International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 10, October- 2014

Design and Implementation of Driver Observation System for Automobiles using Qt-Creator

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Abstract:- **Today compared with previous, everything that we accessed for our basic requirements are changed with the greatest development in science & technology. Every product in the market will be available with low-to-high end in cost, which depends up on quality, lifetime and people's economic status. Now a day's, a backward family requires a motor cycle and a middle class family requires a car for travelling purpose. Whereas, Road accidents are getting to be happen in our day to day life, due to driver's loss of attention. As a measure to overcome from this, the Driver Observation System (DOS) had been developed, where the visual information of driver will be monitored for the driver attentiveness in car that which implemented in real time.**

The main intension is to replace the surveillance system for Automobiles and other existing systems, which has been implemented previous as a safety measure to overcome accidents. The Surveillance system contains a lot of disadvantages such as time space in-bound and human identification issues in dark. Here we designed a low cost featured device which can be integrated with older version of Automobile's which possess Surveillance system as a safety measure to rescue from accidents that do-not occur during driving. This project is implemented on embedded platform as Processor controlled specifically, our Embedded System includes a webcam placed on the steering column which will capture the eye movements of the Driver. If the driver is sleeping ahead and a dangerous situation is detected, the system will warn the driver with in a delay of 5 seconds by producing beep sounds and this delay can be adjusted according to our requirement by changing the source code which has been implemented using Mikro-Boot Loader.

There are a lot of factors involved and not every person has the same electrical resistance. For instance, men tend to have lower resistance than women. Just like for the resistors used in electronics, the resistance of a person's arm depends on the arm's length and diameter. For that case, a common resistivity measurer is placed using which the accidents can be avoided, where driver's steering is molded with a resistivity measurer. If hands lost its grip from the steering column, automatically alarm raises with a delay adjusted in it. With a due time the entire system will shutdown the working machine.

1. INTRODUCTION:

There are so many problems which are associated with driving the car in real life. A small mistake can change and lead the whole lives in the car to face a dangerous situation, which we are simply known as "Accident". This one seems to be a small thing for another's but it is a life turning problem who faces this situation. Major accidents are happening due to driver drowsiness. To overcome this, driver drowsiness detection had been implemented. The **Driver drowsiness detection** is a car safety technology which prevents accidents when the driver is getting drowsy. Various studies have suggested that around 20% in world of all road accidents are fatigue-related, up to 50% on certain roads. Some of the current systems learn driver patterns and can detect when a driver is becoming drowsy. To overcome this situation, many Automobile industries focused on redesigning and integrating some of the systems which are implemented in cars to overcome fatigue are listed below.

- BMW: **Active Driving Assistant**
- Ford: **Driver Alert**
- Mazda: **Lane Departure Warning System**
- Mercedes-Benz: **Attention Assist** Subaru: **Eyesight Driver Assist**
- Volkswagen: **Fatigue detection system**
- Volvo Cars: **Driver Alert Control** in 2007
- **Anti Sleep Pilot** - Danish device
- **Vigo** - Smart Bluetooth headset that detects

Improvements in roadway and automobile designs have steadily reduced injury and death rates in all first world countries. but in developing and under developing countries, the scenario is entirely different, as they were unable to prefer these costly cars. To overcome this case, the Driver Observation System using Qt- creator had been designed and these can be integrated in any type of car.

2. BLOCK DIAGRAM:

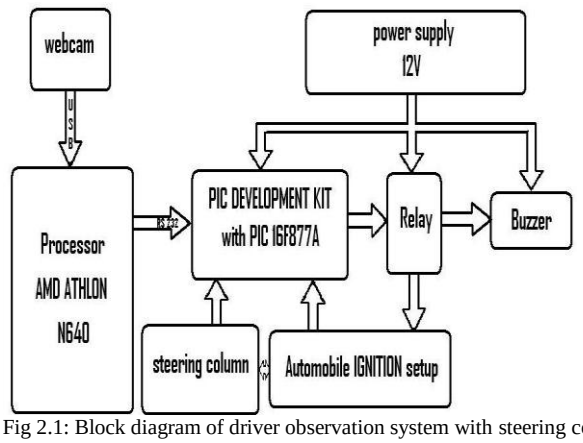

Fig 2.1: Block diagram of driver observation system with steering column operated in it.

Face detection and eye detection are all accomplished by the Haar algorithm. We firstly find the location of face, and reduce the range in which we will detect the eye position. Prior to the eye localization, a robust face detector described in it is applied to extract face images from video frames (in-side the green rectangle). This original detector runs less than 10 frames per second when used in video with 640*480 resolutions, which is not an acceptable result we want. We will optimize it to reduce the time it costs in detecting one frame. Here we propose a very simple but powerful method to reduce the computational complexity on detecting the face.

Since it is developed for fatigue monitoring in vehicle environment, we simply capture the eye movements and when they got closed or moved away from the frame, automatically the default data is transferred to the AMD processor, where these processor sends serial instructions to the PIC board possessing PIC-16F877A as controller. When these instructions are received to the PIC controller, it waits for another instructions from the AMD processor, where we set the waiting time i.e., delay for five seconds or more, as it can be adjusted by re-programming a microcontroller using Mikro-Boot Loader. As no any further instructions are received from the AMD processor, the PIC-16F877A microcontroller sets the relay1 in the relay board to OFF state, where the ignition setup of the car turns off. During the delay created in the PIC controller, it turns the second relay in the relay board to ON state, as to alert the driver in the seat that he closed or moved from the driver seat.

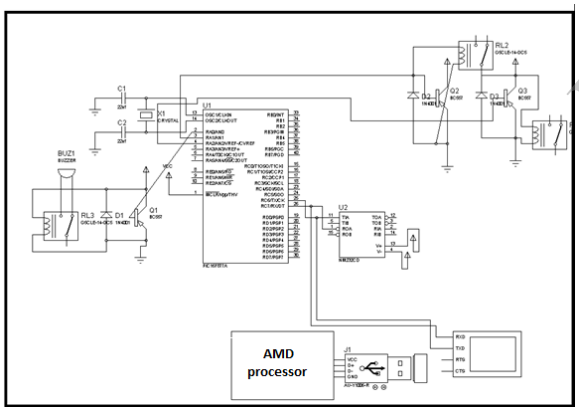

Fig 2.2: Schematic of driver observation system for automobiles

As we all know that, some people gets sleep by opening the eyes itself. So during this situation, there is another option to find the driver is moving to fatigue or not. i.e., Controlling the Steering wheel using human resistivity measurer. When the driver looses the grip of the steering wheel, automatically the instructions are transferred to the PIC board. Hence the same operation is repeated to overcome the accident that is getting to be happened. The working flow-graph is shown below.

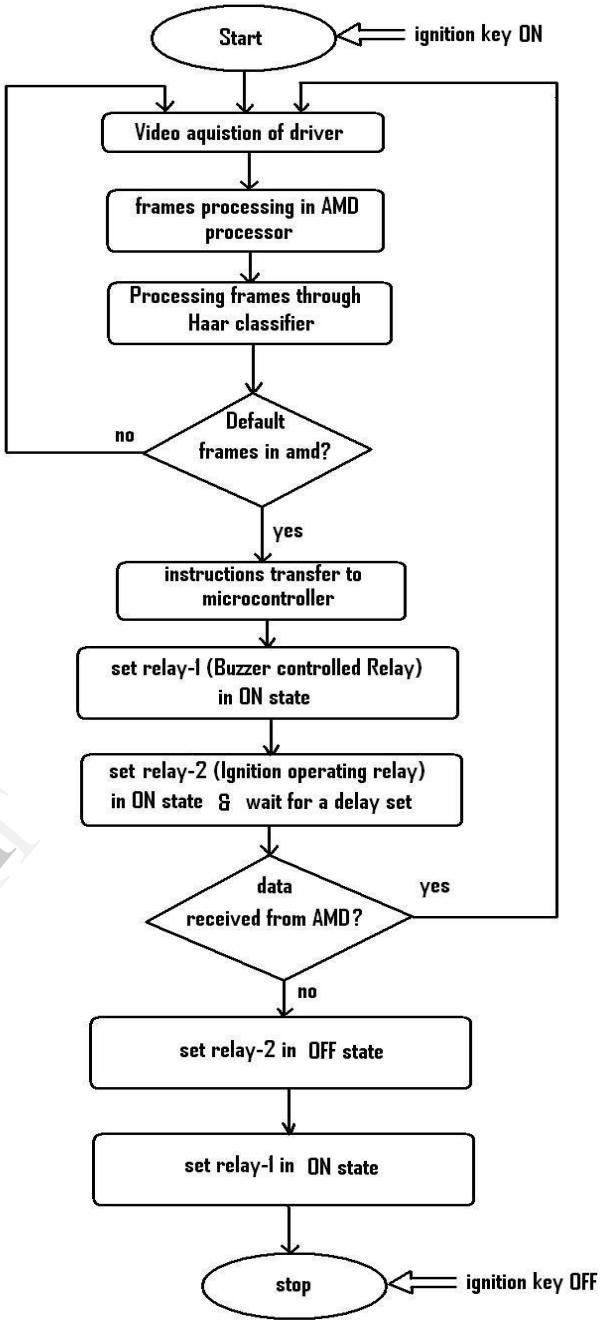

Fig 2.3: Flow chart of Driver observation system

3. FACE AND EYE DETECTION:

The searching region from the whole image to the nearby region around the previous detected face is difficult. There are 2 parameters which will greatly influence the computing time in the haar-based object detection algorithm, one is the Region of Interest(ROI) of the image (denoted as FACE_ROI) in which range we will detect the face, the other is the minimum searching window (denoted as MIN_WND). In the beginning, we set the MIN_WND as a very small square and let the FACE_ROI cover the whole image. Once we have detected the face, since most time driver's face will not move rapidly and the size of face will not vary sharply, we can set the FACE_ROI as a square with side length r*6/5 concentric with previous detected face, and set the MIN_WND as a square with side

length r*9/10(r is the side length of previous detected face, the factors are empirically set for best result). If no face is detected, the detector will expend FACE_ROI and reduce MIN_WND until face is found or boundary is reached. Using this simple method, we can reduce the time of detecting face in every frame from about 130ms to about 40ms. Rectangle of face be [0,0,w,h], we set the rectangle of right eye ROI as [0,h/6,w/2,h/2]. After extract the right eye ROI, we can detect the right eye (inside the small rectangle, using the Haar-algorithm in the interest region. Experiment results show that this method can greatly reduce the time on searching the eye. Be-sides, the rate of detecting wrong eye is decreased.

The Fig 3.1 shows the dark part of the eye, which need to be grabbed in the video frame of the webcam and detection possibilities included in car shaking.

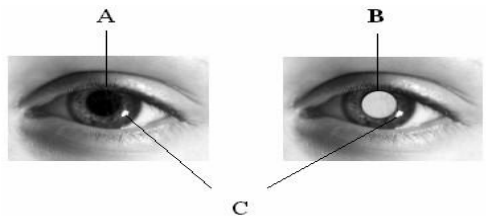

Fig 3.1: a) normal eye, b) grabbed part
c) comparision

Fatigue Detection:

There are many cues which can be used for detecting fatigue, like eyelid movement, head movement, gaze, facial expression, among which the eyelid movement reflects the state of fatigue most well. Here we propose an automatic threshold method based on histogram to get the eye contour, and compute the distance of eyelid. We find that this method works very well. After we get the eye region image, we change it from color image to gray image then use the automatic threshold algorithm to get the eye contour with only eyeball and eyelid. Here we calculate the histogram of eyelet H be the index with max value in the histogram (the x-coordinate with biggest y value), we find that H*2/3 is a good threshold to segment the eye con-tour from the skin around the eye. Through the above method, we can get the distance of eyelid. By analyzing the state and changing trend of eyelid distance, we can clearly decide whether driver is clear-headed, drowsy or even asleep. Eyelid distance is defined as the distance from upper eyelid to lower eyelid. By using this, we can estimate whether the driver is active or not.

4. QT-CREATOR:

Qt is a cross-platform application frame work that is widely used for developing application software with a graphical user interface (GUI) (in which cases Qt is classified as a *widget toolkit*), and also used for developing non-GUI programs such as command-line tools and consoles for servers. Qt uses standard C++ but makes extensive use of a special code generator (called *Meta Object Compiler*) together with several macros to enrich the language.

Qt can also be used in several other programming languages via language bindings. It runs on the major desktop platforms and some of the mobile platforms. It has extensive internationalization support. Non-GUI features include SQL database access, XML parsing; thread management, network support, and a unified cross-platform application program interface for file handling.

4.1 Applications of the Qt framework

Qt is available under 3 different licensing, the GNU LGPL v 2.1, GUN GPL v.3.0, and the Qt Commercial Developer License. The Qt framework is used by other widely used softwares, such as VLC media player, Virtualbox, KDE, etc. As users today uses a variety of different platforms, it is important that developers can have a GUI front that can be run in most OS environment and it is easy to implement, and it interfaces well with the existing language they are using to build the back end of the software without or with little overhead. This is where the Qt framework comes into play.

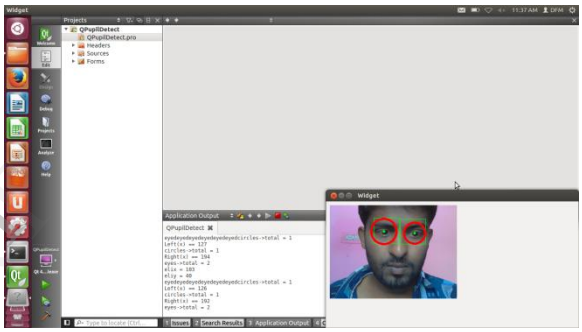

Fig 4.1: Webcam capturing both eyes with normal light conditions using Qt IDE

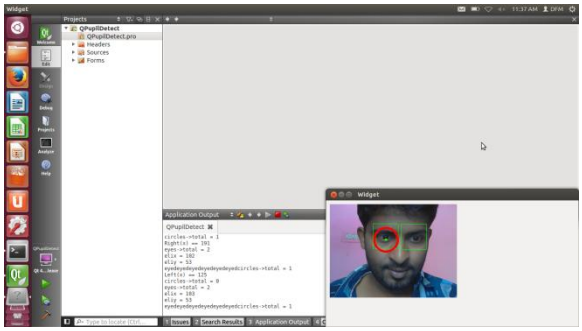

Fig 4.2: Webcam capturing eyes with low light

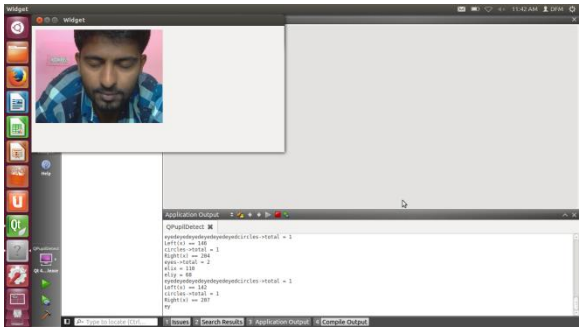

Fig 4.1: Webcam unable to detect eyes.

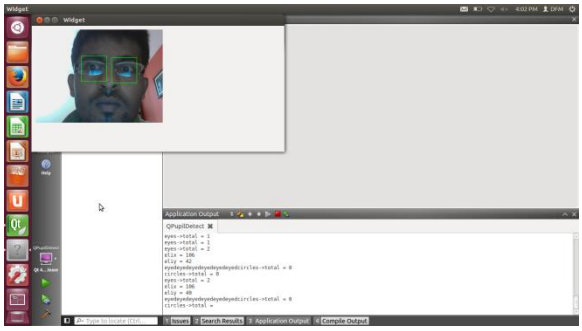

Fig 4.1: Webcam detect eyes with sight glass.

5. PIC DEVELOPMENT BOARD:

Ready for PIC Board is the best solution for fast and simple development of various microcontroller applications. The board is equipped with the PIC16F877A MCU that is placed in a DIP 40 socket and contains male headers and connection pads for all available microcontroller ports. The pins are grouped according to their functions, which is clearly indicated on the silkscreen. The MCU comes preprogrammed with mikro-Bootloader, but it can also be programmed with mikroProg programmer. The board also contains USB-UART module, prototyping area and a power supply circuit. It is specially designed to fit into the special white plastic casing so that you can turn your PIC project into a final product.

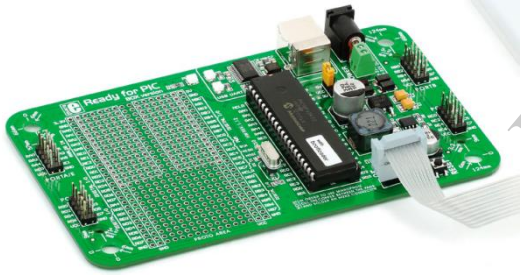

Fig 5.1: PIC BOARD with 16F877A MCU

5.1 System specifications:

- Power LED indicator
- UART communication LEDs
- FTDI chip
- USB UART connector
- Power supply select
- Power adapter connector
- Power screw terminals
- Male headers
- Reset button
- mikroProg connector
- PIC18F45K22 microcontroller
- Crystal oscillator
- Connection pads Prototyping area

Mikro-bootloader:

Fig 5.2: Mikro-bootloader for programming MCU

The PIC board can be powered in three different ways: via USB connector (CN1), via adapter connector using external adapters (CN2) or via additional screw terminals (CN46). The USB connection can provide up to 500mA of current which is more than enough for the operation of every on-board module and the microcontroller as well. If you decide to use external power supply, voltage values must be within 7-23V AC or 9-32V DC range. Power LED ON (GREEN) indicates the presence of a power supply. Use only one of the suggested methods for powering the board. If you use an MCU with a 5V power supply place jumper J1 in the 5V position. Otherwise, it should be placed in the 3.3V position.

6. STEERING WHEEL:

Due to driver's loss of attention, the accident is getting to be occurred. To avoid this, the video acquisition is quite enough. Whereas, there is a rare case scenario, as some drivers are sleeping by keeping their eyes open. For that situation, the Human Resistivity Measurer had been integrated to the steering wheel of the driver, when he lost his grip due to fatigue. The resistance values will get changed and hence alerts the driver.

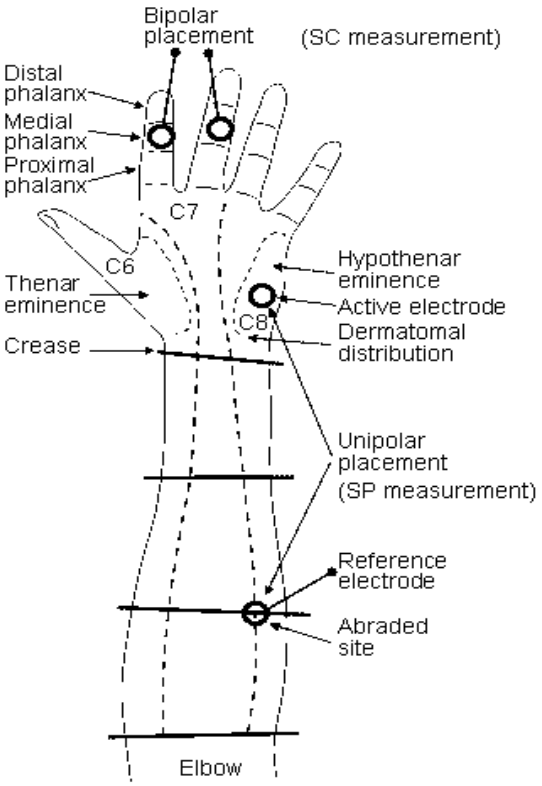

Fig 6.1: Human Resistivity measurement in terms

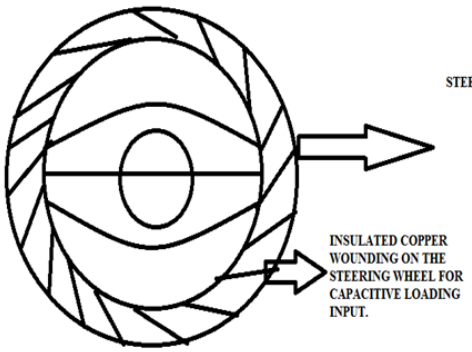

Fig 6.2: Rough sketch of steering Module

7. CONCLUSION

Things that driver's do to keep themselves awake and alert when driving are ineffective, and should only be regarded as emergency measures to allow the driver time to find somewhere safe to stop. This Driver Observation System helps the driver to overcome this fatigue related problems, which drastically reduces the accidents.

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My special thanks to
Mr.J.LINGAIAH,M.Tech.,(Ph.D) helping me for successful completion of project

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