linity agents, oxidation inhibitors, dispersants, and anti-wear agents. These additives give the engine oil its desirable qualities.

The best way to keep overall diesel engine maintenance costs low is to get regular servicing. A certified technician has to run numerous tests on diesel engine, ensuring quality fuel efficiency, mileage, part integrity and durability. It's not a complicated equation: Taking care of your diesel engine means it will take care of you and your time.

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MAINTANENCE ON MODERN FARMS: INNOVATIVE EQUIPMENT

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Adstract. Smart farming and precision agriculture involve the integration of advanced technologies into existing farming practices in order to increase production efficiency and the quality of agricultural products. They also improve the quality of life for farm workers by reducing heavy labor and tedious tasks.

Keywords: automation, agricultural robot, smart equipment, autonomous tractor, technological advancement, precision seeding equipment, smart factory, drone.

Every aspect of farming can benefit from technological advancements – from planting and watering to crop health and harvesting. Most of the current and impending agricultural technologies fall into three categories that are expected to become the pillars of the smart farm: autonomous robots, drones or UAVs, and sensors and the Internet of Things (IoT).

Replacing human labor with automation is a growing trend across multiple industries, and agriculture is no exception. Most aspects of farming are exceptionally labor-intensive, with much of that labor comprised of repetitive and standardized tasks – an ideal niche for robotics and automation.

We're already seeing agricultural robots – or AgBots – beginning to appear on farms and performing tasks ranging from planting and watering, to harvesting and sorting. Eventually, this new wave of smart equipment will make it possible to produce more and higher quality food with less manpower.

The tractor is the heart of a farm, used for many different tasks depending on the type of farm and the configuration of its ancillary equipment. As autonomous driving technologies, tractors are expected to become some of the earliest machines to be converted.

In the early stages, human effort will still be required to set up field and boundary maps, program the best field paths using path planning software, and decide other operating conditions. Humans will also still be required for regular repair and maintenance.

Nevertheless, autonomous tractors will become more capable and self-sufficient over time, especially with the inclusion of additional cameras and machine vision systems, GPS for navigation, IoT connectivity to enable remote monitoring and operation and radar and LiDAR for object detection and avoidance. All of these technological advancements will significantly diminish the need for humans to actively control these machines [1].

Sowing seeds was once a laborious manual process. Modern agriculture improved on that with seeding machines, which can cover more ground much faster than a human. However, these often use a scatter method that can be inaccurate and wasteful when seeds fall outside of the optimal location. Effective seeding requires control over two variables: planting seeds at the correct depth, and spacing plants at the appropriate distance apart to allow for optimal growth.

Precision seeding equipment is designed to maximize these variables every time. Combining geomapping and sensor data detailing soil quality, density, moisture and nutrient levels takes a lot of the guesswork out of the seeding process. Seeds have the best chance to sprout and grow and the overall crop will have a greater harvest [1].

As farming moves into the future, existing precision seeders will come together with autonomous tractors and IoT-enabled systems that feed information back to the farmer. An entire field could be planted this way, with only a single human monitoring the process over a video feed or digital control dashboard on a computer or tablet, while multiple machines roll across the field.

Subsurface Drip Irrigation (SDI) is already a prevalent irrigation method that allows farmers to control when and how much water their crops receive. By pairing these SDI systems with increasingly sophisticated IoT-enabled sensors to continuously monitor moisture levels and plant health, farmers will be able to intervene only when necessary, otherwise allowing the system to operate autonomously.

Weeding and pest control are both critical aspects of plant maintenance and tasks that are perfect for autonomous robots. A few prototypes are already being developed, including Bonirob from Deepfield Robotics, and an automated cultivator that is part of the UC Davis Smart Farm research initiative [2].

While these examples are robots designed for weeding, the same base machine can be equipped with sensors, cameras and sprayers to identify pests and application of insecticides.

These robots, and others like them, will not be operating in isolation on farms of the future. They will be connected to autonomous tractors and the IoT, enabling the whole operation to practically run itself.

Harvesting depends on knowing when the crops are ready, working around the weather and completing the harvest in the limited window of time available. There are a wide variety of machines currently in use for crop harvesting, many of which would be suitable for automation in the future.

Traditional combine, forage, and specialty harvesters could immediately benefit from autonomous tractor technology to traverse the fields. Add in more sophisticated tech with sensors and IoT connectivity, and the machines could automatically begin the harvest as soon as conditions are ideal, freeing the farmer for other tasks [2].

Developing technology capable of delicate harvest work, like picking fruit from trees or vegetables such as tomatoes, is where high-tech farms will really shine. Engineers are working to create the right robotic components for these sophisticated tasks, such as Panasonic's tomato-picking robot which incorporates sophisticated cameras and algorithms to identify a tomato's color, shape and location to determine its ripeness.

This robot picks tomatoes by the stem to avoid bruising, but other engineers are trying to design robotic end effectors that will be capable of gently griping fruit and vegetables tight enough to harvest, but not so hard that they cause damage.

Another prototype for fruit picking is the vacuum-powered apple picking robot by Abundant Robotics, which uses computer vision to locate apples on the tree and determine if they are ready to harvest [2].

These are only a few of the dozens of up-and-coming robotic designs that will soon take over harvesting labor. Once again, with the backbone of a robust IoT system, these agbots could continuously patrol fields, check on plants with their sensors and harvest ripe crops as appropriate.

Innovative, autonomous agbots and drones are useful, but what will really make the future farm a "smart farm" will be what brings all this tech together: the Internet of Things.

The IoT has become a bit of a catch-all term for the idea of having computers, machines, equipment and devices of all types connected to each other, exchange data, and communicating in ways that enable them to operate as a so-called "smart" system. We're already seeing IoT technologies in use in many ways, such as smart home devices and digital assistants, smart factories and smart medical devices.

Smart farms will have sensors embedded throughout every stage of the farming process, and on every piece of equipment. Drones will tour the sky, getting the bird's eye view of plant health and soil conditions, or generating maps that will guide the robots, and help the human farmers to plan for the farm's next steps. All of this will help create higher crop production, and an increased availability and quality of food.

This mountain of data and other information generated by farming technology, and the connectivity enabling it to be shared, will be the backbone of the future smart farm. Farmers will be able to "see" all aspects of their operation – which plants are healthy or need attention, where a field needs water, what the harvesters are doing –and make informed decisions.

And this discussion has only touched on the tip of the proverbial iceberg with the focus on vegetative crops; there is an equal groundswell of smart technology adoption for animal husbandry, and many more drones and robots for every aspect of farming. If every farm in the country becomes a smart farm, reaching 70 percent increase in food production is a certainty.

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ТЕХНОЛОГИИ ОЧИСТКИ ДВИГАТЕЛЯ И ЕГО ДЕТАЛЕЙ ПРИ ПРОВЕДЕНИИ РЕМОНТА

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Аннотация. В статье рассматриваются существующие способы очистки двигателя и его деталей от нагароотложений. Отложения в виде асфальто-смолистых веществ и нагаров ухудшают ресурсные показатели работы двигателя.

Ключевые слова: двигатель, нагароотложения, очистка, водотопливная эмульсия.

В процессе эксплуатации сельскохозяйственной техники на поверхностях деталей двигателя образуются отложения в виде асфальто-смолистых веществ и нагаров, что ухудшает ресурсные показатели работы двигателя.