DIGITAL SPIRIT LEVEL METER

A PROJECT BASED LEARNING REPORT

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BONAFIDE CERTIFICATE

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TITLE OF CONTENT

ABSTRACT

Flatness measurement is always an emerging problem in broad area of Machines, automobile, construction etc. For any machine before its operation should have an accurate alignment. A simple spirit level is commonly employed in order to measure Flatness but the results are not so accurate. Although we have electronic devices such as inclinometer for those tasks but they are so much costly. Here comes our technology "A hybrid spirit level" through which measurement of inclination becomes more precise at very cheap cost. The apparatus consist of a sprit level integrated with electronic circuit to detect the inclination/ flatness of the required surface. Here the property of conductivity of liquid will be employed in the job of detecting the inclination of the surface. By using this method it is possible to minimise the error to great extent and also will help in automatic detection of flatness.

CHAPTER 1

INTRODUCTION:

The digital spirit level meter heralds a new era in precision measurement, embodying technological excellence in the realm of leveling and alignment tools. This innovative device combines state-of-the-art sensors with digital display capabilities, revolutionizing the way we approach tasks requiring accuracy and equilibrium. Designed for professionals and hobbyists alike, its intuitive interface and high-resolution display provide instant, precise readings for inclination and alignment, eliminating the complexities associated with traditional bubble levels.Crafted for versatility, the digital spirit level meter finds application in diverse fields, from construction and carpentry to DIY home projects. Its sleek and ergonomic design enhances user comfort, ensuring a seamless experience during operation. By replacing the subjective interpretation of bubble positions with clear, numeric data, this tool enhances efficiency and minimizes errors, making it an indispensable companion for anyone seeking unparalleled precision in their work.In a synthesis of cutting-edge technology and practical utility, the digital spirit level meter redefines our expectations of accuracy, bringing a new standard to tasks that demand flawless alignment. With its robust construction and advanced features, this tool is a testament to the seamless integration of digital innovation into traditional craftsmanship, empowering users to achieve unmatched precision in their endeavors.

CHAPTER 2

HARDWARE REQUIRED:

2.1 ULTRASONIC SENSOR HC-SR04:

The HC-SR04 Ultrasonic Sensor is a widely-used distance measuring device known for its simplicity and effectiveness. Operating on ultrasonic sound waves, it consists of a transmitter that emits ultrasonic pulses and a receiver that detects the reflected signal. By calculating the time taken for the signal to travel and return, the sensor accurately determines distances with remarkable precision. Popular in robotics, automation, and IoT projects, the HC-SR04 offers a non-contact method for distance measurement, making it invaluable for obstacle avoidance, object detection, and distance monitoring applications. Its affordability, reliability, and ease of integration contribute to its widespread adoption in diverse technological endeavors. hc-sr04

Fig 2.1 Ultrasonic Sensor HC-SR04

2.2 GYROSCOPE ACCELERATOR (MPU 6050 3AXIS)

The MPU-6050 is a popular integrated circuit that combines a 3-axis gyroscope and a 3-axis accelerometer, enabling precise motion tracking in electronic devices. Manufactured by Inven Sense, it employs MEMS (Micro-Electro-Mechanical Systems) technology for accurate measurement of angular velocity and acceleration. With a compact design and low power consumption, the MPU-

6050 is widely used in applications such as robotics, drones, and electronic gadgets. Its ability to provide real-time data about orientation and movement makes it a valuable compone6050 3Axis Gyroscope Accelerator for motion sensing and control systems. The MPU-6050 communicates with microcontrollers through I2C or SPI interfaces, allowing seamless integration into various projects for motion analysis and stabilization. Overall, the MPU-6050 plays a crucial role in enhancing the functionality of devices that require precise motion sensing capabilities.

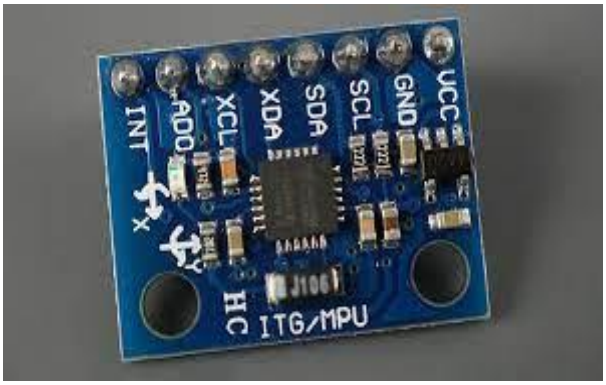


Fig 2.2 MPU 6050 3axis gyroscope accelerator

2.3 CHARACTER LCD(16x2)

A 16x2 character LCD (Liquid Crystal Display) is a common alphanumeric display with 16 columns and 2 rows, providing a total of 32 characters. These displays are widely used in electronic projects for showing text-based information. They operate on low power, making them suitable for battery-powered devices. Each character position can display letters, numbers, or symbols. The interfacing typically involves connecting the LCD to a microcontroller or other control circuit. Users can program the display to show relevant data, making it a versatile and user-friendly output interface in various applications, such as digital clocks, temperature displays, and more.

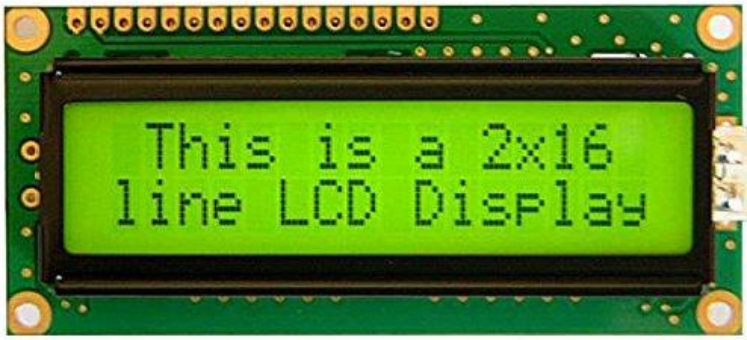
- 

Fig 2.3 16x2 Character LCD

2.4 ARUDINO NANO:

The Arduino Nano is a compact and versatile microcontroller board based on the ATmega328P chip. With a small form factor, it's suitable for projects with space constraints. The Nano is part of the Arduino ecosystem, making it easy to use for both beginners and experienced developers. It features 14 digital input/output pins, 8 analog pins, and a micro USB connector for programming and power. The board supports a variety of sensors and actuators, making it ideal for a wide range of applications, from simple LED projects to complex robotics. Its affordability and ease of integration contribute to its popularity in the community.

Fig 2.4 Arduino Nano

2.PROGRAMMING:

2.1 CODING:

```
#include<Wire.h> // I2C communication library

#include <LiquidCrystal.h> // includes the LiquidCrystal Library

LiquidCrystal lcd(7, 6, 5, 4, 3, 2); // Creates an LCD object. Parameters: (rs, enable, d4, d5, d6, d7)

const int MPU = 0x68; // I2C address of the MPU6050 accelerometer

#define trigPin 8

#define echoPin 9

#define selectButton 10

int16_t AcX, AcY, AcZ;

long duration;

float distance;

int program = 0;

float d = 0;

float d1 = 0;

float d2 = 0;
```

```
float area = 0;
int axis = 0;
int angle = 0;
int unitSelect = 0;
String unit = "cm";
void setup() {
// Initialize interface to the MPU6050
Wire.begin();
Wire.beginTransmission(MPU);
Wire.write(0x6B);
Wire.write(0);
Wire.endTransmission(true);
lcd.begin(16, 2); // Initializes the interface to the LCD screen
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(selectButton, INPUT_PULLUP);
}
void loop() {
switch (program) {  // Switch between different programs
case 0:  // Select unit of measurement
```

```
lcd.setCursor(0, 0); // Sets the location at which subsequent text written to the LCD will be displayed
lcd.print("Select Unit: ");
lcd.setCursor(13, 0);
lcd.print(unit);
lcd.print("  ");
delay(10);
case 1:   // Distance measuring program
distance = getDistance(); // Distance to the nearest object
lcd.setCursor(0, 0);
lcd.print("Dist: ");
lcd.print(distance); // Prints the distance value from the sensor
lcd.print("    ");
lcd.setCursor(14, 0);
lcd.print(unit);
delay(10);
lcd.setCursor(0, 1);
lcd.print("d:");
lcd.setCursor(8, 1);
lcd.print("d:");
delay(200);
```

```
// Save distance 1
delay(500);
if (digitalRead(selectButton) == 0) {
program = 2;
d = 0;
lcd.clear();
delay(500);
}
}
break;
case 2:   // Area measuring program
distance = getDistance();
lcd.setCursor(0, 0);
lcd.print("Area: ");
lcd.print(area); // Prints the calculated area from the two measurements
lcd.setCursor(12, 0);
lcd.print(unit); // Prints the selected unit and the square sign below

lcd.print("^2");
delay(200);
if ( d == 0) {
```

```
lcd.setCursor(0, 1);
lcd.print("d1:       ");
if (digitalRead(selectButton) == 0) {
program = 3;
d = 0;
lcd.clear();
delay(500);
}
}
break;
case 3:    // Angle measuring program
// Read the accelerometer data
Wire.beginTransmission(MPU);
Wire.write(0x3B); // Start with register 0x3B (ACCEL_XOUT_H)
// Clears the trigPin
digitalWrite(trigPin, LOW);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
```

```
duration = pulseIn(echoPin, HIGH);
// Calculating the distance
distance = duration * 0.034 / 2; // distance in cm
// Converting the units
if (unitSelect == 1) {
distance = distance; // cm to cm
unit = "cm";
}
else if (unitSelect == 2) {
distance = distance *  0.393701; // cm to in
unit = "in";
}
else if (unitSelect == 3) {
distance = distance * 0.01; // cm to m
unit = "m";
}
else if (unitSelect == 0) {
distance = distance * 0.0328; // cm to ft
unit = "ft";
}
return distance;
```

CHAPTER 3

BLOCK DIAGRAM:

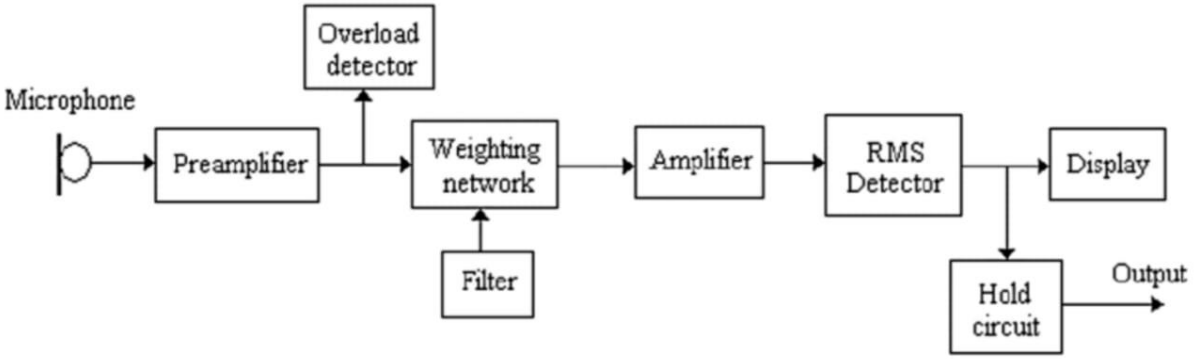


Fig 3.1 Block diagram of the proposed system

In this project, we will use a GY-521 3 Axis Accelerometer for determining at which angle a surface is. For displaying the angle, we will use a 7 Segment 4 Digits display. The µC used will be an Arduino Nano, in order to keep everything compact on PCB.

3.1 CIRCUIT DIAGRAM

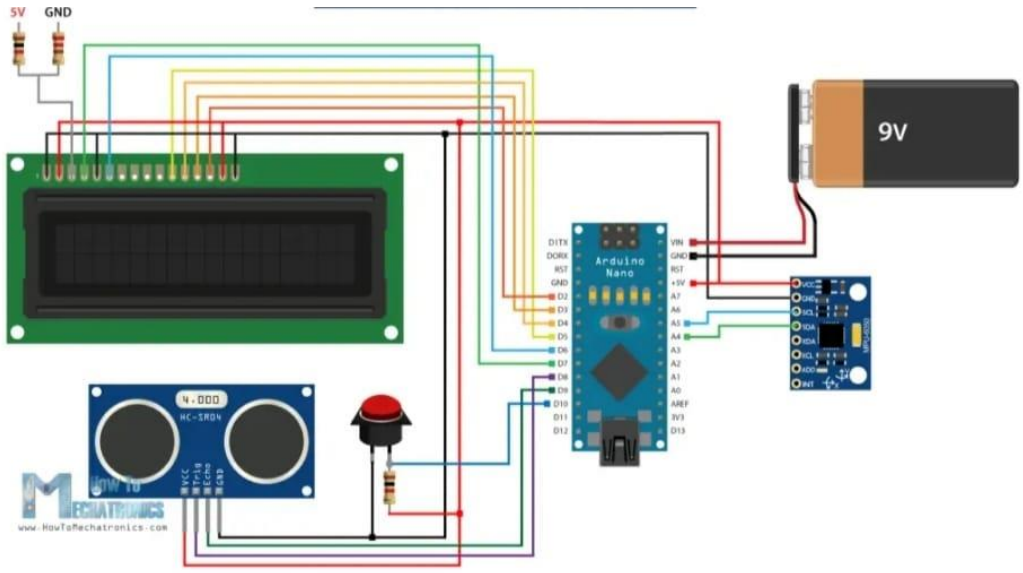


Fig 3.2 Circuit Diagram of the proposed system

WORKING OF DIGITAL SPIRIT LEVEL METER

A digital spirit level meter is a precision tool designed to measure and indicate the inclination or tilt of a surface relative to the Earth's gravity. Unlike traditional bubble levels, digital spirit level meters employ advanced sensor technology, such as accelerometers, to provide accurate and instantaneous readings.

Working with a digital spirit level meter involves activating the device, ensuring it is calibrated correctly, and then placing it on the surface to be measured. The device typically displays the angle of inclination digitally, allowing for quick and easy readings. Some advanced models may also have additional features like audible alerts or visual indicators for precise leveling.

In professional settings, such as construction or carpentry, digital spirit level meters have become indispensable tools. They offer advantages like high accuracy, ease of use, and the ability to measure angles with greater precision. The digital display eliminates the need for manual interpretation of bubble positions, reducing the likelihood of errors in measurement.

As technology continues to advance, digital spirit level meters may incorporate wireless connectivity or integration with mobile apps, enhancing their functionality and data logging capabilities. Overall, these devices streamline the leveling process, contributing to efficiency and precision in various applications.

CHAPTER 4

CONCLUSION:

In conclusion, the digital spirit level meter stands as a technological marvel, revolutionizing precision measurements in construction, woodworking, and various industries. Its reliance on advanced sensor technology ensures accurate and immediate readings, surpassing the limitations of traditional bubble levels. The user-friendly digital display enhances ease of use, while potential integrations with mobile apps and wireless capabilities further extend its functionality. This tool not only expedites the leveling process but also minimizes human error, becoming an indispensable asset for professionals who prioritize accuracy and efficiency in their work. The digital spirit level meter exemplifies the intersection of technology and practicality in modern measurement tools.

FUTURE SCOPE:

1. Enhanced Connectivity: Integration with IoT for real-time data sharing.
2. Smartphone Integration: Seamless communication with mobile apps for remote monitoring.
3. Advanced Sensors: Inclusion of additional sensors for multi-dimensional measurements.
4. AR Integration: Augmented reality overlays for on-site guidance.
5. Data Analytics: Capability for storing and analyzing leveling data for project optimization.

REFERENCE

https://howtomechatronics.com/tutorials/arduino/arduino-range-measurer-and-digital-spirit-level-project/

APPENDIX:

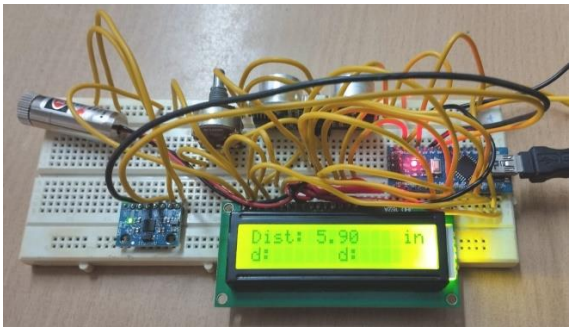


Fig 4.1 Front View

A digital spirit level meter is a precision tool designed to measure and indicate the inclination or tilt of a surface relative to the Earth's gravity. Unlike traditional bubble levels, digital spirit level meters employ advanced sensor technology, such as accelerometers, to provide accurate and instantaneous readings. Working with a digital spirit level meter involves activating the device, ensuring it is calibrated correctly, and then placing it on the surface to be measured. They offer advantages like high accuracy, ease of use, and the ability to measure angles with greater precision. The digital display eliminates the need for manual interpretation of bubble positions, reducing the likelihood of errors in measurement. . Overall, these devices streamline the leveling process, contributing to efficiency and precision in various applications.