State of the Art SONAR Sensor Technologies

Introduction

The sound navigation and ranging system (SONAR) is used to determine whether solid objects are located in the surrounding area. The most common uses for SONAR sensors include underwater and terrain exploration as well as ultrasounds in everyday medical practices. This paper reviews some commercial applications of the state of the art SONAR sensors and summarizes briefly the underlying technology.

Commercial Applications of SONAR Sensor Technologies

Strictly Underwater

Commercial fishing vessels use passive SONAR technologies to detect where the fish are and passive SONAR to protect their nets from underwater snags and terrain. The most popular fishfinder is a fathometer which consists of SONAR is Humminbird 570. It is valued at $210.99 and considered the biggest company for SONAR technologies in the fishing community. They are “the leading edge of innovation in this market with brilliant new technology [and] craftsmanship [1].”

Airborne/Dipping

Currently the United State Navy is using Autonomous Underwater Vehicles (AUV). The passive SONAR sensors employed are used as surveillance and for reconnaissance activities such as Mine Counter Measures operations, specialized mapping of the ocean floor, and Oceanographic surveys [2]. In the beginning of June 2008, the company Raytheon Co. was awarded a $63.4 million contract with the U.S. Navy. These AN/AQS-22 Airborne Low Frequency Sonar sensors, which are currently being administered to U.S. Navy helicopters, are able to maximize the sonar performance by using a “multi-frequency operation that adapts to [the] changing environmental conditions [3].” This newest technology, utilized by this particular system, implements a dipping sonar system (into the ocean) which enables the detection, tracking, localization, and classification of submarines from the sky. Additional usages administered will be underwater communication as well as environmental data collection [4]. Currently, it is considered State of the Art for its “safest and most capable sonar dipping in service today [3].” These 59 systems will be employed by January 2011.

Strictly Terrain

Luxury vehicles such as Lexus and Mercedes have begun to provide active SONAR sensors on the bumpers of their cars for the purpose of parking or reversing safely without collision. The most popular brand currently on the market is the Dorman ultrasonic SONAR sensor. Whole sale, it is $120, while used, this item is half-price: $60. These may also be used on most cars, such as Cadillacs, Audi, Pontiacs, GMCs, Buicks, and Fords.
Medical

The most utilized and broadest application of SONAR technologies called sonography belongs to the medical field. This industry uses ultrasounds to scan the human body and produce an image of potential defects and unborn babies. This imaging technique is inexpensive in respect to magnetic resonance imaging (MRI) and computed tomography (CT) and no detrimental risks have been found. The newest devices produced by General Electric and Siemens are hand-held cellphone sized ultrasounds called vScan, which are currently selling for $10,000. They are to be used to check internal injuries or hints of possible cardiac trouble by people such as paramedics and nurses, not just ultrasound trained technicians [5]. Morgan Johnson from the Alliance Ob/Gyn P.C. of Atlanta stated the latest SONAR technology all of their facilities utilize is the GE Logiq 9 Ultrasound Machine which is valued at $70,000 refurbished [6].

Technology of SONAR

The active SONAR sensors are based on the propagation of waves from the transmitter to the target, back to the detector. Regions are insonified by an outgoing pulse; this area which is now flooded with carefully-controlled sound waves is called a sonar's footprint [7]. The microcontroller activates the SONAR. The sonar emits an inaudible sound (or a “ping”) at 40 KHz and as time passes, an echo is returned. A voltage is returned back to the microcontroller which calculates the distance of the object detected. The distance is determined by multiplying the speed of sound (345 meters per second in air) by half of the amount of time passed to receive the voltage reading. In water, the measured travel time of SONAR pulses is dependent on the salinity and temperature of the water. SONAR sensors necessitate ground, power, signal transmitter and signal receiver lines [8]. Passive SONAR sensors solely listen for sounds made by objects, such as other vessels underwater and fish.

Implementation of SONAR Systems

In order to implement SONAR systems, a microcontroller, wires, and a breadboard or a PCB are required. A highly compatible microcontroller is required for the interface with the SONAR; it activates the SONAR system. The initiation (or transmitter) line is brought high and a timer is started. When the echo (or receiver) line is brought high, the timer is stopped. The distance of the object from which the echo returned is calculated. Microcontrollers range from $3.75 to $199 prices. Breadboards are valued at $15 to $25[9].


– Introduction with explicit statement of what is being reviewed
– Commercial applications summarizing what’s on the market, how much it costs, who makes it
– How the underlying technology works
– Building blocks for implementation