HOME AND FACTORY AUTOMATION VIA SMS

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ABSTRACT

In this paper an interactive remote automation system has been designed. The system has also implemented and tested in all conditions. By this project one may gain the ability of administering several predefined electronic devices connected to the computer, simply sending an SMS message.

I. INTRODUCTION

Technological developments tend to consider people and make life easier for people. Yet as it is experienced everyday, again and again made life more complicated and stole time which cannot be turned back. Thus, saving time while improving solutions or (at least) combining and administrating technological products is the key mentality of this project[3]. Against modern life's challenges this project offers an easy to use mechanism to monitor and administer all electronic and basic control devices around your home/factory. This system may reduce the relevant human factor in such a service sector and may increase the productivity not just by spearing more resources for the production but also decreasing the defections that may be originated by human factor. The system is designed to cover a large spectrum where automation is needed yet there is little budget to support the implementation costs as well as large scaled factories which may not exist without automation systems. System is open to develop simply adapting database to your system necessities.

The project can be applied to all vehicle, house, office, and factory media[4]. This project is initially designed for house automation. The system requires two basic cellular phones and a basic computer which has a parallel port connected to the devices to be controlled. The system is triggered by receiving an SMS message from one of the registered cellular phones, then the SMS is parsed and message is retrieved by the database and relevant action is returned.

The goal of the project is just gain of money, time and human factor, or can be described as using the technology advancements for people's own benefit.

II. SMS SYSTEM

In the remote control system a carrier is needed to transfer data from one cellular phone to the other. In this transfer data is needed to be packed and placed in a protocol which is suitable to transmit the data. In this project Short Messaging System (SMS)[1] is selected as the carrier of the data. The easy usage, being primitive cellular phone functionality, being fast, reliable and acknowledged automatically are the reasons of this initial selection yet other GSM services may be used as extra media to carry data over. By using AT command set which is common for cellular phones one may use all the features of a cellular phone and write programs to make those actions. There are two ways for sending message, the first one is sending message in Protocol Description Unit (PDU) format and the latter is sending as it is. In the implementation one chose the text mode for simplicity and for making sense to the end users who will use the database and this automation system. And this solution makes the software to use resources effectively on all kinds of computers and react faster.

III. DATABASE SYSTEM

Database[2] is a collection of data stored in a computer in a way that makes it easy to obtain when needed. One could consider database as just a collection of data but in this project it placed at the centre. All the commands and all the reactions stored in a database as well as all user interactions with the system. Connection strings and types may show some differences from Database Management System (DBMS) to DBMS the SQL commands show similarities which allow the software to use same structure for all supported DBMSs.

The most important difference of this project with compare to others is existence of a highly functional database system which makes the system is an expandable, easy to modify automation project that fits for most of remote assistance/management requirements.

Programmer or even end user may change the commands to be sent by cellular phone, and output pin locations in the database -without any need to recompilation of the

code- while the application is running. Or he may add different and making sense commands in addition to the current ones and may use whichever he wants to use for the same purpose.

In the project one database with two main tables –user and action- and one intersection table –userAction- which stores all of the user actions with date, time and whether the action is successfully completed.

As a conclusion database system is one of the vital parts of the automation system and managed by directory services by the help of translator adaptor which is placed at the center.

IV. HOME/FACTORY AUTOMATION

In order to run this project successfully one needs a plain PC with one parallel port and one serial/USB port to connect the cellular phone to the PC (if PC and cellular phone already has infrared port to communicate, serial or USB connection is not required), one cellular phone around PC and relevant cabling to connect devices to the system. It is the central management (Host) module of the system. Peers just need to send SMS to use the system. In order to do that they may their personal cellular phones or services offered by internet web sites.

In the implementation of the central management module one decided to use a PC in order to take advantage of its relatively high storage capacity which is needed for the database system[5]. And the tests show that software has no overhead on an average PC when one considers the CPU and memory usages as the main criteria.

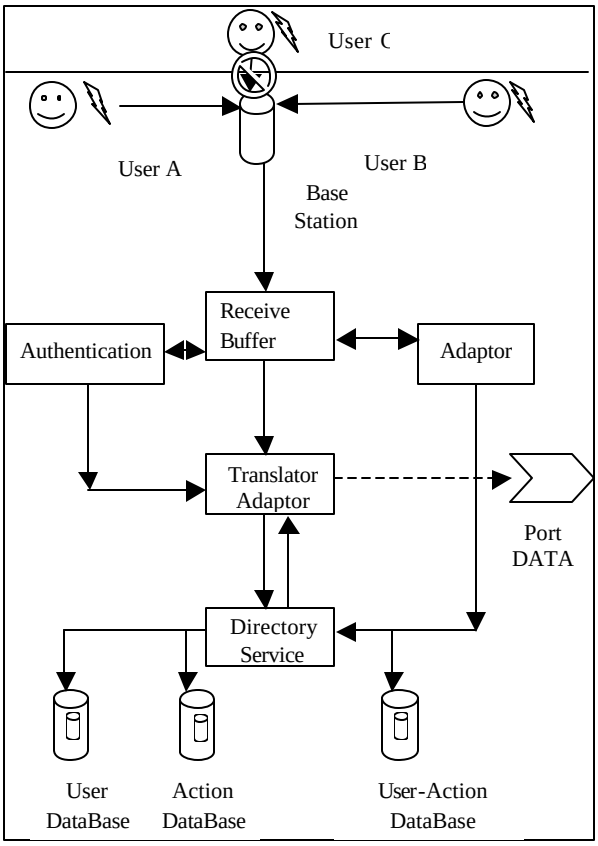
In an automation system there are two vital actions that must be implemented in order to satisfy home/factory needs[6]. One of the critical actions is keeping track of the actions, users and the combination of two. This makes the system up, and allows administrators two modify system while it is running and prevents costs due to the system shutting down costs. The second action is the feedback system that informs users about the comments, message structure as well as the status –action start, finish or current-. So this makes the system more reliable and stable in critical operations.

A simple diagram that gives brief information about the peer to host and host to peer system is given in figure IV.1.

FigureIV.1
(Home/factory automation process flow diagram)

The system triggered with a received SMS from peer. When cellular phone at host receives an SMS via its existing connection, the software provides infrastructure for the PC to get the message over serial/USB port. Secondly software analyses the message and checks its structure which consists of username-password-duration-action given in order. Thirdly if message format is valid the translation process occurs, in this step SMS message is parsed to its components and stored in a temporary place in the RAM. In this step the message is translated to the keywords that the central database is taking care of. In the fourth step software tests the information that has been generated in the previous step by using relevant table in the database. In the next step if message has been sent by a pre-registered peer with correct username, password, valid duration and action software generates an action id which will drive the relative device. Next step in this process is initiating the task using ports and pins which the appropriate task is assigned. Then the initiator and the administrator of the system are informed by sending a feedback message which includes the action, duration and status and writes all information to the database. And finally system is ready for the next message to arrive and process the same task again.

After the brief process flow one may explain implementation details by describing figure IV.2 in words.

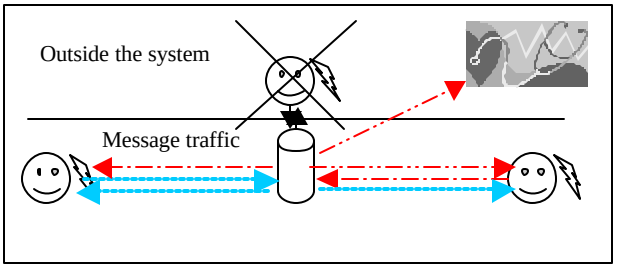


FigureIV.2
(*Detailed implementation* process)

In the implementation process there are mainly three user groups. Two of them are shown figure IV.2 as registered users (User A, User B) and unregistered users (User C). Received messages are kept in a temporary place (receive buffer) at first and authentication process starts working on the data in the receive buffer. Unregistered users are banned when they try to access the central management module. In order to do this system need to receive the message, check for the structure and parse the message to gather enough information about the sender, its id and other verification details. By using the details a query on user table is executed if the user is not an active user –who uses the system frequently-, yet if he is an active user it just checks its id from the adaptor module and then forwards the request to the translator adaptor where all message to action matching (Many to One) algorithms, initiating port algorithms and directory service algorithms which reads current user and action values, and writes log data for each access.

Translator adaptor gathers the ready information pieces packed into the SMS (username-password-duration-action) and executes relevant SQL statements to validate every piece and decides for the right action. Every time after any process translator adapter is sent a feedback message to the appropriate users.

As explained above and showed in figure IV.3 unregistered users may not use the system even they know the username, password and message structure. Yet system may inform unregistered authorities like police, fire station, first aid stations.



FigureIV.3
(*Message traffic within and outer system*)

V. CONCLUSION

Home/factory automation system is an expandable, easy to modify automation project that fits for most of remote assistance/management requirements. In the very first step the project can be considered as a home/factory automation system controls various devices at home with great security and feedback mechanism. Project accomplished by designing a system that consists of a plain PC and a cellular phone which has basic features. Making this combination reduces the costs and maintenance overheads. Although implementing a relatively large system due to the microprocessor based systems, unlimited resources and improving technology is on the way to overcome these disadvantages.

The project can be applied to all vehicle, house, office, and factory media. So one may monitor and administer any property in one of its application area. The system is designed to cover a large spectrum where automation is needed yet there is little budget to support the implementation costs as well as large scaled factories which may not exist without automation systems. System is open to develop simply adapting database to your system necessities. It is foreseen that the system can be used for time consuming processes like preparing meal that is already placed in an oven, warming or cooling houses before owners come back, activating and deactivating alarm systems, or monitoring unstable conditions like keeping track of the children and patient or old people –via sending their blood pressure, etc- in home systems. It may also be applied factories by activating and deactivating machinery in mission critical applications and one secure and reliable decision should be made, monitoring stock and production values continuously, activating and deactivating alarm systems. And for the vehicles engine may be started before you leave home, or its position may be defined by giving a signal.

The system has been tested under all possible negative circumstances and passed without any error or warnings. This project was the fundamentals of an automation system. It will be supported with new and becoming widespread technologies like GPRS and wireless technologies which will increase the usage spectrum like salesman-stock automation and will reduce the institutional costs.

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