**Background:**

Driven by a keen interest in adventure experiences and powerful global tourism trends, scuba diving is becoming a more and more popular recreational sport. According to PADI (Professional Association of Diving Instructors), one million new divers worldwide are trained annually [1]. The safety issues related to scuba diving have been a big concern ever since the dawn of diving history. One of the most common illnesses that could happen during scuba diving is nitrogen narcosis. Due to the high pressure of sea water, the nitrogen gas concentration in the blood rises when a scuba diver is under water. When the concentration reaches a certain level, nitrogen narcosis happens. It causes similar symptoms as alcohol intoxication where a diver’s reasoning and judgement are impaired [2]. Poor concentration ensues if the diver continues to stay at the same depth. In the worst scenario, a diver won’t be able to come up and die from drowning.

**Problem:**

To avoid nitrogen narcosis, the traditional air tank provides the divers with a table indicating the maximum length of time a diver can stay under water at a certain depth without experiencing nitrogen narcosis. However, such a period of time is not accurate enough as it varies among people because of the differences in the condition of their bodies. As a result, nitrogen narcosis badly affects hundreds of people and around 100 persons die from nitrogen narcosis each year.

**Solution:**

The solution we provide is an intelligent nitrogen level sensor integrated with the breathing regulator.

The intelligent sensor contains two major components, one is the flow capacity and concentration sensor, the other is a microcomputer with preprogramed chip. The device will be integrated inside the breathing regulator so that whenever the diver inhales and exhales, all the gas will go through this censor.

Under initialization, the device will ask the user his/her body weight, then estimates the total volume of blood in the user’s body. When the user is underwater, the device will detect the flow speed of inhaling and exhaling along with the nitrogen concentration respectively, the computer calculates the exact amount of nitrogen of each whole breath, then derives the difference of the amount of nitrogen and add it up to the accumulated nitrogen. Once the accumulated nitrogen has reached the level that will soon go beyond the tolerance of the diver but still enables the diver enough time for safe surfacing, the device will alarm the diver by creating loud sound and beaming red lights to warn the diver. Then the diver will follow the instruction of the device to complete his/her safe stopping and finally, safe surfacing.

**Implementation:**

To produce and develop this device, five steps will be taken.

1. Cooperate with a computer-engineering research team to clear out other technical issues related to the sensor and produce a prototype.
2. Conduct a survey of mainstream air tanks and modify the prototype to make it compatible with them.
3. Test the performance of the device underwater to improve on it.
4. Collaborate with a company for mass production.
5. Promote the selling and make more improvements with the feedback of customers.

**Benefits:**

It has been a trend that more and more people who have the eagerness to discover the magnificent wonders underwater were attracted to the charm of scuba diving. Statistics have shown the total number of divers ranged from 1.6 million to 2.9 million worldwide, and increasing with 80,000 annually. However, even with more than half a century’ development and all the safeguarding equipment, scuba diving stays an extreme sport with high injury and fatality rate. An average of 80 fatalities and 2,000 injuries are reported annually, in which 25% are due to decompression sickness and nitrogen narcosis. Our solution will benefit divers and encourage people to experience scuba diving by enhancing the safety method and reducing fatalities. With more accurate and real-time data about body nitrogen level, divers are equipped with the capability of making more appropriate decisions when surfacing or facing emergency. Divers will acquire more accurate safe-stop time to lease the nitrogen in their bodies and prevent the effects of decompression sickness and nitrogen narcosis. Thus, more people can enjoy themselves in recreational scuba diving with ensured safety.

**Costs:**

Nitrogen gas flow capacity and concentration sensor 200$

Microcomputer 30$

Pre-programmed chip 10$

Electrical wires for connection 3$

Total 243$

**Conclusion:**

The current solution to avoiding nitrogen narcosis is not appropriate in that it fails to take into consideration the physical condition of each scuba-diving individual. The proposed intelligent nitrogen gas sensor aims to give the divers more accurate and timely alert on when to surface to remain free from nitrogen narcosis. This will significantly reduce the number of people suffering from nitrogen narcosis and make scuba diving as a safer kind of sport as a whole.

Words:799

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