ADAPTIVE SPEED SETTING ON CURVE BANK ROAD WITH PRE-CRASH SENSING& WARNING

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***Abstract*- Vehicles today are equipped with control systems that improve their handling and stability. Knowledge of road bank angle and vehicle parameters is crucial for good behavior in this type of control. This paper develops a new method for estimating different states, such as vehicle roll angle, road bank angle, and vehicle speed. To provide safety & prevent the accidents by means of measuring the accurate banking angle of a road by using accelerometer. By using the banking angle of road and the radius of curvature of road the desirable speed calculation of vehicle.**

***Keyword* – 8051Microcontrollers, Node, reconfigure, road bank angle.**

I. INTRODUCTION

The purpose of this project is to make a system by which a driver can continuously get the desirable speed of vehicle on the curved banked road. For example in ghats there is always possibility of getting break fail, which causes accidents to happen. In order to avoid such kind of accidents & break fail of a vehicle, it is necessary to have such system, which will indicate desirable speed of vehicle. With rapid advances in car designing technique the automatic speed controlling can be achieved, such kinds of techniques are presently introduced in expensive cars[1].

This project deal with determination of desired velocity on curved banked road. Here three axis accelerometer is used to determine the banking of road which gives banking in terms of voltages, which is input to the microcontroller. By using formula $V=(r\times g\times \tan\theta)$^1\2.Desired velocity v is calculated by using the software program, which is very useful at the time of sharp curves this project provides desirable velocity on the banked road only.

So, this is the system which can predict the desirable speed of vehicle with respect to the banking of road , so that proper turn should be made without skipping of vehicle.

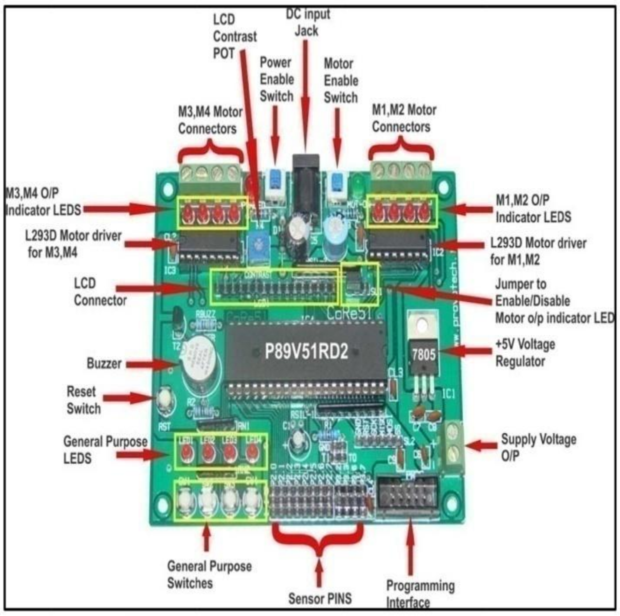


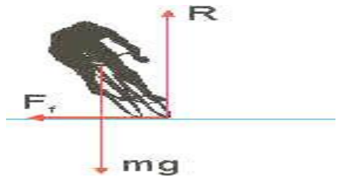
Fig 1 - 8051Microcontrollers kit.

II. LITERATURE SURVEY

A. BANKING OF A ROAD SURFACE

1) Moving in a Straight line on a Horizontal Surface.

2) Turning on a Horizontal Surface



3) Turning on a Banked Surface

The normal reaction, R, has no component acting towards the centre of the circular path. Therefore the required centripetal acceleration is provided by the force of friction, Ff, between the wheel and the road. If the force of friction is not strong enough, the vehicle will skid. The normal reaction, R, now has component acting towards the centre of the circular path. If the banking angle is just right, the correct centripetal acceleration can be provided by the horizontal component of the normal reaction[4]. This means that, even if there is very little force of friction the vehicle can still go round the curve without skidding.

III. SIGNIFICANCE & SCOPE

The common causes for vehicle accidents are driver distraction or negligence, urban location-heavily populated areas or small areas with insufficient transport facilities, vehicle handling problem and weight distribution problem.

Accident in road curve mainly occurs when the centrifugal force is more than the direction and momentum force which makes the vehicle to move in a straight line instead of curved path.

Under estimation of speed in curved roadways maybe a contributing factor necessitating speed adjustment and thus causing fatal and serious injury accidents in curves especially in heavy vehicles[4].

As the result of approaching sharp curves without realizing that current speed is dangerous to passing through the curve, when driver fails to decelerate while just realizing that, the driver feels a tense moment and traffic incidents may occur.

IV. METHODOLOGY

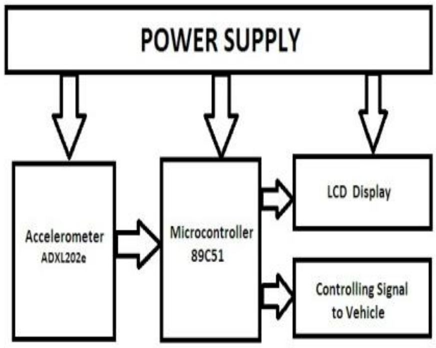


Fig 2 - Block Proposed work

A. ACCELEROMETER

It sense banking of a road as input in the form of acceleration and converts it into output in the form of duty cycle output, which vary with respect to banking of road[2].

It provides θ for the calculation of desirable velocity given by

$$V=(r\times g\times \tan\theta)^{1/2}$$

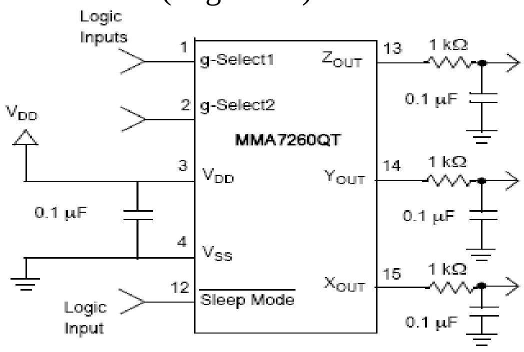


Fig 3 - Accelerometer with Recommended Connection Diagram

The Free scale accelerometer is a surface-micro machined integrated-circuit accelerometer. The device consists of two surface micro machined capacitive sensing cells (g-cell) and a signal conditioning ASIC contained in a single integrated circuit package. The sensing elements are sealed hermetically at the wafer level using a bulk micro machined cap wafer.

The g-cell is a mechanical structure formed from semiconductor materials (poly silicon) using semiconductor processes (masking and etching). It can be modeled as a set of beams attached to a movable central mass that move between fixed beams. The movable beams can be deflected from their rest position by subjecting the system to an acceleration. As the beams attached to the central mass move, the distance from them to the fixed beams on one side will increase by the same amount that the distance to the fixed beam son the other side decreases. The change in distance is a measure of acceleration. The g-cell beams form two back-to-back capacitors. As the center beam moves with acceleration, the distance between the beams changes and each capacitor's value will change, (C = A∑/D). Where A is the area of the beam, ∑ is the dielectric constant, and D is the distance between the beams. The ASIC uses switched capacitor techniques to measure the g-cell capacitors and extract the acceleration data from the difference between the two capacitors. The ASIC also signal conditions and filters (switched capacitor) the signal, providing a high level output voltage that is ratio metric and proportional to acceleration[3].

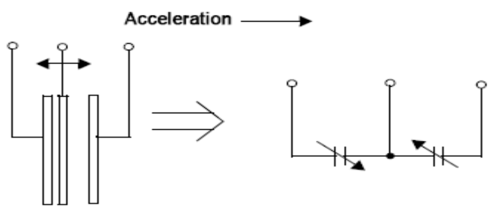


Fig4-Simplified Transducer Physical Model.

B. SPECIAL FEATURES

g-Select

The g-Select feature allows for the selection among 4 sensitivities present in the device. Depending on the logic input placed on pins 1 and 2, the device internal gain will be changed allowing it to function with a 1.5g, 2g, 4g, or 6g sensitivity. This feature is ideal when a product has applications requiring different sensitivities for optimum performance. The sensitivity can be changed at anytime during the operation of the product. The g-Select1 and g-Select 2 pins can be left unconnected for applications requiring only a 1.5g sensitivity as the device has an internal pull-down to keep it at that sensitivity (800mV/g)

Table g-Select Pin Descriptions

g-Select2	g-Select1	g-Range	Sensitivity
0	0	1.5g	800mV/g
0	1	2g	600mV/g
1	0	4g	300mV/g
1	1	6g	200mV/g

C. SLEEP MODE

The 3 axis accelerometer provides a Sleep Mode that is ideal for battery operated products. When Sleep Mode is active, the device outputs are turned off, providing significant reduction of operating current. A low input signal on pin 12
(Sleep Mode) will place the device in this mode and reduce the current to 3 A typ. For lower power consumption, it is recommended to set g-Select1 and g-Select2 to 1.5g mode. By placing a high input signal on pin 12, the device will resume to normal mode of operation.

D. FILTERING

The 3 axis accelerometer contains onboard single-pole switched capacitor filters. Because the filter is realized using switched capacitor techniques, there is no requirement for external passive components (resistors and capacitors) to set the cut-off frequency.

E. CALCULATING DEGREE OF TILT :-

In order to determine the angle of tilt, θ, the A/D values from the accelerometer are sampled by the ADC channel on the microcontroller. The acceleration is compared to the zero g offset to determine if it is a positive or negative acceleration, e.g., if value is greater than the offset then the acceleration is seeing a positive acceleration, so the offset is subtracted from the value and the resulting value is then used with a lookup table to determine the corresponding degree of tilt (See Table1 for a typical 8-bit lookup table), or the value is passed to a tilt algorithm. If the acceleration is negative, then the value is subtracted from the offset to determine the amount of negative acceleration and then passed to the lookup table or algorithm. One solution can measure 0° to 90° of tilt with a single axis accelerometer, or another solution can measure 360° of tilt with two axis configuration (XY, X and Z), or a single axis configuration (e.g. X or Z), where values in two directions are converted to degrees and compared to determine the quadrant that they are in. A tilt solution can be solved by either implementing an arccosine function, an arcsine function, or a look-up table depending on the power of the microcontroller and the accuracy required by the application. For simplicity, we will use the equation: θ = arc sin(x). The arc sin(y) can determine the range from 0° to 180°, but it cannot discriminate the angles in range from 0° to 360°, e.g. arc sin(45º) = arc sin(135º). However, the sign of x and y can be used to determine which quadrant the angle is in. By this means, we can calculate the angle β in one quadrant (0-90º) using arc sin(y) and then determine θ in the determined quadrant[2]

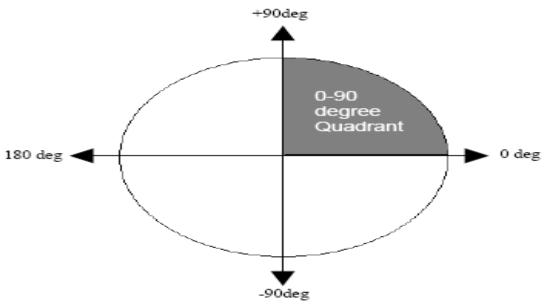


Fig4-The Quadrants of a 360 Degree Rotation

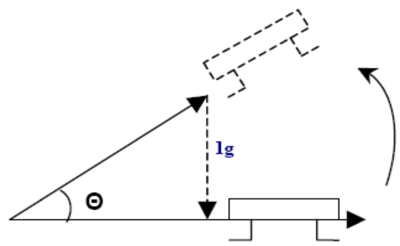


Fig5-An Example of Tilt in the First Quadrant

1) $V_{OUT} = V_{OFFSET} + \left(\frac{\Delta V}{\Delta g} \times 1.0g \times \sin\theta\right)$

where ,V_{OUT}=Accelerometer Output in Volts

V_{OFF}= Accelerometer 0g Offset

$\frac{\Delta V}{\Delta g}$ = Sensitivity

1g = Earth's Gravity

θ = Angle of Tilt

Solving for the angle :

2) $\theta = \arcsin\left(\frac{VOUT - VOFFSET}{\frac{\Delta V}{\Delta g}}\right)$

This equation can be used with the MMA6260QT

V_{OUT} = 1650mV +800mV × sinθ

Where the angle can be solved by

$$\theta = \arcsin\left(\frac{VOUT - 1650mV}{800mV/g}\right)$$

From this equation you can see that at 00 the accelerometer output voltage would be 1650mV and 900 the accelerometer output would be 2450mV.

F. A 12-BIT ADC :-

A 12-bit ADC cuts 3.3V supply into 4095 steps of 0.8mV for each step. Therefore, by taking one ADC reading of the MMA6260Q again at 0g (0° of tilt for an x-axis device), would now result in the following :-

This results in a 0.057 degree resolution at the highest sensitivity point (0°) and 1.63 degree resolution at the lowest sensitivity point (90°). However, for 0.8mV changes, the noise factor becomes the factor to consider during design. How much noise the system has will depend on how much resolution you can get with a higher bit co0°: 1650mV + 0.8mV = 1650.8mV 90°: 2450mV + 0.8mV = 2450.8mV

G. SOFTWARE IMPLEMENTATION

1) The software part consists of Programming.
   - C
   - Assembly
2) Keil
3) Flash magic

H. KEIL

The Keil products from ARM include C/C++ compilers, debuggers, integrated development and simulation environments, RTOS and middleware libraries, and evaluation boards for ARM, Cortex-M, Cortex-R4, 8051, C166, and 251 processor families.

It was then that Keil implemented the first C compiler designed from the ground-up specifically for the 8051 microcontroller.

Keil development tools for the 8051 Microcontroller Architecture support every level of software developer from the professional applications engineer to the student just learning about embedded software development. When starting a new project, simply select the microcontroller you use from the Device Database and the µVision IDE sets all compiler, assembler, linker, and memory options for you.

The Keil µVision Debugger accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 device. Simulation helps you understand hardware configurations and avoids time wasted on setup problems. Additionally, with simulation, you can write and test applications before target hardware is available. When you are ready to begin testing your software application with target hardware, use the MON51, MON390, MONADI, or FlashMON51 Target Monitors, the ISD51 In-System Debugger, or the ULINK USB-JTAG Adapter to download and test program code on your target system.

I. FLASH MAGIC

Flash Magic is an application developed by Embedded Systems Academy to allow you to easily access the features of a microcontroller device. With this program you can erase individual blocks or the entire Flash memory of the microcontroller. This application is very useful for those who work in the electronics field. The main window of the program is composed of five sections where you can find the most common functions in order to program a microcontroller device. Using the “Communications” section you will be able to choose the way a specific device connects to your computer. Select the COM port to be used and the baud rate. It is recommended that you choose a low baud rate first and increase it afterwards. This way you will determine the highest speed with which your system works. In order to select which parts of the memory to erase, choose from the items in the “Erase” section. The third section is optional. It offers you the possibility to program a HEX file. In the next section you will be able to find different programming options, such as “verify after programming”, “gen block checksums”, “execute” and others. When you’re done, click the Start button that can be found in the “Start” section. The program will start the device, and you will able to see the progress of the operations at the bottom of the main window. Using Flash Magic, you are able to perform different operations to a microcontroller device, operations like erasing, programming and reading the flash memory, modifying the Boot Vector, performing a blank check on a section of the Flash memory and many others.

J. HARDWARE IMPLEMENTATION

1) 8051Microcontrollers kit.
2) Accelerometer MM`A7260QT.

V. CONCLUSION

Analysis and design of rollover meter is presented. The proposed system is used to avoid various road curve accidents which are caused due to speeding and loss of control.

This system will sense and measure different parameters like road curve distance, load on the vehicle, and speed of the vehicle.

The above measures parameters help to reduce accidents in road curve. Thus, it makes the public transport more efficient & effective.

By using this project , we can indicate desired velocity of a vehicle on the curved banked roads, so that proper turn can be made & skidding away from road is avoided. This reduces the accidents in ghats, hilly areas.

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