

2186380 (12)

- 1 -

DOMESTIC WEATHER INFORMATION DISPLAY APPARATUS

This invention relates to domestic weather information display apparatus, that is to say, to apparatus suitable for use in the home or other inhabited buildings, for displaying information relating to current weather conditions in the immediate vicinity.

Domestic weather information display apparatus has hitherto customarily taken the form of a combined set of small meteorological instruments, typically an aneroid barometer and a thermometer. A crude form of hygrometer may also be included which, by mechanical means, indicates whether the atmosphere affecting the hygrometer is dry or damp. Such instruments are difficult to interpret and do not give immediate clear information on the prevailing conditions such as whether or not it is raining or cloudy.

Nowadays, especially in cities such as Singapore, there are further difficulties in that most of the high-rise buildings and modern houses are air-conditioned and the windows are fitted with tinted dark glass and covered with thick curtain. Consequently, people staying inside are frequently unable to know by simple inspection what the weather conditions outside are. Even if buildings and houses are not air-conditioned, it is still very inconvenient for busy people to go outside or to the window to check on the weather. Other places where there is usually no information available on the prevailing weather conditions outside are conference halls, meeting rooms, shopping centres below street level, and MRT stations.

According to the present invention there is provided domestic weather information display apparatus comprising means for sensing ambient light intensity and generating an electrical signal representative thereof, a rain drop detector arranged to detect the occurrence of a rain drop in a restricted region and to generate an electrical signal indicative thereof, and means for so utilising the said electrical signals as to provide distinct visual indication of the sensing of sunny and cloudy conditions, and of absence and presence of rain drops in the said region.

The apparatus may also be such as to utilise the electrical signal representative of ambient light intensity to indicate

darkness. Audible alarms may be included to indicate cloudy conditions and rain. The visual indication may be by means of differently coloured lamps, and, in the case of indication of ambient light intensity alternatively or additionally by means of an electrically driven meter having a pointer arranged to sweep over a range calibrated by successive differently coloured background bands indicating darkness, cloud and sunshine.

A preferred embodiment of the present invention monitors outdoor weather conditions continuously on a 24 hours a day basis. The weather information is displayed by four different coloured lights: green, amber, blue and red. When the weather is fine or fair, the green light is illuminated; cloudy, amber light; dark, blue light; and raining red light. The preferred embodiment also gives audible warning when there is cloud or rain. In addition to the four coloured lights, a sensitive brightness meter marked with green, amber and blue bands is also included to show the weather conditions. The preferred embodiment is very compact and is small enough to be placed on an office desk or hung on a wall in the hall of a house. Manufacturing cost is low and the apparatus operates on 230V A.C. mains with a power consumption of less than 5 watts.

The preferred circuitry employs light dependent resistors for sensing ambient light intensity, and a unique form of rain drop detector.

Accordingly there is provided a rain drop detector comprising a funnel mounted with its mouth disposed to receive rain falling over a restricted region, and a pair of electrical contacts so disposed below the outlet of the funnel and so spaced from one another to be capable of being electrically connected together by a rain drop falling from the outlet of the funnel into the space between the said contacts.

In the preferred embodiment, the funnel is supported above the contacts by a container formed of insulating material, such as a plastics material, and having outlet for rain water so that the contacts do not become submerged in accumulated rain water. This container can also serve as the means for mounting the light dependent resistors of the sensing means.

The invention will now be described in more detail by way of example, with reference to the accompanying drawings in which:-

Fig. 1 is a perspective view of an outdoor weather sensing unit of an embodiment of the invention,

Figs. 2 and 3 are a partial vertical section and a horizontal section of the sensing unit of Fig. 1,

Fig. 4 is a block diagram of the circuitry of the embodiment, and

Fig. 5 is a detailed circuit diagram of the sensing unit and indoor analysing and display unit of the embodiment.

The embodiment described hereinafter with reference to the accompanying drawings has an outdoor weather-sensing unit 11 and an indoor analysing and display unit 12. Mechanical features of the unit 11 are illustrated by Figs. 1, 2 and 3, and its circuitry by Figs. 4 and 5. Figs. 4 and 5 also show the circuitry of the indoor analysing and display unit 12, and Fig. 4 shows in block form a power supply unit for connection to domestic A.C. mains of 230 volts giving an output of 12 volts D.C. A mains on/off switch SW is included in the power supply unit.

OUTDOOR WEATHER SENSING UNIT 11

This unit 11 is normally placed on the roof top of a house or other building to sense outdoor weather conditions. The weather information is fed to the Indoor Analysing and Displaying Unit 12 and is electrically connected to the latter by a 5-wire cable.

The outdoor weather sensing unit 11 consists of a funnel 13 of about 10 cm in diameter at its mouth, which is a component of a rain drop detector 14, and light dependent resistors 15 and 16. The funnel 13 and other components of the rain drop detector 14 are housed in a substantially square plastic box 17 measuring 14cm x 14cm x 14cm. When it rains, the rain drops collected in the plastic funnel 13 drop into a space where a pair of metal contacts 18 and 19 are positioned with their tips opposite one another. The gap 20 between the tips of the contacts 18 and 19 is about 2 mm, and is directly under the outlet tube 21 of the funnel 13 to detect the presence of rain drops.

Two light dependent resistors 15 and 16 are deployed for sensing the changes in outdoor ambient light. One of them is

connected to a sensitive colour-band meter for indicating the intensity of brightness and the other is connected to the Analysing and Displaying Unit 12 for triggering coloured lamps. Both light dependent resistors 15 and 16 are mounted in holders secured to a lid 22 of the box 17. The mouth of the funnel 13 is secured in an aperture in the lid 22 as shown in Fig. 1 of the drawings.

The box 17 has four studs or feet, one at each bottom corner, so that its floor is spaced above the supporting structure, such as the roof of a building. Holes are provided in the floor of the box 17 as outlets for the rain water. Thus the contacts 18 and 19 do not become submerged by rain water accumulated within the box 17. The contacts 18 and 19 are mounted in opposing walls of a smaller open topped box glued to the floor of the box 17. This smaller box is also made of insulating material...

INDOOR ANALYSING AND DISPLAYING UNIT 12

This unit 12 receives weather information from the Outdoor Weather Sensing Unit 11 for analysis and display, and is formed by a circuit which includes three integrated circuit modules IC1, IC2 and IC3, five transistors TR1 to TR5 and four coloured lamps LP1 to LP4 which are respectively green, blue, amber and red. When the weather sensed by the sensing unit 11 is fine or fair, the green light is illuminated; when cloudy, the amber light; when dark, the blue light; and when rain, the red light. In addition to the coloured lamps, there is a sensitive meter M1 marked with three bands, respectively, green, amber and blue also for indicating weather conditions. An audio buzzer is provided to sound when there is cloud or rain. The buzzer may be switched off when it is not required.

The electronic components are housed in a small plastic box measuring approximately 12 cm high by 6 cm wide x 20 cm long, with the coloured lamps and the meter mounted in a front panel of the box.

The block diagram of Fig.4 indicates in functional terms the electrical elements of the outdoor sensing unit 11 and the indoor analyzing and displaying unit 12. Two blocks in the outdoor sensing unit 11 are inscribed BRIGHTNESS SENSOR and each is formed by a respective one of the light dependent resistors 15 and 16. The

16

block inscribed RAIN SENSOR represents the electrical function of the rain drop detector 14. The light dependent resistor 16 is coupled to the meter M1 in the indoor unit 12. The light dependent resistor 15 is coupled to circuitry represented by a block inscribed ANALYSER which distinguishes between signals representing respectively light intensity in direct sunlight (FINE), light intensity under cloud (CLOUDY), and light intensity at night (DARK), and accordingly controls energisation of lamps emitting green, amber and blue light respectively. The rain drop detector 14 is coupled to circuitry represented by a block inscribed RAIN DETECTOR which is a triggered circuit arranged to control energisation of a lamp emitting red light to indicate RAIN. Respective buzzers can be connected to the control circuits for the amber and red lamps to provide audible indication of cloud and rain.

In Fig.5, details of the circuitry are shown, including connections to ground and the positive 12 volt d.c. line provided by the power supply indicated in Fig.4. The green lamp LP1, the blue lamp LP2 and the amber lamp LP3 are respectively connected in series with the transistors TR3, TR4 and TR5, which are NPN transistors, between the positive 12 volt d.c. line and ground. The red lamp LP4 is connected between the positive 12 volt line and one side of a set of normally open (N.O.) contacts of a first relay RL1. The other contact of the normally open set of relay RL1 is connected to a normally closed (N.C.) set of contacts of a second relay RL2 and thence to ground.

The transistors TR1 and TR2, also NPN transistors, are coupled in respective series circuits between a nominal 6 volt terminal provided by a parallel combination of a 6 volt zener diode and a capacitor C3, and ground.

The function of the analyzer block shown in Fig.4 is effected by the biasing conditions of the five transistors TR1 to TR5.

The function of the RAIN DETECTOR block of Fig.4 is effected by the integrated circuit IC2 and discrete circuit elements coupled thereto.

The operation and further details of the circuitry of Fig.5 will now be described.

FUNCTION OF LIGHT DEPENDENT RESISTOR 15, TRANSISTORS TR1, TR3,
INVERTERS ICI-1, ICI-2 AND GREEN LAMP LP1

The light dependent resistor 15 serves as an outdoor ambient light sensor. Its resistance changes according to the intensity of ambient light, i.e. its resistance becomes low when the weather is fine (sunny) and becomes high when it is cloudy or dark. The light dependent resistor 15 is connected in series with a fixed resistor R1, a variable resistor RV1 and a fixed resistor R8 between ground and a +12 volts supply rail 23.

The variable resistor RV1 is a potential divider for adjusting the bias supply to the base of transistor TR1 and is set to a value that the transistor TR1 is non-conducting during fine weather. When the transistor TR1 is not conducting, its collector is at a high potential, which is then coupled to series inverters ICI-1 and ICI-2. The high potential at the output of the inverter ICI-2 is applied to the base of lamp driver transistor TR3 and causes the green lamp LP1 to be energised.

FUNCTION OF TRANSISTOR TR5 AND AMBER LAMP LP3

When the sky is cloudy, the resistance of the light dependent resistor 15 is increased. As a result, the bias supply to the base of transistor TR1 is proportionately increased and the transistor TR1 becomes fully conductive. As the transistor is fully conductive, the potential at its collector becomes low or at ground potential. The low potential at its collector is inverted to high potential by the inverter ICI-1 and applied to the base of lamp driver transistor TR5 via resistors R13 and R14. The high potential at the base of TR5 causes TR5 to conduct and energises the amber light LP3.

FUNCTION OF TRANSISTORS TR2, TR4, INVERTERS ICI-3, ICI-4, AND BLUE
LAMP LP2

When it is dark (night time), the resistance of the light dependent resistor 15 becomes extremely high which causes a higher potential to be developed across a second potential divider RV2 connected in parallel with the combination of the resistor R1 and the light dependent resistor 15. The high potential at the moving contact of the divider RV2 is coupled to the base of transistor TR2 via a resistor R6. The transistor TR2 is thus biased to conduct,

and the low resulting potential or ground potential at its collector is inverted by the inverter ICI-3 to become high potential and then applied to the base of lamp driver transistor TR4. As a result, the blue lamp LP2 is energised.

FUNCTION OF INTEGRATED CIRCUIT IC2, BUZZER BZ1 AND RED LAMP LP4

The integrated circuit IC2 is a triggered monostable and operates as a rain detector. When it rains, the rain drops collected by the funnel 13 fall into the rain drop detector 14. The metal contacts 18 and 19 are connected in parallel with a capacitor C4 which is charged through two fixed series resistors R17 and R18. When rain drops fall through the contacts 18 and 19, this causes a momentary short-circuit of the contacts 18 and 19.

The capacitor C4 discharges rapidly through the short-circuited contacts 18 and 19, creating a short negative spike as a triggering pulse for the integrated circuit IC2. The triggering of this monostable IC2 generates an output pulse of width $T = 1.1 CR$ where C is the capacitance of a capacitor C6 and R is the resistance of a resistor R19. A relay RL1 which is normally energised, releases and sends ground potential to operate a buzzer BZ1 and the red lamp LP4. The release time of the relay RL1 is determined by the time-constant of the resistor R19 and capacitor C6 and in this case, it is set to about 30 seconds. If there are no further rain drops detected by the rain drop detector 14 after 30 seconds, the circuit will be automatically reset.

The buzzer BZ1 can be switched off by a buzzer on-off switch SW1-a, when it is not required. LED1, which is a light emitting diode, is a rain buzzer on-off indicator and is switched on or off by a switch SW1-b which operates with the switch SW1-a.

FUNCTION OF INTEGRATED CIRCUIT IC3 AND BUZZER BZ2

The integrated circuit IC3 is an astable multivibrator and controls the function of a second buzzer BZ2. A variable resistor RV3 varies the frequency of the astable multivibrator and is normally set to 2 or 3 HZ/sec. A switch SW2 serves as a cloud buzzer on-off switch and a light emitting diode LED2 is cloud buzzer on-off indicator.

During fine weather, the astable multivibrator IC3 does not oscillate, because the potential at the junction of the inverters

ICI-1 and ICI-2 is low or ground potential and the junction of series resistors R20 and R21 is partially short-circuited via a diode D1 to the junction of ICI-1 and ICI-2 so that pin 7 of IC3 is held low.

When it is cloudy, the potential at the junction of ICI-1 and ICI-2 is high and the diode D1 stops conducting. When the diode D1 stops conducting, the potential at the junction of R20 and R21 rises, the multivibrator IC3 oscillates, a relay RL2 is intermittently de-energised and its contacts intermittently apply ground potential to operate the cloud buzzer BZ2.

FUNCTION OF LIGHT DEPENDENT RESISTOR

16 METER M1 AND VARIABLE RESISTOR RV3

The light dependent resistor 16 supplies ambient light intensity information to the ambient light intensity meter M1. The meter M1 is a 200 micro-amp meter calibrated with three coloured bands or sectors which are green, amber and blue. The variable resistor RV3 is provided to allow adjustment of the zero setting of the meter M1.

When the weather is fine (sunny), the pointer of the meter M1 is over the green band; for cloudy weather the amber band, and for darkness or night the blue band.

1. Domestic weather information display apparatus comprising means for sensing ambient light intensity and generating an electrical signal representative thereof, a rain drop detector arranged to detect the occurrence of a rain drop in a restricted region and to generate an electrical signal representative thereof, and means for so utilising the said electrical signals as to provide distinct visual indication of the sensing of sunny and cloudy conditions, and absence and presence of rain drops in the said region.
2. Apparatus according to claim 1, wherein the means for utilising the said electrical signals is adapted to indicate darkness.
3. Apparatus according to claim 1 or 2, wherein the means for utilising the said electrical signals is provided with means for producing audible alarms to indicate cloudy conditions and rain.
4. Apparatus according to any preceding claim, wherein the distinct visual indication is provided by differently coloured light sources.
5. Apparatus according to any preceding claim, wherein the means for utilising the said electrical signals includes an electrically driven meter having a pointer arranged to sweep over a range calibrated by successive differently coloured background bands.
6. Apparatus according to any preceding claim, wherein the rain drop detector comprises a funnel mounted with its mouth disposed to receive rain falling over the restricted region, and a pair of electrical contacts so disposed below the outlet of the funnel and so spaced from one another as to be capable of being electrically connected together by a rain drop falling from the outlet of the funnel into the space between the said contacts.
7. Domestic weather information display apparatus substantially as described hereinbefore with reference to the accompanying drawings.

