The Design of an Intelligent Robotic Ground Vehicle

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• Introduction
  o 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
  o Possible applications: precision farming, autonomous landscaping, indoor search and rescue, outdoor scientific exploration and military applications

• How does it work
  o 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
  o 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
  o 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
  o Fulfill the predefined task
    ▪ In the meantime, may communicate with a control station to update and report the progress

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