Automatic Street Light Intensity Control and Road Safety Module Using Embedded System

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***Abstract*- This paper is aimed at creating safer roadways with intelligent light system to reduce power consumption. This system has automatic street light intensity control based on the vehicular movement and switching ON and OFF of street lights depending on the light ambiance. This will help in reducing the power consumption during hours of meager road usage. The street light module is installed consequently for every certain distance. This paper also aims at reducing road accidents by detecting consumption of alcohol by the driver. This can be implemented using alcohol sensor module which contains skin sensor, breath alcohol sensor and proximity sensor. The skin sensor and breadth alcohol sensor detects the presence of alcohol content and the proximity sensor helps in detecting any kind of malpractice. The novelty of this paper is to effectively reduce the energy consumption of the street lights by controlling the street light's intensity, sensing both human as well as vehicular movement and injury and death caused by drunk driving can be prevented by prior sensing of the alcohol content in drivers by a simple and economical way.**

***Index Terms*- Street light intensity control; PIR sensors; LDR; alcohol detection; alcohol sensors; skin sensors; proximity sensors; reduced power consumption; safer roadways.**

I. INTRODUCTION

Street lighting provides a safe night time environment for all road users including pedestrians. Research indicates that night-time vehicular accidents are significantly reduced by the provision of street lighting. It also helps to reduce the fear of crime, and encourages social inclusion by providing an environment in which people feel they can walk in hours of darkness. Providing street lighting is one of the most important and expensive responsibilities of a city. Lighting can account for 10– 38% of the total energy bill in typical cities worldwide. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically (often by 25-60%).

The implementation of street light intensity control using LUX meter, traffic sensor and complex sub-control machines are in process in the Norway. (Oslo street light control)[6]. But the power consumption is reduced only by nearly 30%. There also exists a project in progress where in the street light power consumption is reduced using a remote controlled system [1], but the disadvantage is that it is not cost efficient and that the initial investment is not economical. This paper is aimed at designing and implementing an automatic system to control and reduce energy consumption of a town's public lighting system up to 60%. This can be done using PIR sensor which senses the movement and passes the information to the PIC (peripheral interface control) microcontroller. The pattern in which the lights have to be turned ON can also be programmed, as in dimming of lights etc. Additionally LDR (Light dependent resistors) can be used. The ambiance of light is checked and lights are turned ON when it is dark and are turned OFF during the day time. The advantage of using the PIR is that it can sense the human movement and also that of the vehicle. Thus this paper once implemented on a large scale can bring in significant reductions in the power consumption caused by street lights.

Impairment by alcohol is an important factor in causing accidents and in increasing the consequences of the same. From various studies conducted, it has been found that alcohol consumption was present up to 33% - 69% among fatally injured drivers, and in between 8%-29% of drivers involved in crashes who are not fatally injured. Although the proportion of crashes that are alcohol-related has dropped in recent decades, there are still far too many such preventable accidents. In spite of great progress, drunken driving remains a serious national problem that tragically affects many victims annually. The disadvantage of the already existing alcohol detecting wrist band which uses similar technology of transdermal sensor [3][5] is that it is not certain that every driver will be wearing it, so a separate module should be added to assure that the person who drives should wear it each time which would make the circuitry more complex. Another proposed technology is Alcokey [7] but it can be malpracticed by someone else other than the drunk driver. This paper is aimed at detecting consumption of alcohol by the driver and if it exceeds certain level (0.08mg/100ml), access and movement of vehicle will be impaired. This prevents occurrence of accidents or any fatal crashes. This is done using skin sensors and breadth alcohol sensors for the detection of alcohol consumption. This paper is organized as follows. Section II discusses about implementation of new road safety and street modules. The flowchart describing the overall system is illustrated in section III. Section IV is on results and discussions.

II. IMPLEMENTATION OF NEW ROAD SAFETY AND STREET LIGHT MODULES

The two proposed modules corresponding to road safety and street light control are implemented as follows.

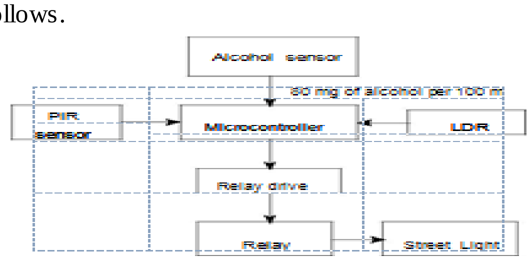

Figure1 Reduced power consumption and road safety system

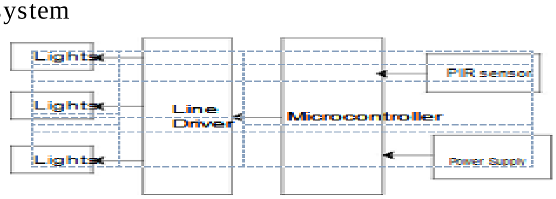

Figure 2 Street light module

In our street light system, the human as well as vehicular motion will be detected by the passive infrared sensor. The term 'passive' in this instance means the PIR does not emit energy of any type but merely accepts incoming infrared radiation. Apparent motion is detected using the variation in the IR rays emitted by the vehicles and this information is given to the microcontroller. Here PIC16F877A is used. It is based on Harvard architecture and the reduced instruction set computing makes it even faster. The controller has peripheral features like inbuilt ADC, required to get signals from the various sensors. The maximum clock frequency is 20 MHz and hence it is faster than 8051. Embedded C is used for programming the microcontroller. And through the relay drive, this information will be passed on to the street lights .The relay drive is used for current amplification purpose. Current amplification is done between the low current digital circuitry and the relays. Additionally LDR’s (light dependent resistor) are used to switch ON and OFF the street lights based on detecting the light ambiance. Depending upon the illumination level the resistance of the sensing element varies, which varies the voltage. ADC measures this voltage drop. In the vehicular module alcohol sensors are placed to detect the consumption of alcohol. The Alcohol Detection Systems for Safety would keep impaired drivers off the road by detecting their alcohol content. If alcohol is consumed, it is metabolized and diffuses throughout the body. This alcohol is present in various bodily substances such as breath, blood, and perspiration. Some percentage of consumed alcohol is metabolized through the skin. The sensor measures the specific characteristics that are chemically emitted transdermally from the body. Skin sensors are placed on the vehicle’s door and if the detected alcohol content is above the legal limit of .08mg/100ml, then entering the vehicle would be impaired. Breadth alcohol sensors are placed inside the vehicle. This alcohol sensor is suitable for detecting alcohol concentration on breath, just like common breathalyzer. It has high sensitivity and faster response time. This sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple; all it needs is one resistor. A simple interface could be a 0-3.3V ADC. And if alcohol consumption above the legal level is detected, then the movement of the vehicle will be simply impaired.

III FLOW CHART

The implementation of this paper will have the following work flow as mentioned in the Figure-3. When the driver tries to unlock the vehicle, the skin sensors senses the presence of alcohol .The skin sensor module has the transdermal sensor for sensing the alcohol content and the proximity sensor to make sure the contact remains constant. If the alcohol content is above the threshold level entitled the vehicle cannot be unlocked. In the absence of the above scenario the vehicle access is allowed. There are breath alcohol sensor placed near the headrest and the steering wheel, when the Breath Alcohol Content (BAC) is above the threshold the vehicle movement is reduced gradually. This is necessary if the person has consumed alcohol just a little while before or consumes alcohol on board; the breath sensor senses the same because the time taken for alcohol to diffuse in the blood stream is more. When the vehicle passes the street light module, the movement is sensed using the Passive Infrared (PIR) sensor. And the intensity of the street lights which are already switched ON/OFF using the LDR based on ambient presence of sun light is been increased. By using the complete module as in Figure-1 the drunken driving can be prevented and power consumption is reduced.

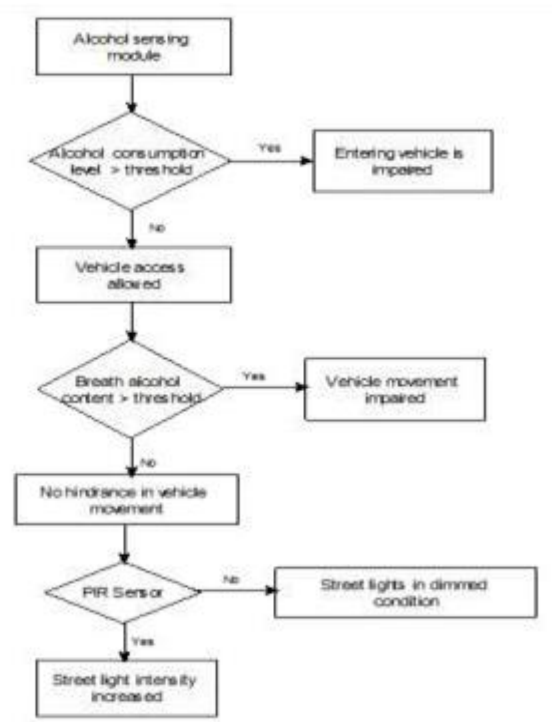

Figure 3 Sequence of operation of the proposed paper

IV RESULTS AND DISCUSSIONS

The main objective of this paper was to reduce the power consumption of street lights by avoiding inefficient lighting which wastes significant financial resources each year. This is done by dimming the lights during less traffic hours. For this purpose PIR sensor which detects any movement. This paper also aims at reducing the fatal crashes and road accidents caused due to alcohol consumption. This is done using skin sensors placed in vehicle doors and also using breadth sensors inside the vehicle. By implementing this death rates due to drunk driving can be reduced to a great extent. The prototype has been implemented and works as expected and will prove to be very useful and will fulfill all the present constraints if implemented on a large scale.

V CONCLUSIONS

This paper is aimed at designing and implementation of an automatic system where in the street lights that are not required through the night can be dimmed. Additionally, the ambiance of light is checked and lights are turned ON when it is dark and turned OFF during the day. Our government is striving hard to provide electricity to customers. Thus this paper once implemented on a large scale can bring in significant reductions in the power consumption caused by street lights. This initiative will help the government to save this energy and meet the domestic and industrial needs. Alcohol-impaired driving remains a serious national problem that tragically affects many victims annually. The proportion of crashes that are alcohol-related is still a point of consideration. This paper also aims at detecting consumption of alcohol by the driver and if it exceeds certain level it impairs the driver from entering into the vehicle. This prevents occurrence of accidents or any fatal crashes.

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