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AUTOMATIC HIGH BEAM CONTROL FOR DRIVER ASSISTANCE SYSTEM

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Abstract: *In the present scenario new technology is trending in automobiles. One of the technologies in automobiles is Automatic Driver Assistance system (ADAS). ADAS provides an effective system for detecting vehicles. In this, the system works automatically and provides safety to the passengers. As traffic is increasing on the roads, accidents are also increasing. To reduce the accidents caused at night time a system called Automatic High Beam Assist is proposed. This technology assist driver by providing information and acting on environmental data on front, side and rear vehicles to help and warn drivers of impending danger. By installing this system in vehicles, light intensity of the corresponding vehicle is varied in accordance of range of the detected vehicle. This system makes use of different sensors to detect vehicles. In this paper, Unit level testing is done for different environmental cases in Embedded C, simulated in Visual Studio and results are displayed using GUI.*

Keywords: *AHBA (Automatic High Beam Assist), IPC (Instrument Panel Cluster), GUI (Graphical User Interface), ADAS (Automatic Driver Assistance System), CAN (Controller Area Network).*

1. INTRODUCTION

Automatic High Beam Assist is one of the features of ADAS (Automatic driver assistance system). This ADAS process inputs from various sensors [2], [5] such as CMOS image [6] sensor, RADAR and LIDAR [7]. The system automatically changes the light from high beam to low beam [1] based on traffic in-front. High beam will be selected when there is no other vehicle within the range and low beam will be selected when it detects other vehicle. The system controls the headlights by collecting the information from various sensors placed on the chassis of the vehicle. Communication between them will be carried through CAN protocol.

At present vehicles include a variety of lamps to provide light in various conditions. In this, headlamps are altered between high beam and low beam. Low beams produce less light and used at night time to illuminate when vehicles are in-front [3]. High beams produce more light and used at night time [4] to illuminate when it does not detect any vehicle. The range of low beam provides up to 80-90 meters and high beam ranges above 180 meters. The AHBA Feature will deactivate the High Beam Lights, when it detects oncoming vehicle at a distance of 800m and preceding vehicle at a distance of 350m [10].

The devices for actual process of providing high beam and low beam involve camera, image processor, and microprocessor and CAN bus. Mainly the AHBA [9] depends on different states such as Active High, Active Low, Blocked and Disabled states. The system requires a camera mounted in the windshield with at least 15mm distance. Camera provides the information about weather status, camera blockage and urban area detection. Image processor is used to detect vehicles and capture images and processed using microcontroller. The camera-based system uses machine vision algorithms to analyze the image of the roadway scene ahead and determine crash threats. The enhanced image is ready for shape detection which locates possible road signs in the video frames. All the detected shapes will be sent to road sign recognition module to check whether they correspond to the known road signs stored in the database. If a road sign is recognized, it will be displayed on the screen. The system uses a 32-bit microcontroller which operates at a speed of 120MHz.

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2. LITERATURE SURVEY

The method for detecting vehicles in front of a camera-assisted vehicle during night-time driving conditions in order to automatically change vehicle head lights between low beams and high beams is presented. Accordingly, high and low beams are selected depends on the traffic conditions. Our system uses a micro-camera mounted in the windshield area of a car [1]. The information about different sensors used in ADAS systems like RADAR, LIDAR, CMOS image sensor etc. have learned [2]. The visibility of the road for safe night time driving is used in this thesis. The system requires the detection of oncoming and preceding vehicles up to such a distance that only camera based approaches are reliable. At nighttime, detecting vehicles using a camera requires to identify their head or tail lights. The main challenge of this is to distinguish these lights from reflections due to infrastructure elements [3].

This paper presents, a simple, low cost and easy to install, design for an intelligent automatic on/off high beam light controller. The system provides the driver with the required automatic control; by turning on and off the high beam light when facing other drivers. Moreover, the system will turn off the high beam light if there is enough lighting on the surrounding environment such as when driving inside cities [4]. An infrared (IR) sensor based camera has been installed in automobiles for monitoring the images. A stabilization of temperature during a build can lead to more uniform microstructure and mechanical properties throughout the fabricated part [5]. Cameras will become a key sensor in increasing car safety, driving assistance and driving comfort. The image sensors for automotive will be dominated by CMOS sensors as the requirements are different from the consumer market. Dynamic range, temperature range, cost, speed and many others are key parameters that need to be optimized. For this reason, automotive sensors differ from the other sensors and need to use different design and processing techniques in order to achieve the automotive specifications [6].

The paper is concerned with the topic of “LiDAR”, or Light Detection and Ranging technology, and its specific usage in autonomous or “self-driving” cruise control systems for automobiles. LiDAR is a high tech remote sensing technology that makes use of lasers to analyze and map various objects and landscapes. LiDAR works by emitting infrared, ultraviolet, or visible light at an object, and then measuring how quickly the light returns to the source, as well as measuring other disturbances in the laser as it returns to the LiDAR source [7].

The primary goal of an automotive headlight is to improve safety in low light and poor weather conditions. This gives the information of switching between high and low beams, turning of beams toward the opposing lane, or rotating the beam as the vehicle turns - and are not designed for all driving environments. This also introduces an ultra-low latency reactive visual system that can sense, react, and adapt quickly to any environment while moving at highway speeds [8]. Now-a-days many accidents are occurring on roads mainly during night times. To prevent this some safety systems are used to reduce it. This AHBA system is also one of the systems to reduce accidents. Usage of some sensors, actuators and other ECUs based on that the system can switch to high beam and low beam at night [9]. In this the paper describes the rules and regulations of the automobiles and their shriving conditions [10].

3. BLOCK DIAGRAM OF AHBA

The block diagram of AHBA consists of following

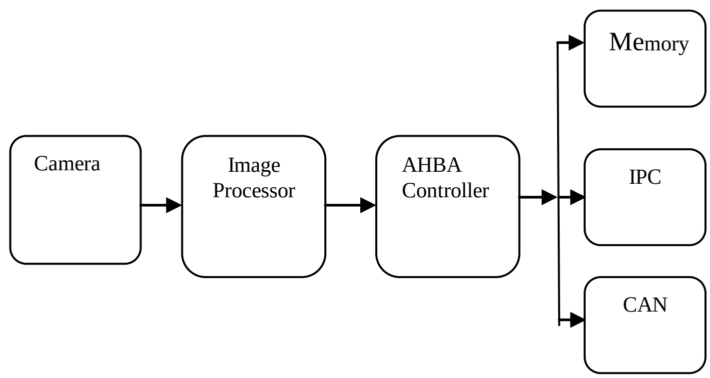

Figure 1: Block Diagram oh AHBA

The above block diagram shows how input is processed and output is extracted in AHBA module.

The image processor provides the information about camera blockage information, urban area detection, beam decision and weather information. Camera Blockage information detects whether the camera is blocked or not blocked. Weather information detects the Weather conditions whether it is foggy or snow. Urban area detection detects whether the area detected is urban or rural. Beam decision detects whether the beam is Low beam or High beam [8].

AHBA controller is used to control the functionality of the entire module. Memory refers to the devices which are used to store information.

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 AHBA

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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 AHBA controller and headlights.

Unit level testing is done for Automatic High Beam Control module. The unit testing is used to isolate each part of the program and show that individual parts are correct in terms of requirements and functionality. Unit testing is performed by the respective developers on the individual units of source code assigned areas. Unit testing can detect errors, error correction cannot be done. AHBA is tested as follows.

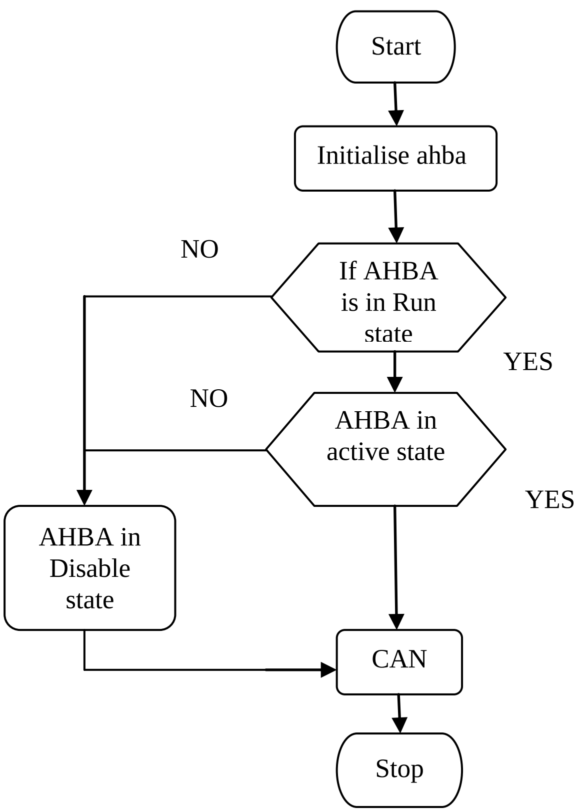

Figure 2: Flowchart of AHBA

4. NEW PROPOSED SCHEME

The Automatic High beam Control module is implemented by using GUI (Graphical User Interface) application. Microsoft Visual Studio is an Integrated development environment (IDE) from Microsoft. The below windows shows the sample GUI of AHBA. The below windows shows the screens of GUI.

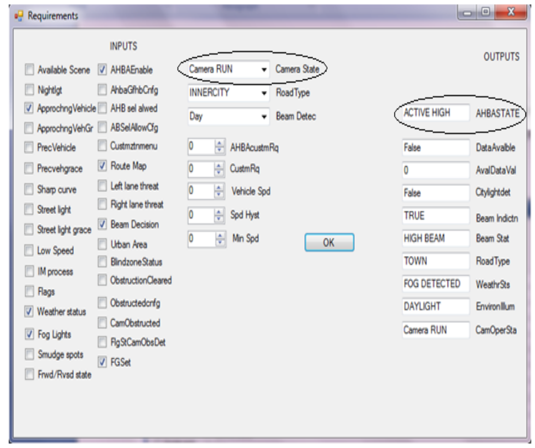

Figure 3: AHBA in Active High State

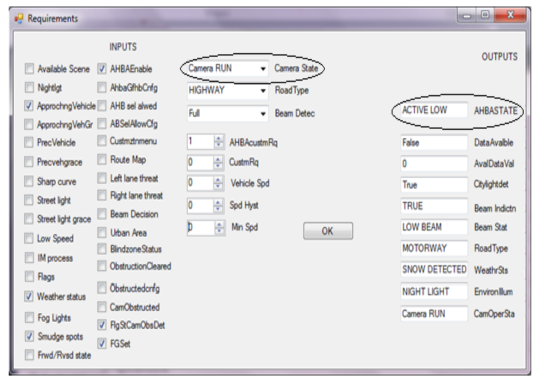

Figure 4: AHBA in Active Low State

5. CONCLUSION AND FUTURE WORK

In this paper, unit level testing is done for different environmental cases in embedded c and simulated in Visual Studio. Functionality of AHBA is tested by writing test codes and GUI is also implemented. By installing AHBA in all vehicles, light intensity is varied reducing the case of accidents during night time. This device provides high beam when no vehicle is detected, and again switches to low beam when it detects any vehicle in-front automatically by reducing the road accidents. 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 from low beam to high beam. CAN protocol is used for transmission of data from AHBA to memory. Different states of the AHBA module are explained in this paper and GUI application is created from which inputs are given and outputs for different cases are obtained. Further it can be implemented by using DOA (Direction of Arrival) algorithm by using stereo camera by measuring the angles.

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