

SPECIFICATION

Improvements in or relating to traffic signal systems

5 This invention relates to traffic signal systems and in particular to road traffic signal systems.

As is well known, what may be termed priority vehicles, such as police cars, ambulances and fire engines, tend not to obey traffic signals set against them when their mission is of an urgent nature. Whilst this practice is understandable and indeed is generally condoned, nevertheless this does involve a certain risk of causing an accident and all too often the mere presence of the priority vehicles does not result in the general traffic giving way.

The present invention seeks to provide an improved traffic signal system in which the foregoing difficulties are mitigated.

According to this invention a traffic signal system comprises means for detecting a warning of approach or presence signal emitted by a priority vehicle and means for determining the direction of approach of said priority vehicle to provide a control signal for setting said signal system to give priority of passage to said priority vehicle, said detecting means comprising means for storing signal pattern characteristics and repetition rate characteristics of warning signals emitted by priority vehicles, means for comparing the signal pattern characteristics and repetition rate characteristics of received warning signals with said stored characteristics and means responsive to a predetermined degree of coincidence over a plurality of cycles of said received warning signals for providing said control signal.

40 Preferably said plurality of cycles comprises three to four cycles.

Preferably again means are provided for subjecting received warning signals to band-pass filtering of sufficiently wide bandwidth to encompass likely variations in individual warning signals emitted by different priority vehicles.

Preferably said storage means comprises a PROM (programmable read only memory) store and said comparison means and said responsive means form part of a microprocessor.

Said priority vehicle may be a police car, an ambulance or a fire engine or the like. Such priority vehicles are normally provided both with visible means, such as a flashing coloured light, and audible means, such as a repeated two-tone horn signal for warning other traffic of their approach or presence. In accordance with the present invention said detector means may be such as to detect either or both visible and audible warning signals but preferably said detector means is, such as to respond only to audible warning signals.

Said audible signal may have the nature of a multitone and/or a warble.

Preferably said means for determining the direction of approach of said priority vehicle comprises a directional receiver for said warning signal directed downstream of each approach path to said system and means for comparing the level of output of each directional receiver in order to elect which of said approach paths is taken as that along which said priority vehicle is approaching said system.

Preferably where said first mentioned comparison means and said responsive means forms part of a micro-processor said means for comparing the level of output of each directional receiver also forms part of said micro-processor and means are provided for interrupting, in sequence and in turn, the connection from each of said directional receivers to said micro-processor whereby to enable said micro-processor to determine which of said directional receivers is receiving with the greatest strength, a warning signal emitted by a priority vehicle.

The invention is illustrated in and further described with reference to the accompanying drawings in which,

Figure 1 schematically represents a typical road traffic signal system in accordance with the present invention and

Figure 2 is a block schematic diagram of one form of signal processing circuit which may be used in carrying the present invention into effect.

In both Figs., like references are used to denote like parts.

Referring to Fig. 1, this schematically illustrates a typical cross road junction having approach paths from four different points of the compass, considered for the purpose of explanation to be north, south, east and west. The path approaching from the north is referenced 1, that from the south referenced 2, that from the east referenced 3 and that from the west referenced 4. Controlling the passage of vehicles are clusters of traffic lights 5, 6, 7 and 8 which are arranged generally as known *per se*. Carried by traffic light cluster 6, which is on the near side of approach path 1, is a directional microphone receiver 9, which is directed towards the north so as predominantly to receive audible signals approaching from a northwardly direction. Similarly, traffic light clusters 5, 7 and 8 carry directional microphones 10, 11 and 12 which are directed westwardly, eastwardly and southwardly respectively.

As will be appreciated, sound originating from the direction in which the microphone is pointing will be received with a higher level of intensity than sound from other directions.

In practice all of said microphones could be located at a single point, if signal pick-up is satisfactory from the different directions at

that point, in order to reduce the number of cables required.

Referring to Fig. 2, the directional microphones 9, 10, 11 and 12 correspond to the similarly referenced directional microphones in Fig. 1. Each microphone 9 to 12 is connected to the input of a respective one of four normally open (i.e. conductive) electronic gates 13, 14, 15 and 16. The output of each switch 13 to 16 is connected to a combining circuit 17, which in turn is connected to apply signals received by the four microphones 13 to 16 to a tone bandpass filter 18. Tone bandpass filter 18 has a bandwidth which is sufficiently wide to embrace variations likely to occur in the individual warning signals emitted by different priority vehicles.

Tone bandpass filter 18 is connected to apply signals passed thereby to a squaring circuit 19, the output of which is connected directly to the input addressing circuits 20 of a micro-processor 21.

Tone bandpass filter 18 is also connected to apply signals passed thereby to an amplitude detector 22 (i.e. a threshold circuit) the output of which is applied via an analogue-to-digital converter 23 to the input circuits 20 of the micro-processor 21.

Also shown connected to micro-processor 21 is a required source of timing signals 24 and a PROM (Programmable read only memory) store 25, which contains data relating to the frequency and repetition period characteristics to be expected of the audible warning signal of a priority vehicle and a processing control programme. The last mentioned programme is such that the micro-processor compares the signal pattern characteristics and the repetition rate characteristics of each warning signal applied to it via input circuits 20 with corresponding characteristics of warning signals likely to be emitted by priority vehicles over a period of say three cycles of the received warning signal. If the required degree of coincidence is maintained over the aforementioned three cycles the micro-processor decides that the warning signal of a priority vehicle is present.

Micro-processor 21 is addressed by output addressing circuits 26, which controls gates 13 to 16 via lead 27 to 30 respectively so that initially gates 13 to 16 are closed (i.e. rendered non conductive) in turn. This action permits the micro-processor 21 to determine which of the microphones 9 to 12 are responsible for the highest amplitude of warning signal identified as that of a priority vehicle. In dependence upon this determination output control signals are made available on leads 31 to 34 in order to set the pattern of traffic signals so as to give priority to traffic which is approaching from the direction in which the priority vehicle appears to be approaching.

Typically, during the search routine, each of the gates 13 to 16 will be closed for approxi-

mately two seconds.

By utilising a micro-processor and PROM store, the system may be adapted for use with a wide range of different warning signal characteristics, since one PROM store may readily be exchanged for another and the degree of variation in the individual warning signals emitted by different priority vehicles may readily be accommodated in the processing of the micro-processor.

CLAIMS

1. A traffic signal system comprising means for detecting a warning of approach or presence signal emitted by a priority vehicle and means for determining the direction of approach of said priority vehicle to provide a control signal for setting said signal system to give priority of passage to said priority vehicle, said detecting means comprising means for storing signal pattern characteristics and repetition rate characteristics of warning signals emitted by priority vehicles, means for comparing the signal pattern characteristics and repetition rate characteristics of received warning signals with said stored characteristics and means responsive to a predetermined degree of coincidence over a plurality of cycles of said received warning signals for providing said control signal.

2. A system as claimed in claim 1 and wherein said plurality of cycles comprises three to four cycles.

3. A system as claimed in claim 1 or 2 and wherein means are provided for subjecting received warning signals to bandpass filtering of sufficiently wide bandwidth to encompass likely variations in individual warning signals emitted by different priority vehicles.

4. A system as claimed in any of the above claims and wherein said storage means comprises a PROM (programmable read only memory) store.

5. A system as claimed in any of the above claims and wherein said comparison means and said responsive means form part of a micro-processor.

6. A system as claimed in any of the above claims and wherein said detector means is such as to respond only to audible warning signals.

7. A system as claimed in claim 6 and wherein said audible signal has the nature of a multi-tone and/or a warble.

8. A system as claimed in any of the above claims and wherein said means for determining the direction of approach of said priority vehicle comprises a directional receiver for said warning signal directed downstream of each approach path to said system and means for comparing the level of output of each directional receiver in order to elect which of said approach paths is taken as that along which said priority vehicle is approaching said system.



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Micro-processor 21 is addressed by output addressing circuits 26, which controls gates 13 to 16 via lead 27 to 30 respectively so that initially gates 13 to 16 are closed (i.e. rendered non conductive) in turn. This action permits the micro-processor 21 to determine which of the microphones 9 to 12 are responsible for the highest amplitude of warning signal identified as that of a priority vehicle. In dependence upon this determination output control signals are made available on leads 31 to 34 in order to set the pattern of traffic signals so as to give priority to traffic which is approaching from the direction in which the priority vehicle appears to be approaching.

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2. A system as claimed in claim 1 and wherein said plurality of cycles comprises three to four cycles.

3. A system as claimed in claim 1 or 2 and wherein means are provided for subjecting received warning signals to bandpass filtering of sufficiently wide bandwidth to encompass likely variations in individual warning signals emitted by different priority vehicles.

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6. A system as claimed in any of the above claims and wherein said detector means is such as to respond only to audible warning signals.

7. A system as claimed in claim 6 and wherein said audible signal has the nature of a multi-tone and/or a warble.

8. A system as claimed in any of the above claims and wherein said means for determining the direction of approach of said priority vehicle comprises a directional receiver for said warning signal directed downstream of each approach path to said system and means for comparing the level of output of each directional receiver in order to elect which of said approach paths is taken as that along which said priority vehicle is approaching said system.



9. A system as claimed in any of the above claims wherein said first mentioned comparison means and said responsive means forms part of a micro-processor, and wherein
- 5 said means for comparing the level of output of each directional receiver also forms part of said micro-processor and means are provided for interrupting, in sequence and in turn, the connection from each of said directional re-
- 10 ceivers to said micro-processor whereby to enable said micro-processor to determine which of said directional receivers is receiving with the greatest strength, a warning signal emitted by a priority vehicle.
- 15 10. A traffic signal system substantially as herein described with reference to the accompanying drawings.

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