МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ БІОРЕСУРСІВ І ПРИРОДОКОРИСТУВАННЯ УКРАЇНИ
ІНСТИТУТ МЕХАНІКИ ТА АВТОМАТИКИ АПВ НААН
ДЕРЖАВНИЙ БІОТЕХНОЛОГІЧНИЙ УНІВЕРСИТЕТ

ЗБІРНИК
ТЕЗ ДОПОВІДЕЙ

X Міжнародної науково-технічної конференції з нагоди 116-ї річниці від дня народження
доктора технічних наук, професора,
члена-кореспондента ВАСГНІЛ,
віцепрезидента УАСГН
КРАМАРОВА
Володимира Савовича
(1906-1987)

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реалізації ударно-коливального навантаження різної інтенсивності є суттєва відмінність в кількості наявної θ-фази (Al_2 Cu). Вона безпосередньо пов‘язана з вихідною концентрацією міді в сплавах.

REVIEW OF DEVELOPMENT OF AN INSTRUMENTATION SYSTEM FOR MEASURING TRACTIVE PERFORMANCE OF TRACTOR

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Introduction

Tractors are major investment in farming, and the significant costs of tractors makes it worthwhile to do research before purchasing them (PAMI, 1996). The primary purpose of agricultural tractors, especially those in the middle to high power ranges, is to perform drawbar work, Zoz and Grisso (2003). Due to the rising demand for highly efficient machineries that directly influence agricultural productivity, it is essential that tractor testing be carried out (Abrahám *et al.,* 2015).

Test procedures and standards for agricultural tractors have been recognized in several developed countries for many years (Sim *et al.,* 2011). These standards are built on transparency, liberality, equity, unanimousness, effectiveness, and due process (OECD, 2014). Standardization offers significant advantages to manufacturers and farmers by guaranteeing that tractors produced or purchased meet all national and international safety and performance standards (Bertram and Liberatori, 1998). Results from these standardized tests may also be useful for comparing the performances of various tractor models, as well as to help farmers obtain unbiased performance and safety information before making a purchase decision (Sim *et al.,* 2011). Tests are done by instrumented systems developed specifically for the purpose of measuring the performance of the tractor. These systems could be onboard (on the tractors) or remote (as seen in precision agriculture).

Instrumented Systems in Agriculture.

An instrumented system consists of primary and secondary transducers, sensors, signal conditioning systems, and data acquisition systems respectively.

A lot of attempts have been made to gain substantive information on the performance indices of the tractor in field operations. Rasool *et al.,* (2017) developed an instrumentation system for the evaluation of tractive performance of walking tractors. Manuwa *et al.,* (2011) developed an outdoor soil bin facility for soil tillage dynamics research using load cells and load cell amplifiers for the measurement of

soil/tool interaction forces and moments. Many systems have been developed to measure the performance of tractors in field operations. Younis et al., 2010 developed a local instrumented system for the measurement of tractor performance. The system comprised of hydraulic pull dynamometer for the measurement of drawbar force and strain gauge dynamometer. Raheman and Jha (2007) developed a microcontroller-based slip sensor for a 2WD tractor for measuring slip values during field use of the tractor.

Alimardani, (1987) Developed a computer-based instrumentation system for measuring tractor field performance using Micro logger, Analog Printer digital tape recorder and programming module as instrumentation system for measuring tractive performance. Other efforts include the use of mechanical sensors, strip charts, oscillographs and manual recording of data (Cullum *et al.,* 1989), use of computer-based systems to monitor tractor performance (Carnegie *et.al.* 1983., Harter and Kaufman, 1979., Lin , 1980., Wendte and Rozeboom, 1981) and similarly using microcomputer and microelectronics-based system utilizing onboard computer and signal conditioning hardware respectively (Tompkins and Wilhelm, 1982).

Despite the wide availability of these innovations, little work has been done to develop a robust on-field evaluation of agricultural tractors using instrumented systems for tractor performance especially in Nigeria. The progress made in the development tractive performance measurement systems in Nigeria has not measured favourably and not compared to the other developing countries of the world countries hence, it is needed that an instrumented system be developed to measure tractive parameters.

Developments in Instrumentation of Tractive Performance

Most of the already instrumented alternatives are very expensive, complex and hard to set up without specialized technical knowledge. This has limited the availability and affordability of tractive performance instrumented technology to many developing nations in their quest to standardize local agricultural machinery industries and agricultural mechanization respectively. Furthermore, some of the instrumented systems come at a cost to the environment and adversely affect the soil -machine productivity.

Arduino Modules as a Data Acquisition Platform

Arduino is an open-source prototyping platform that is based on easy-to-use hardware and corresponding software (Tutorialpoint, 2019). It consists of a programmable circuit board, (also known as a microcontroller) and a corresponding development environment called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board (Tutorialpoint, 2019). With a dynamic ability to acquire data from various analog and digital sources at low power, the Arduino platform represents an important opportunity for tractive performance instrumentation to become widely available to many developing nations and therefore enabling them to build robust systems to be built for measuring the draft, travel speed, tillage depth, ride comfort, noise and vibration levels respectively.

A schematic figure of a proposed force measuring system is shown in the figure below:

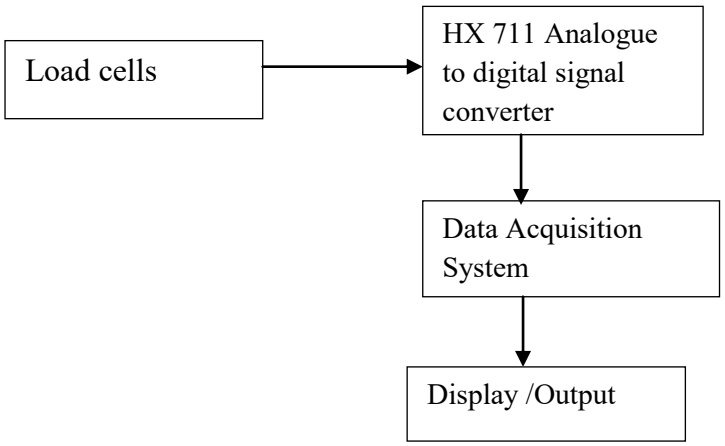

Figure 1: A proposed force measuring schematic for the three-point hitch dynamometer in an existing study.

Conclusion

This article reviews existing body of knowledge and different attempts at developing instrumented systems for measuring tractive performance of agricultural tractors. The existing methods are highly specialized, expensive and way beyond the technical reach of many developing nations. It was also highlighted that Arduino platforms be used as alternative platforms for data acquisition while reliable low cost and durable sensors and signal conditioning systems be adopted for use by nations, farmers and industries seeking to gain the edge in the sustainable development of agricultural machinery for field operations in their localities.

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ДОСЛІДЖЕННЯ КОЛИВАЛЬНОГО РУХУ ОЧИСНИКА ГОЛОВОК КОРЕНЕПЛІДНИХ КУЛЬТУР ВІД ЗАЛИШКІВ ГИЧКИ НА КОРЕНІ

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Збирання гички коренеплідних культур на корені, передбачає суцільне її видалення на корені на заданій висоті зрізу гичкозбиральною машиною і подальше очищення головок від залишків за допомогою очисника.

Нами розроблений очисник головок коренеплідних культур від залишків гички на корені вдосконаленої конструкції, який навішується позаду на агрегатуючий трактор. За результатами проведених польових випробувань було