VOICE AUTOMATED HYDRAULIC JACK

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ABSTRACT

The Automotive Industry faces extreme safety concerns during the vehicle lifting process, how can these safety concerns be mediated for the personals in the automotive industry during this process? A revolutionary vehicle jack "The Voice Automated Hydraulic-Jack" was developed to remove all unnecessary safety concerns that are presented to the user during the vehicle lifting process. Removing the user from having to position a standard vehicle jack and/or jack stands underneath the vehicle once the vehicle is lifted will eliminate all safety concerns surrounding user inflicted failure. A hydraulic circuit is used to operate the Voice Automated-Jack, this allows the user to operate the jack from a safe distance. A vehicle jack with a larger surface area will eradicate all possibilities of collapse or malfunctions to take place during the lifting process. Garages are normally manpowered with very minimum of skilled labours. In most of the garages the vehicles are lifted by using screw jack. This needs manual work and which tires the worker. In order to avoid all such disadvantages. This, motorized hydraulic jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force. The operation is made to be simple that even an unskilled worker can handle, by just demonstrating the working of the motorized hydraulic jack once. The D.C motor is coupled with the hydraulic jack by cam mechanism. The cam shaft moves up and down depends upon the rotation of D.C motor by cam mechanism. This is a simple type of automation project. This equipment is fixed to the chassis of the vehicle, so that it facilitates the lifting the vehicle.

1. INTRODUCTION

A. Description:

In today's fast-paced world, time is of the essence, and we all look for ways to make our lives more efficient and hassle-free. A hydraulic jack is an essential tool for lifting heavy objects, but traditional jacks require manual effort and can be time-consuming to operate. This is where the Voice Automated Hydraulic Jack comes in - a cutting-edge innovation that allows you to operate the jack with just your voice. With this revolutionary technology, you can lift and lower objects with ease, without ever having to touch the jack. The Voice Automated Hydraulic Jack can be controlled using simple voice commands, making it a perfect solution for anyone looking for a fast and easy way to lift heavy objects

B. Function Statement:

The primary problem for mechanics and automotive enthusiasts is the risk associated with lifting and securing a vehicle with conventional jack stands. Often times improper jack stand installation results in the vehicle collapsing unexpectedly. When this happens, the personal near/under the vehicle can be seriously injured or killed. If an elderly person or woman is using the car and there is necessity of changing one of the tyres due to a puncture, then to avoid the manual work which requires lot of effort can be avoided using the Voice Automated Hydraulic Jack. Android has complete software package consisting of an

operating system, middleware layer and core applications. In this project we present a review of hydraulic jack controlled by voice automation.

2. LITERATURE REVIEW

The paper [1] is about the integrated automated jack for 4 wheelers, i.e. by the single push button provided an automobile jack can be operated. The system consists of three main parts that is hydraulic pump, driven by an electric motor, hydraulic cylinder for vehicle lift. During the breakdown condition hydraulic jacks actuate separately for either side of car. By the oil incompressible of the hydraulic jack the lifting capacity is more compared with the pneumatic system where it operates on air which is compressible. With the single acting cylinders which are controlled by the control valves and the relief valve the circuit has been done.

Paper [2] overcomes the problem of automated car jack. In order to facilitate repairs a device used to raise all or part of vehicle into the air done by an automotive jack. In this work, electric car jack has been used by the current supply from the car battery which makes easy to operate. For the polarity of motor, a switch is provided. As the required torque is applied at the screw the gear ratio provided the torque. The jack is plugged in where 12V Power supply is used to gear up.

Paper [3] gives information on development of auto car jack using internal car power. By the manual force car jack is a mechanical advantage to allow a human to lift a vehicle. The internal cigarette lighter power (12volts) in order to ensure the power is adequate, gear was used. In this paper they have used two relays where it is connected to the motor with the 12V power supply has been used for switch circuit. And implementation the prototype for the modification on the features and design, it was implemented on PERODOA Kancil, with the higher torque such as Proton Wira® and ProtonIswara® car.

3. OBJECTIVES AND METHODOLOGY

3.1. Objectives:

The primary objective of developing a voice-automated hydraulic jack is to create a more efficient, safe, and convenient way of lifting heavy loads. This technology allows users to control the hydraulic jack with voice commands, eliminating the need for manual operation or remote control. The following are some of the specific objectives that are considered when developing it: -

- Developing a reliable and accurate voice recognition system that can interpret user commands and control the hydraulic jack accordingly.
- Testing the voice-automated hydraulic jack in various scenarios to evaluate its performance, efficiency, and usability.
- Identifying the potential applications of the technology in different industries and explore ways to improve its functionality and performance.

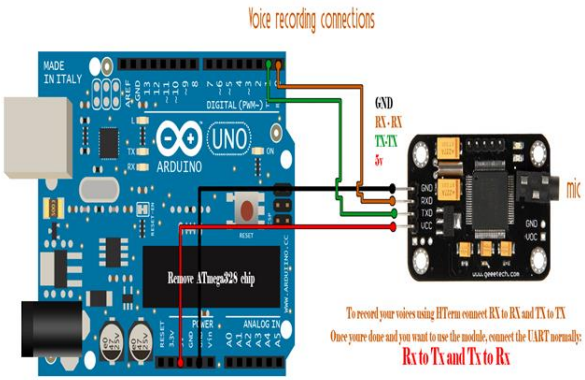
3.2. Methodology:

In the development of a voice-automated hydraulic jack involved: -

System Design: In our first step in developing a voice-automated hydraulic jack we made a design on system architecture, which includes the hydraulic jack and the voice recognition system. The design should consider various factors such as load capacity, size, weight, and compatibility with different voice recognition software.

3.3. Voice Recognition:

The voice recognition system is a critical component of the voice-automated hydraulic jack. To develop an effective voice recognition system, the first step would be to collect a large amount of training data to train the machine learning algorithm. The collected data would include different voice commands and variations in tone, accent, and language. This data would be used to train the machine learning algorithm to recognize different voice commands accurately. Manual hydraulic jack is converted to automatic one by establishing an interface between the app, electronic circuit, and DC motor and the gearbox. When the Arduino receives signals, the relay passes the 12V DC to the motor which drives the gear train which pumps the jack. Thus, this can be achieved by providing the power source to drive the motor and it turns the shaft which will rotates and the jack shaft is lifted. Manual jack is converted into automatic one by establishing an interface between the app, electronic circuit, D.C motor and the gear box. When the Arduino receives the signals, the relay passes the 12v dc to the motor which drive the gear shaft, which in turns rotates the shaft of the jack. When the shaft turns the jack will lift i.e., the jack shaft lifts up. It initially asks us to train the module with our voice and then configure the led controls with the commands we used to train it and then store the commands in hexadecimal format so that it can bridge them.



Connections of Ardiuno with Voice Module

3.4. Arduino:

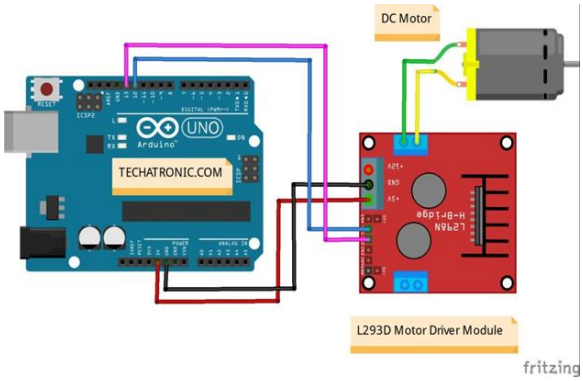
Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial

communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins, 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The ATmega16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .ino file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are two RX and TX LEDs on the arduino board which will flash when data is being transmitted via the USB-to- serial chip and USB connection to the computer (not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins.

3.5. DC Motor Driver: -

DC motor drivers are commonly used in Arduino projects to control and drive DC motors. Arduino, being a microcontroller-based platform, has limited capability to directly drive motors due to current and voltage limitations. A DC motor driver serves as an interface between the Arduino and the DC motor, providing the necessary power and control signals to drive the motor effectively. Connect the control pins of the motor driver to the appropriate digital pins of the Arduino. Refer to the datasheet or documentation of the motor driver for pin configuration. Connect the positive and negative terminals of the DC motor to the corresponding outputs of the motor driver. Typically, motor drivers have separate terminals for motor power supply, which should be connected to an appropriate power source based on the motor's requirements. Use the Arduino IDE or any compatible software to write the code. First, initialize the control pins as output pins in the setup() function. Then, in the loop() function, use functions such as analogWrite() or digitalWrite() to send control signals to the motor driver. These signals will determine the motor speed and direction. Connect the Arduino to your computer, compile the code, and upload it to the Arduino board. Make sure the motor driver and motor are properly connected and powered. Once the code is uploaded, observe the motor's behavior. You can modify the code to adjust the motor speed, direction, or implement any

desired functionality. If any issues occur, double-check the wiring connections and ensure the motor driver is compatible with the motor and Arduino.



Connections of Aurdino with Motor Driver.

3.5. Integration:

The next step is to integrate the hydraulic jack and voice recognition system into a single unit. The hydraulic jack would need to be modified to enable communication with the voice recognition system, and the voice recognition system would need to be programmed to control the hydraulic jack.

3.6. Testing and Validation:

Once the voice-automated hydraulic jack has been integrated, it is tested and validated to ensure that it performs as expected. Testing would involve simulating different load scenarios and evaluating the jack's ability to lift and lower loads accurately and safely. Validation would involve testing the voice recognition system under different conditions to ensure that it can recognize and interpret voice commands accurately.

3.7. Deployment and Maintenance:

After the voice-automated hydraulic jack has been tested and validated, it can be deployed for use in various industries. Maintenance would involve regular inspections and repairs to ensure that the jack remains in good working condition and continues to perform as expected.

4. EXPERIMENTAL PROCEDURE

4.1. Experimental Procedure:

To test the performance of the voice-automated hydraulic jack, a series of experiments were conducted. The experiments involved lifting different loads using various voice commands and evaluating the jack's ability to lift the load safely and accurately. The following are the steps that are followed to conduct the experimental procedure:

Load Configuration: The first step would be to configure the load that will be lifted by the hydraulic jack. The load should be selected based on the jack's load capacity and the experimental objectives. The load should be placed on the hydraulic jack's platform, and its weight should be measured accurately.

4.2. Voice Command:

The next step would be to use a pre-determined voice command to activate the hydraulic jack. The voice command should be clear and unambiguous and should be recognized accurately by the voice recognition system and complete the circuit.

4.3. Lifting:

Once the voice command is recognized, the hydraulic jack should begin to lift the load. The lifting process should be monitored carefully to ensure that the load is lifted smoothly and without any jerks or sudden movements.

4.4. Analytical Procedure:

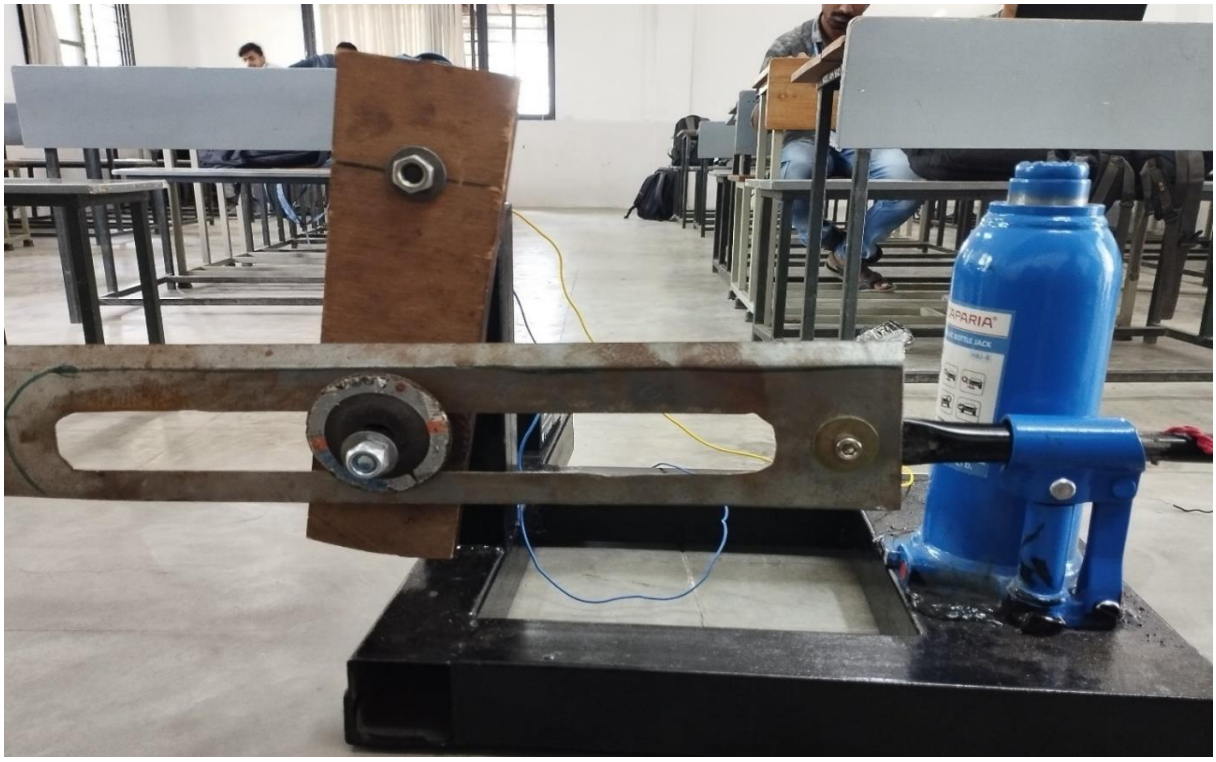
In addition to experimental procedures, analytical and numerical methods could also be used to evaluate the performance of the voice-automated hydraulic jack. These methods could involve creating computer models of the hydraulic jack and using simulations to test its performance under different conditions. The following are the steps that could be followed for an analytical procedure:

4.5. Modelling: The first step would be to create a computer model of the hydraulic jack. The model should include all the components of the jack and should be accurate and representative of the real-world hydraulic jack.

4.6. Simulation: Once the model has been created, simulations could be conducted to test the jack's performance under different conditions. The simulations could involve lifting different loads, changing the voice commands used to control the jack, and testing the jack's performance under different environmental conditions.

4.7. Analysis: After the simulations have been conducted, the results could be analyzed to evaluate the jack's performance. The analysis could include measuring the time taken to lift and lower the load, the load's maximum height, and the accuracy of the jack's movements.

4.8. Optimization: Based on the results of the analysis, optimizations could be made to the hydraulic jack's design or the voice recognition system's algorithms to improve the jack's performance. The simulations could be repeated to test the effectiveness of the optimizations and to identify any additional areas where improvements could be made. Overall, a combination of experimental and analytical procedures could be used to evaluate the performance of the voice-automated hydraulic jack and to identify areas for improvement.



Final Fabricated Model of Voice Automated Hydraulic Jack

ARDIUNO CODE:-

```
#include <SoftwareSerial.h>
#include "VoiceRecognitionV3.h"

/**
  Connection
  Arduino    VoiceRecognitionModule
   2   ------->     TX
   3   ------->     RX
*/
VR myVR(2,3);    // 2:RX 3:TX, you can choose your favourite pins.

uint8_t records[7]; // save record
uint8_t buf[64];

int led = 13;

#define onRecord    (0)
#define offRecord   (2)


int motorPin1 = 4; // IN1
int motorPin2 = 5; // IN2
int enablePin = 9; // ENA

/**
  @brief   Print signature, if the character is invisible,
```

```
        print hexible value instead.
  @param   buf     --> command length
        len     --> number of parameters
*/
void printSignature(uint8_t *buf, int len)
{
  int i;
  for(i=0; i<len; i++){
    if(buf[i]>0x19 && buf[i]<0x7F){
      Serial.write(buf[i]);
    }
    else{
      Serial.print("[");
      Serial.print(buf[i], HEX);
      Serial.print("]");
    }
  }
}

/**
  @brief   Print signature, if the character is invisible,
        print hexible value instead.
  @param   buf  -->  VR module return value when voice is recognized.
          buf[0]  -->  Group mode(FF: None Group, 0x8n: User, 0x0n:System
          buf[1]  -->  number of record which is recognized.
          buf[2]  -->  Recognizer index(position) value of the recognized record.
          buf[3]  -->  Signature length
          buf[4]~buf[n] --> Signature
*/
void printVR(uint8_t *buf)
{
  Serial.println("VR Index\tGroup\tRecordNum\tSignature");

  Serial.print(buf[2], DEC);
  Serial.print("\t\t");

  if(buf[0] == 0xFF){
    Serial.print("NONE");
  }
  else if(buf[0]&0x80){
    Serial.print("UG ");
    Serial.print(buf[0]&(~0x80), DEC);
  }
  else{
    Serial.print("SG ");
    Serial.print(buf[0], DEC);
  }
  Serial.print("\t");

  Serial.print(buf[1], DEC);
```

```
  Serial.print("\t\t");
  if(buf[3]>0){
    printSignature(buf+4, buf[3]);
  }
  else{
    Serial.print("NONE");
  }
  Serial.println("\r\n");
}

void setup()
{
  /** initialize */
  myVR.begin(9600);

  Serial.begin(115200);
  Serial.println("Elechouse Voice Recognition V3 Module\r\nControl LED sample");

  pinMode(led, OUTPUT);
  pinMode(motorPin1, OUTPUT);
  pinMode(motorPin2, OUTPUT);
  pinMode(enablePin, OUTPUT);

  if(myVR.clear() == 0){
    Serial.println("Recognizer cleared.");
  }else{
    Serial.println("Not find VoiceRecognitionModule.");
    Serial.println("Please check connection and restart Arduino.");
    while(1);
  }

  if(myVR.load((uint8_t)onRecord) >= 0){
    Serial.println("onRecord loaded");
  }

  if(myVR.load((uint8_t)offRecord) >= 0){
    Serial.println("offRecord loaded");
  }
}

void loop()
{
  int ret;
  ret = myVR.recognize(buf, 50);
  if(ret>0){
    switch(buf[1]){
      case onRecord:
        /** turn on LED */
        digitalWrite(led, HIGH);
        digitalWrite(motorPin1, HIGH);
```

```
    digitalWrite(motorPin2, LOW);
    analogWrite(enablePin, 200);
    break;
  case offRecord:
    /** turn off LED*/
    digitalWrite(led, LOW);
    digitalWrite(motorPin1, LOW);
    digitalWrite(motorPin2, LOW);
    analogWrite(enablePin, 0);
    break;
  default:
    Serial.println("Record function undefined");
    break;
}
/** voice recognized */
printVR(buf);}}
```

5. RESULT AND DISCUSSIONS

A voice automated hydraulic jack is a hydraulic jack that can be controlled by voice commands. It typically involves integrating a voice recognition system into the hydraulic jack, allowing users to operate the jack hands-free by simply speaking commands. One potential benefit of a voice automated hydraulic jack is increased convenience and efficiency, particularly in situations where the user's hands are occupied or where manual control is difficult or impossible. For example, if a mechanic is working under a car and needs to adjust the height of the jack, they can do so without having to stop what they're doing or risk losing their grip. However, there may be some drawbacks to a voice automated hydraulic jack as well. For example, the voice recognition system may not always work reliably, particularly in noisy environments or with users who have accents or speech impediments. Additionally, there may be concerns about the security of the system, particularly if it is connected to a larger network or control system.

Overall, a voice automated hydraulic jack could potentially offer benefits in terms of convenience and efficiency, but it would need to be carefully designed and tested to ensure that it is both reliable and secure.

6. CONCLUSION

In conclusion, a voice automated hydraulic jack has the potential to offer benefits in terms of convenience and efficiency, but it also poses some challenges that need to be addressed. The integration of a voice recognition system into a hydraulic jack could provide users with hands-free control and eliminate the need for manual control, which could be particularly useful in

situations where the user's hands are occupied or where manual control is difficult or impossible. However, the reliability of the voice recognition system could be a concern, as it may not always work effectively in noisy environments or with users who have accents or speech impediments. Additionally, there may be concerns about the security of the system, particularly if it is connected to a larger network or control system. Overall, a voice automated hydraulic jack could be a valuable addition to the field of hydraulic equipment if it is designed and tested with careful consideration of these challenges. As technology continues to evolve, it is likely that we will see more innovative approaches to enhancing the efficiency and functionality of hydraulic equipment, and voice automation may play an important role in these developments. A voice-based jack system can be easily attached to all currently manufacture chassis and frames. The main objective of this design is safety, reliable and able to rise with the android app considering some specification based on testing, it is considered safe to use automated voice jack system. By the torque supplied on the system is more enough to lift the cars.

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