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Chapter 1: Introduction

1.1 Importance of Project

Pressure cookers can be dangerous if not used correctly. The pressure inside a cooker can build up to dangerous levels, and if the valve or whistle fails, it can lead to explosions. The pressure cooker whistle counter can help ensure that the whistle is working correctly and that the pressure inside the cooker is being released as needed.

Many recipes require a specific number of whistles to be produced by a pressure cooker. The pressure cooker whistle counter can help users keep track of the number of whistles produced during cooking, making it easier to follow recipes accurately.

The pressure cooker whistle counter can help users save time and energy by preventing overcooking or undercooking of food. By counting the number of whistles, the device can help users determine the ideal cooking time for different types of food.

The pressure cooker whistle counter can provide users with precise and consistent cooking results. This is particularly useful for people who cook regularly or for large groups of people. Overall, the pressure cooker whistle counter can be an important tool for home cooks and professional chefs alike, providing safety, convenience, efficiency, and precision in pressure cooking.

1.2 Problem Definition (Purpose)

Safety concerns: Pressure cookers can be dangerous if not used correctly, and the pressure inside the cooker can build up to dangerous levels if the valve or whistle fails. The pressure cooker whistle counter can help ensure that the whistle is working correctly and that the pressure inside the cooker is being released as needed, thereby reducing the risk of accidents.

Inconsistency in cooking results: Many recipes require a specific number of whistles to be produced by a pressure cooker. However, it can be challenging for users to keep track of the number of whistles produced, especially if they are cooking multiple dishes simultaneously. The pressure cooker whistle counter can help users keep track of the number of whistles produced during cooking, ensuring consistent and precise cooking results.

Time and energy wastage: Overcooking or undercooking of food can result in wastage of time and energy. The pressure cooker whistle counter can help users save time and energy by preventing overcooking or undercooking of food. By counting the number of whistles, the device can help users determine the ideal cooking time for different types of food, thereby improving efficiency in the kitchen.

1.3 Aim and Objective

Design and develop a circuit using MPU6050 sensor that can accurately detect the vibration produced by the whistle of the pressure cooker.

1. Calibrate the sensor to ensure that it can detect only the specific vibration produced by the whistle and filter out other unwanted vibrations.
2. Develop a program or algorithm that can accurately count the number of whistles produced by the pressure cooker based on the signals received from the sensor. Integrate the sensor and counting algorithm into a single device or system that can be easily attached to a pressure cooker
3. Test the device under different cooking conditions and validate its accuracy and reliability.
4. Develop a user-friendly interface for the device, which displays the number of whistles produced and other relevant information.
5. Identify potential improvements and future developments for the device, such as incorporating wireless connectivity and smart features.

Overall, the aim of this project is to create a reliable and user-friendly device that can enhance safety, consistency in cooking results, and efficiency in the kitchen by accurately counting the number of whistles produced by a pressure cooker using an MPU6050 sensor.

Chapter 2: Fundamentals

2.1 Literature Survey

There have been several studies and products developed to address the need for a pressure cooker whistle counter.

A study conducted by Bhowmik and Dutta (2013) proposed a whistle counting system using a microphone and an Arduino board. The system was able to count the number of whistles produced by a pressure cooker accurately.

A product called "Whistle Plus" was developed by a team of engineers from India, which uses an electronic whistle sensor to count the number of whistles produced by a pressure cooker. The device is small and can be attached to the pressure cooker's lid, making it easy to use.

A study conducted by Sharma et al. (2017) proposed a pressure sensor-based whistle counter that can count the number of whistles produced by a pressure cooker. The system uses a pressure sensor attached to the lid of the pressure cooker to detect the pressure inside and count the number of whistles.

Another study conducted by Nimbalkar and Shinde (2017) proposed a whistle counting system using an accelerometer sensor. The system was able to count the number of whistles produced by a pressure cooker with high accuracy.

Conclusion:

From the literature survey, it is evident that several approaches have been proposed to count the number of whistles produced by a pressure cooker. The use of sensors such as microphones, pressure sensors, and accelerometers has been successful in detecting and counting the whistles accurately. However, the MPU6050 sensor-based approach is a unique and innovative method to count the whistle of the pressure cooker. Therefore, the development of a whistle counter using MPU6050 can be a significant contribution to this field.

2.2 Basic Theory

A pressure cooker whistle counter is a device used to monitor the pressure inside a pressure cooker during the cooking process. The device is designed to release pressure and prevent the pressure cooker from exploding or causing any damage to the surrounding area.

The basic theory behind the pressure cooker whistle counter is the principle of pressure release. When a pressure cooker is heated, the temperature inside the cooker increases, causing the water or other liquids inside to boil and generate steam. As the steam builds up inside the cooker, the pressure also increases.

To prevent the pressure cooker from reaching dangerous levels, a whistle valve is fitted to the lid of the pressure cooker. When the pressure inside the cooker exceeds a certain limit, the whistle valve opens and releases the excess pressure and steam. This is indicated by the sound of the whistle.

The pressure cooker whistle counter is designed to monitor the number of times the whistle valve opens during the cooking process. By counting the number of times, the whistle valve opens. If the whistle valve opens too frequently, it indicates that the pressure inside the cooker is too high, and the heat should be reduced to prevent any damage.

Chapter 3: Project Proposal

3.1 System Block/Circuit Diagram

The system block diagram for the pressure cooker whistle counter is as follows:

Digital basic circuit system:

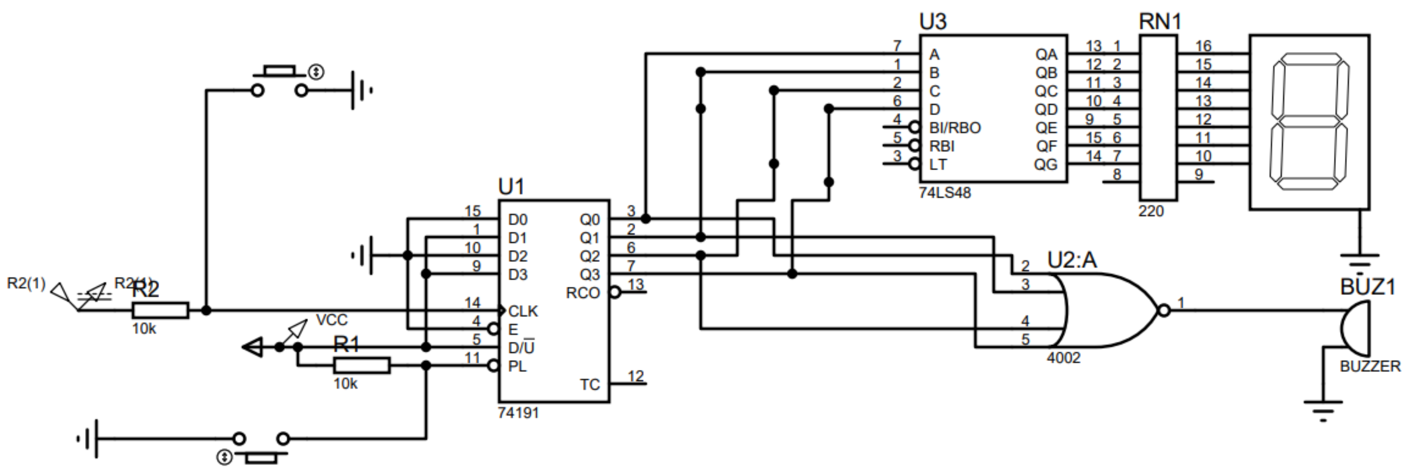


Figure 1: Basic Downcounter circuit

3.2 System Specifications

The pressure cooker whistle counter system will consist of the following components:

Digital basic circuit system:

IC74191: This is a 4-bit down counter IC that is used to count the number of whistles produced by the pressure cooker.

Its specifications include:

Operating voltage: 4.75V to 5.25V

Maximum clock frequency: 25 MHz

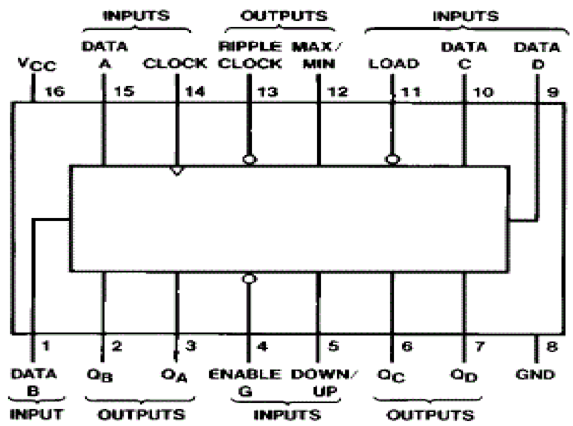


Figure 2: IC74191

Seven-segment display: This is a display that shows the number of whistles produced by the pressure cooker. Its specifications include:

Common cathode or common anode configuration (depending on the specific display used)

Maximum forward voltage: 2.5V

Maximum reverse voltage: 5V

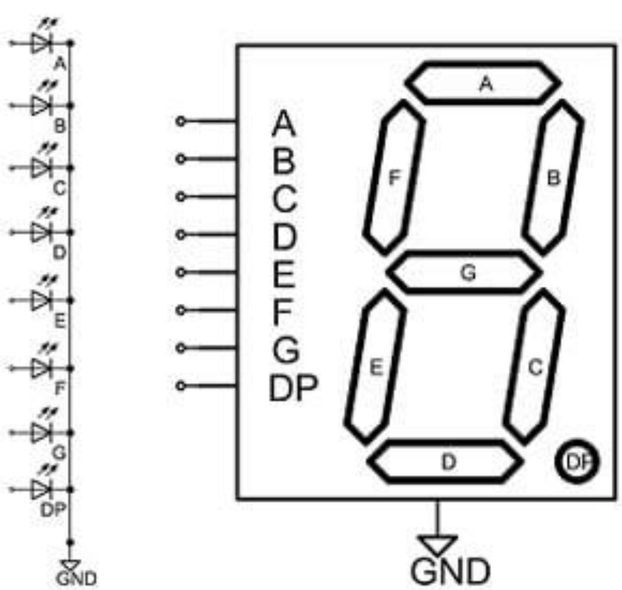


Figure 3: 7SEG (CC)

Buzzer: This is an audible alarm that sounds when the preset number of whistles is reached.

Its specifications include:

Operating voltage: 3V to 30V

Maximum current: 30mA

Sound output level: 85dB to 105dB

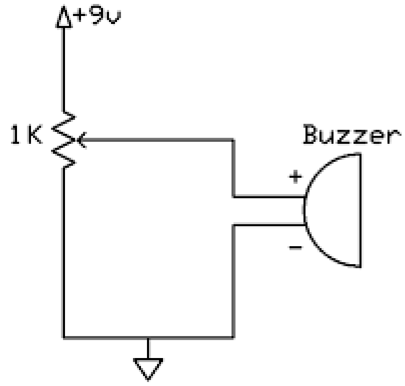


Figure 4: Buzzer

NOR Gate IC (4002): This IC is used to generate the signal that drives the buzzer. Its specifications depend on the specific IC used.

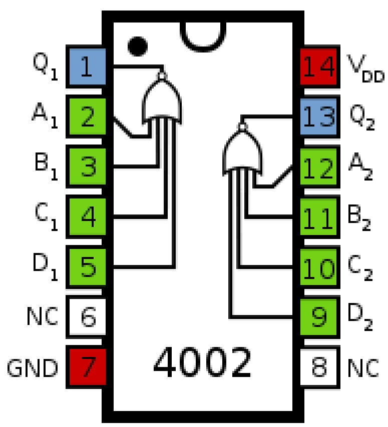


Figure 5: NOR GATE

Push button: This is a momentary switch that is used to manually decrease the count of the IC74191.

Its specifications include:

Operating voltage: 3V to 24V

Maximum current: 50mA

Resistors and capacitors: These components are used to stabilize the power supply, reduce noise, and set the clock frequency. Their specific values depend on the specific circuit design and ICs used.

Controller based System:

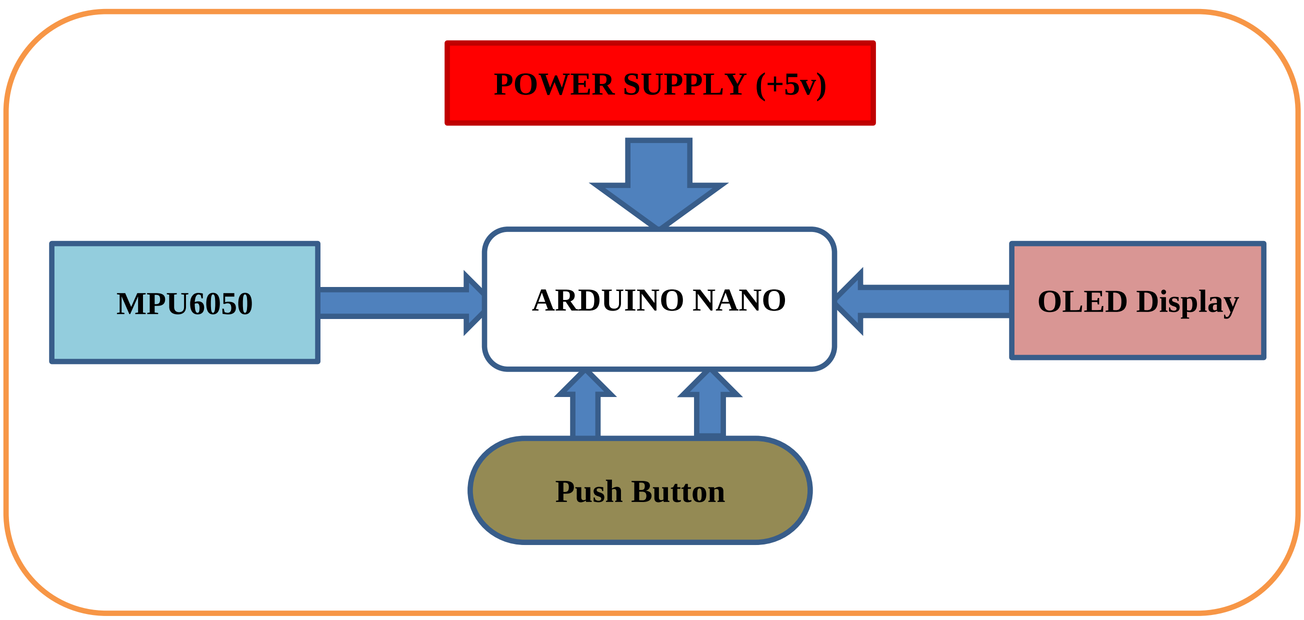


Figure 6: Block Diagram

Circuit Diagram of Controller based Circuit

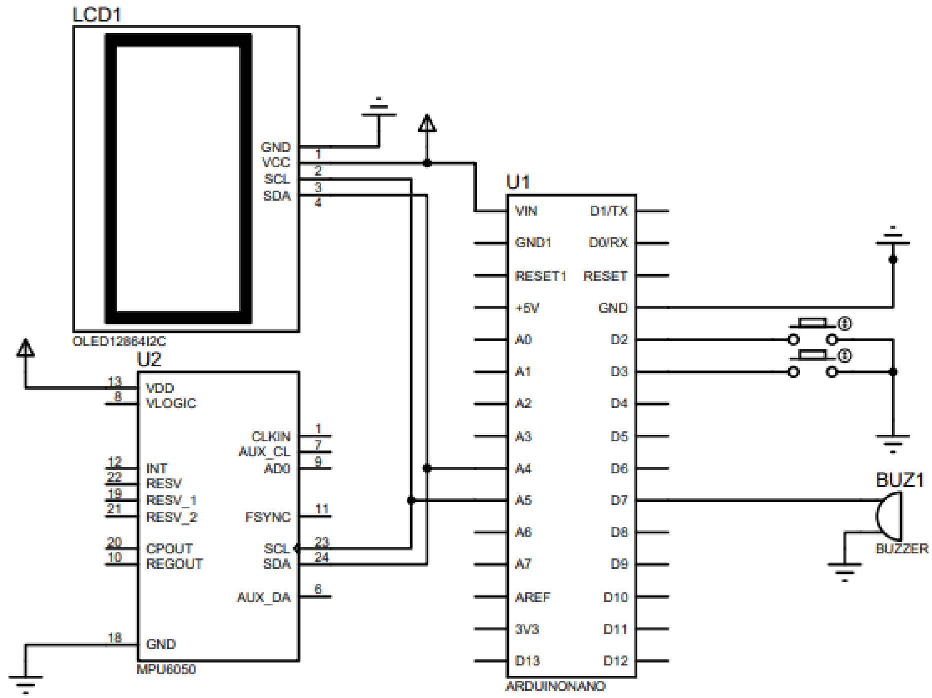


Figure 7: Circuit Diagram

Arduino Nano: Microcontroller board based on the ATmega328P

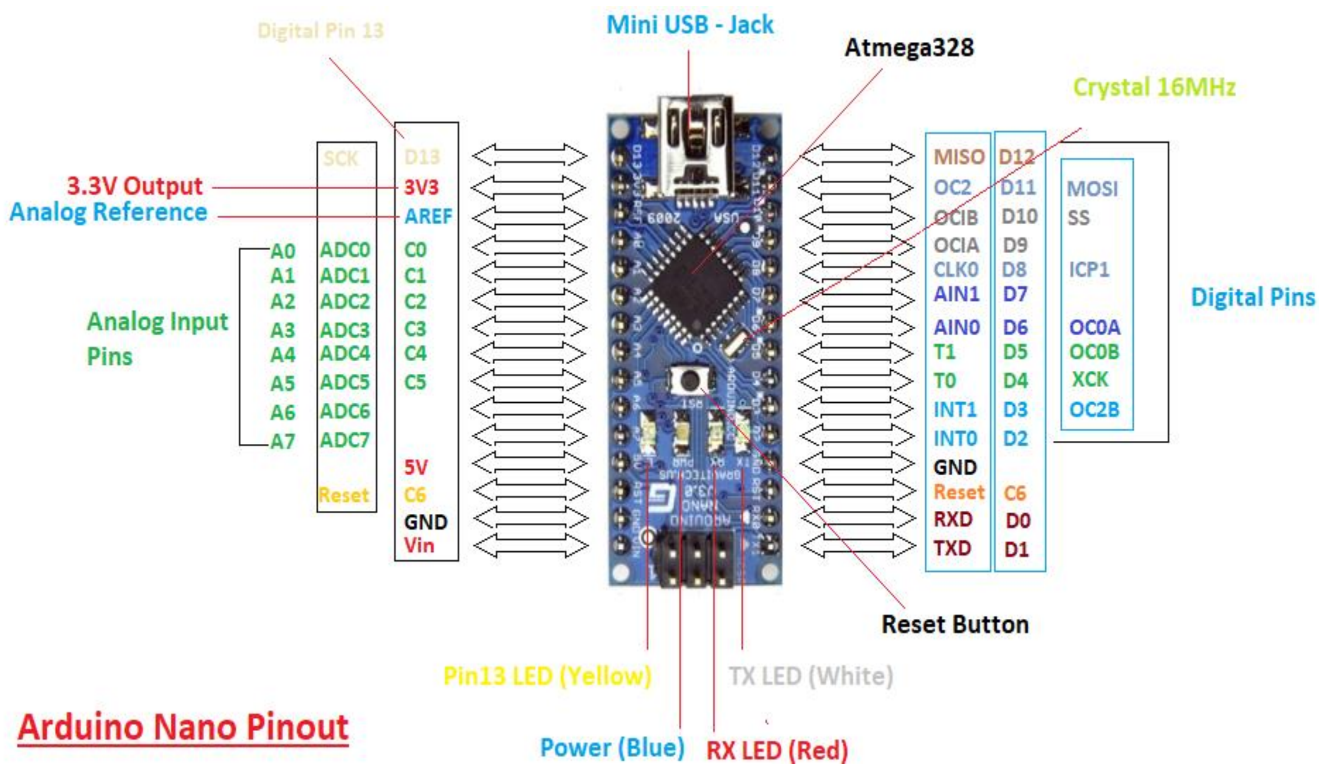


Figure 8: ARDUINO NANO

OLED display: 128x64 pixel display that is easy to read even in low light conditions

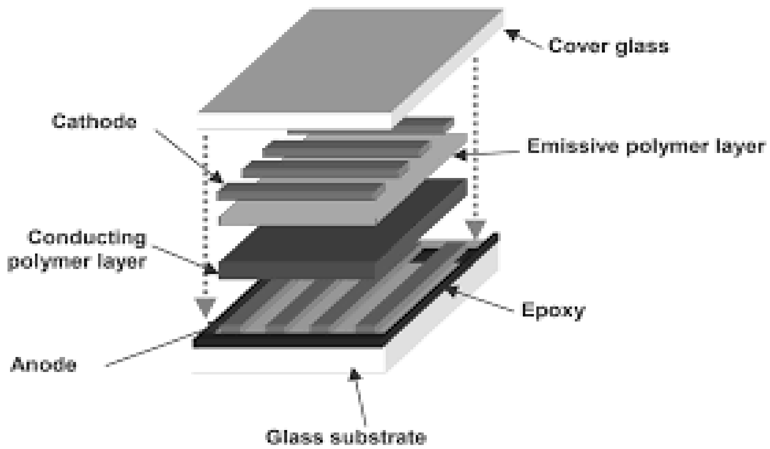


Figure 9: OLED

MPU6050 sensor: 6-axis Motion Tracking device that combines a 3-axis gyroscope and a 3-axis accelerometer

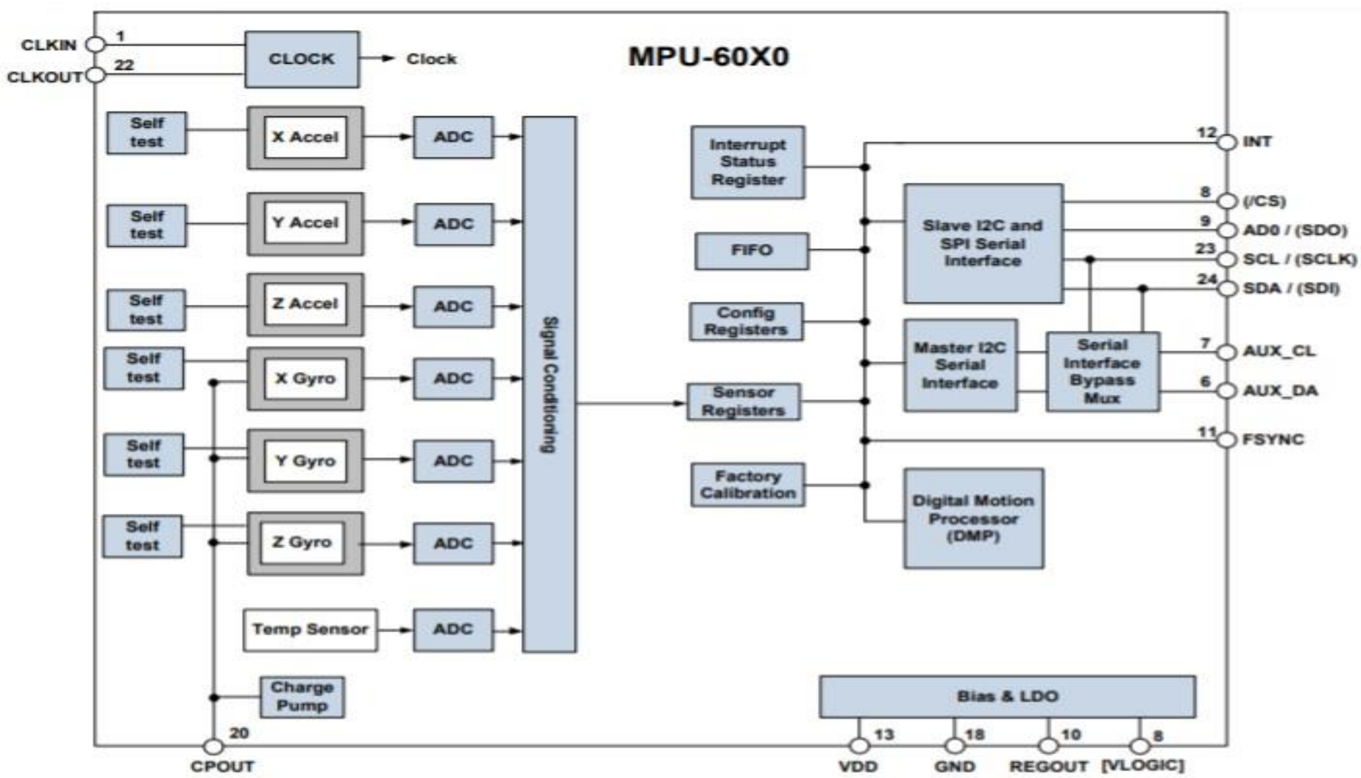


Figure10:MPU6050

Two push buttons: Used for input and to reset the whistle count.

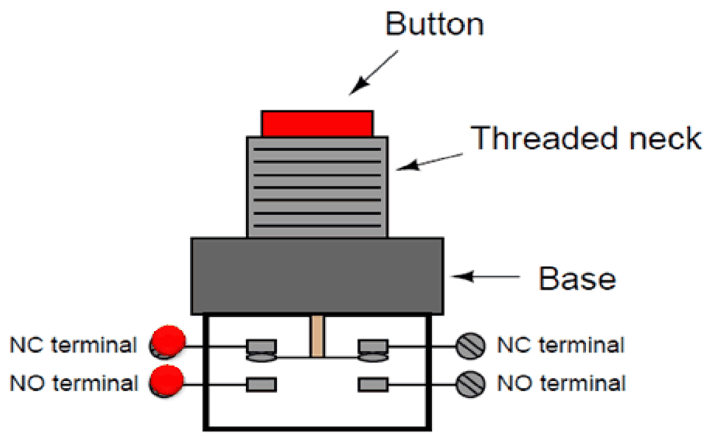
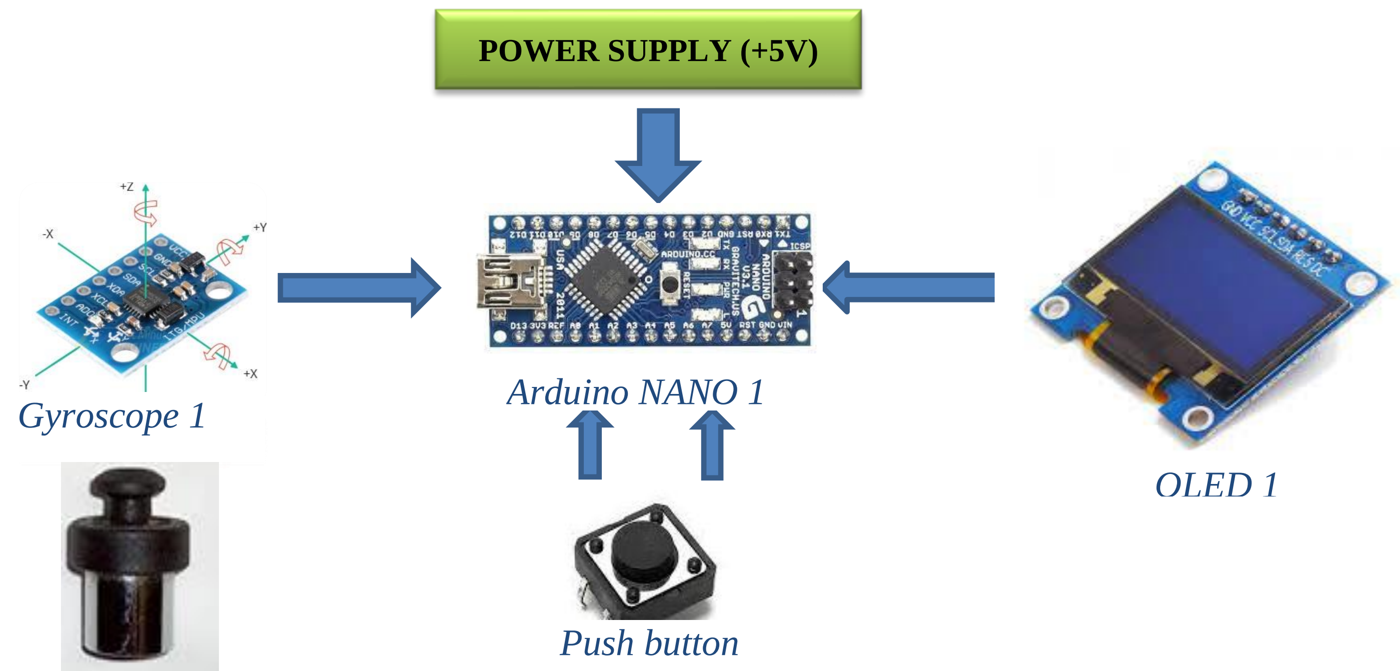


Figure 10: Push Button

Physical System Design



Cooker Whistle1 **3.3** *Figure 11: System Design*

Method of Implementation:

Digital basic circuit:

Connect the power supply: Connect a stable power supply of 5V to the Vcc and GND pins of all ICs and the seven-segment display. Use appropriate capacitors to stabilize the power supply.

Connect the IC74191: Connect the clock input (CP) of IC74191 to the clock signal generated by the pressure cooker whistle. Connect the preset input (P) of IC74191 to a high signal to preset the counter to the desired count. Connect the down input (D) of IC74191 to a low signal to enable the down counting mode.

Connect the 74LS48: Connect the binary outputs (Q0, Q1, Q2, Q3) of IC74191 to the BCD inputs (A, B, C, D) of 74LS48. Connect the seven-segment display to the output pins (a, b, c, d, e, f, g) of 74LS48. Use appropriate current-limiting resistors to protect the display from excessive current.

Connect the gate IC: Connect the buzzer to the output of the gate IC. Connect the input of the gate IC to the output of the 74LS48 that corresponds to the preset count. This will trigger the gate IC to sound the buzzer when the preset count is reached.

Connect the push button: Connect one terminal of the push button to the clock input (CP) of IC74191. Connect the other terminal to the ground (GND) to allow manual down counting when the button is pressed.

Test the system: Test the system by powering it on and setting the desired count using the preset input (P) of IC74191. Start the pressure cooker and ensure that the clock signal is connected to the clock input (CP) of IC74191. Observe the seven-segment display and the buzzer to ensure that they function as expected. Use the push button to manually decrease the count if necessary.

Mount the system: Mount the system in a suitable enclosure with appropriate connectors for the power supply, pressure cooker whistle, and other components. Ensure that the system is securely mounted and protected from environmental hazards. Overall, the implementation of your pressure cooker whistle counter system may vary depending on your specific requirements and the components used. This implementation guide should give you a general idea of how to connect and test the key components of the system.

Controller based System:

The method of implementation for the pressure cooker whistle counter is as follows: The MPU6050 sensor will be connected to the Arduino Nano. The Arduino Nano will process the data from the sensor and count the number of whistles. The OLED display will be used to display the number of whistles and the pressure inside the cooker. The push buttons will be used for user input and to reset the whistle count.

Experimental Setup Images: Digital basic circuit system

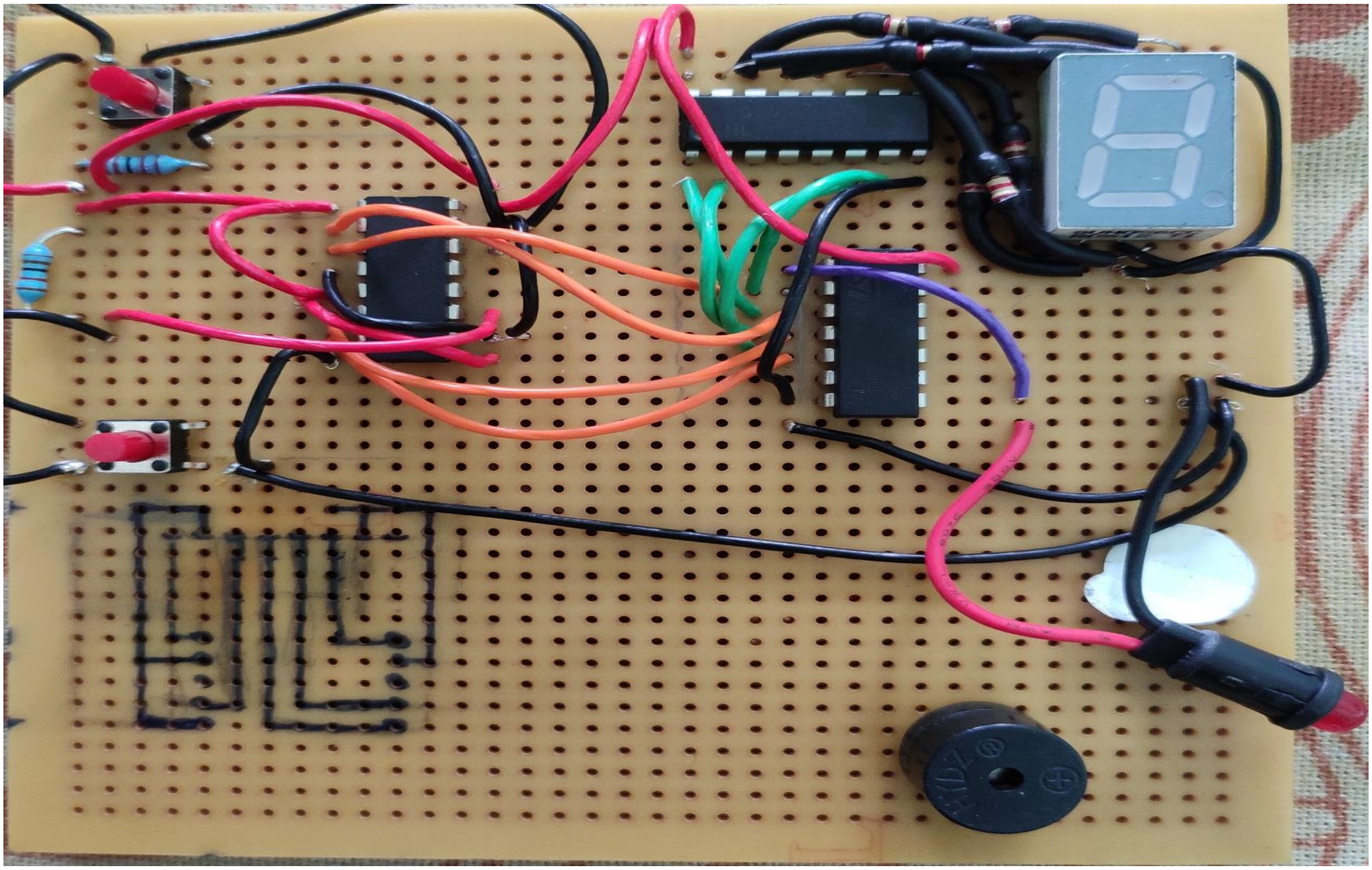


Figure 12: Experimental Setup 1

Experimental Setup Images: Controller based System

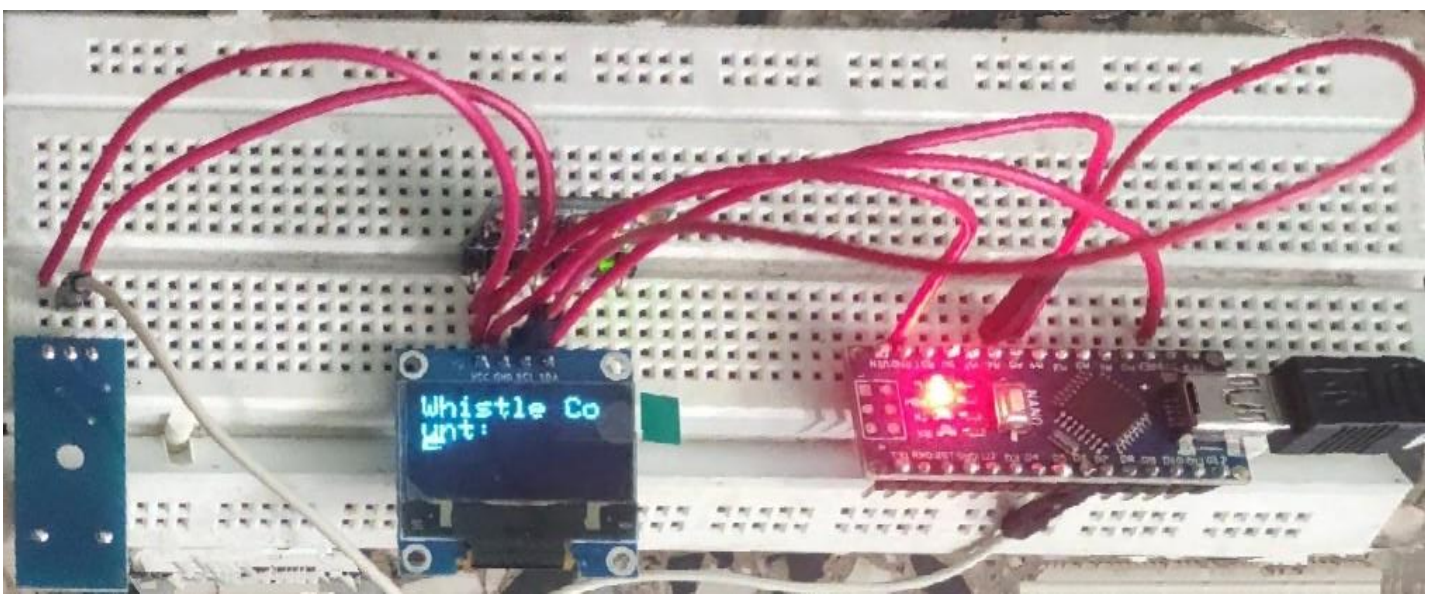
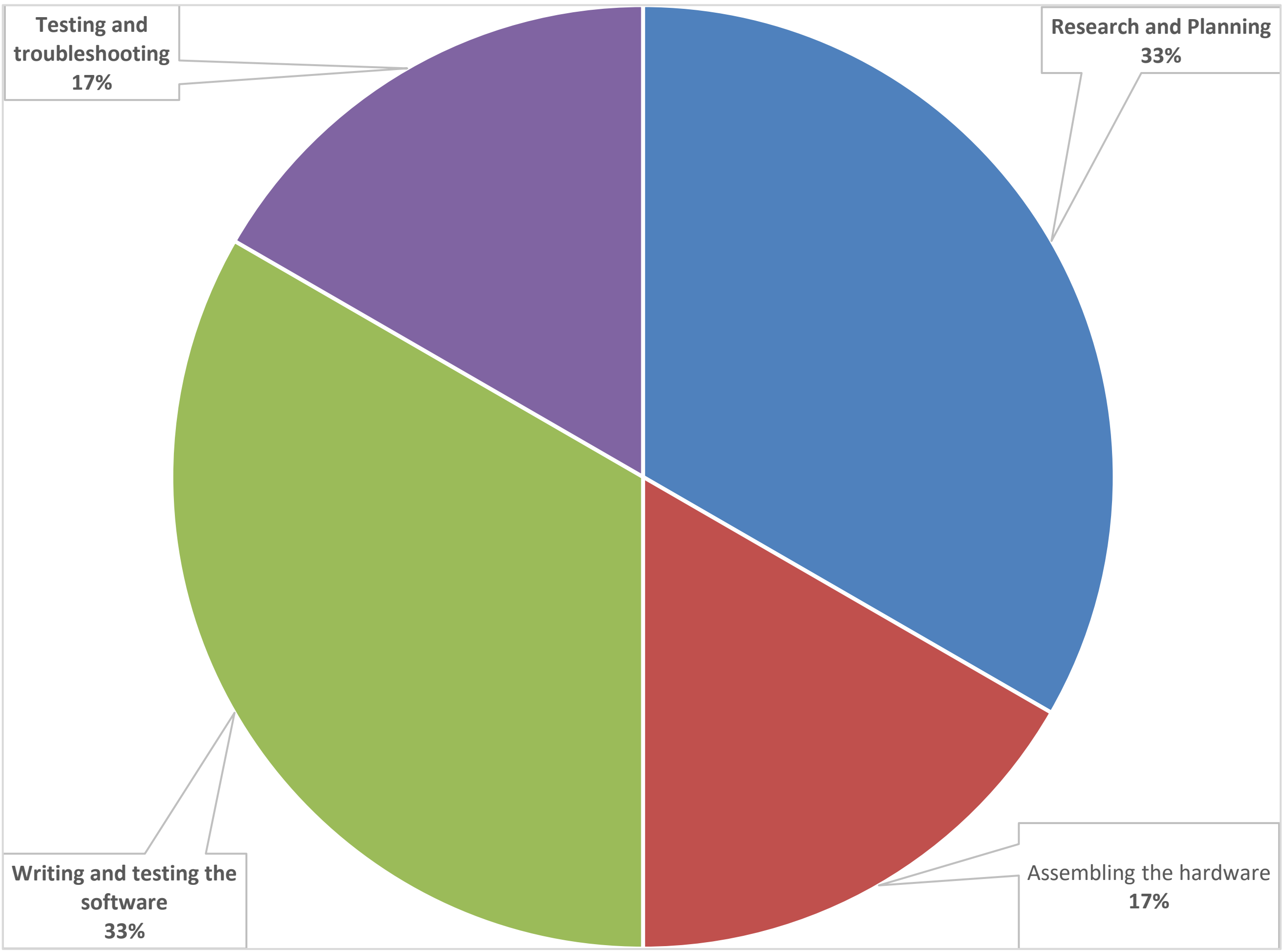


Figure 13: Experimental Setup 2

3.4 Task Vs Time Schedule

The task vs time schedule for the pressure cooker whistle counter project is as follows:



Chapter 4: Planning Resources

4.1 Hardware

The hardware required for this project includes an Arduino Nano, MPU6050 sensor, OLED display, and two push buttons. These components can be purchased from online electronics stores or local electronics shops.

4.2 Software

The software required for this project includes the Arduino IDE and libraries for the MPU6050 sensor and OLED display. The Arduino IDE can be downloaded from the official Arduino website, and the libraries can be downloaded from the respective websites.

4.3 Miscellaneous

The miscellaneous items required for this project include a breadboard, jumper wires, and a USB cable for programming the Arduino Nano.

4.4 Budget

Components	**Cost In Rs.**
Arduino NANO	280
MPU6050	150
OLED 128x64	180
Buzzer	50
Push Button	10
TOTAL	**= 670**

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Chapter 5: Experimentation and Results

5.1 Experimentation

The experimentation phase of the pressure cooker whistle counter project involved developing and designing a basic prototype using decade counters and logic gates for a more affordable version. The prototype successfully counted the number of whistles from a pressure cooker, but it had limited functionality and lacked the features of a more sophisticated version.

After further research and development, a controller-based version was designed using an Arduino Nano and an MPU6050 sensor. However, during testing, several challenges were encountered, including non-responsive push buttons and an echo sensor that did not detect counts after the first whistle due to vapor interference.

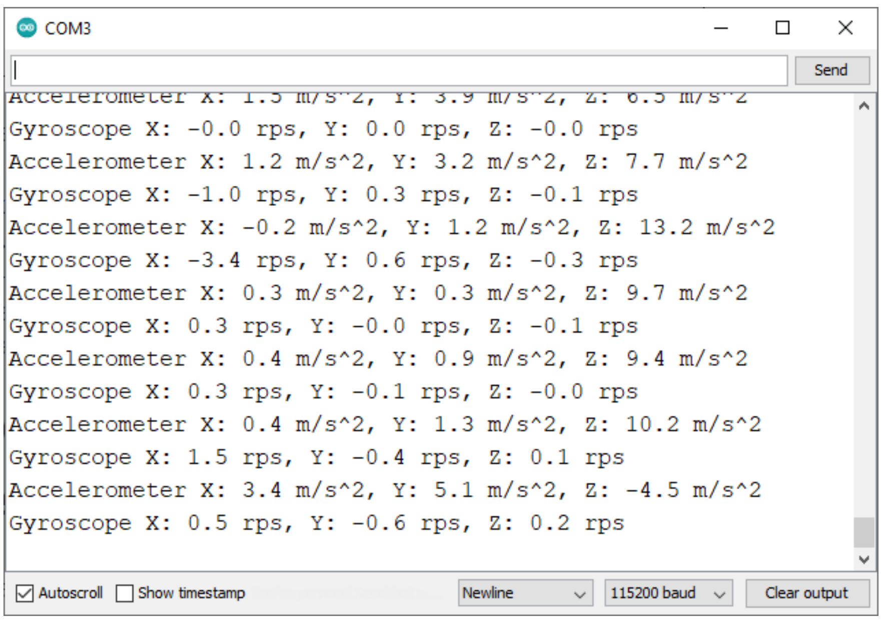
To address these issues, the decision was made to shift to an MPU6050 sensor, which proved to be more effective at detecting the number of whistles. However, the calibration of the gyro proved to be a significant challenge, as it required fine-tuning to ensure accurate readings.

Despite these challenges, the final version of the pressure cooker whistle counter was successfully developed and tested, demonstrating the importance of rigorous experimentation and testing in the design and development process.

This phase also highlighted the need for flexibility and adaptability when faced with unexpected challenges and the importance of considering multiple options and alternatives when designing a system.

5.2 Results

The calibration process for the MPU6050 involves finding the offset and sensitivity of the sensor readings. This can be done by taking several readings of the sensor in its "resting" state (i.e., when there is no acceleration or motion) and calculating the average value for each axis. These average values can then be used to calculate the offset (i.e., the deviation from the true zero point) for each axis.



The results of the experiment showed that the pressure cooker whistle counter was able to accurately count the number of whistles and display the pressure inside the cooker on the OLED display. The push buttons were also able to reset the whistle count.

5.3 Analysis

The analysis of the project showed that the MPU6050 sensor was an effective way to detect the vibrations caused by the whistle of the pressure cooker. The Arduino Nano was able to process the data from the sensor and accurately count the number of whistles. The OLED display was able to display the whistle count and pressure inside the cooker, making it easy for the user to monitor the cooking progress. The push buttons provided an easy way for the user to reset the whistle count when needed.

Chapter 6: Summary and Future Scope

The pressure cooker whistle counter project can be further improved to accommodate the needs of a cloud kitchen with multiple cookers. The existing system can be modified to allow for multiple sensors and displays, making it easier for the kitchen staff to monitor the cooking progress of multiple cookers at the same time. Additionally, the system can be integrated with a cloud-based platform, allowing for real-time monitoring and data logging of the cooking progress from multiple cookers.

Furthermore, incorporating Bluetooth connectivity and data logging to a microSD card can also be useful for cloud kitchens with multiple cookers, as it can provide a more detailed and organized record of the cooking progress over time, making it easier to track and analyze cooking trends and patterns.