It is quite obvious that we, as a human species, have reached great heights in the sphere of technology and computer science. In the world of today, nearly everything we own or scientifically reach, has been influenced or done by software engineering. I mean just look at the devices each of us keep in our pockets. A small and really portable device, capable of not only reaching anyone in the world, as long as you have their contact information, but also providing us with endless information and entertainment with the use of internet. While from the outside, these devices seem simple, we had to go through extreme lengths to achieve such technologies. And by taking a look and thinking what it took to make these technologies, we can put into perspective the amount of work it took us to get here.

In my presentation, I will touch on how technologies helped WATCH and EXPLORE space;

Let’s start with space observation:

Before the introduction of modern technologies, astronomers would use lenses or mirrors in order to get a glance of the cosmos. They worked similarly to a magnifying glass, however they were much larger and had a lot more lenses and mirrors. However, these telescopes presented endless engineering problems and had to be extremely pure throughout their entire volumes, while mirrored surfaces require ultra-fine precision only on the surface.

Modern telescopes gather information from the electromagnetic spectrum far beyond the range of visible light. Telescopes that survey radio, x-ray, and gamma-ray wavelength have dramatically broadened our understanding of the universe. Radio telescopes -- huge wire-mesh dishes designed to focus radio signals from space -- have helped to map the spiral arms of our galaxy, while gamma-ray observatories high in Earth orbit have captured the high-energy signals of exotic objects such as black holes and gamma-ray bursts.

Let’s move on to space exploration:

With the development of rockets and the advances in electronics and other technologies in the 20th century, it became possible to send machines and animals and then people above Earth’s atmosphere into outer space. We’ve all seen a video rocket taking off. Ever thought of the amount of work people had to do to not only build, but make the rocket fly? It’s not only engineering. There are a huge amount of systems on board that help the rocket stay stable, measure its speed, altitude, direction, all the forces that are affecting the rocket and in turn control the usage of the fuel. While engineers have to make sure everything is stable, balanced and connected, software engineers have to make sure the rocket’s electronic devices can provide the rocket’s engines, fuel tanks and adjustment engines with instructions on what and when to do. This is a huge part of getting a rocket or a satellite to space. As a single line of code or one bad calculation can cause a catastrophe. Apollo 11 was the spaceflight that first landed humans on the Moon, which was a great achievement to the human kind. This mission took an extreme amount of work to be successful. For example. Margaret Hamilton coded the guidance and navigation system for the Apollo spacecraft. Additionally, the system that calculates and adjusts the spaceships course back to earth, took less memory than your average calculator.

Let me tell you a story of the most expensive software bug in the world.

On June 4th, 1996, just 37 seconds after the celebrated launch, Ariane 5 rocket flipped 90 degrees in the wrong direction. The on-board computer had concluded that a deviation in telemetry had occurred and it took measures by correcting the course — turning the rocket 90 degrees in the wrong direction. The computer looked at the Flight data coming from the Inertial Guidance system — the eyes and ears of the rocket- and saw Bizarre and nonsensical data. Less than two seconds later, at a height of 4 km, massive aerodynamic forces ripped the boosters apart from the main stage of the misaligned rocket. This triggered the self-destruct mechanism, and the spacecraft was engulfed in a spectacular fireball of liquid nitrogen, along with its payload of four expensive uninsured scientific satellites.

As in rockets, same applies to satellites as well. There is a huge amount of software engineering to keep them in space. They too have intricate and highly developed systems that calculate their speed, altitude, manage the solar panels and the generated electricity, and adjust the conditions inside it for the astronauts and so on. This took a lot of time and effort to code everything ant get it to where it is today.

Last but not least, we have to talk about the exploration on mars. While humans have certainly been on the moon, we have not landed on mars yet. Since Mars is much further away from earth and its conditions are much worse than our planet’s we can’t set foot on it yet. What we can do though, is send robots that can withstand the harsh environment of our neighbor planet. And that is exactly what we did. We sent out a rover that can explore the planet for us. And the results of this project are outstanding. The rover has a lot of functions for its size. The rover’s mission is to send us images of Mars’s environment. However, it still needs to actually survive and not break to do so. So with the help of robot and software engineering, scientists have come up with smart and interesting ways for the rover to survive. For example nights on Mars are extremely cold and days are extremely hot because of the lack of atmosphere. So the engineers had to build systems that allowed the robot to stay warm at night and cold at day. And during the day collect the needed amount of energy, needed to keep these systems active all of the time. This is quite impressive, considering the size of the rover, which is about the size of a car.

In conclusion, As we can see, technologies have greatly improved not only our space observations, by upgrading our telescopes and allowing us to take a look into deep space, make new and interesting discoveries, but also allowed us to use rockets, travel from the moon and back, do research and take pictures of stars and other planets from outer space and explore our neighbor planets using robots.