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Automation System for Driver Assistance in Vehicles with High Level Efficiency

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Abstract:
It is estimated that 10–30 % of road fatalities are related to drowsy driving. Autonomous nervous system activity, which can be measured noninvasively from the heart rate signal obtained from heart beat sensor and eye blink detection sensor, presents alterations during stress, extreme fatigue and drowsiness episodes. We hypothesized that these alterations manifest and thus could be used to detect driver's drowsiness. The main aim is to provide awareness and safety mechanism for the driver. Main reason of an accident is due to drowsiness, alcohol consumption and abnormal pulse rate of driving person. In addition to this theft detection, security system and person level identification is determined. In this paper alcohol detection and heart rate monitoring system, person level identification system, eye blink that is drowsiness level, theft detection is used to avoid an accident. Password authentication, message alert method, pulse level and eye blink checking mechanism is processed.

1. Introduction
The number of traffic fatalities in Japan as of 2012 has fallen below 4,500, however, the number of traffic injuries has still exceeded 0.8 million. Japanese government has set the challenge to reduce the number of traffic fatalities lower than 3,000 levels by the end of 2015 fiscal year. To create the sustainable mobility society, establishing technologies which may prevent traffic accidents remains one of the highest ranked issues.

From the reason preventive safety technologies may play more important role as well as passive safety technologies. Recently pre-crash safety system with function that detects eye closure of a driver has been introduced into production vehicle, to reduce inattention related accidents. Driver's psychosomatic state adaptive driving support function may have potential ability to enhance safety performance of the preventive safety systems. Among driver's psychosomatic state, drowsiness is one of crucial risk factors being involved in the traffic accident. Therefore a method to detect driver's drowsiness is highly expected for driver monitoring safety function. Lots of studies have been executed to detect drowsiness of a driver by using heart rate and eye blinking respectively.

Autonomic activity can be evaluated by analysis of heart rate variability (HRV). HRV changes during different sleep stages, showing a predominant parasympathetic activity to the heart during non-rapid eye movement sleep and an increased sympathetic activity during rapid eye movement sleep. However time response of HRV is not feasible for real-time use in detecting onset of sleep. Because time response of blinking is said to be approximately 1 to 5 sec, measuring time duration of blinking may bring good prediction of drowsiness of a driver invasively. Recently an infrared ray based CCD camera unit has been developed for in-vehicle applications to obtain driver's psychosomatic state by capturing movement of head, face and eye of a driver.

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This study aimed at establishing a method to predict onset of drowsiness by simultaneous measuring of heart rate related physiological signals (HRV) and blinking of eye on a non-invasive basis, which should be applied for the constituent technology of driving support safety function in the area of vehicle preventive safety.

2. Proposed System:

This project presents a driver-monitoring system that contains both drowsiness detection method and distraction detection method. Drowsiness involves a driver closing his eyes because of fatigue, and distraction involves a driver not paying sufficient attention to the road despite the presence of obstacles or people like alcohol consumption, heart attack and in emergency. This project presents a non-invasive system to detect individuals driving under the influence of alcohol by using digital signals. We used different sensor analysis to attempt to distinguish between normal and intoxicated states of a person as the basis of the sensing system.

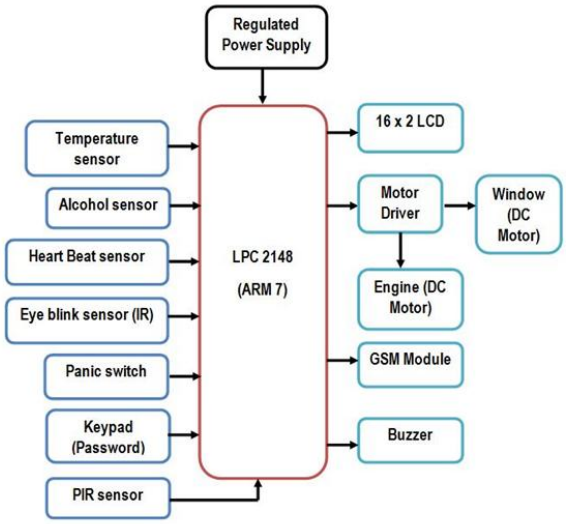

Fig. Proposed block diagram

A. LPC 2148

The LPC2148 microcontrollers is based on a 32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADCs, 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

Features of LPC 2148:

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package
- 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory; 128-bit wide interface/accelerator enables high-speed 60 MHz operation
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software, single flash sector or full chip erase in 400 ms and programming of 256 B in 1 ms.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution. USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM
- In addition, the LPC2146/48 provides 8 kB of on-chip RAM accessible to USB by DMA
- One or two (LPC2141/42 vs, LPC2144/46/48) 10-bit ADCs provide a total of 6/14 analog inputs,

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with conversion times as low as 2.44 ms per channel Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only)

- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input
- CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pads.

B. PIR Sensor

The PIR (Passive Infrared) sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

C. Regulated Power Supply

There are several ways to convert an AC voltage into the DC voltage. Traditionally, this has been done with a transformer and rectifier circuit. However, in applications that involve providing a DC voltage to only the controller and a few other low-current devices, transformer-based or switcher-based power supplies may not be cost effective. So, Transformer less power supplies which provide a low-cost alternative to transformer-based are used in this robot.

D. Temperature Sensor

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C).

The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/ ^{o}C.

E. Alcohol Sensor

This module is made using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc.

F. Buzzer

Buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc. Piezo buzzer is based on the inverse principle of piezo electricity discovered in 1880 by Jacques and Pierre Curie. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are called piezo electric materials. Piezo electric materials are either naturally available or manmade. Piezoceramic is class of manmade material, which poses piezo electric effect and is widely used to make disc, the heart of piezo buzzer.

G. DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical power

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into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

H. Eye blink Sensor (IR)

This sensor sense the eye blink using infrared rays. The Variation Across the eye will vary as per eye blink. If the eye is closed the output is high otherwise output is low. The eye-blink sensor works by illuminating the eye and eyelid area with infrared light, then monitoring the changes in the reflected light using a phototransistor and differentiator circuit. The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye.

I. Heart Beat Sensor

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual- reality system. The amount of the blood in the finger changes with respect to time. Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes.

3. WORKING PRINCIPLE

In this project, the whole system is maintained in a vehicle (car). Whenever any person reaches or opens the car door, the PIR sensor detects the person and asks for the authorized password to be entered through keypad. If the password does not match, the person has to enter once again until then the engine will be locked. If the password matches, the person has to keep heart rate sensor to the finger and has to wear the spectacles which consists of eye blink detection sensor. The system will continuously monitors the heart rate, drowsiness, alcohol consumption, temperature.

The panic switch will acts as an emergency switch, when the person is not in a stable condition. If any abnormal condition occurs to the person, the engine will stop automatically and sends the relevant information to the owner or remote person.

4. RESULTS

Fig. Hardware implementation

In this project, the LPC 2148 controller plays a major role which connects all the input as well as output devices to its GPIO pins.

Fig. Output representation of sensors in the vehicle

Here the output is displayed in the LCD screen, which shows the data of different sensors i.e., temperature, alcohol, heart rate, eye blink and person identification. The controller continuously monitors the sensors data and controls the vehicle automatically.

5. Advantages:

1. Road accidents occur due to distraction of driver will be reduced
2. Continuously monitors driver condition and there by alert him/her in case of distraction

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3. No need of image processing techniques
4. Less expensive

6. CONCLUSION

This is an easier way to report this info via SMS to the emergency services. This device mainly concerns about safety and security of the vehicle and as well as the passenger. This device prevents the collision of the vehicle. This device transmits the information to the predefined numbers, when any abnormal behavior is found. Alcohol gas detection and drowsiness detection applications are also included. In this manner this device will provide the safety and security of the vehicle as well as passengers.

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