MSP430 BASED OBSTACLE AVOIDANCE ROBOT

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Abstract

An obstacle avoidance robot is a quick-witted robot, which can automatically sense and overcome obstacles on its path. [1] The robot will use four DC motors and will employ a differential drive system. The Intelligence is provided with an MSP430 Launchpad Board and the motors are controlled by L298N Motor Driver. It contains a microcontroller to process the data and Ultrasonic sensor to detect the obstacles on its path with the help of servo motor. And also monitor the environmental Condition with Humidity Sensor.Obstacle avoidance is one of the most important aspects of mobile robotics.The aim of the system is to send the robot to a restricted Area (i.e. Radioactive) and it monitors the environmental condition autonomously.

Keywords*: MSP430G2553, Servomotor, Humidity sensor, Ultrasonic sensor*

INTRODUCTION

In the current era, *ROBOTS* are very useful because of their Core performance, reliability and which is a great help for human beings and even many industries use robots. ROBOTICS is fast growing and interesting field so we decide to work on the robotic project and make something which will make human life simple in today's world. As robots and their outer lying equipment become more reliable, cosmopolitan and miniaturized, these systems are increasingly being utilized for entertainment, military, and surveillance purposes. This robot consists of integral intelligence to cover an area around it. It uses an ultrasonic sensor that is used to sense the obstacles which come in the path. The obstacle detection is a prerequisite of this autonomous robot. The robot gets the information from the neighboring area through mounted sensors on the robot. The robot will detect the obstacle and move in a particular direction and be avoiding the obstacle which is coming in its path. A more general and commonly engaged method for obstacle avoidance is based on edge detection. A disadvantage with obstacle avoidance based on detecting is the need of the robot to stop in front of an obstacle in order to provide a more precise measurement. In industries automation predefined robots are employed to reduce manpower, even in the Amazon uses the autonomous robotic shelf in a warehouse. Then many delivery companies use the robots to deliver in the concerned address. Robots are robots that can perform desired tasks in amorphous environments without continuous human instruction. [2] There are many types of navigation technique mobile robots like map interrupting, self-localization and path planning. This robot is a type of autonomous mobile robot which avoids the strike with unforeseen obstacles. In this Ultrasonic range sensor used to avoid the collision. The concept of the mobile robot is fast growing and its convolution is increasing with various applications. This Obstacle Avoidance robot reduces human monitoring and its stand 24X7 flexible performance. It can able to operate productively in an unknown environment. It would require no exterior support in its operation. The largest downside of the robotics is their inability to board not in excellent condition. Advances in the AI will fix this issue. This may change even as an autonomous fighter and more than 5000 delivered to the defense and civic organizations.[3]. There are many microcontrollers in the market consisting of different types of capability from general input-output to the high-end microcontroller.

BLOCK DIAGRAM

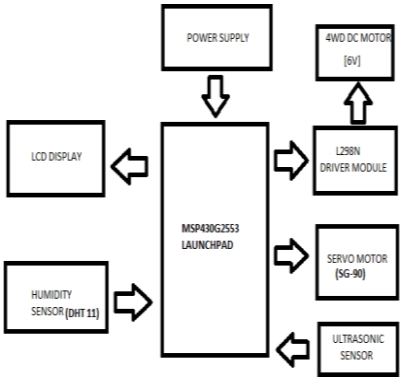

Fig-1 Proposed Block diagram

WORKING PRINCIPLE

In the obstacle avoidance robot, there are six blocks along with the MSP430G2 Launchpad. These are general input and output sensors or components. At first Ultrasonic sensor is the digital input. The Ultrasonic sensor uses sonar to detect the distance like dolphins, Bats. Servo motor is the digital output which fitted above the servo motor. Servo motors are motor with a combination of particular parts, which happen to include an AC or DC motor, and are suitable for use in a closed-loop control system.[10] In the L298N Module, four input pin is connected from the MSP430G2. The L298N Module is the Dual H-bridge Motor Driver Module The operating range DC power supply 7-35V.[9] This Module is mainly used for controlling the speed and directions of the motor. It has four OUT pins, 12v, 5v power supply and ground pin. The humidity sensor is the digital input connected to the data pin of Launchpad and Both temperature and humidity measurement supported by the sensor. Using a moisture dependent resistor, humidity has been sensed. It is low cost and its humidity range is 20-80%, the temperature range is 0-50°C. Then LCD I2C Display is used to monitored output can get from the microcontroller. The display composed of 16 characters and 2 line LCD display with a blue backlight and white characters with which each character is composed of a 5 x 8 dot matrix for character representation[16]. The MSP430G2553 is the heart of this robot. The Launchpad firmware is used for the overall control of the system. MSP430 based microcontroller from Texas Instruments. And it is developed by Texas Instruments as an intensely low power **16 bit - architecture** for use in low power, low cost and energy guarded embedded applications. it receives the input signal from the sensor and recognizes the Obstacle and changes the direction of the sensor using a servo in 180 degrees. These various types of microcontroller are purpose-made for a basic application.[6] And The Launchpad which contains a programmer/Debugger plus two microcontrollers making it an absolute platform to start learning about the MSP430G2 controller. The specification of the MSP430G2553 is 6kB Flash, 512B RAM, 16GPIO, 2×16-bit Timer, Watch Dog Timer, Brown Out Reset, 1×USI (IIC/SPI/UART), 8ch 10-bit ADC, 8ch Comparator, Capacitive Touch IO Module.[11] Then 4 wheel drive Dc motor connected with the L298N because it drives the 6V motor.[15] The motor draws 210mA current with no load, and 3.14 amps with generating 46.2 Gram-cm torque. Finally, connect with the power supply with the board. Launchpad gets the input as 5V. Totally six components connected with this TI Launchpad and it performs multitasking in high speed with low consumption of power, this is the specialty of Launchpad. This all performs in a loop until it gets a false condition.

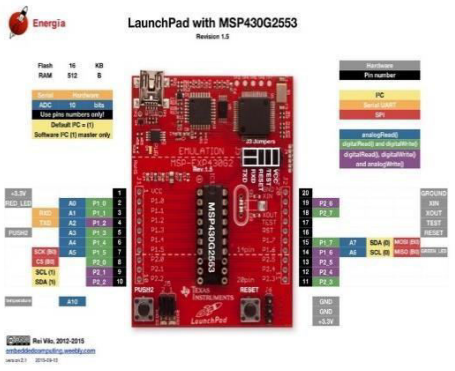

Fig-2 MSP43022553 PINOUT

SCHEMATIC DIAGRAM

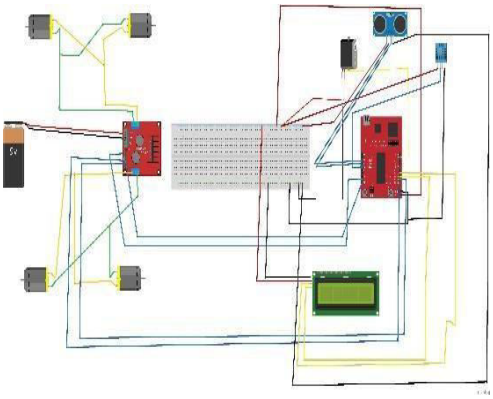

Fig-3 Proposed Obstacle Avoidance Robot Schematic diagram

EXPERIMENTAL RESULT

When all the connections are all-set to fuse the Launchpad with the USB cable. Usually, Launchpad is being programmed by using the Energia IDE[17]. The Energia IDE is a cross-platform application for Windows, Mac OS, Linux, etc.

Initially, the Obstacles will be detected if it determines any Object then the robot gets stops and senses using the Ultrasonic sensor (HC-05). The ultrasonic sensor enables virtually the robot to see and recognize an object, avoid obstacles, measure distance. The range of the ultrasonic sensor is 10 cm to 30 cm. The condition works on first Servo motor turn Right and left direction along with the sensor fitted to it. And then compares both distances, it gives prior to the longer distance. Likewise, the program gets looped if it detects an object otherwise it goes forward.DC motor plays a vital role in the process. To drive the 4WD L298N motor driver module is used. In this robot included the humidity sensor to monitor the condition of the weather. To monitor the humidity and the temperature LCD Display is used. The I2C interface is a board attached to the back of the LCD module. It consists of a potentiometer which is to control the backlight of the LCD display. The board supplies only 3.3V so if we connected any sensors it requires the 5V supply .so add the 5V supply externally to the required components.

Motor data:

MOTOR	PIN 9	PIN 10	PIN 12	PIN 13
FORWARD	0	1	0	1
BACKWARD	1	0	1	0
RIGHT	1	0	0	1
LEFT	0	1	1	0
STOP	0	0	0	0

Table-1 Motor Data

In this sequence the motor drives using the L298N.The dc motor connected from the four pins of the driver module. The circuit diagram is made with the Fritzing software and also able to stimulate the constructed circuit.[18] The four-pin 9, pin 10, pin 12, pin 13 connected to the driver module from the MSP430G2553.If any problem occurs or not output displayed check the data pin whether the required voltage supplies to the concerning part.Connect the pin with the Jumper wires. The board gets its power from the mini USB port at the 5V level and converts it to 3.6V with the help of the onboard LDO regulator. The emulation section and the microcontroller needs a voltage at this level to operate. 3.6V net is labeled as VCC on the board and VCC and GND lines are expanded to J1, J2 and J6 headers. [11] At first I have checked the weather the data receiving correctly using LED with the motor sequence mentioned above. His robot used in Military Application and City Wars. Obstacle avoidance robots will be used in almost all mobile robot navigation systems. They can also be used in a hazardous situation, where human penetration could be fatal. It can also be used as the Robot Vacuum cleaners.

CONCLUSION

This obstacle avoidance robot using MSP430G2553 will detect the incoming objects and robots directed to the free path. Then monitors the climatic condition of the area and the LCD displays those data. The future Work is to enhance the robot design, Camera and GPS will be added with robot to make as Surveillance Robot. It will be used as Environmental safety Robot while adding the Flame sensor and Temperature sensor also connected with IOT to get instant report through server.

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