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LabVIEW Based Hill Assist and Black Box in Four Wheelers

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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, GIS.

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1. 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.

1.1 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 other. 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.

Figure.1. myRIO

1.2 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.

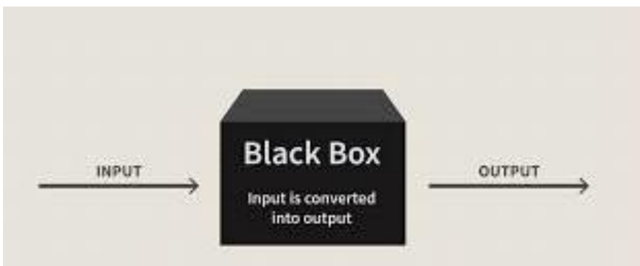

Figure.2. Black Box

1.3 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-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 behavior 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 swiveling headlamp can be simulated.

1.4 Controller

myRIO is a portable device and students can easily use it for the design and control of robots and many 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 microcontrollers. 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 a 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 to 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.

2. Software Description

2.1. Introduction

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.

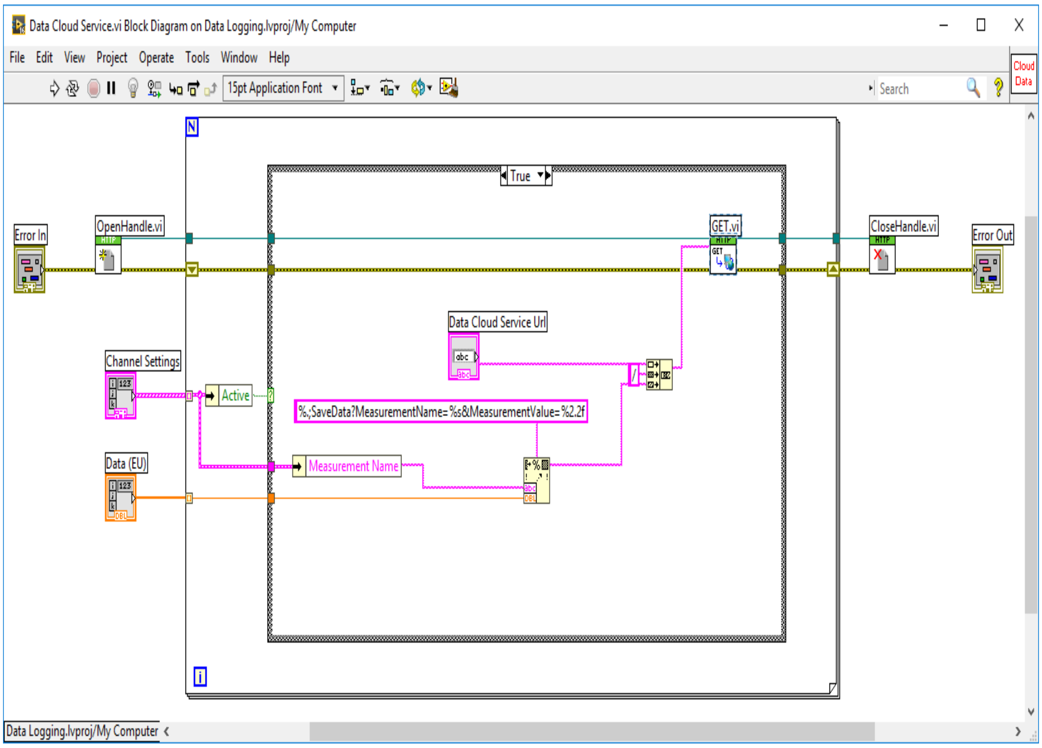

Figure.3. Block Diagram Window

2.2. Schematic of the System

The schematic of the system is shown below, myRIO.

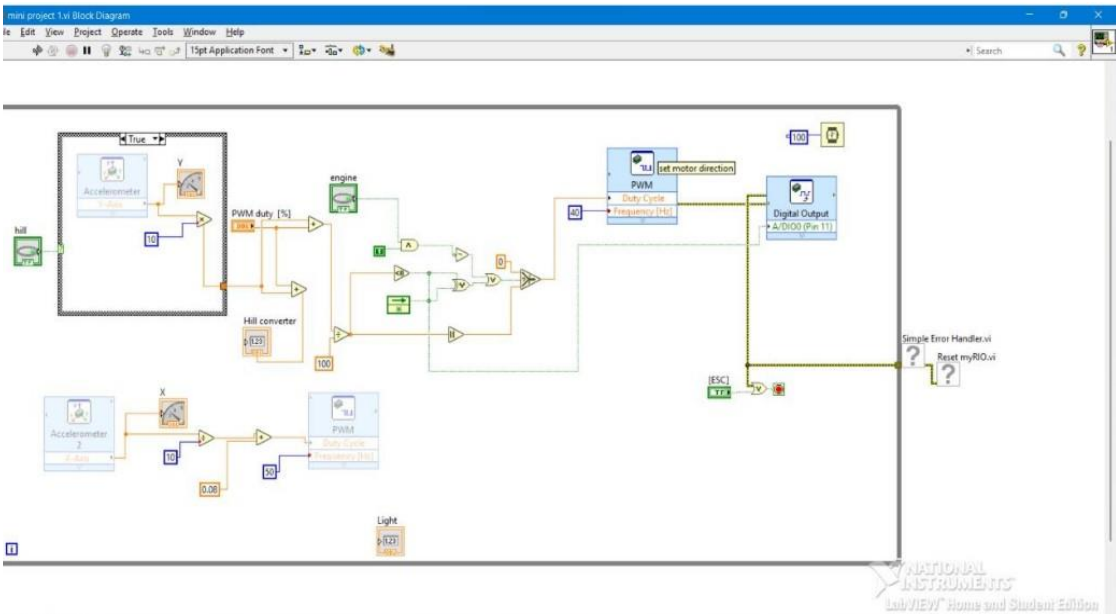

Figure.4. Schematic of the System

2.3. Circuit Connection

The below circuit shows the connection among the LABVIEW myRIO, Four Wheelers.

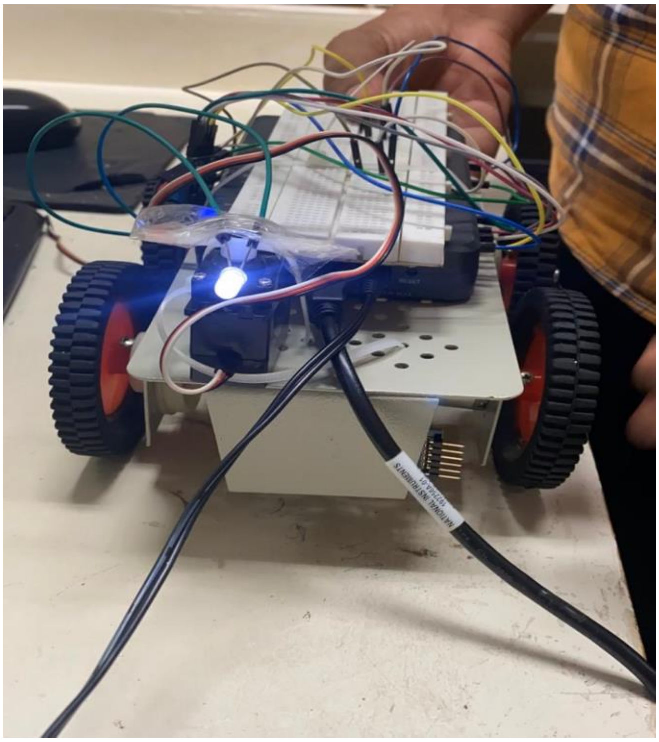

Figure.5. Circuit Connection

2.4. Experimental Setup/Hardware Prototype

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

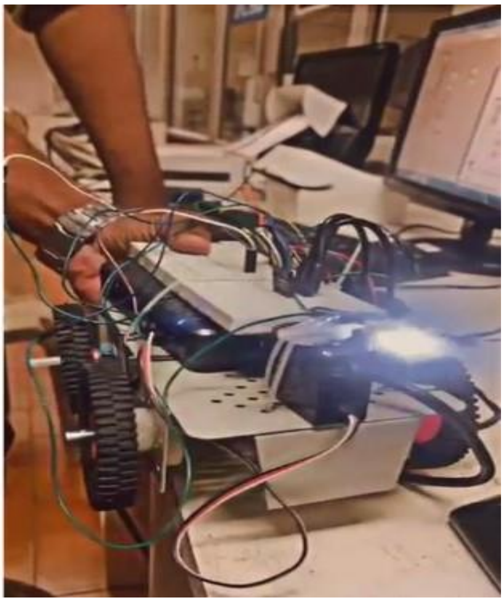

Figure.6. Experimental Setup

3. Operation

Stage 1

In motor control we have chosen y axis in both positive and negative axis and other two axis are neglected to control according change in level

Figure.7. Motor Control

Stage 2

Adaptive braking system works on seat belt principle (keeping the occupant in a more static motion despite a sudden stop or change in momentum). instant rapid change in rotation of wheel in negative y axis. This is been sensed using tachometer Based on instant change in wheel rotation (negative) the servo motor is activated and acts as a clamp which stops the rotation of wheel in negative direction This is how clamp action takes place.

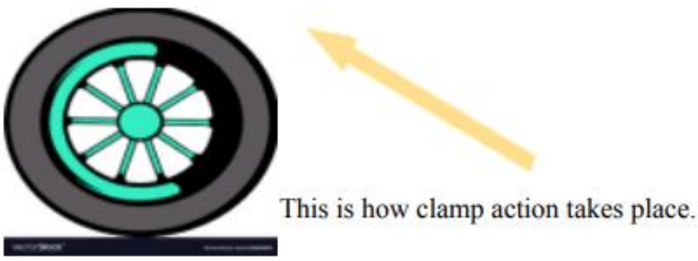

Figure.7. Braking System

Stage 3

Adaptive front light system (AFS), here using accelerometer's x-axis the servo motor turns the flash light accordingly, adaptive headlights are headlights that actively respond to changing conditions. Their goal is to provide drivers with better visibility and more time to react to conditions ahead. It's a term that encompasses several different features, most common of which is curve-adaptive headlights. STAGE 4: Using a gyroscope camera is stabilized to capture all the events occurring despite the change angle maintains the same position. Controlled with the help of 3 axis (3nos) servo meter.

Stage 4

Using a gyroscope camera is stabilized to capture all the events occurring despite the change angle maintains the same position. Controlled with the help of 3 axis (3nos) servo meter.

4. Result

LabVIEW based hill assist & black box in four wheelers output shown in the below figure

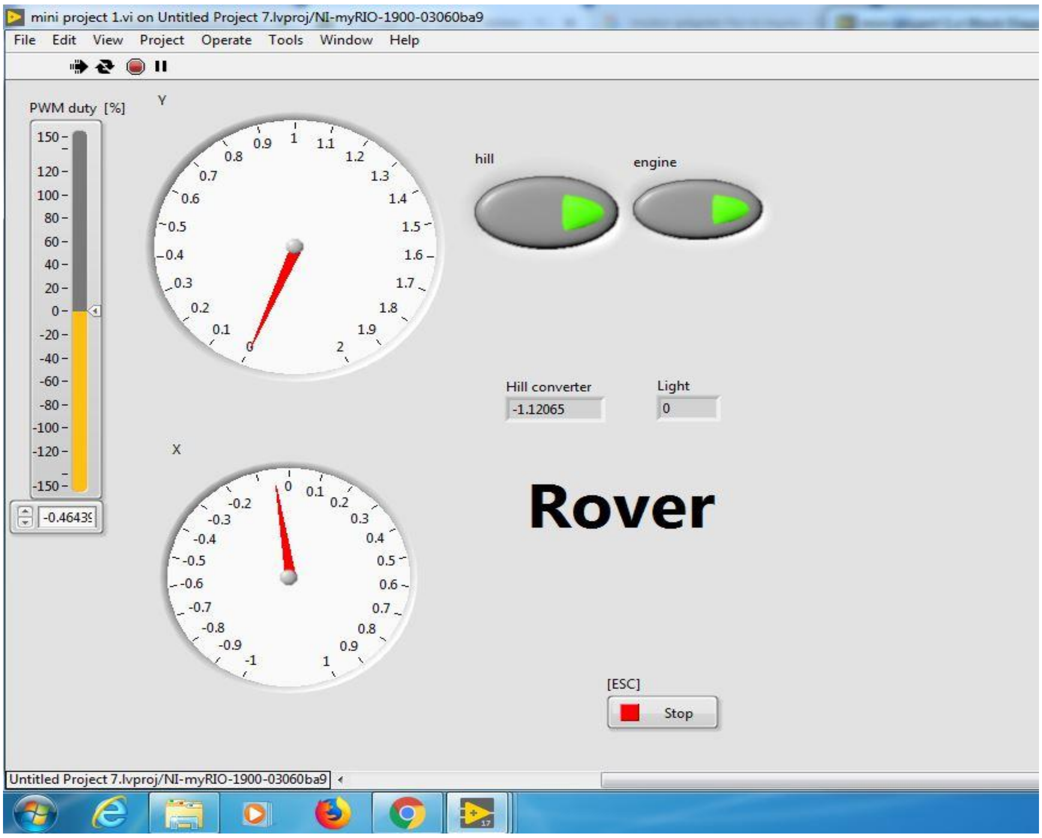

Figure.8. Front Panel

5. Conclusion

As a conclusion, the mountain assist system was done successfully with the help of labVIEW, the cruise control and adaptive front light system was installed in the system. With this controller the safety of the vehicle in sloppy or mountain areas are ensured.

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