Long-Term Visions for Equipment

Opportunities for Innovative Equipment, and Some Challenges

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Equipment are Tools that:

- Increase/Multiply Human Ability/Capacity
  - hydraulics, wheeled equipment, speed, over-the-horizon radar, computers

- Extend/Supplement Human Ability
  - ultrasound, IR/UV, precision, flying

- Enable Humans to Go Where They Cannot Survive
  - underwater, outer-space, hazardous environments
New Resources Available Now/Soon

- Sensors – single-chip ultrasound, tactile, cheap lidar
- Miniature machines
- Processors and software – vision & sensor input
- Multi-spectrum vision systems – visual, IR, sound, etc.
- 30 cm accuracy GPS (L5), or better if needed
- 3D Manufacturing
- Augmented Reality (AR), Artificial Intelligence (AI)
- IP Remote feedback, <200ms and <500ms delay
- Overhead Platforms – UAV, pole, balloon
- 3D GIS Maps with feature definition
- Transparent photovoltaics – windows that create electricity
Opportunities

- One operator controls many semi-autonomous machines
- Primarily semi-automation, some full automation
- Intuitive controls – less learning curve
- Sequenced worksite – multi-unit oversight from above
- Interconnected work zones, employees, equipment, vehicles, bicyclists, and pedestrians
- Auto-sense impaired/tired operators by voice pattern?
- Micro-machine applications?
- More Safe - reduce accidents and injury/deaths?
- Faster - remote and automated work 24/7 instead of 8/5?
- Less Cost – can overall cost decrease?
Challenges

- **Human Factors**
  - Operator controls multiple equipment pieces simultaneously
  - Intuitive controls

- **Software and Sensors**
  - Semi-automation, automation, and multi-machine sequencing and coordination

- **Mapping**
  - GIS and feature mapping the right-of-ways

- **Support and Maintenance**
  - OEM/Distributor maintain ownership and users pay a fee when using equipment?

- **Security**
  - Vandalism of remotely-located items
  - IT, remote control

- Envision continued daily fuel truck visit, but this is good since it means daily hands-on and eyes-on inspections.
Its Already Begun

[VIDEO] Autonomous Rebar-Tying Robot Could Revolutionize Bridge Construction

Contractor-designed Tybot can tie rebar automatically with only one worker supervising the operation and could ultimately halve rebar-tying labor hours.

NOV. 2, 2017

[VIDEO] Built Robotics Develops Autonomous Track Loader for Construction

Prototype autonomous compact track loader designed specifically for construction completed its first project this summer.

OCT. 20, 2017
Perceptin's Under-$10K Self-Driving Vehicle

It's a slow-driving pod, but that should be good enough for corporate campuses

By Philip E. Ross

PerceptIn provides core technologies and solutions for the next generation of robotic computing platforms

**Hardware**
- Multi-Sensor Computing Module
- Factory Calibration
- Hardware Synchronization

**Software**
- User-Friendly SDK
- Heterogeneous Computing
- Dynamic Workload Scheduling

**Algorithm**
- Sensing
- Perception
- Decision
Asphalt-Printing Drones Could Be Solution to Potholes

Researchers have "trained" image recognition algorithms to detect potholes and then installed them into drone cameras. After the damaged areas were identified, a drone is dispatched to the site, using an on-board asphalt 3D printer to patch the hole.

JUNE 25, 2018
Imagine if we move beyond today...

Invest in Innovation. Invent new.
References:

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