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Automatic Car Control For Arrhythmias

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Abstract: Now a days, the death toll of individuals due to arrhythmias are increasing, mainly due to changing life style and eating habits. Three fourth of the world population is having car and most of the drivers are vulnerable to arrhythmias. This leads not only to the death of individuals suffering because of arrhythmias but also to accidents, caused due to this. So we are interfacing an intelligent system in the car in order to avoid the accidents due to arrhythmias. A heart beat sensor is used to pick the signals from the finger and thus continuously monitor the pulse rate. If any abnormality arises in the heart rate, the system activates the warning lamp and alarm, slows down the car and parks it in a safer place parallel. Using GPS system current location of the car is located which gives the latitude and longitude coordinate values. These values are sent to the relatives simultaneously through GSM. An additional feature which we have included is drunken drive detection. Alcohol sensor which is interfaced in the car, detects the presence of alcohol. If the alcohol content is detected the car will not start and it automatically generates warning sound and lamp.

Index Terms: Heart Beat sensor, alcohol sensor, pulse rate, GPS, GSM.

INTRODUCTION

Road accidents in India have reached a questionable extent. Officially the death in India due to accidents tolls up to 1.3 lakhs every year. India now has the worst road traffic accident rate worldwide. This is now a serious issue which is at its alarming rate and is a matter to be considered seriously. India loses $20 billion due to road accidents annually, which the World Health Organization (WHO) estimates is enough to feed 50% of the nation's malnourished children. This report is pointed on road accidents caused due to arrhythmias and drunken drive. In a report from WHO, it is found that the proportion of injuries 'linked' to alcohol use was 58.9% .The number of people killed in alcohol related crashes has risen slightly since 1999 ending years of steady decline. Last years 17,448 were killed accounting for 41% of traffic deaths. There are an estimated 45 million patients of coronary artery disease in India. An Increasing number of young Indians are falling prey to coronary artery disease. With millions hooked to a roller-coaster lifestyle, the future looks even grimmer. This project is done as a safety measure for the persons driving who suddenly acquire arrhythmias.Patients with arrhythmias may experience complete or partial loss of consciousness. Probably the most common problem concerned is the advisability of driving, because the safety of both patients and others may be threatened when personal or professional activities are performed by persons with arrhythmias that may impair consciousness. It must be recognized that the goal of zero percent is unattainable indeed; society already accepts certain degrees of risk by allowing the young and elderly to drive. For example, although a person may have a quantifiable risk for arrhythmia recurrence, the consequence of such a recurrence will differ, depending on whether the driver is alone on a deserted country road or driving a school bus full of children. Where the welfare of public is concerned, society has legislated and will continue to define what it sees and an acceptable risk. Sometimes the degree of risk lies on a continuum. Approximately there are 62.5 million alcohol users estimated in India. Impairment by alcohol is an important factor in causing accidents and in increasing the consequences of the same. . Alcohol consumption by drivers puts pedestrians and riders of motorized two wheelers at risk. Around 40% of patients admitted to Accident and Emergency departments (A&E) are diagnosed with alcohol-related injuries or illnesses. Though the laws to check drinking and driving do exist in India, there is a need to effectively implement the law. The fatalities caused due to accidents can't be reduced until the country implement strict laws and adopts a new method for checking drunkenness.

EXISTING METHODOLOGY

A. Wireless sensor for arrhythmia detection system

A new wireless ECG recorder has been developed and clinically tested. The patient will wear a totally wireless ECG sensor, to be fastened at his chest. A dedicated receiver device is to be carried by the patient .While using this patient can be able to carry out the daily activities including bathing.

B. Chest Trap Transmitter

Heart rate monitors is a personal monitoring device that allows the subject to measure his/her own heart rate .A set of electrode leads are attached to the chest. Heart rate monitors usually comprise 2 elements, a chest strap transmitter and wrist receiver. Water or Liquid is used to get good performance. Strapless Heart rate monitors now allow the user to just touch two sensors on a wrist watch display for a few seconds to view the heart rate.

C. Pressure sensor

The most commonly used sensor is Wheatstone bridge piezoresistive silicon pressure sensor. The pressure sensing element combines resistors and diaphragm structure to provide an electrical signal those changes with the pressure. Using this variation found in the signal with respect to the pressure the heart rate can be monitored easily. Choosing the proper location of the resistors and controlling the orientation of the resistors allows the person to predict how the resistor will change in value for a given deflection of the diaphragm.

MATERIALS AND METHODS

This project deals with the implementation of automatic car control for arrhythmic patients (driver) and also sending alert to the doctor/relatives about the location. Additionally we are also using alcohol detection. We use heart beat sensor as well as alcohol sensor for this purpose. And also PLL (Phase Lock Loop), GSM, GPS, relay, driver, level convertor, motor, manual and reset switches, warning lamp, buzzer, and ATMEL 89S52 microcontroller. Hence this system will not turn on the vehicle, when the user is in drunken condition and produce an alert sound and light if detected. Once the vehicle starts it continuously monitor the pulse rate using finger probe sensor, slow down and stops the vehicle to a safer side if any abnormal condition arises, simultaneously sends a message informing the current location of the car.

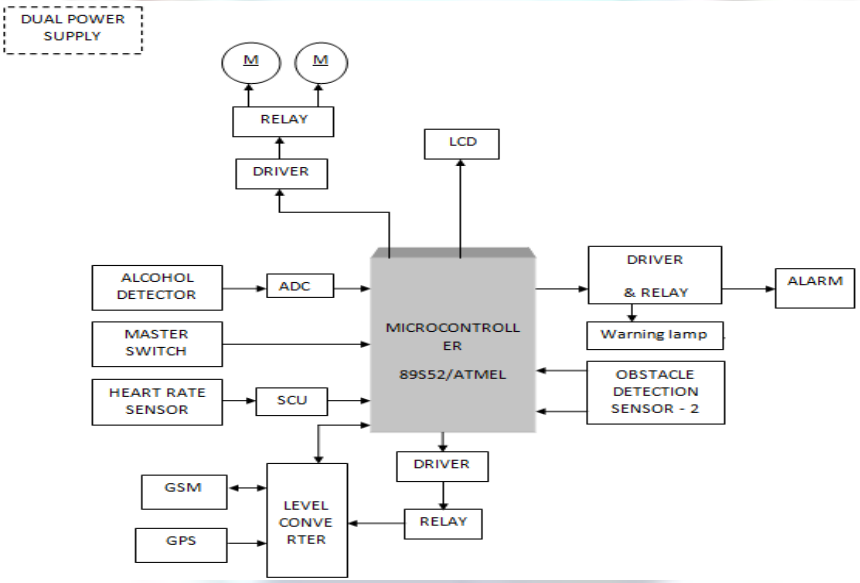

Figure 1: Block diagram of automatic car control for arrthymia

BLOCK DIAGRAM DESCRIPTION

Heart beat sensor senses the blood flow in the finger and sends the signal to microcontroller. Similarly the alcohol sensor detects the alcohol content and ADC converts the analog value into digital value when the person/driver blows the air into the sensor and sends the signal to microcontroller. The microcontroller ATMEL 89S52 is the controlling brain of the system. According to the received inputs it generates the outputs.PLL (Phase Lock Loop) acts as the obstacle detector sensor, helps in the safe parking of the car. Along with the PLL, RF Transmitter and Receiver transmitting the signals and reflected signals are received and given to the PLL for further operations. DC Motor helps in controlling the speed of the car. GPS used to detect the current location of the car and through GSM the latitude and longitude coordinate values are sending to doctor/relatives. Both are serially connected to level convertor.

Level converter helps to communicate with the microcontroller by avoiding the voltage mismatch between microcontroller and GSM, GPS. Driver works under TTL and converts the input signal as ‘High’ and ‘Low’ and give it to relay. Relay is an electro-mechanical switch the low voltage to high voltage. In some exceptional cases, such as driver is in conscious conditions but with abnormal heart rate after a heavy exercise or/and hearing rock music, he/she would press a manual switch which will deactivate the alerts. Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled.

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D. Heart beat sensor

Here we are using IR sensor for detecting the HEART BEAT. IR has less noise and ambient light than at normal optical wavelengths. The light is produced only when current passes through in the forward direction and block current in the reverse direction. Plethysmograph is an infrared photoelectric sensor used to record changes in pulsatile blood flow from the finger. The Plethysmograph operates by recording changes in blood volume as the arterial pulse expands and contracts the microvasculature.

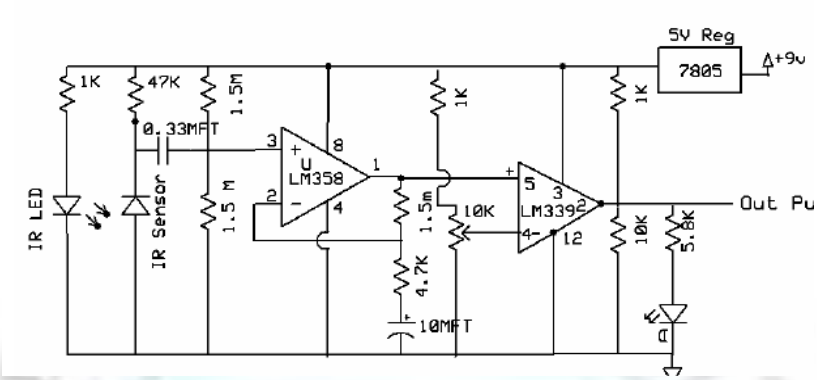

Figure 2 Circuit Diagram of Heart Beat Sensor

The circuit consists of an infrared phototransistor and infrared LED. This transducer works with the principle of light reflection, in this case the light is infrared. The skin is used as a reflective surface for infrared light. The density of blood in the skin will affect on the IR reflectivity.In heart beat sensor we are using two diodes of forward bias and reverse bias respectively. Among those one diode acts as a transmitter and another diode acts as a receiver. When there is no interrupt (blood flow) between transmitter and receiver the voltage on the side of the transmitter gets grounded and only the voltage in receiver side goes to the non inverting amplifier and gets amplified. The amplified voltage is given to comparator where it is compared with reference voltage. The voltage would be less than the reference voltage so the output would be zero which indicates the absence of blood flow. In case of any blood flow, voltage is transmitted to the receiver & it is amplified as well as compared in comparator. If the voltage is higher than the reference voltage, the output would be 1.The pulse rate is detected for every 10 seconds.

The output from the detected is given to the microcontroller, and it gives the output as per the following conditions.

60 < Heart Beat < 80, Normal condition, car moves normally.
Heart Beat > 80 and Heart Beat < 60 abnormal condition, car slow down and park in a safer place.

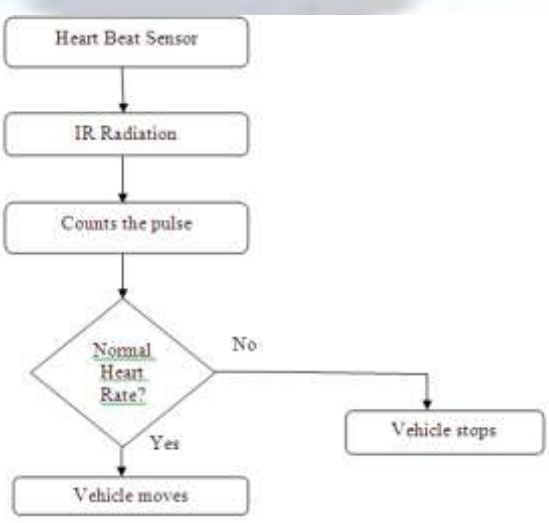

Figure 3 Flow daigram of Heart Beat Sensor

E. Alcohol sensor

Alcohol sensor, here we are using is the MQ-3 gas sensor. Even though lot of alcohol sensor existing in the market, this type is highly recommended because of the following reasons

- High sensitivity to alcohol & Fast response & high sensitivity
- Good resistive towards other gasoline, vapour, smoke etc.
- Stable & long life
- Simple drive circuit
- Operation temperature : -10 to 70 degrees

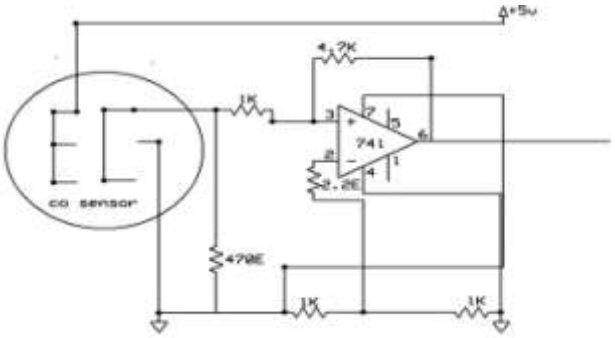

Figure 4 Circuit diagram of alcohol sensor

MQ-3 type is suitable for detecting alcohol content from the breath. So it can be placed just below the face shield and above the additional face protection. The surface of the sensor is sensitive to various alcoholic concentrations. It detects the alcohol from the rider's breath; the resistance value drops leads to change in voltage (Temperature variation occurs). Generally the illegal consumption of alcohol during driving is 0.08mg/L as per the government act. But for demonstration purpose, we programmed the threshold limit as 0.04 mg/L. Threshold can be adjusted using variable resistor. Sensor provides an analog output based on alcohol concentration. ADC is used to convert the output to digital form. It is fed to the microcontroller. Microcontroller compares the output continuo sly 3 times with the predetermined threshold limit. If the output level exceeds the threshold limit, signal will be transmitted to the vehicle unit where it won't allow the vehicle to start.

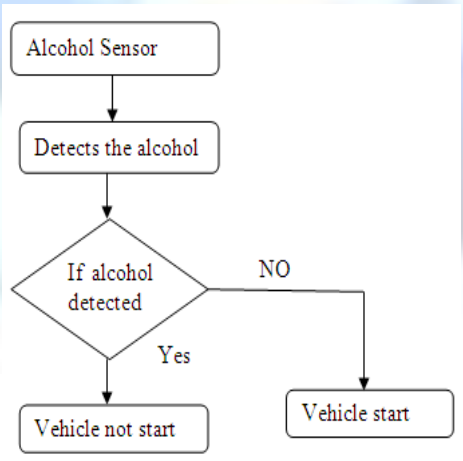

Figure 5 Flow diagram of alcohol detection

F. Interfacing the sensor

The alcohol sensor will deliver a current with a linear relationship to alcohols concentrations in air from zero to high concentrations. This output will require amplification and, depending upon the accuracy required, temperature compensation.

G. Global position system (GPS)

The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth.

- All satellites know their exact position in space from data sent to them from the systems controllers.

- Each satellite transmits its position and a time signal.
- The signals travel to the receiver delayed only by distance traveled.
- The receiver calculates the distance to each satellite and trilaterates its own position.
- 31 satellites currently active (9/2007)
- Orbit 11,000 miles above Earth
- 6 visible sats from any point on Earth
- 5 monitoring stations synchronize the atomic clocks on board each satellite
- distance from a satellite to a receiver in miles=(186,000 mi/sec) x (signal travel time in seconds)

H. Global system for mobile communication (GSM)

GSM stands for "Global System for Mobile Communications". This refers to a digital cellular phone technology that is primarily based on a specified standard for how data is sent over a wireless network.
GSM is used in the case of accident detection and theft detection application. In case of any accident the alarm will get activated, if the rider is in conscious stage he would suppress the alarm; if not a short message service will be sent to the friend's mobile number. Various mobile numbers can be programmed in the microcontroller.
GSM and GPS do not communicate directly with each other. Microcontroller acts as an intermediate between them. To know the location of the vehicle soon after the theft, rider has to send an SMS to the modem present in the vehicle unit. GSM set up in the vehicle unit consists of subscribers identity module (SIM) whereby it receives the SMS and communicates with GPS regarding the current location of the vehicle position and sends the message to the pre defined mobile number(s) programmed in the microcontroller.

OBSTACLE DETECTION SENSOR

I. Phase Lock Loop (PLL)

A phase-locked loop or phase lock loop (PLL) is a control system that generates a signal that has a fixed relation to the phase of a "reference" signal. A phase-locked loop circuit responds to both the frequency and the phase of the input signals, automatically raising or lowering the frequency of a controlled oscillator until it is matched to the reference in both frequency and phase. A phase-locked loop is an example of a control system using negative feedback. The NE567/SE567 tone and frequency decoder is a highly stable phase-locked loop with synchronous AM lock detection and power output circuitry. Its primary function is to drive a load whenever a sustained frequency within its detection band is present at the self-biased input. The bandwidth center frequency and output delay are independently determined by means of four external components.

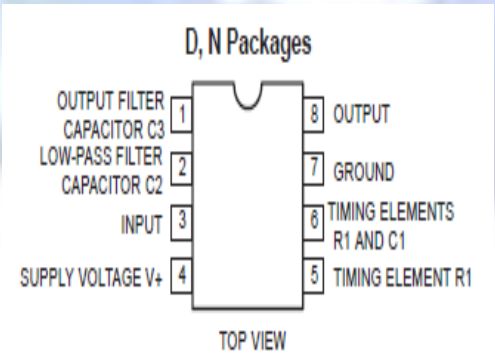

Figure 6 Pin Diagram of PLL

$$Fo \sim = 1/1.1R1C1 \quad (1)$$
$$B.W =\sim 1070(v1/FoC2) \quad (2)$$
$$V1 <= 200Mv \quad (3)$$

Where,
V1= Input Voltage (Vrms)
C2=Low-Pass filter capacitor

J. DC Motor

DC motors are part of the electric motors using DC power as energy source. These devices transform electrical energy into mechanical energy. The basic principle of DC motors is same as electric motors in general, the magnetic interlock miraction between the rotor and the stator that will generate spin. Simple motor has six parts:

- Armature or rotor
- Commutator
- Brushes
- Axle
- Field magnet
- DC power supply of some sort

When DC electric current flowing in the coil in accordance with the direction of the arrow, while the direction of the magnetic field B is from north to South Pole, the coil will be driven by the force F in the direction as shown in Figure 1. This condition occurs continuously so will result in rotation on the axis of the coil. The direction of the electric current in the coil is fixed, because of the split ring on the end of the coil.

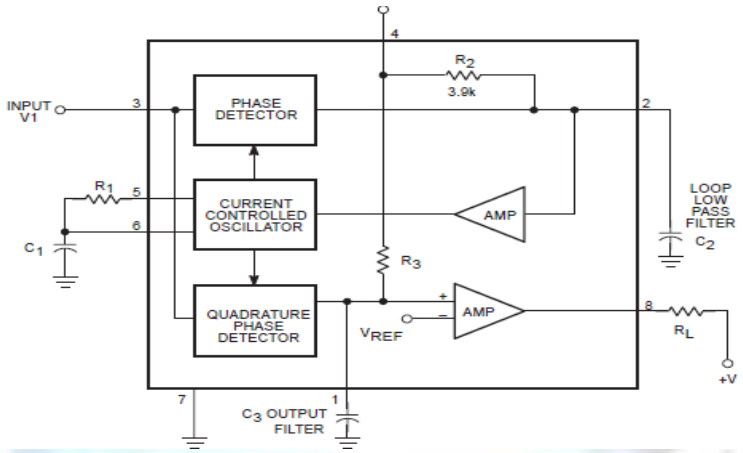

Figure 7 Block Diagram of PLL

SUMMARY AND CONCLUSION

Our system efficiently monitors the pulse rate using heart rate sensor, if any abnormality arises, it control the car and efficiently park the car to a safer place and thus avoid accident due to it. It also helps in quick medical care by sending alarms to the public through warning buzzer and lamp. Simultaneously through GPS, current position of the car is located, and longitude and latitude coordinate values are sent to doctor/relatives through GSM technology. Thus the life of the person is safeguarded. Also the alcohol sensor which is interfaced in this system detects the presence of alcohol avoids drunk and drive .Thus the system avoids the accident due to it and also safeguarding the rules and regulations.

FUTURE ENHANCEMENT

Presently the Heart Beat is sensed using the Finger Probe and Ear Lobe Sensor which causes inconvenience for the person who is driving. So the future enhancement that could be made in this project is that these sensors which cause the inconvenience could be replaced by the sensors which can be placed in the seat belts, car steering etc. Thus we can attain the ECG signals to detect the abnormalities (mainly myocardial infarction) without causing any inconveniences to the person driving. Also the physiological body condition of the person other than heart rate such as temperature, pressure, glucose level, respiratory rate etc can sent through GSM.

SNAPSHOTS OF PROJECT MODEL

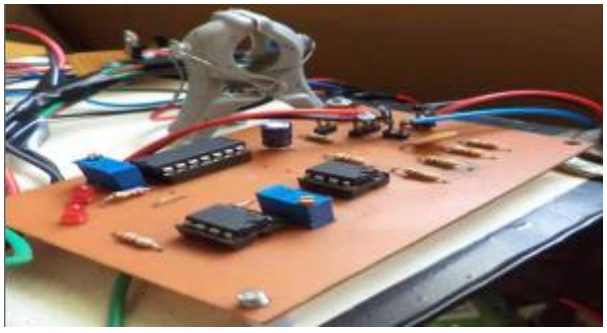

Figure 8 Circuit of heart beat Sensor

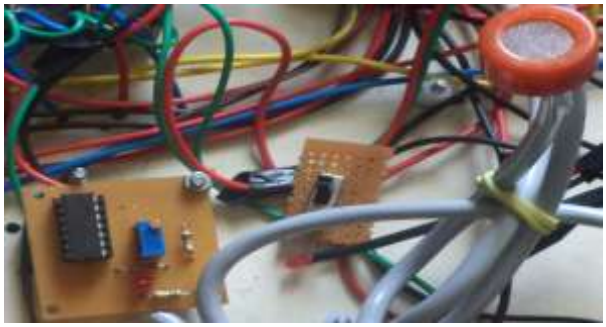

Figure 9 Circuit of Alcohol Sensor

Figure 10 Overall View

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