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Advance Patient Monitoring Gloves for Surgical or Non Surgical Treatment

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Abstract: ***Patient monitor play a key role during treatment. Patient monitor uses to see some parameters. During operation doctor see patient monitor or other device for checking that patient's blood pressure, SPO2, ECG, temperature, pulse rate and etc. During operation doctor see these parameters many time and it can cause pain in the eyes and neck of doctor or cause disturbing doctor during operation. We are making the gloves in which we are inserting display, sensors, camera, and wireless technology. These gloves can connect with any other patient monitor by wireless technology and doctor can see patient monitor output at gloves, it can be comfortable for doctor during operation because doctor get tired to see on patient monitor for result again and again during operation. We can use the gloves for normal treatment like a doctor want to check blood pressure then it can use this gloves and measure blood pressure by blood pressure sensor and temperature by temperature sensor, or also can find pulse rate and we can also connect it with some other feature. This glove also save cost and time during treatment because we can connect this gloves to other patient monitor or devices and see patient's condition at own office by wireless technology and we don't need to buy some devices like blood pressure, temperature, pulse rat or etc. We also use camera for seeing thing correctly or easily and we can used this gloves for telemedicine by camera and treat in better way. Here we are using paper battery to reduce size of design or ease to fold, or high quality charging and have great efficiency. In our project, we use flexible display screen for seeing output. We are implementing this electronic paper display on over medical gloves because this E-paper display is flexible, more comfortable to read then conventional display, have wider viewing angle, light weight, thinness and durable, efficient and clear resolution. We can sterilize gloves and sterilization can be achieved by applying heat, chemicals, irradiation, high pressure or filtration.***

Keywords: Wearable Sensors, Camera, Conductive Fabrics, Wireless Technology, Paper Battery

1. Introduction

As you know that Gloves play an important role during surgery because it create a barrier between germs and your hands. Gloves are called personal protective equipment (PPE). Other types of PPE are gowns, masks, and shoe and head covers. [1] Medical gloves are defined as disposable gloves used during medical procedures; they include:

1) Examination gloves (non sterile or sterile)
2) Surgical gloves that have specific characteristics of thickness, elasticity and strength and are sterile
3) Chemotherapy gloves – these gloves are not addressed within this document.

When an indication for hand hygiene precedes a contact that also requires glove usage, hand rubbing or hand washing should be performed before donning gloves. [2] Here we use E-technology in gloves. E-textiles also known as electronic textiles, smart textiles, or smart fabrics, are fabrics that enable digital components (including small computers), and electronics to be embedded in them. Many intelligent clothing, smart clothing, wearable technology, and wearable computing projects involve the use of e-textiles. Electronic textiles are distinct from wearable computing because emphasis is placed on the seamless integration of textiles with electronic elements like microcontrollers, sensors, and actuators. [8] Textiles with electronics could be wearable fashion, upholstery, fabrics, rugs, or wearable computing. It does not have to be textile-based, but can be soft circuits – electronic hardware that is created with soft materials. Smart fabrics are materials that inherently respond to environmental stimuli – antimicrobial fabrics, thermo chromatic fabrics, conductive materials. Here we also use wireless technology. We can sterilize our device gloves. Sterilization is a term referring to any process that eliminates or kills all forms of life, including transmissible agents such as fungi, bacteria, viruses, spore forms, etc. present on a surface, contained in a fluid, in medication, or in a compound such as biological culture media. Sterilization can be achieved by applying heat, chemicals, irradiation, high pressure, and filtration or combinations thereof. . [9] Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio. With radio waves distances can be short, such as a few meters for television or as far as thousands or even millions of kilometers for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking.

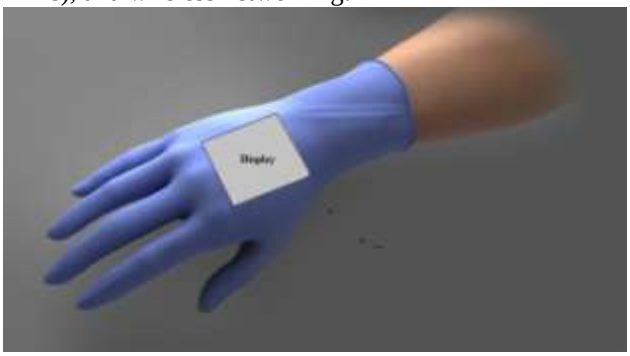


Figure 1: An example of Patient Monitoring Gloves for Surgical or Non Surgical

2. Materials & Method

2.1 . Conductive Fabric
2.2 . Display Monitor
2.3 . Wireless Technology
2.4 . Sterilization
2.5 . Camera
2.6 . Sensor
2.7 . Paper battery

2.1 Conductive Fabric

Here we are using conductive fiber for making medical gloves. We are using E-textile for gloves. E-textiles, also known as electronic textiles, smart textiles, or smart fabrics, are fabrics that enable digital components, and electronics to be embedded in them. We are also using conductive textile, a conductive textile is a fabric which can conduct electricity. Conductive textiles can be made with metal strands woven into the construction of the textile. Medical gloves are made of different polymers including latex, nitrile rubber, vinyl and neoprene. There are two main types of gloves: exam and surgical. Surgical gloves have more precise sizing with a better precision and sensitivity and are made to a higher standard. Conductive fibers make glove to conduct electricity. Conductive fibers provide medium to connect electronic component that are embedded on gloves and give electricity for getting output. We will also make this fabric gloves to flexible, ease to adjust with skin, making them easier to put on the hands, and also protect to touching blood, bodily fluids, bodily tissues, mucous membranes, broken skin, prevent contamination of materials during handling, or protect from getting germs that can make you sick.

2.2 Electronic Paper Display

In these gloves, we use flexible display screen for seeing output. The screens are made by layering stacks of semi-conductor materials and metals between pliable plastic sheets. Electronic paper is display technology. Basically, this form of e-paper is created by sandwiching millions of tiny plastic wells between two sheets of flexible plastic. Each well contains both white and black particles, suspended within a clear fluid. The power requirements for e-paper displays are also much lower than for traditional displays. It has two different parts; one is Front plane and second is Back plane. Front plane contain E-ink and backplane contain electronic circuitry. The backplane is made of thin organic film transistor array which provide voltage needed by E-paper. We can form electronic display the ink is printed onto a plastic film that is laminated to a layer of circuitry. E-ink is made up millions of tiny microcapsules. We are implementing this electronic paper display on over medical gloves because this E-paper display is flexible, more comfortable to read then conventional display, have wider viewing angle, light weight, thinness and durable, efficient and clear resolution.

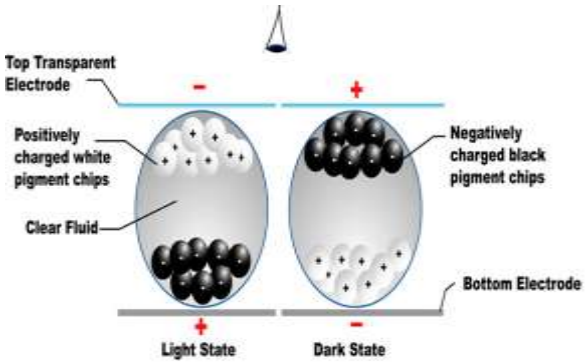
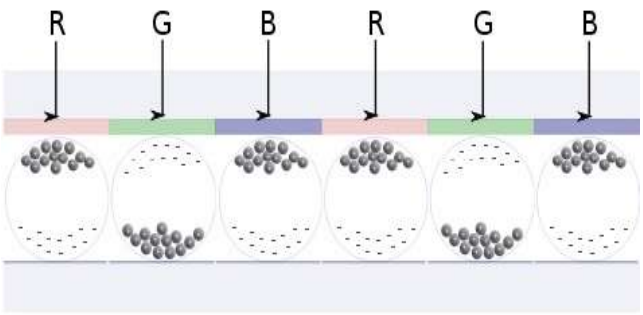


Figure 2: It show that when a voltage is applied, the particles will migrate eclectically to the plate bearing the opposite charge from that on the particles



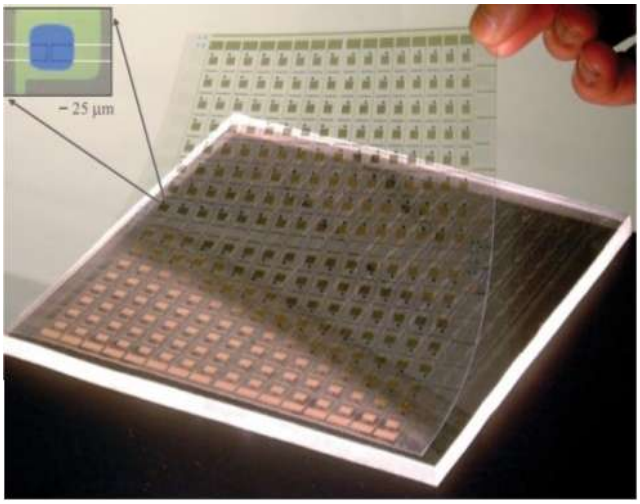


Figure 3: Basic scheme of an Electrophoretic Display using color filters and Rubber Stamped Plastic Circuitry for Electronic Paper

Table 1: Comparison Table of Display Technologies

	E-ink	TFT-LCD	OLED	TN-LCD	Ch-LCD
Mechanism	Charged particles movement in capsules	Twist of liquid crystal	Emissive layer of organic compounds	Twist of liquid crystal	Twist of cholesterol liquid crystal
Bistable	◎	X	X	X	O
Reflectivity	◎	?	X	?	?
Power	◎	X	X	?	◎
Contrast Ratio	O	◎	◎	?	X
Response Time	?	O	◎	O	?
Color	?	◎	◎	O	?
Viewing Angle	◎	O	◎	?	?

◎ :Great O :Good ? :Acceptable X:Bad/don't support

2.3 Wireless Technology

We use wireless communication for the transfer of information between two or more points that are not connected by an electrical conductor. A radio frequency (RF) signal refers to a wireless electromagnetic signal used as a form of communication, if one is discussing wireless electronics. Radio waves are a form of electromagnetic radiation with identified radio frequencies that range from 3Hz to 300 GHz.

RF is any frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.
Providing health care professionals the ability to remotely program devices, and providing the ability of physicians to remotely access and monitor patient data regardless of the location of the patient or physician (hospital, home, office, etc…)[16] An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices.

Most standard, well known types are covered here:
- Transmitter module
- Receiver module
- Transceiver module

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which can be transmitted.

An RF Receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: super heterodyne receivers and super-regenerative receivers. Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage. Super heterodyne receivers have a performance advantage over super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range.

An RF Transceiver module incorporates both a transmitter and receiver. Signals through RF can travel through larger distances making it suitable for long range applications. RF signals can travel even when there is an obstruction between transmitter & receiver. RF communication uses a specific frequency.

Figure 4: The figure show mechanism of Wireless Technology

Table 2: Frequency Band Designations

f	λ	Band	Description
30–300 Hz	10^4–10^3 km	ELF	Extremely low frequency
300–3000 Hz	10^3–10^2 km	VF	Voice frequency
3–30 kHz	100–10 km	VLF	Very low frequency
30–300 kHz	10–1 km	LF	Low frequency
0.3–3 MHz	1–0.1 km	MF	Medium frequency
3–30 MHz	100–10 m	HF	High frequency
30–300 MHz	10–1 m	VHF	Very high frequency
300–3000 MHz	100–10 cm	UHF	Ultra-high frequency
3–30 GHz	10–1 cm	SHF	Superhigh frequency
30–300 GHz	10–1 mm	EHF	Extremely high frequency (millimeter waves)

Table 2 shows a relationship between frequency (f) and wavelength (λ). A wave or sinusoid can be completely described by either its frequency or its wavelength. They are inversely proportional to each other and related to the speed of light through a particular medium. The relationship in a vacuum is shown in the following equation:

$$C = f \bullet \lambda$$

Where c is the speed of light

2.4 Sterilization

[17] Sterilization is a term referring to any process that eliminates (removes) or kills all forms of life, including transmissible agents (such as fungi, bacteria, viruses, spore forms, etc.) present on a surface, contained in a fluid, in medication, or in a compound such as biological culture media. Sterilization can be achieved by applying heat, chemicals, irradiation, high pressure, and filtration or combinations thereof. We can use steam under pressure (autoclave) that is the most dependable and economical

method of sterilization. It is the method of choice for metal ware, glassware, most rubber goods, and dry goods. Heat destroys microorganisms, but this process is hastened by the addition of moisture. Direct saturated steam contact is the basis of the steam process. Steam, for a specified time at required temperature, must penetrate every fiber and reach every surface of items to be sterilized. When steam enters the sterilizer chamber under pressure, it condenses upon contact with cold items. This condensation liberates heat, simultaneously heating and wetting all items in the load, thereby providing the two requisites: moisture and heat. Most prepackaged sterile items like surgical gloves and suture packets have been sterilized with ionizing radiation. Exposure of these items to a radioactive source, such as cobalt 60, destroys microorganisms. The surgical gloves can be sterilized using gamma radiation from 60Co.

2.5 Camera

In this glove, we use camera for seeing organs and we can use this camera during surgery. We can also use this camera for telemedicine. It can be helpful for doctor to see some vessels or organ by camera during operation.

2.6 Sensor

In this glove, we use different sensors for measuring temperature, blood pressure and etc. These sensors help to measuring blood pressure or temperature or etc during treatment. It can make ease treatment and no need to extra device. We can connect these senses on finger of gloves and it is ease to handle or ease to use during treatment.

2.7 Paper Battery

A paper battery is a flexible, ultra-thin energy storage and production device formed by combining carbon nanotube with a conventional sheet of cellulose-based paper. A paper battery acts as both a high-energy battery and super-capacitor, combining two components that are separate in traditional electronics. Generally Li-ion re-chargeable batteries are used in mobiles, laptops and most of the electronic devices. The flexible battery can function even if it is rolled up, folded or cut. Nanotubes are members of the fullerene structural family. The diameter of a nanotube is on the order of a few nanometers. Their name is derived from their long, hollow structure with the walls formed by one-atom-thick sheets of carbon, called graphene. These sheets are rolled at specific and discrete angles, and the combination of the rolling angle and radius decides the nanotube properties. Paper batteries may be folded, cut or otherwise shaped for different applications without any loss of integrity or efficiency. These are environmentally friendly and can be recycled.

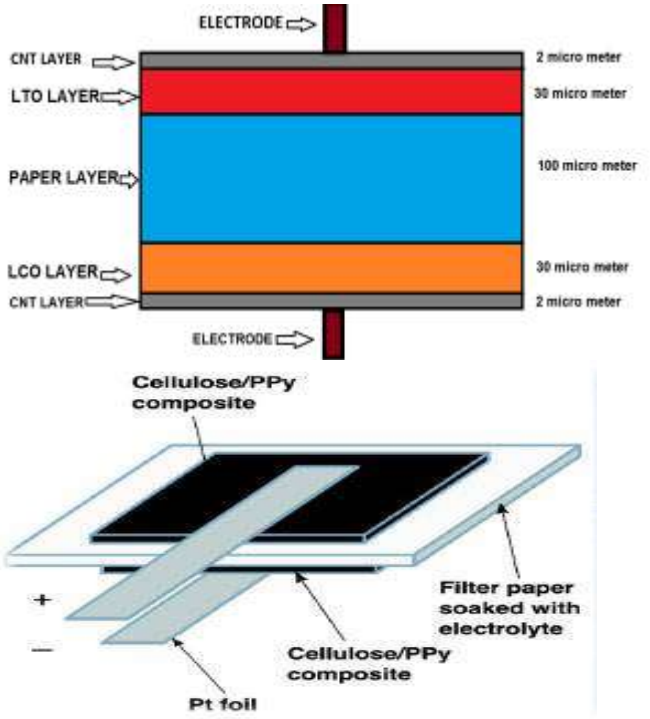


Figure 5: Structures of paper battery, the components are molecularly attached to each other.

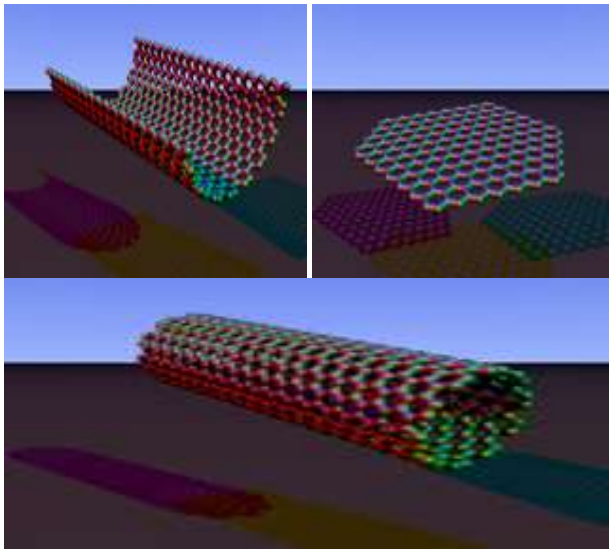
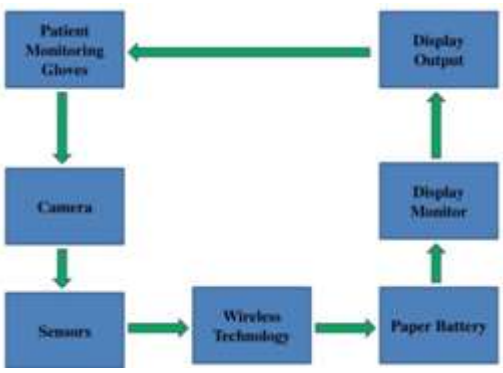
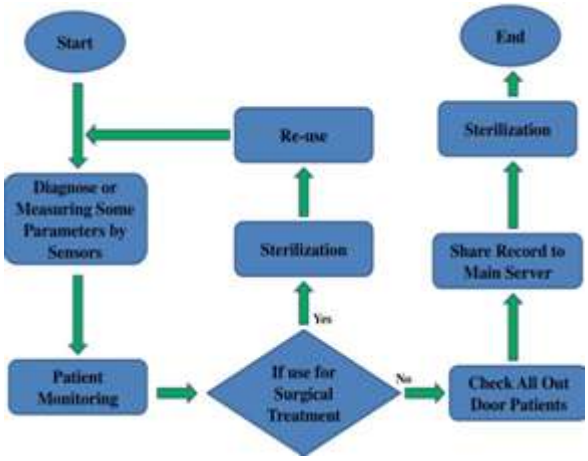


Figure 6: Graphene structure, Rolled at angle, Carbon nanotube

3. Block Diagram



4.Flow Chart



5. Conclusion

The paper has described that the system and the research mechanism of Monitoring Gloves for Surgical or Non Surgical which provides an immense help and support to physician. Medical glove not only help in operation and also help in diagnosis and treatment of common patients. It will be helpful in Telemedicine and provide better healthcare in villages where health facility is not available. It not only works as a patient monitor but also help as diagnostic gloves. It saves money, time of doctor and provides quick help in treatment. Our aim is to provide good healthcare everywhere in the world because Allah says that if anyone saved a person; it would be as if he saved the whole humanity. No doubt, the best work is to help humanity.

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