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PORTABLE DEVICES IN THE FIGHT OF SARSCOV2

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Abstract: *Finding various solutions to solve the pandemic challenges made me approach this topic. Why are we interested in smart textiles or those with electronic involvement in the fight against viruses? We can even use textiles to monitor an individual's health. In a pandemic case, the interaction with a patient must be as small as possible. That's why I thought of creating a system for remotely capturing essential biological information, such as body temperature. Such a device must contain sensors, a storage system and information transmission. The paper aims to present an attempt by the author to design a smart textile by introducing various electronic devices in the child's usual clothes, which allow remote temperature monitoring. Even if the tests were performed on a child, the idea can be extrapolated to adults, especially in a pandemic context. Existing devices on the market were used in combination with textiles in the child's wardrobe to study the effectiveness of temperature monitoring, using devices integrated in textiles. It is an attempt to find the cheapest possible solutions for monitoring the health condition remotely. It is far from being a perfect solution, but I do not want to stop here, but I will look for finding the most viable solution.*
Key words: *viruses, smart textiles, sensors, monitoring, temperature, e-textiles.*

1. THE REASON FOR CHOOSING THE THEME

Recently, the term "quarantine" has become familiar due to the global COVID-19 pandemic. Elevated body temperature (fever) is the most common symptom of COVID-19 and therefore. People in quarantine should have their temperature checked frequently. Children and the elderly often omit rigorous temperature monitoring or do not take it accurately. Taking into account these aspects, it is necessary to have a tool that allows the temperature to be taken remotely without causing discomfort to the patient, knowing that the internal temperature of the human body is between 36.5 ˚C to 37 ˚C.

In this project, two portable devices are integrated, with temperature sensor and which allow the capture of information via Bluetooth or Wi-Fi.

Portable electronic devices are recommended for use in the early detection of COVID-19 cases and beyond.

How to integrate them without creating discomfort? To provide extra comfort, we have introduced sensors in textiles in the child's wardrobe. It's not the only problem! If we do not have a wireless medical device, can we use one with a home application?

I tested the use of two devices designed to measure the ambient temperature to measure my child's body temperature. We know that such a device must contain sensors, storage system and information transmission. Because we do not always have the latest medical devices at our disposal, we must be able to use what we have at hand to monitor in the event of a critical situation of the child to allow remote temperature monitoring. It is an attempt to find the cheapest possible solutions for monitoring the state of health remotely. Even if the tests were performed on a child, the idea can be extrapolated to adults, especially in a pandemic context. It is far from a perfect solution, but I do not want to stop here, but I will look for the most viable solution.

We chose contact sensors because the infrared thermometer, although it presents the information in a shorter term, it is less accurate.

In my study I looked to see if what I want to do is within the terminology of e-textiles and I found that the composition of e-textiles includes sensors and flexible computers, with mostly invisible circuits providing discretion and comfort.

Without mistake, we can perceive e-textiles as intelligent systems that take information from outside the human body and transmit it to a control center: tablet, phone, PC, etc.

These systems have inside them electrical, thermal, mechanical, chemical, magnetic components that allow information collection. Good, but so do portable computing systems! The answer is "yes", but smart textile systems aim to incorporate them into fabric or knit, to give the wearer a comfortable coat with extra options.

E-textiles are practically a multidisciplinary concept as seen in Figure 1.

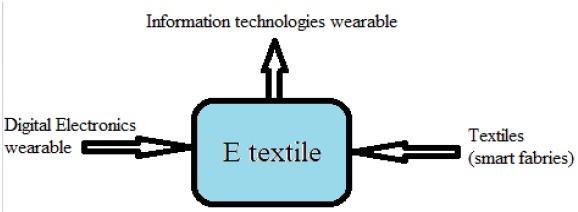

Fig. 1. Multidisciplinary of e-textiles

If so far it has been possible to introduce various systems in areas of clothing, at present we are working to obtain small electronic materials placed directly in the textile so as not to affect the comfort of standard clothing.

Such an electronic system must contain sensors, data processing, actuators, storage and communication.[26]

These electronic devices must be compatible with the function of the clothing: comfort, durability, resistance to regular textile maintenance processes, etc. [30]

So my device can be classified as e-textile, with the specification that I do not seek to obtain new threads or fabrics but only the use of existing devices on the market, not approved for medical purposes.

Fig. 2. Smart textiles [12]

2. GENERAL INFORMATION

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2.1 What is temperature and how can we measure it?

The human body normally has a temperature of 37 degrees Celsius. The German physician Carl Reinhold August Wunderlich is the one who established this average value in the nineteenth century, after millions of measurements performed on 25,000 patients in Leipzig. However, modern studies show that the normal temperature of the human body is lower than the known standard: 36.6 degrees Celsius. [21]

We are currently talking about a change in body temperature. Behind this decline may be a lower metabolic rate of modern man. Normal body temperature has large variations. Beyond infectious diseases such as COVID-19, there are many factors that influence normal body temperature: age, sex, time of day, physical activity, weight, outdoor temperature, food and drink.

So, it is considered that we have a fever when the body temperature rises by one degree Celsius above the normal, usual value.

Body temperature can be measured taking into account:

- Internal Temperature: is the temperature of the deep tissues of the body.
- Surface Temperature: is the temperature on the skin

To measure body temperature, we have several types of thermometers: glass thermometers, heat sensitive plates, electronic thermometer, and tympanic thermometer.

Fig. 3. Several types of thermometers

The temperature measurement area is important. Depending on the chosen area we have different values. Thus, we have:

• Oral temperature: Normal figures are 36.6-37.20 C.

• Rectal temperature: Normal figures are 36.8-37.60 C.

• Armpit temperature: Normal figures are 36.2-36.90 C

• Ear temperature: this method allows the measurement of the internal temperature but does not show the normal figures.

2.2 Development of temperature monitoring systems for a child

Monitoring a child's health during this pandemic period is useful and necessary. I chose this topic for my project, because it is a problem that I face and that I can study more easily with growing minors. But the subject itself is of major importance in monitoring the health of any individual and so the extension can be easily done for any type of patient.

Okay, I'm monitoring the temperature, but how? I want a monitoring at regular intervals, which I can store and send to the doctor without creating discomfort to the child.

I did an analysis with three instruments for measuring the temperature of the skin, following the difference by rectal measurements, knowing that a rectal measurement of temperature decreases 0.5 degrees to obtain the actual temperature of the skin.

The tools used were:

- Heat sensitive plate
- Two wireless electronic devices

The first device chosen is not an electronic system, but useful in demonstrating the principle behind obtaining an e-textile. Discreetly, positioned in various places where contact with the child's / individual's body is optimal, the thermal band is an important aid in monitoring health.

I tried to integrate a thermal tape in a blouse (coarsely sewn only in the test) to monitor my child's temperature. The chosen tape is commercially available. I integrated it into the sleeve on the inside of my hand. The child was not disturbed, the contact was continuous, and the monitoring was discreet, without stress.

The values are presented on intervals of 36, 37, 38, 39, 40, the sub febrile value of 36 (N) being the one considered to be associated with a healthy individual.

It is not an exact measurement system, but it is very useful in transmitting alarm signals when a thermal change occurs.

At a change in temperature, the child or individual can be taken out of the community and directed to a medical post.

If we integrated a tape on this principle to transmit the information to a device, the efficiency would be much higher!

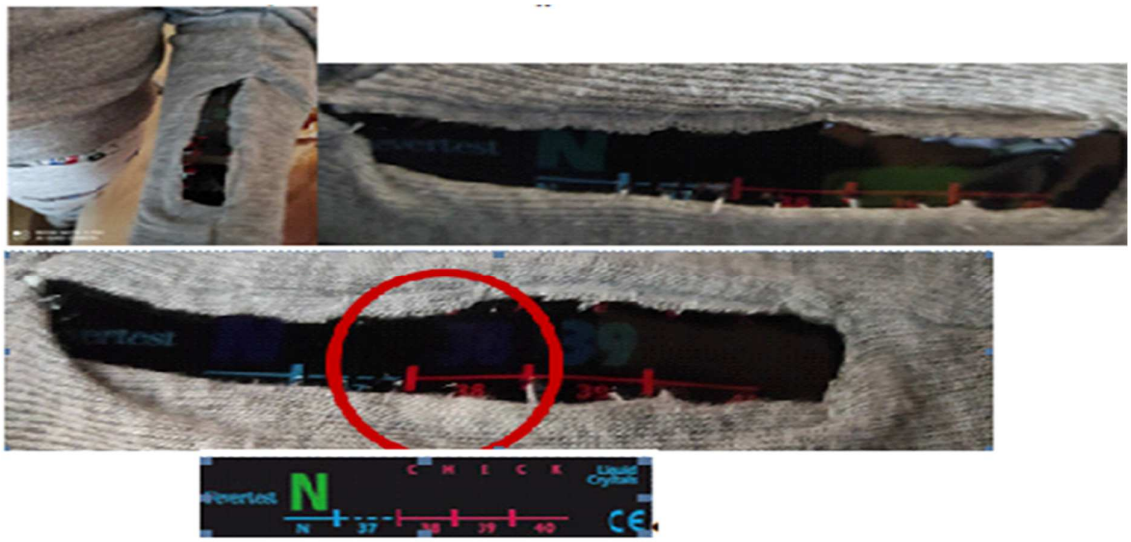

Fig. 4. Thermal tape

The second device is the second-generation Xiaomi Mijia Thermometer, which via Bluetooth transmits to a mobile application all the data it records and allows the generation of a graph. A small device that addresses room temperature monitoring but which I tried for a day to see how it manifests in contact with the human body.

The device once connected to the batteries was placed on an elastic belt for easier temperature measurement.

The measurements made are stored on the phone in an application that allows real-time monitoring of the measured temperature.

Fig. 5. Xiaomi Mijia Thermometers

The third device chosen is the Sonoff Wireless Relay Module for temperature and humidity monitoring connected to a Sonoff Si7021 sensor designed to find out the temperature in liquids. And this device is one that addresses the supervision of the home, the relay can be connected to various devices in the house (e.g. light bulb), a device that can be controlled wireless. This device needs direct current. The challenge was to turn it into a battery-connected device for greater independence and to be able to integrate it into the coat. Once integrated, it is important to see if the measurements are good.

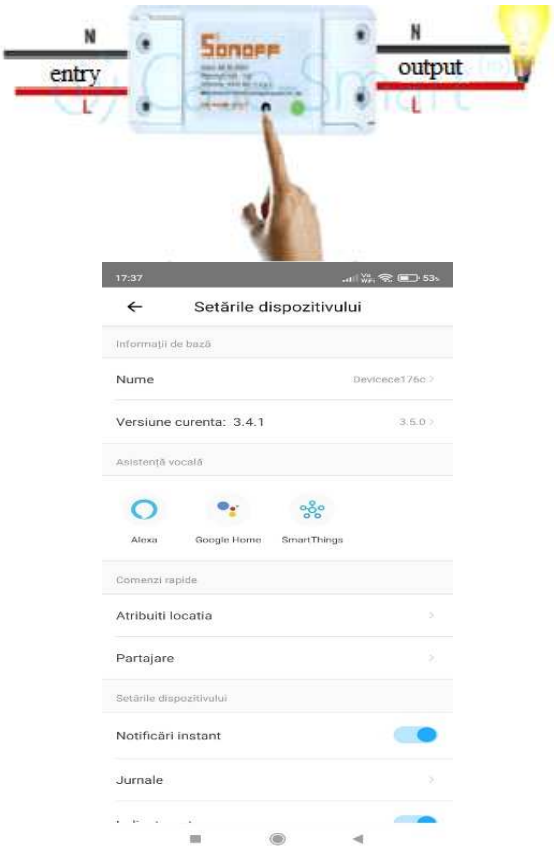

Fig. 6. Sonoff Wireless Relay Modules

Fig. 7. Sonoff Si7021

All measurements made in a predetermined period of time, are stored in excel format and can be analyzed to see the evolution of the analyzed.

The measurement differences are a maximum of 0.5 degrees and fall within the margin of error of the contactors.

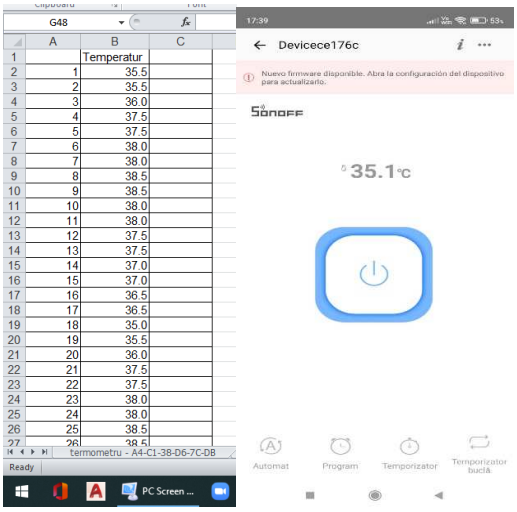

Fig. 8. All measurements made are stored in excel format

3. CONCLUSIONS

The present paper aims to present some ways to obtain integrated devices for medical use. It is only at a conceptual level, the realization of such a system opening new opportunities in monitoring different patients in real time.

There are a number of e-textiles and smart products on the market; however the current needs leave room for the development of adaptive clothing.

Although remarkable progress has been made in the field of e-textiles, their adaptation to new Nano technological discoveries is still inadequate. It is also necessary to work on obtaining a high impermeability and flexibility, so that these products can be easily exposed to mechanical washing with various cleaning substances.

Because there are concerns about the toxicity of nanomaterials used in fabrics, new knowledge in processing is needed. [27]

The uses of classical manufacturing techniques to produce textile-based sensors as well as integration into wearable garments have managed to create great potential for the mass market.

Nano technology is gaining ground in all areas by feeding the human need new and fast, while providing added comfort but until their widespread implementation they leave room for the integration of non-invasive tools in various textiles, so we can manage a problem of health by remote monitoring reducing from patient stress.

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Dispozitive portabile în lupta cu SarsCov2

***Rezumat**: Găsirea diverselor soluții pentru a rezolva provocările legate de pandemie m-a făcut să abordez acest subiect. De aceea m-am gândit să creez un sistem pentru captarea de la distanță a informațiilor biologice esențiale, cum ar fi temperatura corpului. Un astfel de dispozitiv trebuie să conțină senzori, un sistem de stocare și transmisie de informații. Chiar dacă testele au fost efectuate pe un copil, ideea poate fi extrapolată la adulți, mai ales într-un context de pandemie. Dispozitivele existente pe piață au fost folosite în combinație cu textilele din garderoba copilului pentru a studia eficiența monitorizării temperaturii, folosind dispozitive integrate în textile. Este o încercare de a găsi cele mai ieftine soluții posibile pentru monitorizarea stării de sănătate de la distanță. Este departe de a fi o soluție perfectă, dar nu vreau să mă opresc aici, ci voi căuta să găsesc cea mai viabilă soluție.*

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