our proposed design is to make optimized and simple device controller equipment. Here we use 74138 (74LS138) IC, which is a 3-8 de-multiplexer. This will help us to control more devices by using less pin. 7404 is the inverter IC or we can call it hex inverter because there are 6pin input and

corresponding 6-pin output. This IC just makes input 1 to 0 and vice versa. We use 7404 (74LS04) to make all the 1 (from IC 74138) to 0.

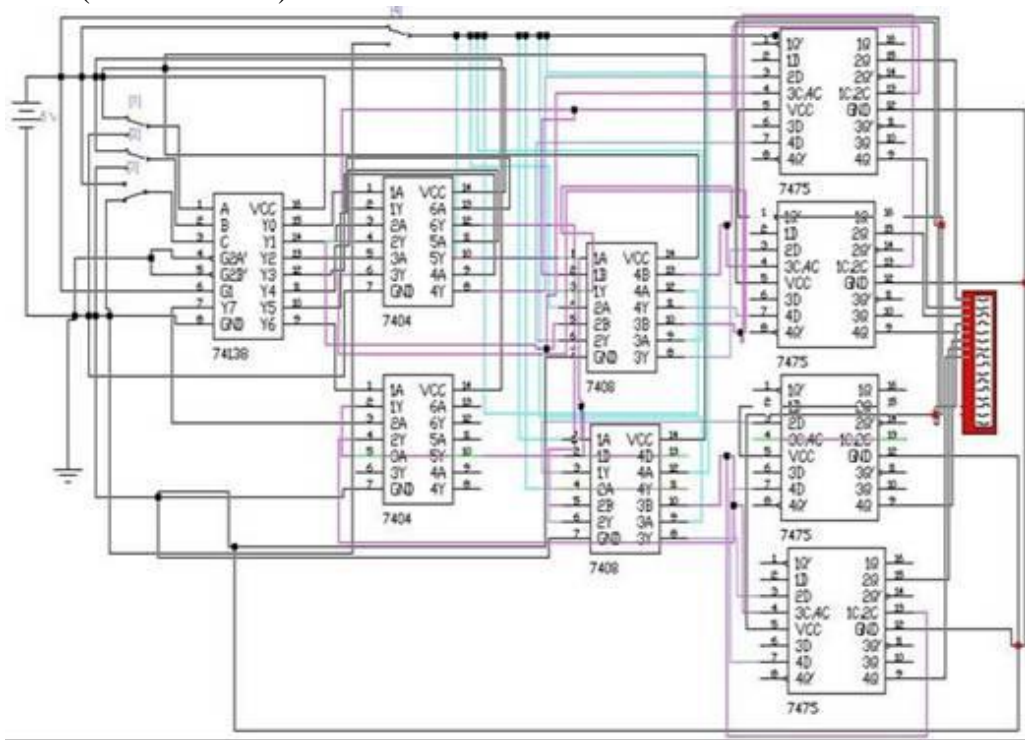


Fig. 4 Design of Hardware controller

To change a final output to 1 make sure that the AND gate 7408's pin A is 1 and the output n attached with B pin of the AND gate that is Bn is 1. Finally the output of latch 7475's Q is 1.

To change a final output to 1 make sure that the AND gate 7408's pin A is 1 or 0 and the output n attached with B pin of the AND gate that is Bn is 0. Finally the output of latch 7475's Q is NULL.

To change a final output to 0 make sure that the AND gate 7408's pin A is 0 and the output n attached with B pin of the AND gate that is Bn is 1. Finally the output of latch 7475's Q is 0.

TABLE 2 List of Parts used

NAME	DEVICE NUMBER	INDUSTRIAL NUMBER
3-8 DEMULTIPLEXER	74138	74LS138
NOT Gate	7404	74LS04
AND Gate	7408	74LS08
Latch	7475	74LS75

Working Procedure:

Our software system mainly performs five independent tasks. Those tasks are [4]

- It can send status to client by SMS through GSM modem.
- It can receive instruction by SMS through GSM modem.
- It can get instruction manually from control panel.
- It can send instruction to the hardware device.
- It can preserve message its own database.

Our server communicates with GSM modem through the USB or serial port and communicates with hardware device through the parallel or printer port of the computer. So to communicate hardware device, we have to interface our software system with the parallel port. For this interfacing we are using a dynamic link library, which is jnpout32.dll. On the other hand to access serial port we are using java communication API.

Suppose we want to know the current status of our system. Then we just send a SMS from any mobile phone to a specific number that we are using in our GSM modem. Status message pattern is given bellow:

TABLE 3 List of Status Message

Status request SMS by the client	Status SMS send by the system	Status change request SMS by the client	Status SMS send by the system
Status	Switch-0:Off	Set 5 true	Switch-0:Off
	Switch-1:Off		Switch-1:Off
	Switch-2:Off		Switch-2:Off
	Switch-3:Off		Switch-3:Off
	Switch-4:Off		Switch-4:Off
	Switch-5:Off		Switch-5:On
	Switch-6:Off		Switch-6:Off
	Switch-7:Off		Switch-7:Off

When our system gets this message at first it check what kind of message it is. When it finds that it is a status request message then it sends a SMS to that specific no. and that SMS contain the last status of our system.

In our hardware system we have eight-switch panel. Initially all switch are off. So when client send request SMS for the current status, system send this SMS to the client. Suppose client want to turn on the switch-5.

It can be done by.

- Switch ON manually from the control panel
- Switch ON by sending a SMS to a specific cell no.

In our system there is a control panel, from which we can control each and every switch manually from the server. When we change any of the switch status from the panel, system just do a change to status array and perform that task.

On the other hand we can change switch status automatically by sending a SMS from any mobile phone. To do this task a client sends a SMS to the system for that purpose. When system get that SMS it just update its status array according that SMS and it send that instruction to the hardware device through the parallel port. After that again client send a status request SMS to the system.

Project Risk Management:

The process of risk management for developing the software involves the following:

- Try to identify and anticipate all realistic risks that might affect project
- Analyzing probability and potential impact of said risks.
- Project management decides on whether to avoid/take no action if a risk happens or to tackle it.
- Apply contingency plan if risk was anticipated and planned for or devise a solution then and there.
- Constant monitoring by project members of the situation to watch for risks occurring, new risks emerging, or changes in the assessment of existing risks.

Conclusion:

Considering the cost effectiveness and ease of use our proposed system has a better prospect in the field of SMS based automatic hardware controlling system. We worked hard and at last came to an end after running the system successfully. We hope in future we can make it more cost effective and available in market.

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