IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022

DOI: 10.17148/IJIREEICE.2022.10468

LabVIEW BASED HILL ASSIST AND BLACK BOX IN FOUR WHEELERS

Thirumurugan P[1], Aashik G[2], Nithish Anand S[3] , Selvabalaji K.P[4], Shivaa Sankar A[5]

Assistant Professor, Instrumentation and Control Engineering, Saranathan College of Engineering, Trichy, India[1]

Student, Instrumentation and Control Engineering, Saranathan College of Engineering, Trichy, India[2,3,4,5]

Abstract: At the present, the vehicle operation research on slope sections in mountainous areas mainly use statistical analysis to describe the correlations between operating speed and road alignment, which could not explain the vehicle's driving risks with different dynamic characteristics on slope sections. Based on vehicle dynamic analysis, a basic operating speed of a passenger car is achieved by the dynamic model, then the model amended by road factors is acquired to predict the operating speed. The operating speed of passenger cars on some of the slope sections were carried out by LABVIEW programming and GUI visualization. The comparison of observation speed with operating one shows that the accuracy of operating speed of the forecast model is higher and has a good applicability.

Keywords: AFS, Automatic braking, LabVIEW, Hill safety, Driving Assist, cruising control, tracking control, hybrid dynamical system, GPS,GSM.

I. INTRODUCTION

The technical level of mountainous highways is relatively low. Due to the terrain limit, there are plenty of gradient sections and long slope, road safety issues become more and more prominent. The reason is that the vehicle's operating speed and design is inconsistent. The most important reason is that the area of irradiation of the front light is not at the proper position which causes low visibility and leads to accidents. Because of this, a new technology of enhancing vehicle driving safety appears which is called Adaptive Front light System (AFS). AFS is a driving safety enhancing system which can adjust front light dynamically based on the angle of the vehicle's steering wheel, the velocity of the vehicle, the pitching and lateral roll angle of the vehicle, to make sure the best illumination to the front road the research on AFS is gradually being carried out around the world. The vehicle black box system VBBS, The VBBS can contribute to constructing safer vehicles, improving the treatment of crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate.

From this paper was focused on control model and simulation for Adaptive Front light System (AFS) of vehicles on curve roads. Because vehicles' movement was related to complex dynamics, firstly linear two-degrees-freedom turning model and lateral role model of vehicles were studied. On the basis of these models, this paper put forward control algorithm of adaptive front light on curve roads[1]. Prototype of the Vehicle Black Box System VBBS there can be installed into any vehicle all over the world. This prototype can be designed with minimum number of circuits. The VBBS can contribute to constructing safer vehicles, improving the treatment of crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate[2]. Accident detection and collision is optimised using traffic signals and effective traffic management using vehicle class information. From this paper, we infer systematic approach to the above problem statement, outline the drawback of existing models and explain the need of effective traffic management in hairpin curves [4]. A system is developed to warn drivers about the approaching traffic in hill curves using ultrasonic sensors placed on both the sides of the road. The output of the ultrasonic sensor is interfaced. When a vehicle is detected by ultrasonic sensor, Processor triggers the camera to capture the image of the vehicle. The image of the vehicle is then compared with the images already uploaded in the database. The match is found and the data is send to the receiver side through Bluetooth. The output is displayed as "Two wheeler" or "Four wheeler" in the Liquid Crystal Display (LCD) [5]. Speed of a vehicle depending on the distance to an obstacle and also can initiate emergency braking automatically if needed. From this project report,

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526
International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022
DOI: 10.17148/IJIREEICE.2022.10468

the implementation of a Smart Automatic Braking System is introduced. The system has also speed control features. It will reduce or increase the speed of the vehicle depending on the obstacle distance from the moving vehicle to minimize the damage or collision of an accident [6].

II. BLOCK DIAGRAM

The figure 1 of the system is shown below.

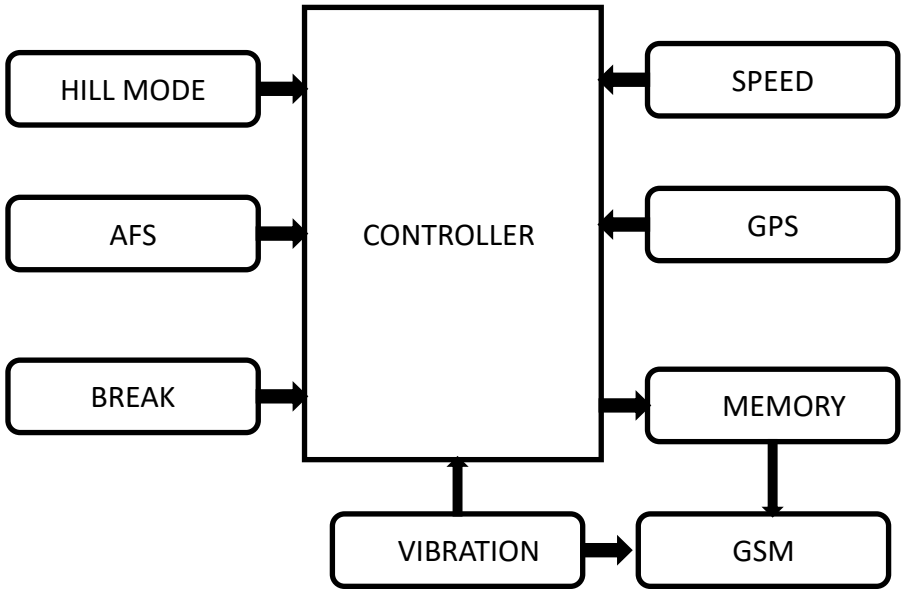


Fig .1 Block Diagram of the System

III.HARDWARE DESCRIPTION

1. myRIO

myRIO is a portable device and students can easily use it for the design and control of robots and may other systems quite efficiently. It operates on the frequency 667 MHz. myRIO has dual core ARM cortex A9 programmable processor. It has a Xilinx Field Programmable Gate Array (FPGA). FPGA support in myRIO helps the students to design real life developing systems and to solve real problems quite faster as compared to the other micro controllers. Using FPGA support we can avoid the complicated syntax used in C language and in many others. We just have to create logic instead of writing the complicated code with the proper syntax. So, it has reduced the student's difficulties while designing complicated systems. It is student friendly device and is very easy to use. The processing speed of myRIO is quite higher than the standard micro controllers. So, it can be used t solve real life problems and it can be easily used in efficient systems which need a quick output response. It supports different languages e.g. C, C++ and graphical language (FPGA). The further detail about NI myRIO will be provided later in this article.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526
International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022
DOI: 10.17148/IJIREEICE.2022.10468

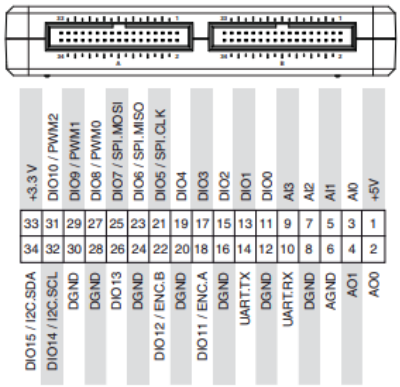


Fig.2 myRIO pin out Diagram

MyRio Control and Apparatus: -
1. NI myRIO-1900
2 .myRIO Expansion Port (MXP) Breakouts (One Included in Kit)
3. Power Input Cable
4. USB Device Cable
5. USB Host Cable (Not Included in Kit)
6. LEDs
7. Mini System Port (MSP) Screw-Terminal
8. Audio In/Out Cables (One Included in Kit)
9. Button 0

2. Black Box

In science, computing, and engineering, a black box is a device, system, or object which produces useful information without revealing any information about its internal workings. The explanations for its conclusions remain opaque or "black. "Financial analysts, hedge fund managers, and investors may use software that is based on a black-box model in order to transform data into a useful investment strategy. Advances in computing power, artificial Intelligence and machine learning capabilities are causing a proliferation of black box models in many professions, and are adding to the mystique surrounding them. Black box models are eyed warily by potential users in many professions. As one physician writes in a paper about their uses in cardiology: "Black box is shorthand for models that are sufficiently complex that they are not straight forwardly interpretable to humans.

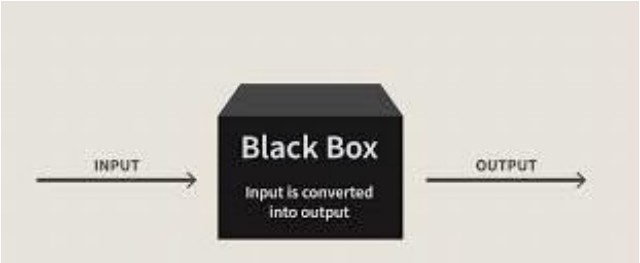


Fig.3 Black box block diagram

3. Adaptive Front Light System

Dangerous traffic accidents happen when vehicles move on curved roads at night. The main reason is conventional front lights do not provide sufficient and reasonable illumination for night-time visibility to be adapted to curves. In that situation, this paper was focused on the control model and simulation for Adaptive Front light System (AFS) of vehicles on curve roads. Because vehicles' movement was related to complex dynamics, firstly linear two-degrees-

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022

DOI: 10.17148/IJIREEICE.2022.10468

freedom turning models and lateral role models of vehicles were studied. Based on these models, this paper put forward the control algorithm of adaptive front light on curve roads. From the research, it was concluded that horizontal swing angles of vehicles' front light on curve roads were adjusted according to drivers' visual angle change with velocity change, front wheels' swing angle and side-slip angle, and vertical swing angles of vehicles' front light on curve roads was adjusted according to lateral roll angle of the vehicle' body, and longitudinal irradiation distance of vehicles' front light on curve roads was controlled by safe stopping distance of vehicles. LIN (Local Interconnect Network) based systems may alter the dynamic behaviour of a vehicle. The vehicle's motion directly influences the lighting direction of AFS (Adaptive Front-lighting System), and the effect of the vehicle dynamics on the swivelling headlamp can be simulated.

4. GPS

Global positioning system (GPS) it provides users with positioning, navigation and timing (PNT) services. This system consists of three segments “SPACE SEGMENT, CONTROL SEGMENT,USER SEGMENT”. It provides geo location and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Using GPS, we can position the vehicle where accident took place with the co-ordinates, we can act accordingly.

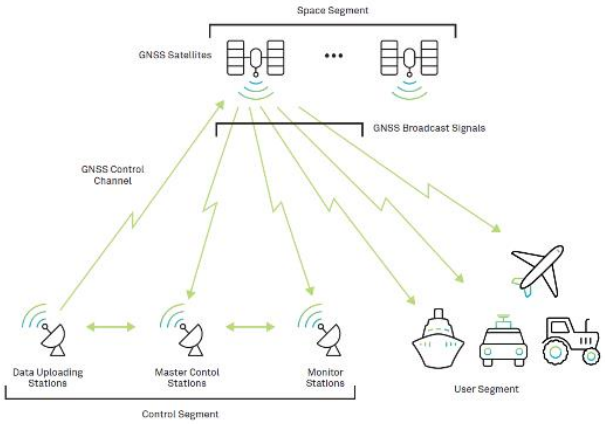


Fig.4 GPS working model

5. GSM

The Global System for Mobile Communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets.The GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony.Cell horizontal radius varies – depending on antenna height, antenna gain, and propagation conditions – from a couple of hundred meters to several tens of kilometers.Using GSM interfacing it with GPS we can send the coordinates to the destination device that records the coordinates and passes the information to connected devices.

IV. SOFTWARE DESCRIPTION

2 . LABVIEW

LabVIEW (**Lab**oratory **V**irtual **I**nstrument **E**ngineering **W**orkbench) is a graphical programming environment which has become prevalent throughout research labs, academia, and industry. It is a powerful and versatile analysis and instrumentation software system for measurement and automation.It's graphical programming language called G programming is performed using a graphical block diagram that compiles into machine code and eliminates a lot of the syntactical details .LabVIEW offers more flexibility than standard laboratory instruments because it is software-based. Using LabVIEW, the user can originate exactly the type of virtual instrument needed and programmers can easily view and modify data or control inputs. The popularity of the National Instruments LabVIEW graphical dataflow software for beginners and experienced programmers in so many different engineering applications and industries can be attributed to the software’s intuitive graphical programming language used for automating measurement and control systems.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022

DOI: 10.17148/IJIREEICE.2022.10468

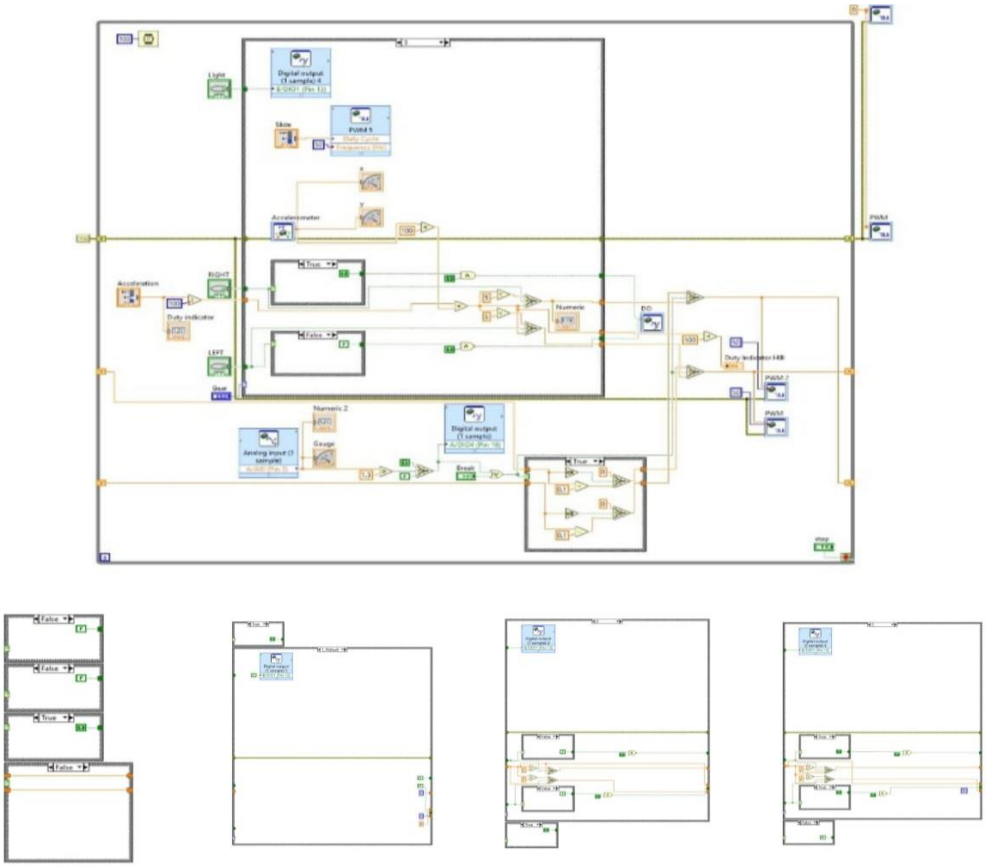


Fig.5 LABVIEW Block Panel of Hill Assist and Black Box in Four Wheelers

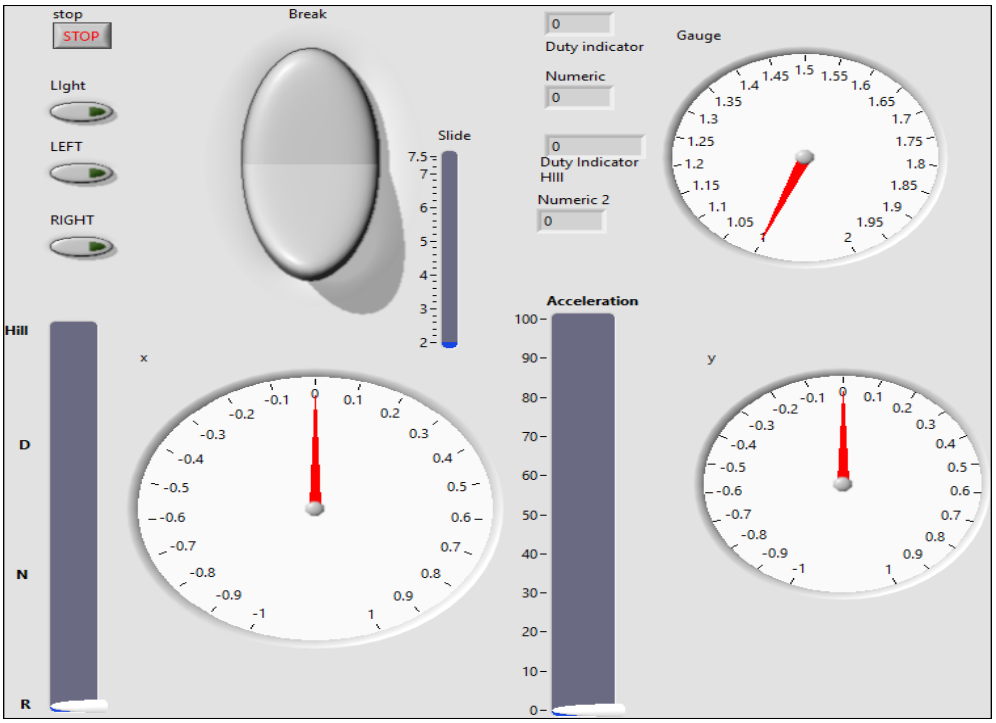


Fig.6 LABVIEW Front Panel of Hill Assist and Black Box in Four Wheelers

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022

DOI: 10.17148/IJIREEICE.2022.10468

V. EXPERIMENTAL SETUP / HARDWARE PROTOTYPE

Figure 6 depicts the hardware prototype that has been developed to realize the proposed methodology. The tests were conducted using the below experimental setup.

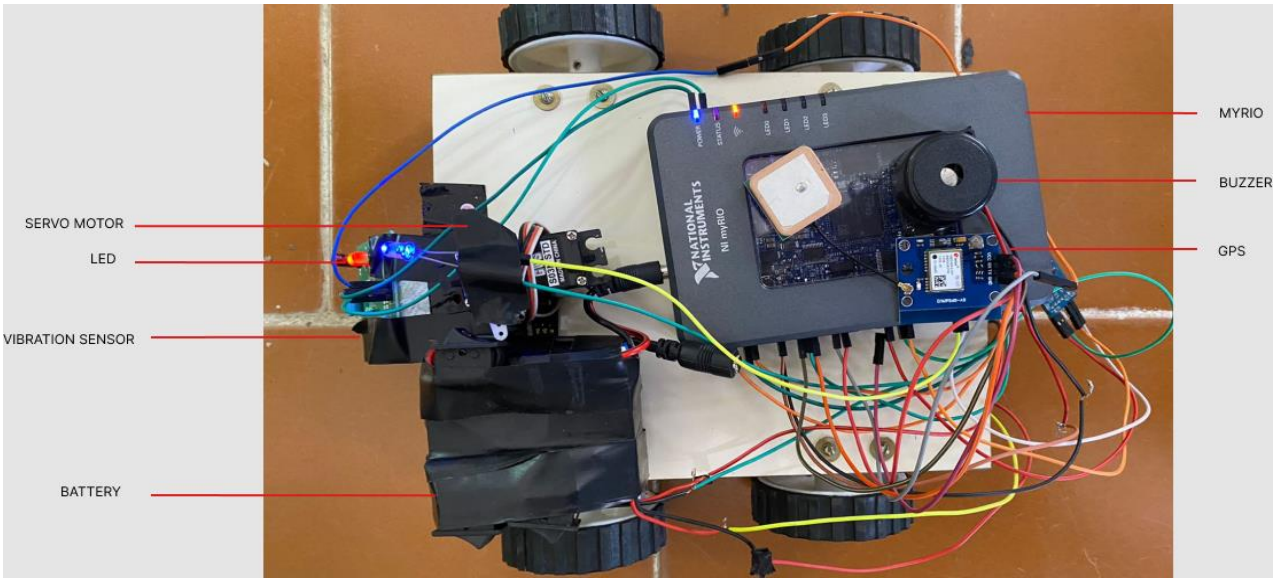


Fig.6 Experimental Setup.

VII.PROCESS DESCRIPTION

The Process Starts With The Power Supply And Input Command. Engine On Checks For The Door Status If All Four Doors Are Closed The Processor Enables The Engine, Else an Indication Is Shown To Close All The Doors.
Idle Works With Basic Working Of The Car Gets Starts Based On The Pre-Defined Conditions.

Gear Has Four Cases In This State

1.Neutral
2.Drive
3.Reverse
4.Hill Mode

Neutral -This Mode The Vehicle Is In Static Position (Zero Acceleration) And The Breaks Are Enabled.

Drive- This Mode The Car Engine's Motor Is Activated And Controlled By The User/Driver Based On The Acceleration In Forward Direction As Per User's Acceleration.

Right This State The Speed Of The Right Motor Is Reduced Three Times The Actual Speed And Reversed. The Direction Of Vehicle Is Manipulated To Right Side.

Left This State The Speed Of The Left Motor Is Reduced Three Times The Actual Speed And Reversed. The Direction Of Vehicle Is Manipulated To Left Side.

Reverse-This Mode The Car Engine's Motor Is Activated And Controlled By The User/Driver Based On The Acceleration In Reverse Direction As Per User's Acceleration. Negative Pulse Is Given To The Motor By The Processor To Reverse The Direction Of Vehicle.

Right- This State The Speed Of The Right Motor Is Reduced Three Times The Actual Speed And Reversed. The Direction Of Vehicle Is Manipulated To Right Side.

Left This State The Speed Of The Left Motor Is Reduced Three Times The Actual Speed And Reversed.The Direction Of Vehicle Is Manipulated To Left Side.

Hill Mode(Up-Hill)- This Mode Is Used To Assist While Driving In Inclined Surface By Controlling The Acceleration And Break Based On The Gyroscope's Input I.E., The Inclination Is Sensed With The Help Of Inbuilt Gyroscope Sensor In Myrio. To Increase The Acceleration During Uphill Drive An Additional Impulse Is Given To The Motor As Per Pre-Set Value.

Forward This Mode The Car Engine's Motor Is Activated And Controlled By The Processor Based On The Acceleration In Forward Direction As Per User's Call I.E. Based On The Angle Of Inclination Provided By The Gyroscope.

Right In This State The Speed Of The Right Motor Is Reduced Two Times The Actual Speed And Reversed.The Direction Of Vehicle Is Manipulated To Right Side.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526
International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022
DOI: 10.17148/IJIREEICE.2022.10468

Left In This State The Speed Of The Left Motor Is Reduced Two Times The Actual Speed And Reversed.The Direction Of Vehicle Is Manipulated To Left Side.

Reverse- This Mode The Car Engine's Motor Is Activated And Controlled By The Processor Based On The Gyroscope's Input And Acceleration In Reverse Direction As Per User's Call And Controlled By Processor Based On Change In Angle Of Inclination.

Right This State The Speed Of The Right Motor Is Reduced Two Times The Actual Speed And Reversed.The Direction Of Vehicle Is Manipulated To Right Side.

Left This State The Speed Of The Left Motor Is Reduced Two Times The Actual Speed And Reversed.The Direction Of Vehicle Is Manipulated To Left Side.

Hill Mode(Down-Hill) This Mode To Increase The Safety Of The Vehicle During Down Hill Drive Break And Acceleration Is Controlled Using The Processor And Gyroscope. To Increase The Safety The Vehicle Speed Is Reduced As Per The Angle Of Inclination Also Maximum Speed Is Also Pre-Set.

Forward This Mode The Car Engine's Motor Is Activated And Controlled By The Processor Based On The Acceleration In Forward Direction As Per User's Call And The Value Is Maintained Within The Pre-Set Value I.E. Based On The Angle Of Declination Provided By The Gyroscope .

Right This State The Speed Of The Right Motor Is Reduced Two Times The Actual Speed (Down-Hill Speed) And Reversed. The Direction Of Vehicle Is Manipulated To Right Side.

Left This State The Speed Of The Left Motor Is Reduced Two Times The Actual Speed(Down-Hill Speed) And Reversed .The Direction Of Vehicle Is Manipulated To Left Side.

Reverse This Mode The Car Engine's Motor Is Activated And Controlled By The Processor Based On The Gyroscope's Input And Acceleration In Reverse Direction As Per User's Call And Controlled By Processor Based On Change In Angle Of Declination. An Alert Indication Is Also Enabled During Down-Hill Reverse Condition.

Right This State The Speed Of The Right Motor Is Reduced Two Times The Actual Speed(Down-Hill Speed) And Reversed .The Direction Of Vehicle Is Manipulated To Right Side.

Left This State The Speed Of The Left Motor Is Reduced Two Times The Actual Speed(Down-Hill Speed) And Reversed .The Direction Of Vehicle Is Manipulated To Left Side.

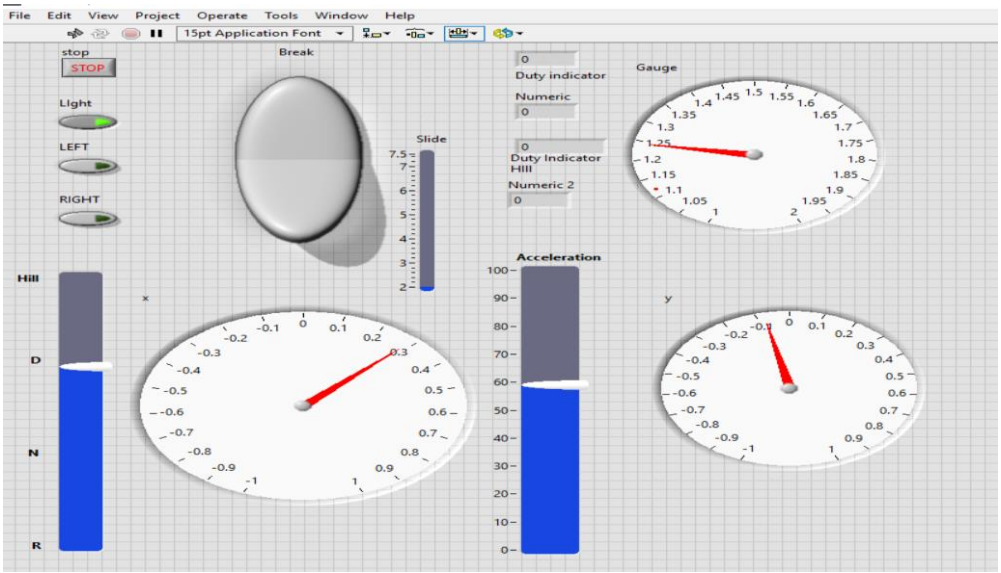
AFS(Adaptive Front Light System)

Adaptive Front Light System (Afs), Here Using Accelerometer's X-Axis The Servo Motor Turns The Head Light Accordingly. Adaptive Headlights Are Headlights That Actively Respond To Change In Direction Of Vehicle. Their Goal Is To Provide Drivers With Wide Range Of Visibility And More Time To React To Conditions Ahead .Afs Servo Motor Is Controlled With The Help Of Gyroscope, Where The Processor Calculates The Better Visibility Angle.

Vibration(Accident)

To Support The Emergency Response Team The Accident Is Detected Using Vibration Sensor And The Damage Intensity Is Sensed, Also The Co-Ordinates (Gps) Of The Accident Location Is Shared Via Gsm .Here The Accident Is Detected With The Help Of Vibration As Per Pre-Set Value.If The Vibration Detected Above The Pre-Set Value The Speed Of The Vehicle Is Slowed Down.As Soon As The Pre-Set Vibration Value Is Detected Parameters Like Speed, Indications, Gear And Door Status Will Be Recorded Like A Black Box.

VIII.RESULT



IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 4, April 2022

DOI: 10.17148/IJIREEICE.2022.10468

XI.CONCLUSION

This set up gives us most safety and better driving experience in hill stations and assists the emergency response team with location and impact intensity. This also has improved the field of vision in wide range of vehicles so that it can be very useful while driving in sharp bends. The total vehicle can be monitored through IOT. The hill hold feature itself has proven to be very beneficial to manual transmission drives that find themselves on grades that would normally make driving difficult. In addition to manual transmission vehicles, the driving experience of vehicles with automatic transmissions can be enhanced. When implemented correctly, the functionality of the hill hold feature seamlessly matches the driver's normal driving habits and instincts. By using this feature we can drive vehicle easily.

X.REFERENCES

[1] Weifeng Wang, Qing Wu, Zhiyong Lu, XiuminChu , "Control Model and Simulation for Adaptive Front light System of Vehicle on Curve Roads"

[2] SysCon 2018 – IEEE International Systems Conference Montreal, Canada, April 7–10, 2008 Vehicle Black Box System Abdallah Kassem, Rabih Jabr, Ghady Salamouni, Ziad Khairallah Maalouf Department of Electrical and Computer Engineering, Notre Dame University, P.O.Box: 72 Zouk Mikayel, Zouk Mosbeh, Lebanon

[3] D. Corona and D. Schutter, "Adaptive cruise control for SMART car: A comparison benchmark for MPC-PWA control methods", *IEEE Transactions on Control Systems Technology*, vol. 16, no. 2, pp. 365-372, 2018.

[4] V R Prajwal; (2020). Vehicle Detection and Collision Avoidance in Hairpin Curves . 2020 IEEE Pune Section International Conference

[5] L. Vijayalakshmi, P. Pradeepa and S. Sairam, "Driver warning System in Hill Bends," *2018 International Conference on Intelligent Computing and Communication for Smart World (I2C2SW)*, 2018.

[6] M. S. Rezwan, M. A. Islam, M. M. Islam and M. R. Hasan, "Vehicle Breaking Support System," 2018 3rd International Conference for Convergence in Technology (I2CT), 2018, pp. 1-4, doi: 10.1109/I2CT.2018.8529608.

