Published by :
https://www.ijert.org/
An International Peer-Reviewed Journal

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 10 , October - 2026

AutoScrewFit: Automatic Screw Feeding, Fitting and Counting System

Project Guide: P. B. Bhopale

Om Ranjit Sawant, Harshad Amol Shinde, Prerana Ajit Shinde, Sarvashree Amar Suryawanshi

Department of Electronics and Telecommunication Engineering
D.K.T.E.'s Yashwantrao Chavan Polytechnic, Ichalkaranji, Maharashtra, India

Abstract - AutoScrewFit is an automated system designed to simplify screw feeding, fitting and counting in industrial applications. Traditional manual methods require time and effort and may cause counting and fitting errors. The proposed system uses an ESP32 microcontroller, sensors, motors, motor drivers and a mechanical arrangement. Screws are supplied one by one, detected by sensors and processed by the controller. A display can show the count and system status. Automatic stopping, jam detection and alerts may also be included. The system aims to reduce manual intervention, save time and improve counting consistency. It may be useful in automobile, electronics, electrical and small-scale manufacturing applications.

Keywords - AutoScrewFit, automatic screw feeding, screw fitting, screw counting, ESP32, sensors, stepper motor, industrial automation.

I. INTRODUCTION

Automation plays an important role in modern manufacturing industries. It helps improve productivity, reduce human effort and maintain consistency in production processes. Screw fastening is commonly used in automobile manufacturing, electronics assembly, electrical equipment and mechanical products.

In many small-scale industries, screw feeding, fitting and counting are performed manually. This process requires continuous human attention and consumes valuable production time. Manual operations may also lead to incorrect screw counting, improper fitting, inconsistent assembly and reduced production efficiency.

To address these problems, AutoScrewFit is proposed as an automated screw feeding, fitting and counting system based on embedded-system technology. The proposed design uses a microcontroller, sensors, motors and a suitable mechanical arrangement. The feeding mechanism supplies screws one by one to the fitting unit. Sensors detect screw presence and position, while the controller processes sensor signals and controls the motors. A display can show the screw count and operating status.

II. LITERATURE REVIEW

Previous work and industrial systems demonstrate the use of feeders, sensors, counters and controlled screwdrivers for automated screw handling. Studies on automated screw fastening of MCB components describe material handling, screw attachment and automatic ejection to reduce manual effort. Automatic screwdriving arrangements commonly use bowl feeders, linear feeders, indexing mechanisms, stepper motors and pneumatic screwdrivers. Industrial screw-counting systems use vibratory bowl feeders and sensors to count small components and stop after a preset quantity.

A survey of automated threaded fastening methods discusses fastening mechanisms and the technical challenges associated with automated screw assembly.

Research Gap: Many industrial systems are designed for specific production requirements and may be expensive or complex for small workshops and educational laboratories. AutoScrewFit therefore proposes an integrated, compact prototype that combines screw feeding, fitting and counting using a controller, sensors and controlled motor mechanisms.

III. PROBLEM STATEMENT

In many manufacturing industries, screw feeding, fitting and counting are performed manually or by using separate machines. These processes require time and human effort and may lead to incorrect counting, improper screw fitting and reduced production efficiency. Existing automated systems can be expensive and complex for small-scale industries. There is therefore a need for a simple and cost-effective solution that integrates screw feeding, fitting and counting.

IV. OBJECTIVES

1. To study existing screw feeding, fitting and counting systems and identify their limitations.
2. To design an automatic screw feeding, fitting and counting system.
3. To develop the required hardware and software.
4. To use sensors for screw detection and counting.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 10 , October - 2026

5. To control the feeding and fitting mechanisms using motors.
6. To implement and test the proposed system.
7. To evaluate the performance, accuracy and efficiency of the developed system.

V. PROPOSED SYSTEM

The proposed AutoScrewFit system consists of an ESP32 microcontroller, input sensors, motor drivers, stepper motors, a screw-feeding mechanism, a fitting unit and a display system.

The ESP32 acts as the main control unit. It receives signals from the sensors, processes the information and provides control signals to the motor drivers. The motors operate the feeding and fitting mechanisms according to programmed instructions. An IR sensor detects screw presence, while a proximity sensor can detect the position of a screw or workpiece. Additional sensors may be used to detect feeding jams and low screw levels.

The system includes start, stop and reset buttons. An LCD display can show the number of screws processed and the current operating status. A buzzer or LED can provide an alert when the preset quantity is reached or an error occurs.

VI. SYSTEM BLOCK DIAGRAM

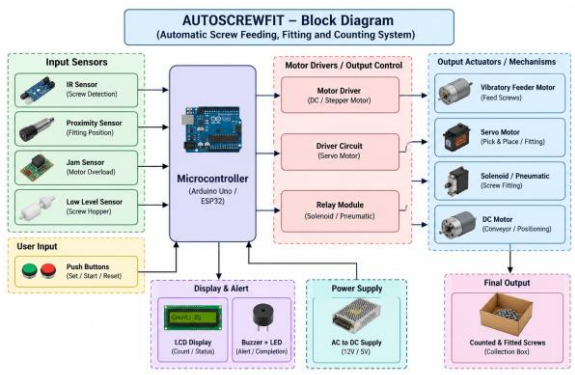


Fig. 1. Block diagram of the proposed AutoScrewFit system.

The main blocks are: (1) input sensors such as IR, proximity, jam and low-level sensors; (2) user input buttons; (3) ESP32 microcontroller; (4) motor drivers; (5) output mechanisms such as feeder motor, servo motor, solenoid or pneumatic mechanism and DC motor, depending on the final design; (6) LCD display, buzzer and LED; (7) power supply; and (8) final collection of processed and counted screws.

The block diagram of AUTOSCREWFIT – Automatic Screw Feeding, Fitting and Counting System represents the overall working of the proposed system. It consists of input sensors, a microcontroller, motor driver circuits, output mechanisms and a display unit. The IR sensor detects screws, the proximity sensor detects the fitting position, and other sensors monitor screw availability and possible blockages.

The Arduino Uno acts as the main controlling unit. It receives signals from the sensors and processes them according to the programmed instructions. Based on these signals, it controls the vibrating feeder motor, servo motor, solenoid and DC motor through suitable driver circuits to perform screw feeding and fitting operations.

The LCD displays the screw count and system status, while the buzzer and LED provide alerts during operation and completion. A suitable power supply is provided to operate the system. Finally, the screws are collected in a box after the counting and fitting process. The system helps reduce manual effort and improves productivity and counting accuracy.

VII. WORKING METHODOLOGY

1. **Screw Loading:** Screws are stored in a hopper or storage unit. The feeding mechanism guides them towards the feeding chute.
2. **Automatic Feeding:** The feeder motor supplies screws one by one to the detection point.
3. **Screw Detection:** An IR sensor detects the presence of each screw. A proximity sensor can detect the position of the screw or workpiece.
4. **Signal Processing:** The ESP32 receives sensor signals and processes them according to the programmed instructions.
5. **Screw Fitting:** The fitting mechanism positions the screw and performs the fitting operation using an electric screwdriver or another suitable controlled mechanism.
6. **Screw Counting:** The controller updates the count whenever a screw is detected.
7. **Display and Alert:** The display shows the screw count and system status. A buzzer or LED can indicate completion or an error.
8. **Automatic Stopping:** The system can stop feeding when the preset quantity is reached. A jam-detection mechanism can identify blockages.

VIII. HARDWARE REQUIREMENTS

The synopsis identifies the following proposed hardware: ESP32 development board (1); ESP32-compatible controller or stepper-control board (1); NEMA 17 stepper motors (3); stepper motor drivers (3); X-axis and Y-axis linear guide rails (one set each); lead screw or belt-drive mechanisms (2); electric screwdriver (1); Z-axis linear actuator or slide (1); limit switches (3); 24 V DC power supply (1); machine frame (one set); IR or optical screw-detection sensors (1–2); hopper and feeding chute (one set); couplings, brackets and bearings as required; buck converter (1); emergency stop, wiring and connectors (one set); and workpiece fixture and screwdriver holder (one set).

The final quantity and selection of components should be confirmed according to the completed mechanical design.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 10 , October - 2026

IX. SOFTWARE REQUIREMENTS

Arduino IDE is proposed for writing, compiling and uploading the ESP32 program. The ESP32 board support package enables ESP32 programming in the IDE. A suitable stepper or motion-control library can be used to generate motor steps and coordinate movement. The Serial Monitor can be used to debug sensor readings, axis movement and screw count. CAD software may be used to prepare mechanical layouts and mounting drawings.

X. SYSTEM IMPLEMENTATION

Implementation involves mechanical design, electronic circuit development and software programming. First, the mechanical frame, hopper, feeding chute and fitting arrangement are designed. The ESP32, sensors, motor drivers and motors are then connected according to the circuit design. The control program is uploaded using the Arduino IDE. Sensor signals are checked and motor movements are calibrated according to the mechanical arrangement.

After hardware and software integration, the prototype should be tested for screw feeding, detection, fitting and counting. Troubleshooting should address missed screws, incorrect counts and feeding jams. Actual performance values should be reported only after prototype testing.

XI. APPLICATIONS

The proposed system may be used in automobile component assembly, electronics manufacturing, electrical equipment assembly, small-scale manufacturing units, hardware assembly, production and packaging units, educational laboratories and other production lines where repeated screw feeding, fitting or counting is required.

XII. ADVANTAGES AND LIMITATIONS

Advantages:

- Reduces manual effort in repetitive screw-handling operations.
- Can save production time.
- Supports sensor-based screw detection and counting.
- Provides controlled motor operation.
- Can provide display and alert facilities.
- Can be configured to stop after reaching a preset quantity.

Limitations:

- Proper mechanical alignment is required for smooth operation.
- Different screw sizes may require changes to the feeding mechanism.
- Sensor performance depends on correct positioning and calibration.
- Motor movement requires suitable calibration.
- The final machine may require additional mechanical adjustments.

XIII. FUTURE SCOPE

The system may be improved by adding camera-based screw detection, automatic sorting for different screw sizes, IoT-based remote monitoring, production data logging, improved jam detection and integration with industrial production lines. Further development may provide a fully automatic screw-feeding and fastening machine with improved positioning and control.

XIV. CONCLUSION

AutoScrewFit is a proposed automatic screw feeding, fitting and counting system intended to improve the efficiency of industrial assembly operations. The design integrates a microcontroller, sensors, motors and mechanical components to automate repetitive screw-handling processes. It aims to reduce manual effort, save time, improve counting accuracy and maintain consistency in assembly operations. The system may be useful in automobile industries, electronics manufacturing, electrical equipment assembly and small-scale production units. Prototype testing is required to quantify its actual performance.

ACKNOWLEDGMENT

The authors express their sincere gratitude to Mrs. P. B. Bhopale, Project Guide, Department of Electronics and Telecommunication Engineering, D.K.T.E.'s Yashwantrao Chavan Polytechnic, Ichalkaranji, for her guidance and support. The authors also thank the Head of Department, teaching staff and institute for providing the necessary support and facilities.

REFERENCES

[1] U. G. Kulkarni, H. P. Shah, S. M. Sanas, A.P.Shete, and G. H. Kekan, "Design and Development of Screw Feeder," International Journal of Advance Research, Ideas and Innovations in Technology, 2017. Available: https://www.ijariit.com/manuscript/design-and-development-of-screw-feeder/

[2] Balu, "Research And Analysis Of Automated Special Machine For Fastening Of U-Frame And Screw," International Journal Of Innovative Technology And Exploring Engineering, 2019. Available: Https://Www.Ijitee.Org/Portfolio-Item/L105610812s19/

[3] Z. Jia, A. Bhatia, R. Aronson, D. Bourne, and M. T. Mason, "A Survey of Automated Threaded Fastening," IEEE Transactions on Automation Science and Engineering, vol. 16, no. 1, pp. 298–310, 2019.

[4] M. Nimitha, M. G. Jitendra, N. Apoorva, A. Mohammed Shuaib, and K. Nagarathna, "Design and Development of Metal Parts Counting Machine," Journal of Emerging Technologies and Innovative Research, 2019. Available: https://www.jetir.org/view?paper=JETIRCD06037

[5] **[5]** Arduino, "Arduino Uno Rev3 – Official Hardware Documentation." Available: https://docs.arduino.cc/hardware/uno-rev3/

[6] **[6]** Arduino, "Arduino Programming and Language Reference." Available: https://docs.arduino.cc/

[7] **[7]** Pololu Robotics and Electronics, "Motor Drivers and Electronics Documentation." Available: https://www.pololu.com/

[8] **[8]** International Organization for Standardization, "ISO 12100: Safety of Machinery – General Principles for Design – Risk Assessment and Risk Reduction." Available: https://www.iso.org/standard/51528.html

(This work is licensed under a Creative Commons Attribution 4.0 International License.)