Designing a Visual Adhesive Thermometer based on TRIZ Systematic Innovation Method

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Abstract

The prior art electronic thermometers nowadays have a common flaw, which is unable to attach to the surface of a measured individual or article for showing the temperature at any time, only for single measurement of the temperature, where every use calls for a repeat of a like procedure. Since young and small children will occasionally be sick, which definitely requires a couple of days to rest for earlier recovery; at the moment, their parents, attended them day and night, have to measure their temperature. In this study, a new and feasible problem-solving process based on a TRIZ Su-Field analysis model is constructed. The Su-Field analysis enables the author to generate ideas to solve the temperature repeat measured problem. A set of innovative temperature measured device designs for children that are going through a systematic application process is proposed. Based on this work, a Visual Adhesive Thermometer was generated. This inventive devices has featured in many exhibitions and gained one Silver Medal Awarded, and two Golden Medal Awarded

Keywords: Awards, Su-Field analysis, Temperature repeat measured, Visual Adhesive Thermometer.

1. Introduction

1.1 Motivation of the Research

The prior art electronic thermometers nowadays (for instance the aforesaid three types) have a common flaw, which is unable to attach to the surface of a measured individual or article for showing the temperature at any time, only for single measurement of the temperature, where every use calls for a repeat of a like procedure (repeat for reset, repeat for the approach of the measured target, and repeat for the hold of the thermometer). A demand of a using mode for showing temperature at any moment, which could only be achievable by the sophisticated monitoring system of some medical organizations, where all the aforesaid prior art electronic thermometers are not available for the requirement; therefore, a thermometer of a novel structural combination is absolutely needed to be invented to meet such usage. It is worth further noting that

the using mode of the thermometer that can stick to the measured individual for showing the body temperature at any time is most demanded by the parents with young and small children. Since young and small children will occasionally be sick, which definitely requires some time (a couple of days) to rest for earlier recovery; at the moment, their parents, attended them day and night, have to measure their temperature repeatedly, to know if they are getting better. Such efforts for the parents that have already looked after their sick children for a long time are really awful fatigues for them. The inventor realized the suffering of the parents deeply, which hence motivated the inventor in initiating the idea of the invention, for offering a thermometer that features sticking to the measured individual, for showing the body temperature directly; moreover, it can further show the temperature situation in surface of thermometer through a number and color generator, for providing the caretaker a better control over the measured temperature for action. In the same measure, this thermometer can also be applied to the measured location of an article or a place once the temperature is demanded for observation at any time.

1.2 Field of the Invention

The present invention relates to thermometers which can attach to the surface of a measured individual or article for showing the temperature at any time

1.3 Description of the Prior Art

As regards the drawbacks of the traditional mercury thermometers, electronic thermometers have gained their popularity because of the following well-known advantages: highly assured safety, short measuring time and handy viewing readout. Conventional electronic thermometers appear in various outlooks, for instance, a popularly seen electronic thermometer, where its front is provided with a sense unit which is placed in some portions of the human body (mouth, armpit or anus) of the measured individual, to sense the temperature, and the sensed temperature is read out from the display unit located outside the human body. another electronic thermometer also named ear thermometer, where its cone-shaped sense unit is inserted into the ear of the measured individual for the sense of the temperature, and the readout is shown in its display unit. Aside from the aforementioned two electronic thermometers, there are quite many different types, for instance, for some organizations or places (kindergartens, schools or department stores) that are prone to contagious diseases, a forehead thermometer is being used to aim at the forehead of someone entering to scan and induce the body temperature within a short distance, which enables a selection of potential fevered persons of temperature over 37.5℃, for further affirmation or elimination, the said infrared forehead thermometer is categorized as an electronic thermometer.

2. Literature Review of TRIZ

Su-Field analysis model

Su-Field analysis is a basic concept used to symbolize a technical system and to identify its completeness and effectiveness. Recognized as one of the most valuable contributions of TRIZ, Su-Field analysis is used to not only model a system in a simple graphical approach and to identify problems, but also to offer standard solutions to improve the system.

According to TRIZ, the rationale of creating a Su-Field model is to set up a system with the ultimate objective of achieving a function. This normally consists of two substances and a field, as shown in Figure 1. The term S2 represents an object that needs to be manipulated, and the term S1 represents a tool that acts upon S2. Both substances can be as simple as a single element or as complicated as a big system with many components, each of which can also be explained by individual Su-Field models. The field is the energy required that will enable the interaction between the substances. The states of substances can be typical physical forms (e.g., gas, liquid and solid), interim forms or composite forms (e.g., aerosol, power, porous). Likewise, the field can refer to a broad range of types of energy such as mechanism, chemistry, physics, acoustics, optics and radiations.

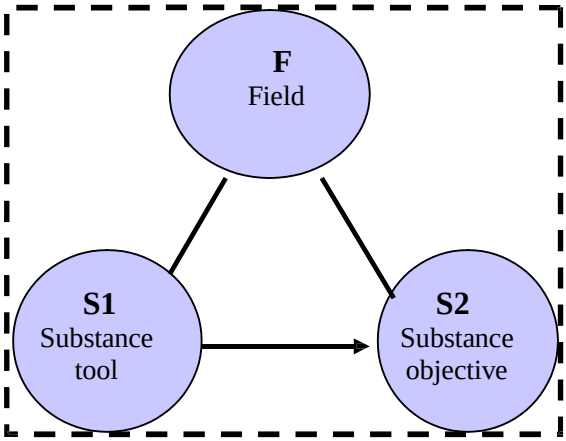

Figure 1 Basic Substances-Field Triangle Model

Genrich Altshuller and his colleagues, the creators of TRIZ, graphically represent a Su-Field model as a triangle. This is a simple and ingenious way to explain a technical system. Given the assumption that the field is generated by a hidden substance, the triangle can be simplified into a dumbbell shape with the field indicated above the arrow and the relationship indicated beneath the arrow, as shown in Figure 2. There are five main types of relationship between the substances: useful impact, harmful impact, excessive impact, insufficient impact and transformation. Among these relationships, useful and harmful interactions are the most common.

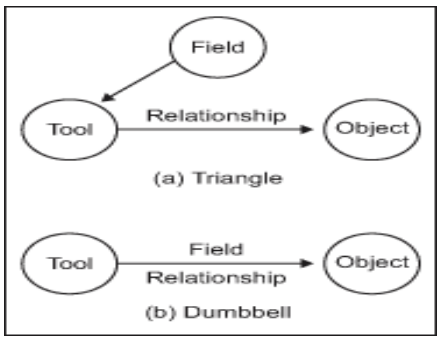

Figure 2 Basic Triangle and Dumbbell Su-Field Model (Mao, et al 2007)

The Su-Field model is a fast and simple analytic tool for identifying problems in a system and for providing insights that help with the evolution of the system. Once a model is created, Su-Field analysis is used to determine if any of the three elements of the model is missing, or if there are any undesired effects in the system. Then, the analysis indicates the direction for improving the system. A complex system can be modeled using multiple, connected Su-Field models. Generally, there are four types of basic Su-Field models: (1) an effective complete system, (2) an incomplete system that requires completion or a new system, (3) a complete system that requires improvement to create or to enhance certain useful impacts and (4) a complete system that requires the elimination of some harmful or excessive impacts. (Terninko, 2000; Mao, et al 2007)

3. Innovative Concept for a temperature continuous measured Device

3.1 Problem Description

The prior art electronic thermometers nowadays (for instance the aforesaid three types) have a common flaw, which is unable to attach to the surface of a measured individual or article for showing the temperature at any time, only for single measurement of the temperature, where every use calls for a repeat of a like procedure (repeat for reset, repeat for the approach of the measured target, and repeat for the hold of the thermometer).

3.2 Requirement Analysis

It is worth further noting that the using mode of the thermometer that can stick to the measured individual for showing the body temperature at any time is most demanded by the parents with young and small children.

Since young and small children will occasionally be sick, which definitely requires some time (a couple of days) to rest for earlier recovery; at the moment, their parents, attended them day and night, have to measure their temperature repeatedly, to know if they are getting better. Such efforts for the parents that have already looked after their sick children for a long time are really awful fatigues for them.

Parents with young and small children want to know the temperature at any time, so that they can have a better control over the measured temperature for action. For example, when the body temperature of children increases suddenly, eating antipyretics is necessary.

3.3 Function Analysis

Function Analysis can identify key problem, the Function Analysis of 3.1 Problem Description, as Figure 3 shows, Thermometer cannot show the temperature of fever children at any time.

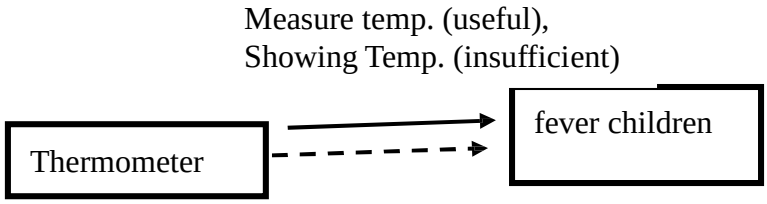

Figure 3 Function Analysis of prior art electronic Thermometer cannot show the temperature of fever children at any time

3.4 Applying Standard Inventive solutions

(1) Describe the key problem

as Figure 5 shows, the prior art electronic thermometer cannot show the temperature of fever children at any time, only for single measurement of the temperature, where every use calls for a repeat of a like procedure (repeat for reset, repeat for the approach of the measured target, and repeat for the hold of the thermometer).

(2) List all substances and Fields in the interactions related to the problem

From step (1), the key problem is, the prior art electronic thermometer cannot show the temperature of fever children at any time. There are two substances, fever children and Thermometer. The field is thermal.

(3) Create a Su-Field model of the engineering problem

As Figure 4 shown, a TRIZ Su-Field analysis model is constructed. In the model, there are two substances. The fever children represent an objective substance termed S2, and the hermometer represents a tool substance termed S1. The thermal field, which is the temperature deliver from S2 to S1, is termed T1. S1 detect S2 insufficient information, the model of the problems is given in Figure 4.

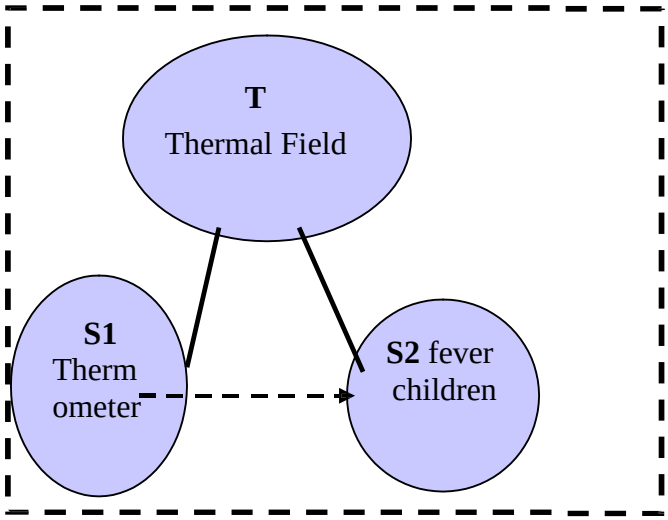

Figure 4 The model of problems of young children's temperature can't know at any time

(4) Solution in the model

Write the standard inventive solution applicable for solving the problem

As for the Standard Inventive Solution 1.1.3 of Su-Field analysis, the solution provided by the model is added an external complex Su-Field.

(5) Create the new Su-Field Model of the engineering problem by applying the Standard inventive solution indentified in step (4)

As for the Standard Inventive Solution 1.1.3 of Su-Field analysis, Figure 5 shows that the solution provided by the model is added an external complex Su-Field, and therefore the introduction of the attached material S3 between S1 and S2, S3 makes S1 and S2 continuous contact, the parents can know the temperature at any time, and they can deal with fever children base on his/her temperature.

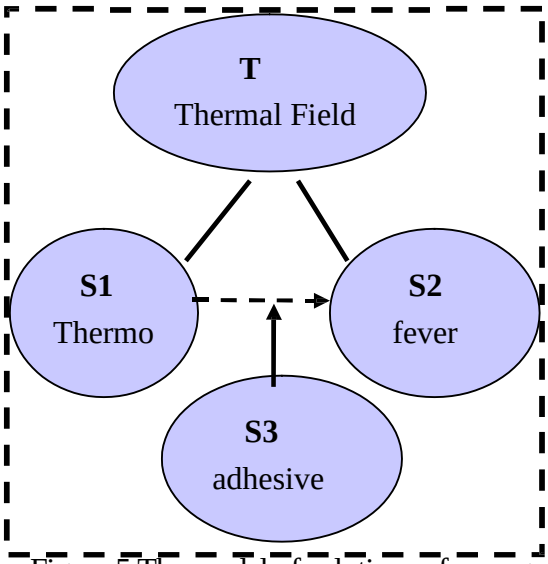

Figure 5 The model of solutions of young children's temperature can know at any time

(6) Visual Adhesive Thermometer design

Here describe the solution for implementing the Su-Field Model created

A visual adhesive material makes thermometer touch fever children continuously. Visual things such as number, color change in thermometer displaying the temperature of the fever children.

4. Present Achievements

4.1 Visual Adhesive Thermometer Design

To achieve the foregoing objects of the present invention, the techniques adopted and the achievable functioning are detailed described with reference to the following preferred exemplified embodiments and the accompanying drawings, which helps a thorough comprehension of the present invention.

Referring to Fig. 6 and 7 the first exemplified embodiment of the present invention as a whole is an adhesive thermometer, comprising a display unit , an attachment unit and a sense unit, where the display unit and the sense unit are joined into a rectangular parallelepiped, and the display unit is located on the top of the rectangular parallelepiped, which actually is a display screen on top of the rectangular parallelepiped, and a switch (preferred to be a thin-film switch); the sense unit is located at the bottom of the rectangular parallelepiped, where its edge of the bottom side is indented to form a joining fringe; its bottom side is the sensing surface of the sense unit, once the sensing surface is stuck to a measured individual

(human body) or a measured article, followed by a pressing on the switch for the power-on, and the sense unit then measures the temperature which is shown on the display screen of the display unit. The display screen is provided with a plurality of using modes, for instance, in Fig.6, within the left frame of the display screen, there is a numeral display screen which shows temperature directly in numerals (36℃, 37℃, 38℃, 39℃ or 40℃ --etc.), while a status display screen is located in the right frame of the display screen, which shows the temperature in terms of the status. Fig.6 shows the display screen which has both using modes of a numeral display screen and a status display screen.

The status display screen shows different temperatures in terms of different colors, for instance: a light green (light color) is shown for the temperature below 37℃, an orange yellow (medium color) is shown for the temperature between 37℃ ~ 39℃, and a deep red (heavy color) is shown for the temperature over 39℃, which displays the degree of the measured temperature for the observer. The way that the status display screen displays the status of the temperature could be shown in Fig.7, where the display screen is partitioned into several display icons corresponding to different regions of temperatures, as the temperature reaches to some region, only the corresponding display icon lightens (the other display icons do not lighten), for the display of the temperature is in that region; it could also be realized by displaying different temperatures by different colors for the entire display screen, to represent the temperature is in that region.

The display screen could have other display modes or ways, for instance: by means of the built-in heat-sensitive substance, to sense different region of the temperature, and to display different color or odor through the chemical reaction; where the color displaying is same as the above procedure; while the odor diffusion is subject to the odor diffuser built in the display screen, and different concentration of odor represents a specific temperature region, for instance, a refreshing fragrance means the temperature is below 37℃, a medium fragrance specifies that the temperature is between 37℃ ~ 39℃, and a dense fragrance represents the temperature is over 39℃, which specifies the degree of the measured temperature for the smeller. It hence shows that the display screen could have multiple display modes, and the display screen can have a mono display mode, two or multiple display modes coexistent. As long as the display screen is capable of showing status of different temperatures is construed to be within the scope of the claim of this invention.

To assure the rectangular parallelepiped can be stuck long on the measured location, a structural combination with an attachment unit is required. The attachment unit is provided

with a flat adhesive pad for the attaching purpose, and an opening is in its central portion, where the edge along the top side of the opening is provided with gluey substance, and the gluey substance is also placed at the bottom side of the adhesive pad for the attachment; the depth of the joining fringe is roughly equivalent to the thickness of the adhesive pad. During assembly, the joining fringe is stuck firmly to the adhesive pad by means of the effect of the gluey substance, which also enables the downward exposure of the bottom side of the sense unit through the opening, and a protective pad is attached to the bottom side of the adhesive pad; the protective pad is stuck by the gluey substance for temporary attachment, for the protection of the gluey substance from contacting with air. When using, simply tear down the protective pad and the exposed gluey substance is ready to stick to wherever location to be attached (for instance: the forehead of a fevered patient, or any measured location of an individual body).

The protective pad could be a single whole piece, which is stuck at the bottom side of the adhesive pad and the sense unit; it could be made of two pieces, which are stuck at the both ends of the bottom side of the adhesive pad by the gluey substance, and crossed over below the bottom side of the sense unit. In the exemplified embodiment, the protective pad is a two-piece type (shown in Fig.7), but not excluding the possibilities of being a mono-piece type or multiple-piece type over two pieces, which are all within the scope of the claim of this invention.

Once the rectangular parallelepiped integrated by the display unit and the sense unit is further combined with the attachment unit, shown in Fig.7, the gluey substance is used to stick the rectangular parallelepiped which has avoided the air contact, while the gluey substance is covered by the protective pad temporarily, also avoiding the air contact; the rectangular parallelepiped is provided with electric power setup (for instance: thin battery cell), for powering the sense unit and the display unit, where the switch is for power-on/off of the power setup. The structure of the switch is preferred to be somewhat concave, for the prevention of being touched by any article. As production is done, it’s better to be packed by a plastic protective packing.

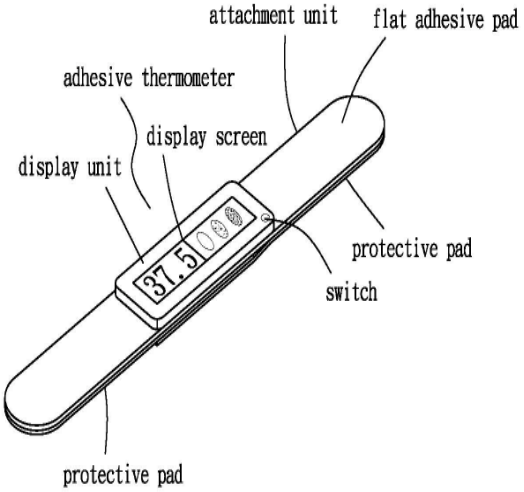

Figure 6 Exploded view of Visual Adhesive Thermometer

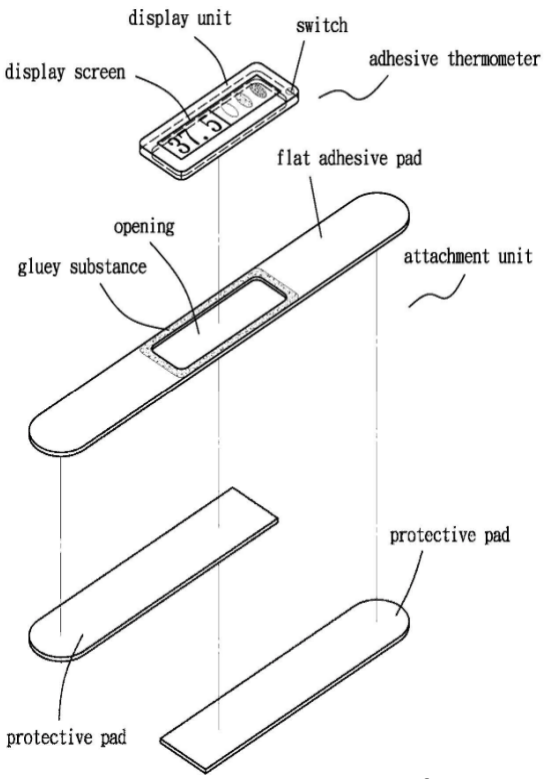

Figure 7 Decomposed view of Visual Adhesive Thermometer

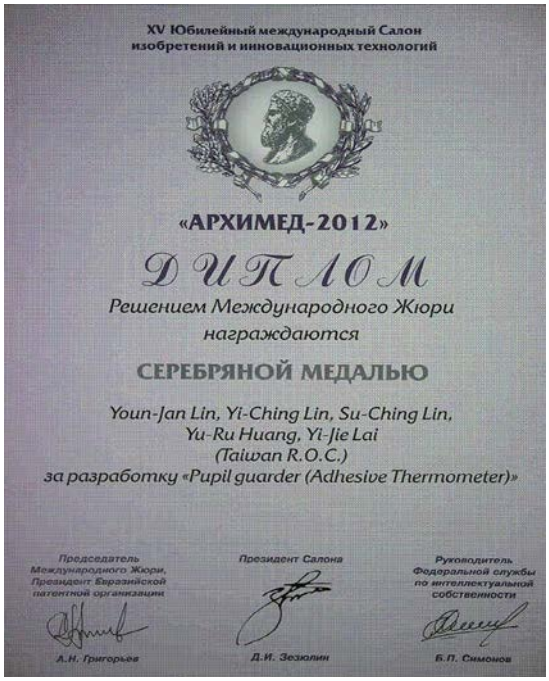

Figure 8 “2010 Moscow International Salon of inventions and innovation technologies”. Silver Medal Awarded

4.2 Awards

This inventive device has featured in many exhibitions and gained one Silver Medal Award, and two Golden Medal Awards, as follows: 1.Shown at “2010 Moscow International Salon of inventions and innovation technologies”. Silver Medal Awarded (see Figure 8). 2. Shown at “ANDI Invention Awards 2012”. (Italian Exhibition of Inventions) Golden Medal Awarded (see Figure 9). 3. Shown at “2011 5th International Warsaw Invention”. Gold Awarded with mention (see Figure10).

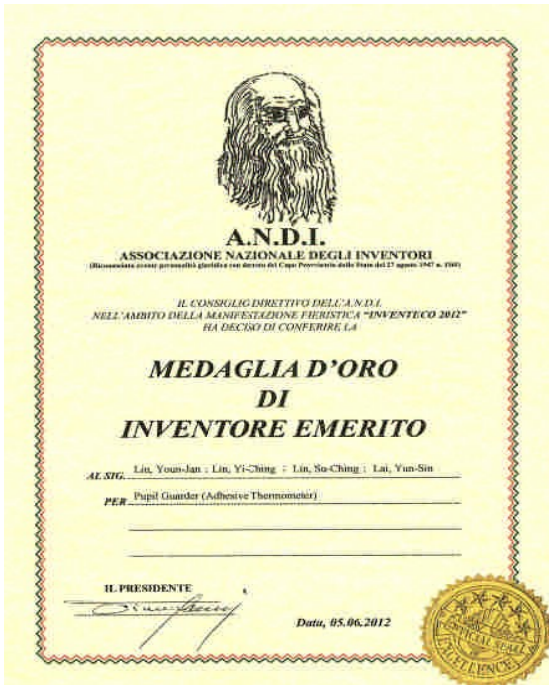

Figure 9 “ANDI Invention Awards 2012”. (Italian Exhibition of Inventions) Golden Medal Awarded

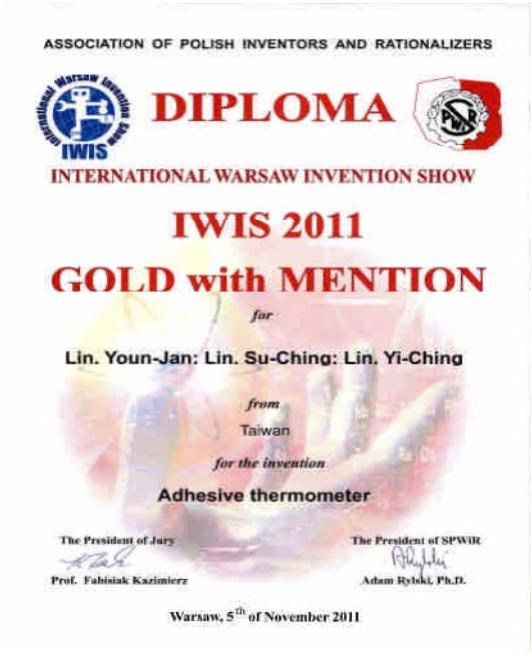

Figure 10 "2011 5th International Warsaw Invention". Gold Awarded with me

5. Conclusions and Suggestions

The prior art electronic thermometers nowadays have a common flaw, which is unable to attach to the surface of a measured individual or article for showing the temperature at any time, only for single measurement of the temperature, where every use calls for a repeat of a like procedure. Since young and small children will occasionally be sick, which definitely requires a couple of days to rest for earlier recovery; at the moment, their parents, attended them day and night, have to measure their temperature.

In this study, a TRIZ Su-Field analysis model is constructed. In the model, there are two substances. The fever children represent an objective substance termed S2, and the Thermometer represents a tool substance termed S1. The thermal field, which is the temperature deliver from S2 to S1, is termed T1. S1 detect S2 insufficient information, and therefore the introduction of the attached material S3 between S1 and S2, S3 makes S1 and S2 continuously contact, the parents can know the temperature at any time, and they can deal with fever children base on his/her temperature.

In addition, the use of the Inventive Principles 32 color change inspires us to display information by setting to display different information, for example, if children temperature is high, the adhesive thermometer displays of a color red for dangerous, if children temperature is low, the adhesive thermometer displays of a color of green for safe, and the color yellow is in between of them.

This invention is to provide a visual adhesive thermometer that is capable of being stick to the sensed position of an individual or an article, where the temperature is measured and exhibited in terms of different message types: numeral, color. This visual adhesive thermometer comprises a sense unit, a display unit and an attachment unit, where the display unit and the sense unit are combined into a rectangular parallelepiped, and the display unit is located at the top while the sense unit at the bottom. The attachment unit is formed by an adhesive pad and the rectangular parallelepiped, which makes the sense unit to be disposed for exposing

downward. The bottom of the adhesive pad is provided with gluey substance, and a protective pad is stuck to the gluey substance for temporary attachment. When using, simply tear down the protective pad and stick the thermometer to both ends of a measured location by means of the exposed gluey substance, and adhere the sense unit to the measured location to sense thetemperature, followed by exhibiting the sensed temperature at the display unit in terms of different message types: numeral, color.

This inventive device has featured in many exhibitions and gained one Silver Medal Award, and two Golden Medal Awards.

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AUTHOR BIOGRAPHY