

Design and Implementation of Iot- Based Hand Gesture Controlled Robot

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ABSTRACT

This paper reports the design, construction and control of a IOT based hand gesture controlled robot. The system architecture comprises a pair of DC motor and an Arduino microcontroller board, a single-axis gyroscope and a 2-axis accelerometer are employed for attitude determination. In addition, a complementary filter is implemented to compensate for gyro drifts. Electrical and kinematic parameters are determined experimentally, by PID and LQR-based PI-PD control designs respectively, and are performed on the linearized equations of motion. Experimental results show that self-balancing can be achieved with PI-PD control in the vicinity of the upright position.

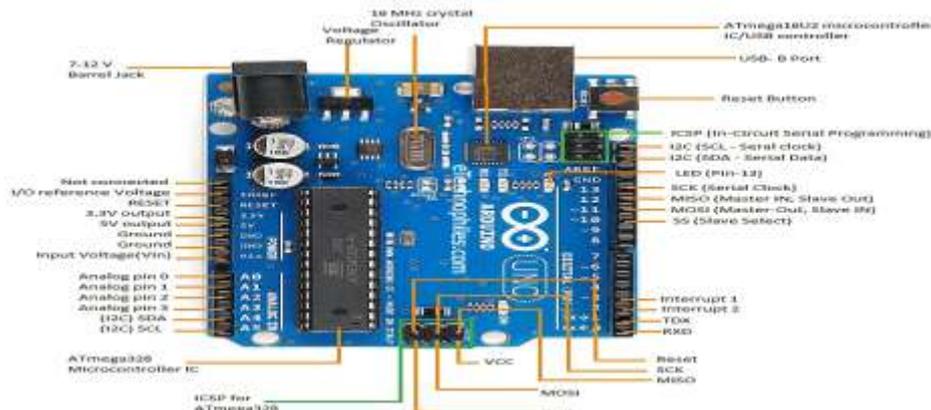
I. INTRODUCTION

The aim of a self-balancing robot is to balance itself on four wheels, being able to drive around without toppling over. Robot use a “closed-loop feedback control” system which means that real-time data from motion sensors is used to con-

trol the motors and quickly compensate for any tilting motion in order to keep the robot upright. Similar self-balancing feedback control systems can be seen in many other applications. Some of the obvious examples include bipedal robots and space rockets (A few rockets have been lost due to a faulty balancing system).

But what many people don't realise is that often the same type of controller is also used in a large variety of other applications which aren't related to balance. Proportional-integral-derivative (PID) controllers are used by elevators to control their motion and position, used by air-conditioning units to control the temperature within a room, and even used to control the operation of jet engines. Of course, rockets use significantly more complex controllers than air-conditioners but the underlying principle is still the same as how to adjust the system in order to get as close to the desired target value (be it temperature, angle, or position) as possible. That is why building a self-balancing robot is so educational you can use the same control methods over and over again for other projects.

Circuits Components Arduino UNO



Arduino Uno is a microcontroller board based on an 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists of other components such as crystal oscillator, serial communication, voltage regulator etc to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

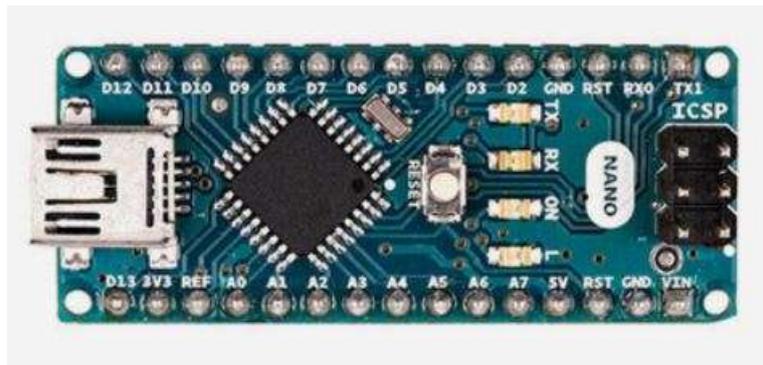
Arduino can be used to communicate with a computer, another Arduino board or other microcontrollers. The ATmega328P microcontroller provides UART TTL (5V) serial communication which can be done using digital pin 0 (Rx) and digital pin 1 (Tx). An ATmega16U2 on the board channels this serial communication 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 .inf 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. The ATmega328P also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

It is used to produce a clock of precise frequency using constant voltage. There is one limitation using ArduinoNano i.e. it doesn't come with DC power jack, means you can not supply external power source through a battery.



Wi-Fi Module (ESP8266)

The ESP8266 Wi-Fi module is a complete Wi-Fi network where you can easily connect as a serving Wi-Fi adapter, wireless

internet access interface to any microcontroller based design on its simple connectivity through Serial Communication or UART interface.



Accelerometer (ADXL335)

The MPU-6050 devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an onboard Digital Motion Processor™ (DMP™), which processes complex 6-axis Motion Fusion algorithms. The device can access external magnetometers or other sensors through an auxiliary master I²C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor. The devices are offered in a 4 mm x 4 mm x 0.9 mm QFN package.

Camera(V380s)

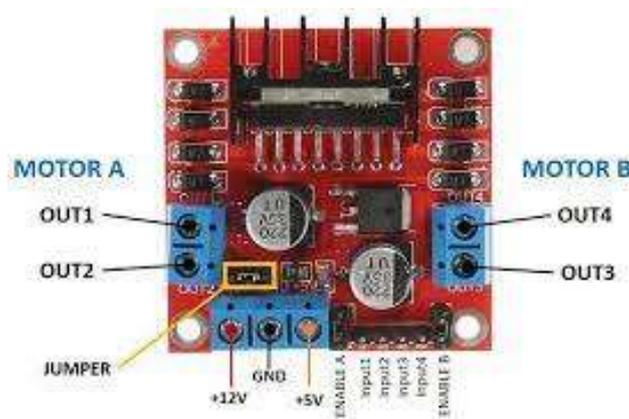
V380s Mini HD 720P Camera is a two-way Intercom/Audio camera. Wi-Fi connection with multiple users is allowed without a

specific display in this camera. Its specifications are :

- 1.Two-way Audio
- 2.Day&Night Vision
- 3.Mobile Remote
- 4.WiFi
- 5.Pan/Tilt

Motor Driver(L298)

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors.



DC Gear Motor

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing

the torque output. Most of our DC motors can be complimented with one of our unique gearheads, providing you with a highly efficient gear motor solution.



RF Transmitter&Reciever

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data.

Transmitter modules are usually implemented alongside a microcontroller which will provide data to the module which can be transmitted.



II. CONCLUSIONS

This project was successful in achieving its aim IOT based hand gesture controlled robot based on the inverted pendulum model. The control strategy called proportional integral derivative controller to control the trajectory.

III. ACKNOWLEDGMENT

Our project would not have been possible without the guidance of Dr. Amit Saxena and Assistant Professor Dr. Narendra Singh Pal and other faculties, lab assistance of ECE

department,MIT for their technical support and constant supervision which contributed immensely to project development. Last but not the least, special thanks to all my friends for sharing their experience in completing this project.

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