having transducers **231**, **232** and **233** plus microprocessor **101**, such as shown in **FIG. 7**A, programmed to compare the motions of the driver over time and trained to recognize changes in behavior representative of becoming incapacitated. If the system determines that there is a reasonable probability that the driver has fallen asleep, for example, then it can turn on a warning light shown here as **805** or send a warning sound. If the driver fails to respond to the warning by pushing a button **806**, for example, then the horn and lights can be operated in a manner to warn other vehicles and the vehicle brought to a stop. One novel approach,not shown, would be to use the horn as the button **806**. For a momentary depression of the horn, for this case, the horn would not sound. Naturally other responses can also be programmed.

[**0288**] An even more sophisticated system of monitoring the behavior of the driver is to track his eye motions using such techniques as are described in: Freidman et al., U.S. Pat. No. 4,648,052 "Eye Tracker Communication System"; Heyner et al., U.S. Pat. No. 4,720,189 "Eye Position Sensor"; Hutchinson, U.S. Pat. No. 4,836,670 "Eye Movement Detector"; and Hutchinson, U.S. Pat. No. 4,950,069 "Eye Movement Detector With Improved Calibration and Speed", all of which are incorporated herein by reference in their entirety to the extent the disclosure of these references is necessary. The detection of the impaired driver in particular can be best determined by these techniques. Also, in a similar manner as described in these patents, the motion of the driver's eyes can be used to control various systems in the vehicle permitting hands off control of the entertainment system, heating and air conditioning system or all of the other systems described above. Although some of these systems have been described in the afore-mentioned patents, none have made use of neural networks for interpreting the eye movements.

[**0289**] In most of the applications described above,single frequency energy was used to irradiate various occupying items of the passenger compartment. This was for illustrative purposes only and this invention is not limited to single frequency irradiation. In many applications, it is useful to use several discrete frequencies or a band of frequencies. In this manner, considerably greater information is received from the reflected irradiation permitting greater discrimination between different classes of objects. In general each object will have a different reflectivity, absorbtivity and transmissivity at each frequency. Also, the different resonators placed at different positions in the passenger compartment can now be tuned to different frequencies making it easier to isolate one resonator from another.

[**0290**] 12. Near Field Antenna Sensor

[**0291**] A block diagram of an antenna based near field object detector is illustrated in **FIG. 20**. The circuit variables are defined as follows:

[**0292**] F=Frequency of operation (Hz).

[**0293**] $\omega=2*\pi*F$ radians/second

[**0294**] α=Phase angle between antenna voltage and antenna current.

[**0295**] A,k**1**, k**2**, k**3**, k**4** are scale factors, determined by system design.

[**0296**] Tp**1**-**8** are points on **FIG. 20**.

[**0297**] Tp**1**=k**1***Sin(ωt)

[**0298**] Tp**2**=k**1***Cos(ωt)Reference voltage to phase detector

[**0299**] Tp**3**=k**2***Sin(ωt) drive voltage to Antenna

[**0300**] Tp**4**=k**3***Cos(ωt+δ) Antenna current

[**0301**] Tp**5**=k**4***Cos(ωt+δ) Voltage representing Antenna current

[**0302**] Tp**6**=0.5□t)Sin(δ. . . Output of phase detector

[**0303**] Tp**7**=Absorption signal output

[**0304**] Tp**8**=Proximity signal output

[**0305**] In a tuned circuit, the voltage and the current are 90 degrees out of phase with each other at the resonant frequency. The frequency source **300** supplies a signal to the phase shifter **302**. The phase shifter **302** outputs two signals that are out of phase by 90 degrees at frequency F. The drive to the antenna **304** is the signal Tp**3**. The antenna **304** can be of any suitable type such as dipole, patch, yagi etc. In cases where the signal Tp**1** from the phase shifter **302** has sufficient power, the power amplifier **306** may be eliminated. The antenna current is at Tp**4**, which is converted into a voltage since the phase detector **308** requires a voltage drive. The output of the phase detector **308** is Tp**6**, which is filtered via an amplifier filter **312** and used to drive the varactor tuning diode D**1** (**314**). Multiple diodes may be used in place of diode D**1**. The phase detector **308**, amplifier filter **312**, varactor diode **314** and current to voltage converter **316** form a closed loop (tuning loop) servo that keeps the antenna voltage and current in a 90-degree relationship at frequency F. The tuning loop maintains a 90-degree phase relationship between the antenna voltage and the antenna current. When an object such as a human comes near the antenna **304** and attempts to detune it, the phase detector **308** senses the phase change and adds or subtracts capacity by changing voltage to the varactor diode D**1** thereby maintaining resonance at frequency F.

[**0306**] The voltage Tp**8** is an indication of the capacity of a nearby object. An object that is near the loop and absorbs energy from it will change the amplitude of the signal at Tp**5**, which is detected and outputted to Tp**7**. The two signals Tp**7** and Tp**8** are used to determine the nature of the object near the antenna.

[**0307**] An object such as a human or animal with a fairly high electrical permittivity or dielectric constant and a relatively high loss dielectnc property (high loss tangent) absorbs a lot of energy. This effect varies with the frequency used for the detection. If a human, who has a high loss tangent is present in the detection field then the dielectric absorption causes the value of the capacitance of the object to change with frequency. For a human with high dielectric losses (high loss tangent), the decay with frequency will be more pronounced than objects that do not present this high loss tangency. Exploiting this phenomenon makes it possible to detect the presence of an adult, child, baby, pet or other animal in the detection field.

[**0308**] 13. Summary

[**0309**] An older method of antenna tuning used the antenna current and the voltage across the antenna to supply the inputs to a phase detector. In a 25 to 50 mw transmitter