The Design of an Intelligent Robotic Ground Vehicle

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- **Introduction**
  - The primary goal of this research is to design and implement an intelligent robotic ground vehicle
    - Robotic: not only working under remote control, but also working fully autonomously without human control
    - Intelligent: able to collect and process real-time information so as to make sound decisions
  - Possible applications: precision farming, autonomous landscaping, indoor search and rescue, outdoor scientific exploration and military applications

- **How does it work**
  - Accept a predefined task
    - For example, using an autonomous lawnmower to mow a grass field accurately and rapidly
    - For another example: using a search and rescue robot to search a field dangerous to human being, looking for victims and making rescue efforts
  - Detect the working environment
    - Use advanced sensor technologies, map the surrounding environment
      - Tasks may include determining the boundary and shape of the working field, and looking for existing objects within the field
      - Ultimately, map the working field with coordinates
  - Navigation, guidance and control
    - Determine current position, velocity, acceleration and attitude information
      - Outdoor navigation using Inertial Navigation System (INS) and satellite positioning like GPS
      - Indoor navigation using INS, laser scanners and camera
    - Define a path to follow for completing the predefined task
      - Waypoint navigation
    - Fully electrical driving under the control of a computer
    - Detect and avoid obstacles
      - Detect stationary and moving obstacles
      - Dynamic path planning and following
  - Fulfill the predefined task
    - In the meantime, may communicate with a control station to update and report the progress

- **Technologies used or being developed**
  - Machine vision and pattern recognition
  - Advanced navigation technologies
  - Sensor fusion techniques
  - Artificial intelligence and mobile robotic control
  - Wireless communication and networking
  - And more