

## **A Novel Air Bubble Removal System in Infusion Pumps Utilizing Vacuum and Air-Permeable Membrane Technology for Enhanced Patient Safety**

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Bubbles of air within the IV infusion lines are dangerous and common where incorrect estimation of fluids is inhibited. In the past, most of the standards included removal of the liquid from the IV tube by pulling out the infusion to remove the bubble; this results in a reduction of the quantity of liquid that is infused into the patient. This paper presents a novel air bubble removal system in combination with an infusion pump. The overall intended procedure is to be set up for a continuous fluid supply through the vacuum type of air filter which involves a vacuum-assisted removal made of an air-permeable membrane through which the air bubbles are filtered out from the IV tube without having to stop the process. It requires the formation of the motor sensor system connected to the pumping equipment and controlled by the Raspberry Pi Pico microcontroller. This system was designed in a way that air bubble formation is reduced and will not require any intervention. Among these, some show how the system provides control over the flow of fluids and how it may be used to enhance the protection of patients and the effectiveness of the overall healthcare program. In conclusion, this solution provides the automation of air bubble removal thus ending fluctuating fluid supply and air embolism. The evolution of infusion pumps will make the device more reliable and safer in the healthcare environment in the future.

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