Implementation of Automatic Upper Dipper in Car Dashboard using CANoe

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Abstract *Since the turn of the century, the automobile industry has evolved significantly to build smart and fuel-efficient vehicles. In the vehicle business, fresh breakthrough concepts in design, appearance, performance, and economy arise every day. When purchasing a car for personal use, customers evaluate aesthetics, cost, and safety. To the user, the dashboard is the first and most apparent component of an automobile. It functions as a console for many components while keeping the occupants comfortable. Making automobiles safe for passengers and pedestrians is the most important field of research and development. Passenger and pedestrian safety is also improved by improved nighttime visibility and accurate visualization of automobile characteristics for the driver. ALCS (adaptive light control systems) are a type of active safety system that lights the road and gives the driver the best vision possible in changing weather conditions. Also, Car Dashboard is being used with CANoe software to verify the detailed preview of the messages being sent.*

Keywords—Car Dashboard, CAN protocol, CANoe, safety, light, automobile, Upper, Dipper, etc...

1. INTRODUCTION

Electronic gadgets in vehicles are becoming increasingly common as automotive electronic technology advances and automotive capability needs continue to improve. The widespread use of electronic equipment will certainly result in a gigantic and complex body wire harness, a lack of installation space, a decrease in operational dependability, and an increase in the complexity of failure maintenance. A huge amount of data information is asked to be exchanged in different electronic units in order to improve the used rate of signal, and a big number of control signals in the car control system require real-time exchange.

Most traditional electricity systems rely on point-to-point connections, which have proven insufficient to fulfill demand. As a result, automobile network technology evolves as the times demand. Automotive networks provide several benefits such as decreasing harness to a great amount, realizing data exchange, significantly boosting the intelligent control level of the car, improving failure detection and repair capabilities, and so on.[1]

Vector created CANoe, a practical and effective tool for system design and analysis. It can establish a connection between a virtual bus and a physical bus using Vector's CAN bus interface technology. With CANoe, we can achieve whole digital simulation of a bus application system based on total virtual nodes, half-physical simulation of a physical node and virtual node combination, and real-time monitoring of genuine physical bus communication. CANoe covers the whole bus development process, from original design through simulation and final test analysis, and accomplishes the seamless integration of network design, simulation, and testing. This study focuses on the development technique of a simulation and test system for a vehicle body CAN network, and it employs CANoe software to carry out actual simulation and testing. Finally, it demonstrates that the intended simulation and testing system for car body CAN network is possible.[3]

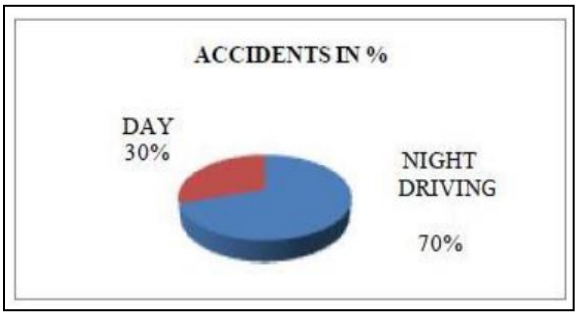

Fig -1: Accidents percentage in India

The number of vehicles on the road is rapidly rising, as is the number of traffic accidents as we can see in Figure 1. The majority vehicle accidents, especially at night, are caused by blinding headlights. While diving at night, the headlight beam of incoming vehicles immediately impacts the driver's eye, causing blurry vision that takes 3 to 8 seconds to recover. If the car's speed is 70 km/h at the moment, it will go off the road or collide with an incoming vehicle. [9]

To address the issues raised in both papers (refs. 3 and 4), we created a new circuit that operates the headlight beam directly. Some components must be added, as well as wiring alterations. In both papers, a typical problem occurs while driving in cities, where street lights or store lights damage the system and shorten the life of the relay and headlight. The manual mode, which is already available in the car, is employed to lessen this. In modern practice, the dipper beam is controlled manually by a switch mounted on the steering column. Most drivers do not employ manual dipper control for a variety of reasons, including the fact that the dipper control switch is used hundreds of times during night driving. Another explanation is that the driver would rather focus on the steering wheel than dip the headlight beam. Another big factor is ego, which causes one individual to wait for the other to start dipping, which may or may not happen.

2. SOFTWARE STRUCTURE

2.1.CAN Bus in an Automobile

A CAN bus is a LAN (Local Area Network) controller. The CAN bus can transport serial data one at a time. For transmitting and receiving data, all participants in the CAN bus subsystems are available via the control unit on the CAN bus interface. The CAN bus is a multi-channel communication system. When one unit fails, it has no effect on the others. The data transfer rate of the CAN bus in a vehicle system varies. The high-speed real-time control fashion ranges from 125Kbps to 1M bps. While the low-speed transmission rate ranges from 10 to 125K bps. Others, such as multimedia systems, operate at a medium-speed pace in between the previous two. This method distinguishes distinct channels and improves transmission efficiency.

2.2.Simulation of Car Dashboard

A. CANoe Database

The Vector CAN tools only read-access communication-relevant data, which is defined, changed, and maintained exclusively inside CANdb++. So that the Vector May tools can access the communication-relevant data, it must exist in the form of CANdb network files .

We're making four message signals here: EMS (Engine Management System), Engine, and Light. Each message signal is allocated to a certain system to connect with.

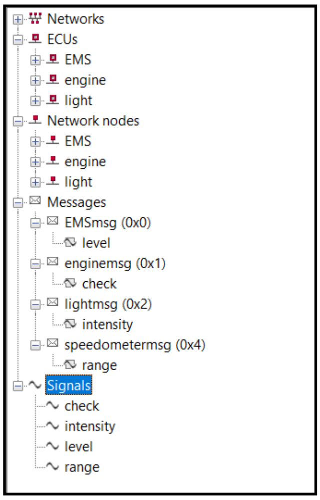

Fig -2: CANdb++ messages and signal

B. Simulation Setup

CANoe is used at the start of the development process for an ECU or ECU to construct simulation models that emulate the behavior of the ECUs. These models will be used as a foundation for analysis, testing, and integration of bus systems and ECUs throughout the lifecycle of ECU development. Data can be displayed and analyzed in either raw or symbolic form.

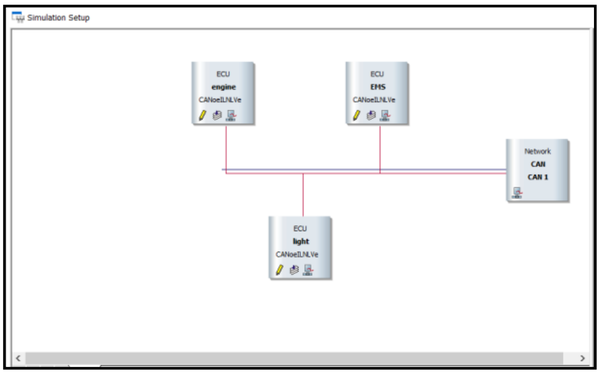

Fig -3: CAN Bus representation over nodes

C. Panel Design

With the Panel Editor, you may design visual panels on which the user can adjust the values of discrete and continuous environment variables, as well as display signals, interactively throughout the simulation. Figure 5 depicts the design system's Instrument Cluster panel, whereas Figure 4 depicts the simulation sensors. The Instrument Cluster, in particular, shows some Running status, light signals, automobile speed, engine speed, and Fuel detection. The simulation

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sensor panel primarily delivers signal values for Car Speed and Engine Speed to the bus to replace real nodes that are simple to operate.

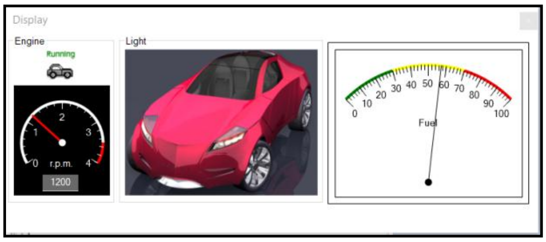

Fig -4: Display panel

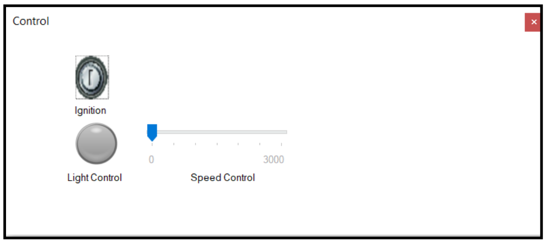

Fig -5: Control panel

D. Simulation Results

We may use the tracing window to monitor the data from the bus and see if there is an incorrect frame. We may also see and determine if the data being sent and received is correct. This can aid development engineers in debugging and modifying the application, as well as improving development efficiency. Figure 6 depicts several data frames used while debugging.

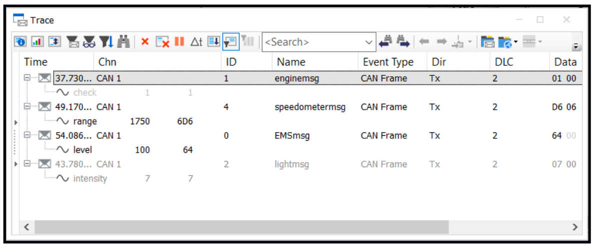

Fig -6: CAN messages in different nodes

3.AUTOMATIC UPPER DIPPER

3.1.Headlight of Vehicle

Figure 7 shows a headlight vehicle with a double filament bulb. One filament is used for the top beam and another is utilized for the lower beam. The headlight is the only source of visibility while driving at night, and it is required generally from evening 6.00pm until morning 6.00am. The driver may manually alter the headlamp from upper to lower beam or vice versa.

Fig -7: Headlight of Vehicle

Upper beam covers a bigger extent of up to 70 meters, while dipper beam covers a smaller distance of up to 25 meters, and the intensity of head light is varied at both times. Figure 8 shows how much distance is covered by the top and lower beams of a headlight.

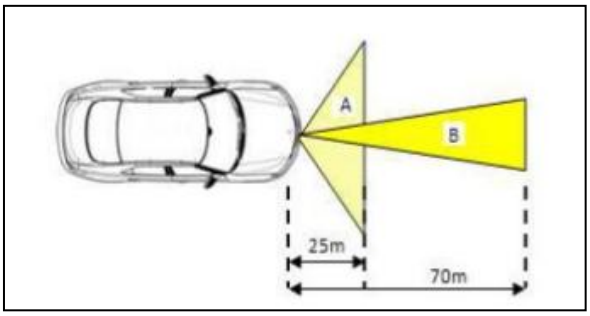

Fig -8: Headlight of Vehicle

3.2.CIRCUIT DEVELOPMENT

A. Circuit Design

Because there are fewer circuit components in this system, the circuit breadboard design is not as crucial. The breadboard is used to implement the circuit as shown in the diagram. For the design and implementation of the components depicted in fig.4, the most readily accessible and correct components are employed.

B. Circuit Components

i. IC 555

The fundamental control of this system is the 555 timer IC, which is well recognized for producing consistent time delays. The timing logic for this system is developed in monostable mode. It is a dual-in-package 8-pin integrated circuit (DIP). Figure 9 depicts the 555 IC's pin diagram.

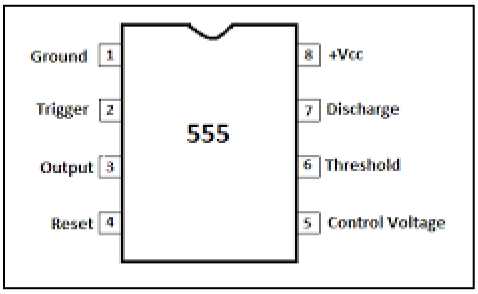

Fig -9: Pin Diagram of 555 Timer

ii. LDR

In this setup, the LDR serves as a sensor, detecting the incoming vehicle's headlight beam. The LDR construction schematic is shown in Fig.10.

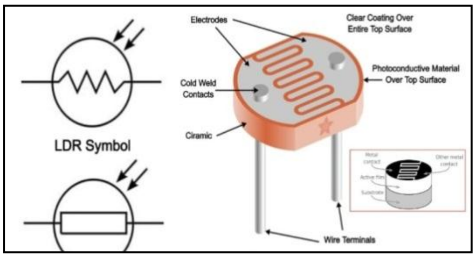

Fig -10: LDR Sensor

iii. Battery Source

This system operates on a 12V supply that is drawn straight from the car battery, which is already present in each vehicle. It offers a steady DC supply, and the system may be securely powered by the vehicle's battery without the use of any extra components.

3.3.Operating principle and working

A. Operating Principle

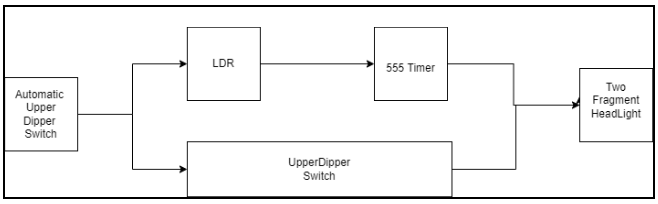

Fig -11: Block Diagram

The block diagram in fig.11 illustrates the dipper control system clearly. LDR detects approaching car headlights in automated mode, as the resistance of LDR varies with light intensity. The voltage supplied to the 555 timer control IC changes as the intensity changes. The output changes its status to high or low according on the trigger and threshold conditions, causing the headlight control to move from upper to dipper. When the oncoming car passes, the LDR becomes black and the output of the 555 IC changes. It switches the headlight beam from dipper to higher.

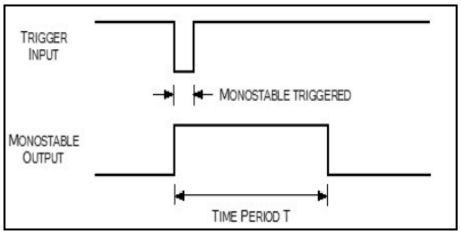

Fig -12: Output waveform of the monostable mode

The monostable mode of the 555-timer application is used in this system. Figure 12 depicts the output waveform of the monostable mode, which provides the time delay T when a low input pulse is supplied to the 555 IC.

B. Working

A 555-Timer IC is used in this circuit as shown in Fig 13. When the voltage at pin number 2 is less than one 3rd of the supplied VCC, the timer IC will output at pin number 3. The circuit employs three LEDs: an indication LED, an upper light LED, and a dipper light LED. In the circuit, there is an LDR that provides variable resistance based on the intensity of the light shining on it. When the circuit first turns on, the upper light will shine and the dipper light will remain off. However, when light from an oncoming vehicle strikes LDR, the resistance reduces. Because of this decrease in resistance, the voltage applied to timer IC pin number 2 will be less than one-third of the given VCC. As a result, the timer IC is activated, and we get a high output voltage at pin number 3. This output will be linked to the dipper LED, causing it to shine while also turning out the upper LED. When no light is landing on the LDR, its resistance increases, causing the timer IC's output to be low. As a result, the upper LED will once again illuminate while the dipper LED will switch off.

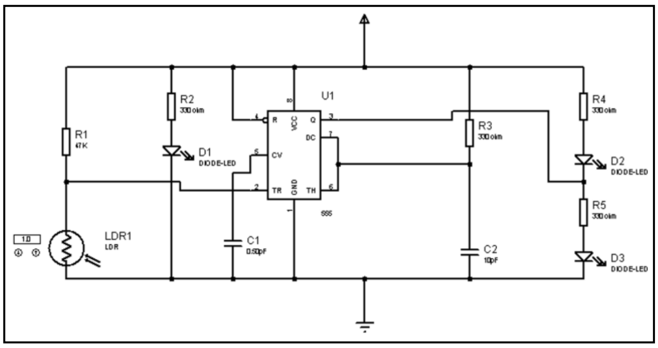

Fig -13: Circuit Diagram

4. RESULTS

The circuit is created on the breadboard according to the circuit schematic, and a 12V power source is used to power it. LDR resistance is high in the dark (20 k) and low in the light (2 k). Allow the little torch light to fall on the LDR and measure its resistance. We alter the resistance of the LDR with a little flame and measure some distance at different resistances.

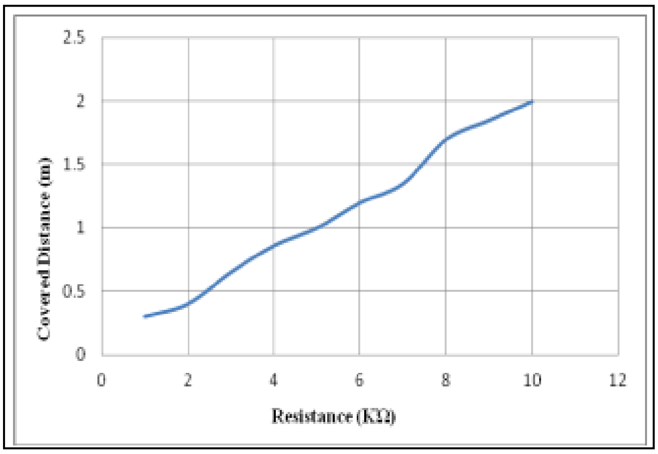

Fig -14: Graph Representation of Resistance vs Distance

As a result, the preceding graph shows that LDR resistance is high in darkness and low in light. As a result, the dipper control is affected by light intensity and distance.

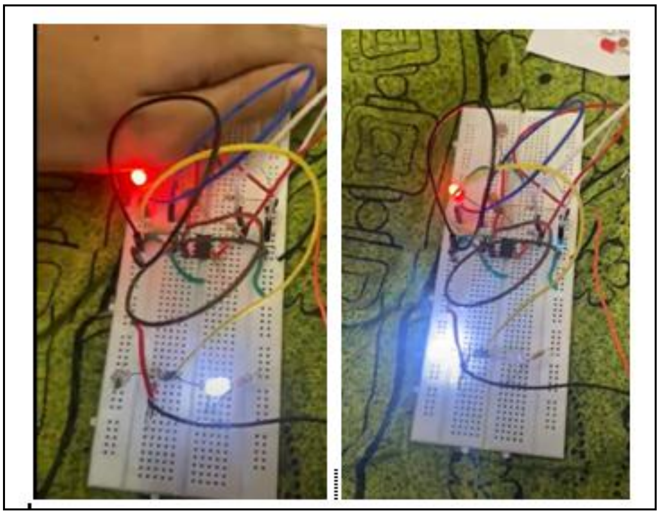

Fig -15: Automatic Upper Dipper

5. CONNCLUSION

This article describes the simulation and testing system development process for the Car Dashboard CAN bus. Using the system development and analysis tool CANoe, we establish the simulation and test environment in which we complete the simulation and testing for each node of this system as well as the overall system coordination test.

The automatic dipper improves nighttime safety, allowing drivers to drive pleasantly and safely to their destination. There are two modes available: automatic and manual. When travelling in cities, there are lights everywhere, which might interfere with the device's operation; at that point, the mode can be switched to manual mode to eliminate headlight flickering. When both cars were outfitted with the "Automatic Dipper," they efficiently dipped each other's headlight beams. The main components required to run the circuit are readily accessible and reasonably priced. The circuit is compatible with any car and does not require any additional power; it may operate efficiently on the vehicle's battery. As a result, the installation of this safety system in each car provides safety while driving at night, increases the driver's comfort level, and reduces the risk of an accident road traffic collisions

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