Experimental Validation of Smart Farming Tool For Modern Agriculture

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Abstract- *Agricultural production is very much in focus and the demands to the industry is increasing day by day. Now a day's everything is becoming compact, portable and mobile. With the help of smart technolo-gies, agriculture may promoted to higher level of up gradations. The smart ploughing tool helps to reduce the man power requirements in agricultural works. Due to modernizing the agriculture tools we may inhibit huge number of younger generation peoples to take part in the agriculture works and also this leads to shortfall the unemployment problems.*

I. INTRODUCTION

Pair bullocks are used to carry the heavy equipment of leveling and ploughing. There is need to study on upgrading agricultural equipment. The energy needed for robotic machine is less as compared with other machine like tractors or any agriculture tools.

we present an agriculture tool for ploughing using PIC that employs the movement of direction through contactless (wireless) communication. Driverless robots are designed to replace human labor. In this paper performs ploughing and powered by solar panel with a control of android mobile.

II. EXISTING SYSTEM

In traditionally drawn by working animals such as horses and later are drawn by tractors. This primary purpose is to turn over the upper layer of the soil and modifies the upper 12 to 25 cm of the soil. It results heavy load on the agricultural land which increasing the density of the soil and also which cost more man power. It is used for the cultivation fuel based machinery results in polluting the environment.

Fig.1 Existing Ploughing Tool

Fernando Auat Cheein says *(Intelligent Sampling Technique for Path Tracking Controllers - IEEE transactions on control systems technology, vol. 24, no. 2, march 2016)* Path tracking controllers in mobile robots are aimed at driving the vehicle following a previously defined path. For implementation purposes, the path is discredited into samples. Each sample is theoretically reachable by the robot. Nevertheless, the motion commands could exceed the actuators' limit causing their corresponding saturation, especially when maneuvering in constrained spaces. In this brief, a technique is proposed and implemented for an intelligent sampling of the path to be tracked by an automated vehicle. On the one hand, it is based on finding the best reference in a path in order to improve the controller's performance without compromising the kinematic restrictions of the robot. On the other hand, it uses a probabilistic framework to predict and to avoid collision with moving objects.

Chris McCool, Tristan Perez, and Ben Upcroft says *(Mixtures of Lightweight Deep Convolutional Neural Networks: Applied to Agricultural Robotics- IEEE robotics and automation letters, vol. 2, no. 3, July 2017)* that a novel approach for training deep convolutional neural networks (DCNNs) that allows us to tradeoff complexity and accuracy to learn lightweight models suitable for robotic platforms such as AgBot II (which performs automated weed management). Our approach consists of three stages, the first is to adapt a pre-trained model to the task at hand. This pro- vides state-of-the-art performance but at the cost of high computational complexity resulting in a low frame rate of just 0.12 frames per second (fps). Second, we use the adapted model and employ model compression techniques to learn a lightweight DCNN that is less accurate but has two orders of magnitude fewer parameters. Third, *K* lightweight models are combined as a mixture model to further enhance the performance of the lightweight models. Applied to the challenging task of weed segmentation, we improve the accuracy from 85.9%, using a traditional approach, to 93.9%.

Christopher Lehnert, Andrew English, Christopher McCool, Adam W. Tow, and Tristan Perez says *(Autonomous Sweet Pepper Harvesting for Protected Cropping Systems IEEE robotics and automation letters, vol. 2, NO. 2, April 2017)* that a new robotic harvester (Harvey) that can autonomously harvest sweet pepper in protected cropping environments. Our approach combines effective vision algorithms with a novel end-effectors design to enable successful harvesting of sweet peppers. Initial field trials in protected crop- ping environments, with two cultivar, demonstrate the efficacy of this approach achieving a 46% success rate for unmodified crop, and 58% for modified crop. Furthermore, for the more favorable cultivar we were also able to detach 90% of sweet peppers, indicating that improvements in the grasping success rate would result in greatly improved harvesting performance.

Ron Berenstein and Yael Edan says *(Automatic Adjustable Spraying Device for Site-Specific Agricultural Application IEEE transactions on automation science and engineering, vol. 15, NO. 2, April 2018)* that a device for accurate pesticide spraying capable of dealing with amorphous shapes and variable- sized targets. The device includes a single spray nozzle with an automatically adjustable spraying angle, color camera, and distance sensors, all mounted on a pan tilt unit. The site-specific spraying device aims to spray specific targets while reducing the use of pesticides.

Fig. 2. Top is an image of AgBot II which performs weed management and bottom is Harvey a robotic sweet pepper harvester.

The spraying diameter is set as the minimum closing circle diameter according to the shape and size of the target. Two preliminary experiments were conducted in order to evaluate the spray nozzle flow rate in relation to the spray diameter and the spray diameter in relation to the nozzle's angular position. A main outdoor experiment was conducted to evaluate the complete spraying device using artificial targets of varying sizes. The results indicated that the spraying device is capable of reducing the amount of pesticides applied. An economic analysis estimates that up to 45% of pesticide reduction is possible when using the suggested spraying method. Actual savings depend on the spraying durations, target size, and distribution.

Jing Geng says *(Accuracy improvement of positioning data in greenhouse for agricultural machinery via optimization algorithm J. Eng., 2019, Vol. 2019 Iss. 15, pp. 547-551 an open access article published by the IET)* that although several indoor positioning systems for greenhouse have been developed in automated agricultural machinery monitoring, the data measured by positioning systems still has large errors. In order to solve the problem, in this study, improved weighted centroid algorithm and maximum likelihood estimation (MLE) algorithm were developed to optimize positioning data of agricultural machinery in the greenhouse, which is measured by ultra-wide band-based indoor positioning system according to different agricultural machinery working states. Compared with real coordinate data, when agricultural machinery stays still, the average static error of the data was 66.4 mm with the improved weighted-centroid algorithm; when the machinery is in dynamic state, the average dynamic error of the data was 61 mm and the probability that error <60 mm was 0.848 according to the MLE. Hence, the optimization algorithms presented in this study improve the positioning accuracy significantly and the position of agricultural machinery is able to be estimated better compared with the raw data.

Fig. 3 Data acquisition at experiment site

III. PROPOSED SYSTEM

The proposed weeding tool is highly portable even it works on small gap between the crops. In this paper contactless (wireless) mode of communication is used for portability. It is an electro mechanical tool which operates on renewable energy. There were no possibilities for polluting the agriculture land. And agriculture species.

IV. METHODOLOGY

The process is carried out by the microcontroller assembly. The ploughing tool of the land is based on fixed hardware distance. The main hardware blocks of our model are

- Controller unit
- LCD module
- Bluetooth
- DC motor
- Power supply
- DHT11 sensor
- IR sensor
- RF Transmitter & Receiver

Control unit is said to the brain of the project since it controls the entire working model by collecting the information. PIC microcontroller is used for interfacing components in the device.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being:

- ✓ LCDs are economical
- ✓ Easily programmable
- ✓ Have no limitation of displaying special characters.

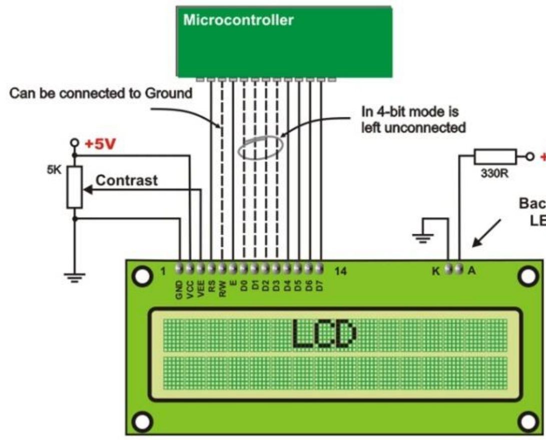

Fig.4 Implementation of LCD in Microcontroller

- ✓ LCD module is the very common type of LCD module that is used in 8051 based in embedded.
- ✓ It consists of 16 rows and 2 columns of 5x7 or 5x8 LCD dot matrices.
- ✓ The module are talking about here is type number JHD162A which is a very popular one.
- ✓ It is available in a 16 pin package with back light, contrast adjustment function and each dot matrix has 5x8 dot resolution.
- ✓ It has two built in registers namely data register and command register.
- ✓ Data register is for placing the data to be displayed, and the command register is to place the commands.
- ✓ The 16x2 LCD module has a set of comments each meant for doing a particular job with the display.
- ✓ High logic at the RS pin will select the data register and low logic at the RS pin will select the command register.

A Bluetooth-enabled mobile phone is able to pair with many devices. To ensure the broadest feature functionality together with compatibility with legacy devices, the Open Mobile Terminal Platform (OMTP) forum has published a recommendations paper, entitled "Bluetooth Local Connectivity".

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

A D.C. Motor is a machine which converts electrical energy into mechanical energy. Its location is based on the principal that when a current carrying conductor is placed in the magnetic field, it experiences a mechanical force whose direction is given by Fleming’s left hand rule.

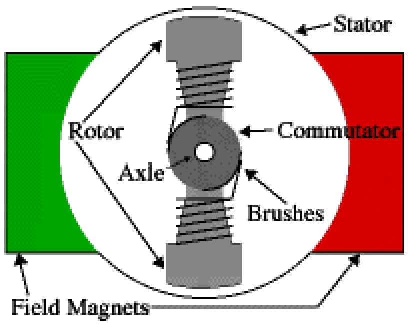

Fig. 5. Rotation of DC motor

Every DC motor has six basic parts like axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that BEAMers will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotors (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets.

DHT 11 Humidity & Temperature Sensor

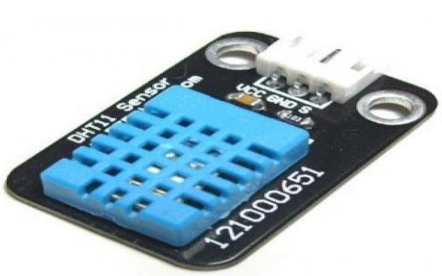

Fig.6. DHT11 sensor

This DF Robot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature &humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

By using an LCD which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LCD bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

Fig.7. IR sensor

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

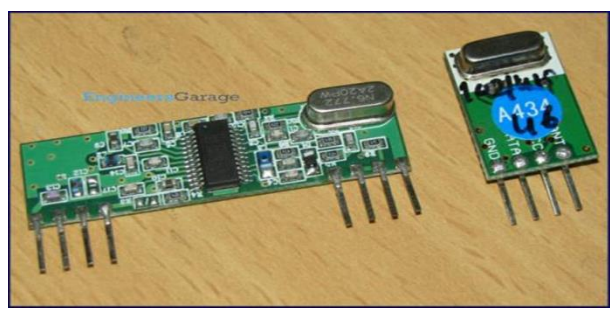

Fig.8. RF transmitter & receiver

This power source block consists of a step-down transformer, a bridge rectifier, a capacitor and a voltage regulator. Single-phase active current power supply from the mains is step down to a lower voltage range which is again rectified to direct current by using a bridge rectifier. This rectified direct current is filtered and regulated to the whole circuit operating range with a capacitor and voltage regulator IC, respectively.

Fig.9. Battery diagram

V. RESULTS AND DISCUSSIONS

This is an ongoing research. Our prime objective is to assist agricultural people. This paper gives basic idea of design implemented a portable ploughing tool using a renewable energy source (solar energy). So overall implementation cost is very cheap and it reduces the time consumption and labor for crop cultivation. Looking at the current scenario we have chosen android platform, so that most of the farmers can get benefit.

The design consists of android phone with remote control by the use of Bluetooth. Farmers can interact with the android phone and sends the control signal by the Bluetooth module which in turn will control other embedded devices/sensors. So that we have discussed a simple system by use of Bluetooth in this paper but in future it can be expanded to many other areas.

VI. CONCLUSION

In conclusion, this low cost system is designed to improve the standard living in agricultural field. The remote control function by microcontroller provides help to farmers. The chassis handles the complete weight of solar panel, battery and the hardware mounted on agriculture robot which is able to perform each and every operation skillfully and successfully. Moreover, implementations of contactless (wireless) Bluetooth connection in control board allow the system installation in more simple way.

VII. FUTURE SCOPE

Useful suggestion based on survey in this research to develop this application in the future such as

- Give additional features to the remote control.
- Provide additional features such as implemented in GSM.
- Develop the new user interface to make it more interesting and also more attractive to users.
- Image processors are involved to control the losses of crops cultivated in the agriculture land while the device roaming into the field.

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