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ROCKER-BOOGIE FOR MILITARY USE

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ABSTRACT - The rocker-bogie suspension system has robust capabilities to deal with uneven terrain because it's distributing the payload over its six wheels uniformly. Most of the cover designs have been developed for Mars and Moon surfaces in order to understand the geological history of the soil and rocks. Exploration operations need high-speed and long-distance traversal in a short mission period due to environmental effects, climate, and communication restrictions In this research, a new suspension mechanism has been designed and its kinematic analysis results were discussed. One of the major shortcomings of current Rocker-Bogie rovers is that they are slow. In our project, we have focused on a six-wheeled rocker-bogie suspension system design which has the advantage of linear boogie motion in protecting the whole system from getting rollovers during high-speed operations. This has greatly increased the reliability of the structure on rough terrains and also enables its higher speed exploration with the same obstacle height capacity as twice the diameter of the wheel. The project aims to improve some basic working so that it can perform in a better way.

1. INTRODUCTION

The rocker-bogie suspension system was initially used for the Mars Rover and is currently NASA's preferred design for rover wheel suspension. The perfectly designed wheel suspensionallows the vehicle to travel over very uneven or rough terrain and even proceed over obstacles.This rocker suspension is a type of mechanism that allows a six-wheel vehicle to constantly keep all six wheels in contact with a surface when driving on uneven terrain surfaces. The rocker bogie mechanism describes a method of driving a rover so that it can progressively stepover most obstacles rather than impacting and climbing over them. Most of the benefits of thismethod can be achieved without mechanical modification to the same designs – only a changein control structure. Some machine changes are suggested to gather the maximum profit and togreatly increase the effective speed of future rovers. The rocker bogie mechanism is one of themost popular suspension mechanisms, which was initially designed for space travel vehicles having its own deep history embedded in its development.

PROBLEM STATEMENT

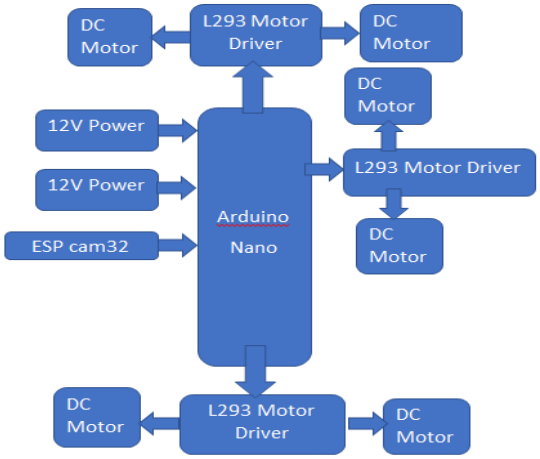
Modern militaries face a huge challenge of logistics while scaling alien areas. The modern militaries have the restriction of slow movement in the absence of good transportation network. The average soldier carries around a 100 pounds of military gear with him.

LITERATURE SURVEY:

1) Para Bimal Saraiya "Design of Rocker Bogie Mechanism" The proposed modification increases in the stability margin and proved with valuable and profitable contrasting the SSFmetric with the 3D model simulations done on AUTOCAD. Study of the existing models of rocker bogie suspension enabled rovers and tried to manufacture a similar kind with the material available. 2) Roshan Sharma, Rajesh Jaiswal, Ankit Yadav, Subash Roy "Design and Fabrication of Rocker Bogie Mechanism Automated Combat Rover" The proposed paper presents a special design in seeking after of developing the rocker-bogie portability framework in

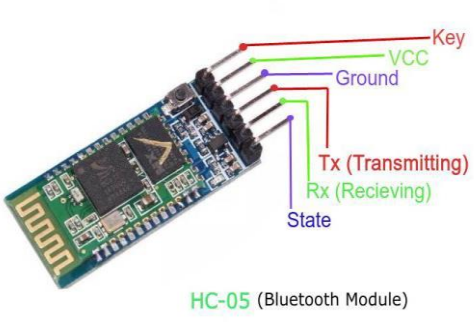
customary overwhelming stacking vehicle conduct while high-pace traversal is required and to expand the battery effectiveness and working time of the Rover, which become made achievable theuse of the autonomous directional control machine which utilizes least power modules organized upon the working condition and circumstance.

2. BlOCK DIAGRAM



Bluetooth Model (HC05) :

Wireless communication is swiftly replacing the wired connection when it comes to electronics and communication. Designed to replace cable connections HC-05 uses serial communication to communicate with the electronics. Usually, it is used to connect small devices like mobile phones using a short-range wireless connection to exchange files. It uses the 2.45GHz frequency band. The transfer rate of the data can vary up to 1Mbps and is in range of 10 meters.The HC-05 module can be operated within 4-6V of power supply. It supports baud rate of 9600, 19200, 38400, 57600, etc. Most importantly it can be operated in Master-Slave mode which means it will neither send or receive data from external sources.



HC-05 (Bluetooth Module)

Description of Pins :

Enable - This pin is used to set the Data Mode or AT command mode (set high).

VCC - This is connected to a +5V power supply.

Ground - Connected to the ground of the powering system.

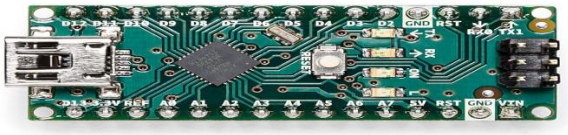
Tx (Transmitter) - This pin transmits the received data Serially.

Rx (Receiver) - Used for broadcasting data serially over Bluetooth.

State -Used to check if the Bluetooth is working properly.

Arduino Nano :

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.



The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. To use the SPI communication, please see the ATmega328 datasheet.

Input and Output

Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Nano has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the analogReference() function. Analog pins 6 and 7 cannot be used as digital pins. Additionally, some pins have specialized functionality:

- I2C: A4 (SDA) and A5 (SCL). Support I2C (TWI) communication using the Wire library (documentation on the Wiring website).

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with analogReference().
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Esp32 Camera : The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides an onboard TF card slot.The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, Wi-Fi image upload, QR identification, and so on.

Specifications:

- WIFI module: ESP-32S
  - Processor: ESP32-D0WD
- Built-in Flash: 32Mbit
- RAM: Internal 512KB + External 4M PSRAM
- Antenna: Onboard PCB antenna
- WiFi protocol: IEEE 802.11 b/g/n/e/i
- Bluetooth: Bluetooth 4.2 BR/EDR and BLE
- WIFI mode: Station / SoftAP / SoftAP+Station
- Security: WPA/WPA2/WPA2-Enterprise/WPS
- Output image format: JPEG (OV2640 support only), BMP, GRAYSCALE
- Supported TF card: up to 4G
- Peripheral interface: UART/SPI/I2C/PWM
- IO port: 9
- UART baudrate rate: default 115200bps
- Power supply: 5V
- Transmitting power:
  - 802.11b: 17 ±2dBm(@11Mbps)
  - 802.11g: 14 ±2dBm(@54Mbps)
  - 802.11n: 13 ±2dBm(@HT20,MCS7)
- Receiving sensitivity:
  - CCK,1Mbps: -90 dBm
  - CCK,11Mbps: -85 dBm
  - 6Mbps(1/2 BPSK): -88 dBm
  - 54Mbps(3/4 64-QAM): -70 dBm
  - HT20,MCS7(65Mbps, 72.2Mbps): -67 dBm
- Power consumption:
  - Flash off: 180mA@5V
  - Flash on and brightness max: 310mA@5V
  - Deep-Sleep: as low as 6mA@5V
  - Modern-Sleep: as low as 20mA@5V
  - Light-Sleep: as low as 6.7mA@5V
- Operating temperature: -20 ℃ ~ 85 ℃
- Storage environment: -40 ℃ ~ 90 ℃, <90%RH
- Dimensions: 40.5mm x 27mm x 4.5mm

3. CONCLUSIONS

The proposed paper produces a novel design in pursuit of increasing the rocker-bogie mobility system in conventional heavy loading vehicle behavior when high-speed traversal is required. The proposed modification increases the stability margin and proved with valuable and profitable contrasting with the 3D model simulations done in SOLIDWORKS. In the future, if the system is installed in heavy vehicles and conventional off-road vehicles, it will definitely decrease the complexity as well as power requirements to retain bumping within it Future scopes of Rocker Bogie Mechanism are in military operations as a weapon carrier & for locating coal deposits in coal mines.

Application :

1. It can travel to uneven terrain.
2. Measurement of basic climatic changes.
3. It will reduce the weight a soldier carries.
4. Surveillance of human able area.

FUTURE SCOPE :

1) This system can be configured to work on protocol other than Wi-fi.
2) Other Mechanism for application Can be added in the system
3) SPY Operation
4) Rescue Operation
5) Surveillance Operation
6) Sensors can be incorporated in order to monitor an area under observation.

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