If the Internet of Things is Able to Detect Physical Health

Muchen Lei

Yali High School International Department
*Corresponding author. 1924967458@qq.com

ABSTRACT

Nowadays, we can see many applications of Iot (Internet of Things) in various dominance. Indeed, IoT technology brings us more than just convenience in life, but also as assistance in medical operations, which makes the author wonder, what if this technology can be used for disease detection? In this essay, it will discuss the usefulness of this kind of application, the principles and ways to run the systems and approaches to enhance privacy security. And of course, the applications that already exist are used to explain the sensor component.

Keywords: *Internet of Things, Physical health, 5G, Diseases treatment.*

1. INTRODUCTION

Before the article begins, the author wants to ask a few questions: Why do people need the Internet of Things? What exactly does the 5G bring to us? Why are companies and even countries so eager to compete for the dominance of both? Are these caused by the infinite convenience to mankind they brought, the advancement they make up to process society, or their indirectly showing of the strength of a company, a country? Nevertheless, there is no denying that the Internet of Things and 5G have played pivotal roles in today's society, including medical and health applications.

Parasite, cardiovascular disease, cancer. These are as difficult to find as thieves breaking into houses in the middle of the night, which are extremely harmful. As long as attaching these, patients need to receive weeks of clinical treatment, even lose their organs or their own lives. People are well aware that these diseases come from unhealthy habits, or some are unhygienic moves, but most of people never know what is "unhealthy" or "Unhygienic". For instance: Is it reasonable to go to sleep at midnight? How to use health supplies to minimize side effects on the body? How often should people clean the house up, so they can reach the standard of "tidy"? Most of all, for us, how is it possible to feel physically wrong in the first place? Thousands of problems confuse us, and these problems are destroying our bodies step by step.

Now that the Internet of Things and 5G technology have been used in the medical industry, the author is assuming if it is possible they can help us discover and come up with suitable treatment options. In turn, users can know in advance and give feedback on their condition. But are these possible? How can these be realized? The author will explain this by stating the uses, principles, and existing applications.

2. THE USAGE OF IOT TECHNOLOGY ON PHYSICAL HEALTH DETECTING

Before envisioning the application of such techniques, the researches must consider the early disease-onset symptoms of the diseases. Take lung cancer as an example:

"Lung cancer is the highest incidence of all cancers, its onset mainly related to smoking, environmental pollution, home kitchen lampblack and other factors. Lung cancer has three early manifestations.

Cough. Two-third of lung cancer patients will have early dry coughs. Patients with long-term cough, if they find their cough frequently increases, or find out irritant dry cough occurs, then they must be alert to lung cancer.

Grow blood. Men over 40 years of age who often smoke, and it appears blood, blood silk or small blood clots in the sputum, then it has a huge possibility to be lung cancer.

Chest pain. Lung cancer develops intermittent non-intense chest drill pain, which lasts for minutes to hours. If the cancer swelling invades the pleural area, the pain will be fixed, persistent, and severe" [1].

If the application of such technology has to be used to take protection against lung cancer, it's able to detect abnormalities in the body. The detector should make a judgment and alarm when patients repeatedly dry cough, hemoptysis, or even cover their chest because of pain. At the same time, it needs to inform patients about countermeasures and reasonable medical advice on the screen.

In response to diseases infected by hygienic reasons, such as malaria pathogen infection, it has to understand the condition from the internal condition of the patient:

"The patient had malaria attack with diarrhea as the first symptom, blood cell analysis: leukocyte count (WBC) 5.02 × 109 / L, erythroid cell count (RBC) 3.91 × 1012 / L, hemoglobin (HGB) 130 g / L, platelet count (LT) 81 × 109 / L, the ratio of neutrophils (NEU%) 85.1%, the ratio of eosinophils (EOS%) 1.3%.C-reaction protein (CR) 53.29 mg/L, plasma D dimer 4.93 μg/m L.Plasmodium rapid diagnostic reagent (RDT) detection suggests P. dium falciparum , Plasmodium lobodies were detected by microscope" [2].

From the transformation of the number of cells in the blood, the rise of the protein concentration, or the abnormal blood investigation, the terminal must show the human information and the response plan, so that the patient can respond according to the instructions.

3. THE PRINCIPLES AND OPERATION

3.1. Principles

If the Internet of Things technology is put on disease defense, researchers may see this operation mechanism as the same a receiver, while the 5G can be seen as an enhancer that keeps the receiver operating smoothly and quickly.

Similar to the principle of each receiver, the Internet of Things technology is mainly divided into perception layer, transmission layer and application layer; on the receiver, it needs to detect and obtain information with a sensor, transmit with wired facilities, wireless signal or wireless network, and finally complete the transmission of information on the speaker or displaying screen. The Internet of Things, take a home microwave oven equipped with the Internet of Things as an example, holder operates on the premise of a command by using a mobile (or fixed) equipment, which allows information to be obtained by the device; then thousands of network cables and signal base stations play the role of transmitting; and finally, when the command reaches the microwave oven, that is, on the application layer, the food preparation is done. And here are other applications in life.

"One of the most talked about apps for the Internet of things is its use in the home. Today, the Internet of Things

has played a role in making our home appliances smarter. Whether you think of lighting systems or home monitoring, the Internet of Things really takes the convenience of our home to a new level. Take home lighting as an example, and home lighting systems and monitoring are also combined with the Internet of Things. You can largely enhance security in your home by turning on lights off with your smartphone or by setting up smart IoT security cameras and monitoring systems" [6].

Today, there are more advanced receivers emerge, and some researchers apply the Internet of Things technology to the receivers. The author found a design that approximates the purpose he envisioned. That is, if this design is simplified and transformed, then it gets the effect that the author wants to realize.

"(the greenhouse) system adopts NB-IoT narrow broadband Internet of Things technology, Java programming language technology, data control technology and fuzzy control technology to realize the intelligent monitoring of the greenhouse. The system collects the terminal control sensor collecting environmental information about temperature, humidity, light intensity and carbon 2 concentration in the greenhouse, transmitting data to a remote server via the NB-IoT network and stored in the database. The control terminal uses the Web page developed by B/S structure, calls the data in the remote server, and displays in the website pages in the form of charts and data, and the greenhouse administrator can pass via C or mobile terminal Log in to specific websites, and monitor the greenhouses anytime and anywhere" [3].

3.2. Operation with 5G

In the above literature, the author envisions applying the Internet of Things to the control of the greenhouse environment. But one thing that doesn't fit with the author's idea is that the IoT has to deliver only data and icons, and the ultimate response is from the administrator by browsing the site. NB-IoT technology is adequate to deal with low energy consumption and small volumes of information, so more than enough to be used in gardening. However, for ordinary patients, data and icons are hard to understand, let alone, they cannot have browsing access to the medical database, so we need to replace 5G technology for NB-IoT to find big data corresponding information.

Why does it have to use 5G here? 5G is a new generation of broadband mobile communication technology with high speed, low latency and massive connectivity. It also realizes network infrastructure for human-computer connectivity, such as enhanced mobile broadband (eMBB), massive machine-like communication (mMTC) and ultra-high reliable low latency communication (uRLLC). Enhanced Mobile Broadband (eMBB) is mainly used for the explosion of

mobile Internet traffic, providing mobile Internet users with more terrific application experience; huge machine communication (mMTC) is mainly for smart cities, smart homes, environmental monitoring for sensing and number according to the target application requirements of acquisition; ultra-high reliability and low latency communication (uRLLC) is mainly aimed for industrial control, telemedicine, autonomous driving and other vertical industry application requirements with extremely high delay and reliability. In conclusion, 5G makes the matching and exchange of medical information faster and more secure.

3.2.1. The approaches to match Information of diseases treatment

If information matching has to be done, a database of medical information and a pool of patient information are needed, and it also requires a way to match rehabilitation programs for the disease. There are two schemes to exchange such information.

Establish a memory with great storage space, manually screen the corresponding treatment plan when the terminal makes requests, and then transmit it back.

Edit an AI program, but put the solution to many kinds of diseases into the program in advance, and finally the system chooses the process and transmits them to the patient.

From the perspective of short period from economy, rationality, the difficulty of developing an AI program is more substantial than enabling manual operation. First, developing an AI program system, including software and artificial intelligence that is capable of classification, and using applicable servers require heavy money to invite technicians; plus because it's used for the first time, errors and failures are inevitable, so repairs are more frequent than later times, and so operating costs increase. Just like games on Steam, such software starts by carrying subtle system vulnerabilities, such as coming up with false information about a condition, which is irreparable for patients and operating companies. The only way to avoid the above problems is to broaden trial operation time so as to eliminate as many problems as possible, but it will cost more funds.

From the long-time effect, developing an AI program may be a better solution. The biggest advantage of AI over humans is that it does not have free will. After being created, it does not work to get paid, and it do not have consciousness to tell that they are tired. But for labors, they need to rest, with the minimum wage (which rises all the time) of the government and unions, insurance and training costs, and the productivity must be lower than that of AI retrieval. Employees may also be injured, so the company needs to pay compensation or grant subsidies. If the artificial spending of money at the beginning is flat, but later on it will be slow and steep, years past it will be beyond the spending on AI.

It's insightful to make a choice between these two options. For a company who's well-funded and is able to hire or has a development team, and willing to expand its business, developing an AI program is a good choice; if it is a new startup team, it's a good choice to start with manual work.

3.3. Ways to keep privacy security

The stability and security of material information transmitting are points that people have always attached great importance to, and how to keep information privately has become a problem that everyone must consider. People can never know who will intercept our body information on signal transmission and how to use it for other purposes.

Before continuing to go deeper into the above questions, the author will start by answering the beginning of the essay: Why do we need the Internet of Things? The answer is obvious: it has brought us convenience; it has promoted social progress; and it is also an important basis to prove a country's scientific and technological strength. More systematically, it's automatic, insight and decisive, and it's also a virtual physical world interface. However, these bring us danger of individual information leakage.

Speaking of which, there are a huge number of IoT users whose private information is leaked and has the problem of unsafe firmware. So a method is needed to solve this issue.

The device hardware may have opened the debug port to interact with the system. In short, it is a set of pins on a printed circuit board (PCB) connected to microcontroller/microprocessor pins that we can use client software to communicate through hardware communication protocols, thus allowing us to interact with the system. The level of interaction and privileges depends on the type of protocols and its usage. For example, there may be a pin output for the UART interface that allows us to access advanced software or applications, namely the command enclosure, recorder output, etc.We can also perform the low-level interaction with the microcontrollers using the following protocol : JTAG,SWD et al., these help us directly control the microcontroller, so we can test and analyze the microcontroller pin values, read or write internal flash memory, read or write register values, debugging OS or basic firmware code, etc.If these ports or pins are enabled on the device, an attacker can hijack the device or extract sensitive information from the device, including firmware and data. These ports are usually enabled to resolve faults or debugging problems in production devices.

In the survey, there are other problems that users can and can only solve by themselves:

Unsecure data storage

Insufficient certification

Unsecure Communication

Unsecure Configuration

In short, the key to those problems is to get better equipment, so users are able to obtain security of private information.

Then it should talk about the basis of what makes everything possible: the perceptual layer, that is the sensor. In real life, many companies have developed their own brand of smartwatches. These watches capture the user's body information and transmit it to the cloud database, and extract reasonable health advice on their exercise and physical conditions. Speak in short, this technology completes human abnormality detection by matching with a licensed database.A new chapter should be started to better explain it.

4. THE APPLICATION OF INTERNET OF THINGS NOWADAYS AND THE DESIGN OF SENSORS

From Apple, Samsung to Huawei, Google, each company is in the same way to observe the health condition of users, namely to sell their own brand of watches customers, and then through the watch perception of pulse, blood observation to analyze, finally from the Internet or the company's information database search for the situation of the illness. As said before, the essence of disease monitoring is the enhanced version of health testing, so there are inspiration from the products of these companies can be extracted. Take Apple as an example.

Target

To determine the availability of Apple Watch after falls in elderly emergency department (ED) patients.

Methods

We recruited fallen seniors and visited ED in two cities. They attended the 30-day Apple Watch event and interviewed their experiences using the table to accomplish various tasks. Interview records, transcription, coding and analysis were analyzed by frame.

Results

"Eight participants (mean age of 77.6 years) were enrolled from November 2019 to March 2020. Participants reported that they were able to apply and charge watches but had difficulty navigating the screen, monitoring charging status and responding to de novo text messages" [4].

Older adults have successfully completed the basic Apple Watch function.

According to the above experiments, the Internet of Things has been relatively mature. In reality, through the support of smartwatches, people can understand the situation of their bodies.

In the design of the sensors, Apple officially gave an explanation:

How Apple Watch measures heart rate.

The Apple Watch heart rate sensor uses photoplethysmography. Technology seems complicated and incomprehensible, but the principle is simple: blood is red because it reflects red light and absorbs green light. The Apple Watch uses a green LED light paired with a light-sensitive photoreceptor to detect blood flow through the wrist at any time point. As the heart beats, blood increases through the wrist and green light absorbed; less during heartbeat intervals. With hundreds of flashing LED lights per minute per second, Apple Watch calculates yours per minute number of heart beats, which is your heart rate. Moreover, specially designed heart rate sensors can improve LED brightness and sampling rate, and then compensate for the problem of weak signal.
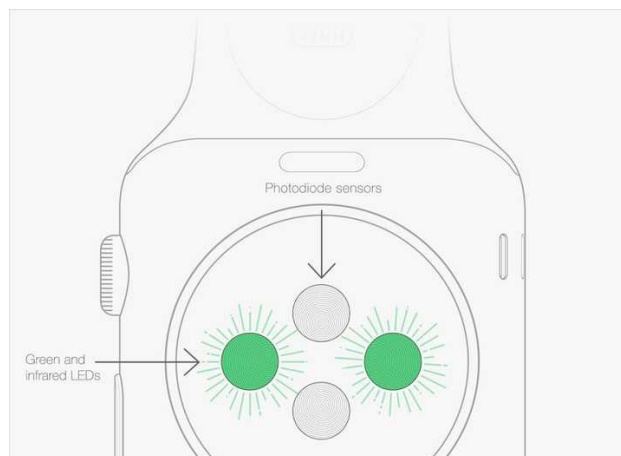

Figure 1 Principle of the Sensors on Apple Watch

The heart rate sensor also uses the infrared line. Apple Watch uses this way to measure your heart rate every 10 minutes.

There are also other monitoring methods:

The Apple Watch has just so many ways to measure your activity and exercise, and the heart rate is just one of them. It chooses the best way based on the movement you do. For example, when you run indoors, it uses an acceleration sensor, while it uses iPhone's GPS. When you ride outdoors, even if not in a special sports environment, it can still measure your daily activity. So Apple Watch can give you information, giving you motivation to improve your fitness and health [5].

That is to say, Apple used LED lights to assess user heart rate through the flesh and the calculating system on their watch. Then, we can use this to observe the number of cells in the human blood, the rise of protein concentration, or blood abnormalities. Through the phonograph, we can also collect the number of coughs, and then judge the disease type based on the disease information matching in the information database.

There is also the easiest way，ask users to fill in a form of physical symptoms at a regular time, and then judge it through artificial intelligence.

5.CONCLUSION

From the early days of the Internet of Things came out, humans have been keenly aware that it can benefit themselves, and this is exactly the case. It is, still booming when this writing is finished. Perhaps one day, the technology the essay is imagining will appear in the world as scheduled, which will be a huge step in the healthy application of the Internet of things. What it has said above is the idea based on things the author have learned, and that the introduction of this technology still requires the participation and efforts of many scientists and technicians.

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