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Mechatronics Control System in Two Wheelers

Shaik Sagar, K.Hemanth Kumar, S.Shanmukh Rao, B. Ajay, B.Gowthami , V.Maruthi
Corresponding Author:
Mr.D.V.Praveen kumar ReddyM.Tech (A.M.S)

Sri Krishnadevaraya university college of Engineering and technology,Ananthapur,

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ABSTRACT: As we know that Engine is the heart of Automobile.Proper maitainance of engine also increses the efficiency of the vehicle.Now a days accidents are also shows more impact on human life sometimes ir may leads to death. So that inorder to increase the efficiency of the engine and also to save the human life we are going to implement this mechatronics control system in two wheelers. In this system we introduce arduino micro controller and warning system are combined implemented and customised design for two wheeler. This system is implemented on bikes and the actual demo will be done on the bike the aim of this project is to design to develop such type of system for an engine which will aid in protecting the engine from overheating, changing of lubrication oil and alert the driver regarding the engine over speed and over load over the vehicle.

KEYWORDS: Arduino, Speed Sensor, Load Sensor, Temperature Sensor, Viscosity Sensor, Buzzer and Light Indicators,

I. INTRODUCTION

Now a days accidents are major problem in all over the world. The latest statistics revealed by world health organization (WHO) in its first global status report on road safety thousands people are killed on Indian roads due to over speed and the heavy load in two whellers.Among the 89 major cities in India, Bengaluru has reported the highest number of accidents caused by overspeeding, a National Crime Record Bureau (NCRB) data cited.More than a third (37%) of those killed in road accidents in 2019 were two-wheeler riders, noted a Ministry of Road Transport and Highways' report published in October this year. Majority of deaths due to two wheelers accidents were reported in Maharashtra (5,877 deaths) and Uttar Pradesh (5,735 deaths), accounting for 10.1% and 9.9% of total deaths due to twowheeled vehicles respectively.Large number of deaths in road accidentsdue to over- speeding were reported in Karnataka (10.4%) (7,809 out of 75,333 deaths) followed by Madhya Pradesh (9.4%) (7,086 out of 75,333 deaths). Dangerous/careless driving or overtaking caused maximum fatalities in Uttar Pradesh (10,171 out of 35,219) which accounted for 28.9% of total deaths followed by 10.8% (3,817) deaths in Maharashtra. Maximum fatalities due to driving under influence of drug/alcohol were reported in Uttar Pradesh (17.9%) followed by Telangana 11.3%) , Jharkhand (10.4%), Tamil Nadu (9.4%) and Madhya Pradesh (8.7%) during 2020. Most probably young people are effecting to the accidents due to overspeed and triple ride mainly in India.Good maintenance of the engine is also important factor to increase the performance as well as life of engine.Due to overheating of engines which leads change in mechanical properties and cause engine to seize.In order to avoid these difficulties we are implementing the mechatronics contro system. Here in this project we use Arduino to control overspeed, speed at overload, changing of lubrication oil and engine overheating. To control engine overheating we are placing thermocouple

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sensor, for over load condition placing the load sensor, for detecting the over speed we are using speed sensor , finally changing of lubrication we are placing viscosity sensor. This sensor acts as a input devices to the Arduino. In order to control this system we need instructions to the microcontroller in the form of programme in specified language. We make a programme to set a limits regarding the over speed, over load, over heating temperature of engine and low viscosity. As these sensors acts as a input devices to the Arduino. The arduino which receives input signals and run the programme in the microcontroller when ever the limit reaches and delivers a output signal to the output devices.In this way we are controlling the two wheeler. the world, the report noted. India accounts for 11% of the global road accident fatalities.another latest report of national crime record bureau says that 40 peoples under the age of 25 this paper i.ecamless engine, the valve

COMPONENETS IN THE PROJECT

1.Arduino

Input devices

- Sensors
- Temprature sensor
- Soad sensor
- Speed sensor
- Viscosity sensor

Output devices

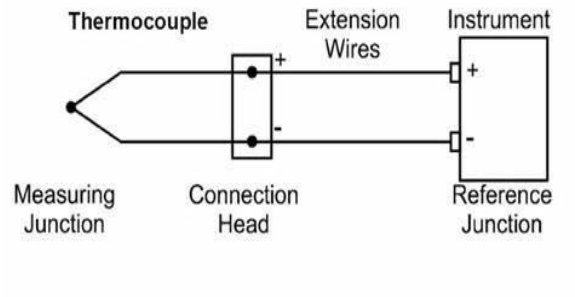
- Speakers
- Light indicators

Conventional throttle control system

ARDUINO;-

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

TEMPERATURE SENSORS



A **thermocouple** is a sensor for measuring temperature. This sensor consists of two dissimilar metal wires, joined at one end, and connected to a thermocouple thermometer or other thermocouple-capable device at the other end. When properly measurements over wide range of temperatures.

Thermocouples are known for their versatility as temperature sensors therefore commonly used on a wide range of applications - from an industrial usage thermocouple to a regular thermocouple found on utilities and regular appliances. Due to their wide range of models and technical specifications, it is extremely important to understand its basic structure, how it works, its ranges as to better determine what is the right type and material of thermocouple for your application.

The type K is commonly found in nuclear applications because of its relative radiation hardness. Maximum continuous temperature is around 1,100C. Thermocouple grade wire, –454 to 2,300F (–270 to 1260C)

LOAD SENSOR

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Load cell is a sensor or a transducer that converts a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used.
There are many different kinds of load cells.

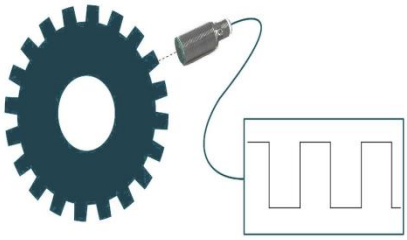
Resistive load cells work on the principle of piezo-resistivity. When a load/force/stress is applied to the sensor, it changes its resistance. This change in resistance leads to a change in output voltage when a input voltage is applied.
Capacitive load cells work on the principle of change of capacitance which is the ability of a system to hold a certain amount of charge when a voltage is applied to it. For common parallel plate capacitors, the capacitance is directly proportional to the amount of overlap of the plates and the dielectric between the plates and inversely proportional to the gap between the plates.

How does a resistive load cell works ?

A load cell is made by using an elastic member (with very highly repeatable deflection pattern) to which a number of strain gauges are attached.

In this particular load cell shown in above figure, there are a total of four strain gauges that are bonded to the upper and lower surfaces of the load cell. When the load is applied to the body of a resistive load cell as shown above, the elastic member, deflects as shown and creates a strain at those locations due to the stress applied. As a result, two of the strain gauges are in compression, whereas the other two are in tension During a measurement, weight acts on the load cell's **metal spring element** and causes **elastic deformation**.
This strain (positive or negative) is converted into an electrical signal by a **strain gauge (SG)** installed on the spring element. The simplest type of load cell is a bending beam with a strain gauge.
We use wheatstone bridge circuit to convert this change in strain/resistance into voltage which is proportional to the load.

SPEED SENSOR



What is speed sensor?

The speed sensor belongs to the tachometer category. It is a device used to measure the speed of wheel rotation of a vehicle. The speed sensor was initially used to replace the mechanical connection between the rotating wheels and the speedometer, reducing the use of cables and facilitating construction by reducing rotating parts. These sensors also generate data that allows automatic driving to take place.

The speed of an object is the magnitude of the change of its position; it is thus a scalar quantity. The average speed of an object in an interval of time is the distance travelled by the object divided by the duration of the interval; the instantaneous speed is the limit of the average speed as the duration of the time interval approaches zero. Speed has the dimensions of distance divided by time. The SI unit of speed is the meter per second, but the most common unit of speed in everyday usage is the kilometer per hour.

Major types of speed sensors:
There are many types of speed sensors, here we will see about the sensor which is the most important of them;
a. Hall Effect Sensor
b. Inductive Sensor
c. Optical sensor
d. Reed switch
e. Potentiometers

Working principle of speed sensor:
b. Inductive Sensor:

An inductive Encoder also known as an Incoder, is a contactless speed and positioning sensor suitable for linear and angular displacements. Based on the electromagnetic induction principle the sensor measures. Main components of an inductive sensor are spools or printed circuits on board. When a metal target approaches the inductor a change of

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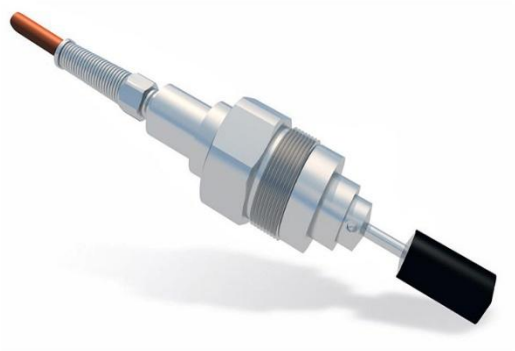
magnetic field happens. As per the law of induction, the sensor creates a voltage at outlet, which is proportional to the changing of a magnetic flux. This allows a current to flows through the inductor and connected wires to the output device. The sensing range depends on the type of target material i.e ferrous metals allow a longer sensing range than nonferrous metals. The electronics board are be placed in proper way from the sensing area which allows for the use of the Incoder in rough environments.

VISCOSITY SENSORS



The viscosity sensor 501 is used extensively for compressor, used oil analysis, on-engine and hydraulic fluid applications. It is ideal for installations where form factor and small sample volume are important. A built-in temperature detector (RTD) senses the actual temperature in the sampling chamber. Constant in and out motion keeps samples fresh, mechanically scrubs the sampling area and provides excellent viscosity tracking. Measurements can be made in any of 6 different 20:1 viscosity ranges between 0.5 and 500 centipoise (cP). Recommended fluid flow over the sensor is up to 30 cm/sec. (1.0 ft/sec.). The viscosity sensor 571 OILSENSE™ is used extensively for compressor, used oil analysis, on-engine and hydraulic fluid applications. It is ideal for installations where form factor and small sample volume are important.

Options:

• Multiple Ranges (one piston per range) • Additional Cable

• *High Pressure System (also available) Key features VISCOSITY SENSOR 501

OUTPUT DEVICES

SPEAKERS

Actually speakers work based on just reverse principle of a microphone which converts sound wave into electrical signals. These electrical signals are then recorded into CDs, magnetic tapes, etc. Speakers produce vibrations when converting electrical signal to sound. This is the basic principle.

The first loudspeaker was invented by Ernst Siemens on december 14 in 1877 in the country Germany. Later, in 1958, the first box type speakers were produced by cabisse, a french company. A speaker is a device that converts electrical pulses it receives to audible sound. We use speakers in cell phones, ipad, ipod, computers, stereo and every device that have audio feature in it. The basic working principle of speakers are as follows:

Working of a speaker

A speaker consist of an electromagnet(an electromagnet is simply a metal coil which produces a magnetic field when an electric current flows through it), and a fixed permanent magnet.

To understand its working, consider an electric current or pulses of electricity passing through the coil of the electromagnet. When current passes through it a magnetic field is produced in the direction determined by the polarity of the input signal. As the direction or polarity of this input signal keeps on changing, the direction of its magnetic field also changed rapidly.

LIGHT INDICATORS

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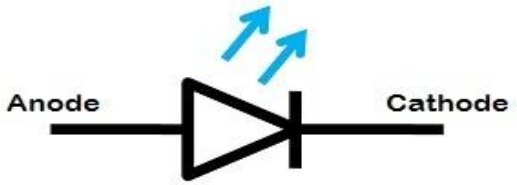
The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconductors. When the light emits in the forward biased, then it is called a light-emitting diode.

LED Symbol

The LED symbol is similar to a diode symbol except for two small arrows that specify the emission of light, thus it is called LED (light-emitting diode). The LED includes two terminals namely anode (+) and the cathode (-). The LED symbol is shown below.



How does the Light Emitting Diode Work?

The light-emitting diode simply, we know as a diode. When the diode is forward biased, then the electrons & holes are moving fast across the junction and they are combined constantly, removing one another out. Soon after the electrons are moving from the n-type to the p-type silicon, it combines with the holes, then it disappears. Hence it makes the complete atom & more stable and it gives the little burst of energy in the form of a tiny packet or photon of light.

CONVENTIONAL THROTTLE CONTROL SYSTEM

On vehicles with conventional throttle control via a control cable or mechanical linkages, the PCM has no direct control over the movement or position of the throttle plate. The PCM can only infer the position of the throttle plate by comparing input data from two or more position sensors.

As a practical matter, the PCM has no way of controlling the amount of intake air an engine needs to run at idling speeds, and especially because mechanical wear of control cables, linkage pivots, and even the throttle plate spindle bushes can eventually reach the point where even the correlation between position sensors becomes impossible to verify.

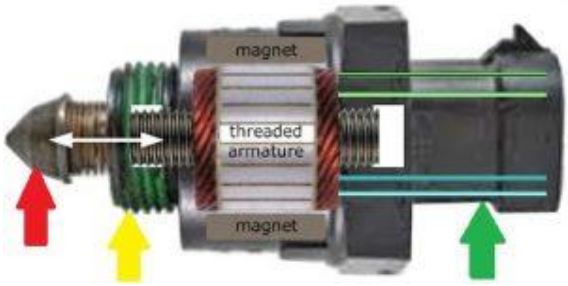
Therefore, to provide for an accurate method of managing the idling speed, conventional throttle control systems incorporate Idle Air Control valves that allow a small volume of air to bypass the throttle plate when it is in the closed position. As a practical matter, the PCM monitors the engine speed directly after starting and uses this information to open the Idle Air Control valve just enough to allow sufficient air to bypass the throttle plate, which is what allows the engine to idle.

On a fully functional system, the PCM will use input data from the engine speed sensor, throttle pedal position sensor; throttle plate position sensor, and others, including the intake air temperature sensor, to maintain the position of the IAC valve spindle as a means to maintain a stable idling speed.

Moreover, the PCM will close the IAC valve to shut off the airflow bypassing the throttle plate when the engine speed exceeds idling speed, and re-open the IAC valve when the engine speed decreases, to establish and maintain stable idling when pressure is removed from the throttle pedal.

Thus, from an engine management perspective, a fully functional IAC valve is a critical component since, without this valve, an engine with a conventional throttle control system cannot run at idling speed.

How Does the Idle air control valve (IAC) Work?



This image shows the inner workings of a typical Idle Air Control valve. In this example, the red arrow indicates the valve pintle, the yellow arrow indicated the threads that mount this particular example on the throttle body, and the green arrow indicates the electrical connector.

In these applications, the electric motor is known as a “stepper motor”, because the PCM can activate them in such a way that they rotate in very small increments, or steps, which allows for very precise control over the position of the valve pintle. In practice, rotating the motor in one direction extends the valve pintle, while rotating the motor in the opposite direction retracts the valve pintle.

Nonetheless, the valve pintle is the most important part to consider here, since its distance from a seat in the throttle body determines the volume of air that is allowed to bypass the throttle plate. This is the air the engine uses to run at idle, so when an issue such as excessive carbon build-up blocks the passage of air, the engine is starved of the air it requires to run at idling speeds.

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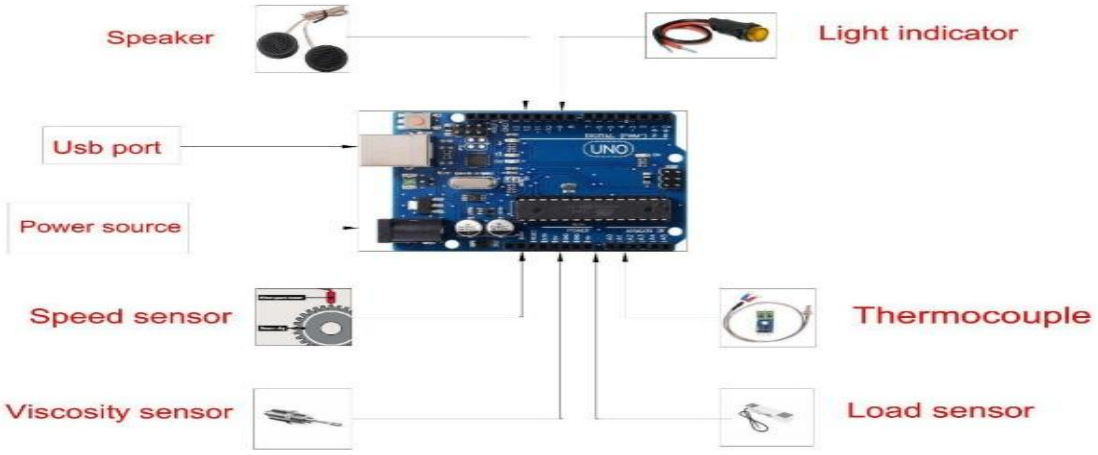
Moreover, the PCM can adjust the position of the pintle relative to its seat in exceedingly small increments to allow for more air to pass when electrical consumers such as the A/C place an additional load on the engine. By making continuous small adjustments to the position of the valve pintle to increase or decrease the volume of air that passes through the idling circuit in the throttle body, the PCM can maintain a stable idling speed regardless of the loads placed on the engine during idling.

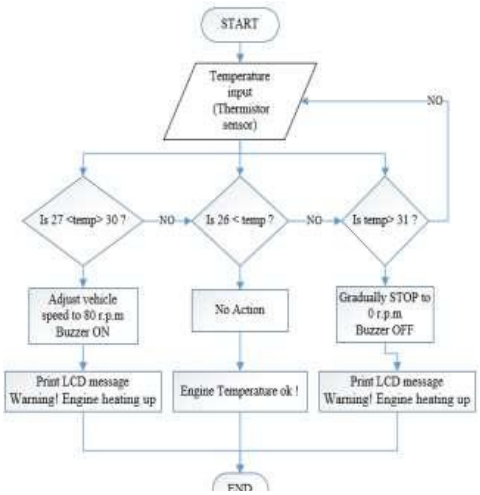
CIRCUIT DIAGRAM

The given circuit digram shows that the construction and working of mechatronics control system in two



wheelers.In this circuit the input devices gives input signals to the Arduino and the Arduino will run programme in microcontroller when ever the specified limits have reached and then it gives the output signals to outputs devices.Basically it gives output signals whenever the engine will get overheat,gives output signal when vehicle go beyond the limit its about 80 km/hr.Based on load increases on vehivle it will control the engine speed and finally it gives signal to the driver when ever the lubrication oil required to change.

Temperature unit flow chart



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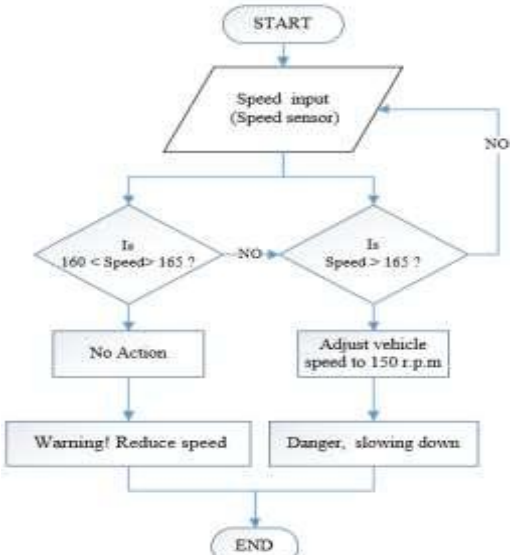
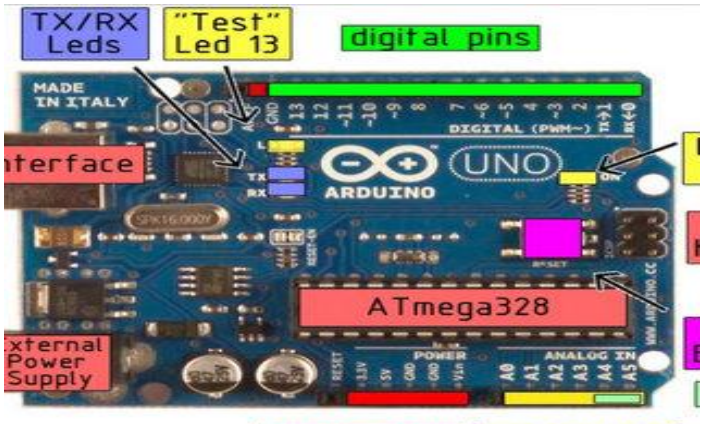


Speed unit flowchart



Arduino UNO

ADVANTAGES:
1. Increase the performance of the engine parts.
2. Provide safety while driving two wheelers.
3. Less complicated mechanism design.
4. It provides high degree of flexibility to modify or redesign the system.
5. It provide excellent performance characteristics.

DISADVANTAGES:
1.The initial cost is high.
2. It has complexity in identification and correction of problems in the system.
3.It require small power supply to operate the control system.
4.Programming is difficult.

CONCLUSION:

In order to increase the life of Engine parts as well as prevent the driver from the accidents we are going to implement the sensor system by using mechatronics in two wheelers.
The algorithm is being stored in the sensor which can sense and give signal to the display and driver by warning device .

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