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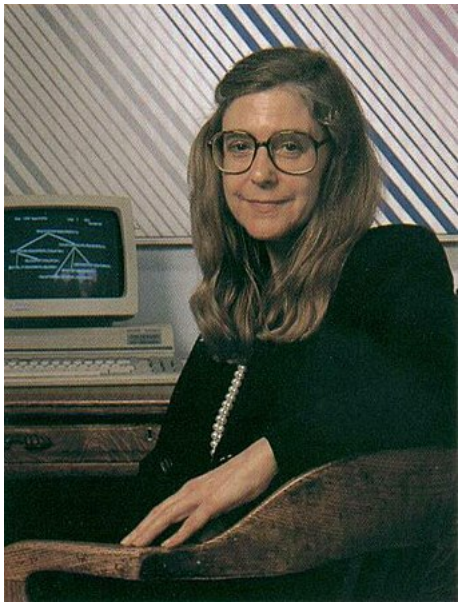
CS3012/CSU33012- Software Engineering

Biography of Margaret Hamilton



Early Life

Margaret Hamilton was born August 17, 1936 in Indiana USA. In 1955 she began studying at the university of Michigan. However, she transferred to Earlham College where she earned her BA in mathematics. During her studies she met her first husband, James Hamilton. After completing her undergrad, she got a job as a programmer at MIT in order to support her husband through his studies at Harvard Law School. While working at MIT the couple had their first child in 1959, Lauren. Unfortunately, the couples romance was not meant to be, they were divorced in 1967. While working at MIT Margaret Hamilton began postgraduate work in Metrology.

Career

In 1961 she began working at the MIT Lincoln Lab. While there she was working on Semi-automatic Ground Environment (SAGE) project, where she was a key software engineer on the first prototype for the AN/FSQ-7 computer (the XD-1). After her work on SAGE, Hamilton joined the Charles Stark Draper lab in MIT. Where she worked on the Apollo space mission. Soon she led the team who were key in developing the software for the Apollo missions.

Hamilton's team were responsible for developing the in-flight software for the Apollo 8 and Apollo 11 missions. Hamilton worked to pioneer software engineering itself as there was few computer science courses available at the time and software engineering courses were unheard of. Developers in the project, such as Hamilton, often invented code to solve any problems that arose. Software engineering was not held with too much regard at that time

in NASA. It was not included in the budget. With Hamilton's work, the Apollo project soon learned that software was critical in completing their missions. In 1965, Hamilton became responsible for the onboard flight software on the Apollo computers. Her dedication to the projects was immense and the pressure sometimes kept her up at night. According to McMillan, one night after a party, she raced back to the lab to correct code that she realised was wrong. She was quoted as saying "I was always imagining headlines in the newspapers, and they would point back to how it happened, and it would point back to me." Hamilton's diligence in the fledgling software engineering field contributed enormously to the Apollo programme, allowing the spacecrafts to complete their missions safely.

As a working mother in the 1960s Hamilton was an anomaly, especially in the field of science and engineering. She often would have to bring her daughter, Lauren into the lab with her. One day, Lauren was playing with the MIT's command module simulator's unit. As she continued pressing buttons, an error message came up on the screen. Lauren had crashed the simulator by activating a prelaunch program called P01 while the simulator was in flight. "Digital Apollo" details that Hamilton wanted to write code to prevent the crash happening during the real flight. However, NASA overruled this as unnecessary. They were adamant that there was no reason an astronaut would activate this program during flight. Hamilton said; "We had been told many times that astronauts would not make any mistakes, they were trained to be perfect." However, Hamilton still created a program note inside its documentation that was available to NASA engineers and the astronauts. "Do not select P01 during flight." Hamilton wanted to add error-checking code to all Apollo systems to prevent a disaster such as this from happening. All of her superiors rejected such a notion, claiming that it would 'never happen'. Hamilton's proficient solution to this complication within the software is representative of her contribution to the Apollo missions.

However, during the historic Apollo 8 flight, Hamilton's worst fears came true. It was during Christmas in 1968, on the way back to earth from the first manned orbit of the moon. Astronaut Jim Lowell accidentally selected the P01 program during flight. Launching this program had erased all of the navigation data he had been collecting. Without this information, the Apollo program had no way of bringing the astronauts home. After nine hours of searching through a program listing, Hamilton and her MIT team figured out a

solution. Houston would upload navigational data to the spacecraft, using Hamilton's programs. If it were not for Hamilton and her team, the astronauts of the Apollo 8 mission would not have been able to return to Earth. Her expertise in software engineering provided a proficient solution, which saved the astronauts' lives. This signifies the importance of her contributions to the Apollo 8 mission.

According to McMillan, The Apollo 11 flight carried two identical computers. One was in the lunar module, which landed the astronauts on the moon and the other for the command module that brought them to and from Earth. It was the first computerized onboard navigation system designed to be operated by humans but with autopilot technology. It also was the first time that a computer had been in a spacecraft and software was given the responsibility of landing a spacecraft. "It was the first time that an important computer had been in a spacecraft and given a lot of responsibility for the mission," says Don Eyles, a colleague of Hamilton's. Without the code written by Hamilton and her team, the computer would have failed. Neil Armstrong, Buzz Aldrin and Michael Collins would not have made it to the moon. This is an example of Hamilton's vast contribution to the Apollo 11 mission.

In a crucial moment of the Apollo 11 mission, the on board guidance computer and Hamilton's software. Moments before the landing module several alarms were triggered. A documentation error had occurred. The computer began to spit out error messages during this crucial stage of the mission. Hamilton's priority alarms interrupted the astronauts' normal monitors to warn them that the computer systems were failing. The astronauts were given a choice by the computer, 'a go or no go' decision whether or not to land. Hamilton's software recognised that it was being overloaded with tasks and began to prioritise them, with landing the module being the highest priority. Without Hamilton's fault-recognising programs, the Apollo 11 mission would not have been successful and the astronauts would not have been able to walk on the moon. Dr. Paul Curto, a senior technologist in NASA, called Hamilton's work "the foundation for ultra-reliable software design." Hamilton later said of the incident, "if the computer hadn't recognized this problem and taken recovery action, I doubt Apollo 11 would have been the successful moon landing it was."

Legacy

Thanks to Hamilton and the work she led, notions of what humanity could do, and be, changed not just beyond the stratosphere but also here on the ground. She was credited with creating the term software engineer. Hamilton left MIT in the mid-1970s to work in the private sector. She cofounded the company Higher Order Software in 1976 and established Hamilton Technologies 10 years later. Hamilton also received various honours, including NASA's Exceptional Space Act Award (2003). Pres. Barack Obama presented her with the Presidential Medal of Freedom in 2016. More recently this year she was awarded the Washington award and the Intrepid Lifetime Achievement Award. Furthermore, she was part of the Women of NASA LEGO set. Her contributions to software engineering were key to the development of software engineering.