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A Proposal for an Ultrasound/Sound Holographic Microscope Using Entangled Mobile Phone Inductors

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ABSTRACT

In this study we propose a model for building a holographic ultrasound microscope. In this model two mobile phones are first connected by waves and techniques like the WhatsApp waves. If the mobile phones are close to each other, their inductors and speakers become entangled, they exchange electromagnetic and sound waves, and they vibrate many times with each other. Objects placed between two mobile phones change the sound waves and electromagnetic waves and appear as holographic images within the inductors and also on the plastic of the speakers. To see these images, a hologram machine is built from a room of plastic, one or two magnets, iron particles, and sound producers. Holographic waves change the magnetic field within the hologram machine and move the plastic and iron particles. These objects take the shape of waves and produce holographic images. To see microbes, one can send a weak current to a container of microbes and then connect it to an amplifier. The weak current takes the shape of the microbes and is amplified by one strong amplifier. Then this current goes to the mobile phone and sound card and, after passing some stages, is sent to the second mobile phone. In the second mobile phone, the sound wave is amplified by speakers and transmitted to the hologram machine. Consequently, particles within this machine move and produce big holographic images of the microbes.

Introduction

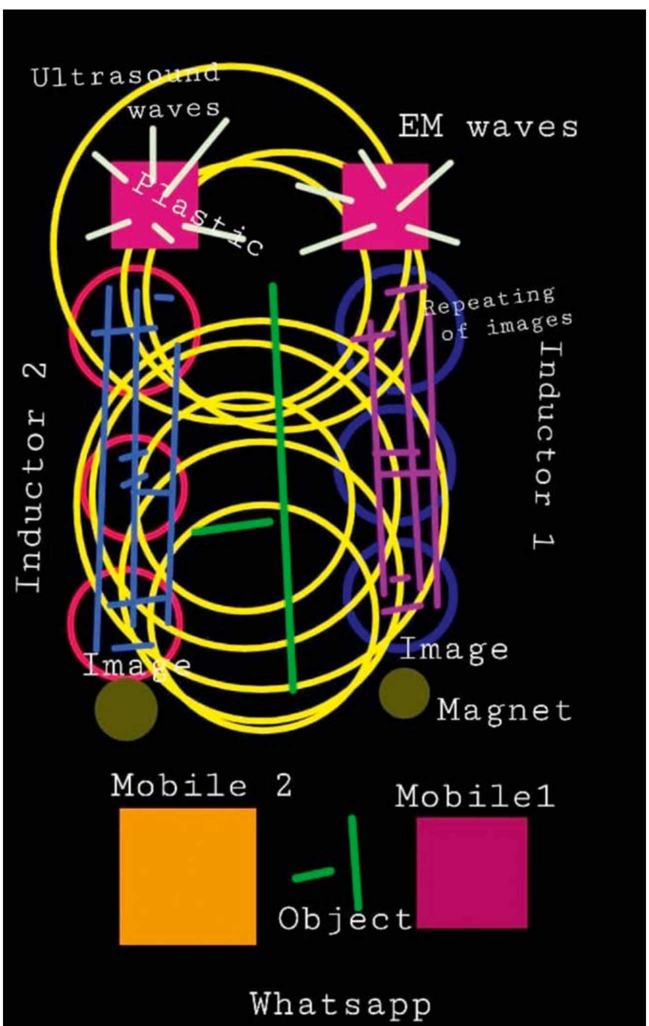
Holography is a current topic of research among many scientists. It has many applications in medical physics, biophysics, physics, and cosmology and for industrial purposes [1–4]. To date, many techniques have been proposed for holography. For example, in some optical methods, an image of a real object is taken and is presented on a slide. Then, a light wave is emitted, and after passing through the image and slide, it is concentrated on a screen. Consequently, a holographic image of the real object appears [5–7]. In some of these optical methods, two light waves are emitted so that one of them is scattered by a real object and the other does not collide but rather combines with the first wave on a screen. In addition to optical holographic methods, there are also some computer models. In these techniques, computers analyze emitted or scattered waves from an object and make a three-dimensional hologram of it [5–9]. Finally, some scientists are using sound or ultrasound waves for holography. In most of these techniques, sound/ultrasound waves collide with the object and take its shape. The reason for this is that sound waves are carried by molecular oscillations and thus, after collision with an object, the molecules can be re-arranged and take its shape. By using computers and spectrum analyzers, one can observe changes in the sound/ultrasound waves and build the holographic image [10–12].

Holographic images could help us to consider the evolution of biological cells. When using a two-dimensional system, approximately half of the information may be lost because each cell or microbe has at least three dimensions. To consider a biological process, the evolution in all dimensions needs to be observed. For this reason, a holographic microscope is needed. In this paper, we introduce a holographic sound microscope which is built with the help of mobile phones. In fact, we explore a way of determining the sizes and structures of microbes and making holograms thereof based on biological changes in exchanged waves between mobile phones. This may be a wonderful advancement in industry, because this model can be used to make a hologram of not only microbes but also of any state of objects.

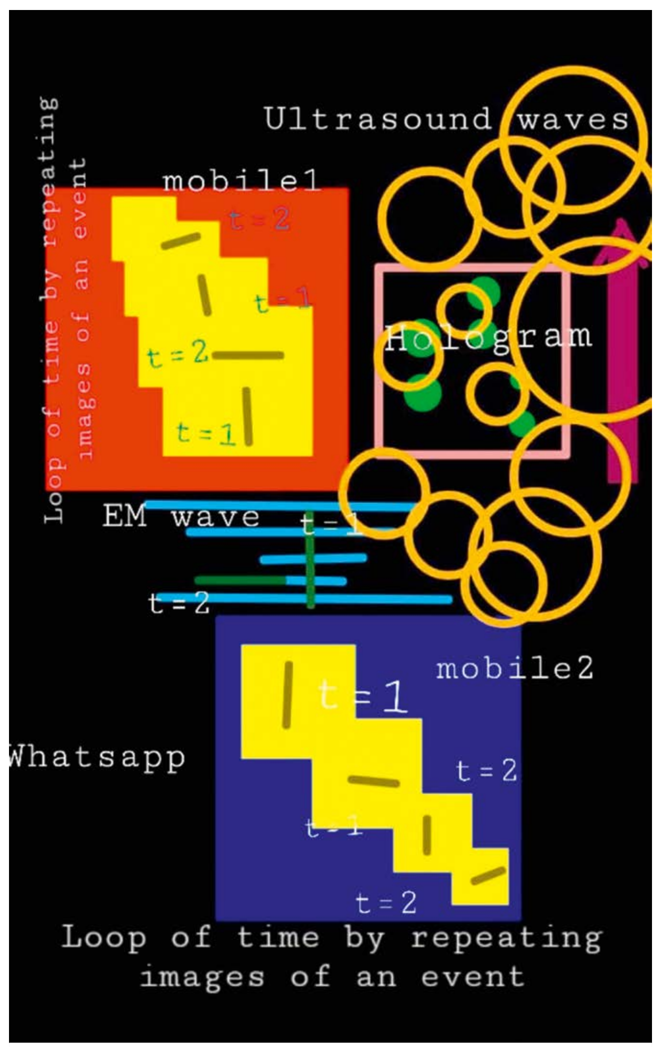
Hologram machine

A mobile phone includes many inductors, coils, capacitors, and wires. The main role of these inductors is to receive and send electromagnetic waves. A sound transmitter within a mobile phone is built from an inductor, plastic, a magnet, and related waves. When two mobile phones are communicating with each other, electromagnetic waves enter the inductors, oscillate and, consequently, the plastic in the sound transmitters begins to vibrate and produces sound waves.

When two mobile phones are communicating via WhatsApp and are close to each other, the inductors within the mobile phones get entangled and oscillate with each other not only through WhatsApp waves but through direct electromagnetic fields. Any change in an inductor of a mobile phone causes a change in the inductor of the other mobile. For example, if a sound wave collides with an inductor, its effects are transmitted via WhatsApp and di-



▶ **Fig. 1** Interacting mobile inductors exchange sound/ultrasound and electromagnetic waves.



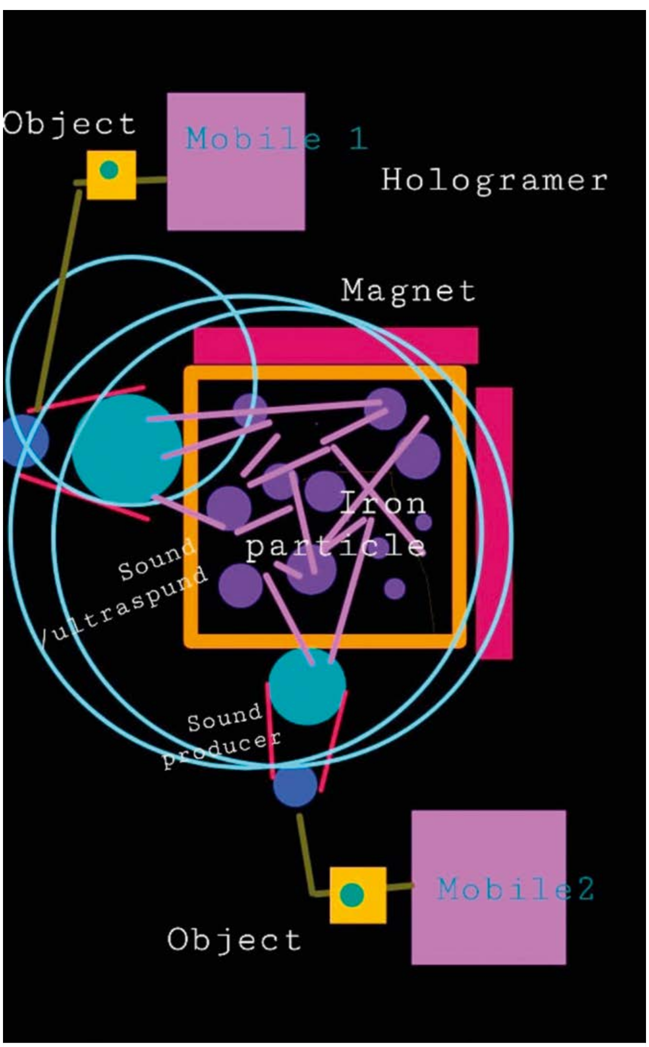
▶ **Fig. 2** Repeating images caused by the entanglement of two mobile inductors.

rect electromagnetic waves to the inductor in the other mobile phone. Then these sound effects return to the first inductor and this process repeats many times. If an object is placed between the two mobile phones, its shape has a direct effect on the shape of the sound waves. Consequently, these waves create the shape of that object on the plastic, and the to-and-fro movement of the waves between the mobile phones results in many holographic images of the object being formed on the plastic (see ▶ **Fig. 1**).

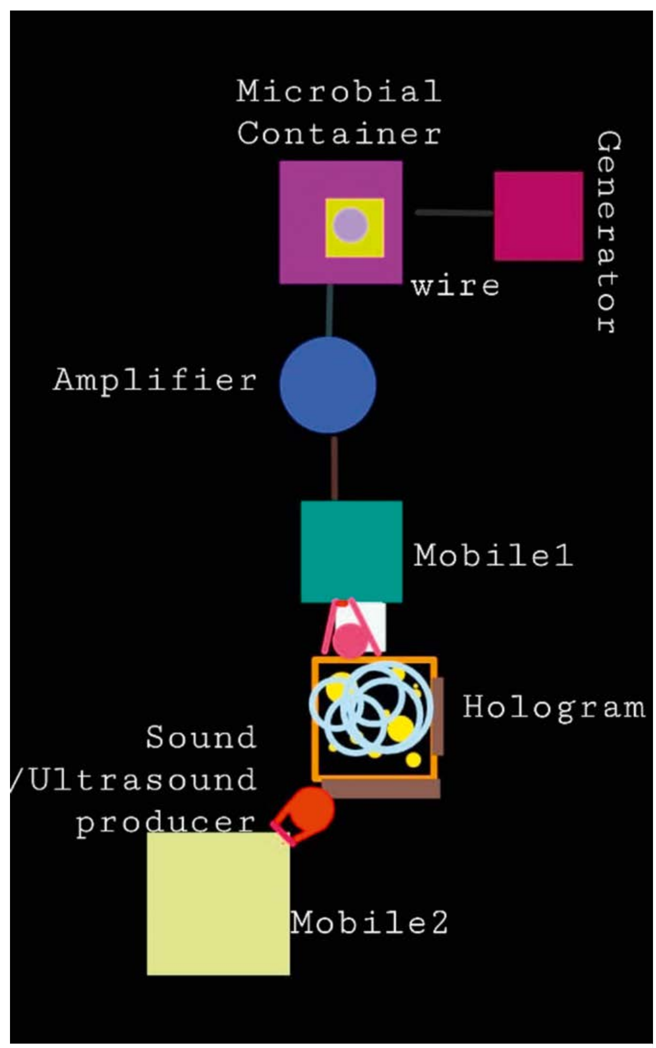
To observe the signature of the entanglement between the WhatsApp of the two mobile phones, we can put a linear object between the two phones and connect them via WhatsApp. If at t = 1, the line is vertical, and at t = 2, the line is horizontal, one can see that at t' = t = 1; 3; 5; 7; 9,...the line on the mobile screens is vertical and at t' = t = 2; 4; 6; 8,...the line is horizontal. This means that the event of the reversing line could be repeated many times. Using the electrons and atoms within the screens of the mobile phones, a hologram of various states at specific points in time can be made. This property is not limited to mobile screens but could also be seen in a sound holographic machine. This machine is built from iron particles, sound/ultrasound producers, and a room of plastic (See ▶ **Fig. 2**). In this holographic machine, mobile sound waves move iron atoms and produce images. These images may correspond to an object that interferes with the initial sound waves and produces new waves including holographic patterns.

To build a simple holographic machine, a room made of plastic should first be built. This room should contain many light magnetic particles like light iron particles. A magnet on one side emits a magnetic field, and mobile inductors on the other side emit another magnetic field which strengthens or weakens its effect. Two sound producers connected to two mobile phones could be placed on the two other sides of the plastic room and move its walls. A mixture of these waves causes vibrations of the light iron particles. These particles could show patterns that may correspond to objects that change the initial sound waves (see ▶ **Fig. 3**).

If two mobile phones are placed near each other and connected via WhatsApp, the inductors of the two mobiles become entangled and they vibrate many times. Eventually, the frequencies and power of the sound waves increase and tend to become ultrasonic. These waves have a smaller wavelength and could collide with microbes. These collisions change the shape of the ultrasonic waves. If these energetic waves collide with the iron particles within the hologram machine, they move them and form the pattern of the



▶ **Fig. 3** The hologram machine.



▶ **Fig. 4** The holographic ultrasound mobile microscope.

microbes. Thus, by viewing holographic images, we can consider the evolution of real microbes (see ▶ Fig. 3).

Holographic ultrasound mobile microscope

To build a holographic ultrasonic microscope, we need: 1. Two mobile phones; 2. A hologram room including plastic, a magnet, and iron particles; 3. A generator; 4. An amplifier; 5. A sound/ultrasonic producer; 6. Wires.

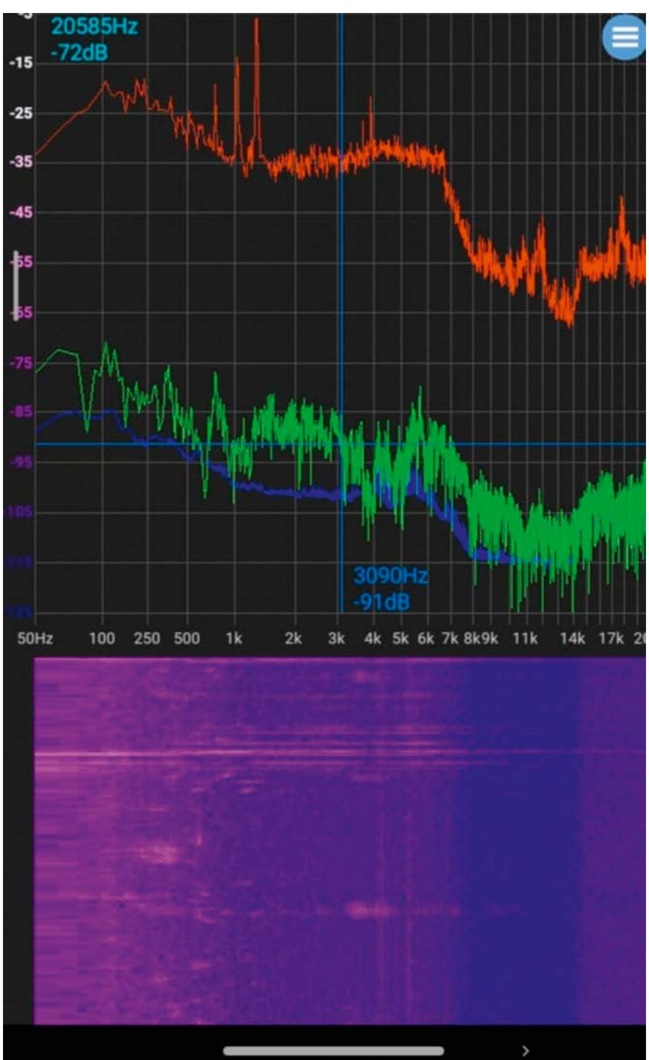
In this machine, a generator first sends a weak current towards the microbe. This current collides with a microbe and takes its pattern. Then, this current can be strengthened by the amplifier and received by the sound card of the mobile phone. The mobile phone is connected to another mobile phone via WhatsApp. The second mobile phone sends strong currents to the speakers or the sound/ultrasonic producers. These devices produce sound/ultrasonic waves. These waves move the iron particles and the plastic within the hologram machine and form the pattern of the microbes (see ▶ Fig. 4).

In ▶ Fig. 5, we present the background of the sound waves of the medium before connection of the mobile phones via WhatsApp. This picture shows that the frequency of the background waves could be near 20,000 Hz. These background waves act like noise and may destroy the hologram.

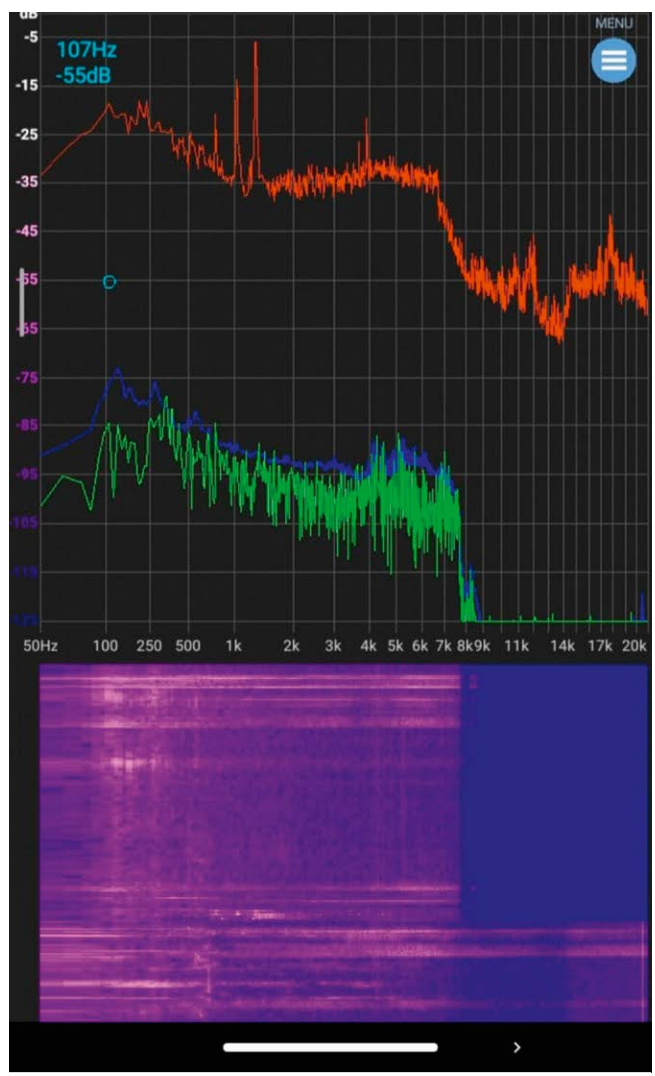
In ▶ Fig. 6, we show the sound spectrum after connection of the mobile phones via WhatsApp. Surprisingly, most of the background waves have been removed, and the initial frequency is very small, around 107 Hz. This frequency corresponds to the initial interaction between the two mobile inductors.

In ▶ Fig. 7, we present the sound spectrum in the next stages of interaction between the mobile inductors. It is clear that the sound spectrum has significant growth from 107 Hz to 6223 Hz. This increase in frequency continues to an intolerable level. The spectrum analyzer that has been established on the mobile phone also terminates, and the WhatsApp connection ends.

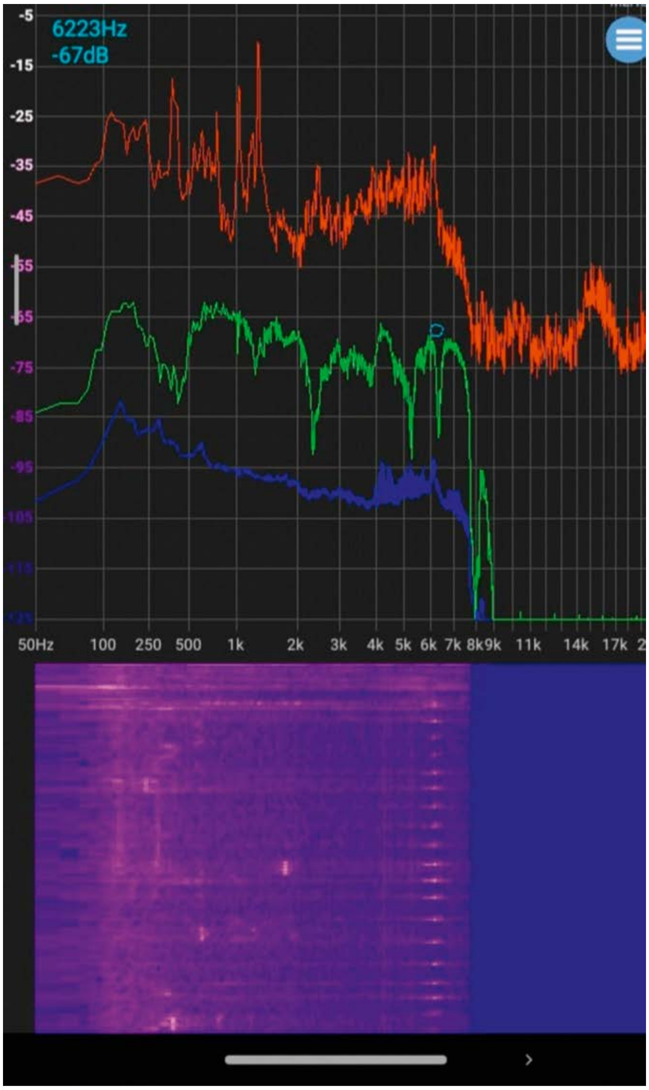
In ▶ Table 1, we list the values of the sound card currents measured by the Radio-SkyPipe software. This current has a direct relationship with the emitted sound waves. The molecules and cells vi-



▶ Fig. 5 Background sound waves before connecting by WhatsApp.



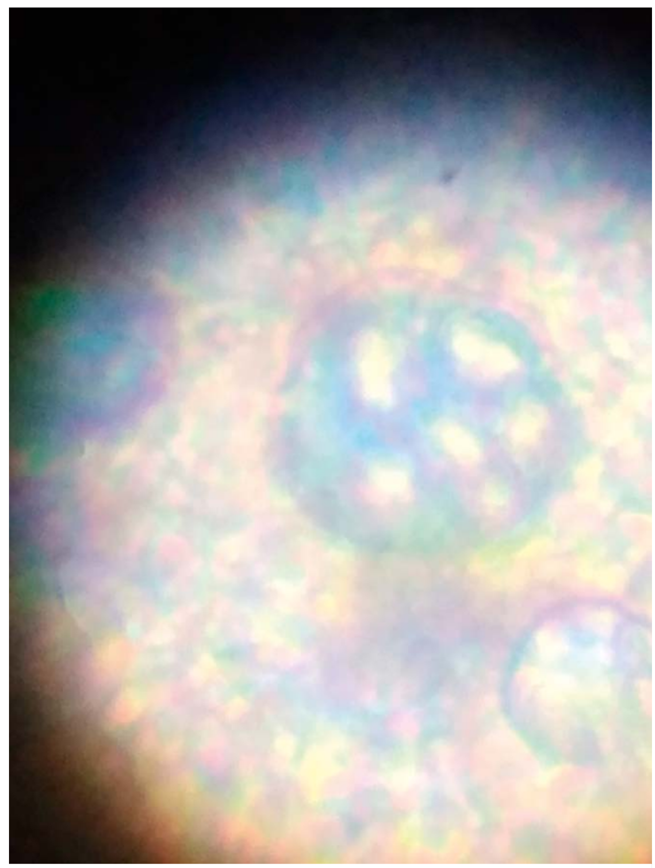
▶ Fig. 6 Reduction of frequency and intensity by connecting whatsapp.



▶ **Fig. 7** A sudden increase in WhatsApp wave frequencies.

▶ **Table 1** Sound card current measured by Radio-SkyPipe for different objects.

States	Current (mA)	Temperature
Pure water	Twenty-five	Thirty-three
Leaf	Fifty	Thirty-five
Water + sugar	Forty-eight	Thirty-seven
Water + sugar + chick embryonic cell	Seventy-two	Thirty-nine
Chick embryonic blood cell	Ninety	Forty-two



▶ **Fig. 8** An image of a chick embryonic cell taken by a light microscope.

brate and emit sound waves that can be detected by software. The number of waves emitted by pure water is less than pure water + sugar because sugar causes an increase in the number of bacteria. Chick embryonic cells also emit more sound waves compared to pure water. Finally, blood cells contain iron atoms and hemoglobin, and they emit more electromagnetic and sound waves. Thus, sound waves could help us in holography and the imaging of microbes and cells.

Discussion: Why we need a holographic microscope?

To date, many strong microscopes, such as light microscopes or electronic ones have been proposed. These microscopes may show most aspects of the evolution of microbes and cells. However, most of them use a screen that only shows two-dimensional images (see ▶ **Fig. 8**). In these images, at least half of the information may be lost. We need a hologram machine that produces three-dimensional and larger images of microbes and shows their structures with the larger size. This gives scientists the opportunity to consider not only the evolution of microbes but also the evolution of their bodies and structures. In this paper, we have proposed a simple model of a large piece of technology that may appear in the near future.

Conclusion

Holography in mobile systems can help transmit the topology of objects from one place to another. To utilise this property, a plastic room which contains iron particles and one or more magnets that emit magnetic fields is required. Alternatively, a sound/ultrasonic producer can be placed on one side of the plastic room. When the sound waves hit the plastic, causing it to vibrate, iron particles move and adopt the shape of the sound waves. Thus, if the sound waves collide with an object and then enter the hologram machine and plastic room, all particles move and form the shape of the object. This property can be adapted to achieve the holographic shape of microbes by connecting two mobile phones via WhatsApp using strong amplifiers.

Conflict of Interest

The authors declare that they have no conflict of interest.

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