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(54) VIBRATION DETECTING TRANSDUCER INTEGRATED WITH A NETWORK TRANSFER FUNCTION

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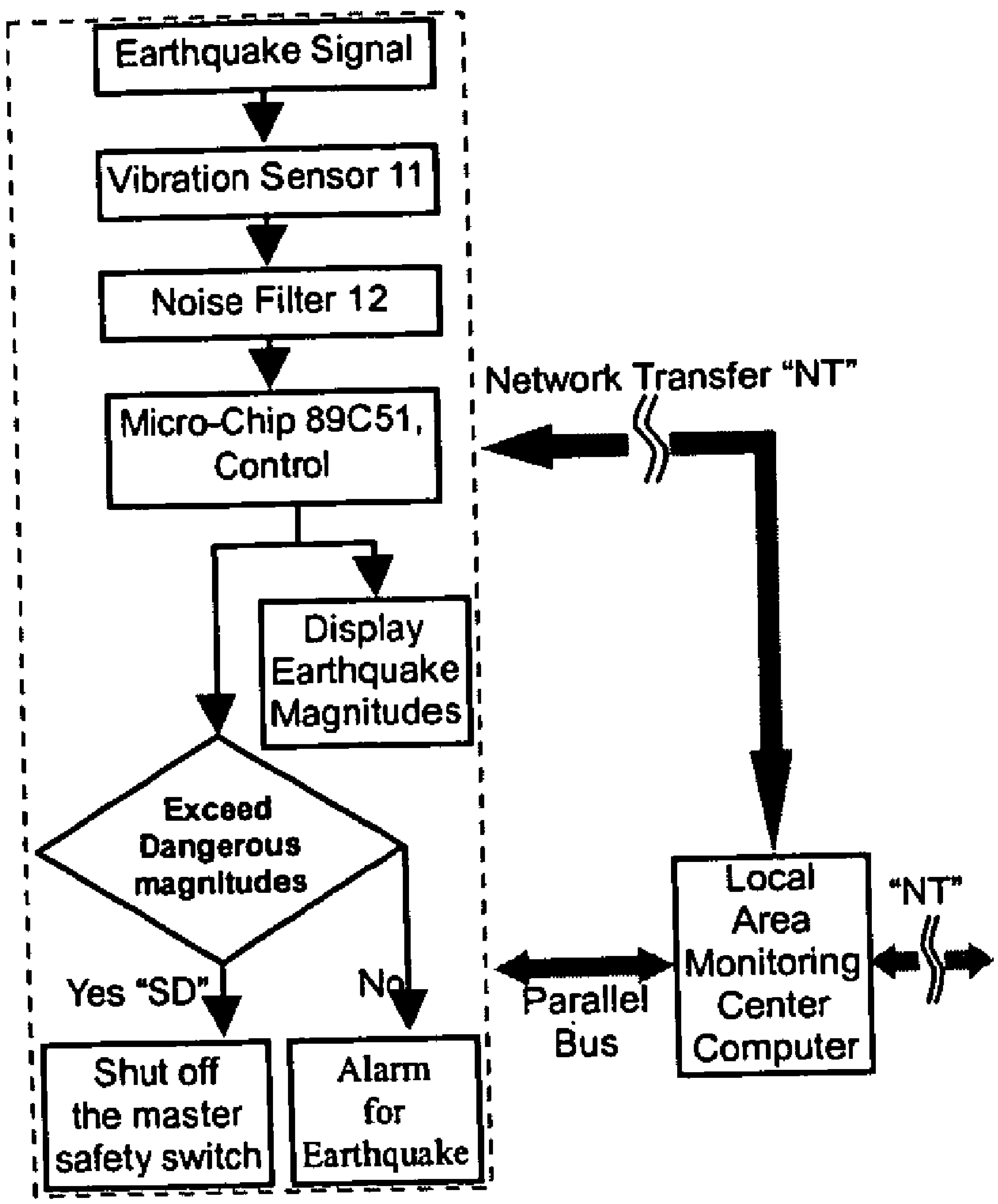
(57) ABSTRACT

The present invention discloses an earthquake detection control system, comprising: a detection device, having a plurality of vibration sensors and a microprocessor, the detection device uses the ON/OFF states of the vibration sensors to detect the occurrence of earthquake and uses the microprocessor to calculate the number of the ON/OFF states so as to obtain vibration data; a central monitor computer **2** for receiving, analyzing and judging the vibration data and outputting an output signal representing earthquake intensity; and a control device **3** for generating a control signal according to the output signal so as to perform a predetermined control action.



Block Diagram of the "NT&SD Transducer"

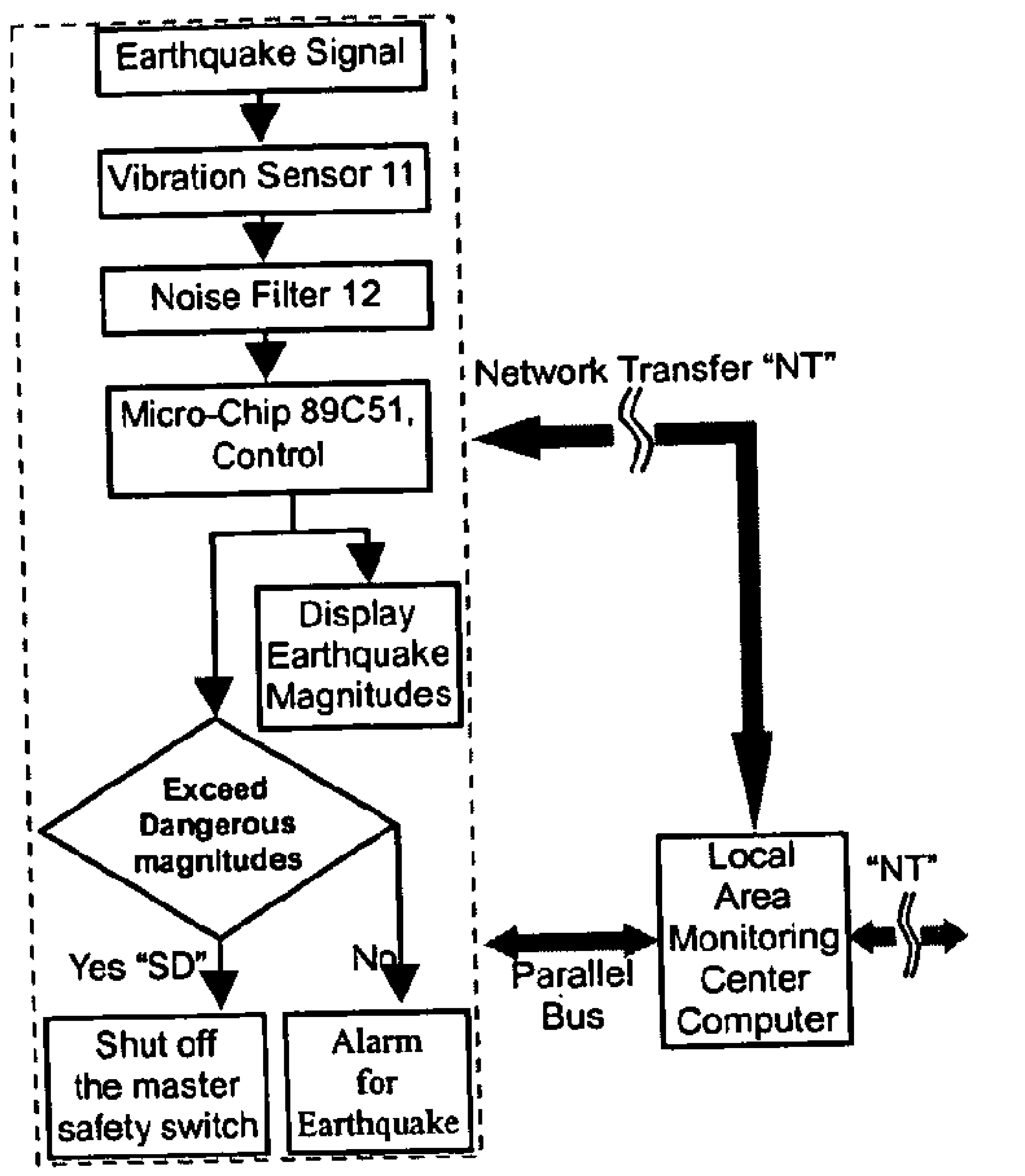


Fig. 1、Block Diagram of the "NT&SD Transducer"

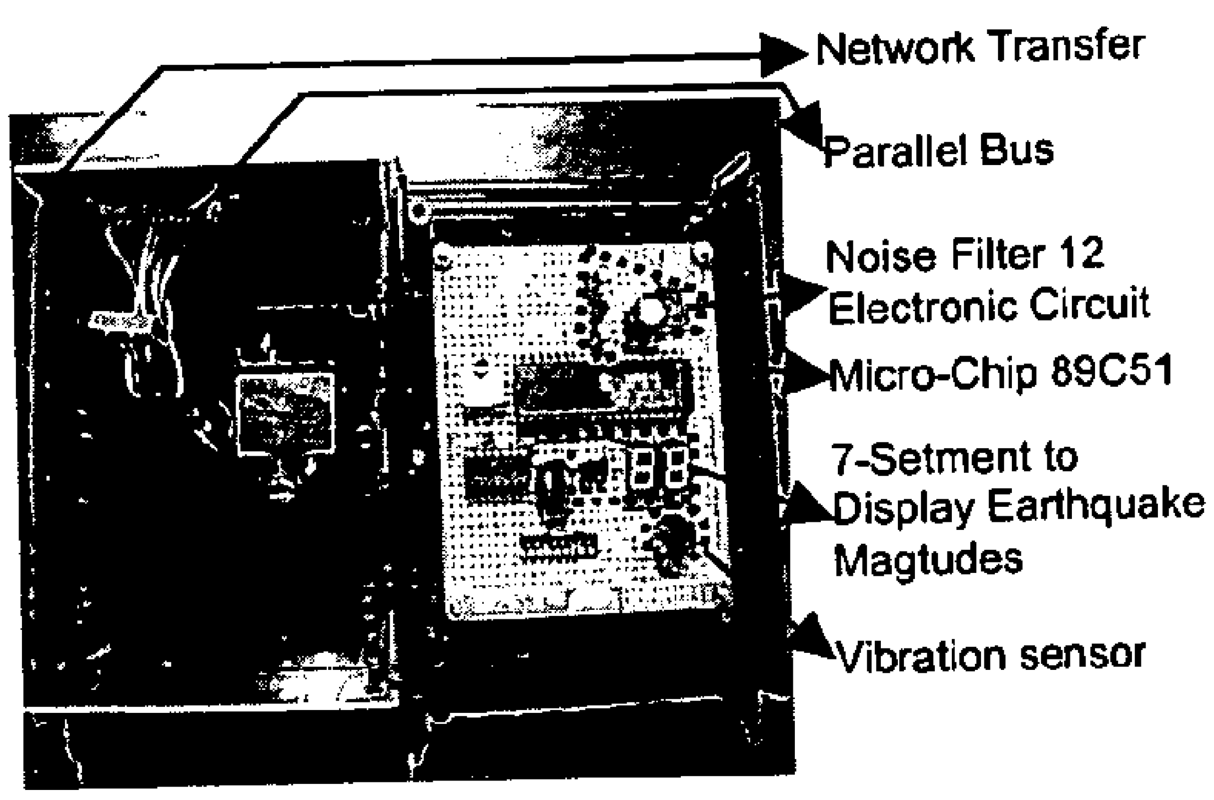


Fig.2、Internal Hardware Structure of the "NT&SD Transducer"

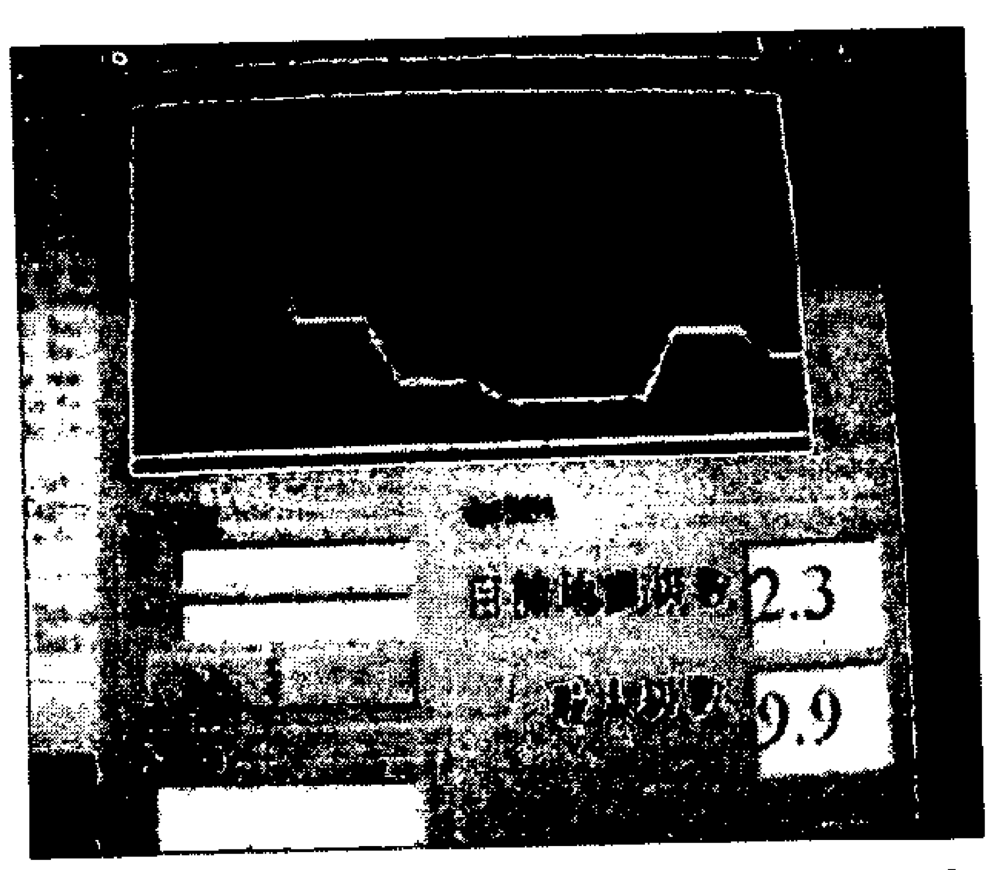


Fig.3、Central Monitoring Center Display of Earthquake waveform and magnitudes

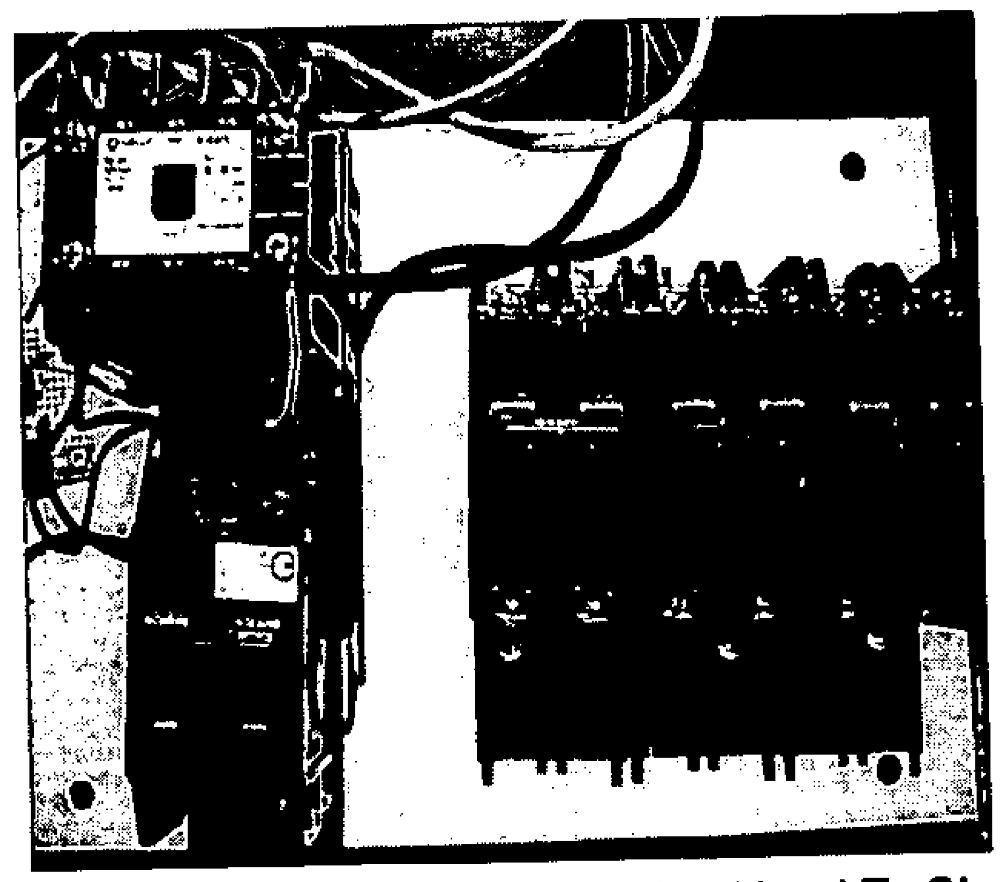


Fig.4、An Electric Relay Device Used To Shut Off The Master Safety Switch of power

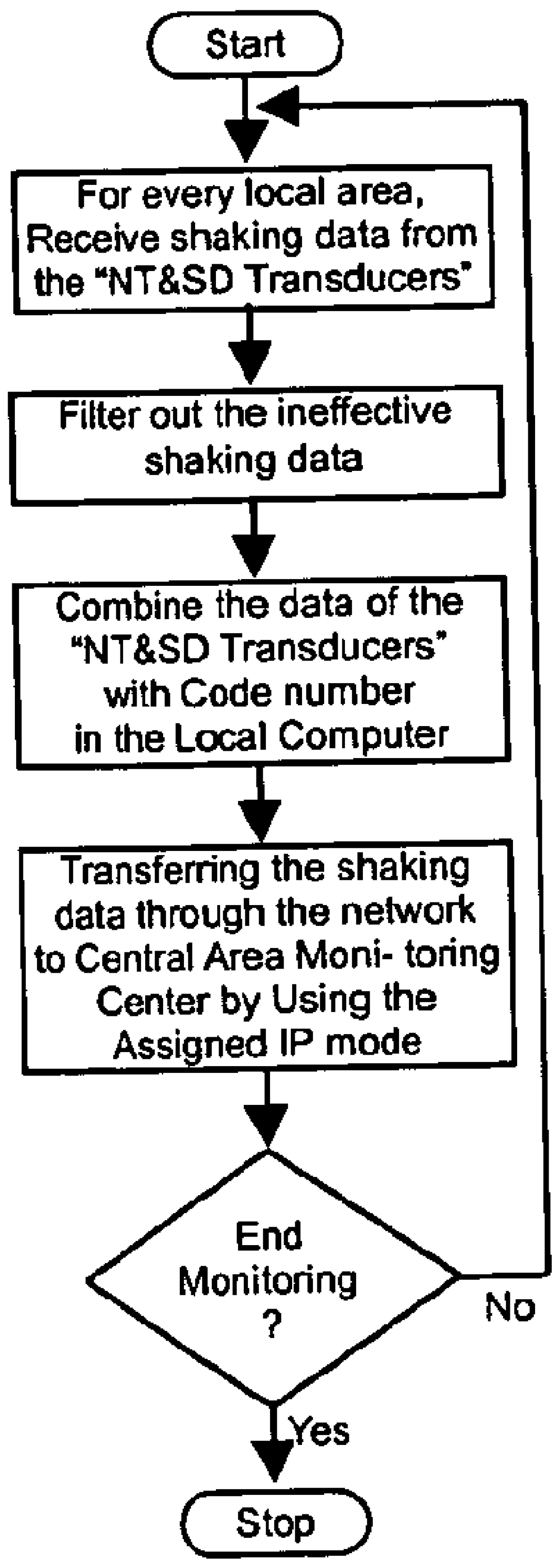


Fig.5、The Flowchart of the real time Local Area Data Processing Program

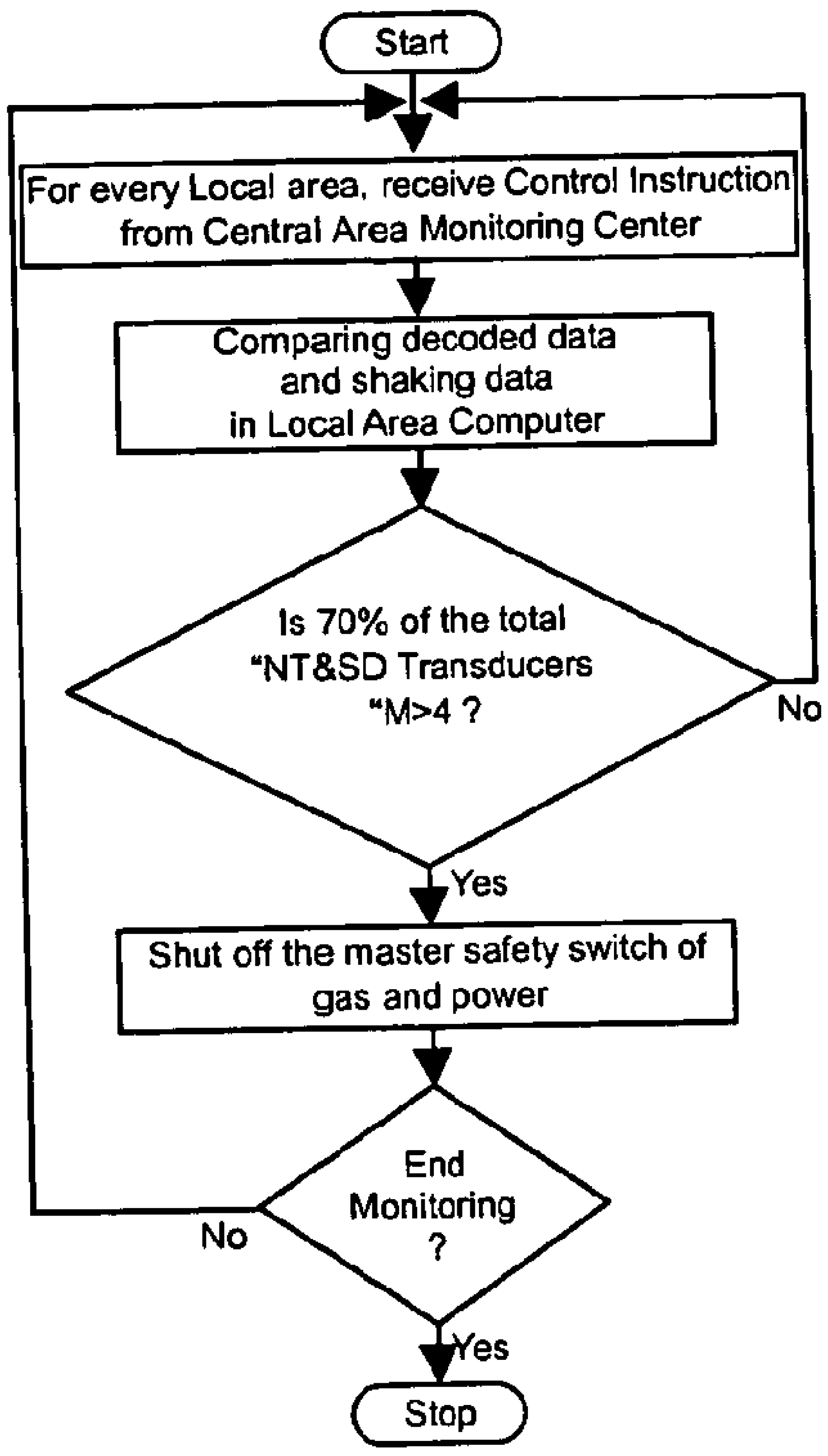


Fig.6、The Flowchart of the real time Local Area Control Instruction Executing Program

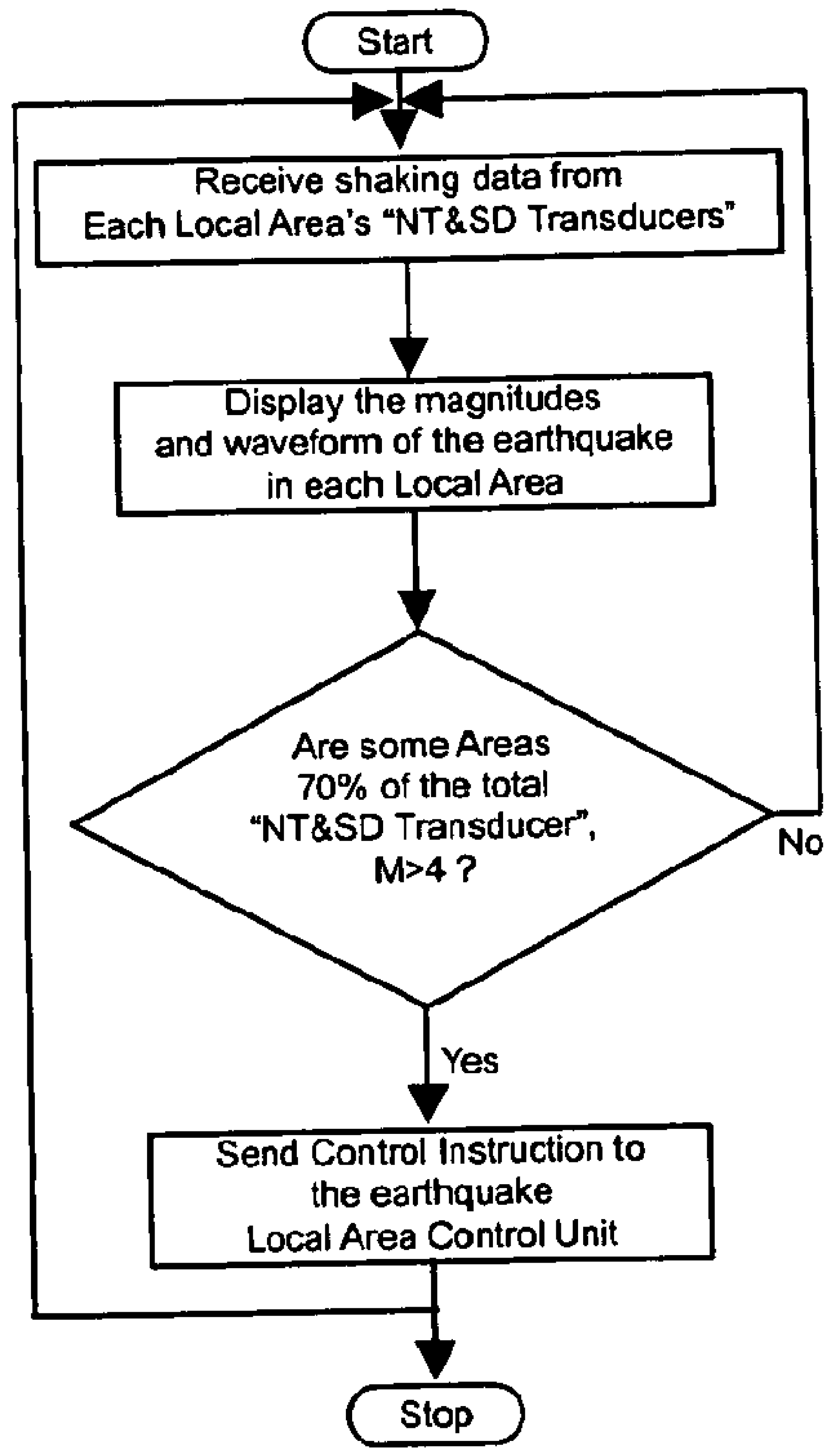


Fig.7、The Flowchart of the real time Central Area Monitoring Center Data Processing & Control Instruction Program

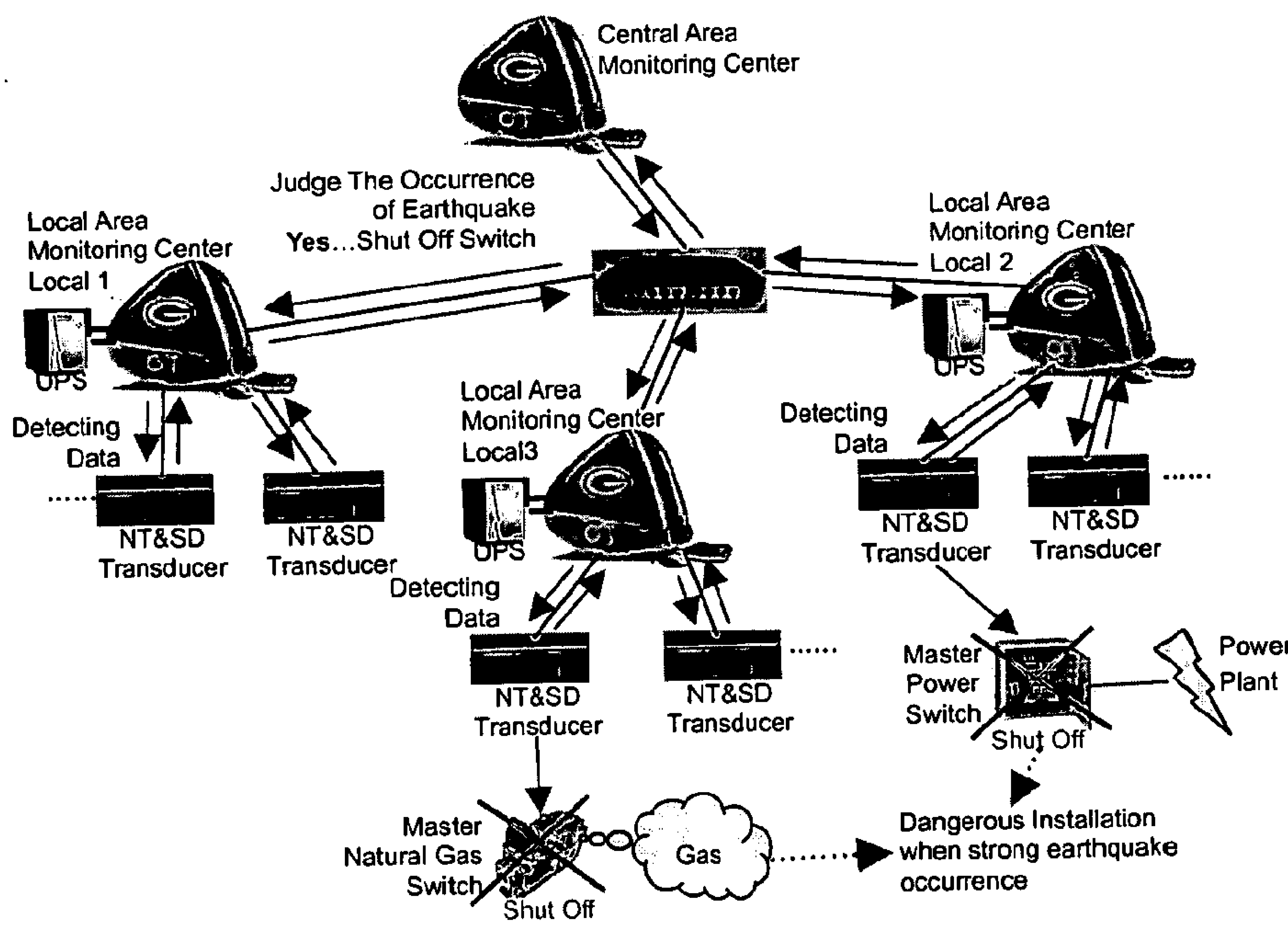


Fig.8、The "NT&SD Transducer" Used in the Danger Eliminated Monitoring System in a Distributed Area

VIBRATION DETECTING TRANSDUCER INTEGRATED WITH A NETWORK TRANSFER FUNCTION

BACKGROUND OF THE INVENTION

[**0001**] 1. Field of the Invention

[**0002**] The invention relates to an earthquake detection control system, and in particular to an intelligent earthquake detection control system, using an intelligent control method to complete the manufacture of an earthquake detector. First, a feedback control technique is used to sense the magnitude of vibration strength by a sensor, and then the sensed magnitude is transmitted to a central monitor center. After the central monitor center judge magnitude and hypocenter, a precaution action is taken and sent to local computers through a local area network. After that, before the seismic waves arrive, the local computers shut off immediately some important instruments (such as gas switches and main power switches) of dangerous installations which may cause a second disaster. When the earthquake occurs, an appropriate action is taken so as to attain the purpose of distributed control.

[**0003**] 2. Description of the Related Art

[**0004**] Even in the high-technique age, earthquake is one of the natural disasters that can't be predicted or forbidden. The area of Pacific Ocean comprising western US, Japan and Taiwan belongs to the area where earthquake frequently occurs and some of them are very strong. According to the detecting data of the past ninety years collected by the Central Weather Center, there is an average number of 2200 times of earthquake occurred in Taiwan each year, wherein most of them can't be felt by human, 214 times can be felt and almost one dangerous earthquake brings disaster.

[**0005**] Even the earthquake may not bring direct harm to the human and animals, the building may be destroyed as to hurt other people and animals after serious shaking, and thus the status of damage would be very serious.

[**0006**] While serious earthquake or after serious earthquake, at least one of the following damages may occur: The breakdown of the buildings, especially the public buildings, like theaters, schools, hospitals, markets and crowded area where many people get hurt or die; The collapse of the dam, the breakdown of the reservoir; and the route change of the river; The breakdown of the house, it turns that the gas, oil and oven may cause fire accident; The breakdown of the highway and bridge, the road may turns up or turns down, it may cause traffic jam that may delay the fire engine and the ambulance; it expands the crisis of the earthquake; and As to nuclear plant, it makes the radioactive material spread out. Additionally, it also damages the electric power plant and causes fire. In another aspect, it also damages the natural gas plants and makes the gas spread out. To sum up, these dangerous installations cause 'the second disaster'.

[**0007**] Some published papers concern earthquake detection and the warning after earthquake occurs, i.e., the paper of Paolo Gamba and Casciati et al., "GIS and image understanding for near-real time earthquake damage assessment" (*Photogram metric Engineering & Remote Sensing*, Vol. 64, No. 10, pp. 987-994, 1998); the paper of M. Matsuoka and F. Yamazaki et al., "Use of interfero metric satellite SAR for earthquake damage detection" (*Proc.* 6th *International Conference on Seismic Zonation, EERI*, CD-ROM, 2000); and that of Yu Moroz, "On the Technique for tracking bried precursors of strong earthquake in the low-frequency telluric field of Kamachatka," (*Phys, Sold Earth* (*Eng. Transl.*), Vol. 30, pp. 830-832,1995), however, few of these papers concern vibration detection device and real time earthquake detection control system; however, the focus of these papers' attention still is the detection of earthquake and some warning instruction thereof.

[**0008**] Jiro Chiba has proposed one method to measure earthquake magnitudes. As his paper, "Sensor for Gravitational Field and It's Application To Measure Against Large Earthquake Disasters" (Proceedings: *Institute of Electrical and electronics Engineers* 28*th Annual International Carnahan Conference* on, 12-14, 1994), where is a theory that applies the Gravitational Field to use the Michelson interferometer to measure earthquake magnitudes, however, it doesn't teach how people should adapt the immediate responding methods after earthquake occurrence. Besides, in the paper of Kou Takubo, Takashi Yanada, et al., "Innovative Spectral Intensity Transducer Using Three-Axial Micro Machine Accelerometer For Earthquake Crisis Management" (*Emerging Technologies and Factory Automation, Proceedings. ETFA* '99. 1999 7*th IEEE International Conference on*, vol. 1, pp. 379-384, 1997), a new generation Spectrum Intensity (SI) transducer has been developed by utilizing micromachining three-axial accelerometer and a newly developed SI calculation algorithm for the earthquake damage detection. This is a precisely seism scope limited to detection function, but it doesn't disclose the real time algorithm for processing methods. While the strong earthquake occurs, the seismic center spreads out the earthquake waveform, it moves toward the four directions at the speed of 7 km/sec. If the master safety switch of the high dangerous installations, such as nuclear power plant and natural gas plant can be cut off immediately before the seismic waves arrive and the disaster resulted from earthquake would be reduced.

SUMMARY OF THE INVENTION

[**0009**] The object of this invention is to design a vibration detecting transducer with network transfer and shut-off dangerous installation switch function (NT&SD Transducer) . It is not to predict the time of earthquake or to analyze the reasons of earthquake occurrence. According to this invention, a detection device as "NT&SD Transducer" is provided. While the earthquake occurs, the main control center will focus on the dangerous installations, such as natural gas plant and power plant, which may cause the secondary disaster, if they are shut down immediately before the seismic waves arrive, people will be protected from those equipments and the secondary disaster can be reduced.

A BRIEF DESCRIPTION OF THE DRAWINGS

[**0010**] **FIG. 1** is a block diagram of the "NT&SD Transducer";

[**0011**] **FIG. 2** is an internal hardware structure of the "NT&SD Transducer";

[**0012**] **FIG. 3** shows earthquake waveform and magnitudes from the Central Monitoring Center Display;

[**0013**] **FIG. 4** shows an electric relay device used to shut off the master safety switch of power;

[0014] **FIG. 5** is the flowchart of the Real Time Local Area Data Processing Program;

[0015] **FIG. 6** is the flowchart of the Real Time Local Area Control Instruction Executing Program;

[0016] **FIG. 7** is the flowchart of the Real Time Central Area Monitoring Center Data Processing & Control Instruction Program;

[0017] **FIG. 8** is the "NT&SD Transducer" used in the Danger Eliminated Monitoring System in a Distributed Area.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The technology of so-called "NT&SD Transducer" according to this invention is described based on the design concept of vibration detection device which is: while the magnitude of the strong earthquake reaches 7 (M=7), the earthquake wave moves to the four directions at the speed of 7 km/sec. Exactly, the speed of the network transfer is about 400 times over the seismic waves, if the network transfer method is applied to shut off the master safety switch of dangerous installations before the seismic waves arrive while the strong earthquake occurs, the degree of disaster will be decreased. That is, the purpose of the "NT&SD Transducer" is to adapt required methods before the seismic waves destroy the dangerous installations.

[0019] The "NT&SD Transducer" essentially comprises following functions including Detection of shaking degree, Network Transfer (NT) and Shut-Off Dangerous Installation (SD).Besides, details related to "NT&SD Transducer" includes (1) the design rule analysis (2) the production method ; (3) the calibration of the "NT&SD Transducer" and ; (4) the corresponding real time algorithm of the "NT&SD Transducer" in Local and Central Area Monitoring Center will be described as follows:

[0020] 1. The Design Rule Analysis

[0021] The "NT&SD Transducer" uses the vibration sensor to detect the occurrence of the shaking. The characteristic of the vibration sensor is: while the shaking sensor stands stationary, the resistance of the vibration sensor is infinite, then it is at the OFF status; while the "NT&SD Transducer" is suffered by the external power, it reaches at the status of centrifugal force, the plane surface slants, the characteristic of the resistance of the vibration sensor has been changed to 0, then it is at the "ON" status. While the external power disappears, the vibration sensor turns back to the 'OFF' status. And the data of the shaking will be analyzed through the micro chip 89C51 in reference to Ayala (1997), "The 8051 Microcontroller: Architecture, Programming and Applications" and Kleitz (2000), "Digital & Microprocessor Fundamentals Theory & Application"; then judge the level of the shaking; through the detecting of 89C51 and the calculation of the occurrence times of 'ON', 'OFF'. Therefore the magnitude of the earthquake can be decided. Through the network, the "shaking data" can be transferred, detected by the "NT&SD Transducer" to the PC computers of the Local Area Monitoring Center. the detected "shaking data" can also be transferred by the parallel bus, then the data reaches the 8255 interface card **21** in reference to Brain (1995), "Visual C++2 Developing Professional Applications in Window 95 & NT Using MFC", then transfer to the PC Computer of the Local Area Monitoring Center finally. The Local Area Monitoring Center collected all the shaking data of the "NT&SD Transducer", then through the TCP/IP communication protocol in reference to Feit (1993), "TCP/IP Architecture Protocols & Implementation", the data transfers to the Central Area Monitoring Center.

[0022] The Central Area Monitoring Center will judge whether it is the earthquake or not. At the meantime, the Central Area Monitoring Center will judge if the earthquake magnitude exceeds the dangerous status. If the reliability of the earthquake is ensured, the Control Instruction will be sent out immediately. The UPS will be turned on. Furthermore, by using of the TCP/IP protocol, the Control Instruction will be transferred to the Local Area Monitoring Center. The Local Area Monitoring Center will execute the mission to shut off the master safety switch of the dangerous installation finally.

2. The Production Method

[0023] The block diagram of the "NT&SD Transducer" and the internal hardware structure are shown in **FIG. 1** and **FIG. 2** respectively. There are three key functions of the "NT&SD Transducer": one is the real time Detecting Unit; the other is the real time Data Transfer Unit; and another is the real time Control Unit.

2.1 The Real Time Detecting Unit:

[0024] First, a filter is designed which can filter out the noise of the external shaking signals while the earthquake waveform signals enter the "NT&SD Transducer". Then the shaking degree of the rest of the signals will be going through the micro-chip 89C51 analysis.

2.2 The Real Time Data Transfer Unit

[0025] The "NT&SD Transducer" has two ways to transfer the detected shaking data to the Local Area Monitoring Center computer, one is using the Ethernet Wire Network Transfer, and the other is using the Parallel Bus and the 8255 interface card **21** of the Local Area Monitoring Center computer.

2.3 The Real Time Control Unit:

[0026] The Central Monitoring Center can detect the transferred shaking signal analysis, and judge the shaking magnitude and the shaking source, as **FIG. 3**. If there are 70% of the "NT&SD Transducer" in the Local Area has detected the magnitude exceeds the safety range, a Control Instruction will be sent to the Local Area Monitoring Center. The Local Area Monitoring Computer will execute the "SD" action through the "NT&SD Transducer" and shut down the master safety switch of the dangerous equipment that could reflect the secondary disaster easily, such as the power plant and the natural gas plant. In **FIG. 4**, an Electric Relay Device is designed to shut off the master safety switch of power.

3. The "NT&SD Transducer" Calibration

[0027] In order to forbid bringing people the damages of economics and the inconvenience of life by executing incorrect "SD" action of the incorrect earthquake magnitudes detected by the "NT&SD Transducer", the most important part is to establish the calibration table prior to actually applying the "NT&SD Transducer". The distinction of the magnitudes of the earthquake is based on the ON-OFF times of the vibration sensor that is detected by the inner "micro-chip" of the "NT&SD Transducer". During the same period of time, if the ON-OFF times of the vibration sensor are higher, then the magnitudes of the earthquake is stronger, and vice versa.

[0028] The "NT&SD Transducer" calibration table which is the results of some specific vibration experiments, i.e., in Taiwan, there is a "Building Vibration Damage Center" where provides a vibration platform in the laboratory thereof. Some experiments capable of simulating the 1 to 7 magnitude's earthquake vibration of the real earthquake are carried out in the laboratory, and the appropriate materials and building structure could be found out and designed as to support the building to against the strong earthquake. Various times of rehearsal experiments are made to establish the calibration table of the relation between the ON-OFF times of the vibration sensor and the magnitudes of the simulated earthquake.

3.1 The Experiment of the "NT&SD Transducer" that Owns One Vibration Sensor.

[0029] To implement the test of the "NT&SD Transducer" that owns one vibration sensor located on the vibration platform in the laboratory, the vibration platform will simulate to occurred earthquake magnitude M=1~7. The micro-chip inside the "NT&SD Transducer" records the data of the total ON-OFF times of the vibration sensor every 5 seconds. If there are 10 intervals, the total time is 50 seconds. The experiment for 1000 tests is implemented repeatedly. The average value of the 1000 tests is shown in Table 1.

3.2 The Experiment of the "NT&SD Transducer" That Owns Eight Vibration Sensors.

[0030] In Table 1, the "NT&SD Transducer" that owned one vibration sensor are tested. But, in order to increase the accuracy of the detection, vibration sensors are installed on the front side and the reverse side of the four corners. There are eight vibration sensors in the "NT&SD Transducer" now. The electric circuit becomes more complicated than before. The detection and calculation of the micro-chip inside the "NT&SD Transducer" becomes more difficult than before, too. But the result becomes more precise. The "NT&SD Transducer" that contains eight vibration sensors are put on the vibration platform in the laboratory. Then, the vibration platform occurred the earthquake magnitudes M=1~7. The micro-chip inside the "NT&SD Transducer" records the data of the total ON-OFF times of the eight vibration sensors every 5 seconds. There are 10 intervals and the total time is 50 seconds. The experiment for 1000 tests is implemented repeatedly. The average value corresponding to the total ON-OFF times and the earthquake magnitudes of the 1000 tests are shown in Table. 2. Remark 1: After establish the "NT&SD Transducer" calibration table, the result is obtained from the vibration experiments, the table of the total ON-OFF times that are correspondent to the magnitudes of the simulated actual earthquake is set in the computers of the Central Area Monitoring Center. Once the earthquake occurred, the data detected by the "NT&SD Transducer" can be analyzed and compared by the Central Area Monitoring Center. Then the Central Area Monitoring Center can implement appropriate mission. Remark 2: According to this invention, it is not necessary to discuss the quantity amount of the vibration sensors owned in a single "NT&SD Transducer" that would increase the correctness of the magnitude of the earthquake detection. But without loss of generality, the more quantity amount of the vibration sensors owned in the "NT&SD Transducer", the higher correctness of the magnitude of the earthquake detection. But the cost of the "NT&SD Transducer" increases a lot, too.

3.3 Comparing With Traditional Seismometer Equipment

[0031] The traditional earthquake seismometers use the electronic moving roller to record the time and the magnitudes of the earthquake. It is necessary to change the recording paper battery and ink after a period of time. This traditional seismometer needs to be adjusted and maintained regularly, it is very inconvenient for the user. Today, the electronic self-recording earthquake detecting equipment is adapted widely, but the price and the usage procedure bothers the users more, too. Therefore, the electronic self-recording earthquake detecting equipment is used a lot in the research unit and college related departments.

[0032] The "NT&SD Transducer" according to this design will keep monitoring while earthquake occurs. And the data would be stored in the computer automatically. The system according to this design could add extra totally automatic recording attachments. These would be stored in the hardware or CD (MO) continuously. And the data stored in the computer could be printed out for an extra back-up.

4. The Real Time Algorithm of the Distributed Area Control System

[0033] The real time Algorithm of Local Area Data Processing Unit, Local Area Control Instruction Executing Unit, Central Area Monitoring Center Data Processing & Control Instruction Unit are presented as follows:

4.1 Local Area Data Processing Unit

[0034] For every local area, it receives the transferred shaking data from all the "NT&SD Transducer" those are connected with the Local Area. Then, it filters out the useless data (Communication Transferring Mistake and Vibrate Sensor Out of work). Then, it assigns the number and records the time and place of each shaking data. Then, it transfers back to the Central Area Monitoring Center through the network wire. As shown in **FIG. 5** is the Flowchart of the real time Local Area Data Processing Program.

4.2 Local Area Control Instruction Executing Unit

[0035] While receiving the "Control Instruction" from the Central Area Monitoring Center, Local Area Control Center decodes the data. The Re-check Action is made (comparing the total shaking data of all the "NT&SD Transducer" in the Local Area Monitor Center computer, then. After that, it judges if the average earthquake magnitude is greater than 4 (Mav>4) of 70% "NT&SD Transducers" in the Local Area. If it does, it shuts off the master safety switch of the dangerous installation. As shown in **FIG. 6** is the Flowchart of the real time Local Area Control Instruction Executing Program.

4.3 Central Area Monitoring Center Data Processing & Control Instruction Unit

[0036] To receive all the shaking data from the "NT&SD Transducers" that is connected to all the Local Area. After that, it decodes the transferred shaking data and displays the earthquake magnitudes and the earthquake waveform of each Local Area, at the same time. It also judges if 70% of all the "NT&SD Transducers" that detected the average earthquake magnitude is greater than 4. If it does greater than 4 (Mav>4), it executes shut off program. The Central Area Monitoring Center computer will send the Control Instruction to shut off the master safety switch of the dangerous installation in those earthquake Local Areas. As shown in **FIG. 7** is the Flowchart of the real time Central Monitoring Center Data Processing & Control Instruction Program

Embodiment

[0037] The present system of "NT&SD Transducer" is simulated by some examples, however, the concepts and claims of the present invention are not limited thereto.

[0038] The "NT & SD Transducer" (owned 8 vibration sensors) is applied in two fields: (1) the danger eliminated monitoring system in a distributed area ; (2) the danger eliminated monitoring system in a building. The detail system description and simulation test results are listed in the following:

1 The Danger Eliminated Monitoring System in a Distributed Area

1.1 System Description

[0039] The first application is focused on the disaster forbidden plans of the power and gas supply plant in each local area. The application example of the danger eliminated monitoring system in a distributed area is shown in **FIG. 8**. It is well known that generally, there are "power supply plant" and "natural gas supply plant" in each local area (ex, Area or town power supply plant, natural gas supply plant). These supply plants are in charge of the resource of the "power and natural gas" in this area. In **FIG. 8**, there are three distributed Local Area Monitoring Centers and one Central Area Monitoring Center. Each local area owns sufficient "NT&SD Transducers", those are distributed in this area equally. In order to forbid the natural damage occurrence, the monitoring center of each area owns its UPS system while power is shut off. The distance between any two Local Area Monitoring Centers is about 350 km. The Central Area Monitoring Center is located in the center of three Local Areas. The distance between Central Area Monitoring Center and each Local Area Monitoring Center is about 200 km. The shaking data detected by all of the "NT&SD Transducers" in each area will be collected by each Local Area Monitoring Center computer. The data collected in each local area will be transferred to the Central Monitoring Center computer.

1.2 Simulation

[0040] According to this invention, four Pentium-IV computers are used to simulate the three Local Area Monitoring Centers and one Central Area Monitoring Center. The four computers were located at four different places; the distance among these computers are the same described in Sec.1.1 (System Description) . There are 10 "NT&SD Transducers" connected to each Local Area Monitoring Center Computer through network-wire. The average distance between these ten "NT&SD Transducers" and Local Area monitoring Center is 70 km. The Local Area Monitoring Centers of the three computers are connected to the Central Area Monitoring Center computer through the network wire. The "Local Area Data Processing Program" & the "Local Area Control Instruction Executing Program" are installed in each Local Area Monitoring Center computer. The flowcharts are in **FIG. 5** & **FIG. 6**, respectively. The "Central Monitoring Center Data Processing & Control Instruction Program" are installed in the Central Area Monitoring Center computer. The flowchart is in **FIG. 7**. In Area 2, a simulation is hold to set up an Electric Relay Device to shut off the master Safety Switch of power. The device is shown in **FIG. 4**.

[0041] An earthquake occurrence simulation is hold in Local area **3** (after the vibration of these 10 "NT&SD Transducers"), the distance from the Seismic Center to the Center of Local area **3** is about 70 km, the average simulated earthquake magnitude M3=5.2 (reported by computer). The seismic waves move to the four directions at the speed of 7 km/sec. The seismic waves will reach the Center of Local Area **3** within 10 seconds (by calculated 70/7=10 second). Due to the farther distance from the center of Local area **2** and Local area **1**, the seismic waves will reach to Local area **2** and Local area **1** after 1 minute (The distance between the seismic center and Local **1** & Local **2** are about 420 km). The earthquake magnitude of Local Area **2** and **1** will be decreased to about M2=4.2 and M1=4.4. At this time, the earthquake waveform data collected in each Local Area Monitoring Center will be transferred to the Central Area Monitoring Center at the speed of 400 times more than seismic waves. The collected data were judged and analyzed by the Central Area Monitoring Center computer. The computer records were stored. The control instructions were delivered to the Local area **1**, **2**, **3** within 0.168 seconds (reported by computer). Based on the earthquake magnitude at each area, the Central Area Monitoring Center will adapt different alternatives. These will reach the objective of the distribution control. The "master safety switch of the power plant" and the "master safety switch of the natural gas plant" were shut off under the instructions right before the seismic waves arrived. At the mean time, the Central Area Monitoring Center sends out the required control instructions. These instructions will execute the required methods in the area where the dangerous earthquake occurred (for example, temporally shut off the operation of the nuclear power plant and temporally cease the high-speed train). It will forbid the second disaster of the earthquake occurrence before the seismic waves arrive.

2. The Danger Eliminated Monitoring System in Building

2.1 System Description

[0042] The second application is focused in the building dangerous eliminated monitoring system. It is well known that generally, each building has a master safety switch of power and a master safety switch of natural gas, suppose there is a ten-floor building, the master safety switch of the "natural gas" and the "power" is installed in the basement of the building. The Central Control Center is located in the basement. The Central Control Center has two functions: the first one is to receive, judge and analyze the earthquake waveform transferred by the "NT&SD Transducers" of the whole building, the second one is the appropriate arrangements should be made while necessary; if the transferred data appeared that the earthquake is dangerous, the "power" and "natural gas" those dangerous installation may create secondary disaster will be shut off. The "NT&SD Transducers" are installed into the walls of the four sides of the building. Each "NT&SD Transducer" is connected to the Central Control Center through the network wire. Remark 3: The reason why the "NT&SD Transducer" is not installed in the floor or in the ceiling is to forbid collecting the ineffective data. Such as the vibration of the walking and doing exercise.

2.2 Simulation

[**0043**] A diorama of ten-floor building is built as a simulation environment. One Pentium-IV Computer is used to simulate the Central Control Center in the basement of the building. An electric relay device (shown in **FIG. 4**) is set up to connect with the computer to implement the simulation on the process of shutting off the master switch of power. There are four "NT&SD Transducers" installed into the wall in each floor, the total amount are 40 "NT&SD Transducers". The appropriate program presented in Section 4 (The Real time Algorithm of the Distributed Area Control System) in the Central Control Center Computer is also set up. In the building, the shaking data detected by each "NT&SD Transducers" will be transferred to the Central Control Center via network. While the computer of the Central Control Center is on, the self-test of the connection function between the computer and all the "NT&SD Transducer" will be implemented first. The objective of the self test is to assure the amount of the "NT&SD Transducers" those functions are normally working via the network. Thru the set up listed above, the data will be collected correctly. The control instruction will be send while 70% of the total "NT&SD Transducer" transferred to the control center computer exceeds the average vibration magnitude M>4. Before the simulation, the computer displays two of the "NT&SD Transducers" are not normal in the building and 38 of the "NT&SD Transducers" are normal. In this application example, two test cases are made. The first case is to vibrate 10 "NT&SD Transducers". The average magnitude of earthquake detected by each "NT&SD Transducer" is M=5.2 (reported by computer). The Central Control Center Computer doesn't take any action on it (because the $^{10}/_{38}<70\%$). The second case, the simulation to vibrate the whole building has been done. It results the simulation of earthquake average magnitude M=6.2 (reported by computer). The control instruction sent from the Central Control Center shuts off the "master safety switch of power' immediately. Remark 4: The reason why the level of 70% of the total "NT&SD Transducer" is set is to keep from the creation of incorrect and ineffective data. It can't be concluded the occurrence of earthquake by the limited (such as, 20%) "NT&SD Transducer" transferred data within few floors. The incorrect 20% of the total "NT&SD Transducers" transferred the shaking data could be resulted from the decoration of the floors. The "NT&SD Transducers" in each floor will receive real vibration signals while the real earthquake occurs.

TABLE 1

Within 1000 vibration experiments, the relation between the simulated actual earthquake magnitudes and the average value of the total ON-OFF times detected by the micro-chip inside the "NT&SD Transducer" (owned 1 vibration sensors) every 5 seconds.

Earthquake	ON-OFF values o(?) Vibration Senso(?)									
Magnitudes	5	10	15	20	25	30	35	40	45	50
1	10	21	29	41	51	59	68	78	92	99
2	14	27	41	54	67	81	94	108	121	135
3	18	35	52	69	89	105	123	142	161	180
4	25	49	74	99	124	152	174	199	224	248
5	28	59	83	112	138	168	180	216	252	279
6	31	63	92	119	148	179	209	238	270	298
7	36	71	109	144	178	216	251	286	321	355

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[**0044**]

TABLE 2

Within 1000 vibration experiments, the relation between the simulated actual earthquake magnitudes and the average value of the total ON-OFF times detected by the micro-chip inside the "NT&SD Transducer" (owned 8 vibration sensors) every 5 seconds.

Earthquake	ON-OFF values o(?) Vibration Senso(?)									
Magnitudes	5	10	15	20	25	30	35	40	45	50
1	72	143	210	279	349	419	502	563	640	718
2	120	238	357	479	602	718	838	954	1073	1212

TABLE 2-continued

Within 1000 vibration experiments, the relation between the simulated actual earthquake magnitudes and the average value of the total ON-OFF times detected by the micro-chip inside the "NT&SD Transducer" (owned 8 vibration sensors) every 5 seconds.

Earthquake	ON-OFF values o⑦Vibration Senso⑦									
Magnitudes	5	10	15	20	25	30	35	40	45	50
3	136	275	405	541	678	750	934	1080	1221	1351
4	198	402	598	803	998	1215	1395	1614	1795	1992
5	224	442	669	898	1121	1341	1543	1785	2034	2241
6	243	482	725	972	1213	1432	1673	1883	2133	2324
7	279	558	839	1011	1368	1652	1902	2201	2453	2765

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Designation of Main Components

[0045] **1** Detection Device

[0046] **2** Central monitor computer

[0047] **3** Control device

[0048] **11** Vibration Sensors

[0049] **12** Noise filter

[0050] **13** Micro processors

[0051] **21** Interface card

[0052] **31** 7-magnitude display device

[0053] **32** Circuit-breaker

We claim:

1. An earthquake detection control system, comprising: a plurality of well-distributed detection devices **1** having a plurality of vibration sensors **11** which are used to sense the occurrence of earthquake and transform the occurrence into electric digitals as shaking data;

a plurality of well-distributed micro processors **13**, which are capable of receiving and calculating the shaking data; and

a plurality of well-distributed local area computers, which are capable of receiving the shaking data from said micro processors **13**; the function of local control computers is not only to transfer shaking data from micro processors **13** to central monitor computer **2** but also to receive remote control orders and to take into actions; and

a central monitor computer **2** of Central Area Monitoring Center, which is capable of integrating, calculating, judging said shaking data after received, transferring the output of magnitude of the earthquake, and remotely controlling local area computers;

wherein, the vibration sensor **11** has the characteristics that while the vibrating sensor **11** stands stationary, the resistance of the vibration sensor **11** is infinite, then it is at the OFF status; while the "NT&SD Transducer" is suffered by the external power, it reaches at the status of centrifugal force, the plane surface slants, the characteristic of the resistance of the vibration sensor **11** has been changed to 0, then it is at the "ON" status; While the external power disappears, the vibration sensor **11** turns back to the 'OFF' status.

2. The earthquake detection control system according to claim 1, wherein the well-distributed micro processors **13** is suitable for Micro-Chip 89C51 and the like, and is used to calculate shaking data, judge the data of magnitude of earthquake; then, said data is transferred to PC8255 interface card **21** and the like through some parallel bus.

3. The earthquake detection control system according to claim 2, wherein the data processed by micro processors **13** is transferred to the central monitor computer **2** of Central Area Monitoring Center by use of the program of the central monitor computer **2**, which follows TCP/IP communication protocols.

4. A method for preventing the second disaster of earthquake, comprising: applying the earthquake detection control system of claim 1 to receive the shaking data by use of a central monitor computer **2** of Central Area Monitoring Center, and then to calculate the data and to judge that, finally to send a output signal of magnitude of the earthquake; subsequently performing a predetermined action according to the signals produced by control device **3** from said output signal.

5. The method for preventing the second disaster of earthquake according to claim 4, wherein the predetermined action can be a secure On/Off action which is performed by applying each local area control computers directly, or a central monitor computer **2** indirectly.

6. The method for preventing the second disaster of earthquake according to claim 4, wherein the predetermined action comprises automatically to shut off the master natural gas switch and the master safety switch of power.

7. The method for preventing the second disaster of earthquake according to claim 4, wherein the central monitor computer **2** of Central Area Monitoring Center comprises a central computer and a plurality of local area computers.

8. The method for preventing the second disaster of earthquake according to claim 7, wherein the central computer and a plurality of local area computers transfer data by following TCP/IP communication protocols.

9. The method for preventing the second disaster of earthquake according to claim 4, wherein the predetermined action is performed by use of an electric relay device of UPS power supply.

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