

A MINI PROJECT REPORT ON

“Smart Industrial Machine Monitoring System (SIMMS)”

Project ID: (CSE-AI-01/2023-24)

For the Partial Fulfillment of Third Year of

**Bachelor of Technology in Department of Computer Science Engineering –
Artificial Intelligence**

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CERTIFICATE

This is to certify that the Mini Project Report entitled “**Smart Industrial Machine Monitoring System (SIMMS)**”, which is being submitted by, **Shruti Jadhav, Arpita Phalke and Kirti Rachkar** as partial fulfillment for the Third Year of Bachelor of Technology (**Computer Science Engineering –Artificial Intelligence**) of DBATU, Lonere

This is bonafide work carried out under my supervision and guidance.

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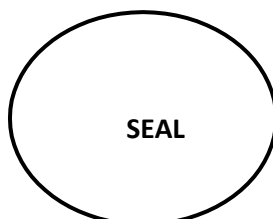
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ABSTRACT

The Smart Industrial Machine Monitoring System enhances the efficiency and accuracy of monitoring machine cycles within industrial settings. Utilizing an Arduino Uno microcontroller, HC-05 Bluetooth module, sensors for cycle detection, and a buzzer for immediate alerts, the system addresses key issues such as data accuracy, scalability, fault tolerance, and sensor precision. By providing real-time cycle data via a Bluetooth terminal app, the system enables proactive decision-making and quick responses to machine-related issues. This innovation minimizes downtime, optimizes maintenance planning, and significantly improves operational oversight, thereby boosting productivity and reducing costs in industrial operations.

Key words: IOT, Arduino Uno microcontroller, HC-05 Bluetooth module, Buzzer module(5V), Servo Motor SG-90, Breadboard and Jumper Wires , CNC Machine.

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1.INTRODUCTION

In today's industrial landscape, maintaining the efficiency and reliability of machinery is crucial for high productivity and minimal downtime. Industries often face challenges with traditional monitoring systems that do not provide timely updates, leading to inefficiencies and increased maintenance costs. To address these issues, the Smart Industrial Machine Monitoring System has been developed to provide a real-time solution for monitoring and managing industrial machines.

This project leverages the capabilities of the Arduino Uno microcontroller and the Bluetooth HC-05 module to create a robust monitoring system. The system accurately tracks the number of cycles a machine completes, with each cycle defined by a set time interval. The collected data is then transmitted wirelessly to a Bluetooth terminal, where it is displayed for operators to monitor machine performance.

In addition to real-time data visualization, the system features an alert mechanism that uses a buzzer to notify operators immediately upon the completion of each cycle. This instant feedback allows for timely interventions and adjustments, helping to maintain smooth operations and prevent unexpected breakdowns.

By integrating these modern technologies, the Smart Industrial Machine Monitoring System aims to enhance operational efficiency, reduce downtime, and support predictive maintenance strategies. This project is a practical application of computer science and engineering principles, demonstrating how innovative solutions can address real-world industrial challenges.

1.1 History:

The Smart Industrial Machine Monitoring System was conceived to address several critical shortcomings in traditional industrial monitoring systems, including data discrepancies due to sensor errors, limited scalability, lack of fault tolerance, and insufficient sensor accuracy. The project team embarked on developing a solution that incorporates error detection, data validation, and redundancy mechanisms.

Initiation and Component Selection:

The project began with the selection of appropriate hardware components. The Arduino Uno microcontroller was chosen for its versatility and ease of use, while the HC-05 Bluetooth module was selected for reliable wireless communication. Sensors were selected based on their ability to accurately detect machine cycles, and a buzzer was included to provide immediate alerts.

Development Phase:

The initial phase involved setting up the hardware and developing the Arduino code to read sensor inputs, track machine cycles, and handle Bluetooth communication. The focus was on ensuring the system could process data in real-time with minimal latency.

Testing and Refinement:

Extensive testing was conducted to calibrate the sensors and ensure reliable wireless communication. The system architecture was refined to support low latency and efficient data transmission. Iterative improvements were made based on testing results to enhance the accuracy and reliability of the system.

Implementation and Results:

Upon successful testing, the system demonstrated its capability to monitor machine cycles accurately, transmit data wirelessly, and provide real-time alerts. The user-friendly Bluetooth terminal app enabled operators to access crucial machine performance data effortlessly. The project concluded with a robust solution that met the initial objectives and provided a scalable platform for future enhancements.

Through its proactive monitoring capabilities and integration of state-of-the-art technology, the Smart Industrial Machine Monitoring System not only improves operational efficiency but also enhances overall competitiveness in the industrial sector. By leveraging real-time data insights and enabling prompt responses to machine events, the system supports agile decision-making and proactive maintenance planning, ultimately leading to increased productivity and cost savings for industrial enterprises.

1.2 Literature Review:

1. Title: CNC Machine Based on Embedded Wireless and Internet of Things for Workshop Development [July 2017]

Author: Ibtesam R. K. Al-Saedi¹, Farag Mahel Mohammed² and Saif Aldeen Saad Obayes

Abstract: This focus on the integration of wireless technology and CAD/CAM system for CNC workshop development. A specific case study is described a system based on embedded wireless device and Internet of Things (IoT) concept with Bezier techniques for the proposed model. The focus of the case study is to show a complete stage of manufacturing process starting from modeling in CAD system passing through CAM system, transferring NC code, gathering machine data, monitoring whole process and finally manufacturing product. Using MATLAB and UG-NX software for modeling, Monitoring machining process using temperature, accelerometers and gyroscope sensors based on IoT concept. Transferring NC codes to CNC machines using FTP protocol and DNC software, real-time report demonstrate information about machine name, parts progress, time, operation condition and Machine Cycle Time depending on DNC network.

2. Title: Research and development of monitoring system and data monitoring system and data acquisition of CNC machine tool in intelligent manufacturing [9 December 2019]

Author: Yuan Guo, Yu Sun and Kai Wu¹

Abstract: Computer numerical control (CNC) machine tools are the core manufacturing equipment in discrete manufacturing enterprises, collecting and monitoring the data is an important part of intelligent manufacturing workshops. It has a great significance to improve the production efficiency of enterprises and eliminate information islands. The purpose of this article is to solve the problems of data acquisition and monitoring of CNC machine tools in the manufacturing workshop of enterprises.

3. Title: Automatic System to Calculate Working Hours for Machines and Operators [February 2021]

Authors: Mohamed abdelrahim

Abstract: This represents designing an electronic system consists of hardware and software that can calculate the total working hours of machines for calculating depreciation and the total working hours of operators to know overtime automatically and accurately Without a report from an engineer or supervisor. Many machines can be connected easily to the system and protected from users so that only an administrator can access the system and see the report that comes from the machines and operators, this report cannot be manipulated in any way.

4.Title: Smart Monitoring System for Industrial Automation (IoT based) [Mar 2019]

Author: Nikita Gosavi, Sakshi Babar, Bhagwan Katale, Prof P.H. Kulkarni

Abstract: IOT or internet of things is a technology that makes use of control systems such as computer to control the physical devices over the internet. Here we propose efficient industry automation system that allows user to efficiently control industry appliances/machines over the internet. The microcontroller 89C51 is used by our system for processing all user commands. For the connection to the internet and to receive the user commands a Wi-Fi modem is used. WIFI modem receives the commands which are sent through the internet. The received information is decoded by the Wi-Fi modem and passed to the microcontroller. IR sensors are also used to count the number of products manufactured. System is divided into two parts software part and hardware part.

5.Title : Real Time Condition Monitoring System for Industrial Motors[December 2015]

Author: S. S. Goundar, M. R. Pillai, K. A. Mamun, F.R .Islam, R. Deo

Abstract: In generally, predictive maintenance of induction motors is well suited for small to larger scale industries in order to reduce downtime, increase efficiency and reliability. In this paper, the vibration and temperature of the induction motor is analyzed in order to gather specific information that can predict motor's bearing failure. Well analyzed vibration signal easily shows the difference between the running operation of the healthy and faulty motor. Using IoT, this paper shows Real Time Condition Monitoring System for Industrial Motors

6.Title: IoT-Based Wireless Induction Motor Monitoring [September 2017]

Author: Mehmet Şen and Basri Ku

Abstract: This study enhances motor efficiency and maintenance in manufacturing by monitoring key parameters of single and three-phase induction motors (S/3P-IMs) via TCP/IP over Wi-Fi. Data such as temperature, current, voltage, speed, and torque are collected and sent to central software using existing internet infrastructure, eliminating extra wiring. This system, implemented in a textile factory, enables predictive maintenance and avoids production disruptions not foreseen by ERP systems.

7.Title: Speed and Direction Control of Dc Motor using Android Mobile Application [June 2022]

Author: N Balakrishna, L. Vijay Kumar, S. Sandeep, D. Durga Prasad, B. Srikanth.

Abstract: This paper presents a method for controlling the speed and direction of DC motors using Android smartphones and Bluetooth technology. An HC05 Bluetooth module is interfaced with a PIC microcontroller to receive commands from a smartphone app. The motor's speed is adjusted using PWM techniques and an IR sensor, while direction control is managed via a driver circuit or H-Bridge network.

Gap finding:

Data Accuracy and Integrity: There may be discrepancies between the actual machine cycle data and the data recorded by the system due to sensor errors or communication issues.

Scalability and Expansion: The current system design may not easily accommodate additional machines or sensors, limiting scalability and future expansion.

Fault Tolerance and Redundancy: The system may lack fault tolerance mechanisms, making it vulnerable to single points of failure or data loss.

Sensor Accuracy: The sensors used to detect machine cycles may not be accurate enough, leading to incorrect cycle detection.

Techniques such as error detection, data validation, and redundancy play crucial roles in maintaining data integrity. Real-time monitoring systems rely on processing data as it is generated, necessitating low latency and efficient data transmission. Scalability and expansion capabilities are essential for accommodating increasing workload or additional machines, requiring modular and loosely coupled system architectures.

1.3 Problem Formulation:

In various industries such as manufacturing, textile, and food processing, the efficient operation of machinery is crucial for maintaining productivity and quality. However, these industries face specific challenges in their respective processes

Manufacturing Plants:

Ensuring assembly lines function efficiently and detecting machine malfunctions in real-time to prevent delays and defects. Providing operators with real-time visibility into machine performance to facilitate immediate interventions and maintain production schedules. Reducing dependency on manual inspections and automating the detection of machine failures to minimize downtime.

Textile Industry:

Accurately monitoring the performance of weaving and spinning machines to ensure consistent production quality and prevent defects in fabric and yarn. Integrating advanced sensor technology to detect and correct anomalies in the production process swiftly. Providing continuous, real-time data on machine performance to support proactive maintenance and reduce the risk of production halts.

Food Processing:

Ensuring packaging and processing machinery in food production facilities operate efficiently and safely with timely updates on their status. Improving the accuracy and reliability of machine monitoring to ensure compliance with safety standards and production efficiency. Implementing a system that provides immediate alerts for machine issues, ensuring prompt responses to maintain operational continuity.

1.5 Problem Solution:

The solutions leverage advanced hardware and software integration to address critical industry needs, enhancing real-time monitoring, improving machine performance, and ensuring operational efficiency across manufacturing, textile, and food processing industries.

Manufacturing Plants: The Smart Industrial Machine Monitoring System provides real-time monitoring of assembly lines using sensors to track machine cycles and detect anomalies. The system utilizes the Arduino Uno microcontroller and HC-05 Bluetooth module to transmit data to a central dashboard. Operators receive real-time visibility into machine performance, enabling immediate interventions when issues arise. This helps maintain production schedules and reduces downtime. By automating the detection of machine failures, the system reduces the dependency on manual inspections, minimizing downtime and increasing productivity.

Textile Industry: The system accurately monitors the performance of weaving and spinning machines using high-precision sensors. These sensors detect cycle completions and other performance metrics, providing real-time data. Advanced sensor technology is integrated to swiftly detect and correct anomalies in the production process, ensuring consistent production quality. Continuous, real-time data on machine performance supports proactive maintenance, reducing the risk of production halts and improving overall efficiency.

Food Processing: The monitoring system ensures efficient and safe operation of packaging and processing machinery by providing timely updates on their status. Real-time data transmission is enabled through the Arduino Uno and HC-05 Bluetooth module. The system improves the accuracy and reliability of machine monitoring, ensuring compliance with safety standards and enhancing production efficiency.

1.6 Objective:

The primary objectives of our Smart Industrial Machine Monitoring System focus on ensuring the reliable operation and real-time monitoring of industrial machines, enhancing both efficiency and responsiveness.

Reliable Hardware Connection: To achieve seamless functionality, it is crucial that all hardware components are correctly connected and fully operational. This involves integrating the Arduino Uno, breadboard, Bluetooth HC-05, and buzzer into a cohesive system. Ensuring reliable connections between these components is essential for the system's stability and effectiveness. Proper setup and testing are necessary to confirm that each part is functioning as expected and that the system can accurately perform its intended tasks.

Accurate Cycle Tracking: A fundamental aspect of our project is the precise tracking and recording of the number of cycles completed by the industrial machine. Each cycle is defined by a predetermined time interval, such as 90 seconds. The Arduino Uno, programmed to monitor these intervals, counts and logs each completed cycle. Accurate cycle tracking is vital for monitoring machine performance and ensuring that operational metrics are recorded correctly for analysis and optimization.

Buzzer Alerts System: To enhance responsiveness, our system incorporates a buzzer that provides immediate auditory alerts upon the completion of each machine cycle. This alert system ensures that operators are promptly notified when a cycle ends, allowing them to make quick responses and necessary adjustments. The buzzer serves as an essential notification tool, helping to minimize downtime and maintain continuous operational efficiency.

Real-Time Data Display: Providing operators with real-time performance data is a key objective of our project. By utilizing the Bluetooth HC-05 module, the system transmits the number of completed cycles to a Bluetooth terminal on a mobile device or computer. This real-time data display enables operators to monitor machine performance continuously and remotely. The visibility of up-to-date cycle counts ensures that operators are well-informed and can manage the machinery effectively, thereby improving overall productivity and reducing the risk of unnoticed issues.

Together, these objectives ensure that the Smart Industrial Machine Monitoring System not only tracks and records machine cycles accurately but also enhances operational efficiency through timely notifications and real-time data visibility. The integration of reliable hardware connections, precise cycle tracking, an effective alert system, and continuous data display forms the foundation of a robust monitoring solution tailored for industrial environments.

2. SYSTEM ARCHITECTURE AND METHODOLOGY

The Smart Industrial Machine Monitoring System enhances operational oversight and efficiency in industries by providing real-time monitoring of machine cycles. Using an Arduino Uno microcontroller and an HC-05 Bluetooth module, the system tracks machine cycles, transmits data wirelessly, and alerts operators through a buzzer when cycles are complete. This approach effectively reduces downtime and improves maintenance planning.

2.1 System Components:

Hardware Requirements:

- 1.Arduino UNO
- 2.Servo Motor SG-90
- 3.BUZZER MODULE (5V)
- 4.Breadboard and Jumper Wires
- 5.HC-05 Bluetooth Module

1. Arduino UNO:

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

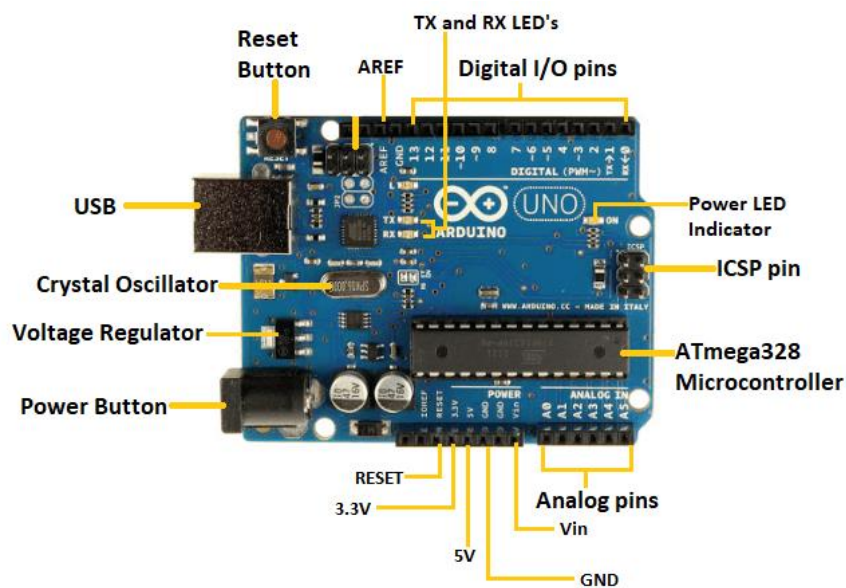


Fig 2.1 Arduino UNO

- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.
- **2ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.
- **AREF**- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.
- **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin**- It is the input voltage.
- **Analog Pins**- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

2.Servo Motor SG-90:

TowerPro SG-90 Features:

Operating Voltage is +5V typically

Torque: 2.5kg/cm

Operating speed is 0.1s/60°

Gear Type: Plastic

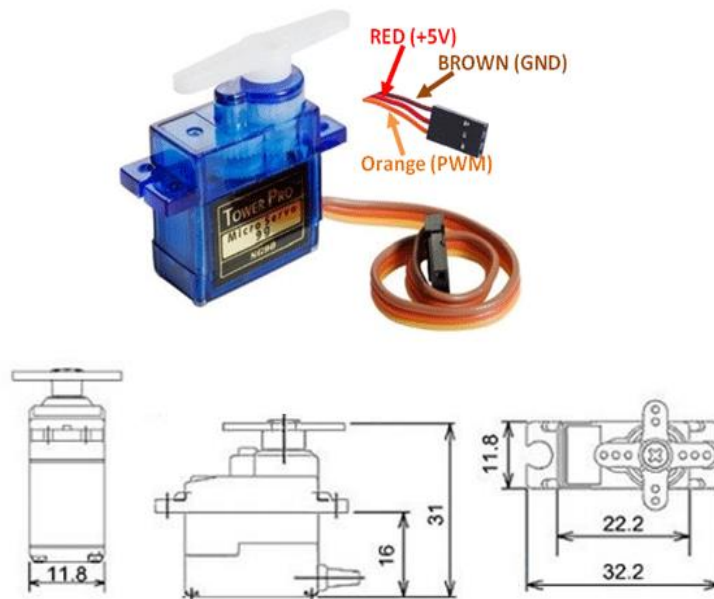


Fig 2.2 Servo Motor SG-90

Rotation : 0°-180°

Weight of motor : 9gm

Package includes gear horns and screws

3.Buzzer module (5v):

Description- Module for Arduino is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 5V DC Electronic Part Active Buzzer Module. Using top quality material, it is durable in use.

Module Interface Specification (3-wire)-

- + External 3.3V-5V voltage (can be directly connected with the 5v and 3.3v MCU MCU)
- External GND out external microcontroller IO port

Specifications-

SPU: MH-FMD

Material: ABS

Color: Blue

Work Voltage: 3.3-5V

PCB Dimension: 31 x 13 mm.

VCC : 3.3V-5V

GND : The Ground

I/O : I/O Interface of SCM



Fig 2.3 Buzzer module (5v)

4.Breadboard and Jumper Wires:

The breadboard is a white rectangular board with small embedded holes to insert electronic components. It is commonly used in electronics projects. We can also say that breadboard is a prototype that acts as a construction base of electronics.

The top and bottom holes of a row in a breadboard are connected horizontally, and the center part is connected vertically, as shown below:

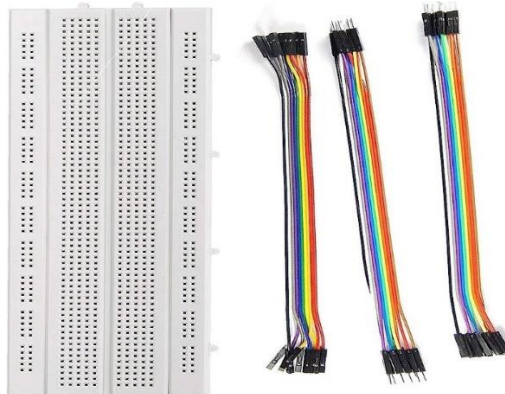


Fig 2.4 Breadboard and Jumper Wires

The breadboard is a white rectangular board with small embedded holes to insert electronic components. It is commonly used in electronics projects. We can also say that breadboard is a prototype that acts as a construction base of electronics.

Jumper wires are wires with a connector at both ends and are suitable for interconnecting components in a breadboard, prototype, or test circuit. They connect components without soldering. If you want to build your own circuits, jumper wires are the way to go.

5.HC-05 Bluetooth Module:

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. Baud Rate: 9600 with 8 data bits, no parity and 1 stop bit

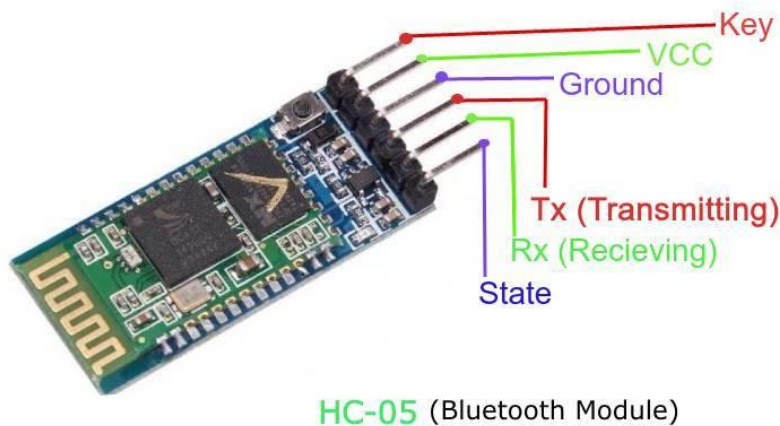


Fig 2.5 HC-05 Bluetooth Module

Description of pins-

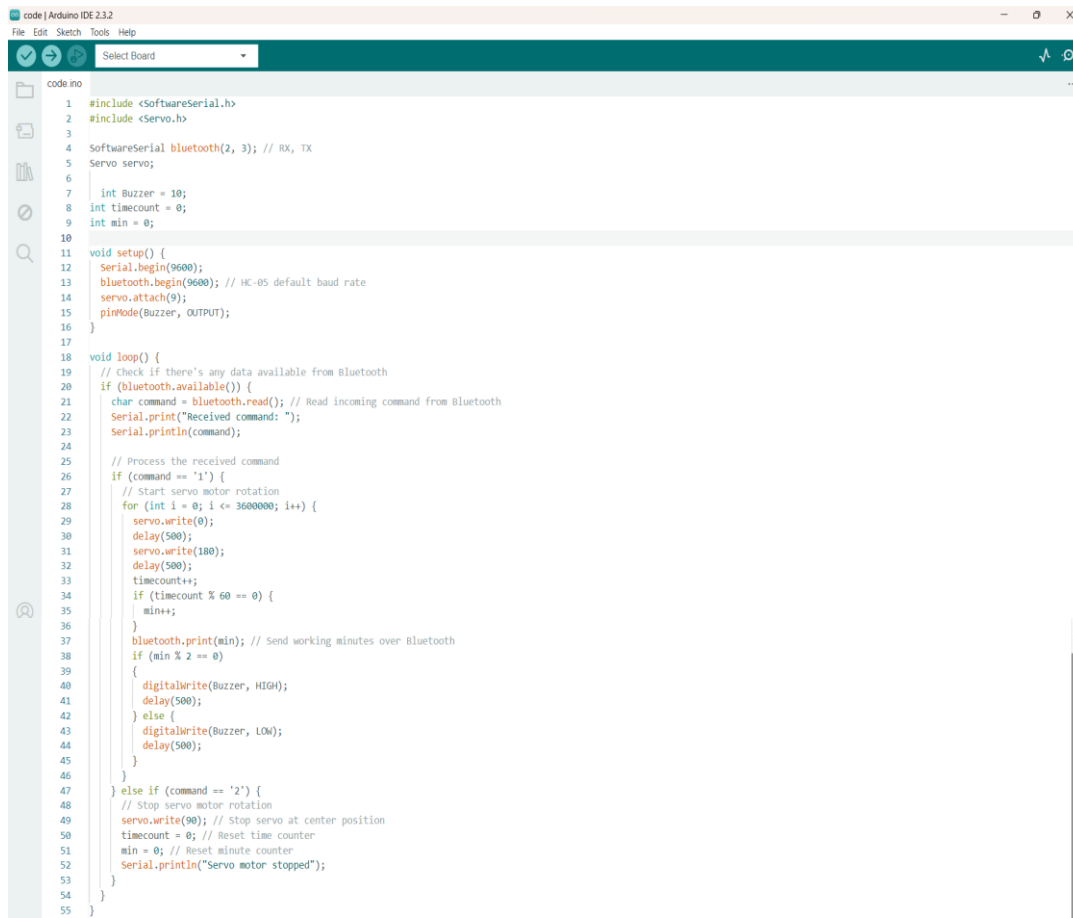
- Enable - This pin is used to set the Data Mode or and AT command mode (set high).
- VCC - This is connected to +5V power supply.
- Ground - Connected to ground of powering system.
- Tx (Transmitter) - This pin transmits the received data Serially.
- Rx (Receiver) - Used for broadcasting data serially over Bluetooth.
- State -Used to check if the Bluetooth is working properly.

Software Development:

Arduino Programming-

Arduino IDE is used to write a program that reads inputs from the sensors, tracks the number of cycles, and triggers the buzzer when a cycle is complete. The program should also handle Bluetooth communication to send cycle data to the central monitoring system.

2.2 Code implementation:



```
1 #include <SoftwareSerial.h>
2 #include <Servo.h>
3
4 SoftwareSerial bluetooth(2, 3); // RX, TX
5 Servo servo;
6
7 int Buzzer = 10;
8 int timecount = 0;
9 int min = 0;
10
11 void setup() {
12   Serial.begin(9600);
13   bluetooth.begin(9600); // HC-05 default baud rate
14   servo.attach(9);
15   pinMode(Buzzer, OUTPUT);
16 }
17
18 void loop() {
19   // Check if there's any data available from Bluetooth
20   if (bluetooth.available()) {
21     char command = bluetooth.read(); // Read incoming command from Bluetooth
22     Serial.print("Received command: ");
23     Serial.println(command);
24
25     // Process the received command
26     if (command == '1') {
27       // Start servo motor rotation
28       for (int i = 0; i <= 3600000; i++) {
29         servo.write(0);
30         delay(500);
31         servo.write(180);
32         delay(500);
33         timecount++;
34         if (timecount % 60 == 0) {
35           min++;
36         }
37         bluetooth.print(min); // Send working minutes over Bluetooth
38         if (min % 2 == 0) {
39           {
40             digitalWrite(Buzzer, HIGH);
41             delay(500);
42           } else {
43             digitalWrite(Buzzer, LOW);
44             delay(500);
45           }
46         }
47       } else if (command == '2') {
48         // Stop servo motor rotation
49         servo.write(90); // Stop servo at center position
50         timecount = 0; // Reset time counter
51         min = 0; // Reset minute counter
52         Serial.println("Servo motor stopped");
53       }
54     }
55 }
```

Code Functions and Process:

The Arduino code provided is designed to monitor machine cycles, send data via Bluetooth, and alert operators with a buzzer. Here's a detailed breakdown of its functions and the process of code execution, including serial communication with Bluetooth.

Library Inclusion and Pin Definitions-

The **Software Serial** library allows for serial communication on other digital pins of the Arduino. respectively

Buzzer Pin and **cycle Sensor Pin** are defined for the buzzer and the cycle detection sensor.

Cycle Duration sets the duration of a machine cycle.

Previous Millis stores the last time the cycle was counted.

Cycle Count tracks the number of completed cycles.

Initializes the Software Serial object BT Serial with RX (receive) on pin 10 and TX (transmit) on pin 11.

Configures the pins: buzzer Pin as output and cycle Sensor Pin as input.

Starts serial communication for both Bluetooth (BT Serial) and the Arduino IDE serial monitor (Serial) at 9600 baud. The loop function continuously checks for cycle completion and handles data transmission and alerts.

Serial Communication with Bluetooth

Software Serial is used to create a serial communication channel on pins 10 (RX) and 11 (TX).BT Serial. begin(9600) initializes the communication at 9600 baud rate .This setup and code ensure that machine cycles are monitored, counted, and transmitted wirelessly for real-time monitoring, with immediate alerts provided by the buzzer to enhance operational efficiency and maintenance planning .This setup and code ensure that machine cycles are monitored, counted, and transmitted wirelessly for real-time monitoring, with immediate alerts provided by the buzzer to enhance operational efficiency and maintenance planning .This setup and code ensure that machine cycles are monitored, counted, and transmitted wirelessly for real-time monitoring, with immediate alerts provided by the buzzer to enhance operational efficiency and maintenance planning.

2.3 Flowchart :

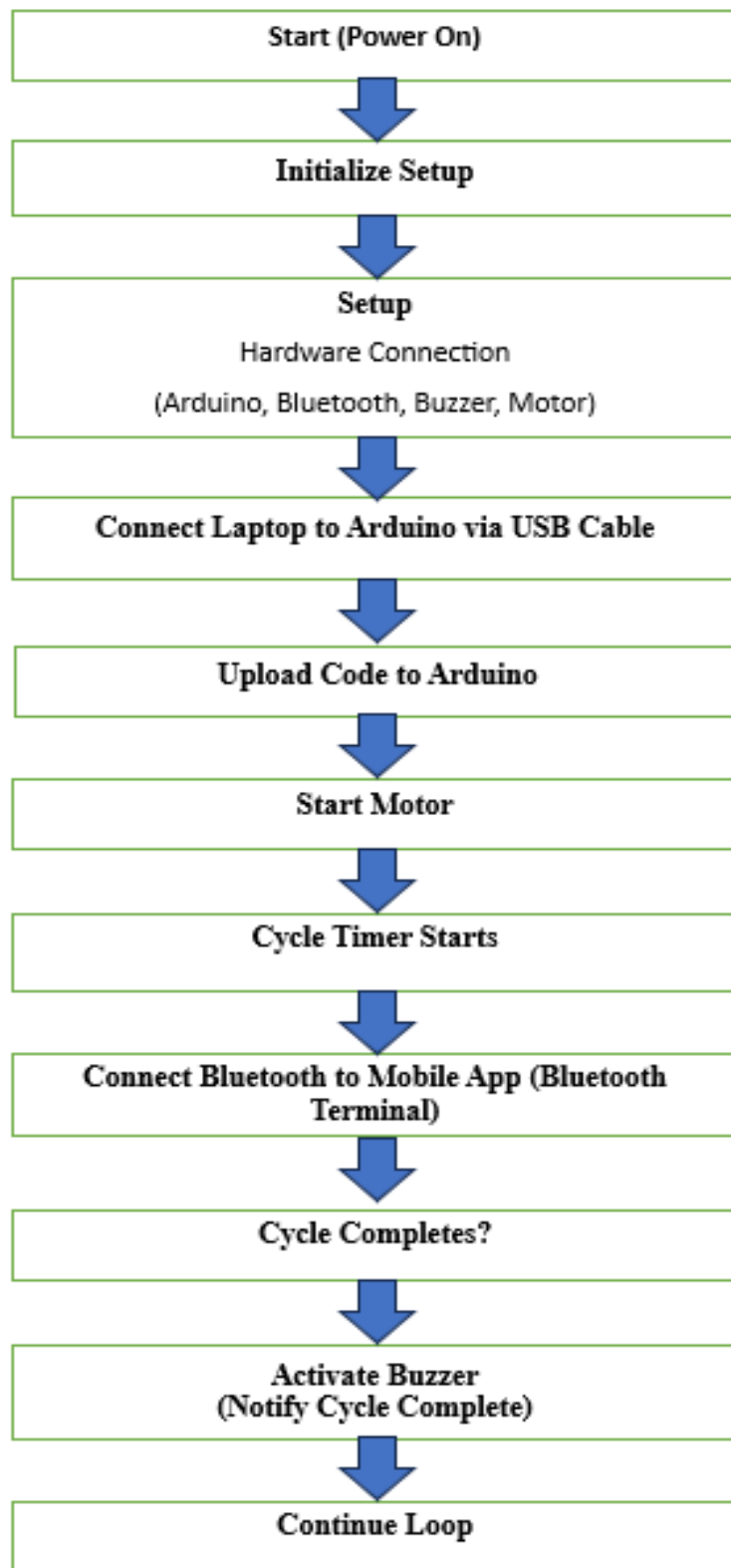


Fig 2.6 FlowChart

2.4 Block Diagram :

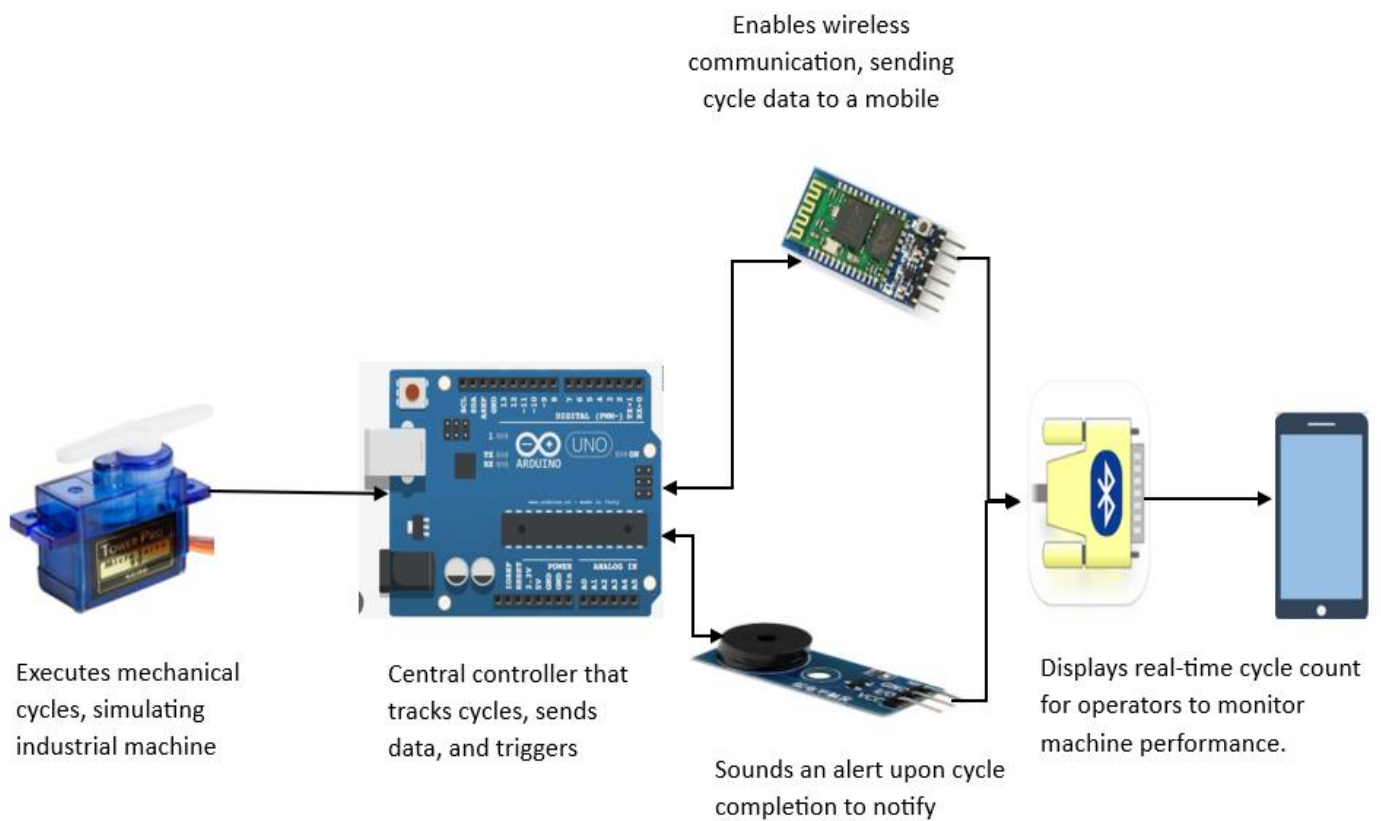


Fig 2.7: Block Diagram Of SIMMS

3.Result

As shown in the screenshot, the terminal displays the cycle count in real-time. Each number represents a completed cycle, with the system accurately tracking and updating the count every 90 seconds.

The consistent and accurate cycle count displayed on the terminal confirms that the system is functioning as intended. The timely updates and alerts ensure that operators are informed immediately, allowing for efficient monitoring and management of industrial machines.

The results validate the reliability and efficiency of the Smart Industrial Machine Monitoring System. The successful implementation of real-time cycle tracking and alert notifications highlights the potential for improved operational oversight in industrial settings.

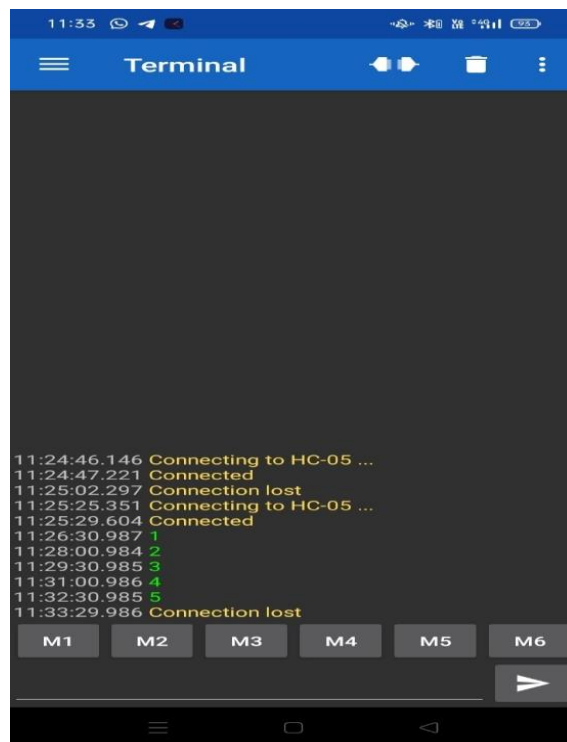


Fig 3.1 Serial Bluetooth Terminal

Calculation of Total Motor Operation Time

To calculate the total time the motor has been operating, we use the following equation:

Total Time=Number of Cycles×90seconds

Number of Cycles: The count of completed cycles as displayed on the Bluetooth terminal.

90 seconds: The fixed time interval for each cycle.

For example, if the Bluetooth terminal shows that 10 cycles have been completed, the total operation time of the motor can be calculated as follows:

Total Time=10cycles×90seconds

Total Time=900seconds

Therefore, the motor has been operating for a total of 900 seconds.

4. CONCLUSION

In conclusion, the Smart Industrial Machine Monitoring System represents a significant leap forward in industrial automation and efficiency. By harnessing the power of advanced hardware components and sophisticated software algorithms, this system offers real-time monitoring capabilities that address critical challenges faced by industries reliant on machinery. From accurately tracking machine cycles to providing immediate alerts and facilitating proactive maintenance planning, the system empowers operators to optimize machine performance and minimize downtime.

Its user-friendly interface ensures ease of use, while its proactive monitoring capabilities enable agile decision-making and enhanced competitiveness. Overall, the Smart Industrial Machine Monitoring System heralds a new era of industrial monitoring, where data-driven insights and proactive strategies drive operational excellence and propel industries toward greater efficiency and competitiveness.

5. REFERENCES

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