Electronics Online Challenge

By TEAM 505 B - RoboBeasts
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Introduction

Our names are Natalie and Suzanna. We are from TEAM 505 B - RoboBeasts. We decided to do this project because we think that electronics are really interesting.

In this project we will be taking apart the “Samsung S4” and the “Kyocera Hydro Reach”. We will show the components, and explain what they do.

Why We Chose These Devices

I (Natalie) personally chose the Samsung S4 because it was my first phone. It’s also on the older side so I thought it would be really interesting to see what’s inside and what makes it work.

I (Suzanna) picked the Kyocera Hydro Reach because I have seen a lot of different kinds if phones but I haven't really seen what an old waterproof phone looked like, so i wanted to see how they made them.

Materials Used

1. Screwdriver
2. Flathead screwdriver
3. Samsung S4
4. Kyocera Hydro reach
5. Phone (for pictures)
6. Chromebook (for research)
7. Gloves (for protection)
8. Goggles (also for protection)
9. Notebook and pencil (for notes)

How We Took The Samsung S4 Apart

The device that I took apart was a samsung galaxy s4. The first thing I did was take the before picture. After that I took the screws off. After that I took the battery cover. It revealed the mainboard and some wires. Then I disconnected the two wires that were connecting the two parts of the mainboard. One of them was a 3g gsm antenna flex cable and the other one was a normal flex cable. Then I took the bottom one out after I disconnected a wire. It was also a flex cable. The bottom mainboard had the charger port and some sensors. After I disconnected the flex cable connecting the other part of the mainboard and the screen, I took the mainboard out. It had a bunch of stuff on it. Like it had the sim and micro sd card. A proximity sensor is also one of the components that was on the motherboard. It also had an external test port. It also had an ambient light sensor. There were also a bunch of rubber gaskets to cover some things. There were also some plastic spacers too. It also had a notification LED. Also there was an LED flash. And of course the camera was there connected by a flex cable. And after I discovered all of the things on the mainboard I took it out of the phone. Then I tried to take the screen off. Then I took the top part of the screen off. It is made of glass. Then I took the other part off. It was hard to take that part off that part of the screen, because it was very fragile. But eventually I got it off. It did break a little but that's ok. And then there was only the base left. (As in the base of the phone.) And there was a heat sink compound. And that was really all there was in the back.

How We Took Apart The Kyocera Hydro Reach

The very first thing I did before taking apart the phone was wiping it down to remove any dirt. Once the phone was wiped down I took off the back covering I realized that the battery wasn't there so i used my screwdriver and unscrewed all the screws (there where only 4) once I unscrewed all the screws I took of the extra cover the phone had. One that was of I saw the SIM card and I took that off. So at this point I decided to try and take off the screen so I looked and looked and kept looking, but I didn't find anything no screws, so I flipped the phone to look at the front side of the phone. So I observed the front side of the phone and I saw a line going around the screen so I tried lifting the screen up but there was like a glue keeping it stuck so I stuck my screwdriver in then moved it around the screen once I went all the way around once I did that I lift it up using a bigger screwdriver And just like that I took the screen off. One the screen was off I saw that I had to take of more screws those screws where what was holding all the hardware in place.So after I took off that metal sheet I saw the motherboard and the area where you charge your phone but I also saw the battery so I took that after the battery was out I saw some more screws so I took those off and when I took them out it helped me take out the motherboard. The only issue I had during this project was figuring out what phone I had taken apart but i went to the kyocera website and found out.

Inside The Phones

1. **Sim card** - They are designed to connect you to a mobile network allowing a user to use the communicative functions of a phone.
2. **Micro sd cards** - They are designed to move your files, photos, and music from device to device without having to rely on steady Wi-Fi or costly data. They can be used to download music apps or pictures.
3. **Proximity sensor** - A sensor able to detect the presence of nearby objects without physical contact.
4. **Motherboard** - The Motherboard itself is a printed circuit board that allows the CPU, RAM, and all other computer hardware components to communicate with each other
5. **Flex cables** - cables, are electrical cables specially designed to cope with the tight bending radii and physical stress associated with moving applications, such as inside cable carriers.

Inside The Phones

1. **Gesture sensors** - touchless sensor that is capable of looking for simple gestures.
2. **Ambient light sensor** - provide measurements of ambient light intensity
3. **External test port** - allow external devices access to computers services on private networks.
4. **Rubber gasket** - Well, it is a mechanical seal that is used primarily to prevent leaks of gas or liquid, but can be used as a barrier between two objects, such as two metals or chemicals.
5. **3g GSM antenna flex cable** - GSM Antenna is one kind of Antenna to transmit GSM signal at specified frequency
6. **Radio frequency-** Contains all of the transmitter and receiver circuits. Normally direct conversion techniques are used the design for the mobile phone receiver.
7. **Digital signal processing**- Undertakes all the signal processing. Such as the radio frequency filtering and signal conditioning.

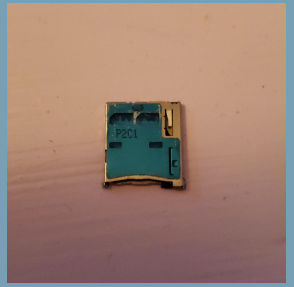
Inside The Phone

1. **Control Processor**- It controls all the processes occurring in the phone from the MMI (Man machine interface) which monitors the keypad presses and
1. **A speaker-** Takes electronics signals stored on things like CDs, tapes, and DVDs and turns it into sound we can hear.
2. **A Battery-** Powers the phone, without the battery you can't turn on the phone

Source - https://electronics.howstuffworks.com/cell-phone6.htm

https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/how-cellphone-works-inside-components.php

SIM Card

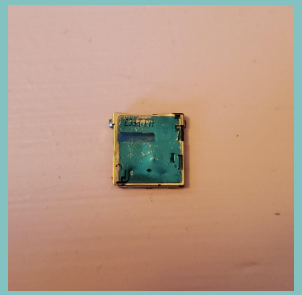


A **sim card** is otherwise known as a subscriber identity module and is used in smartphones everywhere. Its a smart card that stores data for members of the GSM cellular phones. GSM stands for Global System for Mobile communication and it is a digital mobile network that is commonly used in Europe, Asia, Africa, and most of the rest of the world. The U.S. is one exception and uses both GSM and CDMA (Code Division Multiple Access)

SIM cards are the small cards that contains a chip and are removable and transferable to other phones. In order for a GSM phone to work, a SIM card must be put into it so you can access the local mobile network to place or receive calls or send texts.

Source - https://www.thestreet.com/technology/what-does-sim-card-do-14796633

Micro SD Card



An SD card or Security digital card is something that can store additional amounts of information for you. It's used for devices like cameras, phones, for instance and it's capable of being a life saver in some situations.

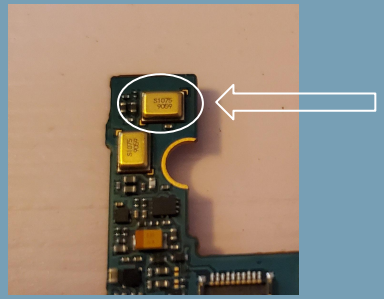
The type of SD card that most tablets, and phones are the micro SD card. A micro SD card is basically just a smaller version of the SD card, they are about the size of your fingernail. They might be small but capable of storing up to several gigabytes of information.

The SD card is a basic way of transferring information and storing it.

Source - https://www.cleverfiles.com/howto/what-is-sd-card.html

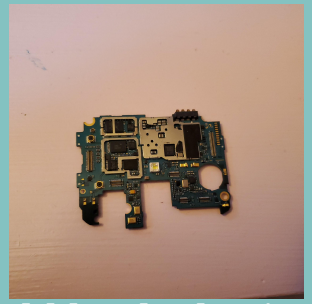
Proximity Sensor

A proximity sensor is a non-contact that detects presence of objects when they enter the sensors field. Depending on the type of proximity sensor, sound, light, infaire radiation (IR), or electromagnetics fields may be used by the sensor to detect something. Proximity sensors are used in so many things like phones, recycling plants, self-driving cars, anti-aircraft systems, and assembly lines, ect.



Source - https://www.fierceelectronics.com/sensors/what-a-proximity-sensor

Motherboard



If thought of your computer as a body, the CPU would be the brain while the motherboard would be the heart. It’s responsible for power routing, that helps coordinate how all CPU components work with one another.

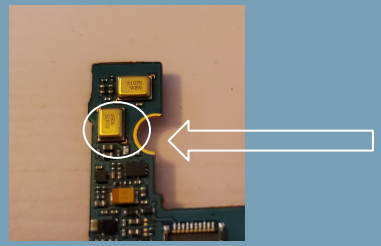
The motherboard simply organizes these computations and their results. While it doesn’t hold a lot of power itself, nothing works without the motherboard, which is why it is so vital.

Since everything is routed through the motherboard, it needs physical contact with nearly all computer components. That includes main power, CPU, RAM slots, USB, PCI, video and sound cards, and expansion slots.

Source - https://www.digitaltrends.com/computing/what-is-a-motherboard/

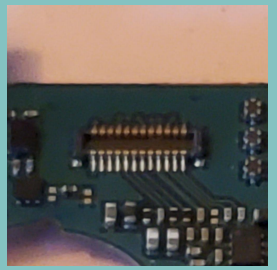
Gesture Sensor/Gesture Recognition

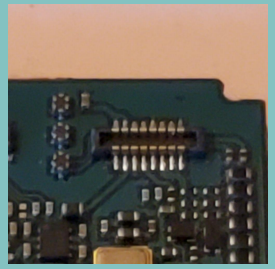
Gesture recognition is a type of perceptual computing user interface that allows computers to catch human human gesture (movements) as commands. The basic definition of gestures recognition is the ability of the computer to catch human gestures/movements, and make commands based on those movements/gestures.



Source - https://www.marxentlabs.com/what-is-gesture-recognition-defined/

Ambient Light Sensor





A ambient light sensors main purpose is, that it is a photodetector. Used for detecting the sum of ambient light nearby and reduces the screen brightness to the light.

This avoids the screen brightness whenever the users are modified for vision in a dark room. Or less brightness whenever the user is outside during the daytime

Soruce - https://www.elprocus.com/ambient-light-sensor-working-and-applications/

Radio Frequency

This are of the phone contains all the transmitter and receiver circuits. The signal output from the receiver is applied to what is termed an IQ demodulator.Here the data in the form of "In-phase" and "Quadrature" components is applied to the IQ demodulator and the raw data extracted for further processing by the phone.

On the transmit side one of the goals is to keep the battery consumption to a minimum. For GMS it is not much of a problem.

Source -
https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/how-cellphone-works-inside-components.php

Digital Signal Processing

The DSP components of a phone undertake all of the signaling processing. Processes such as the radio frequency filtering and signal conditioning at the lower frequencies they are undertaken by this circuitry. Also, equalisation and correction for multipath effects is undertaken in this area of the design.

Source -
https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/how-cellphone-works-inside-components.php

Battery

Batteries provide us with a mobile source of power that makes many modern things possible, the basic concept by which they function remains the same. When a device is connected to a battery, a reaction occurs that produces electrical energy.

Source - https://electronics.howstuffworks.com/cell-phone6.htm

Software

Cell phone networks are divided into specific areas called cells. Each cell has an antenna that receives cell phone signals. The antenna transmits signals just like a radio station, and your phone picks up those signals just as a radio does. Smartphones use cell phone network technology to send and receive data. Some smartphones run on processors. Along with processors, smartphones also have computer chips that provide functionality. Phones with cameras have high-resolution image sensors, just like digital cameras. Other chips have more complex uses, like browsing the internet, sharing files, ect. Some manufacturers develop chips that integrate multiple functions to help reduce the overall cost. The most important software of any phone is the operating system. The operating system manages the hardware and software on a phone. Designed primarily for touch-screen mobile devices, Android, or Droid, technology is the operating system that most mobile telephones used as of comscore february 2014 numbers. Android operating systems can run multiple applications, allowing users to be multitasking mavens. Any hardware manufacturer is free to produce its own Android phone by using the operating system. In fact, many smartphone companies do just that. Android app store has hundreds of thousands of apps. All of the data stored on the phone can be synchronized with outside applications or manipulated by third-party phone applications in numerous ways. First of all, bluetooth allows phones to wirelessly connect with each other and other devices that support it. And synchronized data allows your phone to keep track of your personal information. A phone that is compatible with Java programming allows user to run and load Java applications and MIDlets. MIDlets are applications that use a subset of Java and are specifically programmed to run on wireless devices.

Source - https://electronics.howstuffworks.com/smartphone5.htm

Pictures (For Hydro)

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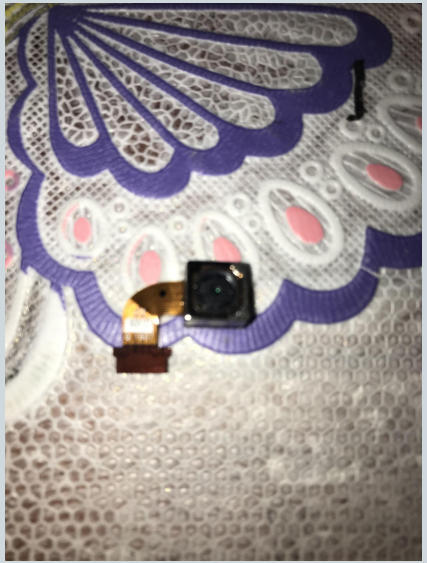

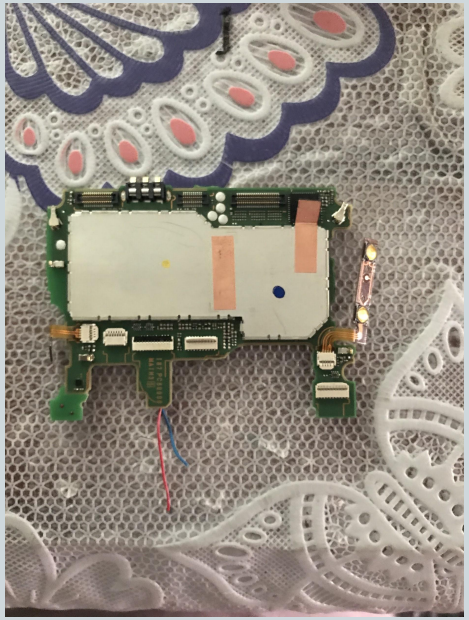

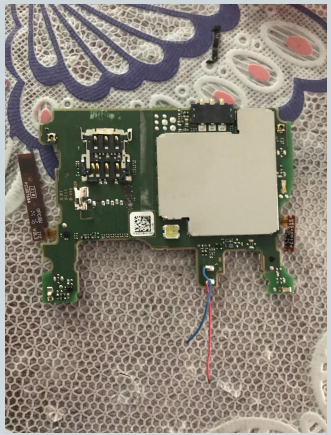

Pictures (For Samsung)

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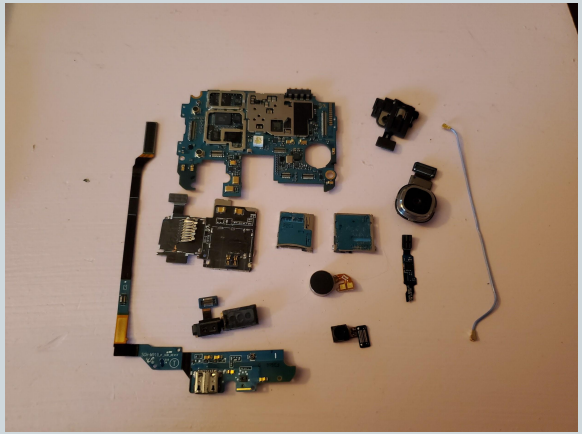

Things Both Phones Have in Common

Both of the phones were similar but still different. These are some thing that are similar. They both have a mainboard. They both had wires/ flex cables. They both had a sim card and a micro sd card. They also both had a speaker. They both had cameras. They both had a charging port. They both had a flash LED. They both had a proximity sensor. They both also had a gesture sensor. They both a 3 GMS antenna flex cable. They both had the external test port. Also both had rubber gaskets.

Things That Are Different

Both phones were similar but also had many differences. Like the hydro was waterproof and the other was not. The Samsung had a ambient light sensor and the hydro didn’t. They are very similar inside but outside (the display) are also different. Like for example the hydro didn’t have a home button. The Samsung had rounded edges and the hydro had square edges.

Final Report

All of the parts are certainly different and have different functions. Two parts could be beside each other and be two completely different things. Like for example sensors. They all are sensors but they do different things. Like a light sensor and a motion sensor. A light sensor detects light and a motion sensor detects motion. So they could be the same TYPE of thing but do two completely different things.

We found many things in the phones. Like the **sim card**, they are designed to connect to a mobile network allowing a user to use the communicative functions of a phone. We also found a **microSD** card, A **microSD** card lets you easily move your files, photos, and music from device to device without having to rely on steady Wi-Fi or costly data. There was also a **proximity sensor**, a **proximity sensor** can detect the presence of nearby objects. There were also a bunch of **flex cables**, they are electrical cables specially designed to cope with the tight bending radii and physical stress associated with moving applications, such as inside cable carriers. There was also a **gesture sensor**, it is a touchless sensor that can detect simple gestures (movements.) There were also **external test ports**, to allow external devices access to computers services on private networks. We found **rubber gaskets**, they are a mechanical seal that is used primarily to prevent leaks of gas or liquid, but can be used as a barrier between two objects, such as two metals or chemicals. And of course there was the **motherboard**, the Motherboard itself is a printed circuit board that allows the CPU, RAM, and all other computer hardware components to communicate with each other.

Final Report

There was also a gesture sensor, a **gesture sensors** is a touchless sensor that is capable of looking for simple gestures. There was also an **ambient light sensor**, an ambient light sensor provides measurements of ambient light intensity. We also saw an **external test port**, this allows external devices access to computers services on private networks. As well as this there were also **rubber gaskets**, its a mechanical seal that is used primarily to prevent leaks of gas or liquid, but can be used as a barrier between two objects, such as two metals or chemicals. There was also a **3g GSM antenna flex cable**, thixs GSM Antenna is one kind of Antenna to transmit GSM signal at specified frequency, there wa alsp **radio frequency**, it contains all of the transmitter and receiver circuits. Normally direct conversion techniques are used the design for the mobile phone receiver. There was also **digital signal processing**, this undertakes all the signal processing. Such as the radio frequency filtering and signal conditioning. We also found a **control Processor**, it controls all the processes occurring in the phone from the MMI (Man machine interface) which monitors the keypad presses. Also a **speaker,** it takes electronics signals stored on things like CDs, tapes, and DVDs and turns it into sound we can hear.There was also **a battery,** it powers the phone, without the battery you can't turn on the phone.

Resources

https://electronics.howstuffworks.com/cell-phone6.htm

https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/how-cellphone-works-inside-components.php

https://fossbytes.com/whats-inside-smartphone-depth-look-parts-powering-everyday-gadget/

https://electronics.howstuffworks.com/smartphone5.ht

https://www.thestreet.com/technology/what-does-sim-card-do-14796633

https://www.cleverfiles.com/howto/what-is-sd-card.html

https://www.fierceelectronics.com/sensors/what-a-proximity-sensor

https://www.digitaltrends.com/computing/what-is-a-motherboard/

https://www.marxentlabs.com/what-is-gesture-recognition-defined/

https://www.elprocus.com/ambient-light-sensor-working-and-applications/

Conclusion

The phones were very similar but also different at the same time. They had had more similarities than we thought they did.

We had a wonderful experience with this project. It was very fun to take the phones apart and do research about them. This was a great learning experience. We learned from this project very much.

In conclusion this was a fun project to do and we had a great time working together.