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AUTOMATIC TECHNOLOGIES IN MODERN FARMING

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ABSTRACT

The future of agriculture lies in automatic technologies. Rising costs for farm labour and the need to improve productivity and farm produce yield is the main reason for developing Automatic technology. The autonomous technologies free the farmer from the repetitive work. More acres of land can be worked and for longer time periods. They are especially helpful for planting and harvesting when the skilled labour are inadequate. Falling costs for self-driving technology also provide further catalysts for the shift. The impact of these autonomous technologies could be dramatic while opening the door for expanding opportunities to improve productivity. The study focuses on the safety features currently available with these, the various advanced technologies that are used in the modern farming and the challenges associated with these automatic technologies.

Keywords: Automatic technologies, driverless tractors, modern farming, safety features, sensing technologies, tracking technologies

I. INTRODUCTION

Many university researches and product development companies are working on automatic vehicles. Rising costs for farm labour and the need to improve productivity and farm produce yield is the main reason for developing Auto-Drive technology for tractors. This technology is aimed at turning existing tractors into semi-autonomous machines. Falling costs for self-driving technology also will provide further catalysts for the shift. At the same time, the progress in self-driving technology for automobiles — including both object detection capabilities using multicamera systems, radar and lidar technology could help speed up and lower the cost of developing autonomous farm machinery. The content and technology to move to driverless cars cost about $2,700 per vehicle, according to Goldman Sachs.

In agriculture, autonomous driving equipment would require technology where there is a slightly higher complexity, but not disproportionately higher. This auto drive technology is set to make farming more productive & profitable, reduce health hazard for farmers and change the future of food production. Autonomous tractor could presumably work unmanned around the clock and uses GPS and sensor technology. The grower could remotely monitor and control the machine using a device such as a tablet.

There's also interest in smaller tractors and agriculture robots, and some see them working in groups of five or more in a swarm-like action. According to Goldman Sachs, a fleet of smaller automated tractors could lift farmer revenue by more than 10 percent and reduce farm labour costs. It also suggests that precision agriculture technology used today is already saving growers money and increasing yields.

II. OBJECTIVES

This study is mainly concerned with the developments in the automatic technologies that are used in automobiles. The objectives of the paper are to focus on the recent advancements in the autonomous tractors, the technologies that are been recently developed, the safety features currently available with these, the various advanced technologies that are used in the modern farming and the challenges associated with these automatic technologies.

III. METHODOLOGY

For Secondary sources and information Journals, articles, newspaper, internet, books and ILO report on women entrepreneurs are referred. The secondary data is also collected from the published reports of World Bank.

IV. LIMITATIONS OF THE STUDY

The study is conducted based on the secondary data available which is only a conceptual research and no empirical results are available.

V. SAFETY FEATURES

Some of the technologies used in driverless tractor are:

Auto steer: GPS based technology that enables a tractor to travel along a straight line.

Auto-headland turn: Enables the tractor to orient itself along adjacent rows for continuous operation without any steering input from the farmer.

Auto-implement lift: Feature in the tractor that automatically lifts the work tool from the ground at the end of a row and lowers the tool after the tractor has oriented itself for operation at the next row.

Skip passing: This technology feature enables the tractor to steer to the next row for continuous operation without any intervention of the driver.

In addition, the driverless tractor is also equipped with some unique safety features as below:

Geofence lock: Prevents tractor from going outside the boundaries of the farm

Control via Tablet User Interface: Enables the farmer to program various inputs needed to farm efficiently. Also offers controls to prevent the tractor veering off from its intended path or desired operation. He can also control the tractor remotely via a tablet.

Remote Engine Start Stop: Ability to stop the engine and hence, bring the tractor to a complete STOP if needed in cases of emergency.

With the deployment of this technology on automatic tractors, the farmers can work their fields for long hours without exposing themselves to harsh weather or difficult operating conditions. They can also protect themselves from potential health hazards resulting from operations like insecticide spraying which now can be done without human intervention. It will also ensure better quality and consistency in farming operations, leading to higher productivity and farm produce yields.

The CNH Industrial and Autonomous Solutions unveiled the NHDrive concept tractor. It is an unmanned, fully autonomous tractor that can be monitored and controlled by the farmer's desktop or tablet, giving them the ability to control the tractor or access data from different locations. Farmers have the freedom to check fields from one location while tending to another field any time day or night. Pre-mapped private paths help the NHDrive concept tractor easily move around the farm. From his desktop or tablet, the farmer can give instructions on where to go around the farm. Once it has reached its destination, the tractor will either begin its task or work in a convoy on command.

The tractor has a live camera feed with four real-time views- two in the front and two from the rear. It also has a screen that shows the tractor's progress as it works the field. There's an option to add an additional monitoring screen that would indicate key machine elements like engine speed and fuel levels but also seeding rates or coulter downforce concept. The tractor can autonomously seed the next crop straight behind the combine. Because it has the capability to work 24 hours a day, 7 days a week, the risks associated with human error can be reduced in addition to extending the work day to take advantage of favorable weather.

For some farmers, automation is already there. Robotic milking machines are used by some dairies, and planting is automated in vegetables, yet weeding and harvesting of vegetables and fruit largely relies on hand labour.

VI. AUTOMATIC TECHNOLOGIES IN PLACE AROUND THE WORLD

Driverless tractors development is already advanced in the US, where John Deere, AGCO and others have working technology that can send tractors on pre-programmed routes.

Mahindra & Mahindra (M&M) plans to introduce first driverless tractor in India in 2018. The tractor was developed at the automobile giant's research facility in Chennai. The tractor can auto-steer and is able to detect and avoid obstacles. It is also capable of making automatic headland turns, automatic lift and drops and make emergency stops. Tractors with any field implement can be controlled and operated remotely using hand held tablets. The technology is aimed at offering small farmers better operational efficiencies for tasks such as planting, spraying and harvesting. Coupled with 'Digisense' technology, the driverless tractor offers a distinct advantage to the Indian farmer by bringing an unprecedented level of intelligence to the tractor

Europe's CNH Industrial, known for its Case IH tractor brand, plans to unveil an autonomous concept tractor presumably work unmanned around the clock and uses GPS and sensor technology. The grower could remotely monitor and control the machine using a device such as a tablet. CNH's concept tractor does maintain the driver cab so the operator can perform tasks not presently suited to automation, such as commuting between fields or going through suburban or rural community roads to reach a farm.

AGCO has a concept that would give small mobile, cloud-controlled units the capability to perform various tasks in farming. The technology from AGCO's Fendt subsidiary "is focused on eliminating not only the cost and inefficiencies of an operator, but also the cost of the tractor and the planter tool bar as well," according to the company.

AGCO expects a fleet of field robots could also be offered as a service by dealers to farmers since they could presumably be put on a trailer and delivered. If that happens, the Duluth, Georgia-based company said it could reduce the capital costs for the farmer since they wouldn't need to make a big equipment purchase.

Blue River Technology, a Sunnyvale, California-based start-up, is using robotics and smart tech to automate lettuce thinning with a so-called lettuce bot. The company also has a machine known as See and Spray, which can identify plants and weeds to spray chemicals precisely. Fragile crops such as fresh tomatoes and strawberries have some of the most hand-labour needs but the company is working on smart machines to automate some of the harvesting of these crops and it could be available to growers within 5 to 10 years.

In Japan greying farmers, rural exodus and low food self-sufficiency are the motives that drive for 'robo-tractors'. These tractors are developed based on artificial intelligence, tracking and safety technologies. Unlike other countries where autonomous tractors are being designed to work huge fields of wheat, corn and soyabeans, Japan's focus is on more intricate business of smaller, waterlogged rice paddies.

In Russia Cognitive Technologies a technological company that develops robotic systems and software is trying to unveil a fully automatic combine harvester. They are working to come up with a practical system using only one video camera, instead of a plethora of cameras and sensors. In effect, the company says that its system employs only one camera and a "neural network", unlike much more expensive systems from mainstream machinery manufacturers.

VII. CHALLENGES

The first challenge faced in developing these driverless tractors is the need to replicate the farmer. The impact of these autonomous vehicles could be dramatic while opening the door for expanding opportunities to improve productivity.

Dan Leibfried, director of embedded solutions at John Deere's Intelligent Solutions Group says "We have to have the ability to sense everything the human would inside of the system related to the quality of the job, whether it be preparing the soil, planting the seed, protecting the crop, or harvesting it."

While a blend of GPS and other location tracking sensors, image sensors, and telematics assist driverless vehicles to navigate fields today, the automatic tractors still can't truly replicate everything a human would see and feel sitting in the tractor cab. For instance, the John Deere's company's latest commercially-available machine with autonomous features, the S700 combine (a vehicle which harvests grain), can automatically adjust its harvesting equipment based on the condition of the crop it sees—but still gives the farmer sitting in the tractor a camera on the process to make sure it's happening correctly. Right now all of John Deere's tractors still require a human to sit inside—a sign that autonomy is a long road even in controlled environments. A collision with other equipment or a misadjusted piece of equipment could mean disaster for an entire season.

Another major problem to autonomy is dust and other weather conditions. Not only does weather change how the vehicle should act in its environment, but it also reduces the accuracy of the sensors. And the solution might come in redundancy—more sensors that could be used as backup, or to infer information not directly able to be seen.

Establishing systems that allow an autonomous tractor to cope with uneven surfaces and fields on a steep tilt are complex, as is the challenge of "teaching" the tractor nuances that have been honed in humans over years of driving.

However no one has developed a completely automatic tractor yet. Operators are still needed mainly for safety purposes. Engineer's fear today's sensing technologies are not reliable enough to ensure an automatic tractor will stop if an object comes in front of it.

VIII. CONCLUSION

Thus the future of agriculture lies in automatic technologies. The autonomous technologies free the farmer from the repetitive work. More acres of land can be worked and for longer time periods. Human errors in the planting and harvesting process can also be eliminated. They are especially helpful for planting and harvesting when the skilled labour are inadequate.

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