Call Button
System Software

Technical Description

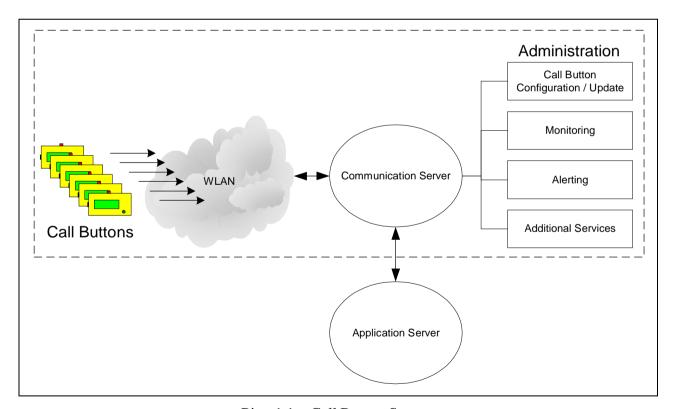ADE Vertriebs-GmbH
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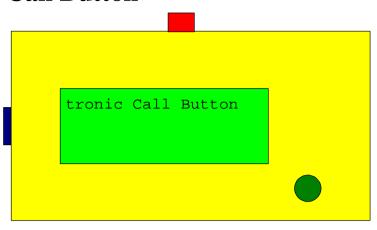
1 Call Button System Software

The Call Button System Software is the interface between the Call Buttons (hardware) and the application. It performs the direct communication with the Call Buttons and meets the following tasks:

- Safe handling of the Call Button communication

- Central contact instance for the application

- Surveillance of the Call Button function

- Administration of the Call Buttons:
    o Configuration
    o Automatic firmware update
    o Warning when battery low
    o Monitoring / logging of Call Buttons and communication

- Minimizing the power on time of the Call Buttons in order to obtain a high operation duration of the batteries

- Minimizing the network load
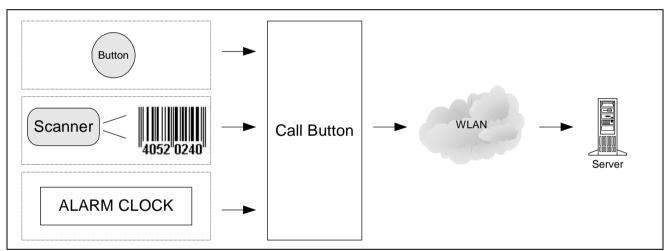

Pict. 1.1 – Call Button System

2 The tronic Call Button
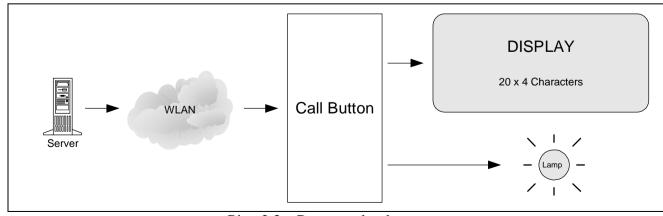

Pict. 2.1 – The Call Button

2.1 Functionality

The tronic Call Button is powered up by an event, establishes a connection to the server and reports the event.
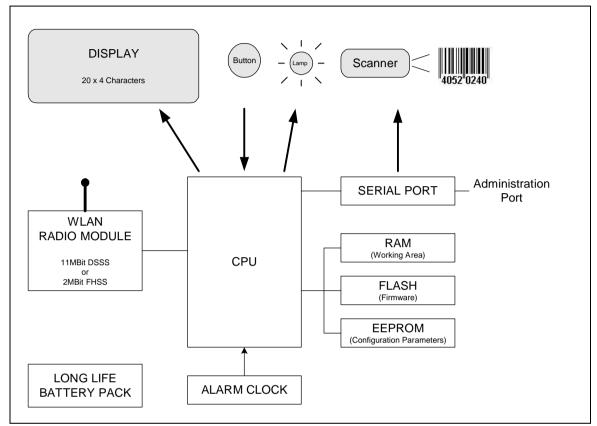

Pict. 2.2 – Events to be reported to the server

The server processes the event and sends a response back to the Call Button. Thus the server can cause a text to be shown on the display, etc. Subsequently, the Call Button turns off.

Pict. 2.3 – Response by the server

2.2 Assembly of the hardware

The tronic Call Button is designed for easy installation (without external power supply) and long, maintenance-free operation time. It contains a durable battery and a sophisticated power management, so that it can be operated for years without battery change (depending on utilization). The firmware abandons a standard operating system to save resource requirements.

Pict. 2.4 – Block diagram

2.3 Power management

At standby state the Call Button is switched off. Only the display und alarm clock are powered on continuously and discharge the battery with only a few microamperes. (Additionally, on request of the server the flash indicator can be switched on at standby.)

Because CPU and radio module are down, the device cannot be reached by the server. Thus network communication can take place only after the device is switched on. It connects to the server subsequently.

The following events switch on the Call Button:

- Button
- Barcode scanner
- Alarm clock
- Administration port (Laptop, etc.), no automatic connection to the server

Upon one of the three main events (not through administration port wakeup), a connection is established immediately und the event is reported. After the response from the server is received and processed, the Call Button switches off.

2.4   Communication

The highest goal when designing the Call Buttons was a long operation time of the built-in battery. This was achieved primarily by powering off the main components of the device at standby time. Thus the server is not able to address the device when it is in standby mode (which is the case most of the time). A transaction can be initiated <u>only</u> by the Call Button through one of the following events:
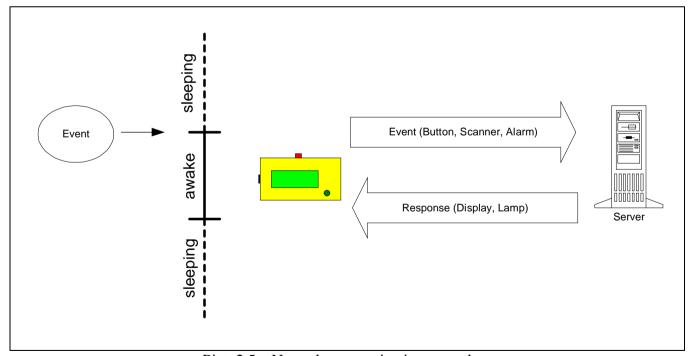
- Button
- Barcode scanner
- Alarm clock

In case the Call Button unit has no manually configured IP address, it obtains a dynamic IP address from a DHCP server in the LAN. The dynamic address is released by the device before switching off and can be reassigned to the next IP host by the DHCP server. The Call Button can be identified by the server through its network name or MAC address.

After a TCP/IP connection to the server is established, a corresponding message is sent. In response to it the server can:

- Send a text to be displayed
- Specify the time the device ought to remain on (in seconds, up to 4 minutes)
- Switch on the flash indicator (optionally „while device is on" or „after device is powered off")
- Specify the next wake up time (in minutes, up to 4 hours)
- Change the configuration of the device
- Perform a firmware update

Before switching off, the TCP connection is finished by the Call Button.

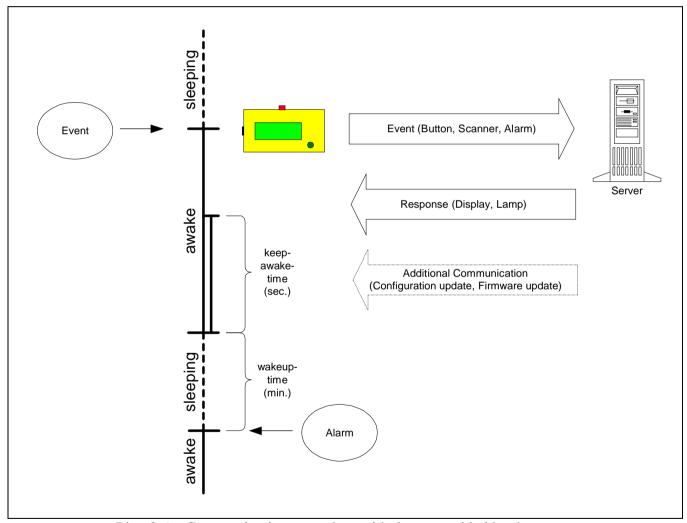Pict. 2.5 – Normal communication procedure

The minimum power-up time depends on the duration of the network communication und the response time of the server.

The server can instruct the Call Button not to switch off immediately (On-time 0 to 255 seconds). The TCP connection is sustained and the server may send additional packets to the device, e.g. in order to change the display again. For example the server might respond "processing, please wait" after a message from the Call Button and when it is ready it can renew the display with the result.

Also the server might send a firmware update during the on-time of the device or change the configuration.

It is to be considered that the power consumption of the Call Button is significantly higher during the on-time compared to standby-time. In order to obtain a high operation time of the battery, the on-time should be reduced to a minimum.

Additionally the server can specify the wake up time (1 to 255 minutes). The build-in alarm clock provides a new event and reports it to the server. So the device can be advised to check the server periodically for a state change and whether new information is to be displayed.
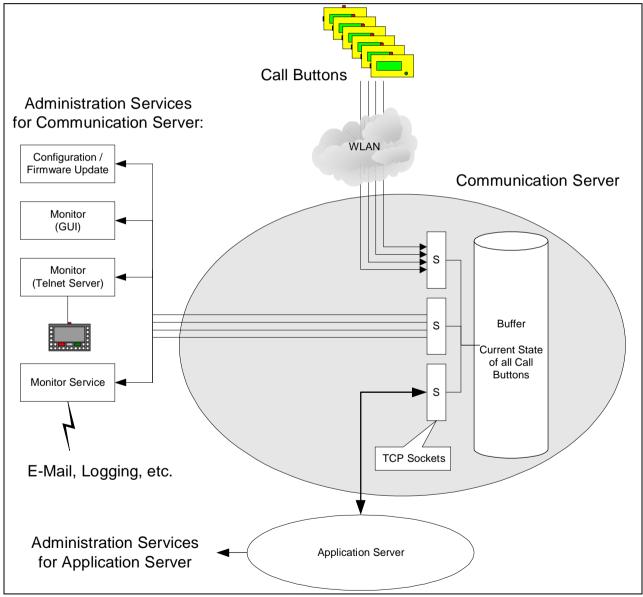

Pict. 2.6 – Communication procedure with times provided by the server

3 Communication Server

3.1 Communication Server

The communication server is responsible for the access of the Call Buttons to the application and vice versa. It is functionally (not technically) transparent from the application's point of view and project independent. In contrast the application can be adapted to the concrete project or can be developed from scratch without the need to worry about the special requirements of the Call Button. Call Button administration is handled by the communication server and held off from the application.

The communication server carries out the direct communication with the Call Buttons and retains (= mirrors) the current states in an internal buffer. It has interfaces to different clients. The most important interface, of course, is the TCP socket to application. In addition to that several administration services can be connected.

Pict. 3.1 – **C**ommunication Server

The communication server runs as a service under Microsoft© Windows©2000, XP and NT 4.0-SP6 (Professional or Server Edition). It has no user interface itself but is controlled by the administrations clients.

All interfaces (Call Buttons, application, administration clients) are addressed by TCP/IP, thus the communication server and the application as well as the clients may run on different machines in the LAN.

3.2 Utility programs (administration services)

The administration services are utilities that connect to the communication server and configure or monitor the system.

3.2.1 Administration client (Windows GUI)

The Admin Client configures the Call Buttons and communication server.

The Admin Client initiates configuration changes and firmware updates for the Call Buttons. The settings can be done in the dialogs of a graphical user interface. The communication server then synchronizes the configuration to the Call Buttons in the WLAN and ensures that all Call Buttons are up to date.

3.2.2 Monitor client (Windows GUI)

The Monitor Client is a Windows program and serves for surveillance of the Call Buttons function and the communication. It connects to the communication server and displays the current states of the Call Buttons in a graphical user interface:

- On/off
- Current display content
- Flash indicator on/off
- Battery load
- Time of the last communication
- Time of the next wake up
- Configuration state, firmware release
- Network name, IP address, MAC, etc.
- Error states

3.2.3 Mini Monitor/Admin Client (Telnet Server)

A basic Monitor/Admin Client is available as a Telnet server and runs as a Windows service. Therewith the communication server can be connected by any Telnet client (Unix, Windows, tronic Radio Terminal).

3.2.4 Monitor service

The Monitor Service runs as a Windows Service (reasonably on the same computer as the communication server) and monitors the (Call Button- and application-) communication.

A communication log (history) can be recorded in a file for later analysis.

On certain events a message can be released, e.g.:

- Battery low
- Error states (e.g. network failure)
- Standard Call Button Events (e.g. button event)
- No event from a Call Button within a defined time

The message can be a record in a protocol or an email to the administrator. The monitor service can be configured by a Windows program with user interface.

3.2.5   Call Button configuration through FBConfig

A standalone program for configuration and firmware update of Call Buttons is FBConfig. It operates independently from the communication server. With this program single Call Buttons can be configured over the serial port. This is necessary for basic network parameters as long as there is no LAN/WLAN connection to the server.
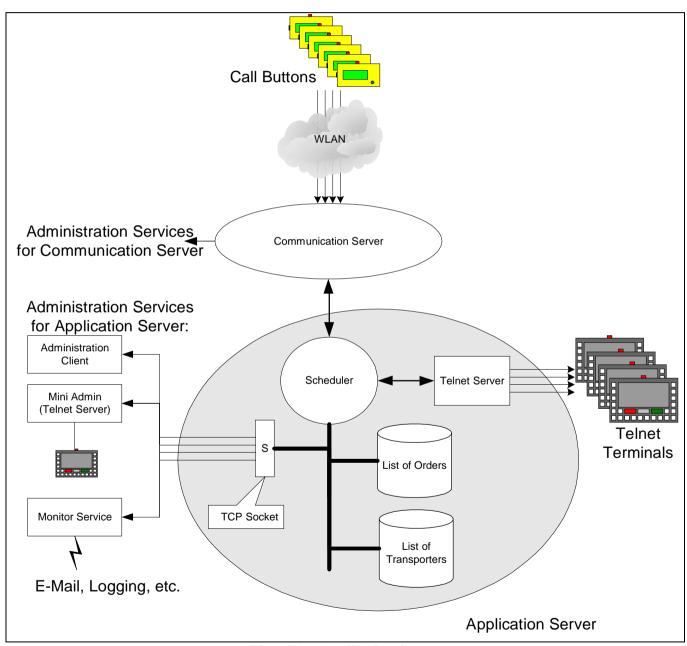
The configuration can be saved in a file and duplicated to other Call Buttons. The file can be distributed to all Call Buttons by the communication server using the Admin Client, provided the network connection to the devices is available.

4 Line Feeding Application

The first application available for the Call System was a line feeding application. The Call Buttons are installed at different points of the production line of a factory and are supposed to report a supply request. Via a mapping in the application the appropriate supply material is determined and an order is put into a queue. Each order in this queue is issued to a Telnet terminal on an industrial truck as soon as available and the completion is monitored. The display on the Call Button shows the current order status.

4.1 Line Feeding Application Server

The line feeding application server assigns the orders to the industrial trucks available. It is installed on a server machine as Windows service (i.e. background process) and contains no user interface itself. It may but need not run on the same computer as the communication server.
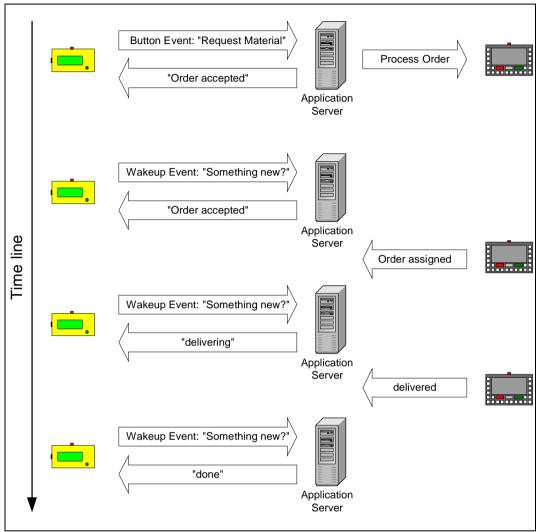

Pict. 4.1 – Application Server

The Telnet terminals of the trucks connect to the Telnet server of the line feeding application and register to the system. The scheduler arbitrates the requests of the Call Buttons to the trucks.

The administration of the application is done by an external program with user interface that connects to the application server via TCP/IP. With this program the current states of the jobs (orders) and the transport units (industrial trucks) can be viewed and edited, etc.
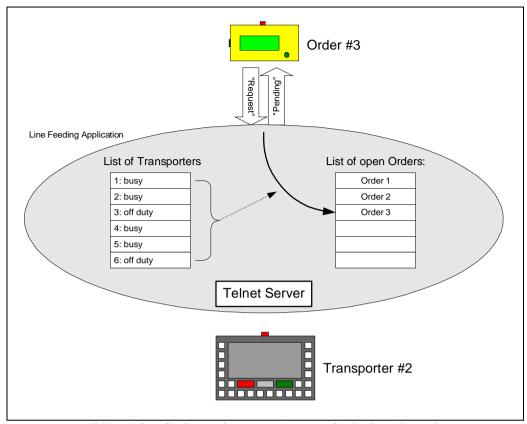
The flow of a supply material order is described in the picture below. The Call Button initiates an order and periodically asks for the current state of the processing by a wakeup event.
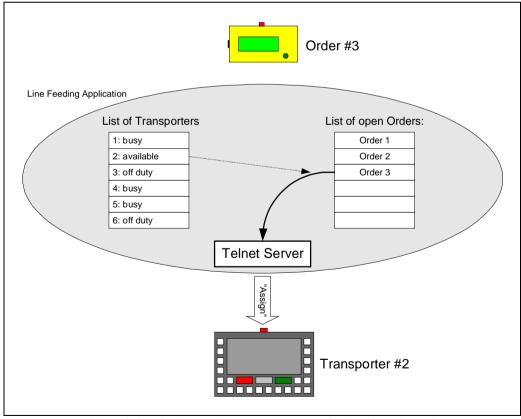

Pict. 4.2 – Flow of a supply material request

The pictures below describe the single steps of an order assignment in the application server. Shown is the order initiation by the Call Button, the assignment to a transportation unit and the respective acknowledgment to the Call Button.
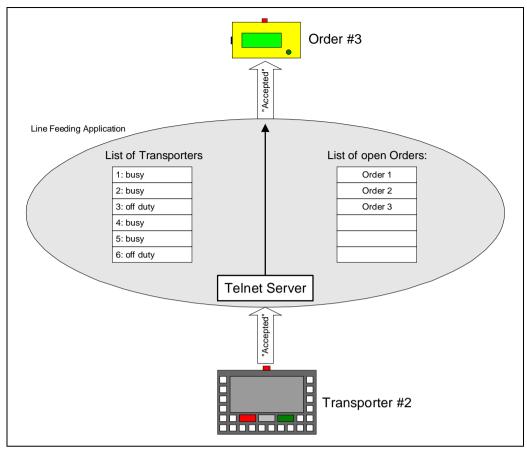
The communication between application and Call Buttons is runs across the communication server. In contrary to the Call Buttons the communication server is permanently accessible and takes care for sending the current return information to the display when the Call Button is active or as soon as it contacts.
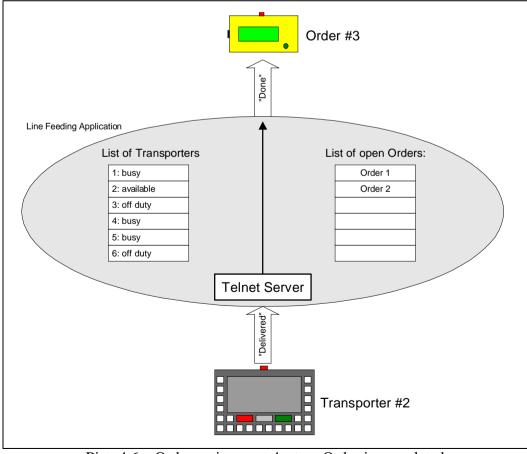
Pict. 4.3 – Order assignment 1. step: Order is released

Pict. 4.4 – Order assignment 2. step: Order is assigned

Pict. 4.5 – Order assignment 3. step: Order is accepted

Pict. 4.6 – Order assignment 4. step: Order is completed

4.2 Configuration

In order to operate the line feeding application the master data must be set up:

- Assignment of the Call Buttons (users) to the locations and the material demand (part number, amount)
- Per user: Priority of order assignment, time limit for completion
- Setup of the transportation units (location, attributes like capacity, special facilities, etc.)
- Assignment of the users and transportation units to user groups
- etc.

4.3 Utility programs (administration services)

The administration services are utilities analogous to the ones of the communication server. They connect to the application server and admit configuration and surveillance of the system.

4.3.1 Administration client (Windows GUI)

The Admin Client configures the application server. Sample parameters are:

- Assignment of Call Buttons to locations
- Material supply (part number), amount and storage location
- Priority of order assignment
- Maximum time limit before error release
- Standard texts for prompting the order state on the Call Button display

The Call Buttons can be monitored from the point of view of the location or part number (current state similar to the monitor client of the communication server).

In addition the jobs (material supply orders) and the appropriate assignments to the industrial trucks can be monitored and manipulated. Thus orders can be re-assigned or deleted.

4.3.2 Mini Admin Client (Telnet Server)

A basic Admin Client is available as a Telnet server and runs as Windows service. Any Telnet client (Unix, Windows, tronic Radio Terminal) can connect to the application server.

4.3.3 Monitor service

The monitor service runs as Windows Service (reasonably on the same computer as the application server) and monitors the order processing.

A log (history) of the orders and assignment can be recorded in a file for later analysis.

On certain events a message can be released, e.g.:

- Orders that could not be assigned (time limit reached)
- Error states

The message can be a record in a protocol or an email to the administrator. The monitor service can be configured by a Windows program with user interface.

The monitor service can collect further information for statistical analysis (e.g. orders per user / user group per time unit for load balancing).

5 Technics

5.1 Platform

5.1.1 Server

The communication server and the line feeding application run as service under Windows2000 / XP and NT4.0/SP6. As the communication is accomplished via TCP/IP the servers can be installed on different machines in the local area network.

5.1.2 Windows clients

The supporting Windows programs with user interface for administration of the servers run under Windows98/2000/XP/NT4. The programs can be installed on desktop computers with LAN access to the appropriate servers and are available for different languages.

5.1.3 Telnet server

The Telnet servers (VT100) for administration run under Windows2000 / XP und NT4.0/SP6 with LAN access to the appropriate servers. Reasonably the Telnet servers are installed on the same computers as the servers.

5.2 Access control

All client programs are provided with password control, thus there is no unauthorized access to configuration changes independently to the LAN access rights.

5.3 Further applications

Also project dependent applications can be designed for the system of Call Buttons and the communication server. The application interface of the communication servers is documented.