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Automatic Driver Assistance System - Glare Free High Beam Control

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ABSTRACT: At present automobiles upgrades with different technologies for assisting and providing safety for the occupant. Due to this a system known as Automatic Driver Assistance System (ADAS) proposed many systems which aim to help the driver in controlling the vehicle and to drive safely during night time. One of the systems of ADAS is Glare Free High Beam (GFHB) control. This provides the information of the oncoming vehicles and preceding vehicles based on camera**,** which slices out the high beam and shades spot when it detects the object by avoiding the glare and provides the driver with greater visibility. It makes use of the various sensors, actuator, image processor and microcontroller to detect an object. In this paper, unit level testing is done for different cases in Embedded C, simulated in Visual Studio and results are displayed using GUI.

KEYWORDS: Glare Free High Beam, Advanced Driver Assistance Systems, Instrument panel cluster, Graphical User Interface, Auto High Beam Assist.

I.INTRODUCTION

In the present day scenario because of the huge competition in the automotive sector, every researcher, designer and engineer are trying to improvise the driving experience as well as safety. A headlamp of the vehicle plays a very important role in driving a vehicle safely especially during the night time. Keeping this in view, the performance of the headlamp is being continuously improved throughout this automotive age. Most of us might have experienced while driving at night time, the glare from oncoming vehicles makes us very uncomfortable or sometimes it may blind us temporarily. Even today also, in most of the vehicles the drivers are compelled to use manual light switching. In order to avoid the manual operation the glare free high beam system has been developed for the motorcycle lighting system.

Glare Free High Beam is one of the features of the ADAS. Advanced driver assistance systems (ADAS) are one of the fastest-growing application areas in present day vehicle sector. The multiple features of ADAS can warn the drivers by allowing better visibility into what is going on outside the car [1]. The ADAS functions and autonomous driving does require the operation of multiple systems at a time.

The ADAS applications require various sensors that collect physical data about the vehicle and its environmental information. Various sensors can be placed throughout the automobile in order to provide the required information to the driver that can be easily viewed on the dashboard and the other types of displays. By seeing on the display the driver can quickly respond and take important driving decisions.

Glare free high beam control is proposed to be used in driver assistance system which uses the information of oncoming and preceding vehicles and other road users to avoid glaring and to enlarge the visibility for the driver at the same time. The vehicle coming towards the host vehicle is said to be oncoming vehicle. The vehicle that is moving ahead of the host vehicle is said to be preceding vehicle. Based on the information the system automatically changes the light beam pattern. It slices out the high beam pattern when it detects the object in front of the host vehicle to protect other road users from glare while always providing the driver with maximum seeing range. The glare from the oncoming headlights sometimes makes the driver discomfort or produces a dazzling effect so most of the accidents occurring during night time even when there is less traffic. Oncoming headlights glare illuminances ranges from 0 to 10 lx [2].

This constantly changing beam pattern requires camera, image processor, microcontroller, CAN and AFL (Advance Front Lighting). The system uses the camera mounted on the windshield with at least 15mm distance. Camera provides the information about weather status, vehicle information and other road user information. Image processor is used to

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detect vehicles and capture images. The microcontroller uses the information of the processor and various other units and controls the beam of the headlamp by sending the information through CAN bus. Communication between various units will be carried through CAN protocol. Based on camera and AHBA (Auto High Beam Assist), GFHB moves to different states such as Active High, Active Low, Blocked and Disabled state.

II.GLARE FREE HIGH BEAM CONTROL

GFHB system takes the inputs from camera and various other units. It is controlled by AFL based on the information from the camera. The basic block diagram of GFHB is as follows

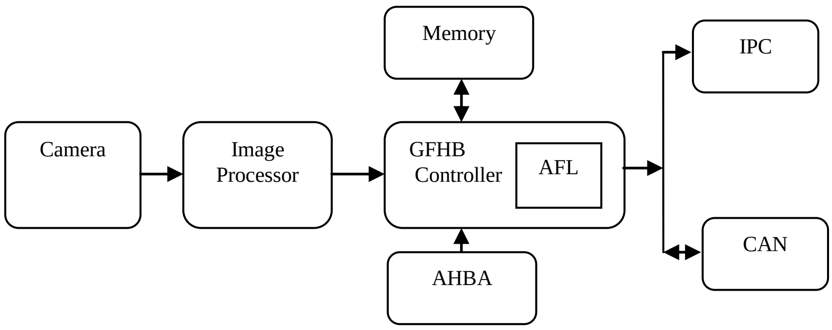

Fig: 1 Block Diagram of GFHB

Fig: 1 refers to the block diagram of GFHB where inputs are taken at camera, processed at image processor, total unit is controlled by the GFHB controller for which the memory and AHBA is connected. Finally the output is sent to the CAN and IPC for further action to be taken.

Camera can be used for the detection of objects. The input images are obtained from the vision system using a camera (CMOS image sensor) which is mounted behind the windscreen inside the camera-assisted vehicle. Based on camera field of view the horizontal, vertical angles and angular velocity of the object from the host vehicle can be detected. When the camera detects the light intensity to be less than 0.25 lx then the GFHB system will be activated automatically. The Image Processor extracts the information from the camera such as lane markings, vehicles, traffic signs and vehicle taillights and headlights, etc. Based on the image and calibration status the processor detects Vehicle type, Road type, Number of Vehicles, Weather conditions, Vehicle Identification, Horizontal position and Vertical position. AHBA (Auto High Beam Assist) automatically change the vehicle head lights between low and high beams. High beam will be selected when none of the vehicle is detected in front of the host vehicle. Low beams will be selected when it detects a vehicle in front of the host vehicle. It operates in different states.

Memory refers to the devices which are used to store information. It is of flash memory which stores the information even when there is no power. An IPC (Instrument panel cluster also called dash, dashboard) is a control panel placed in front of the driver of an automobile for operation of the vehicle. Items on the IPC consist of instrument cluster and steering wheel. Based on the GFHB status the beam indication will be controlled by different ECUs and the indication of the beam is shown as blue or green telltale in IPC. A controller area network (CAN bus) is a vehicle bus standard designed to allow microcontroller and devices to communicate with each other in applications without a host computer. CAN protocol is used for communication between GFHB controller and headlights.

GFHB controller controls the information coming from processor and other units. If the system detects a vehicle/ road user within the range it automatically adapts horizontal and vertical angle of the headlamps. The area surrounding the vehicle/ road user is illuminated with high beam whereas the road user itself will be with a partial beam by avoiding glare. The GFHB system is in different states like Active LOW (whenever the weather is rainy), Active HIGH (when no vehicle is detected), GFHB DISABLED (when AHBA is not active) and GFHB BLOCKED (when camera is in blocked state) based on states of AHBA and camera.

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Unit level testing is done for Glare Free High Beam module. The unit level testing is used to test individual modules in terms of requirements and functionality. Unit level testing is performed by the respective testers on the individual units of source code assigned areas. Unit level testing can detect errors, error correction cannot be done. GFHB flow is as follows.

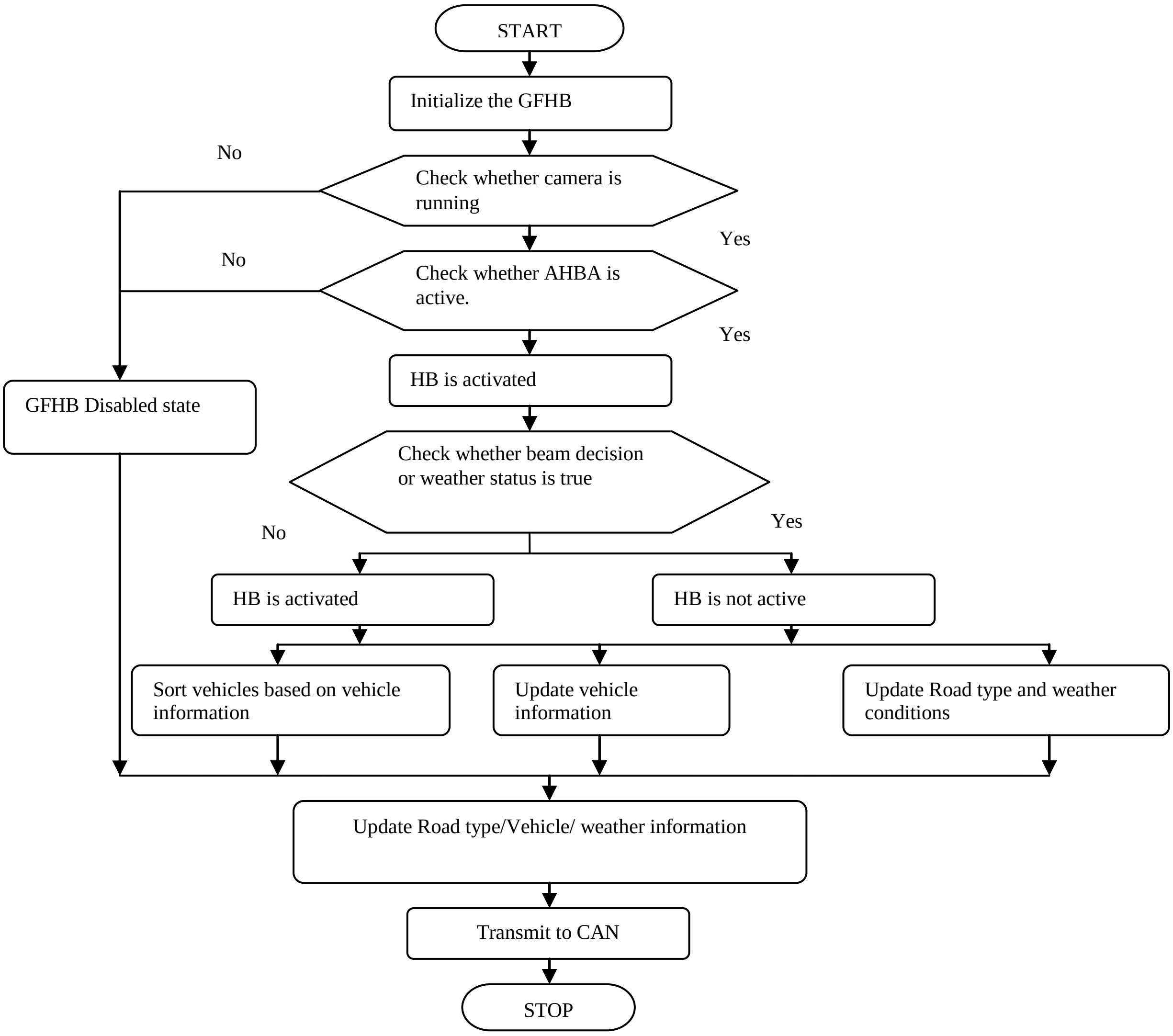

Fig: 2 Flow of GFHB

The flow of the data in GFHB is shown in the Figure: 2. in this data flow modules like Camera, AHBA are checked for the activation/deactivation of the GFHB module thereby data is sent to the respective modules like CAN.

III. GUI IMPLEMENTATION

The Glare Free High Beam module is implemented by using GUI (Graphical User Interface) in Visual Studio. The below windows shows the sample GUI of GFHB.

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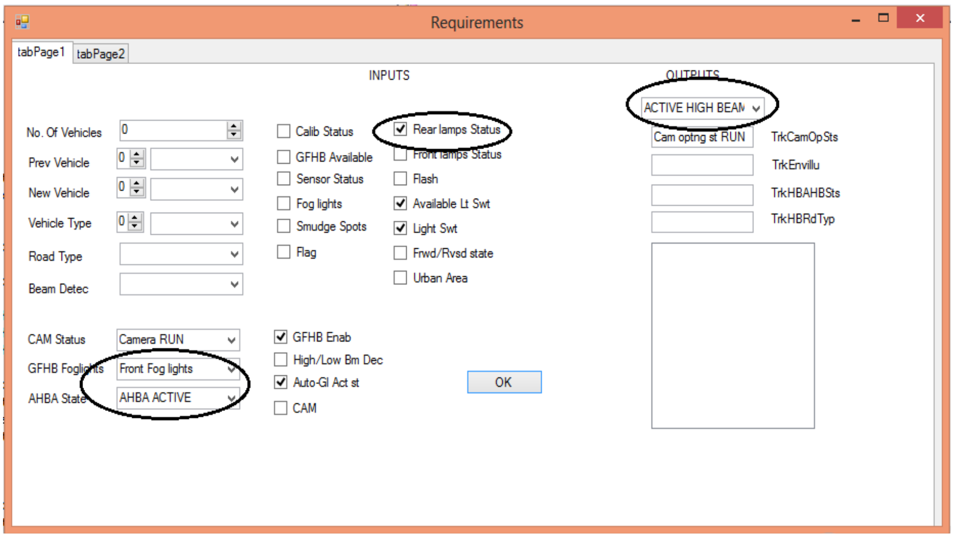

Fig: 3 Requirement showing GFHB in Active High State

In the above figure Fig: 3, it shows the GFHB in ACTIVE HIGH state depending on the inputs of GFHB Foglights and AHBA state. Only when AHBA is in active state then GFHB will be in active otherwise it will be in disable state.

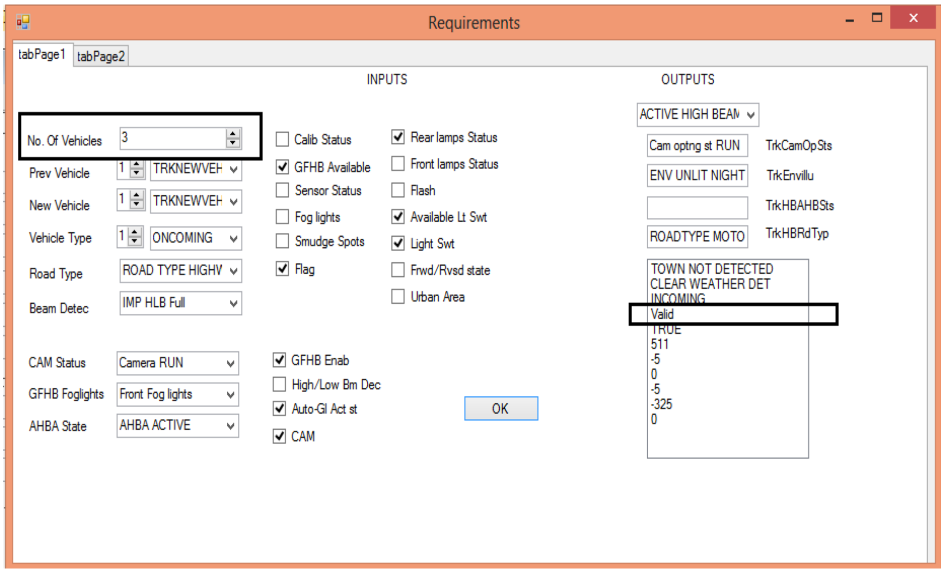

Fig: 4 showing another requirement based on no. Of vehicles

In the above figure Fig: 4 it shows the GFHB distance signal as valid depending on the number of vehicles. If number of vehicles detected is 0 then the output distance signal will be invalid.

IV.CONCLUSION

In this paper unit level testing is done for different environmental cases in embedded c and simulated in Visual Studio. Functionality of GFHB is tested by writing test codes and GUI is also implemented. By installing GFHB in all vehicles, light intensity is varied reducing the accidents during night time. The device will automatically switch to high beam or partial beam based on the information from the camera by using AFL. Different sensors are used in this process for collecting the images from the camera from different vehicles through which the intensity of the light is changed. CAN

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protocol is used for transmission of data. Different states of the GFHB module are explained in this paper and GUI application is created.

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