

# The electronic electrical engineering engineering essay



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Electronic & electrical engineering incorporated with mechanical system has a big impact in a variety of field, such as biomedical, underwater vehicle, safety and security, space and etc. Before we actually start discussing the benefits and advantages that electronic and electrical engineering gives us in our everyday life, let's have some insights of the history of electronic engineering.

Electronic engineering as a profession sprang from technological improvements in the telegraph industry in the late 1800s and the radio and the telephone industries in the early 1900s. People were attracted to radio by the technical fascination it inspired, first in receiving and then in transmitting. Many who went into broadcasting in the 1920s were only 'amateurs' in the period before World War I. The modern discipline of electronic engineering was to a large extent born out of telephone, radio, and television equipment development and the large amount of electronic systems development during World War II of radar, sonar, communication systems, and advanced munitions and weapon systems. In the interwar years, the subject was known as radio engineering and it was only in the late 1950s that the term electronic engineering started to emerge.

In underwater, electronic and electrical engineering is doing a paramount job in the development of underwater vehicle technology, such as submarine, remotely operated underwater vehicle, and more significantly, automated underwater vehicle. An Autonomous Underwater Vehicle (AUV) is a robotic device that is driven through the water by a propulsion system, controlled and piloted by an onboard computer, and maneuverable in three dimensions. This level of control, under most environmental conditions,

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permits the vehicle to follow precise preprogrammed trajectories wherever and whenever required. Sensors on board the AUV sample the ocean as the AUV moves through it, providing the ability to make both spatial and time series measurements. Sensor data collected by an AUV is automatically geospatially and temporally referenced and normally of superior quality. Multiple vehicle surveys increase productivity, can insure adequate temporal and spatial sampling, and provide a means of investigating the coherence of the ocean in time and space.

The fact that an AUV is normally moving does not prevent it from also serving as a Lagrangian, or quasi Eulerian, platform. This mode of operation may be achieved by programming the vehicle to stop thrusting and float passively at a specific depth or density layer in the sea, or to actively loiter near a desired location. AUV's may also be programmed to swim at a constant pressure or altitude or to vary their depth and/or heading as they move through the water, so that undulating sea saw survey patterns covering both vertical and/or horizontal swaths may be formed. AUV's are also well suited to perform long linear transects, sea sawing through the water as they go, or traveling at a constant pressure. They also provide a highly productive means of performing seafloor surveys using acoustic or optical imaging systems.

When compared to other Lagrangian platforms, AUV's become the tools of choice as the need for control and sensor power increases. The AUV's advantage in this area is achieved at the expense of endurance, which for an AUV is typically on the order of 8- 50 hours. Most vehicles can vary their velocity between 0. 5 and 2. 5 m/s. The optimum speed and the

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corresponding greatest range of the vehicle occur when its hotel load (all required power except propulsion) is twice the propulsive load. For most vehicles, this occurs at a velocity near 1.5 m/s.

The degree of autonomy of the robot presents an interesting dichotomy. Total autonomy does not provide the user with any feedback on the vehicle's progress or health, nor does it provide a means of controlling or redirecting the vehicle during a mission. It does, however, free the user to perform other tasks, thereby greatly reducing operational costs, as long as the vehicle and the operator meet at their duly appointed times at the end of the mission. For some missions, total autonomy may be the only choice; in other cases when the vehicle is performing a routine mission, it may be the preferable mode of operation. Bidirectional acoustic, radio frequency, and satellite based communications systems offer the capability to monitor and redirect AUV missions worldwide from a ship or from land. For this reason, semi-autonomous operations offer distinct advantages over fully autonomous operations.

In the outset of development of AUV, AUVs have been used for a limited number of tasks dictated by the technology available. With the development of more advanced processing capabilities and high yield power supplies, AUVs are now being used for more and more tasks with roles and missions constantly evolving. Its application covers a variety of field, such as in commercial, military, research, as well as hobby. In the commercial side, the oil and gas industry employs AUVs to sketch out detailed maps of the seafloor before they start building subsea infrastructure; pipelines and subsea completions can be installed in the most cost effective manner with <https://assignbuster.com/the-electronic-electrical-engineering-engineering-essay/>

minimum disruption to the environment. The AUV allows survey companies to conduct precise surveys of areas where traditional bathymetric surveys would be less effective or too costly. Also, post-lay pipe surveys are now possible. Whereas in the military field, AUV does play an important role as a typical military mission for an AUV is to map an area to determine if there are any mines, or to monitor a protected area (such as a harbor) for new unidentified objects. AUVs are also employed in anti-submarine warfare, to aid in the detection of manned submarines. Apart from that, scientists use AUVs to study lakes, the ocean, and the ocean floor. A variety of sensors can be affixed to AUVs to measure the concentration of various elements or compounds, the absorption or reflection of light, and the presence of microscopic life.

Sensors, the primarily oceanographic tools, AUVs carry sensors to navigate autonomously and map features of the ocean. Typical sensors used by AUV include compasses, depth sensor, side scan and other sonar, magnetometers, thermistors and conductivity probes. One of the most conspicuous contributions of electrical and electronic engineering incorporated with mechanical system is the navigation of AUV. AUVs can navigate using an underwater acoustic positioning system. An Underwater Acoustic Positioning System is a system for the tracking and navigation of underwater vehicles or divers by means of acoustic distance and/or direction measurements, and subsequent position triangulation. Underwater Acoustic Positioning Systems are commonly used in a wide variety of underwater work, including oil and gas exploration, ocean sciences, salvage operations, marine archeology, law enforcement and military activities.

Basically, there are three broad types or classes that can be categorized in underwater acoustic positioning system. The first one is Long Baseline (LBL) Systems: Long baseline systems, use a sea-floor baseline transponder network. The transponders are typically mounted in the corners of the operations site. LBL systems yield very high accuracy of generally better than 1 m and sometimes as good as 0. 01m along with very robust positions. This is due to the fact that the transponders are installed in the reference frame of the work site itself (i. e. on the sea floor), the wide transponder spacing results in an ideal geometry for position computations, and the LBL system operates without an acoustic path to the (potentially distant) sea surface. Acoustic positioning systems measure positions relative to a framework of baseline stations, which must be deployed prior to operations. In the case of a long baseline (LBL) system, a set of three or more baseline transponders are deployed on the sea floor. The location of the baseline transponders either relative to each other or in global must then be measured precisely. Some systems assist this task with an automated acoustic self-survey, and in other cases GPS is used to establish the position of each baseline transponder as it is deployed or after deployment.

When a surface reference such as a support ship is available, ultra-short baseline (USBL) or short-baseline (SBL) positioning is used to calculate where the subsea vehicle is relative to the known (GPS) position of the surface craft by means of acoustic range and bearing measurements. USBL systems and the related super short baseline (SSBL) systems rely on a small (ex. 230 mm across), tightly which is installed either on the side or in some cases on the

bottom of a surface vessel. Unlike LBL and SBL systems, which determine position by measuring multiple distances, the USBL transducer array is used to measure the target distance from the transducer pole by using signal run time, and the target direction by measuring the phase shift of the reply signal as seen by the individual elements of the transducer array. The combination of distance and direction fixes the position of the tracked target relative to the surface vessel. Additional sensors including GPS, a gyro or electronic compass and a vertical reference unit are then used to compensate for the changing position and orientation (pitch, roll, and bearing) of the surface vessel and its transducer pole. USBL systems offer the advantage of not requiring a sea floor transponder array. The disadvantage is that positioning accuracy and robustness is not as good as for LBL systems. The reason is that the fixed angle resolved by a USBL system translates to a larger position error at greater distance. Also, the multiple sensors needed for the USBL transducer pole position and orientation compensation each introduce additional errors. Finally, the non-uniformity of the underwater acoustic environment cause signal refractions and reflections that have a greater impact on USBL positioning than is the case for the LBL geometry integrated transducer array that is typically mounted on the bottom end of a strong, rigid transducer pole.

In the other hand short baseline systems use a baseline consisting of three or more individual sonar transducers that are connected by wire to a central control box. Accuracy depends on transducer spacing and mounting method. When a wider spacing is employed as when working from a large working barge or when operating from a dock or other fixed platform, the

performance can be similar to LBL systems. When operating from a small boat where transducer spacing is tight, accuracy is reduced. Like USBL systems, SBL systems are frequently mounted on boats and ships, but specialized modes of deployment are common too. For example, the Woods Hole Oceanographic Institution uses a SBL system to position the Jason deep-ocean ROV relative to its associated MEDEA depressor weight with a reported accuracy of 9 cm. Besides, GPS Intelligent Buoys (GIB) is also employed in AUV navigation; the systems are inverted LBL devices where the transducers are replaced by floating buoys, self-positioned by GPS. The tracked position is calculated in real time at the surface from the Time-Of-Arrival (TOAs) of the acoustic signals sent by the underwater device, and acquired by the buoys. Such configuration allows fast, calibration-free deployment with accuracy similar to LBL systems. At the opposite of LBL, SBL or USBL systems, GIB systems use one-way acoustic signals from the emitter to the buoys, making it less sensible to surface or wall reflections. GIB systems are used to track AUVs, torpedoes, or divers, may be used to localize airplanes black-boxes, and may be used to determine the impact coordinates of inert or live weapons for weapon testing and training purposes.

In recent years, several trends in underwater acoustic positioning have emerged. One is the introduction of compound systems such the combination of LBL and USBL in a so-called LUSBL configuration to enhance performance. These systems are generally used in the offshore oil & gas sector and other high-end applications. Another trend is the introduction of compact, task optimized systems for a variety of specialized purposes. For

example the California Department of Fish and Game commissioned a system, which continually measures the opening area and geometry of a fish sampling net during a trawl. That information helps the department improve the accuracy of their fish stock assessments in the Sacramento River Delta.

Hundreds of different AUVs have been designed over the past 50 or so years, but only a few companies sell vehicles in any significant numbers. Vehicles range in size from man portable lightweight AUVs to large diameter vehicles of over 10 meters length. Once popular amongst the military and commercial sectors, the smaller vehicles are now losing popularity. It has been widely accepted by commercial organizations that to achieve the ranges and endurances required to optimize the efficiencies of operating AUVs a larger vehicle is required. However, smaller, lightweight and less expensive AUVs are still common as a budget option for universities.

Some manufacturers have benefited from domestic government sponsorship including Bluefin and Kongsberg. The market is effectively split into three areas: scientific (including universities and research agencies), commercial offshore (oil and gas etc.) and military application (mine countermeasures, battle space preparation). The majority of these roles utilizes a similar design and operates in a cruise mode. They collect data while following a preplanned route at speeds between 1 and 4 knots. Commercially available AUVs include various designs such as the small REMUS 100 AUV developed by Wood Holes Oceanographic Institution in the US. Most AUVs follow the traditional torpedo shape as this is seen as the best compromise between size, usable volume, hydrodynamic efficiency and ease of handling. There

are some vehicles that make use of a modular design, enabling components to be changed easily by the operators.

The market is evolving and designs are now following commercial requirements rather than being purely developmental. The next stage is likely to be a hybrid AUV/ROV that is capable of surveys and light intervention tasks. This requires more control and the ability to hover. Again, the market will be driven by financial requirements and the aim to save money and expensive ship time. Today, while most AUVs are capable of unsupervised missions most operators remain within range of acoustic telemetry systems in order to maintain a close watch on their investment. This is not always possible. For example, Canada has recently taken delivery of two AUVs (ISE Explorers) to survey the sea floor underneath the Arctic ice in support of their claim under Article 76 of the United Nations Convention of the Law of the Sea. Also, ultra-low-power, long-range variants such as underwater gliders are becoming capable of operating unattended for weeks or months in littoral and open ocean areas, periodically relaying data by satellite to shore, before returning to be picked up.