PLC Based Adaptive Headlight Beam Assisting System

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***Abstract*— Headlight of vehicle poses a great danger during night driving. Drivers use automatic mode of headlamp by selecting switch so high beam and low beam is adjusted based on oncoming vehicle. Although accidents are happening at highway during night travel because of high beam Glaring effect and low beam improper vision. When opposite vehicle crosses for a while at dark night situation like hilly road, curve road, rainy, foggy situation driver hit the obstacle, another vehicle and even pedestrian. so it is more important for the headlamp not to glare/more brighter and not dim/less brighter on both the condition it causes problem for the driver. So project depicts Adaptive headlight beam assisting system which vary brightness level based on requirement level for driver based on oncoming obstacle at night travel.**

***Keywords*—PLC, Adaptive headlight, Trolxer effect**

I. INTRODUCTION

Driver safety and assistance system plays an important role in Automobile industry. It includes various concept such as adaptive headlight control system , air bag protection to driver during accident situation , Anti-lock brakes and automatic seat belt with pretension and force limiter , rearward facing cameras [5] ,Collision warning sensors, infrared night vision and lane departure warning system etc

In spite of public awareness regarding road transportation and strict traffic rules to bring down road accidents, the accident rate is increasing year by year. In 2012 world accident report India ranked first which is over 1, 30, 000 deaths annually by overtaking china. Reason for these accidents include problem such as drunken driving, momentary optical blindness during night travel, improper signal indication at highway and other etc. Road death increased by 40 percent between 2003 and 2008 in India.

Among which Adaptive Headlight plays an important role during night travel. Headlamp of car usually consists of high beam headlight and array of low beam headlight[1][2]. When driver is travelling during night travel switch the automatic headlight mode where headlamp switches between high and low beam (when there is no vehicle approaching then light sensor senses vehicle on opposite direction and allow both high and low beam headlight to switch on and when another vehicle approaches from opposite direction then it switch off high beam headlamp and switch on low beam headlamp)[1][2].

Trolxer effect

A good visibility of road is important during night driving, meanwhile dazzling also cause a problem. A study shows if our eyes exposed to more than 1000 lumen we experience glare[7]. This glare due to more brightness light falls on rods and cones in our eyes. Even after light source of source glare is moved our eye remain in optical blindness this phenomena is called Trolxer effect [6]. So whenever concentration of glare occurs at night travel which leads to increase in reaction time if the driver, this intern the main cause of accident at night travels [1]. If the driver is moving with high speed and faces a low illumination then also driver reaction time is less due to low beam causes of accident happen because of high speed [2].

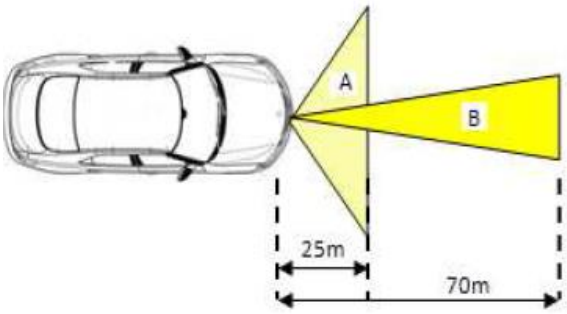

Fig1: Range of low(A) beam bulb and high beam bulb(B) of a car

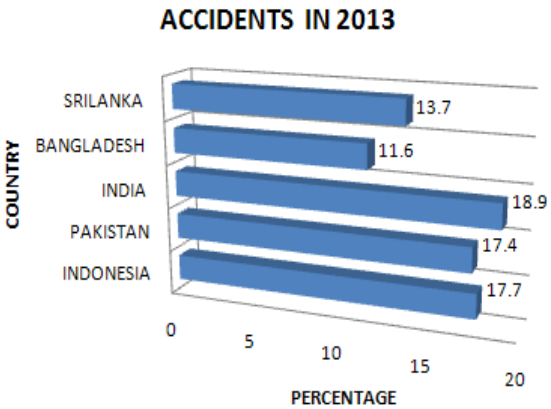

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Fig2: Accident information in Asia due to Trolxer effect

The driver has the control of the headlight which can be switched from high beam to low beam and with advance improvement automatic switch mode is provided where headlight adjust automatically according to the light requirement by the driver. Headlight leveling sensors control and adjust the lights based on real time situation. When the car goes over a bump, a sensor attached to the rear side of car controlled by the vehicle's computer[3][4] .The machinery for the self-adjusting headlights turns the headlight reflectors down, pointing the headlights down. That keeps them from flashing in the eyes of oncoming drivers and keeps the headlights focused on the road [4][8][9].

II. ANALYSIS

PLC is an industrial microcontroller system (in more recent times we meet processors instead of microcontrollers) where we have hardware and software specifically adapted to industrial environment. Special attention needs to be given to input and output, because in these blocks you find protection needed in isolating a CPU blocks from damaging influences that industrial environment can bring to a CPU via input lines. Program unit is usually a computer used for writing a program (often in ladder diagram).

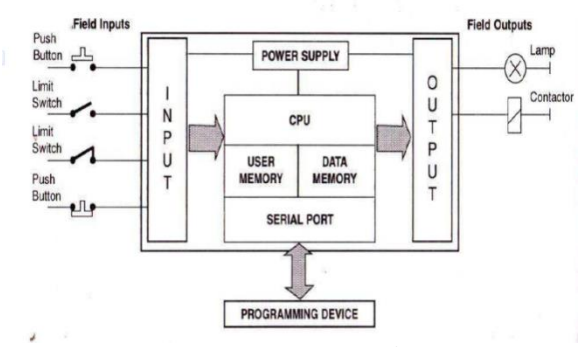

Fig3: Block diagram of PLC

Central processing unit is the brain of a PLC controller. CPU itself is usually one of the Microcontrollers. CPU also takes care of communication, interconnectedness among other parts of PLC controller, program execution, memory operation, overseeing input and setting up of an output. PLC controllers have complex routines for memory check up in order to ensure that PLC memory was not damaged (memory check up is done for safety reasons).

A. Ladder diagram

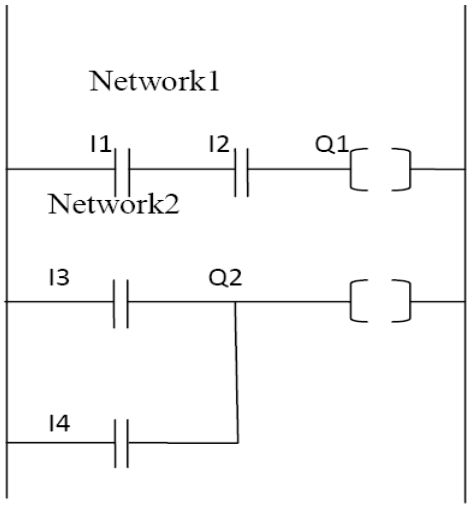

Fig4: Ladder diagram of PLC

The he left vertical line of a ladder logic diagram represents the power or energized conductor. The right vertical line, which represents the return path on a hard-wired control line diagram, is omitted. Ladder logic diagrams are read from left-to-right, top-to-bottom. Rungs are sometimes referred to as networks. A network may have several control elements, but only one output coil.

B. Hardware implementation

The block diagram shows the connection of PLC to the headlamp and 24V DC adapter used which convert 230 V AC to 24 V DC (required for operation) and intern provide control to selector switch , push button and voltage regulator and relay coil voltage. Selector switch is used to provide driver to select automatic or normal mode control of headlamp voltage regulator is used which convert 24 V DC to 5V AC which is input voltage to the IR proximity sensor. Sensor output is 5V but the OMRON PLC input is 24 V so to meet input voltage of PLC , Relay is used between sensor output and PLC input to control. Voltage regulator converts 24 V DC to 5V AC.

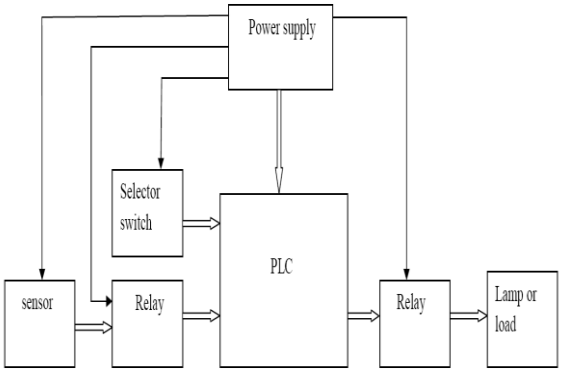

Fig5: Hardware implementation

C. Evaluation

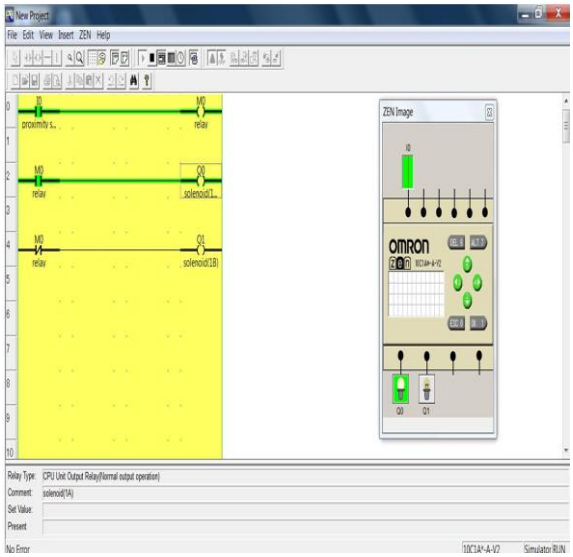

Fig6: program Ladder diagram of OMRON PLC

Above fig shows the ladder diagram of OMRON(PLC kit), left part shows the ladder diagram and the right part shows the results, here the sensor and relay output has been applied to PLC input I0, it is in first rung of the ladder diagram and I0 is directly connected to the relay which is inbuilt in PLC kit, Relay normally open (N.O) contact is connected in the second rung and the output of the relay contact (N.O) is directly connected to the output Q0,when the sensor detects, it sends the signal to the PLC kit through the relay board with input I0 getting activated which subsequently activates the inbuilt relay in the PLC which activates the relay contact (N.O) which further activates the output Q0, which is directly connected to one side of the double side solenoid valve which is activated by output Q0,and when the sensor deactivates the inputI0, relay, relay contact(N.O) and the output Q0 are deactivated instantly.

III. TESTING AND RESULT OBTAINED

When for the above block diagram prototype is tested by writing program on/ off of bulbs then power supply is provided and at next stage as the object is moved toward the IR proximity sensor then it senses at particular distance(based on distance adjusted at back of its screw) ,it sensed the object and the bulbs start dimming (low brighter)as object is approached the object near then brightness reach zero.

When opposite vehicle comes near to driving vehicle controls switching of high beam and low beam light based on threshold value (distance) and control the brightness level portion of low beam not to fall on opposite vehicle windshield.

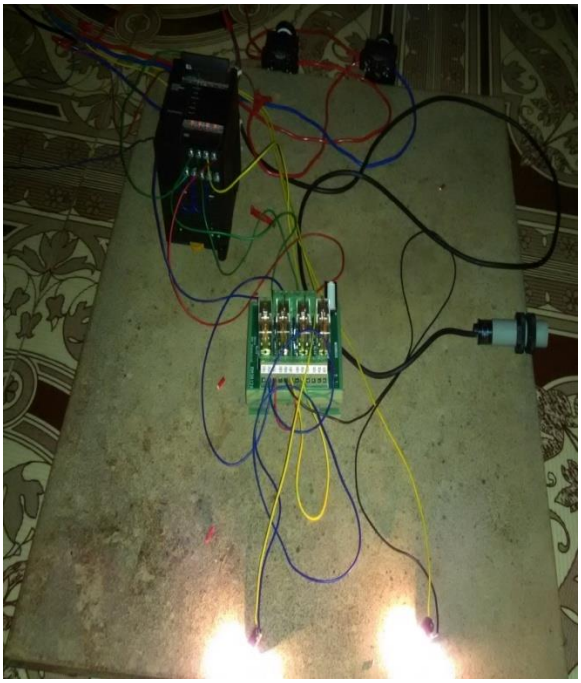

Fig7: when no object is ahead in front of sensor

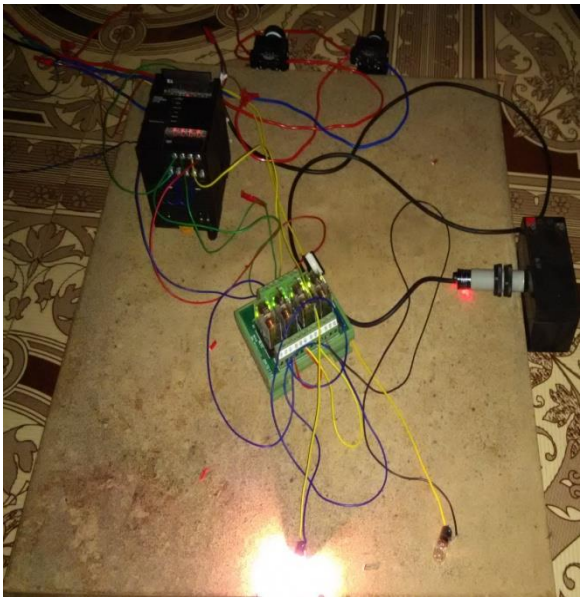

Fig8: when object is detected by sensor

PLC controls glow all array of LED light when required. Based on placement of sensor and headlamp design plays an important role to avoid glare effect. So accident situation in highway are avoided by reducing the glaring effect of human eye during travelling. Results obtained are as following

- It Controls the glaring proportion of Headlamp which is not fall on opposite windowpane
- It Controls contrast / brightness of both high and low beam headlamp based on opposing vehicle
- It avoid switching between High beam and low beam headlamp

So, this gives a clear visual road ahead for vehicle which travel at night.

IV. CONCLUSIONS

In this work clearly demonstrated the capabilities of PLC used as an automating Adaptive headlight beam control. Drive safety is one of the important aspects in automobile manufacturing industry which is not negotiated at any cost. So if the driver doesn't come to hassle any problem at night travel by glaring effect/optical blindness and for the old person whose visual capability is low they too take an advantage furthermore life of pedestrian and all oncoming vehicle accidents are avoided.

When opposite vehicle comes near to driving vehicle controls switching of high beam and low beam light based on threshold value (distance) and control the brightness level portion of low beam not to fall on opposite vehicle windshield.PLC controls glow all array of LED light when required. Based on placement of sensor and headlamp design plays an important role to avoid glare effect. So accident situation in highway are avoided by reducing the glaring effect of human eye during travelling.

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REFERENCES

[1] P. F. Alcantarilla , L. M. Bergasa , P. Jimenez ,I. Parra , D. F. Llorca , M. A. Sotelo , S. S. Mayoral. "Automatic light beam controller for driver assistance" in machine vision and applications doi 10.1007/s00138-011-0327-y 10 February 2011.

[2] Muralikrishnan.r1, "Automatic headlight dimmer a prototype for vehicles" in International journal of research in engineering and technology eissn: 2319-1163 | Pissn: 2321-7308 February 2014.

[3] Rotar dan"vasile alecsandri" university , "Automatic headlight position control with microcontroller "in proceedings of international conference on innovations, Recent trends and challenges in Mechatronics, Mechanical engineering and new high-tech products development –mecahitech'10, vol. 2, 2010.

[4] Ying li and Sharath Pankanti IBM t.j. Watson research center, ny , "Intelligent headlight control using camera sensors "in IBM t.j. Watson research canter, ny{ying li, sharat}@us.ibm.com November, 5 2009.

[5] Feng luo and fengjian hu clean energy automotive engineering center , shanghai, china, "A comprehensive survey of vision based vehicle intelligent front light system" in international journal on smart sensing and intelligent systems vol. 7, no. 2, June 1 , 2014.

[6] Robert Tamburo, Eriko Nurvitadhi , Abhishek chugh, Mei chen,Anthony rowe, Takeo kanade, Srinivasa g. Narasimhan , "Programmable automotive headlights" in Carnegie Mellon university, Pittsburgh, Intel research, Pittsburgh, pa USA 2014.

[7] Kenneth Schofield, mark l. Larson mi (us), "Vehicular vision system "in united states patent no. 8,917,169 b2 Schofield December 23, 2014.

[8] Kenneth c. Peterson, (us), "Adaptable wireless vehicle vision system based on wireless communication error "in United States patent no: us 8,890,955 b2Schofield. November 18 ,2014.

[9] Richard t. fish, Jenison , Danny l. Minikey , Fenwick, Bradley r. Hamlin , Ethan j. lee, Eric p. kern, , "Display mirror assembly" in united states patent no.: us 8,879,139 b2 November 4, 2014.

[10] Kenneth schofield, mark l. Larson, keit j vadas, , "Vehicle headlight control using imaging sensor" in united states patent no: us 5,796,094 August 18, 1998.