International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 07, NCIRTAI - 2026

Automatic Water, Sand and Cement Mixing System using Automation (IoT)

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***Abstract*— This project presents an automated system for mixing water, sand, and cement using a microcontroller-based control system in automatic water, sand and cement mixing system that ensures precise ratio control and efficient material handling. The system ensures accurate proportioning of materials, reduces human effort, and improves efficiency in construction applications. Sensors are used to monitor material levels, and actuators control the flow of materials into a mixing drum. The system can also be enhanced using IoT for remote monitoring and control. The proposed system minimizes material wastage, improves consistency, and enhances productivity in construction sites.**

Keywords— IoT, Automation, Construction, Cement Concrete Mixing, Arduino, Sensors, Smart System Construction Technology

I. INTRODUCTION

Concrete mixing is a crucial process in construction. Traditional manual mixing methods are time-consuming and prone to errors in material proportions. This project introduces an automated system that controls the mixing of water, sand, and cement with precision. The use of microcontrollers ensures consistent quality and reduces labor dependency. Construction work requires accurate mixing of sand and cement to achieve desired strength. Traditional manual mixing methods are time-consuming and prone to human error. With the advancement of Internet of Things (IoT), automation can be introduced in construction processes. This project aims to develop an automatic mixing system that controls the proportion of sand and cement using IoT technology. It allows real-time monitoring and control through a mobile or web application.

II. LITERATURE SURVEY

Various automation systems have been developed for industrial mixing processes. IoT-based smart systems have been widely used in agriculture, manufacturing, and home automation. However, limited work has been done in automating construction material mixing.

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[6] Han et al- Automatic Monitoring of Concrete Mixing using IT Systems-Volume: 14, Issue 10, Article 3248-2024

III. PROPOSED SYSTEM

The system consists of sensors, a microcontroller, actuators (motors and valves), and a mixing drum. The controller receives input from sensors and operates actuators to maintain the desired mix ratio.

The proposed system automatically measures and mixes sand and cement in predefined ratios. The system ensures proper ratio (e.g., 1:2, 1:3) and reduces manual intervention and Previous works include

- Automated concrete mixing machines
- Smart batching systems using PLC
- IoT-based monitoring systems

IV. METHODOLOGY OF MIXING SYSTEM

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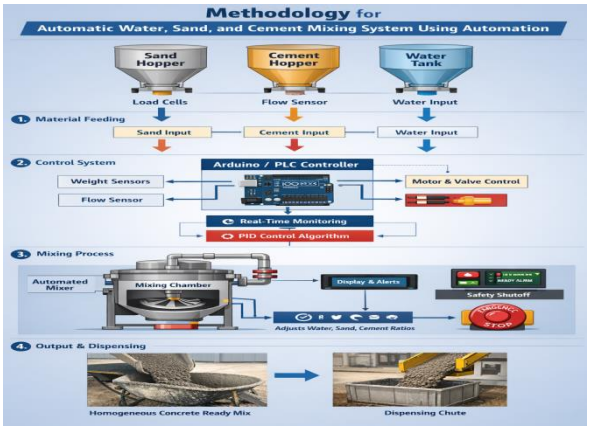

Fig - 4.1 *Working methodology of sand mixture plant*

V. HARDWARE AND SOFTWARE REQUIREMENTS

- Microcontroller (Arduino / ESP32)
- Load Cell Sensor/ Level Sensors for Sand and Cement
- Water Level Sensor
- Relay Module
- Solenoid Valve / Water Pump
- Mixing Drum
- Moisture Sensor (optional)
- DC Motors / Servo Motors
- DC Motors / Conveyor
- Mixing Motor
- Wi-Fi Module (ESP8266/ESP32)
- Power Supply Unit

5.1 Working Principle

The system operates by first detecting the availability of materials using sensors. Based on predefined ratios, the microcontroller activates pumps and motors to dispense water, sand, and cement into the mixing drum. The drum rotates for a fixed duration to ensure proper mixing. Once the process is complete, the mixture is discharged.

1. User inputs desired ratio via IoT app.
2. Sensors measure sand and cement quantities.
3. Motors control material flow into mixing chamber.
4. Mixing motor blends materials uniformly.
5. IoT system sends real-time data to user.

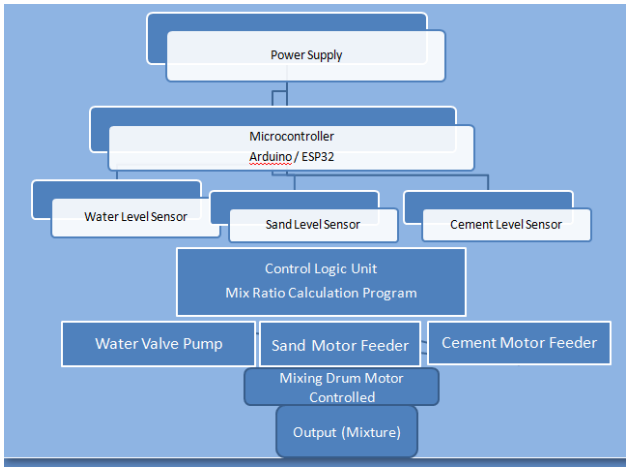

Fig - 5.1 *Explanation of Block Diagram*

Uses of components

- **Sensors** → Measure quantity of water, sand, and cement
- **Microcontroller (Arduino/ESP32)** → Controls entire process
- **Control Logic** → Maintains correct mix ratio (e.g., 1:2:4)
- **Actuators (Pump & Motors)** → Dispense materials automatically
- **Mixing Drum** → Rotates to mix materials uniformly

Output → Ready concrete mixture

5.2 Circuit Description

The sensors are connected to the input pins of the microcontroller. Relay modules are used to control high-power devices like motors and pumps. The power supply provides regulated voltage to all components. Proper grounding is maintained to ensure system stability.

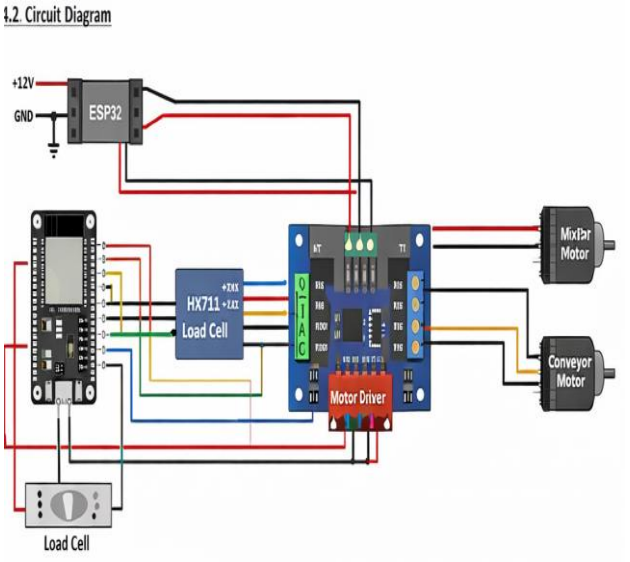

Fig - 5.2 *Circuits diagram for microcontroller*

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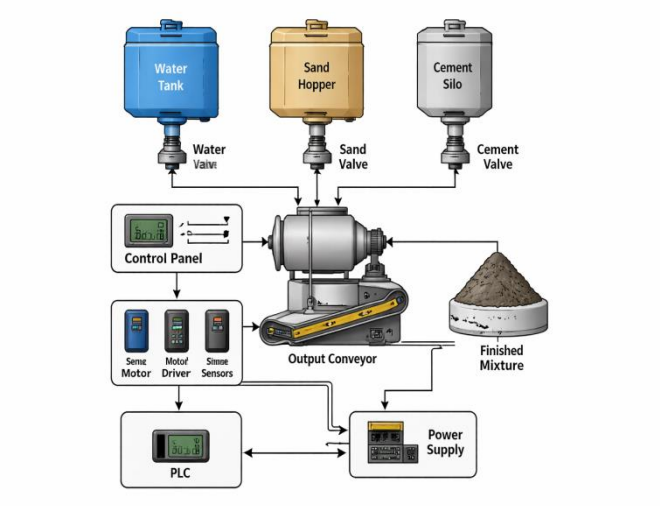

Fig - 5.3 Working process of automatic mixture

vi. aLGORITHM

- Start system
- Connect to IoT network
- Receive ratio input
- Measure sand using load sensor
- Measure cement using load sensor
- Activate motors to dispense materials
- Start mixing motor
- Send status to IoT app
- Stop after mixing complete

VII. ADVANTAGES AND APPLICATIONS

Advantages

- Reduces human error and Reduces human effort
- Saves time and labor
- Ensures accurate mixing ratio
- Remote monitoring via IoT
- Minimizes material wastage
- Accurate material proportion
- Improves construction quality
- Can be monitored remotely (IoT)

Applications

- Construction sites
- Ready-mix concrete plants
- Smart building systems
- Small-scale construction projects
- Automated building systems

Future Scope

- Integration with AI for smart ratio prediction
- Use of mobile app for full control
- Automation of water addition
- Integration with large-scale industrial systems
- AI-based mix optimization
- Real-time monitoring using cloud

VIII. CONCLUSION

The proposed Automatic Water, Sand and Cement Mixing System using Automation introduces an efficient and intelligent approach to overcome the limitations of conventional concrete mixing techniques. Unlike traditional systems that rely heavily on manual labor and fixed ratio mixing, the developed method integrates real-time sensing, automated material dosing, and feedback-based control to ensure precise and consistent output. The proposed system also incorporates a closed-loop control mechanism, which improves accuracy by correcting deviations during the mixing process. Compared to existing approaches, this method significantly reduces material wastage, enhances mixing uniformity, and improves overall productivity. Additionally, the design focuses on low-cost implementation**,** making it suitable for small-scale construction applications and academic projects.

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