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Investigation and Evaluation of Low cost Depth Sensor System Using Pressure Sensor for Unmanned Underwater Vehicle

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ABSTRACT:
This paper presents the investigation and evaluation of low cost depth sensor system design for unmanned underwater vehicle (UUV) using pressure sensor. Two types of low cost pressure sensor system design are proposed for underwater vehicle. The pressure sensors are expected to prevent buckling or damaging to the UUV. The first design uses barometric pressure sensor, while the second design uses MPXAP which is an integrated silicon pressure sensor on-chip signal conditioned and temperature compensated. There are two different sub model of MPXAP put forward in this research namely, MPX4250AP and MPX5700AP. These pressure sensors are tested in three different conditions: in water tank, lake and swimming pool to study their effect on various densities. Details of the designs are discussed and implementations of these sensors on UUV are analyzed. Experimental results showed these pressure sensors have different performances. Based on the analysis of the results, MPX AP sensor is more suitable to be applied to UUV with low cost budget. For the depth from 0 to 30 meter, MPX 4250 AP is selected while MPX 5700 AP is for the range of depth up to 70 meter.

KEYWORDS: Pressure Sensor System; Unmanned Underwater Vehicle; Absolute Pressure; Barometric Pressure Sensor; Integrated Silicon Pressure Sensor; Water Density

1. INTRODUCTION

Underwater vehicle was first developed to study diffusion, acoustic transmission and submarine wakes. Since then, UV technology has evolved tremendously, applied and used in more tasks and roles and missions constantly evolving. The development of more advanced processing capabilities and high yield power supplies, underwater vehicle (UV) are now accepted and widely used for underwater mission [1]. Most of UVs is used in commercial field for oil and gas industry, military mission, underwater researcher and also as a hobby. Underwater vehicle is an application use to observe and monitor any events that occur under water. Generally, there are three types of underwater vehicle used for the application such as autonomous underwater vehicle (AUV), remotely operated vehicle (ROV), underwater gliders and human occupied vehicle. Despite the growing use of UV, a major problem face by the UV is still not solved. UV tends to buck in a certain unknown under water pressure. Normally, each underwater vehicle operates at a depth that has been determined by the engineers. However, by knowing the operating depth without knowing the pressure at that determined depth can cause buckling to UV body. By knowing the pressure on the determined depth, underwater vehicle can be prevented from buckling. To overcome these problems, the underwater vehicle needs a system to measure accurately pressure value at the determined depth. It is also important that the system must be designed esthetically and easy to handle. The system accuracy and reliability are of paramount importance. Suitable material for the UV body should also be considered meticulously.

A suitable device or sensor should be employed on the UV in order to know the depth that can be tolerated by the underwater vehicle. In previous research, there are various measurements method for