Right now, our world is undergoing a major technological revolution. Self-driving cars are being developed to replace human drivers, while restaurants and hotels are starting to use mobile robots to serve customers. These autonomous systems help reduce tedious task and take on dangerous missions that were once performed by people. With these advancements, it’s clear that those robots will play a key role in reshaping how we work in the near future.

However, this technological shift also brings new challenges. In the future, people won’t just encounter mobile robots in high-tech factories—they’ll interact with them in every day settings, including streets and public spaces. While the main task for many of these robots is simple—moving from point A to point B—they often encounter people, cars, or other unexpected obstacles along the way. To ensure safety, these robots must avoid such obstacles in real-time. Unfortunately, many of today’s navigation systems still struggle with dynamic environments, highlighting their limitations in handling moving obstacles. This is a critical area where further improvements are needed.

My research focuses on developing an improved obstacle-avoidance algorithm for a specific type of mobile robot called the General Bicycle Model (GBM). Similar to bicycles, this robot has two wheels. But, unlike regular bicycles that steer by turning the front wheel, the GBM’s two wheels can rotate independently. This design allows the robot to move in any direction without changing its orientation—similar to how a crab moves. This flexibility makes GBM highly maneuverable.

But how can we make the GBM avoid obstacles on its own and reach its destination safely? The solution lies in helping the robot develop a kind of "special awareness." This means the robot must continuously observe obstacles around it, assess the risk of collisions, and adjust its path to minimize those risks. To find the safest route, the GBM must make decisions on the go and refine them in real-time.

However, giving a robot the ability to evaluate risks requires solving complex mathematical equations. These equations describe the risk factors and constraints in its environment. The challenge is that solving intricate equations can slow down the robot’s computer, causing delays in decision-making. In some cases, the robot might even get stuck, which could lead to dangerous situations. To prevent this, my current focus is on simplifying the mathematical functions in order to make GBM move smoothly.

If we can overcome this challenge, we will move one step closer to achieving fully autonomous robots. With better navigation systems, these robots could safely and efficiently operate in complex environments, bringing us to a future where robots are a seamless part of everyday life.