Warning Device for Two Wheelers

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***Abstract*—** The Warning devices for two wheelers consists mainly of Three Types of warning, firstly it has an alcohol sensor, second is slackness in the chain of bicycle and the third is overheating precaution of engine oil. The Arduino microcontroller is used and all three warning systems are combined implemented and customized design for two wheeler. This system is implemented on bikes and the actual demo will be done on a bike. The aim of this project is to design and to develop such type of automatic control system for an engine which will aid in protecting the engine from overheating by means of alarm and signal through a temperature sensor, chain slackness and alcohol sensing for the driver. Nowadays almost most of the countries are forcing motor riders to wear the helmet and not to use the vehicles when the person is in drunken condition. But still in many places, the rules are being violated by the users. In order to overcome this problem, an intelligent system has been embedded in the helmet itself. The signal detected by an alcohol sensor will be transmitted to the vehicle control circuit. It will not turn on the vehicle, when the user is without a helmet or in drunken condition. Modern technology is largely dependent on automation and control systems. Automation and control system refers to the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft, automobile and other applications with minimal or reduced human intervention. The greatest advantage of automation and control systems is that it saves labor. However, it is also used to save energy and materials and to improve quality, accuracy and precision. Because of these advantages, nowadays automation and control systems are used in every sector and the automobile sector is not out of it.

Keywords*—*control systems, Arduino, automation.

1. INTRODUCTION

Now a day's road accident is a major problem all over the world. The recent report says that annual average of 700,000 road accidents, 10 percentages occur in India which has overtaken China. The latest annual statistics revealed by the World Health organization (WHO) in its first Global status report on road safety, 80,000 people are killed on Indian roads due to speeding, drunken driving, less usage of helmets, seat belts and child restraints in vehicles. Another latest report of the National Crime Records Bureau or NCRB says that 40 people under the age of 25 die in road accidents all around the world. It states that drunken driving is a major factor for the rising death on roads. The drunk driving fatalities in the year 2009, till the 27th November were 11,769. The numbers for 2007 and 2008 were 12,998 and 11,773 respectively. It shows that the problem of drunk driving is far from over. In the 2009 DUI national statistics released by the NHTSA (National Highway Traffic Safety Administration) 11,773 people died in alcohol-related crashes. Most of the accidents occurring outside the cities are due to drunken driving and no testing methodology is adopted to avoid these fatalities in highways. This signal and alarming system mainly consists of temperature sensor circuit, microcontroller and LCD. The temperature sensor is fixed to the engine, and operating temperature is measured by this. This produces the alarm and signal when the engine temperature exceeds the set temperature limit. LCD continuously shows the operating temperature of the engine. Generally, normally engines are designed to operate within a normal temperature range. For the proper emissions control, good fuel economy and performance a relatively constant operating temperature is very essential. But problems can arise when the engine runs hotter than normal, resulting in engine overheating. Engine overheating is mainly caused by loss of coolant due to leaks in the cooling system. If the engine is overheated for one of those problems, it may start to detonate. Then, the engine may rattle and ping and lose power. If detonation occurs continuously, it may damage the rings, pistons and rod bearings. Overheating may cause piston scuffing. Engine overheating can cause an overhead cam to seize and break. Engine overheating may stress old radiator and heater hoses and cause them to burst under the additional pressure. So, it is necessary to take some steps to avoid engine overheating. These automatic signal and alarming systems will be helpful. The system will alert the driver by signal before overheating. It is known that overheating temperature is greater than 84^0C for air-cooled engines and is greater than 70^0C for water-cooled engines. So, this system works just before those temperatures (i.e.83^0C & 69^0C respectively). The design temperature of some engines is 90^0C to 104^0C; the temperature parameter can also be set in this system. The automatic overheating signal and alarming system is designed to make awareness and to take proper action and repair. The working principle in this system is controlled by a microcontroller. Temperature sensor provides input whereas LCD, buzzer and LED provides output. Micro-controllers are often used in automobile industries, because they are generally used to control a single process and execute simple instructions. Micro-controllers do not require significant processing power. Chain drive is the way of transmitting mechanical power from one place to another. It is often used to convey power to the wheel of a vehicle, particularly motorbikes. Most often the power is conveyed by a roller chain known as drive chain or transmission chain passing over a sprocket gear with the teeth of the gear meshing with the holes in the chain. The gear is turned and this pulls the chain putting mechanical force into the system. A motorcycle chain that keeps getting loose is usually caused by the rear axle or chain tensioning bolts not being tight enough. It can also be caused by a new chain not being worn in enough, worn down sprocket teeth, having too tight of a tension, or having the wrong size of chain installed. Due to the above reason the chain drive transferring power to the rear wheel drive might lose some power due to the slack in the chain on the tight and slack side of chain drive. By determining the actual power lost in the chain drive and doing analysis on power and slack in the chain, the actual condition of the chain can be determined by a warning device installed in the motorbikes.

2. LITERATURE SURVEY

A. Existing System for temperature sensing system

There are suitable systems available for determining the engine temperature in high end two wheelers by determining the temperature of the coolant circulating around the engine.

The Engine Temperature Sensor accurately measures the engine coolant temperature. Thereby, it gives an indication of the temperature of the engine.

When the temperature of the coolant rises beyond the set limit due to running of the engine at a high temperature caused by many factors such as hot surrounding temperature, improper combustion, etc., the coolant temperature sensor sends this information to the control unit which blinks the engine temperature warning light as an indication of excessive engine temperature.

Hence, it gives a warning in case if the engine runs hotter than usual. Thereby allowing the driver to stop and rectify the problems to avoid serious problems like seizing of the engine or black smoke coming from the exhaust due to abnormal combustion as a result of pre ignition.

But, such facility is not available in 110-150 CC bikes i.e. the mid-range bikes as there is not a coolant system involved and the engines are mostly air cooled.

The method of determining engine temperature through the determination of coolant temperature is only feasible in bikes that are water or coolant cooled.

The engine temperature system has been mostly developed for four wheelers that work with the help of ECU. The temperature is sensed by suitable temperature sensors like RTDs and the input is given to ECU which then processes the signal and displays the warning light.

There is no proper technology for commuter bikes which too get hot under warm operating conditions and long distance traveling.

These types of bikes thus suffer problems due to continued driving despite the engine running at higher temperature.

B. Survey existing system for chain slackness

Nowadays there isn't a normal sensor or warning device used in two wheelers to determine the actual condition of the chain and tell us about its time to maintain or change the chain.

Maintaining your motorcycle chain is a crucial part of keeping your bike in tip top condition, and for a variety of reasons for different riders.

Racers and track day bikers will want to optimise the power output of their bikes, while commuters will want to minimise wear to prolong the life of the chain. Of course, all riders will want to ensure that their bike is safe to ride. Put the bike on its center stand. Rotate the rear wheel until the chain is at its tightest, and measure the chain slack before making any adjustments. Grab the card/ruler in one hand and the chain in the other. Pull the chain down, and line up the "0" mark on the card or ruler with one edge of the chain (either edge of the chain works, as long as you always use the same edge). This is "0".

Holding the card still (at the bottom "0" point), pull the chain up so it's as tight going up as it was going down, and look at the same edge of the chain against the card. This is your chain slack measurement. You're looking for the distance between the low and high points to be between 35 & 45mm.

This sounds a little complicated, but it's really as simple as this illustration shows. "A" is the distance between pulling down and pushing up.

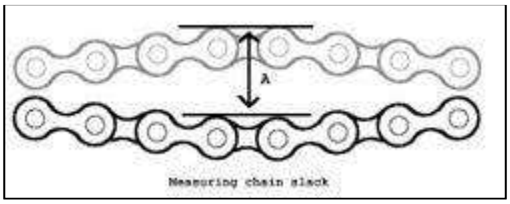

Fig 1. Measuring Chain Slack

C. Survey existing system for alcohol sensing

Sweat sensors, Saab Alco Key, straw like tube on the driver seat are used to check drunken condition of the drivers in cars. But these devices lead to misreading; inaccurate testing and circuit complexity is high. Hongjie Leng and

Yingzi Lin developed a novel carbon nanotube (CNT)-based alcohol sensor with a particular focus on the response delay problem presented in CNT based sensors. William R. Reagen developed a system for locating missing vehicles. Shegeyuki Kojima et al designed a new algorithm to distinguish between the normal and intoxicated state of a person which is proposed as the basic theory of the sensing system. The entire solution requires only a mobile phone placed in the vehicle and with an accelerometer and orientation sensor. A program installed on the mobile phone computes accelerations based on sensor readings, and compares them with typical drunk driving patterns extracted from real driving tests. Jiangpeng Dai et al focused on drunken driving, or officially driving under the Influence (DUI) of alcohol, which is a major cause of traffic accidents throughout the world. Lei Wang et al suggested that the integrity of PPG signal and accuracy of heart rate detection were evaluated and the results showed that with adequate optical shielding and the proposed passive motion cancellation, the device was able to reliably detect heart rate both during rest and moderate exercise. Aditya et al suggested that biometrics can be used in the security mechanism for the motor vehicles, as an anti-theft device. Darnell et al invention comprises a portable locating unit to provide location information signals. Heng et al suggested compulsory helmet laws for bicyclists and expanding anti-drunk driving campaigns to target alcohol-intoxicated bicyclists. Alex Tay et al presented a path-planning algorithm and a novel global navigation strategy for autonomous unmanned ground vehicles in an unstructured terrain. It is able to chart a path along roadways and off-road terrain.

From this review, each and every paper gives only a particular ap-plication to provide safety to the drivers. To overcome the major problems on road accidents and drunk driving, we designed an intelligent system in the vehicle to avoid drunk driving. In addition to this, we have adopted a few more applications to avoid parking of vehicles in No parking/ No entry area. The features incorporated in our system are:

1) Confirmation of helmet wearing
2) Alcohol detection
3) No entry/ No parking indication
4) Accident intimation and
5) Theft detection

3. PROBLEM STATEMENT AND OBJECTIVE

A. Problem Statement

● When the engine is overheated, all sorts of problems arise. Engine may start eating a lot of oil; excess heat may cause oil seals to burst. Excess overheating may damage spark plugs, it may ruin valves. Valves bend due to overheating and in the worst case scenario the engine may seize.

● Causes Of overheating:

a) Revving engine in lower gear
b) Low lubrication oil
c) Carburetor is not tuned as per manufacturer standard
d) In rainy season mud get stuck in between the fins of engine or in radiator. this decrease the heat dissipating capacity of engine
e) Faulty clutch plate.

B. Objective:

The objective is to make a device that will identify the engine heating initially and issue a warning to the driver through visual feedback so that the rider can take a hault and tend to the problems before it gets severe.

A pit stop will thus facilitate in bringing the engine temperature in the working range of engine temperature and help ensure smooth running of engine.

4. SCOPE

Since there are no proper existing devices available for the commuter section two wheelers 110CC -160CC, the device can be employed to give warning when the engine overheats so that problems caused due to continued running in overheated conditions can be prevented. It will provide real time engine temperature along with a certain safe working range depending upon engine specifications.

5. METHODS AND MATERIALS

A temperature sensor is used which can sense the temperature and read it and send it to the control board. Control board is programmed with a microcontroller which will sound the buzzer alarm and control LED according to the temperature reading.

Microcontroller is used to control the overall system automatically that reduces the design and controls complexity. At first, the temperature sensor senses the temperature from the engine and sends it to the microcontroller. The microcontroller is programmed and temperature is shown in LCD. If the temperature is greater than 69 and less than 80, then the LED starts blinking and buzzes on/off, LCD display show the temperature. If the condition fails, then the temperature is again checked. If the temperature is greater than 79 then continuous sounds arise and LED switches on and is shown in LCD. Temperature will be shown in this system continuously.

A. Components

The components of the system are as follows:

1. Battery:

The battery is an electrochemical device useful for converting chemical energy into electrical energy. The main purpose of the battery is to provide a supply of current for operating the cranking motor and other electrical units.

Specification,

- Voltage 12v
- Current 7.2A

Fig 5.1: Battery

2. LED light:

LEDs run on direct current (DC), whereas mains current is alternating current (AC) and usually at much higher voltage than the LED can accept. LED lamps can contain a circuit for converting the mains AC into DC at the correct voltage. These circuits contain rectifiers, capacitors, and may have other active electronic components, which may also permit the lamp to be dimmed. In an LED filament lamp, the driving circuit is simplified because many LED junctions in series have approximately the same operating voltage as the AC supply.

3. Temperature sensor:

LEDs run on direct current (DC), whereas mains current is alternating current (AC) and usually at much higher voltage than the LED can accept. LED lamps can contain a circuit for converting AC current to DC

4. Helmet:

LEDs run on direct current (DC), whereas mains current is alternating current (AC) and usually at much higher voltage than the LED can accept. LED lamps can contain a circuit for converting

5. IR sensor:

LEDs run on direct current (DC), whereas mains current is alternating current (AC) and usually at much higher voltage than the LED can accept. LED lamps can contain a circuit for converting

6. Alcohol sensor :

LEDs run on direct current (DC), whereas mains current is alternating current (AC) and usually at much higher voltage than the LED can accept. LED lamps can contain a circuit for converting.

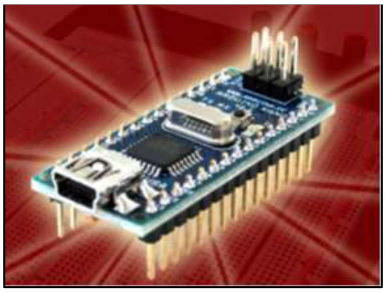

Fig 5.2: Arduino

Fig 5.3: LCD

7. Power Supply:

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable

low voltage supply for electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function.
For example a 5V regulated supply:

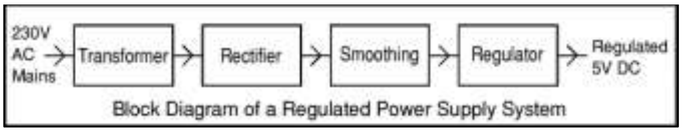

Fig 5.4: Block diagram of regulated Power supply

Each of the blocks is described in more detail below:

Transformer - steps down high voltage AC mains to low voltage AC.

Rectifier - converts AC to DC, but the DC output is varying.

Smoothing - smoothes the DC from varying greatly to a small ripple.

Regulator - eliminates ripple by setting DC output to a fixed voltage.

8. Relays:

The basis for relays, is the simple electromagnet. A nail, some wire, and a battery is all that is needed to make one. A simple relay circuit with its actuation is shown in fig. 5.5 and 5.6.

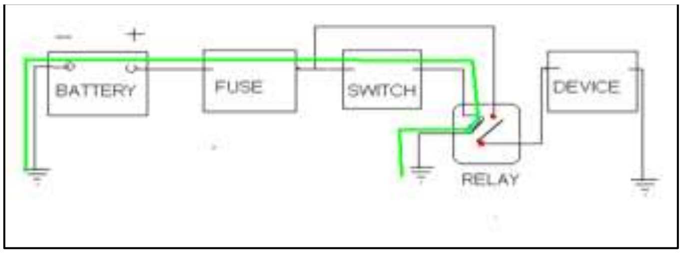

Fig 5.5: Relay circuit before energizing.

The control circuit (GREEN) powers the coil inside the relay, using a small amount of current. It flows from the battery, through the fuse (for protection) to a switch, (say, a light switch) then to the coil in the relay, energizing it.

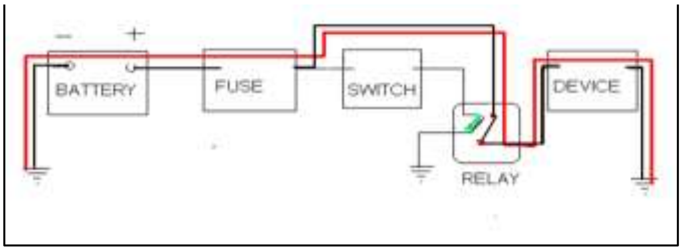

Fig 5.6: Relay circuit after energizing.

The coil, now energized, becomes an electromagnet, and attracts the metal strip with the contacts, which closes, providing a secondary heavy current path (RED) to the device (say, the fog lights).

Turning off the switch, opens the circuit to the coil, removes current flow, and the electromagnet is no longer a magnet, the secondary path is opened, and the lights extinguish

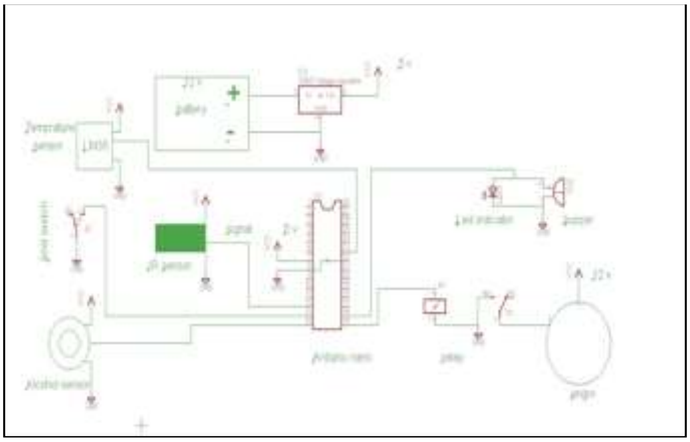

Fig 5.7: Circuit diagram.

B. Machining operations conducted after material selection are as follows:

- Abrasive saw
- Lathe operations such as turning
- Drilling
- Welding
- Threading
- Grinding
- Spray Painting

6. Methodology

The spring damper system is connected to the chain chassis which will calculate the power being transmitted. This system will actually connect to the sensors which will convert this mechanical term into the electrical or electronic signal that will be passed to the display on the motorbike. The Arduino or some LCD display will give this signal and warn the driver whenever the chain is being slacked or loose.

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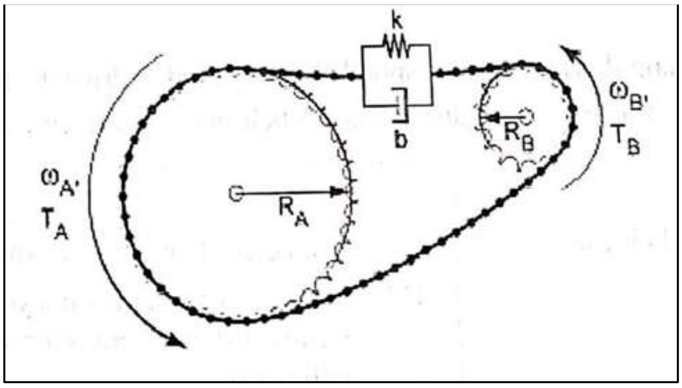

Fig 6.1: Chain Slack.

Power calculation for chain sensor and Algorithm:

The chain tensile force is the net sum force of spring and damper force. The spring force is the product of the tensile strain and the soring stiffness constant. The force is zero whoever the tensile strain and the spring stiffness constant. The force is zero whatever the tensile strain is smaller than the chain shock. The damper force is the product of the tensile strain rate and the damping coefficient.

Mathematically:

F = -(X-s/2)×k-Xb, X >s/2 -Xb , s/2≥X≥-s/ -(X+s/2)k-Xb , X<-s/2

Parameter	Symbol	Unit	Value
Larger sprocket pitch radius	R_1	m	0.1
Smaller sprocket pitch radius	R_2	m	0.05
Angular velocity of larger sprocket	W_1	rad/min	982.49375
Angular velocity of smaller sprocket	W_2	rad/min	2947.4812
Tensile strain rate	xdot	m/s	-0.8187448
Chain slack	S	m	0.05
Spring stiffness constant	k	N/m	100000
Chain damping	b	N/(m/s)	5
Chain tensile force	F	N	0
Torque act on larger sprocket	T_1	Nm	0
Time of one revolution of driven sprocket	t	s	0.1279031
Torque act on smaller sprocket	T_2	Nm	0

Fig 6.2: Chain Parameters.

Parameter	Symbol	Unit	Value
Radius of larger pulley	r1	m	0.02
Radius of smaller pulley	r2	m	0.01
Centre distance between two pulley	C	m	0.048
Contact angle for larger pulley	β1	radian	3.561741185
Contact angle for smaller pulley	β2	radian	2.722258815
Belt inclination angle	α	radian	0.209870592
Linear Velocity of Belt	V	m/s	0.368435155
Centrifugal Tension in belt	Fc	N	0.001357445
Tension on Tight side of the Belt	T1	N	2999.998643
Tension on Slack Side of the Belt	T2	N	1325.691475
Power Transmitted	P	Watts	616.8736213

Fig 6.3: Belt Parameters.

FIG: parameter related to power transmission through chain drive Viscous frictional force is given by,

f1 = C×W1

f2 = C×W2

Torque of the chain is given by the formula

T1 =F×R1-f1

T2 =F×R2-f2

Table 1:

Sr. No.	Time(t)	Displacement(x)	F	f1(viscous)	F*R1	f2(viscous)	F*R2	P
0	0	0	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166
1	0.010658592	0.008726667	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166
2	0.021317184	0.017453333	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166
3	0.031975776	0.02618	-113.906	0.98249375	-11.4889	2.94748124	5.842688	98.89505
4	0.042634368	0.034906667	-986.573	0.98249375	-98.7555	2.94748124	49.47602	813.3823
5	0.05329296	0.043633333	-1859.24	0.98249375	-186.022	2.94748124	93.10935	1527.874
6	0.063951552	0.05236	-2731.91	0.98249375	-273.289	2.94748124	136.7427	2242.365
5	0.05329296	0.043633333	-1859.24	0.98249375	-186.022	2.94748124	93.10935	1527.874
4	0.042634368	0.034906667	-986.573	0.98249375	-98.7555	2.94748124	49.47602	813.3823
3	0.031975776	0.02618	-113.906	0.98249375	-11.4889	2.94748124	5.842688	98.89505
2	0.021317184	0.017453333	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166
1	0.010658592	0.008726667	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166
0	0	0	4.093724	0.98249375	0.311123	2.94748124	-0.05731	2.279166

By considering the slack value constant, the following power can be determined by the above formulae.

The power produced by the chain is given by

P chain = T1W1 –T2W2 P1 & P2 is given by

P1 = P×60/w2×r1 –fc 1

where fc is centrifugal force

P2 = r1/e∧αβ2+fc2

Table 2: power of motor analyzed by different time t.

P1	P2	Pmotor	Tm	Im
2.318419	1.025861	0.476224	0.000677	0.80216
2.318419	1.025861	0.476224	0.000677	0.80216
2.318419	1.025861	0.476224	0.000677	0.80216
100.6518	44.4791	20.69598	0.029416	0.89385
827.874	365.8367	170.2308	0.241954	1.571947
1555.096	687.1943	319.7656	0.454491	2.250044
2282.318	1008.552	469.3004	0.667029	2.92814
1555.096	687.1943	319.7656	0.454491	2.250044
827.874	365.8367	170.2308	0.241954	1.571947
100.6518	44.4791	20.69598	0.029416	0.89385
2.318419	1.025861	0.476224	0.000677	0.80216
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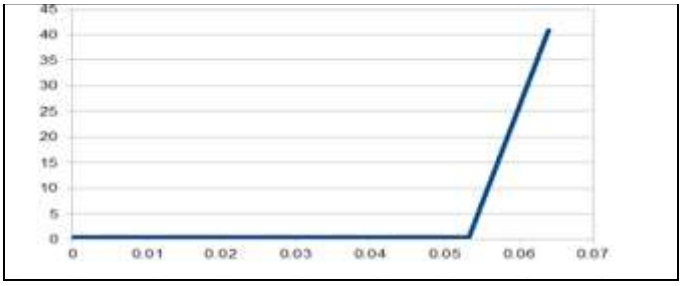


Fig 6.4: Analysis of chain slack and power being transmitted.

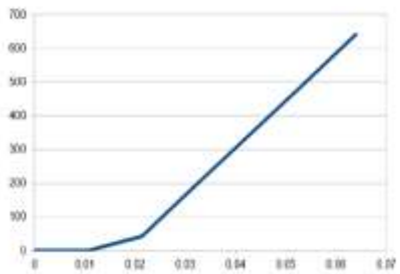
RESULTS

1. Engine Temperature Sensing and Indication:

Sr No.	KM(S)	Temp[°C]	LED	Buzzer
1	5	40	OFF	OFF
2	10	47	OFF	OFF
3	15	56	ON	OFF
4	20	69	ON	ON/OFF Beep
5	25	76	ON	ON/OFF Beep
6	30	82	ON	Continuous Beep

2. Chain Slackness Sending Device:

Sr.no	Time of one revolution of driven sprocket (sec)	Slackness (mm)	Power transmitted through chain (kw)
1	0.05	0.01	600
2	0.05	0.03	400
3	0.05	0.06	175
4	0.05	0.09	0
5	0.05	0.1	0



For slackness 0.01

3. Alcohol Sensing Device :

Specific Amount(mg/ml of Blood)	Ignition Circuit	Bike
5	Completes	Starts
10	Breaks	Still
15	Breaks	Still
20	Breaks	Still

7. CONCLUSIONS

1. Hence by calculating the power transmitted by the chain through the spring damper system attached to the chain, the slackens of the chain can be calculated by the algorithm used above.
2. This algorithm is being stored in the sensor which can sense the slack of the chain and give signal to the display and driver by warning device.

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