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Range Sensor For Front End Vehicular Collision Detection and Avoidance System Using Ultra Low Power TI-MSP430

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Abstract

In this paper, we present CDAAS (Collision Detection And Avoidance System) which is an essential ingredient of ITS (Intelligence Transportation System). It is mainly based on vehicle night light intensity, high-speed and low power processor base using sensor for complete front end vehicle distance measurement, and carries out early measure to ensure driving safety and front end collision detection and avoidance. CDAAS can be achieved using the proposed algorithm with the help of TI –MSP430 G2452. The processor uses 220 micro A current during active stage.. By adopting this design we will able to cure 30% of night accident cause due to careless driving on highways.

***Index Terms*:** *component;night light intensity and sensor; range mesurement ; TI-MSP430 processor:Ultrasonic Sensor.*

1.INTRODUCTION

The front-end collision accident has become a main part of the traffic accidents on the high way at mid night or night driving between midnight to 4 AM for recent years. So the research on collision warning system/collision detection and avoidance system (CWS/CDAAS) has been considered by more and more people, and it has made great progress.

The determination of the safety distance for CW/CA system has been illustrated in a large amount of the literatures. The number of the accidents that occur in the world increases every year but the amount of fatalities has decreased due to new technology developed by the automobile industry. Engineers have been chipping away at the staggering numbers of facilities for a long time by designing air bags and seat belts, stronger frame and special interior designs to increase the safety of Heavy vehicles. However the only way to save far more lives is to keep heavy vehicles from smashing into each other in the first place. Accidents happen mostly due to the carelessness of the driver in not paying attention, being intoxicated and neglecting the blind spots of the vehicle.

Figure (a)

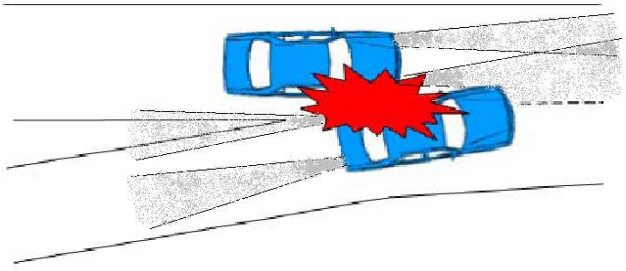

Figure (a). Head to head vehicle collision at night due to miss judgment by driver.

Taking secure traffic into consideration, active anti-collision is far superior to passive one. But it is not popular yet due to the current high cost. However with the gradual improvement of active anti-collision technology, it will be promising in the future

2. CRITICAL SAFETY DISTANCE MESUREMENT

When two vehicles travel in opposite direction on the highway, they will continue to be closing and likely to crash for the front driver's carelessness. To avoid collision, it needs

to determine the relative distance (S_0) safe or not. *So* the condition without collision is

$S_0 > S^*$

*S** stands for the critical safety distance, which is the shortest distance to avoid collision The main objective of ***FEV-CDAAS (Front end vehicular collision detection and avoidance system)*** is to help driver prevent car collisions due to blind spots produce after the pass of nearby approaching vehicle at night.

Night vision visual adaptation: Night vision is the ability to see in low light conditions. Whether by biological or technological means, night vision is made possible by a combination of two approaches: sufficient spectral range, and sufficient intensity range.The eye adapts to changing light level, altering light sensitivity like a camera modifies exposure. Adaptation is an important, but frequently overlooked issue in many cases. A person's perceptual ability is determined, not only by the scene viewed at the time of the accident, but also by what he had previously viewed. In one case, for example, a man walked out of house at night, took two steps to cross a porch and fell on the front steps. The porch light was broken, making the steps difficult to see. However, the broken porch light had a second effect. The man had come out of a brightly illuminated house, so the broken porch put him in a highly maladapted state and impaired his vision.

There are four types of adaptation. The eye can dark adapt, going from bright to dark environment, or light adapt, going from dark to light. Each of these adaptations comes in two varieties, a slow and a transient phase

Transient adaptation : This transient adaptation (masking by light) occurs on a much shorter time scale, lasting a few seconds or less in most cases. This effect has major implications in many situations. Any sudden transition of lighting conditions will greatly impair vision. For example, light flashes, such as from a gun or strobe or headlamp glare, will have two effects. They will adapt the viewer to a higher level of illumination, requiring the gradual slow-phase reacquisition of dark adaptation over several minutes. But they will cause a strong short-term adaptation effect that lasts a second or two.

Lastly, adaptation effects have large safety implications. Whenever a person transitions from a brightly lit or very dark environment to one of very different luminance, there will be a large visual loss.

3. CONCEPT AND SYSTEM ARCHITECTURE DIAGRAM

The basic concept behind design is to operate processor with ADC and handle the head lamp of vehicle using relays as shown in figure (b). Designer has verity of choice in microcontrollers to be use in design. Microcontroller is operated in ADC mode which is connected with the light intensity sensor. LDR converts light obtained into electrical signal. Then passes analog signals to ADC which converts it into digital data.

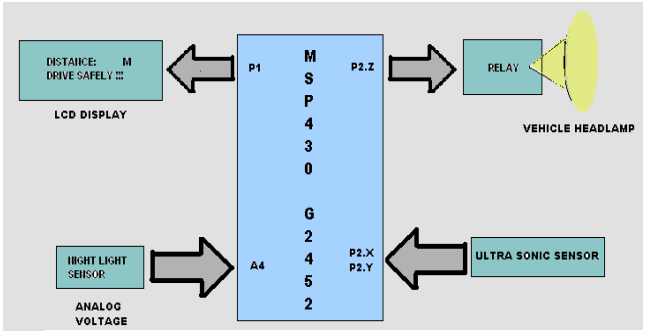

Figure (b)

Microcontroller compares the data (analog voltage) from ADC with the threshold value (which can be set by driver) ,if the data received from ADC is less then default one then no operation take place but if it becomes more then set value, microcontroller energies the relay through driver. Relay is connected with vehicle head lamp whose lower filament gets connected .otherwise upper filament glows.

Figure (c) is the hardware developed to achieve the operation. This embedded design includes a MSP430 G2452 ,LCD 16x2,5 volt 1 ampere relay , LDR connected to ADC channel and Ultrasonic Sensor for measuring distance of approaching vehicle..

Figure (c)

The samples taken by light sensor, generally LDR varies with the distance between the two opposite coming vehicle. As the front vehicle approaches towards each other the light intensity increases and the output of sensor also. Therefore we get different readings at different distance.

When the two vehicles crosses each other the samples data again get greater then default value and headlamp's upper

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filament again get excited. By doing so, we can easily eliminate the stress on drivers eyes and low down the amount of stress to adjust his eye focal length.

Following are the samples readings taken at highway at night in different set. Figure (e), shows us the plot between distance vs voltage drop across the sensor (in this case LDR is used). The sensor has the characteristic to vary its resistance with the intensity of light.

The circuit shown below is the one use for voltage measurement across the LDR at highway at night. The voltage provided is 9 V dc supplies which get partially dropped across 10 k resistor and rest of it across LDR.

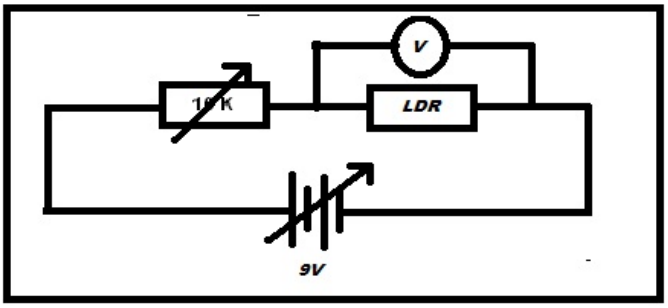


Figure (d)

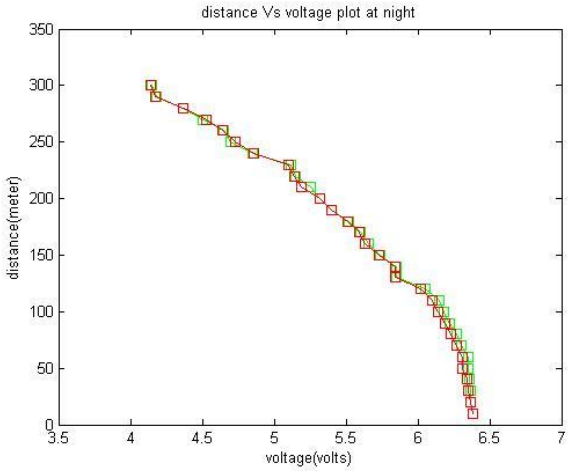


Figure (e)

Below shown plot i.e. figure (f) is the variation of resistance with the distance of vehicle at night .It has been assumed that the sensor is positioned at the front end of the vehicle to avoid front end vehicular collision. As the vehicle coming from head side approaches towards the sensor, the intensity of light on the sensor will get varied and we get the following results. The result is been shown in the form of plot between distance and resistance.

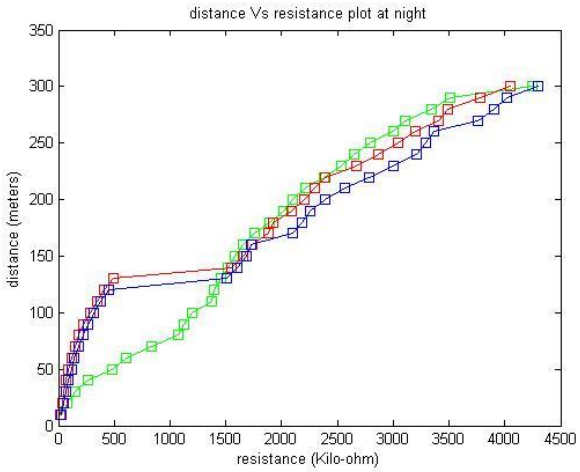
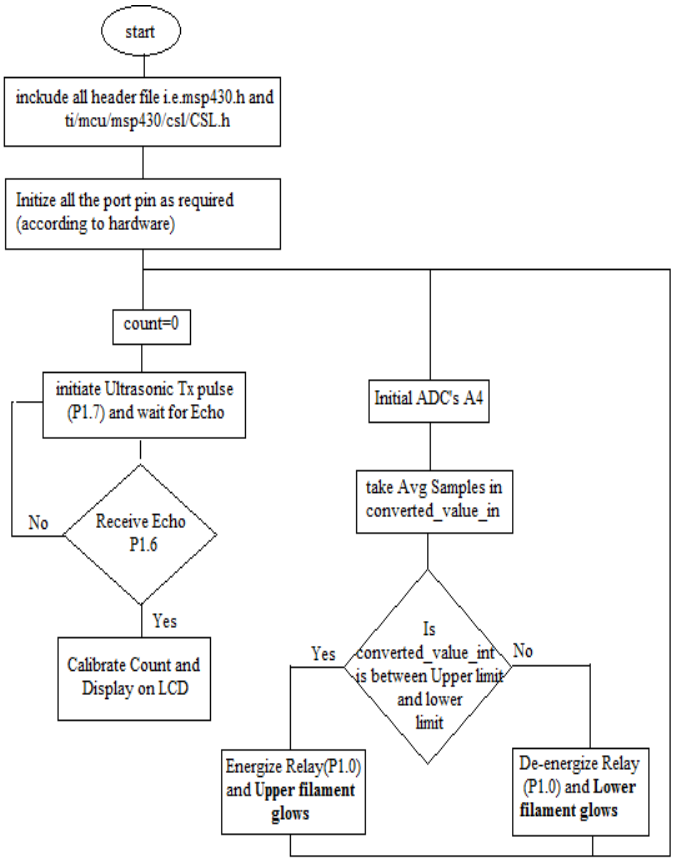


Figure (f)

4.SYSTEM SOFTWARE DESIGN



5. ADVANTAGES

1. Reduce traffic decision conflict
2. Reduce night road accident rate
3. Provide direct vehicle to vehicle communication
4. Indicates the towards approaching distance of vehicle.

6. APPLICATIONS

1. Central traffic management system
2. Visibility enhancer
3. Accident warning system
4. Traffic informatory road advisor.
5. Vehicle distance measurement device.
6. Safety and critical Distance detector.

7.FUTURE SCOPES

Further the use of GPS in the communication setup can provide us display of exact position of vehicle by providing longitude and latitude coordinated of approaching vehicle. A message transmitting system can be implemented. Propose design will pass a massage to central traffic management system about the mishap if occurs

8.CONCLUSION

The papar presents the concept of embedded low power sensor design for front end vehicular collision detection and avoidance on road at night. This concept will display the critical distance on LCD for Driver and operated vehicles head light according to the approaching vehicle distance. It will reduce the highway road accident due to the discomfort happen to driver because of high light intensity when two vehicles travel in opposite direction on the highway.

Here we are using an extremely low power and highly efficient processor MSP430. By doing so, the effective life term of system is increased to an great extend. To avoid collision, it needs we determine the relative safe distance well before so that driver can take effective decision and measures.

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