Corn Seeding Robot

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***Abstract*— This paper sheds light on different features of the prototype designed for farming the corn seeds in the context of Nepalese agriculture. Corn Seeding Robot is an embedded system designed to dig, drop and cover the corn seeds in the farming field which can be an alternative tool to manual farming. The smart phone based robot is composed of both electronics and mechanical system. The ATmega328 microcontroller based system drives the robotic vehicle in different directions according to the user's instructions.**

***Keywords*— Corn Seeding, Robot, Agriculture, Smartphone, Bluetooth**

I. Introduction

Nepal is agricultural country. There is no doubt that the agriculture sector is the backbone of the nation. It has an important role for the GDP growth. Also, Nepal has potential consuming population and day by day it is growing thus demand of such crops is also increasing. Here, the corn is one of the major crops. While farming the corn even commercially the process of ploughing, dropping and pulling is traditional. A modern and reliable method or system for corn seeding is needed so that farmer can do all the mentioned process by the help of electro-mechanical system-so called Corn Seeding Robot. These systems have been growing rapidly in neighbor countries or globally. The process of using machines is called as mechanization. Mechanization and automation in agriculture helps to increase the production and the productivity but the present agrobot models are based upon the heavy types of machinery, which require skilled manpower also causes environmental pollution.

Considering these facts and figures of the agriculture sector especially for the corn seeding process a low cost, eco-friendly robotic prototype is being designed and tested using the easily available hardware and software tools such as ATmega328p, motor driver, relay, dc motors and so on.

II. Literature Review

Various research are conducted in this field. Some of the existing literaturesis represented here. The idea of robotic agriculture (agricultural environments serviced by smart machines) is not a new one [1]. K.Saravananet al. [2] mentioned the use of proximity and IR sensors for sowing Chickpeas seeds automatically.

AsG. Venkatesh etal.notes:The main purpose of mechanization in agriculture is to improve overall productivity and production. Planting is conventionally done manually which involves both animate (humans and draught animals), this result in higher cost of cultivation and delay in planting [3, p. 382].

According to [4] the suitable distance between the plants for corn is 12cm to 25 cm and the planting depth obtained is 2 cm to 4 cm. As seen in [5] the design detail of an autonomous robot which is developed for viewing the constraints imposed by agriculture fields. As demonstrated in [6], Fendt Xaver corn robot navigates with satellite and cloud data management which provides the accurate recording of the planting time and exact position of each seed.

Similarly, J. J. Roldán et al. [7] discussed an autonomous mobile robot used for various field operations like it can be used for capturing and processing high quantities of data and can provide capability of not only individual plant but also a complete field. According to a review [8], the five important operations for agricultural task which are tilling, soil analysis, seeding and transplanting, corn scouting and control and finally harvesting. The smart farm is agricultural based work which is based on three categories: drones, autonomous robot and Internet of Things (IOT) [9].

L. Haiboet al [10] demonstrated the wheat precision seeding robot designed using four wheel drives so that control system could control the movement of robot, picking up the seed of wheat and adjust the pressure of the vacuum chamber. As explained in [11] robotic machines to pick everything from strawberries to apple also involves small robot fleets operating in swarms. Implementation of digital farming and site specific precision management depends not only on sensor but also on continuous collection of field data [12].

For designing an autonomous ground vehicle, ATMEGA328 microcontroller is used to control the vehicle direction and the direction of path is followed by using a compass module [13]. According to [14] the solar operated automatic seed sowing machine is demonstrated for the digging, seed sowing, water pouring and fertilizing. These plant factories in Japan which produce high quality of vegetables free of diseases, insect damage and run with little human intervention. The use of Unmanned Aerial Vehicle (UAV) that quantify the distance between maize plants at field scale affects the final grain yield in row crops [15].

III. METHODOLOGY

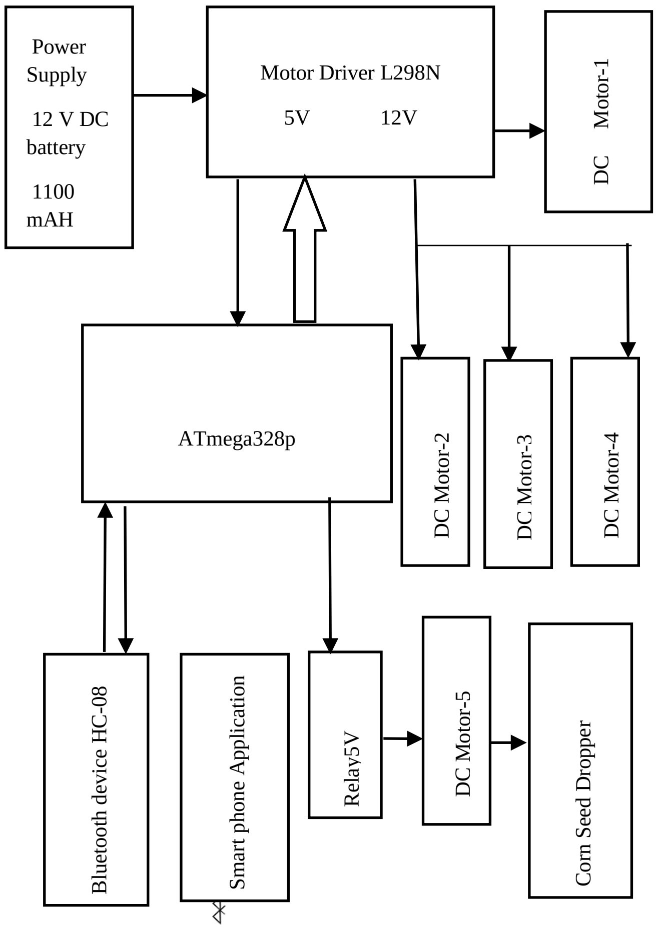

Fig. 1. Block diagram of the system

In the figure 1, the 12V power supply is given to the motor driver L298N to drive the 4 dc- motors simultaneously. The motor driver also provides 5V power supply to the At-mega 328 micro-controller.The Bluetooth device HC-08 is interfaced with micro-controller to control the robotic vehicle using Smart phone. The relay is also interfaced with At-mega 328 so that the motor integrated at corn seed dropping section can be controlled by the user.

In the figure 2, initially the robotic vehicle is initialized and make ready to work in agriculture filed and then the robotic vehicle is connected with the smart phone for the controlling of the system. Afterwards, if the vehicle is connected then user can let it starts to move using an android application. If the robotic vehicle moves in forward direction, then the plougher will plough the field so that the corn can be dropped into the soil from dropping section at the specified distance programmed based on literature [4]. Finally, the soil puller which is integrated at the rear section of the vehicle will cover the corn seed simultaneously. .

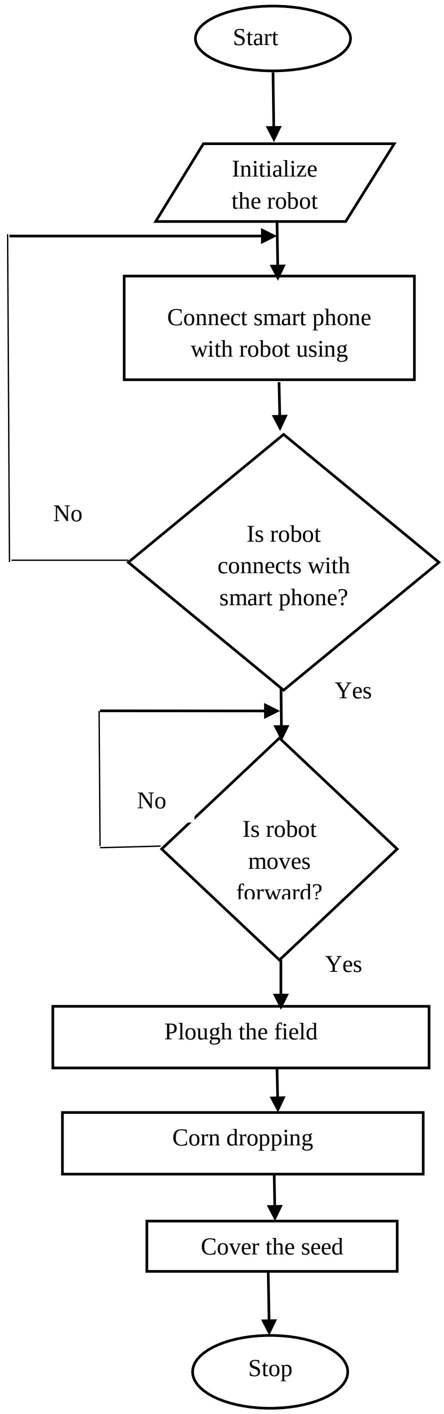

Fig.2. Flowchart of the system

Here, to operate the robotic vehicle in different directions an android app is being used downloaded from Google Play store

IV. Results and Discussion

A) Development of Smartphone based wireless robotic vehicle

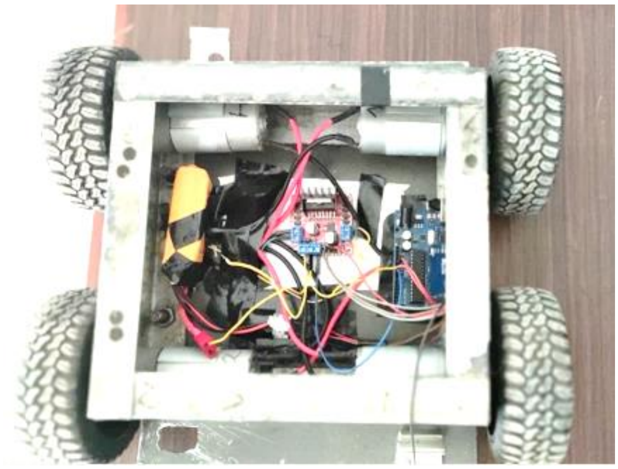

Fig. 3. Top view of the robotic vehicle

The overall system is shown in figure 3. It consists of a Microcontroller, Motor driver, DC-motor, Relay, Bluetooth module HC-05. The robotic vehicle is 23 cm long and 25 cm breadth covering the overall area of 575 cm^2area. This vehicle is operated through 12 V Lipo-Battery to move in the required directions.

B) Interfacing the soil plougher, seed dropper and seed cover

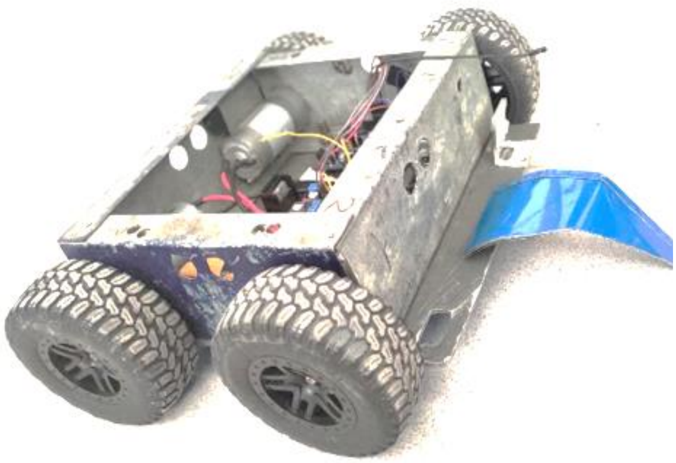

Fig.4.Plougher interfacing with the robotic vehicle

In this "Corn Seeding Robot" there is another major section such as Plougher/Digger which is a mechanical device integrated between robotic vehicle and the corn seed dropper that plough the soft soil enough for corn seed when the vehicle moves forward direction.

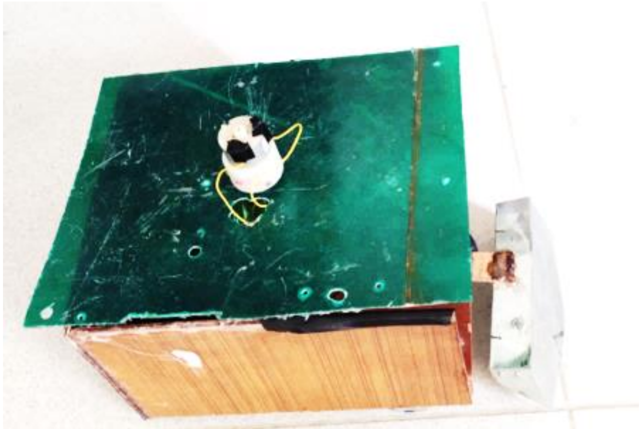

Fig.5. Corn seed dropper with seed cover

The corn seed dropper drops the corn seed at the specified distance when the vehicle moves in its direction and also covers the dropped corn when the robotic vehicle moves in the forward direction.

C) Final prototype

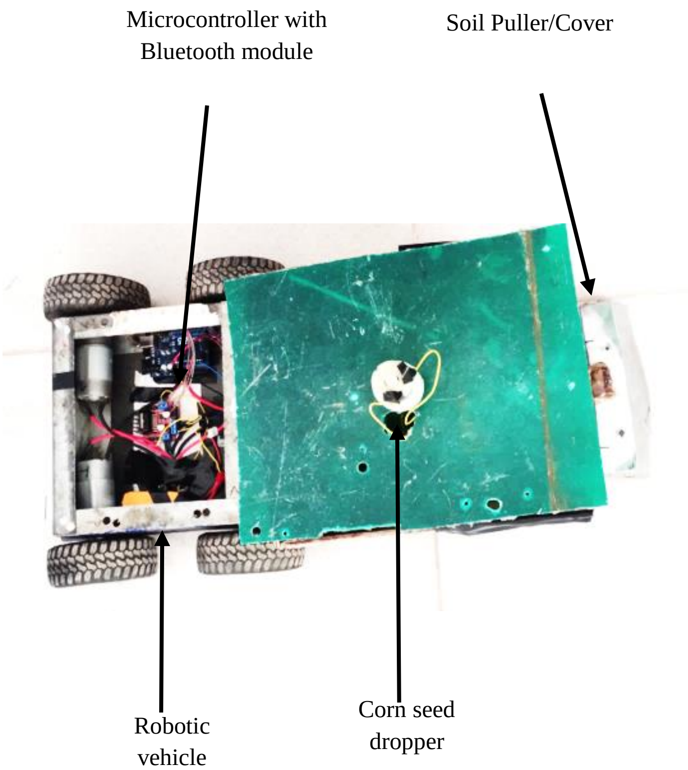

Fig.6. Top view of the prototype

The final prototype consists of Smartphone controlled wireless robotic vehicle which moves in four directions according to the user but the forward direction is preferable for the seeding process, the plougher which plough the field and corn seed dropper which drops the corn seed at a specified distance operated by a dc motor, and the seed cover.

D) Field test

Fig.7. Prototype testing in the Lab

Testing of the prototype is done on the soft soil of the Lalitpur area and with the corn seeds in the lab. It is found that the prototype achieved the desired functions i.e. controlling the robotic vehicle with smartphone is done successfully. Similarly, digging the soft soil with specified depth (in between 2 cm – 4cm) is achieved. Also, dropping the corn seed at specified distance (in between 12 cm – 24 cm) is done with covering the seeds properly.

The designed prototype also has few limitations such as the wireless range of robot is limited up to 10 m because of the use of the Bluetooth technology which is favorable for short range data transfer. A user is always required for its operation since the designed robot isn't fully autonomous.

V. CONCLUSION

The major application of the agriculture based robots is at the harvesting stage, digging, and seeding. This paper also represents a robot capable of performing operations like ploughing the field, seed dispensing and covering with the few centimeters in the distances defined. Less complexity in the mechanical design and smartphone based control technique makes this DC power based system of lower cost, less bulky and eco-friendly compared to conventional system. In future, the system can be modified for automatic operation using sensors. It can be used for planting other seed like wheat, grains etc. with proper arrangements.

ACKNOWLEDGMENT

We would like to thank the Kathford fraternity for giving us a platform for developing and testing the prototype and also thanks to everyone who helped us during the work.

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