

Emergency-Aid: Private Alarm Systems in a Social and Organizational Environment. Experiences and Perspectives of the German "Hausnotruf"

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1. Origins of the development of emergency call systems in Germany

In February 1980, under the name "Hausnotrufsystem St. Willehad", the first prototype of a system based on telecommunication technology in Germany was presented and tried out in a limited local pilot scheme at the St. Willehad Hospital in Wilhelmshaven. Already in the early 1970s, the director of the hospital had given the impulse for the development of the system. On the considerations outlined below, he gained the cooperation of a firm and jointly with the firm obtained funding from the Federal Ministry of Research and Technology which enabled an alarm call system to be developed.¹

What motivated the hospital director? He was of the opinion that in view of the increasing industrialization of the "modern working family", a "functional atrophy" was making a life according to principles of subsidiarity impossible in many ways. In this situation, he felt that more comprehensive support from personnel and technology was necessary in order to initiate "help towards self-help". He felt this situation was reinforced by the ongoing tendency towards a top-heavy age distribution in the population of modern societies, making big demands on care institutions and incurring high costs. In fact, the costs borne by carriers such as health insurance organizations, state and community social assistance organizations continue to increase, as the great

¹ Hormann, W.: "Hausnotrufsysteme. Kommunikationstechnologie im Dienst am Menschen". Wirtschaftsverlag NW, verlag für neue werbung GmbH: Bremerhaven 1980

majority of elderly people in residential care in Germany are not able to meet the costs of living in a residential home.²

With this general orientation of aims, the alarm system was developed in Germany for old people living alone, for the (chronically) ill, the physically handicapped and those in need of security; if emergencies or dangerous situations arose in their home environment they could transmit an emergency call to ask for - and receive - fast and appropriate help from the right place. "We are convinced that the presence of an alarm system, or of our alarm system, will mean that neighbours, relatives or others (...) will be prepared to participate in neighbourhood help."³

The alarm system's especial targeting of the elderly and those living alone has been retained until now; it can also be expected to keep its importance in the future:

- In Germany, the number of one-person households has been rising very steeply since the 1950s; they now make up more than one third of all households in the old Federal Länder. (1925: 7%; 1939: 10%; 1957: 18%; 1975: 28%; 1985: 34%; 1988: 35%⁴). In the industrialized, densely-populated regions the number of one-person households has already overtaken the number of

² The monthly costs incurred for one place in residential care at the end of the 1980s were 3500 DM, quite often 4000 DM and more; cf. Zoche, P.: "Den europäischen Markt im Visier. Einsatzgebiete und Chancen von Temex". In: net special 3 "Datenkommunikation". R.v. Decker's Verlag: Heidelberg 1989.

³ Hormann, W., op. cit., p.149

⁴ Meyer, T.: "Struktur und Wandel der Familie". In: Geißler, R.: "Die Sozialstruktur Deutschlands. Ein Studienbuch zur Entwicklung im geteilten und vereinten Deutschland." Westdeutscher Verlag: Opladen 1992, p. 279 ff.

families. This trend can also be observed - although not in such an extreme form - in the new Federal Länder, where one-person households constitute just under 30 % of all households.⁵

- In both parts of Germany, the age distribution curve shows a continuous shift towards a higher proportion of old people (1950: 14.6 % over 60; 1985: 19.8 %). According to calculations by the UN, by the year 2000 23 % of the German population will be over 60, and a share of 26.2 % is forecast for the year 2010.⁶ The Statistische Bundesamt fears a population development in which one third of the population of Germany will be over 60 by the year 2025.

(This present trend prognosis also substantiates the scenario visualized in "Globus-Grafik" in 1989) (cf. Figure 1: German population curve goes down).

Today - and even more in the future - the group of the elderly differs from the group of old people in former generations in these respects:

- higher income,
- more leisure time,
- better state of health (more than four-fifths of the elderly are able to lead an independent and relatively healthy life).

⁵ In 1990 the average of one-person households in the reunified Germany was about 34%; on this cf. Statistisches Jahrbuch für die Bundesrepublik Deutschland 1992, Statistisches Bundesamt: Wiesbaden 1992.

⁶ Meyer, T.: "Struktur und Entwicklung der Bevölkerung". In: Geißler, R.: "Die Sozialstruktur Deutschlands. Ein Studienbuch zur Entwicklung im geteilten und vereinten Deutschland." Westdeutscher Verlag: Opladen 1992, p. 284 ff.

The elderly thus form an important potential of possible users of technology⁷ and have especial statistical importance for operators of alarm systems in particular,⁸ since "ageing, despite all medical progress" is still associated "with the risk of failing health: as age increases, so does the susceptibility to disease, and considering the state of medicine today, approximately 10 % of elderly people must expect to be dependent on care. In the over-80 age group, as many as one in five are dependent on regular care."⁹

⁷ cf. Mollenkopf, H.: "Technik im Haushalt älterer Menschen". In: Meyer, S. und E. Schulze (Eds.): "Technisiertes Familienleben. Blick zurück und nach vorn." edition sigma: Berlin 1993, p. 233 ff.

⁸ Matheisen, J., U. Schellhaas und M. Voltenauer-Lagemann: "Fernwirken im sozialen Bereich. Problemstudie zur Abschätzung des Bedarfs und der Einsatzmöglichkeiten". Socialdata: München 1983

⁹ Mollenkopf, op. cit., p.234

2. Components and Functioning of the Alarm Call System

Setting up an alarm call system requires a **user** (e.g. a physically handicapped person) with a user station and a **service operator** (e.g. the Red Cross).

The user is provided with an emergency transmitter, or code activator, and a user module. The code activator is always carried with him or her, and is used to activate the alarm call in case of emergency. The user module is installed by the telephone and is connected through it to the telephone network.

The user module consists of an automatic dialling device, a microphone/loudspeaker, a microcomputer and a high-sensitivity UHF receiver. The module is externally equipped with:

- an emergency call button,
- a light diode showing when an emergency call has been sent,
- a day button for activity control,
- a light diode showing that the module is operational,
- a UHF aerial and
- a plug-in transformer unit with cable.

The equipment of the receiver (referred to as the receiver station, central office or operational headquarters - HQ) consists of a computer controlled central unit which enables emergency call signals to be received and evaluated.

The central unit is made up of a receiver and decoder unit, a transmitter unit, a microprocessor unit, a storage unit, screen, loudspeaker and microphone, keyboard and printer.

The alarm call, activated by the user pressing a button on his or her emergency transmitter, reaches the receiver via the public telephone network. With the help of the computer-controlled central unit, the operational HQ evaluates the alarm signal it has received and sets up a connection with the user who sent the call. This two-way communication is made possible by the user module, which automatically connects to the headquarters over the telephone network. Thus two-way contact between the user and the emergency service enables the operational HQ to find out the reason for the emergency call and the kind of help needed, without the user having to get to the telephone receiver. This remote communication possibility is particularly important in cases where the caller is no longer in a position to reach the phone (e.g. a paraplegic who has fallen out of his wheelchair).

In order to ensure that two-way communication is possible at any time, central positioning of the user module in the house or flat, a suitable loudspeaker volume and a sufficiently sensitive microphone are recommended. The outgoing signal is evaluated by the PC in the operational headquarters. In this way, the operator manning the HQ receives the complete data of the emergency caller and can initiate appropriate action. A decoder identifies and evaluates the signal; mis-

identification of emergency callers is not possible. The operational HQ can only connect to a user's home once an emergency call has been received, so that "listening-in" abuse of the two-way communication system is impossible.

A general distinction can be made between "passive alarm systems" in which the person in need of help activates the emergency call by his own activity (e.g. pressing an alarm button) and "active alarm systems" in which the alarm call is automatically activated as soon as sensors installed for the purpose indicate certain conditions. The usual private alarm systems in Germany today are mainly passive, i.e. alarms are activated by emergency buttons. The only technological design feature to depart from this function principle is so-called **activity control**. Activity control means that the user "reports back" to the HQ at certain time intervals, or each day at a prearranged time, by pressing the day button on his user module. The user module monitors this daily procedure, and if the user omits to press the button it emits a reminder signal. If the day button is not pressed following this reminder signal, the user module automatically activates an emergency call to the operational HQ. If the user leaves his or her home for a longer period of time, the headquarters can be informed by pressing the "signing-off" button on the user module.

3. In what situations are alarm calls transmitted ?

Most of the alarm calls reaching a service station are not emergency calls triggered by a dangerous situation. There are no representative data on the ratio of "real" emergency calls to "false alarms"; the operational HQs themselves do not record any statistics on their work. An unofficial ISI-survey carried out by the author in the summer of 1988¹⁰ indicated that c. 90-95% of the alarm calls received were classified as "false alarms" or "routine alarms". In a recent discussion with the Bundesarbeitsgemeinschaft Haus-Notruf (federal emergency home call group) the ratio was even estimated at 100:1.

As well as calls transmitted when testing the technical functions of the equipment, a frequent cause of "false alarms" is incorrect use of the equipment. In the majority of cases, however, "routine alarms" are due to psycho-social rather than technical causes (e.g. a need to communicate arising from feelings of loneliness, insecurity or fear). Thus the staff of the operational HQ have to be prepared to cope with these situations and be equipped to deal with the aspect of "telephone care". This requires sympathy and imagination, psychological and social-work skills and medical knowledge - but above all, time for telephone conversations, which the staff of security services, trained primarily to react swiftly to emergencies with appropriate actions,

¹⁰ This survey was based on telephone interviews with 16 emergency call headquarters in Germany. These operational headquarters were deliberately selected from the research field of c.100 operational h.q.s then in existence according to the criterion of geographical distribution over the whole of Germany, including at least two HQs from towns with up to 200,000 inhabitants and cities with over 500,000 inhabitants for the areas of north, central and southern Germany.

cannot provide. This is probably the reason why security firms do not usually offer private emergency call services, but leave them to the welfare organizations. Frequent reasons for acute emergency calls are falls, asthmatic attacks and heart attacks.

4. Service operators and users, costs of home emergency calls

As already indicated, it is the welfare organizations which are the "classic" operators of private emergency call services in Germany. The Red Cross, the Malteser Hilfsdienst, the Johanniter-Unfall-Hilfe, the Arbeiter-Samariter-Bund, the Caritas-Verband are the most important of them offering this service. However, some hospitals and non-profit foundations of old people's and nursing homes are also active as suppliers of home emergency call services.

In addition, some security firms have used the remote technology of "TEMEX", recently offered by the German Bundespost, to supply emergency call services for the elderly. The multifunctional security technology, which can be used in this type of service (e.g. in combination with metering of energy consumption and tariff switching, home technology, danger signals) at reasonable prices has made this development possible.¹¹ However, these activities were initially limited to a short time span between 1987 and 1991. Moreover, security firms engaged in home alarm call services mainly limited their activities to offering welfare organizations the use of their existing alarm stations subsidiary or overflow stations for emergency calls from the old or handicapped.¹²

¹¹ Zoche, P. und D. Saage: Begleitforschung zu den TEMEX-Betriebsversuchen der Deutschen Bundespost. Fraunhofer-ISI: Karlsruhe 1989

¹² Finnberg, E.: "Wach- und Sicherheitsunternehmen hoffen auf TEMEX". In: TEMEX-INFO. Informationsschrift zu den TEMEX-Betriebsversuchen der Deutschen Bundespost. Fraunhofer-ISI: Karlsruhe 1988

According to the ISI survey of summer 1988 mentioned above, the number of emergency home call service operators at that time was c. 100; the number of users at the beginning of 1988 was estimated by the Bundesarbeitsgemeinschaft Haus-Notruf-Dienst as at least 13,000.

In the survey sample ISI investigated between 40 and 370 persons per operational HQ (average 169 persons) and found that it is clearly the elderly who form the biggest user group, before the ill or the handicapped.

More than four fifths of the emergency call system users are women. Most are drawing pensions or annuities; the proportion receiving social assistance varies from 1 % to 40 %, depending on the service station. Nearly all stations have users who, without the emergency call system, would have to go into a hostel (estimated proportion between 20 % and 80 %). Many stations are also providing a service for old people who are already living in an old people's home or a nursing home. The share of these is between 1 % and 5 %. According to statements by service operators in 1988, a "large proportion" of the users are also receiving other social services (e.g. meals on wheels, care from social care centres and neighbourhood help). Since more than 70 % of alarm system users live alone, and adequate close family or neighbourhood care is often lacking¹³, the alarm system plays an important role by enabling the elderly to continue to live in their own households. According to service operators' assessments, the technology helps to maintain already existing contacts. This assessment is also found in a representative

¹³ The percentage of users in the ISI survey receiving help in their daily lives from friends and relatives is between 40 % and 90 %.

study carried out for the Deutsche Bundespost Telekom, in which 86 % of those questioned stated that they regarded emergency call services as a "meaningful alternative to living in a hostel". They thought it "not probable that the emergency call system could cause the elderly to become even more isolated. (...) Contacts with family are probably not affected by the presence of the emergency device. On the contrary, the possibility of remaining in their old surroundings makes it much easier to keep up contacts with neighbours than in a hostel."¹⁴

Acceptance of the social emergency call system by users is assessed by the service operators questioned as "generally high". All 16 operational HQs questioned mentioned initial mistrust of the technology by users. However, after a trial period of 8 - 10 days they could manage the equipment well and their assessment of the emergency call system was positive in every way. Criticisms and suggestions for improvement mainly regarded the emergency transmitter (not waterproof, too large, insufficiently shock-proof, not stylish enough).

Against this background, it is not surprising that the number of people using the private emergency call system has more than doubled since 1988. According to information from experts questioned by the author at the beginning of June 1993, it is thought that today between 30,000 and 40,000 people are connected up to an emergency call station. This figure covers only the old Federal Länder; in the new Federal Länder, according to information from the "Arbeitsgemeinschaft Haus-Notruf-Dienst", there are probably no equivalent services; moreover, the figure

¹⁴ Bergische Universität GH Wuppertal, Forschungsstelle Bürgerbeteiligung & Planungsverfahren (ed. and publ.): "Bürgergutachten ISDN", Wuppertal 1991, p.99ff.

given is only an estimate, as no systematic statistics of the private emergency call system or its users are recorded.

The largest operational HQ in Germany (Frankfurt am Main) services more than 1500 people; 400 to 800 users per station is quite a usual figure in urban areas. As the equipment costs have gone down over the last few years - user equipment costs between 1400 and 2000 DM - user costs have stayed the same relative to 1988, or have tended to decrease. The charge for users now is in the range of 32 DM to 100 DM; the operational costs are usually covered by a contribution of 58 DM. The systems do not usually receive subsidies (for instance from local authorities). It is legally impossible for health insurance systems to take over the costs. However, in an estimated one third of cases, the users' costs are taken over by social assistance.

5. Future prospects

Population development in the Federal Republic of Germany, and also the experiences and assessments of the service operators, indicate that in future the numbers of service stations and users in the private alarm call system can be expected to continue to develop positively.

As well as the primary applications, monitoring of patients and possibly remote medical care may become possible in the future through the inclusion of more sophisticated remote technologies.¹⁵ However, these systems will no longer primarily serve to activate a simple alarm, but will be concerned with the remote monitoring and possibly remote control of body functions. Thus, for instance, appropriate sensors may be implanted in a patient's body which continually measure his or her biological functions (e.g. body temperature, blood values, pulse etc.) and transmit them automatically to a hospital at certain time intervals, or whenever they show deviations from the norm; the data can be transmitted from the patient to the hospital via radio or an infra-red transmitter. In the other direction, too, the hospital computer may trigger certain activities in the patient's body (for instance releasing a medicinal substance, controlling a pacemaker). It is a definite technical possibility that these activities could be controlled by a programme, rather than having to be activated by a doctor in the hospital.

In the USA and the UK, experiments are being conducted at present in which remote monitoring is being used as an alternative to

¹⁵ On this cf. TEMEX-Info 2/1988, FhG-ISI: 1988

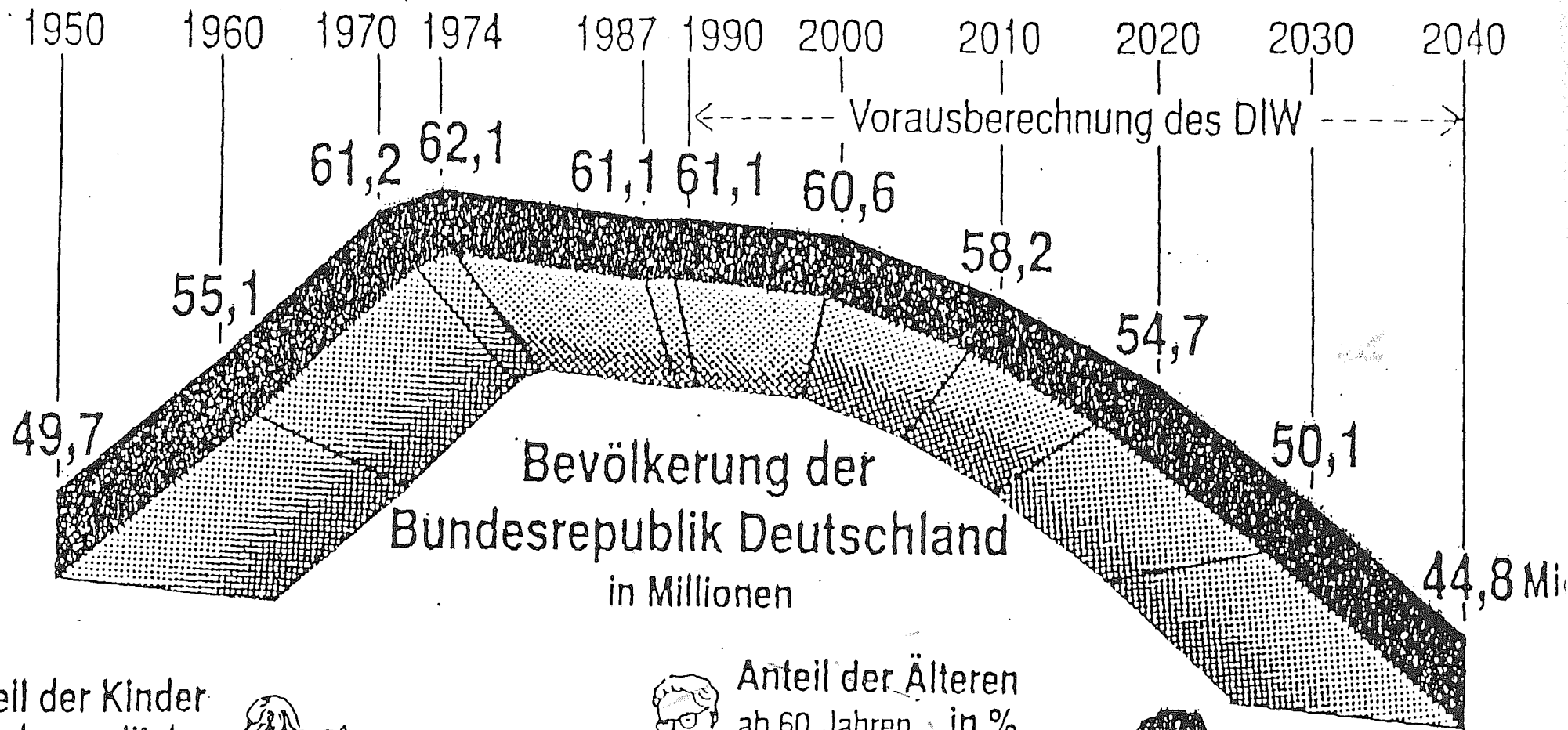
imprisonment for convicted criminals.¹⁶ Thus a delinquent can be kept virtually under house arrest by fixing to his body a transmitter which cannot be removed. This emits a signal which is picked up within a certain radius by a fixed receiver and transmitted to a central unit. If the "prisoner" moves outside the range of the receiver, the alarm is activated. This procedure allows individual penalties to be imposed and remotely monitored. Thoughts are even moving in the direction of implanting the transmitters in the prisoners' bodies, which would in principle allow biochemical measurements (e.g. alcohol level in the blood) to be made, for the purpose of monitoring other conditions imposed on the delinquent.¹⁷

The services provided for users of a private alarm call system by service operators could be made more personal in the future by including visual communication. Considering the fact that many of the alarm calls reaching the service stations do not arise from acute emergencies but rather from the user's wish to speak to his or her fellow men, visual communication could represent an as yet unexploited means of supporting the formation of more intensive communication relationships, thus supporting social integration of the elderly, the handicapped and the infirm into a wider community, and securing the independence and dignity of the users of alarm call systems.

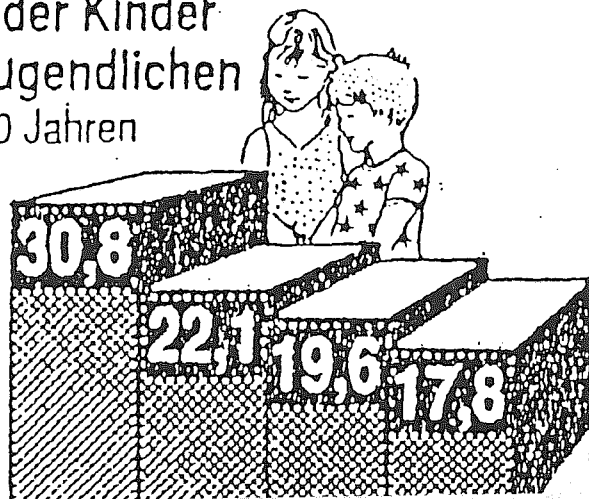
¹⁶ "Alarm beim Empfänger", in: DER SPIEGEL 31/1989 and "Heikler Test des "elektronischen Hausarrests"", in: Frankfurter Rundschau, August 19 1989

¹⁷ Schrempf, M.; H.-J. Albrecht with the collaboration of P. Zoche and D. Saage: "Gutachten zu Fragen des Datenschutzes von TEMEX". FhG-ISI: Karlsruhe 1989

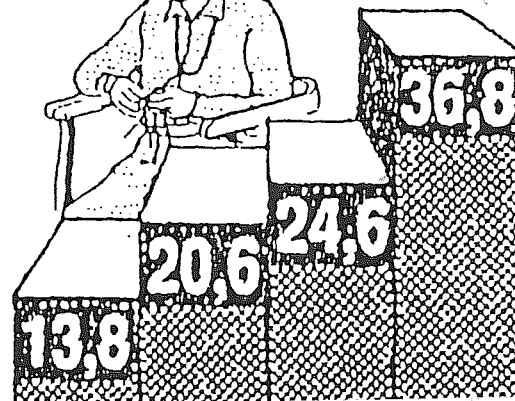
Deutsche Lebenskurve sinkt



Anteil der Kinder und Jugendlichen unter 20 Jahren in %



Anteil der Älteren ab 60 Jahren in %



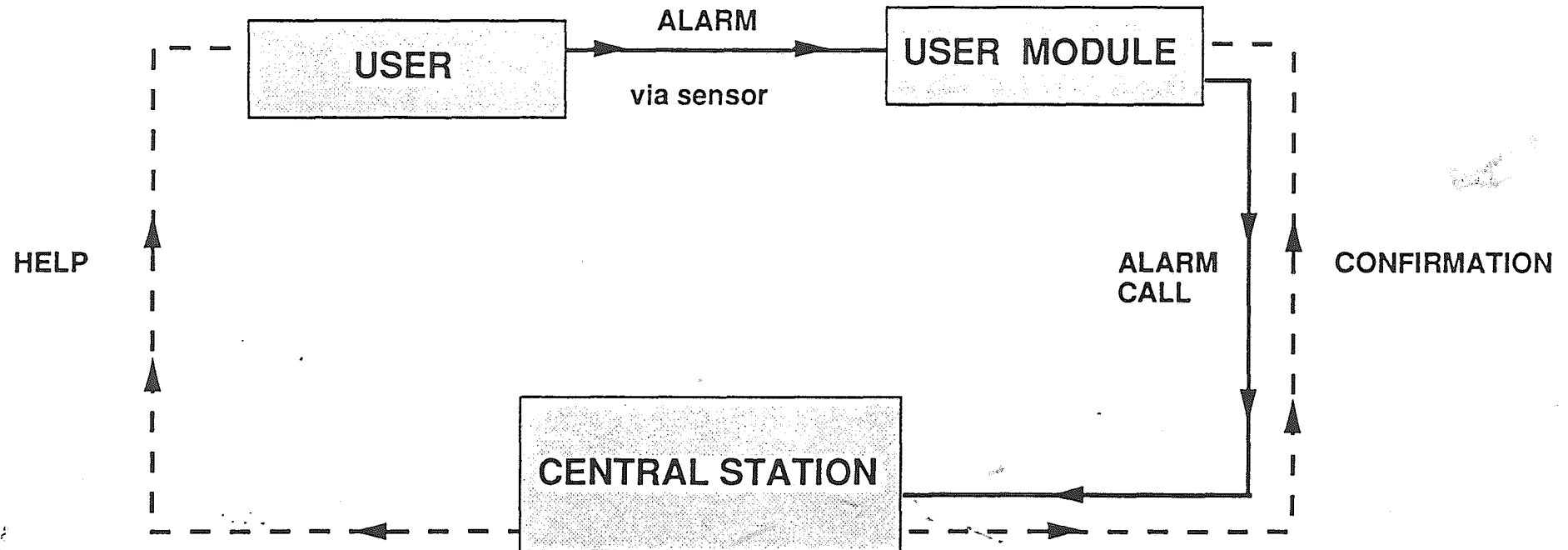
Anteil der Ausländer in %



FUNCTIONAL DIAGRAM OF PRIVATE ALARM SYSTEM AND USER REQUIREMENTS

Most important requirements for house system:

1. Simple and easy to use
2. Equipment reliable and safe
3. Sensor easily portable



Most important requirements for central system:

1. Two-way communication
2. Data protection
3. Fast reaction