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Wireless Ultrasonic Auto Navigation Robot for Agriculture

Dr.J.VijiPriya [1], Dr.S.Suppiah [2], Ms. Rana Mohammad [3]

[1] *Assistant Professor, College of Computer Science and Engineering, University of Hail, Hail, Saudi Arabia*
[2] *Dean, VelTech University, TamilNadu, India*
[3] *College of Computer Science and Engineering, University of Hail, Hail, Saudi Arabia*

vijipriyajkv@gmail.com [1], apravi31@gmail.com [2], lolo112-2015@hotmail.com[3]
Corresponding Author: vijipriyajkv@gmail.com,

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Abstract: - At present, the machinery and their effortlessness are incredibly essential things that compose our lives full of expediency. They can also be enhanced for employ in sensitive sites that cause a threat to the human being. In general a group of people who are involved in agricultural. There are various difficulties they face throughout their works. Naturally, the agriculture land is very complex to reach some of the places we are in. This study makes it easy to use a Wireless Ultrasonic Auto Navigation Robot (Wireless UAN Robot) to diminish the risk of injuries that might occur while walking or by car. The modern robot consists of a custom-made structure with a circular shape that is competent to navigate easily in most hazardous places and rotate in rigid spaces.

Keywords- Agriculture robot, Ultrasonic sensor, Arduino IDE, Bluetooth RC controller, LCD

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1. Introduction

Nowadays a greater part of the population around the world is involved in agriculture as a major profession. In order to accomplish their demand, many researchers are developing intellectual innovative autonomous vehicles for agriculture purposes. The proposed vehicle should be controlled by smartphone through Bluetooth or Wi-Fi or satellite technology. Robotics makes it easy to develop different automatic systems for agriculture. These systems help farmers to reduce the biological impact, increase exactness, competence and supervise individual plant life in novel ways.

In the field of agriculture, there is various operations are executed with advanced technologies. For example, planting, grass cutting, cultivation, seed sowing, water sprinkling, mud closing, remove weeds, row spacing, and harvesting etc. Universally any kind of machinery is used on the farm to help farmers to achieve these operations. But auto navigation is the primary operation of these agriculture operations to be performed well.

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Therefore the Wireless Ultrasonic Autonomous Navigation Robot was developed to be in motion.

The aim of the study is to design and development of Circular Shaped Wireless Ultrasonic Autonomous Navigation Robot lends a hand people to move easily in sensitive places of agriculture land which are troubles to them. The proposed robot reacts automatically or manually by the Bluetooth Remote Controller Mobile Application. The whole system was designed by Arduino Uno, Motors, Sensors, LCD (Liquid Crystal Display) and rechargeable batteries and implemented with Arduino IDE (Integrated Development Environment). After testing, the well-structured wireless robot performs better to rotate, move forward, backward, left, and right in dangerous farming spaces. Wireless UAN Robot enhances other existing agriculture Robots.

2. Related Works

In the last twenty-five years, there are three kinds of main components are integrated to make autonomous vehicle mostly agricultural robots [7].

1. Specialized sensors such as machine vision, global positioning systems (GPS), real-time kinematics (RTK), laser-based equipment, and inertial devices.
2. Actuators such as hydraulic cylinder, linear, and rotational electrical motors.
3. Electronic equipment such as embedded computers, industrial PC and PLC.

Robotics has endless applications in various fields. Some of the amazing agriculture robots are described below.

A. Wireless Controlled Agriculture Robot

Wireless controlled agriculture robot was developed for agriculture to dig the soil, put the seeds, its leveler to close the mu, spray water to the crops and watching the farms day and night. It works with the help of the battery or solar power. The robot structure consists of a front and rear cabin. The front cabin has been used for placing a portable PC or smartphone, motor controllers, camera and other control components to capture the front images. Seeds, water and fertilizers were stored in storage boxes of the rear cabin. The robot driving devices comprise DC motors and wheels. The robot can choose the driving method and anyone of its agriculture operations automatically according to the needs [2].

B. Autonomous Soil Monitoring Rover

An autonomous soil monitoring rover accelerates information. The Auto vehicle can autonomously navigate through an agriculture field using GPS and keep away from obstacles. It collects data on soil moisture and temperatures at a set of given points and communicates the information back to the farm manager. A Steven's hydra probe II has been placed in the rover to sense the soil moisture and temperature. [3].

C. Intelligent Farming Automatic Robot

An intelligent farming automatic robot waters plant according to biological conditions. Mainly the robot designates plant health using image processing. The robot is able to observe the height of the plant and its color of the leaves by taking a photo through the webcam. It examines the temperature and humidity of biological conditions and displays on the LCD. The farming robot drives along crops planted in a row based on Vision based row guidance method [4].

D. Real Time Kinematic Differential Global Positioning System

Real Time Kinematic Differential Global Positioning System (GPS) navigates easily in the sugar beet field. The GPS robot was equipped with automated headland turns to offer a system for crop row mapping combining machine vision. It performs based on hybrid deliberate systems architecture [5].

E. Non-chemical Weed Controller

A non-chemical weed controller works in a natural, complex environment and the similarity between the weeds and the vegetable crop. Vision systems of this controller obtain and investigate field images and send coordinates of the weeds to the robotic arm. This robotic weed control locates and kills the weeds by producing an electrical discharge of 15000V [6].

Arduino Satellite (ArduSat) ArduSat is an open source satellite completely based on Arduino which allows creating and experimenting projects in space. ArduSat collects photography and various types of information from the space, with the help of numerous sensors such as temperature sensors, pressure sensors, cameras, GPS, spectrometer, and

magnetometer etc. with its programmable Arduino processors. ArduSat can be used for photography from space, making a spectrograph of the sun, detecting high energy radiation, compiling temperature readings and observing meteors etc [1,8].

3. Wireless Ultrasonic Auto Navigation Robot

Wireless Ultrasonic Auto Navigation Robot looks like a 2-wheeled vehicle consists of a custom made chassis with a circular form to progress easily in a variety of precarious places and spin in tight places with a total mass of 1200 grams. It has a diameter of 15 cm, and a height of 11 cm. the diameter of each wheel is 6.5 cm. Mobile or tablet control this robot through Bluetooth by sending commands to control the direction and speed of the robot. The smart Robot changes the system from manual mode to automatic navigation mode to avoid collision with obstacles.

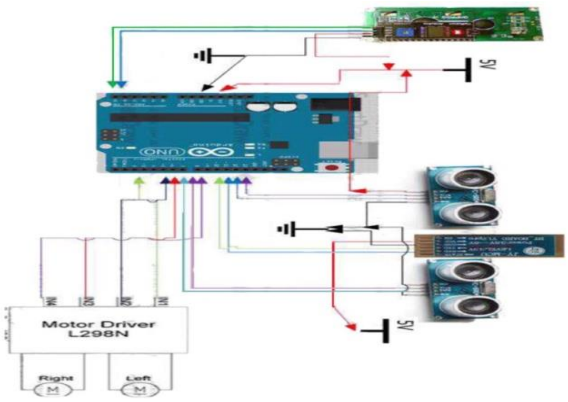

Figure 1. Block Diagram of Wireless UAN Robot

Figure 1 shows the block diagram of the Wireless UAN Robot. The stylish robot consists of two dc motors, each supported with a gearbox in order to increase the torque "decrease speed" for the robot. When the vehicle moves forward, the two wheels rotate in the same direction, and to move backward the wheels rotate in the opposite direction. An Arduino board is used to receive a user command and translate it to the motors as a voltage in certain levels. A power drive circuit unit is also used between the motors and the controller stages in order to protect the Arduino board of high currents drawn by the tow motors. The user command is transmitted by the mobile or tablet to the Bluetooth card that receives the data and transfers them to the Arduino board at which will be translated into motion.

The following electronics components have been integrated to make the intelligent robot with an auto navigation system.

A. Robot LCD

Robot LCD displays distance of the object received from ultrasonic sensors automatically with robot movement when the sensors of the robot detect an object. The novel intellectual robot takes diversion automatically if the object is very near to it approximately less than 50 cm. The I2C interface (IIC) type LCD display needed 6 pins: RS, EN, D7, D6, D5, and D4 to connect with Arduino board for receiving and displaying data on it.

B. Ultra Sonic Sensor

Ultrasonic sound vibrates at a frequency above the range of human hearing. Transducers are the microphones used to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.

C. Arduino Uno board

The Arduino Development Board consists of many components such as Microcontroller ATmega328, External Power Supply, USB plug, Internal Programmer, Reset button, Power and GND Pins, Analog Pins and Digital I/O Pins. The Arduino Uno has some facilities for communicating with a computer, another Arduino, or other microcontrollers.

D. Arduino IDE

The Arduino has his own application software Arduino IDE (Integrated Development Environment) that enables the programmer to download, upload and debugging programs and other functionalities into Arduino Uno board. This software uses C or C++ as the programming languages for the Arduino. The Arduino IDE offers multi-platform environments including Microsoft, Linux and Mac OS X making the active user community. The program code in Arduino IDE written for Arduino is known as a sketch. Every sketch has void setup () and void loop () functions. The setup function contains the initialization of every pin for input or output. The

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loop function consists of code that needs to be continuously executed.

E. Bread Board

A plastic breadboard is used to interconnect most of the electronics components of the robot by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The top and bottom rows of holes in this board are connected horizontally while the remaining holes are connected vertically.

F. Motor Drive Unit

This motor drive unit is a dual H Bridge which is used to operate front and rear DC motors. It can control the rotation direction of two motors easily. The drive unit protects the controller from high currents consumed by the motors and contains heat for heat dissipation.

G. Bluetooth Remote Controller

Bluetooth Remote Controller (RC) is a mobile application (app) used to control this robot by sending and receiving commands such as forward, backward, left, right and stop by manual mode or automatic navigation mode. In automatic mode, all navigation actions will be done automatically while manual mode, the robot will be controlled by manually. The speed of the robot can be adjusted automatically. The circularly shaped robot spins on tight place easily instead of taking the reverse of it.

4. Wireless UAN Robot Implementation

Wireless UAN Robot is controlled by transferring commands from Bluetooth Remote controller App and has been implemented by C language in Arduino IDE described step-by-step briefly below:

1. Include the LCD and Bluthooth card libraries Wire.h, LiquidCrystal_I2C.h, SoftwareSerial.h.
2. Define the main function setup() for initialization of Left and Right Ultrasonic sensors, Bluetooth card, Dual H-Bridge motors, and auto LED.
3. Define the user defined functions LEFT(),RIGHT(),BACKWARD(),FORWARD(),STOP ()are implemented by analogWrite() for navigating the robot via Dual H-Bridge motors.
4. These functions lcd.print(),lcd.clear(),lcd.setCursor() helps LCD to display messages. If the distance of the object from the robot less than 200 cm, display the distance of the object in LCD Otherwise message " no object" is displayed .
5. Define the function loop() repeats the steps from 6 to 9 for triggering robot to make actions until it receives the commands from RC controller mobile app.
6. The left and right distances of the object is determined automatically by measuring time lapses between the sending and receiving of the ultrasonic pulse.
7. If the Bluetooth card receives the data or command 'X' (auto mode) or 'x' (manual mode), the wireless UAN robot is controlled by automatically or manually. In auto mode, the red LED glows.
8. The competent robot reacts manually based on the following received commands:
   (i) 'F' (Forward), moves forward.
   (ii) 'B' (Backward), the robot moves backward.
   (iii) 'R' (Right), the robot turns right side.
   (iv) 'L' (Left), the robot turns left side.
   (v) 'S' (Stop), the robot stops all the actions
9. The novel intelligent robot also reacts automatically based on the distance of the object measured by left and right ultrasonic sensors.

(vi) If the distance of the object is greater than 50 cm, the robot moves forward in the speed of the average distances of the object calculated from both the left and right side of the robot automatically.

(vii) If the distance object is less than 10 cm form both left and right side of the robot, it stops its actions

(viii) If the distance of the object is less than 50 cm from left and greater than 50cm from the right of the robot, it moves right in the speed of summation of the object distances calculated automatically.

(ix) If the distance of the object is greater than 50 cm from the left and less than 50cm from the right of the robot, it moves left in the speed of summation of the distances of the object calculated automatically.

5. Experimental Setup And Result

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Wireless UAN Robot has been designed by Arduino and its IDE and operated by Bluetooth RC controller. Figure 2 shows the hardware result of the Wireless UAN Robot navigates in rigid spaces of agriculture field automatically and manually. The performance of the other existing robots can be improved with this novel navigation system. After testing of Wireless UAN Robot, it was found that it performs better than the other robot navigation system because of its circular shape makes revolving easily in the hurtful field instead of reverse action while detects any object very near to it.

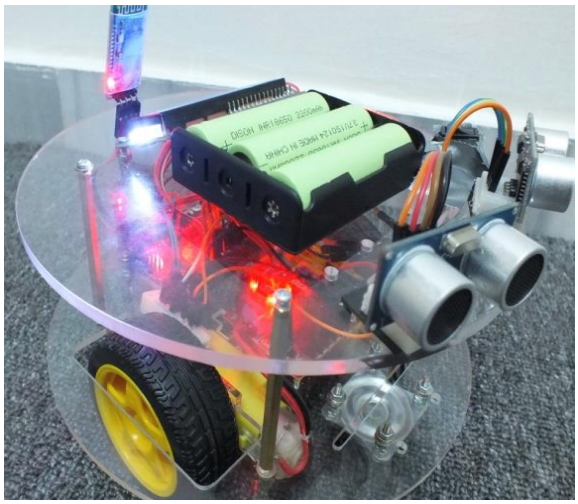

Figure 2. Hardware Result of Wireless UAN Robot

6. Conclusion

The robotics is an imperative role for replacement of conventional techniques with applying automation in biological systems such as agriculture, forestry, and other industries. Mostly Agriculture robotics makes possible advancements to perform the same tasks abruptly with efficiency. In order to enhance these advancements for agriculture purposes, Wireless Ultrasonic Auto Navigation Robot was developed to reduce the threat of agriculture. The robot performs better with its auto navigation system to travel easily anywhere in rigid agriculture field and help the formers to save time and money.

In the future, the other existing agriculture robots can be enhanced with this auto navigation system to obtain their better performance. The wireless UAN robot can be easily improved and equipped with GPS to achieve several agriculture tasks such as sensing more environmental factors like temperature, humidity, light intensity, air quality and monitoring the growth of plants in the right way.

References

[1] Leo Louis, "*Working Principle Of Arduino And Using It As A Tool For Study And Research*", International Journal of Control, Automation, Communication and Systems (IJCACS), **Vol.1, Issue.2, 2016**.

[2] Shubham Dhage , Pradip Patil , Data Kande , Dr. Prakash Pati*,"Wireless Controlled Multipurpose Agricultural Robot",* International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering,**2016**

[3] Patrick Piper and Jacob Vogelpublished a paper on *"Designing an Autonomous Soil Monitoring Robot",* IEEE, **2015.**

[4] Fale and Bhure amit published a paper on *"Autonomous farming robot with plant health indication"*,IJATES, **2015.**

[5] Bakker T, van Asselt K, Bontsema J, Müller J, van Straten G,"*Autonomous navigation using a robot platform in a sugar beet field"*. Biosyst Eng, **2011**

[6] Blasco J, Aleixos N, Roger JM, Rabatel G, Moltó E, *"Robotics weed control using machine vision*". Biosyst Eng, **2002.**

[7] Emmi L, Gonzalez-de-Soto M, Pajares G, Gonzalez-de-Santos P, 2014. "*New trends in robotics for agriculture: integration and assessment of a real fleet of robots*" Sci World J, **2014.**

[8] Galadima, A.A., "Arduino as a learning tool," in Electronics, Computer, and Computation (ICECCO), **2014.**

 https://doi.org/10.22362/ijcert/2019/v6/i03/v6i0301