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Development of a Motorcycle Driving Data Logger for Emissions and Fuel Consumption Assessment.

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Abstract

In this study, a driving data logger for a four stroke gasoline motorcycle has been developed. Recorded data of a driver was used to generate a driving cycle with emission data for exhaust gas and fuel consumption rate assessment. The data from the device can be transferred to the computers by the SD memory cards. This device has been improved from a garage made speed-time data logger. It is more suitable and compact in design. Not only the device can record the movement parameters (velocity and position of a vehicle) but the amount of exhaust emissions, Engine speed, and mass flow rate of intake air via a manifold of a test motorcycle can be written to its memory also. Recording process controlled by a microcontroller. These recorded results will then be used to evaluate a motorcycle driving model in each area. The model could be used to estimate fuel consumption and emissions of a vehicle relating to its driving cycle within any prospective urban area.

Key words: Driving and Engine efficiency data logger, Emissions detector, Driving cycle.

1. Introduction

Presently, air pollution problem have more affect to natural and all living being such as green house effect etc. Especially, the influence of economic growth in central city which has large transportation and rapid growth of vehicles. The motorcycle has become a popular vehicle of transportation system in Thailand. From the traffic congestion which has effect to occur air pollution from exhausts emissions of vehicle and has effect to more fuel consumption. Therefore, the vehicle speed data, speed of engine, air flow rate into intake manifold, the volume of exhaust emissions and fuel consumption ratio have necessary In order to model a driving cycle for reduced

evaluation exhaust emissions and fuel consumption of vehicle then traffic congestion in each area [1, 2] . The data obtained from test driving in the traffic congestion, which has been generate a driving cycle of each area and evaluated the exhaust emissions and fuel consumption of vehicles on the chassis dynamometer testing engine.

The obtained result from tested target method has not accuracy to exhaust emissions assessment. In order to target parameter deviation behavior of driving cycle with compared real data. The developed data logger for recorded data has been was vehicle speed, engine speed, air flow rate of intake air via a manifold was combustion, volume of the exhaust emissions and fuel consumption. It's evaluating vehicle behavior in traffic congestion conditional on road. Meanwhile, fuel consumption and emissions from pollution sources.

This developed device was installed on target motorcycle. Due to the data obtained speed was has driving behavior assessment [3] exhaust emission gas and fuel consumption [4]. Further, The data transfer via a record device send to for analysis program by computer.

In this paper was has to arrive at the detail of equipment development has storage and display unit that from the obtained data.

2. data logger operation

This device has developed based on the equipment "Speed-Time Data Logger" which was developed use to recording data such as vehicle speed, the position coordinate and speed of engine [5]. Presently, the equipment has to developed add the part measures demotion quantity liberates exhaust gas, and adjust the part evaluates to record for support the data has increased.

2.1 Device data management system

In a part, this device data management system to receive sensor processed signals. It is record storage data using by SD card memory.

In show Fig.1 the device data management system separate to the three components which are 1) Microcontroller unit 2) Global Positioning System (GPS) unit 3) Data storage unit.

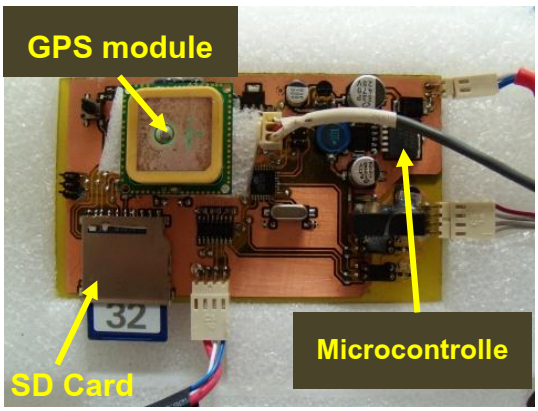

Fig.1 The device data management system

The microcontroller unit used to attribute has performance also instantaneous process data in order to the large number and huge amounts of obtain data from Instrument sensor unit and gas detector. This is calculation and record of data to the SD card every second. the data saving in

hardware the part of system development designs easily for the convenience in appreciating data, consider the event works of the equipment because the data has from the equipment has detected and data administration that must do in one time with at write the data.

As shown in detail in Fig.2 is a detail diagram of Multi Sensors Emission Logger equipment consists of Gas detector, GPS module, Air flow sensor, OPTO-Isolator sensor, and Hall effect sensor.

This paper, the hard system is developed by microcontroller to convert obtain signal data. This is divided into two parts. The quick access to the information that will be used microcontroller. The first microcontroller used to signal data management from instrument sensor unit such as the velocity vehicle data, speed of engine, air flow rate into intake manifold. Second microcontroller unit used to obtain signal data from gas detector unit, Global Positioning System unit (GPS) and recording all data in SD card unit.

3. Sensors Operation

The hardware of the data logger system has developed based Speed-time data logger equipment; the microcontroller is used to obtain all sensor data and to manage the data recording and time stamping. The logger signals from a magnetic sensor to determine the spot speed of the motorcycle by second. Such as gas detector, speed of engine, air flow rate into intake manifold and position of vehicle are also detected by the device. After that these information will be recorded in the logger's memory. And the data can also be

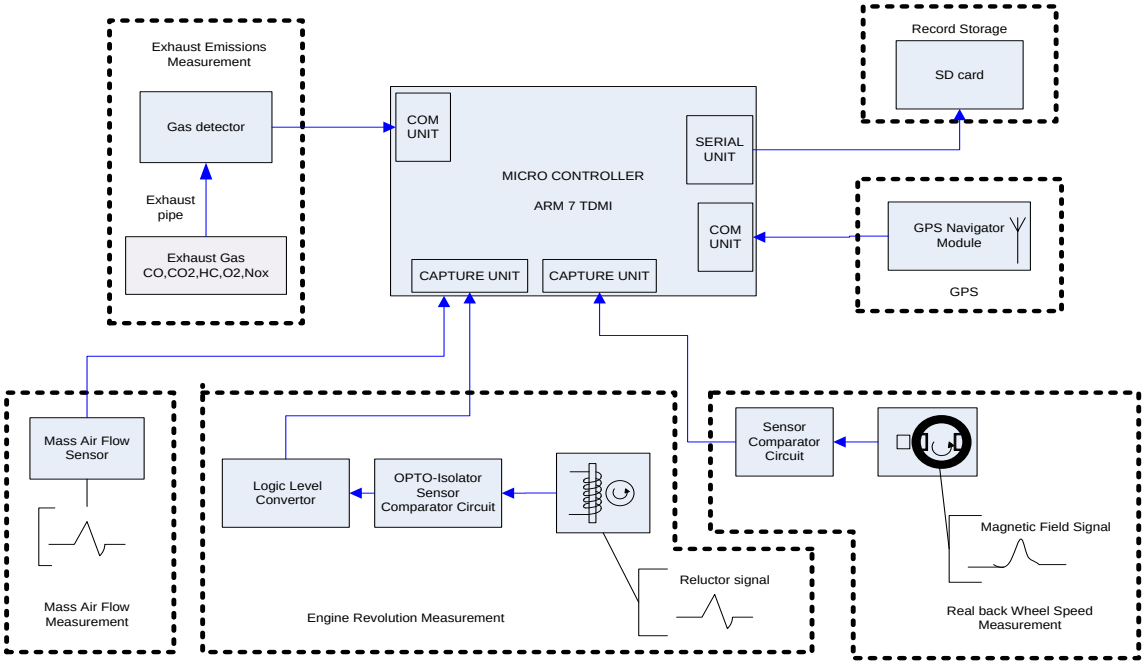

Fig.2 Detail diagram of Multi Sensors Emission Logger equipment

transferred to SD card unit. The data signals come from five parts; 1) Gas detector unit 2) the velocity vehicle sensor unit 3) speed of engine sensor unit 4) air flow rate into intake manifold sensor unit and 5) Global Positioning System unit (GPS)

the data from the equipment was sent to the hardware evaluates and record.(see Fig.2) equipment detects that use in this equipment development keys , will choose for appropriate the event works of a motorcycle , quantity or kind of exhaust gas ,will get explain in the next heading.

3.1) Gas detector analysis unit

The measure of exhaust emissions in order to evaluated performance of vehicle for calibrated motorcycle will must consider important element will use in the assessment exhaust emissions measure is born from the kind of combustion engine. The exhaust gas emitted (CO, CO2, O2, HC, and, NOx) will evaluated by INFRALYT SMART machine (Fig.4). Measurement of the exhaust emission of motorcycle will be gas concentrations (CO, CO2, O2, HC and NOx) by Non-Depressive Infrared (NDIR) for CO, CO2 and HC, Which has measure the amount of oxygen (O2) and oxides nitrogen (NOx) by Electro-Chemical Cell and fuel consumption assessment by carbon balance method.

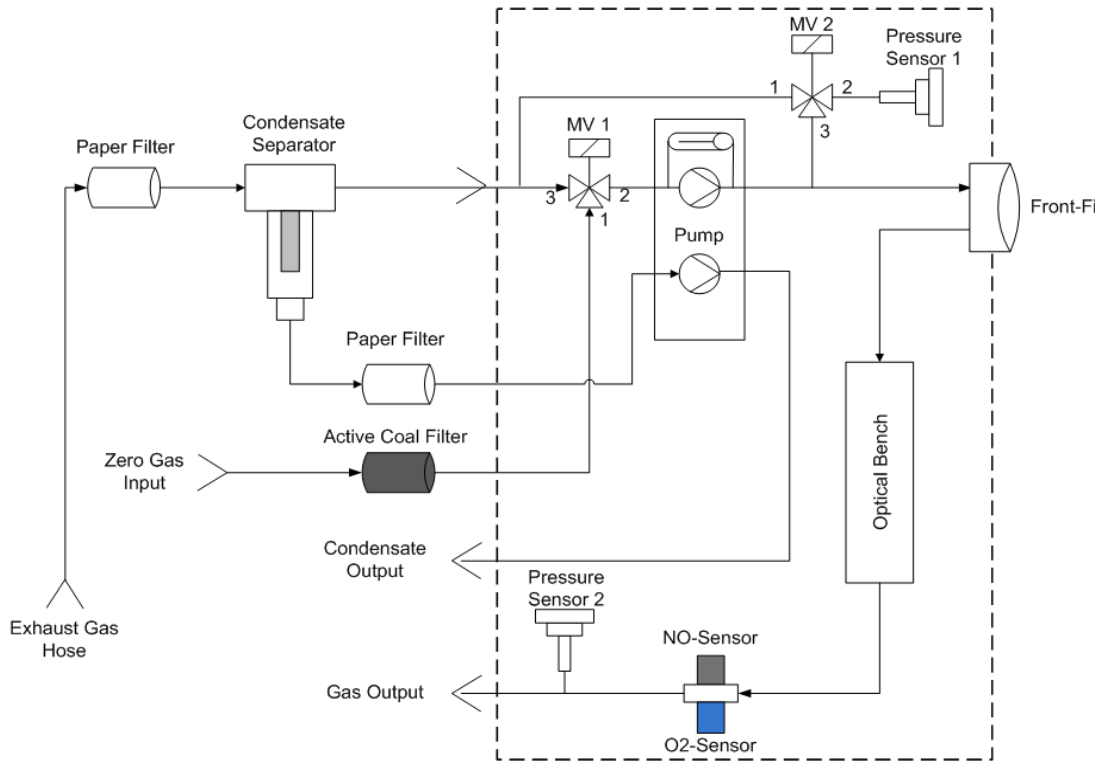

Fig. 3 Gas Flow Schematic Diagram

Fig. 4 Multi Sensors Emission Logger

The exhaust gas analysis equipment upon star-up require warm-up period and automatically sets into Zero-calibration. May be considered the exhaust flow path in Figure 3, in the equipment. Gas detector equipment will be installed at the rear of the motorcycle (see Fig.4) in order to close to the tailpipe exhaust gas which has absorber exhaust emissions into equipped. The equipment will suck exhaust emissions inside gas detector and analysis gas from a motorcycle, the data has from analysis will show still in monitor and sent the data to equipment record every second of data saving.

3.2) The velocity vehicle sensor unit

To measure the velocity of the motorcycle, a Hall-effect base sensor is installed on the rear wheel of the motorcycle (Fig.6) to detect the wheel rotating speed. A producing pulse can be observed via the magnetic sensor (see Fig.2). These pulses are then converted to voltage signal by using a voltage converter circuit.

The microcontroller will convert this voltage signal to be speed time data. The device has been developed to have the capability to log the speed values in term of a per second basis. Fig.6 sensors installed on the rear wheel of the motorcycle.

The position of the pole on the rear wheel of a motorcycle. The angle of 180 degrees a part on the pole. The pole magnetic will be installed on the rear of the motorcycle.

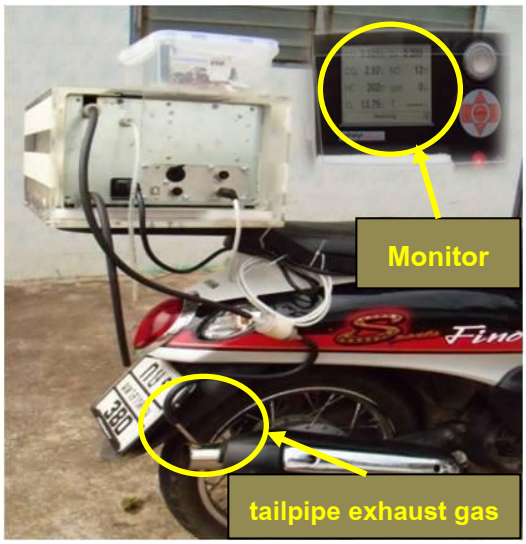

Fig. 5 Gas detector analysis unit on the rear of motorcycle

Fig. 6 The sensor on the rear wheel of the motorcycle.

3.3) The speed of engine unit

The engine revolution signal will be measured from extraction pulse data of the Capacitor Discharge Ignition (CDI) in the motorcycle control unit (see Fig. 3 and 7). The microcontroller will read signal from sensors and record the data to SD card unit. It should be note here that the receiving signal voltage from pulser coil has on the chuck shaft. The microcontroller will convert this voltage signal to be speed of engine data.

Fig. 7 The speed of engine unit from the Capacitor Discharge Ignition (CDI)

3.4) Air flow rate into intake manifold sensor unit

Measurement air flow rate into intake manifold can be installed air flow sensor unit on position air intake into carburetor (see Fig. 8). The sensor measure flow as high as 0-200 standard liters per minute (SLPM) while inducing a pressure drop of 1 inch H_2O. It has a high flow range capability in a small package.

The microcontroller will convert this voltage signal to be air flow rate into intake manifold data.

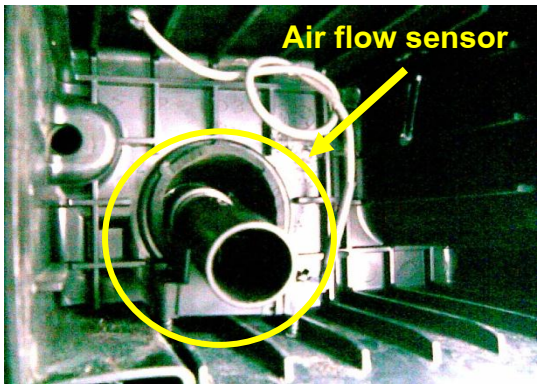

Fig. 8 the Installed air flow sensor unit

3.5) The Global Positioning System (GPS) unit

The measured position and velocity data from the Global Positioning System (GPS) unit. It can also measure position of vehicle. The GPS has accuracy of ± 1.0 meter and ± 0.1 m/sec for position and velocity measurement respectively

The device will transient data from the GPS position and speed of movement of Global Positioning System (GPS) to recorded device to store the data every second while test driving.

4. Results

To test the developed data logger system by test driving motorcycle in route target. The velocity vehicle and exhaust emissions data collection will be carried out using Multi Sensors Emission Logger equipped. Results are shown in Fig.9, the results show that the information velocity vehicle compared with volume of exhaust emissions. To find exhaust gas carbon dioxide (CO_2) have high quantity when have

high-speed driving but while the driving has increase accelerated will be increased excretion rapidly of carbon oxide (CO_2) and nitrogen oxide (NO_x)

a) Carbon dioxide (CO_2) increase from the combustion form the derived that high speed when acceleration has been stable already

b) While enhance the speed to Transient period, at imperfect combustion more has born carbon monoxide (CO) and nitrogen oxide (NOx) and in during the vehicle deceleration has reduced explosion in engine will be the carburetor to mix fuel with air intake via manifold in order to the excess air.

5. Conclusion

This paper, the developed motorcycle driving has data logger equipment for exhaust emissions and fuel consumption assessment. Due to the hard system is developed by microcontroller to convert obtain signal data. It is obtain data from a logger equipment has accuracy. It is more suitable and compact in design. These recorded results will then be used to evaluate a motorcycle driving model in each area. This data can be applied to assess driving cycle of a motorcycle, fuel wastage, and exhaust gas quantity in driving. The data is correct more than the test on Chassis Dynamometer.

6. Acknowledgement

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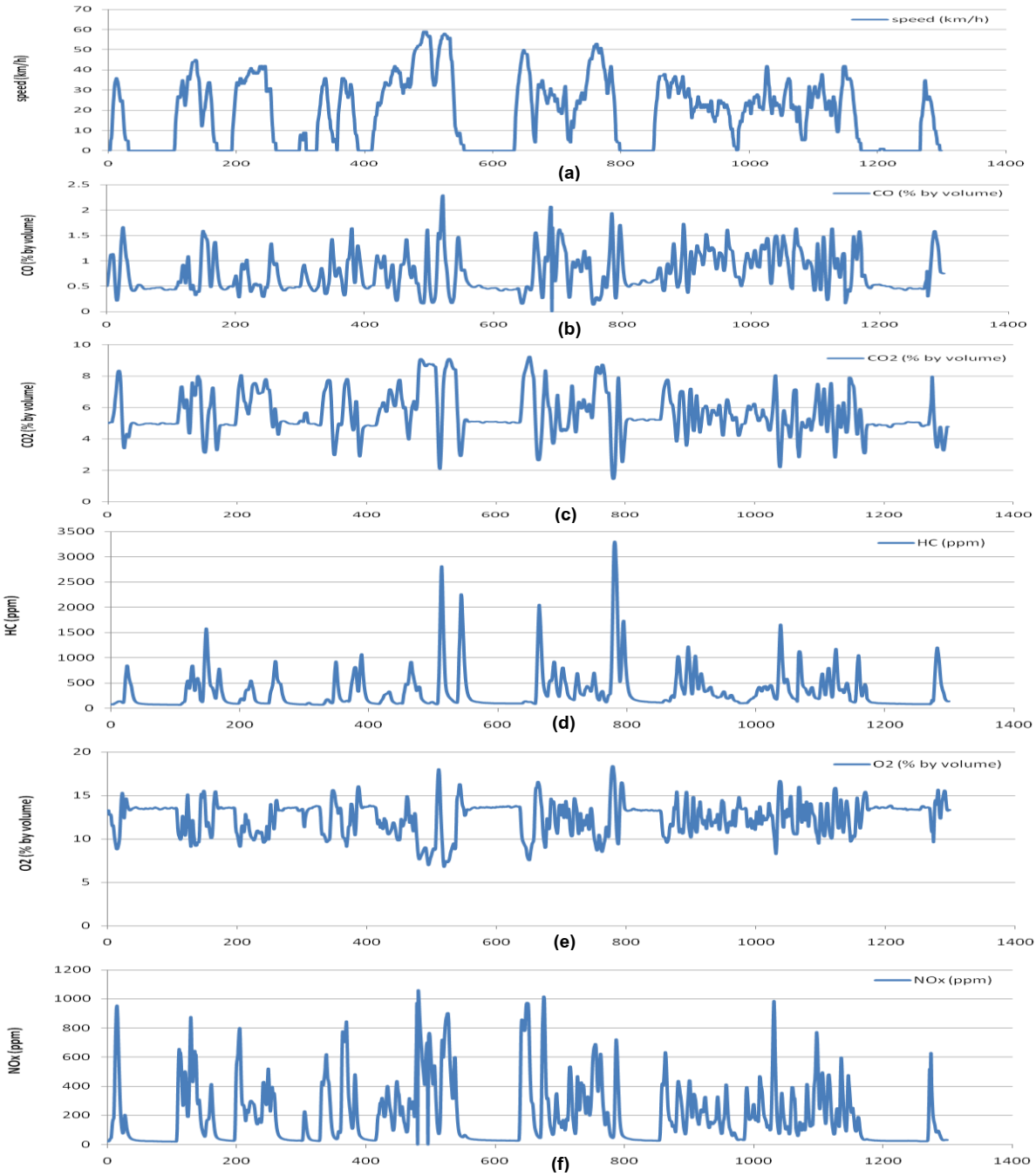

Fig. 9 the information velocity vehicle compared with volume of exhaust emissions (a) Speed, (b) CO, (c) CO_2, (d) HC, (e) O_2, (f) NO_x