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Automated Diesel Engine Test Bench For Earth Moving Vehicles

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Abstract: *The project is for general purpose usage which can be used for industrial and automation applications so that the problem associated with the test bench of diesel engines for earth moving vehicles can be carried out. The proposed work describes the design of prototype of diesel engine test bench for earth moving vehicles. Test bench for the diesel engine is very important for the automotive industries to check the life of the engine. By automating the process, many benefits are available and parallax errors can also be removed. Micro-controller is used as a controller which will provide the needed inputs and outputs and USART lines for the process. This project can remove the human effort and make the whole system automated and display output to the display devices. By interfacing the controller along with LabView the overall data can be transferred to a single user PC.*

Keywords: *Test bench, Diesel engines, Earth Moving Vehicles, Micro-controller, LabView.*

I. INTRODUCTION

The main goal is to develop outline for designing and constructing a kind of test bench module which provides with automated checking of the parameters required for the working of diesel engine of earth moving vehicles.An engine test bench is a facility used to develop, characterize and test engines. The facility, often offered as a product to automotive Original Equipment Manufacturers(OEMs), allows engine operation in different operating regimes and offers measurement of several physical variables associated with the engine operation. An engine test bench comprises of sensors, transducers, data acquisition systems to control the engine. The different type of sensors are used to measure the different parameters.

Need of automated machine is due to the various problems faced like Parallax error, less precision. less accuracy, manual creation of testing reports, regular calibration is also needed and it consumes a lot of time for every process. Main objective of the project is to reduce man power, provide a clean and safe automated diesel engine test bench, increase the speed of test bench module using micro-controller safe and secure operations.An automated test bench provides with the automated sensing of the different parameters and limiting their threshold values, hence protecting the engine. In manual or standard methods of diesel engine test bench, the disadvantages may be:

- Parallax error.
- Less control on the threshold limit values.
- Reduced safety for the operators.

I.1 Limitation of Prior Technology / Art

In the current scenario of digitization, companies are using analog devices to measure numerous data for the testing of engines used in Earth Moving Machines, this technique leads to numerous human error. Even a lot of time is consumed to do every process manually for testing with a lots of human error. Hence if we can develop an automated system it will be helpful in the reducing the errors while testing these machines and can save a lot of time. Even after proper maintenance or repairing of these heavy duty engine report of engine test has to be submitted to the clients of the company as a proof of proper working of engine over certain conditions.These reports are generally created manually with pen and paper which can sometime lead to be not clear hence clients can not read it properly, but with automation these reports can be directly printed out with no errors at all. Even storing these paper reports is a sort of tedious work with a lot paper wastage and also we need some room to store these report. With the help of automation we can remove the paper work and it will a lot easier to store the data of these reports in Electronic storage devices.

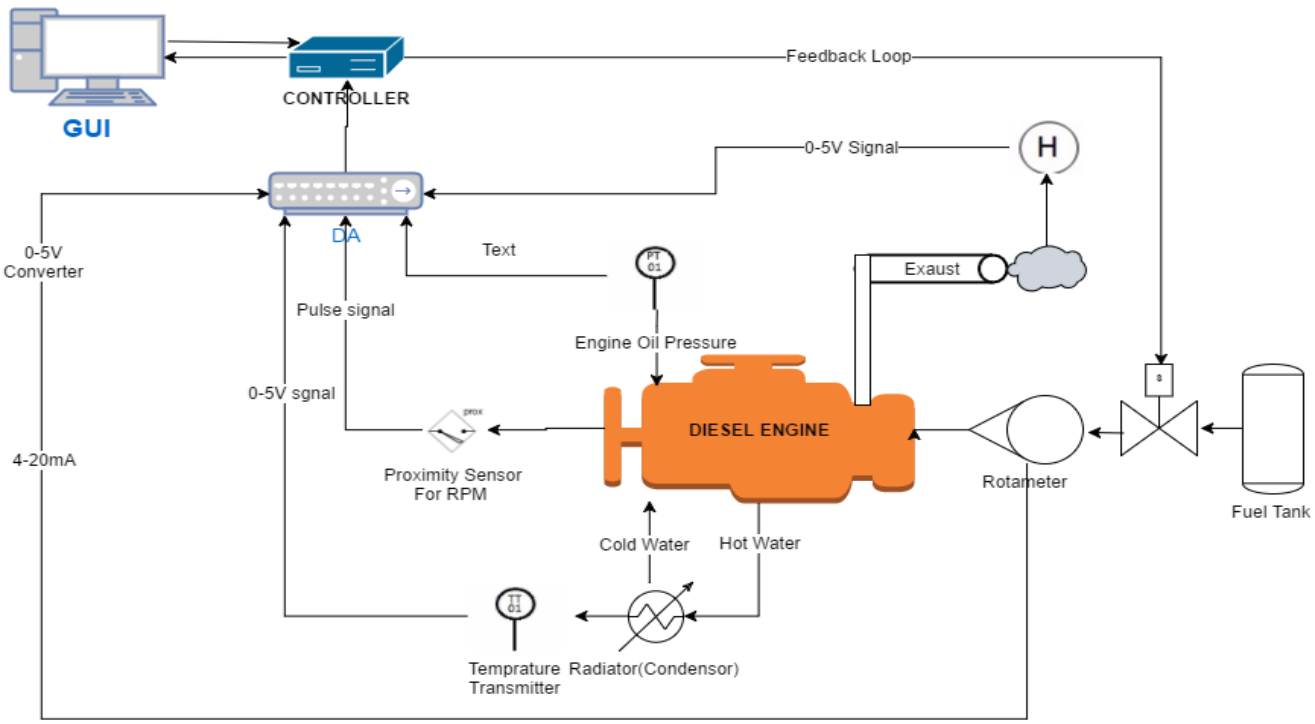
I.2 Specific Problem Solved / Objective of Invention:

- The principal object of this invention is to provide an improved automated diesel engine test bench to provide with accurate engine oil temperature, exhaust gas temperature and radiator temperature through the temperature sensors.
- Another object of this invention is to provide an accurate pressure reading of engine oil pressure through pressure sensors.
- Next objective of this invention is to measure the humidity on the exhaust gas to check the humidity in the engine.
- Further objective is to measure the Rotations Per Minute(RPM) of the engine through the proximity sensor.

I.3 Summary of Invention

- In accordance with the present invention a machine is provided for the test bench of diesel engine. This machine comprises of sensors for sensing different parameters.
- The test bench of diesel engine is used to measure the different parameters which are required for the engine.
- The different parameters like temperature, pressure and humidity are to be measured and can easily display on the screen.
- The display will be done by taking data from numerous sensor and then displaying it graphically over the screen(G.U.I.) of the computer.
- The problems can be decreased with the help of this technique as digital data have high accuracy and high precision as compared to analog data.
- More error due to parallax can be eliminated fully.
- Even we can increase the time lapse between two consecutive calibrations of the testing machines.
- This will also help to provide us the Digital images of the testing which will be helpful to us so that we can easily take a printout of testing conditions.

II. BLOCK DIAGRAM



III. HARDWARE AND SOFTWARE

- Micro-controller (Arduino Board)
- Temperature transmitter
- Humidity and temperature sensor
- Pressure transmitter
- Proximity sensor
- Gas analyzer
- SMPS (Power Supply=24v)
- Display unit
- Jumper wires
- LabView

III.1 MICRO-CONTROLLER:

- After the survey we conducted, ARDUINO MEGA 2560 is best suitable according to our application.
- Technical specifications:
  - 8 bit micro-controller which works with 16 MGHz of frequency on power supply of 5 volts, based on ATmega 2560.
  - Consists of 54 digital I/Os, of which 15 are PWM.
  - 16 analog inputs.
  - 4 UARTS.
  - Connectivity through USB 2.0

III.2 PRESSURE TRANSMITTER:

- Pressure transmitter acts as a transducer, where it generates a signal as a function of the pressure that is imposed on the sensor.
- From the survey, **HONEYWELL PX2CG1XX025BSCHX** pressure transmitter suited the most.
- Technical specifications:
  - Pressure range: 0 to 25 bar.
  - Two wire.
  - 4 to 20 mA output.
  - 24V DC input.
  - Accuracy 0.25%
  - DIN connector.
  - Connection size 1/4” BSP
  - Operating range -40 to 125 ^{o}C

III.3 Temperature transmitter:

- Temperature transmitter is an electrical device that interfaces a temperature sensor to a measurement or control device(controller).
- Dallas DS18B20, suited the best.
- Technical specifications:
  - I2C interface.
  - Power supply 3 to 5.5 Volt.
  - Temperature range: -55 0C to +125 0C.
  - ±0.5°C accuracy from -10°C to +85°C
  - Converts 12-bit temperature to digital word in 750 ms (max.)
  - User-definable, nonvolatile temperature alarm settings.

III.4 RETRO- REFLECTIVE POLARIZED SENSOR:

- Polarized retro-reflective sensor is used to count the rotations per minute of the engine and used for the precise positioning of the objects.
- We have decided to use the PRK 3B Retro-reflective photoelectric sensor with polarization filter.
- Technical specifications:
  - Polarized retro-reflective photoelectric sensor, autocollimation optics with red light.
  - High switching frequency for detection of fast events.
  - Easy adjustment via lockable teach button or teach input.
  - Small and compact construction.

III.5 HUMIDITY AND TEMPERATURE SENSOR:

- Humidity and temperature sensor is a sensor that senses the humidity in the surrounding air and spits out a digital output.
- We opted for DHT11 humidity and temperature sensor.
- By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology.
- It ensures high reliability and excellent long-term stability.
- Specifications:
  - Humidity accuracy: ±5%RH
  - Temperature accuracy: ±2℃
  - Package: 4 Pin single Row
  - Power supply: 3 to 5.5 Volts
  - I2C interface

IV. UNIQUE FEATURE OF AUTOMATED DIESEL ENGINE TEST BENCH

- More convenient,
- Eco-friendly,
- Easy to operate,
- Electricity based,
- Cheap in cost,
- Flexible mechanism,
- Comfortable,
- Stability

IV.1 Advantages of our work:

•Gives automated digital output.
•Quick & Secure operation.
•Useful for engine test bench of diesel engine for earth moving vehicles.

V. CONCLUSION

By using micro-controller as the controller of the system, good control over the system can be achieved, manufacturing lead time of the system can be reduced by developing automatic feeding mechanism and worker safety can be increased by reducing the human participation in the process.

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