



A SYSTEM AND METHOD FOR DETERMINING A QUANTITATIVE RESULT FOR A VEHICLE TRAVERSING A CIRCUIT, A MONITORING DEVICE USED IN THE SYSTEM AND METHOD

5 FIELD OF INVENTION

The present invention relates to a system and method usable for a form of motor racing, particularly, relating to the determination of a quantitative result during the form of motor racing. A monitoring device used in the system and
10 method is also described.

BACKGROUND

Motor sport encompasses many varying types of events which cater to
15 individual preferences of motor sport fanatics. The most popular type of event relate to the "race against the clock" type of events. These events include, for example, Formula One, NASCAR, Super GT, Le Mans, MotoGP, World Rally Championship and the like. In these events, the declared winner is the competitor who sets a fastest time for the event. The manner/style which the
20 declared winner drove to win the event is irrelevant to the final result. There has been criticism for many of such events in relation to the lack of entertainment due to unequal vehicle capabilities and/or the tactical aspect (like pitstop strategy) overshadowing the entertainment aspect.

25 A form of motor racing which is steadily gaining global popularity from its origins in Japan is drifting. Drifting is gradually losing it's status as a fringe motor sport and is steadily entering into mainstream consciousness. The D1 racing series is a series of drifting races which emphasizes driving panache/skill. Proof of the growing popularity can be seen by the expansion of
30 the D1 racing series from Japan to USA, Malaysia and New Zealand. In the D1 racing series, a panel of judges dispenses scores for each competitor, with the scores depending on how the competitor drove at the event (typically a series of bends/corners). A common problem in the D1 racing series relates to how the scoring for each competitor is dependent on each judge in the panel



and is thus highly subjective. Both competitors and attendees to the event may not agree with the opinion of a certain judge or the panel per se. This uncertainty is undesirable to both competitors and attendees as the legitimacy/accuracy of each result may be questioned.

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There is currently no event in the realm of motor sport which combines aspects of both a "race against the clock" and also takes into consideration driving panache/skill. The present invention aims to fill this void in the realm of motor sport. Furthermore, the present invention also aims to avoid uncertainty in the result such the legitimacy/accuracy of each result may not be doubted at the conclusion of the race.

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SUMMARY

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In a first aspect, there is provided a system for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit. The system includes a timer to determine and record a time the vehicle takes to complete the at least one lap; a plurality of monitoring devices located at a plurality of locations along the pre-defined circuit, with each monitoring device being used to record data of vehicle characteristics as the vehicle passes each of the plurality of locations; and a server to store both the time and the data, the server also analyzing both the time and data to provide the quantitative result. It is advantageous that the quantitative result is dependent solely on the analysis by the server. The data of vehicle characteristics is preferably obtained using image analysis of each of the plurality of still images, the data selected from the group consisting of: angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated at each location.

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It is advantageous that the server uploads the time, data and quantitative result to an online storage server, with the online storage server acting as a retrievable archive. A service providing access to the time, data and quantitative result stored in the online storage server may be made available either via subscription or on an on-demand basis. The service may preferably

aid in tracking and quantifying performance at the pre-defined circuit either during a single session or during multiple sessions over a period of time.

Preferably, the plurality of locations are at bends of the pre-defined circuit. It is preferable that the time is given a first weightage and the data is given a second weightage during the analysis to provide the quantitative result. The analysis may be of the form selected from the group consisting of: the first weightage being greater than the second weightage, the first weightage being less than the second weightage, and the first weightage being equal to the second weightage. The weightage may be in the form of a percentage.

Each of the plurality of monitoring devices may include: at least one camera to capture a plurality of still images; a stand to mount the at least one camera in a manner which allows a top view of the vehicle to be captured by the at least one camera; and a receiver to receive signals from a transponder in the vehicle, the receiver sending a command to activate the at least one camera on receiving the signals, and the receiver sending a command to de-activate the at least one camera when no signals are received. Each of the plurality of monitoring devices may be used for both determining and recording drift behavior of the vehicle. It is preferable that the transponder also transmits information to the receiver pertaining to steering angle of the wheels being steered in the vehicle.

Preferably, the plurality of still images are transmitted to the server either through a cable or wirelessly. The at least one camera may be either a video camera or a high speed camera. The plurality of still images may be obtained from frame captures of moving images captured by the video camera. A wide angle lens may be used with the at least one camera to obtain a broader view of each of the plurality of locations.

In a second aspect, there is provided a monitoring device used to record data of characteristics of a vehicle as the vehicle passes a location. The device includes at least one camera to capture a plurality of still images; a stand to mount the at least one camera in a manner which allows a top view of the

vehicle to be captured by the at least one camera; and a receiver to receive signals from a transponder in the vehicle, the receiver sending a command to activate the at least one camera on receiving the signals, and the receiver sending a command to de-activate the at least one camera when no signals are received. It is advantageous that each monitoring device is used for both determining and recording drift behavior of the vehicle. The data of vehicle characteristics may be obtained using image analysis of each of the plurality of still images, the data selected from the group consisting of: angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated at each location.

The at least one camera may be either a video camera or a high speed camera. A wide angle lens may be used with the at least one camera to obtain a broader view of the location. The plurality of still images are then obtained from frame captures of moving images captured by the video camera. The plurality of still images may be transmitted to a server for both storage and analysis either through a cable or wirelessly. Preferably, the transponder also transmits information to the receiver pertaining to steering angle of the wheels being steered in the vehicle.

In a final aspect, there is provided a method for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit. The method includes determining a time the vehicle takes to complete the at least one lap; recording data of vehicle characteristics as the vehicle passes each of a plurality of locations; and analyzing both the time and the data to provide the quantitative result. The quantitative result may preferably be dependent solely on analysis by a server. The plurality of locations may be at bends of the pre-defined circuit.

Recording of the data may be performed by a monitoring device, the monitoring device being like the monitoring device of the second aspect of the present invention.

DESCRIPTION OF DRAWINGS

In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limitative example only preferred embodiments of the present invention, the description being with reference to the accompanying illustrative drawings.

Figure 1 shows an overview of essential components of the system.

Figure 2 shows a representative view of the monitoring device.

Figure 3 shows a process flow of the method of the invention.

Figure 4 shows a representation of a multi-exposure still image of a vehicle as captured by the monitoring device.

DESCRIPTION OF PREFERRED EMBODIMENTS

In a first aspect, there is shown in Figure 1 a system 20 for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit 22. The pre-defined circuit 22 may either be a purpose-built track circuit or a street circuit defined for an event like how the streets of Monaco, Valencia and Singapore are converted for their respective Formula One GPs. The pre-defined circuit 22 of an oval track as shown in Figure 1 is merely representative and not limiting in any manner. The system 20 includes a timer 24 to determine and record a time that the vehicle takes to complete the at least one lap of the pre-defined circuit 22. The timer 24 should be able to keep track of the total time that the vehicle is traversing on the pre-defined circuit 22, and also track individual lap timings.

The system 20 may include a plurality of monitoring devices 26 located at a plurality of locations along the pre-defined circuit 22. In Figure 1, four monitoring devices 26 are shown deployed at various portions of the pre-defined circuit 22. Each monitoring device 26 may be used to record data of vehicle characteristics as the vehicle passes each of the locations where each monitoring device 26 is deployed. The plurality of locations may preferably be at bends of the pre-defined circuit 22, as shown in Figure 1. This is primarily

because of the importance of the data of vehicle characteristics at bends. The data of vehicle characteristics may quantify drift behaviour of a vehicle at the bends. The monitoring device 26 is thus used for both determining and recording drift behavior of the vehicle at the bend. Obtaining the data of vehicle characteristics (drift behavior) is done by using the monitoring device 26 to capture a series of still images of the vehicle at the bend.

A simplified non-limiting representative view of the monitoring device 26 is shown in Figure 2. It should be noted that the monitoring device 26 is also another aspect of the present invention. The monitoring device 26 will thus be described in greater detail in a subsequent portion of this section.

Furthermore, the system 20 includes a server 28 to store both the time (either total time or individual lap timings) and the data. The plurality of still images may be transmitted to the server 28 either through a cable or wirelessly. The server 28 may include at least one set of instructions to analyze both the time and data to provide the quantitative result for the vehicle. The data is obtained by known techniques of image analysis including pixel recognition of each of the plurality of still images. The data obtained includes, for example, angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated (due to wheelspin) at each location. An example of the vehicle moving past a location on the pre-defined circuit 22 with the monitoring device 26 is shown in Figure 4 in the form of a representation of a multi-exposure still image. An image similar to that shown in Figure 4 may be obtained by digitally superimposing a series of consecutively captured still images together. This superimposing may be performed by the server 28. A dot 80 on the vehicle 82 denotes both a front end of the vehicle 82 and a transponder, with the vehicle 82 moving sequentially from 82(a) to 82(b) to 82(c) to 82(d), with each representation denoting a specific juncture in time. The data may be obtained by analyzing the vehicle at the various junctures in time. Signals from the transponder may be detected either by the monitoring device 26 or antennas embedded in a portion of the pre-defined circuit 22 where the monitoring device 26 is located.

The server 28 may upload the time, data and quantitative result to an online storage server 30, with the online storage server 30 acting as a retrievable archive for any person. The uploading of the time, data and quantitative result to the online storage server 30 may be done nearly instantaneously once the time, data and quantitative result are available. In this regard, a service providing access to the time, data and quantitative result stored in the online storage server 30 may be made available to any person, with the service being made available either via subscription or on an on-demand basis. This greatly aids users of the pre-defined circuit 22 in tracking and quantifying their performance at the pre-defined circuit 22 either during a single session at the pre-defined circuit 22 or during multiple sessions at the pre-defined circuit 22 over a period of time.

The at least one set of instructions to analyze both the time and data may be such that the time is given a first weightage and the data is given a second weightage during the analysis to provide the quantitative result. The weightage may be in the form of a percentage. For example, the first weightage may be greater than the second weightage (where driving speed takes precedence over driving style/panache), the first weightage being less than the second weightage (where driving speed is of lower importance compared to driving style/panache), or the first weightage being equal to the second weightage (where equal importance is given to both driving speed and driving style/panache). In this regard, the at least one set of instructions on the server enables the determination of the quantitative result. Reliance of the at least one set of instructions enables sole dependency on the analysis by the server 28, without intervention of any human or variable subjectivity. Thus, the system 20 enables certainty in a result and aids in limiting doubt in relation to the legitimacy/accuracy of each result.

Referring to Figure 2, there is shown the second aspect of the present invention, the monitoring device 26. The monitoring device 26 includes at least one camera 40 to capture a plurality of still images. The at least one camera 40 may be either a video camera or a high speed camera. A wide

angle lens 42 may be used with the at least one camera 40 to obtain a broader view at the location. In an instance when a video camera is used, the plurality of still images are obtained from frame captures of moving images captured by the video camera.

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The monitoring device 26 may include a stand 44 to mount the at least one camera 40 in a manner which allows a top view of the vehicle to be captured by the at least one camera 40. This top view is shown in Figure 4 in the form of a representation of a multi-exposure still image. An image similar to that shown in Figure 4 may be obtained by digitally superimposing a series of consecutively captured still images together. This superimposing may be performed by the server 28. An explanation in relation to Figure 4 has been provided in an earlier portion of this section. The monitoring device 26 may also include a receiver 46 to receive wireless signals from a transponder 80 in the vehicle 82, the receiver 46 sending a command to activate the at least one camera 40 on receiving the signals, and the receiver 46 sending a command to de-activate the at least one camera 40 when no signals are received, typically when the transponder 80 in the vehicle 82 is out of range and out of the field of view of the at least one camera 40. The transponder 80 may also transmit information to the receiver 46 pertaining to steering angle of the wheels being steered in the vehicle 82 and this information may be stamped on the plurality of still images, with the steering angle of the wheels denoted at a particular image at that juncture in time. Thus steering angle of the wheels being steered in the vehicle 82 may also be obtainable. As mentioned in an earlier portion, the plurality of still images obtained by the monitoring device 26 may be transmitted to the server 28 either through a cable 48 or wirelessly 50.

In a final aspect of the present invention as shown in Figure 3, there is provided a method 100 for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit. The pre-defined circuit may either be a purpose-built track circuit or a street circuit defined for an event like how the streets of Monaco, Valencia and Singapore are converted for their respective Formula One GPs.

The method 100 includes recording a time the vehicle takes to complete the at least one lap (102). Subsequently, data of vehicle characteristics is recorded as the vehicle passes each of a plurality of locations (104), with the data being obtained with the use of a monitoring device like the monitoring device described in an earlier portion of this section. The plurality of locations may be at bends of the pre-defined circuit. This is primarily because of the importance of the data of vehicle characteristics at bends. The data of vehicle characteristics may quantify drift behavior of a vehicle at the bends. The monitoring device is thus used for both determining and recording drift behavior of the vehicle at the bend. Obtaining the data of vehicle characteristics (drift behavior) is done by using the monitoring device to capture a series of still images of the vehicle at the bend.

Subsequently, both the time and the data are analyzed (106) to provide the quantitative result (108). A server may include at least one set of instructions to analyze both the time and data to provide the quantitative result for the vehicle. The data is obtained by image analysis of each of the plurality of still images. The data obtained includes, for example, angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated (due to wheelspin) at each location.

The at least one set of instructions to analyze both the time and data may be such that the time is given a first weightage and the data is given a second weightage during the analysis to provide the quantitative result. The weightage may be in the form of a percentage. For example, the first weightage may be greater than the second weightage (where driving speed takes precedence over driving style/panache), the first weightage being less than the second weightage (where driving speed is of lower importance compared to driving style/panache), or the first weightage being equal to the second weightage (where equal importance is given to both driving speed and driving style/panache). In this regard, the at least one set of instructions on the server enables the determination of the quantitative result. Reliance of the

at least one set of instructions enables sole dependency on the analysis by the server, without intervention by any human or variable subjectivity. Thus, the method 100 also enables certainty in a result and aids in limiting doubt in relation to the legitimacy/accuracy of each result.

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Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications in details of design or construction may be made without departing from the present invention.

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CLAIMS

1. A system for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit, the system including:

5 a timer to determine and record a time the vehicle takes to complete the at least one lap;

a plurality of monitoring devices located at a plurality of locations along the pre-defined circuit, with each monitoring device being used to record data of vehicle characteristics as the vehicle passes each of the plurality of
10 locations; and

a server to store both the time and the data, the server also analyzing both the time and data to provide the quantitative result,

wherein the quantitative result is dependent solely on the analysis by the server.

15 2. The system of claim 1, wherein the server uploads the time, data and quantitative result to an online storage server, the online storage server acting as a retrievable archive.

20 3. The system of claim 2, wherein a service providing access to the time, data and quantitative result stored in the online storage server is made available, the service being made available either via subscription or on an on-demand basis.

25 4. The system of claim 3, wherein the service aids in tracking and quantifying performance at the pre-defined circuit either during a single session or during multiple sessions over a period of time.

5. The system of claim 1, wherein the plurality of locations are at bends of
30 the pre-defined circuit.

6. The system of claim 1, wherein each of the plurality of monitoring devices include:

at least one camera to capture a plurality of still images;

a stand to mount the at least one camera in a manner which allows a top view of the vehicle to be captured by the at least one camera; and

a receiver to receive signals from a transponder in the vehicle, the receiver sending a command to activate the at least one camera on receiving the signals, and the receiver sending a command to de-activate the at least one camera when no signals are received,

wherein each of the plurality of monitoring devices is used for both determining and recording drift behavior of the vehicle.

7. The system of claim 6, wherein the plurality of still images are transmitted to the server either through a cable or wirelessly.

8. The system of claim 6, wherein the data of vehicle characteristics is obtained using image analysis of each of the plurality of still images, the data selected from the group consisting of: angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated at each location.

9. The system of claim 6, wherein the at least one camera is either a video camera or a high speed camera.

10. The system of claim 9, wherein the plurality of still images are obtained from frame captures of moving images captured by the video camera.

11. The system of claim 1, wherein the time is given a first weightage and the data is given a second weightage during the analysis to provide the quantitative result.

12. The system of claim 11, wherein the analysis is of the form selected from the group consisting of: the first weightage being greater than the second weightage, the first weightage being less than the second weightage, and the first weightage being equal to the second weightage.

13. The system of claim 12, wherein the weightage is in the form of a percentage.

14. The system of claim 6, wherein a wide angle lens is used with the at least one camera to obtain a broader view of each of the plurality of locations.

15. The system of claim 6, wherein the transponder also transmits information to the receiver pertaining to steering angle of the wheels being steered in the vehicle.

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16. A monitoring device used to record data of characteristics of a vehicle as the vehicle passes a location, the device including:

at least one camera to capture a plurality of still images;

15 a stand to mount the at least one camera in a manner which allows a top view of the vehicle to be captured by the at least one camera; and

a receiver to receive signals from a transponder in the vehicle, the receiver sending a command to activate the at least one camera on receiving the signals, and the receiver sending a command to de-activate the at least one camera when no signals are received,

20 wherein each monitoring device is used for both determining and recording drift behavior of the vehicle.

17. The device of claim 16, wherein the data of vehicle characteristics is obtained using image analysis of each of the plurality of still images, the data selected from the group consisting of: angle of entry of the vehicle to each location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated at each location.

18. The device of claim 16, wherein the at least one camera is either a video camera or a high speed camera.

19. The device of claim 18, wherein the plurality of still images are obtained from frame captures of moving images captured by the video camera.

20. The device of claim 16, wherein the plurality of still images are transmitted to a server for both storage and analysis either through a cable or wirelessly.

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21. The device of claim 16, wherein a wide angle lens is used with the at least one camera to obtain a broader view of the location.

22. The device of claim 16, wherein the transponder also transmits information to the receiver pertaining to steering angle of the wheels being steered in the vehicle.

23. A method for determining a quantitative result for a vehicle traversing along at least one lap of a pre-defined circuit, the method including:

15 determining a time the vehicle takes to complete the at least one lap;
recording data of vehicle characteristics as the vehicle passes each of a plurality of locations; and

analyzing both the time and the data to provide the quantitative result, wherein the quantitative result is dependent solely on analysis by a server.

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24. The method of claim 23, wherein the plurality of locations are at bends of the pre-defined circuit.

25. The method of claim 23, wherein recording of the data is performed by a monitoring device, the monitoring device including:

at least one camera to capture a plurality of still images;

a stand to mount the at least one camera in a manner which allows a top view of the vehicle to be captured by the at least one camera; and

30 a receiver to receive signals from a transponder in the vehicle, the receiver sending a command to activate the at least one camera on receiving the signals, and the receiver sending a command to de-activate the at least one camera when no signals are received,

wherein the monitoring device is used for both determining and recording drift behavior of the vehicle.

5 26. The method of claim 25, wherein the plurality of still images are transmitted to the server either through a cable or wirelessly.

27. The method of claim 25, wherein the data of vehicle characteristics is obtained using image analysis of each of the plurality of still images, the data selected from the group consisting of: angle of entry of the vehicle to each
10 location, angle of exit of the vehicle from each location, drift angle of the vehicle at each location, and amount of smoke generated at each location.

28. The method of claim 25, wherein the at least one camera is either a video camera or a high speed camera.

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29. The method of claim 28, wherein the plurality of still images are obtained from frame captures of moving images captured by the video camera.

20 30. The method of claim 23, wherein the time is given a first weightage and the data is given a second weightage during the analysis to provide the quantitative result.

31. The method of claim 30, wherein the analysis is of the form selected
25 from the group consisting of: the first weightage being greater than the second weightage, the first weightage being less than the second weightage, and the first weightage being equal to the second weightage.

32. The method of claim 31, wherein the weightage is in the form of a
30 percentage.

33. The method of claim 25, wherein a wide angle lens is used with the at least one camera to obtain a broader view of each of the plurality of locations.

34. The method of claim 25, wherein the transponder also transmits information to the receiver pertaining to steering angle of the wheels being steered in the vehicle.