Novelty Journals

ISSN 2394-7349

International Journal of Novel Research in Engineering and Science
Vol. 3, Issue 1, pp: (25-29), Month: March 2016 - August 2016, Available at: www.noveltyjournals.com

A Smart Multipurpose Embedded CAN Controller for Spraying Pesticides Quadruped Robot

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Abstract: **To design a controller is critical importance for an ability to perform a quadruped robot. In this paper, we present a method for embedded controller using ARM Cortex M3 for controlling the quadruped robot. The controller mainly consist ARM Cortex m3 board for motion control. Based on sensors information the Arduino at mega 2560 controls motor speed, this paper is designing for agricultural purpose, military application, and forestry. A The wheel robots are not capable for some fields for that purpose we are designing a quadruped robot which as limbs for controlling and balancing the robots in different areas like rough terrain, mud soil, Rocky area. This designed robot is for agricultural field for spraying pesticides or we can use these types of robots in military applications for carrying the load and in forestry department.**

Keywords: **ARM cortex m3, Arduino At mega, PIR sensor, Ultrasonic sensor, Aluminum Limbs.**

I. INTRODUCTION

For many years of widely using robotics system for industrial production, agricultural field, military applications and forestry researching on autonomous and manually controlled robots for reduction of human power, time saving and in agricultural field for fast growing for developing a robotic system in agricultural field helpful for growing the plants, seeds because of the locomotion capability of the quadruped robot.

In this paper we are introducing a new method for design and controlling of quadruped robot for spraying pesticides, this quadruped robot is designed for agricultural field, military application, and forestry. The designing of this robot we used aluminum metal because the light weight of the quadruped robot, this robot carry up to 5kg weight the physical design of the robot is follows, this quadruped robot has 21cm long an width is 11cm and height is 14cm this robot has 4 servomotors connected at the shoulders of the quadruped robot, ARM cortex m3 controller is using which is placed at the controller side here we are using two controller ARM cortex m3 one is for controlling and other one is monitoring each controller is connected by CAN(controller area network), CAN is a one type of embedded network which has high speed transmission data is 1Mbit/sec, these type of CAN communication provides a standard communication interfaces to different hardware's. Here using can communication between two controllers because of high reliability and this protocol has low cost.

FIG 1: mechanical structure of quadruped robot

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The force sensor is connected to the one of the ARM cortex m3 which is for controlling the servo motors each servo motors are connected by aluminum metal for the locomotion of the quadruped robot, when we apply force on the force sensor the ARM cortex m3 controller which converts force to voltage and this digital output is 12bit and which displays on the LCD display which as eight data pins. And this output value is sends to the ARM cortex m3 of other controller by communicating between CAN controllers and this received value is displays on the LCD on the other controller which is 8 bit output finally this converted value have to send at the robot side via zigbee.

II. SYSTEM ARCHITECTURE OVERVIEW

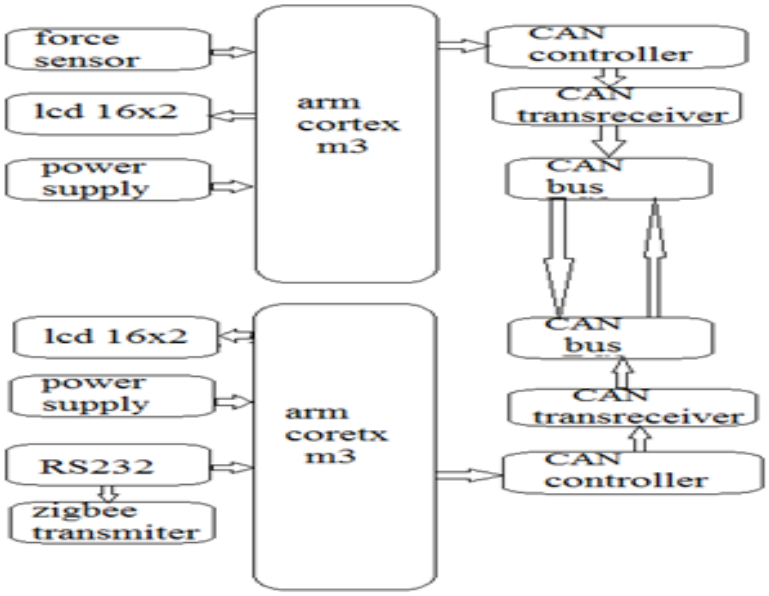

FIG 2: block diagram of transmitter

The above figure is known as the transmission part of an quadruped robot, which mainly consist of a ARM Cortex M3 board, which controls the quadruped robot based on force sensor information we using two ARM cortex m3 one is for controlling and other one is monitoring between these two controller we are using CAN communication for receiving and transmitting the sensor information, force sensor is connected to the one of the controller which is shown in above figure when we apply an external force on the force sensor which converts an force to voltage conversion.

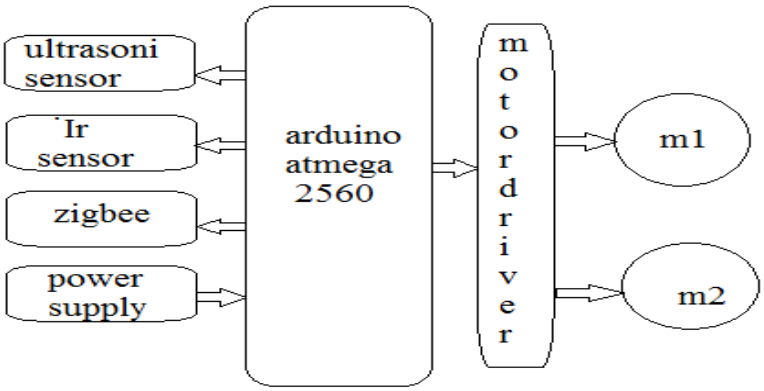

FIG 3:block diagram of receiver

The above block diagram is the quadruped robot receiver part, here we using four limbs for balancing the quadruped robot .each limbs consist of a servo motor for the locomotion of the robot the Arduino at mega 2560 controller which receives the signal command from the transmitter part, based on that command the quadruped robot able to walk and run. If the ARM cortex m3 sends the command like stop through the transmitter of the zigbee then the receiver of the robot side Arduino at mega 2560 which receives the command from ARM cortex m3 from receiver of the zigbee which is connected to the Arduino at mega 2560 controller than the robot will stop if the start command receives the robot will move.

The specification of this designed quadruped robot physical design is shown in below table

Serial number	Description of parts	Value
1	Length of robot body	21cm
2	Width of the robot	11cm
3	Height of robot	14cm
4	Weight of robot	1.2kg
5	Length of upper limb	6.5cm
6	Length of lower limb	8cm

III. EXPERIMENTAL RESULTS

The result of this paper is shown in below figures which are different angle while walking the robot. The limbs of the quadruped robot are aluminum which as 6.5cm and the lower limb is 8cm; the ultrasonic sensor is placed at the one side top of the robot for the detection of the obstacles and a PIR sensor is placed at the other side of the top for detection of humans hence these all parts of the robots is controlled by the controller of the quadruped robot which is Arduino at mega 2560 controller, finally this result shows the quadruped robot has able to perform the locomotion and which can balance itself.

FIG 4: controller board of quadruped robot

FIG 5: changing of force value

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FIG 6: different angle of walking quadruped robot

IV. CONCLUSION

This paper is describes a new approach for spraying pesticides quadruped robot for agricultural field, by using our controller like ARM cortex m3 and Arduino we are able to control the locomotion of the quadruped robot, based on the force sensor information the Arduino at mega 2560 controller plans for robot is run or stop, here we concluded that if the sensor sends the signal from ARM cortex m3 to the Arduino at mega 2560 controller the robot will perform the task based on information, while walking the robot if any obstacles detects the robot will not run the Robot will get stop, if IR sensor detects any human between its ranges then the robot will stop, based on predefined value.

ACKNOWLEDGEMENT

I sincerely thank my project guide Mr.Prasanna Kumar, associate professor and project coordinator Mr. Kiran Kumar, assistant professor in department of electronics and communication engineering for his help, suggestion, and co-operation for valuable guidance of towards the successful completion of this project.

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