RFID Tag Antenna Attached to Drug Nozzle and Electronic Fishing Float

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***Abstract*—** In this paper, we suggest an RFID tag antenna for ultra-high frequency band for radio frequency identification for drug runout management and a float motion detection that can be used in hospitals and fishing. The RFID tag antenna works as a sensor which warns of drug runout when the drug inside the drip chamber is completely consumed, while it does not work if the drug remains inside the drop chamber. Also, the antenna which attached to the fishing float propagates signals when it is exposed to air, but it does not work when submerged in water. The fabricated antenna has an average omnidirectional reading range of 10.65 m in the horizontal plane.

Keywords—Meander Line; RFID; Tag Antenna.

I. INTRODUCTION

Currently, most hospitals use a method in which a nurse directly records the timing of administration. By using this, predicts and confirms the administration rate as a method to check whether the drug administered to the patient is exhausted. However, since nurses in hospitals must check many patients, it requires a lot of manpower and time. And it may be difficult to administer the patient accurately and safely due to mistake of forgetting or mistaken the confirmation time. As a result, hospitals need to efficiently manage their patients. In Automatic medication management it is important to handle drug administration information and medication positions. There many studies have been conducted on these methods [1–4]. In accordance with these studies, a radio frequency identification (RFID) sensor-based system for managing the runout of a drug administered to a patient was proposed and studied [5, 6]. Therefore, to solve this problem, there is a need for an RFID tag system that checks the exact drug consumption time and ensures safe and accurate drug administration to the patient.

As another example, a fishing float can be an index that informs the bite of a fish, that needs to be continuously checked. Normally, during the day, it is natural to observe the bait movement with the naked eye to identify whether the fish is biting, and at night, a luminous or electric lighting method using a motion sensor needs to be used [7]. By means that these method always needs to pay attention to the floats and continuously observes whether the floats are moving or emitting light. Hence, the difficulty of identifying the movements arise for the beginners in fishing, making them difficult to notice the exact timing of the fishing.

This paper proposes an ultra-high frequency (UHF) band (center frequency = 915 MHz) RFID tag antenna. First, it can be attached to a drip chamber while detecting drugs, and secondly, it can be attached to a fishing float while detecting movement. The dipole type RFID tag antenna has been miniaturized by using corrugated meandering lines. The antenna is further miniaturized with a thin meandering wire at the end of the antenna with low current so that the antenna can be attached to the drip chamber. A transparent cover is inserted between the antenna and the drip chamber to increase grip and allow the antenna to be separated.

II. Antenna Design

The chip used in this design was Higgs's Higgs-4, and the chip's impedance value was $Z_{chip} = 18.42 - j181.22\ \Omega$. Therefore, the antenna were designed to satisfy the RFID chip impedance and conjugate matching $Z_{chip} = 18.42 - j181.22\ \Omega$.

A. RFID tag antenna attached to drug nozzle

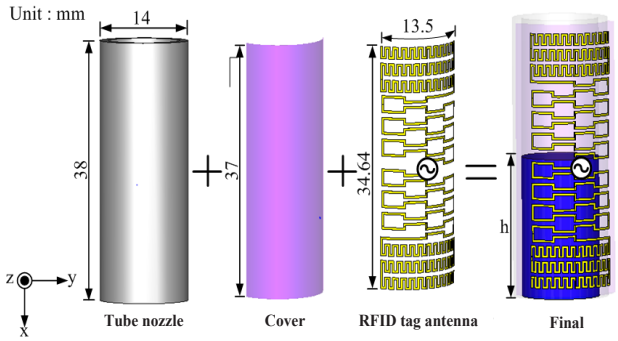


Fig. 1. Structure of the antenna attached to the nozzle.

Fig. 1 shows the structure of attaching an antenna to a cylindrical nozzle. The antenna was attached to a cylindrical polyvinyl chloride (PVC, ε_r = 3) drip chamber 14 mm in diameter and 38 mm in height. The size of the antenna attached due to the dielectric (nozzle) reduced by 32% from 50.66 mm in length to 34.64 mm when there is no dielectric (nozzle) and is designed to be a size that can be attached to the nozzle. It was designed by attaching a cover of thickness 1 mm and length of 37 mm between the antenna and the nozzle.

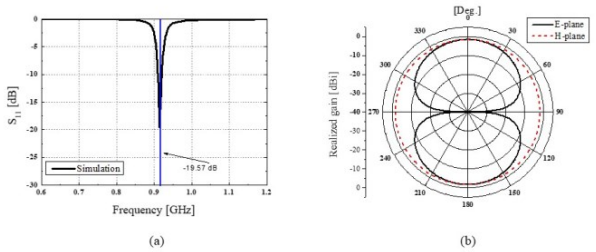


Fig. 2. Characteristics of the antenna attached to the nozzle. (a) S_{11} of the antenna attached to the nozzle (h=0). (b) Radiation pattern of the antenna attached to the nozzle (h=0).

Fig. 2(a) and (b) show the reflection loss and radiation pattern when the antenna is attached to a nozzle without injection chemical. At 915 MHz, the S_{11} of -19.57 dB was well matched and normal operation could be confirmed. It also shows an omni-directional pattern with a gain of -1.7 dBi. Therefore, it can be confirmed that even if the RFID tag antenna is mounted on the nozzle, the characteristic does not change and is suitable for designing a desired system.

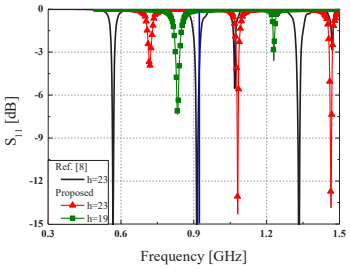


Fig. 3. Comparison of S_{11} between the antenna of ref. [7] and the proposed antenna according to the difference in the height of the drug.

Fig. 3 shows the S_{11} of the antenna when the height (h) of the drug is 50 mm. In the case of the antenna of ref. [8], a harmonic phenomenon occurs at the height (h) of 23 mm, and a malfunction occurs due to matching at the center frequency of 915 MHz. It can be confirmed that the more the drug is used without affecting it, the more the resonance frequency moves to around 915 MHz, so that it can operate normally only when the drug is exhausted.

B. RFID tag antenna attached to electronic fishing float

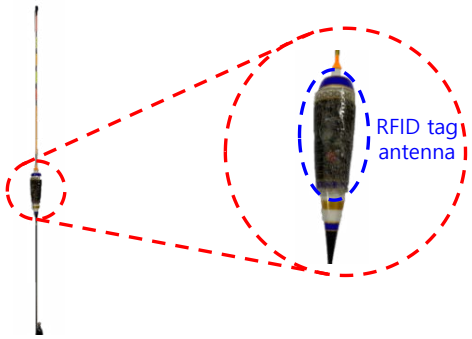
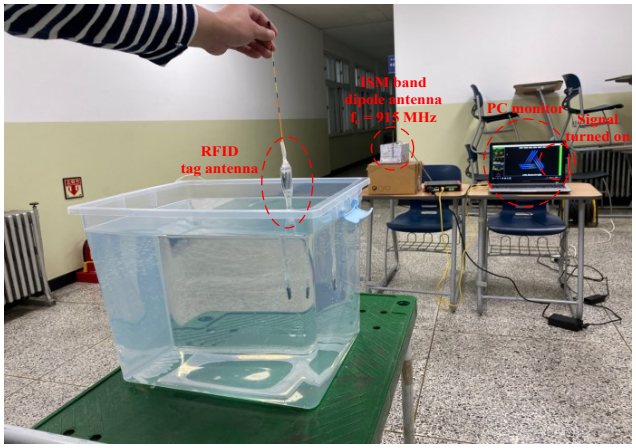


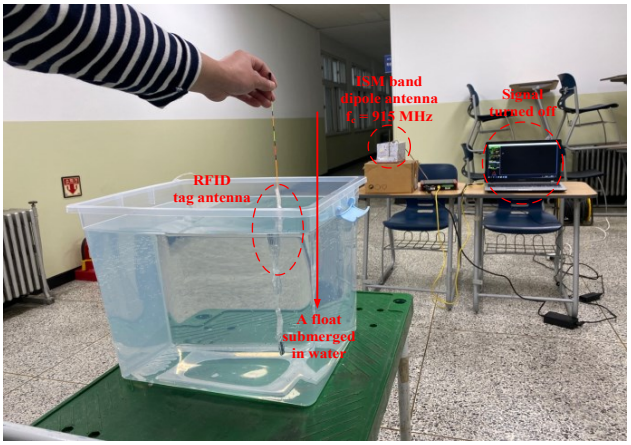
Fig. 4. Structure of the antenna attached to electronic fishing float.

Fig. 4 shows the RFID tag antenna attached to the fishing float. Incresing number of studies focus on a method of developing the convenience of fishing by attaching an RFID antenna to a fishing float by detecting the movement of the float when biting a fish. Our study was able to prevent an electromagnetic wave recognition float, characterized by recognizing a signal appearing on an RFID reader according to whether the float is submerged in water or not.

Fig. 5 shows an experiment conducted using an RFID tag antenna attached to a fishing float. The RFID reader used the ALIEN company's ALR-9900 enterprise RFID reader device. A float was placed in a tank disguised as a lake, and a dipole antenna with a center frequency of 915 MHz was installed to recognize the RFID tag antenna at a distance of 2 m. Fig. 5(a) shows where a normal signal was detected. When the float was



(a)



(b)

Fig. 5. Recognition experiment of RFID tag antenna attached to fishing float. (a) A float exposed to the air. (b) A float submerged in water

exposed to the air, a normal signal is received and the monitor screen turned green. On the other hand, Fig. 5(b) is a picture where no signal was detected. As the float submerged into the water, the dielectric constant changed. Therefore, we were able to find out that the monitor screen was turned off because there were no signal detected.

III. Conclusion

In this paper, we designed an RFID tag antenna that can be In this paper, we designed an RFID tag antenna that can be installed in two applications. First, a drug nozzle can be attached using a matching change according to the presence or absence of a drug. Second, it is an RFID tag antenna that can be attached to a fishing float using the dielectric constant of water.

Accordingly, it was confirmed that it is an RFID tag antenna for attaching a drug nozzle suitable for a system that notifies the administrator of information when all drugs in the nozzle are depleted.

In addition, it has a correlation with a method of increasing the convenience of fishing by detecting the movement of the fishing float with electromagnetic waves. The RFID tag antenna was attached to the bottom surface of the float so that the RFID antenna would not be recognized when the float floats on the water surface. It can provide convenience for fishing by matching the input impedance and notifying whether or not the fish is biting through electromagnetic waves without constantly looking at the float.

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