Wireless Agricultural Seed Sowing Robot

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***Abstract*—Robots are playing a vital role in today's industrial automation and monitoring systems. As, technology developed these robots have increased there application and functionality [1]. A gesture is a movement that you make with a part of your body, especially your hands, to express emotion or information. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even graphical user interfaces which limit the majority of input to keyboard and mouse. Gesture recognition enables humans to communicate with the machine and interact naturally without any mechanical devices. A Gesture Controlled robot is a kind of robot which can be controlled by your hand gestures not by old buttons. Emerging application of robots in agriculture include weed control, harvesting, environmental monitoring and soil analysis. The main reason behind automation of farming processes are saving the time and energy required for performing repetitive farming tasks [3]. With each passing day the gap between machines and human is being reduced with the introduction of new technologies to ease the standard of living. Gestures have played a vital role in diminishing this abyss [2]. In this project we describe about the gesture controlled robot which can be controlled by your normal hand gestures. It consists of mainly two parts, one is transmitter part and other is receiver part. The transmitter transmits the signal according to the position of accelerometer and your hand gesture and receiver will receive the signal and make the robot move in respective direction.**

***Keywords*- Accelerometer, Gesture recognition, Ultrasonic sensor, Infrared sensor, Microcontroller**

I. INTRODUCTION

A robot is a mechanical device that can perform tasks automatically. Some robots require some degree of guidance, which may be done using a remote control, or with a computer interface or can be controlled by gestures. A robot is usually an electro-mechanical machine that is guided by a program or circuitry. In general, robotics can be divided into two areas, industrial and service robotics [4]. International Federation of Robotics (IFR) defines a service robot as a robot which operates semi- or fully autonomously to perform services useful to the well being of humans and equipment, excluding manufacturing operations [4]. These robots are currently used in many fields of applications including office, military tasks, hospital operations, dangerous environment and agriculture [4].Agricultural robots or agbot is a robot deployed for agricultural purposes. The main area of application of robots in agriculture today is at the harvesting stage. Emerging applications of robots in agriculture include weed control, planting seeds, harvesting, environmental monitoring and soil analysis.In this paper we automate the process of sowing crops such as groundnut, sunflower, baby corn and so on. The farming system like ploughing, cultivating, weeding, harvesting, etc are the different process. All the processes are advance to modifying the mechanism in farming which works automatically without the man power requirement. The small machine would be assembled from existing mass-produced components without the need of specialized design and tooling. Also, energy require to this machine is less as compared with tractors or any agricultural instrument. Seeding preparation is our day to day life we use tractor in farms. But it requires more time and the man shortage is faced continuously parts are controlled by microcontroller. Recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, agriculture in a collaborative manner[2].

II. LITERATURE SURVEY

Robots are widely used in machineries, industries, medical field etc which are automated robots. Even in agriculture robots are used to perform mission like fruit picking, ploughing and harvesting. But these robots are pre-defined where mechanism and performance are already assigned. By these robots there is a possibility of occurring malfunction. If a robot went erroneous that will cause many damages so automated robots always have the drawbacks whereas in case of self operated robot breakdown and exertion can be prohibited[1].Motion technology facilitates humans to interact with machines naturally without any interventions caused by the drawbacks of mechanical devices. Using the concept of gesture recognition, it is possible to move a robot accordingly [2]. A rigorous analysis of different techniques of "Human-Machine Interaction" using gestures has been presented[2]. Gestures can be captured with the help of an accelerometer, however, with the evolution of smartphone its independent usage has been rendered useless [2].Accelerometer based system which controls a Robotic car wirelessly using a small, 3-axis accelerometer via RF signals. Many existing technologies and transmission medium use only Radio Frequency because RF can travel through larger distance than Infra Red[1].

III. METHODOLOGY

In this proposed paper, we are presenting that the farm cultivation process in autonomous agriculture system which is controlled by microcontroller assembly. The technique of seed preparation in ploughed land is based on row per column depending on the types of cultivation. An accelerometer (hand gesture) is used to control the robot position. The main part of the robot technique is sensor part .The sensor perform to identifying obstacles as well as the completion of farm for end of the land and then turn the position of robot either in left or right or forward direction. Then remotely we have to control the robot with hand gesture. The system includes three blocks 1. Transmitter 2. Robot1 3. Robot2 controlled by microcontroller. The heart of the system is microcontroller. It is the main control block and other control blocks are interfaced with the controller. The battery power supply goes to the microcontroller with the help of voltage regulator by convert the constant power. The operation of dc motor is based on electromagnetic, to give the energy to the robot vehicle. The driver circuit is used for giving the constant voltage to the DC motor and the motor will turn in both the forward and reverse direction. When the DC motor starts vehicle moves along the particular column of ploughed land for seeding. The ultrasonic sensor is connected to the front edge of robot; other are at left and right side for controlling the movement of vehicle. In the transmitter module an accelerometer is used to generate a hand gesture. The output of accelerometer is given to a microcontroller. The microcontroller finds the the position of hand and sends command to the either robot 1 or robot 2 to move the robot.

This system consists of 3 units: Hand held transmitter unit, Sowing robot and Helping robot. Dip switch setting on fist unit 0000- Robot 1 adjust with hand gesture, 0001- Robot 2 adjust with hand gesture, 0010- Robot 2 pull, 0011- Robot 2 pour, 0100- robot 1 sow. First connect batteries to all units. Select 0000 on dip switch and position the robot with the help of hand gesture. Then select 0100 on dip switch to start sowing. Robot1 will start sowing. An ultrasonic sensor is used to detect the obstacle. If obstacle is detected. Robot will change the direction. If Robot 1 stucks it sends a 1101 code is sent to the robot 2. A red led is turned on at Robot 2. Then switch on power to hand held unit again and set 0001 on dip switch now position the robot with hand gesture. Then set 0010 on dip switch to pull robot 1, then robot 1 will start its work again. If robot 1 is out of seeds it will send 1101 command to the robot 2 a green led will be switched ON. Now set 0001 on dip switch and position the robot and then set 0011 on dip switch the robot 2 will pour the seeds in robot 1 container. Then set 0001 on dip switch and recall the robot with hand gesture. A RF receiver is used to receive 4 bit data. The microcontroller receives the 4 bit data and moves the robot in a direction received from transmitter part. The robot starts dispensing the seeds as soon as it starts motion using seed dispenser. If robot reaches to the end it stops. An ultrasonic sensor finds any obstacle or end of the field. If robot 1 needs seed for sowing it sends the command for help to another robot through RF module.

The human hand movement is detected by an accelerometer, when the gesture of the hand is towards the ground the capacitance between the moving plate and the stationary plate decreases as the dielectric (i.e. Air) between them is reduced thus the signal is sent to the microcontroller in analog form. The received analog signal is then given to inbuilt ADC (Analog to Digital) of the microcontroller then the microcontroller process the signal and then gives the signal to the RF module, the RF module will receive the signal from microcontroller which operates at 433KHz.

Both the robots present in the farms communicate with each other with the help of RF by continuously sending the data and their current positions. The signal received from the transmitter side in the form of digital 4 bit data this data is then given to the microcontroller and then microcontroller further processes it and then sents the signal to the lifting mechanism and wheel rotating driver. The wheel rotating driver i.e. L293D amplifies the recived signal and gives to the robot and seed dispenser. The received signal sent from the microcontroller is given to the lifting arm mechanism and then further passed to the robot lifting arm.

IV. SYSTEM IMPLEMENTATION

The Fig.1 represents block diagram of the transmitter side and Fig.2 represents block diagram of receiver side of robot 1 and Fig.3 represents the block diagram of receiver side of robot 2.

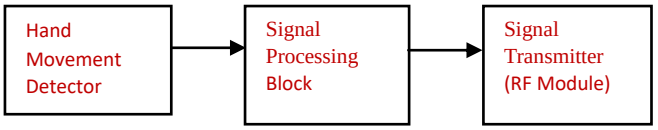

Fig 1: Transmitter Side

In the transmitter module an accelerometer is used to generate a hand gesture. The output of accelerometer is given to a microcontroller. The microcontroller finds the the position of hand and sends command to the either robot 1 or robot2 to move the robot . A RF transmitter transmits the 4 bit data.

The block diagram given below Fig 3.2 is of receiver side of robot 1. When the RF module of transmitter side sends the signal to operate the robot 1, the signal is received by receiver (RF module) of robot 1. The received data is then forwarded to the signal processing block (Microcontroller), which further operates the interfaced devices mentioned in the block diagram

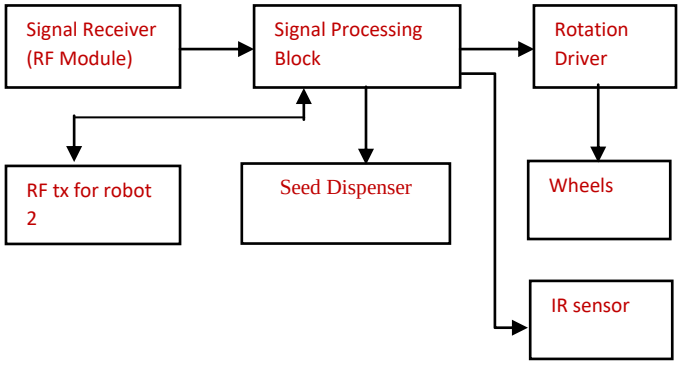

Fig2: Receiver Side of Robot 1

When the faults arises in robot 1 then the RF transmitter of robot 1 sends the signal to robot 2 and at this time the RF module of transmitter side should be OFF, as at one time only one transmitter should be ON to bypass the confusion between two transmitters

The block diagram given below Fig 3 is of receiver side of robot 2. The RF module of robot 2 receives the signal from RF transmitter module of transmitter side as well as robot 1.

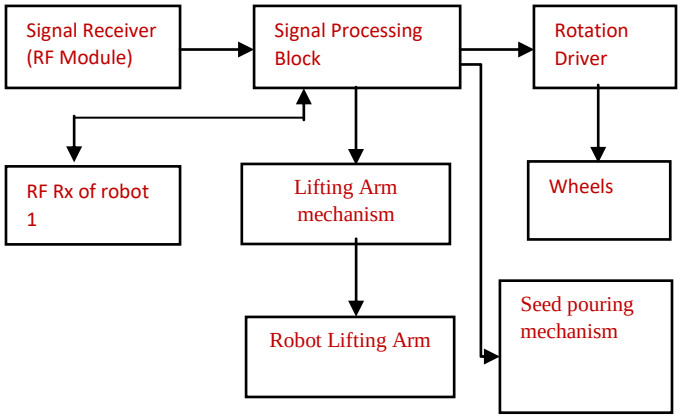

Fig 3: Receiver Side Of Robot 2

Futher the corresponding data is forwarded to signal processing block (Microcontroller) which controls the devices interfaced with it.

V. Simulation Work

The below circuit diagram is of transmitter RF module which consists of PIC Microcontroller to which accelerometer, wheel rotating driver, crystal oscillator, encoder, RF module are interfaced. The circuit to provide voltage of 5V to the microcontroller and L293D is also designed.

The circuit diagram implementation is done by using Proteus software and coding is done in MikroC.

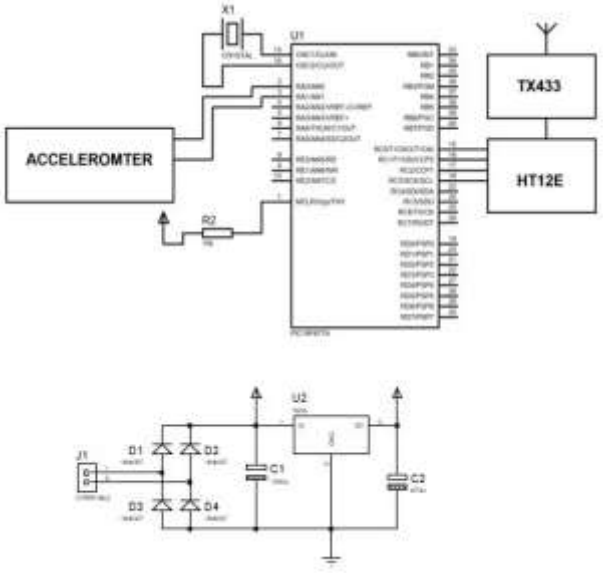

Fig4: Transmitter circuit diagram

The below circuit diagram Fig 5 is of robot 1 in which the Microcontroller interfaces with L293D motor driver, ultrasonic sensor, seed sensor, IR sensor, encoder, decoder, transmitter, receiver, LCD.

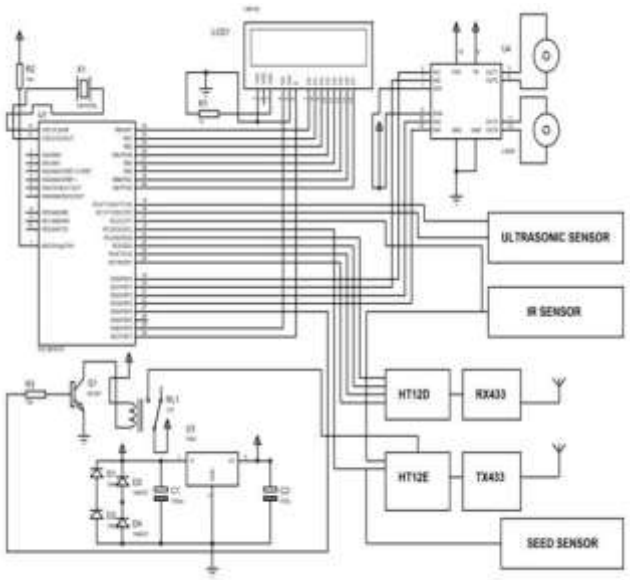

Fig5: Robot 1 circuit diagram

The below circuit diagram is of robot 2 which consists of PIC Microcontrollerinter faced with Encoder HT12E, Decoder HT12D, Receiver RX433, Lifting arm mechanism, Wheel rotation driver L293D to which wheels are connected, Seed pouring mechanism. This circuit is simulated using Proteus software and MikroC software is been used for coding purpose.

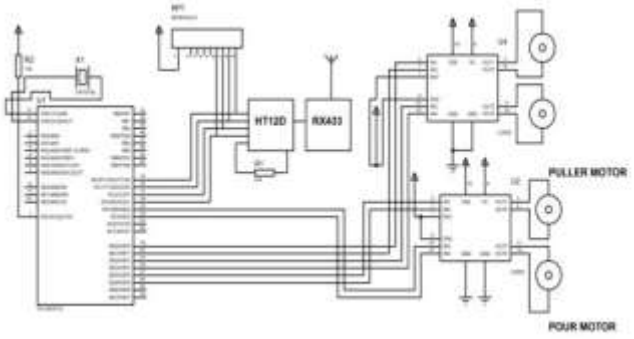

Fig6: Robot 2 circuit diagram

VI. RESULT

At Transmitter side when hand position is kept horizontal the x and y outputs should be 1.68v, output of microcontroller to ht12e encoder will be 4bit and when hand is tilted to the front/back side voltage generated should be 1volt, output of microcontroller to ht12e encoder will be 4bit respectively and also when hand was tilted to the left/right side the voltage should be 3volts output of microcontroller to ht12e encoder will be 4bit respectively.

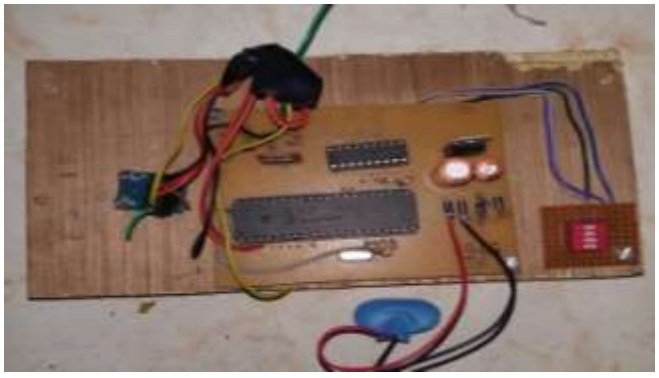

Fig 7: Transmitter unit

Fig 8: Robot 1 unit

At Receiver side when data will be received by ht12d decoder where hand is tilted front/back side then motor will move in right direction/left direction respectively, when data will be received by ht12d decoder where hand is tilted in left/right motor will move in reverse direction/forward direction respectively. Robot 1 successfully receives the signal from transmitter and moves in the respective direction. While working if robot 1 come across the faults ie obstacle, running out of seeds or stucks in puddle then the robot 1 will send the signal to robot 2.

Fig 9:Robot 2 unit

The robot 2 receives the signal from robot 1. When running out of seed fault is generated at that time red led turns ON then robot 2 will provide the seeds and when second fault is generated green led will glow then robot 2 will help robot 1 with help of pulley.

VII. CONCLUSION

Massive amount of work has been done on wireless gesture control robot. This paper has presented the progress made towards achieving a future precision autonomous farming system.The robot performs the complex farming task of sowing seeds. Robot is controlled by using hand gestures therefore, movement of robot can be controlled precisely. Robots are used in many fields, including agriculture field, but not used effectively and securely. Therefore, controlling these robots by the user will be a better job. So this paper covers the ways for implementing robots in agricultural field to reduce the man power. This project consists of two different mechanisms. The first mechanism contains sowing seeds and the second mechanism contains communication among robots for seed sharing.

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