

# Industrial Bottle Filling Process Automation & Data Analytics Powered by Google AI

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**Abstract**— The Internet of Things (IoT) is propagating and blooming technology, in previous years. IoT is the collection of the sensor data through an embedded system and this embedded system uploads the data on the internet. There are many challenges to IoT and Industrial Automation for example Data and service security, Trust, data integrity, information privacy, scalability and interoperability Automation Domain Constraints. This project is mainly focused on developing an intelligent process controller which will completely replace the need of PLC in the factory. Being a sponsored project the requirement was to develop a system which will control and automate the Bottle filling operation in the factory, which will reduce the current limitations. Suitable components are researched to design the prototype. Main components needed are a microprocessor, temperature sensor, pressure sensor, and float sensor, analog to digital converter. To power the prototype, a normal 5V power supply is sufficient. Main components need to be calibrated to ensure the operation and precision of the prototype in its operation. As for the conclusion, although there are many problems and limitations faced, this system demonstrates successful process automation of bottle filling systems and indicates to change the filters if it is damaged. It also senses the workstation temperature.

**Keywords:** Industrial Process Automation, Data Analytics, Internet of Things, Artificial Intelligence

## I. INTRODUCTION

A large range of industrial IoT applications are developed within the last few years. It was initiated from RFID technology, where microchips transmit the identification information to a reader through wireless communication. And further technology goes to the wireless sensor networks (WSNs), which mainly use interconnected intelligent sensors to sense and for monitoring. Internet of Things (IoT) is a concept that considers pervasive presence in the environment of a variety of things/objects that through wireless and wired connections and unique addressing schemes are able to interact with each other and cooperate with other things/objects to create new applications, services and reach common goals. The IoT applications are; smart cities, smart energy and smart grids, smart transportation and enabling traffic management and control.

The R-Pi, is a single-board computer which uses Linux based OS and that can be directly used in this project because it has general purpose input/output (GPIO) pins right on the board. This project involves the detail design and construction of an Industrial automation system using Raspberry Pi board and Internet connection. The automation may be semi or fully controlled and monitors the utility grid connected sensors. This project is a demonstration of how to design and build a multipurpose remotely controlled system that can switch any industrial acuter by accessing a Raspberry pi, which is programmed to control the systems

inside an industrial environment, when the person is away from the workstation and enables a person to get the related information on the phone. The system will provide feedback indicating the current state of the system stopped or functioning. The goal of the system is to create a small industrial environment, where sensors can be monitored and controlled only based on the data received from the industrial site sensors. This data is processed and control actions placed accordingly. The system has to be implemented in a loop, so no human intervention is allowed. This means that the system is adaptive to the environment. The whole control device of the system is a small Raspberry Pi. This computing system is used due to the fact to prove that the whole industrial system can be automated with just a card size computing system or a microchip and the industrial environment data can be viewed or monitored from IoT. Along with this all the data collected by this system can be analyzed by Google AI for Data Mining. Water is essential for the survival of human beings. Water makes up 75% of the human body. On the other hand, the population of the world is steadily growing. This makes the need for clean water ever increasing. There is now, even more, the need to carry clean water around easily. Meeting this need requires mass production of bottled water within a short time as possible. Technological advancement allows for automatic bottle filling with the help of a microcontroller. With automation, product quantity and quality can be improved, and in turn, profit will rise. Automatic control functions to compare actual value from plant output to reference input (desired value), determine deviation, and produce a control signal that will reduce zero deviation or small value. The way a controller generates automatic control is known and control action [1, 2, 3, 4, 5]. Construction of an automatic control can make use of the Raspberry Pi as the control center. This is because Raspberry Pi comes with the high input-output capability and it is also supported by onboard memory and Ethernet [6]. Unlike an ordinary computer or microcontroller, Raspberry is equipped with a 40-pin GPIO system that serves as a sensor input-output and regulator to actuators. Raspberry can also be used for image processing systems as it has sufficient microprocessor and RAM that allows Raspberry to process data. Desktop display and keyboard functions that are similar to Windows platform ease Raspberry Pi operation.

## II. LITERATURE SURVEY

The current system is a traditional control system in which the Bottle filling station simply senses the bottle position and starts filling the bottle regardless of the other parameters i.e. the tank level, filter functioning. Due to this whenever the filter is clogged due to any reason the station starts the bottle filling and this results in the waste of the liquid and also the filter is damaged heavily. Also then after the filters it needs to be changed immediately to resume the work.

Current system is totally manual which needs regular human intervention for its operations. No data can be set for its operations. Data analytics is not at all possible in this system as it's not sensing all the required parameters and neither is it being stored in the database.

### III. NEED OF RESEARCH

#### A. Problem Statement

Implementation of Industrial Bottle Filling Process Automation & Data Analytic Powered By Google AI.

#### B. Objective

- (1) To implement the Industrial Process Automation (Bottle Filling) controlled by Raspberry Pi.
- (2) Design database to store production record.
- (3) To Implement Cloud computing so to access data from anywhere.
- (4) Data Analysis On Google Sheets

#### C. Proposed Work

The thought of this project is to prove that single board computers may monitor and manage industrial machines. Instead of mistreatment pricey PCs or PLC's (comparatively) we have a tendency to square measure about to manage the commercial machine mistreatment of this small embedded computer. This is attainable as a result of Raspberry Pi carries with it increased Quad Core Processor currently provides you with the chance to Broadcom BCM2836 Arm cortex-A7 Quad Core Processor supercharged Single Board pc running at 900MHz with 1GB RAM and peripherals of 40pin extended GPIO, 4 x USB two ports and carries with it four pole Stereo output and Composite video port with Full size HDMI. It has a CSI camera port for connecting the camera and a DSI show port for connecting the 16 bit screen show. Micro American state port for loading your software and storing information and small USB power supply.

We can use any electronic show device like movable, Tablet etc. It eliminates the usage of value on mistreatment computers, that is additional economical. Stepper Drivers that drives the stepper motors square measure directly connected to Raspberry pi pins. The Input command on Raspberry pi is given through the show device to drive the motor. The system can be easily integrated into an existing electrical system of a building thanks to its simplified design. It can also be easily installed for just a single room if one so desires. Modifications to the existing electrical system are minimal, thereby reducing installations costs. The mobile device connects to the server PC through Bluetooth or Wi-Fi or through the internet. The user sends commands to the server from the mobile device. The microcontroller is connected to the server via USB. On receiving commands from the mobile device, the server sends commands to the microcontroller over the USB connection. The microcontroller is directly connected to the relays and it can enable or disable them. The relays are connected to the electrical system of the building so that they can control the plug points.

### IV. SYSTEM DEVELOPMENTS

#### A. Block Diagram

Following is the block diagram of the proposed system.

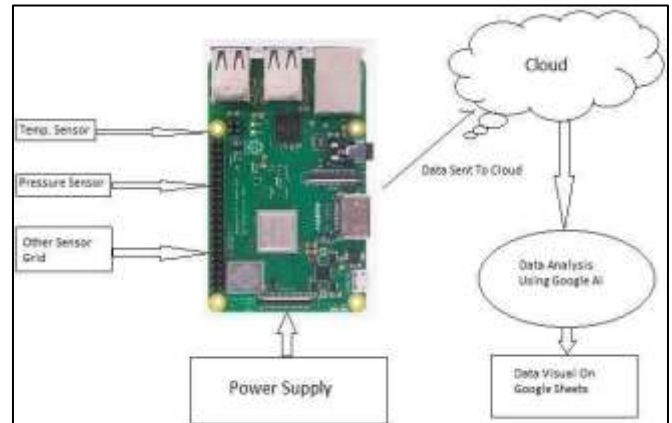


Fig. 1: Block diagram of the system

#### B. Working

- The sensors are interfaced to the raspberry pi module.
- The pi module is powered up by a 5v power supply.
- The system is primarily used for fault detection in bottle filling stations by detecting clogged filters; it also measures surrounding temperature etc.
- It gives qualitative analysis and quantitative analysis by Data Analytics by Google.
- The daily product count can be recorded by the cloud.
- Google Sheets can be used to visualize the data in proper format

#### C. Hardware Required

##### 1) Raspberry Pi 3 Model B+:

The latest Raspberry pi 3 model B+ has a faster 64 bit 1.4 GHz quad core processor, 1GB of RAM faster dual band 802.11b/g/n/ac wireless LAN, Bluetooth4.2, and significantly faster 300Mbit/s Ethernet. The Raspberry Pi3 is the latest version of the credit card sized computer from the Raspberry Pi Foundation. The Raspberry Pi 3 is about 50% faster than its predecessor the Pi 2. It includes built in WIFI and Bluetooth Low Energy connectivity, making it truly an IOT-ready device.

##### a) OS FOR Raspberry Pi:

The Pi can run the official Raspbian OS, Ubuntu Mate, Snappy Ubuntu Core, the Kodi- based media centers OSMC and LibreElec, the non-Linux based RISC OS (one for fans of 1990s Acorn computers). It can also run Windows 10 IoT Core, which is very different to the desktop version of Windows.

*Use of Raspberry Pi:* The Raspberry Pi Foundation has just released the Raspberry Pi 3. It's a full computer, as small as a credit card, and can be purchased from online sites including Amazon, Element 14 and RS Components. Its specs include 1.2GHz 64-bit quad-core ARM Cortex-A53 CPU, 802.11n Wi-Fi, and Bluetooth.

##### 2) MCP 3008

The MCP3008 device is a successive approximation 10-bit analogue-to-digital converter with on-board sample and hold circuitry. It is programmable to provide four pseudo-

differential input pairs or eight single-ended inputs. Differential Nonlinearity (DNL) and Integral Nonlinearity (INL) are specified at  $\pm 1$  LSB. Communication with the devices is accomplished using a simple serial interface compatible with the SPI protocol.

### 3) Power Supply

To obtain this DC voltage from 230V AC mains, we need to use a rectifier. The rectified DC voltage is pulsating in nature. We know that a combination of rectifier and alter can produce a dc voltage which is almost pure i.e. ripple free. However, the problem with such a power supply is that its output voltage will not remain constant in the event of fluctuations in ac input voltage or changes in load current. This type of power supply is called an unregulated power supply. The power supply, which provides a constant output voltage irrespective of everything is called, regulated power supply. So we have to design a regulated power supply using series voltage regulator IC 7805.

## D. Industrial Process Automation

### 1) Raspberry Pi for small shop industrial control

For many smaller operations, the Raspberry Pi 3 platform offers a low-cost solution with Substantial performance capabilities. Fully capable of handling dedicated industrial automation tasks, the Raspberry Pi 3 board combines a Broadcom ARM® Cortex®-A53-based processor, 1 Gigabyte of RAM, digital interfaces, Wi-Fi, and Bluetooth connectivity. The processor itself is a high-performance system-on-chip (SoC) device that integrates a quad-core ARM Cortex-A53 CPU with 512 Kbytes of L2 cache, and 54 GPIOs arranged in three banks. Each individual GPIO variously supports at least two and up to six alternative functions, including pulse-width modulators, clocks, and serial interfaces. Developers can use any unassigned GPIOs as interrupt lines, inputs, or outputs capable of supplying up to 16 milliamps (mA) (up to 50 mA total per GPIO bank). As with other members of the Raspberry Pi family, the Raspberry Pi 3 is designed to make embedded development simple enough for beginners, yet powerful enough to meet the needs of experienced developers with more complex and powerful processing requirements. To start, developers simply connect the board's video ports to their displays and its USB ports to their keyboard and mouse. For software design, developers can build on a broad ecosystem supported by the Raspberry Pi Foundation's free Linux-based Raspbian operating system loaded from a memory card through the board's micro SD interface.

### 2) Adding industrial capabilities:

Beyond its performance and ease of development, the Raspberry Pi's simplified approach for extending its functionality make it well suited to the diverse requirements of industrial automation applications. To add hardware capabilities, developers only need to plug an add-on board called a HAT (Hardware Attached on Top) onto the Raspberry Pi 3 board. As with more complex industrial systems, the HAT provides a standard approach for identifying the HAT and automatically configuring the GPIOs and drivers as needed. As a result, developers can instantly upgrade their Raspberry Pi system for industrial applications simply by plugging in the Pimoroni PIM213 Automation HAT (Figure 1). Figure 1: Developers can

upgrade a base Raspberry Pi 3 board for industrial automation by attaching specialized add-on boards such as the Pimoroni Automation HAT. (Image source: Pimoroni) Specifically designed for monitoring and control of automation systems, the Pimoroni Automation HAT combines multiple I/O channels, including analog and digital inputs, powered outputs, and relay controls. Along with their 24 volt (V) capability, the I/O channels provide substantial input and output buffering. For example, the relay outputs support up to 2 amps (A), sufficient to drive low-power 24 volt parts such as the Crouzet 81 546 001 solenoid valve. For software development with the Automation Hat, Pimoroni provides an associated Python module that requires only a few lines of code to use the HAT's hardware features. When imported into a Python program, the Pimoroni module creates software objects for analog input, digital input, digital output, relay output, and LED light control, each of which includes the appropriate lower level read/write functions (Listing 1)

## V. DATABASE

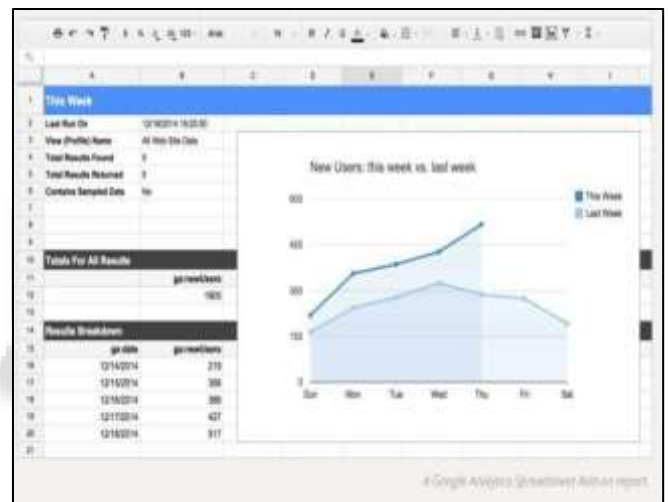


Fig. 2: Database of the system and its analysis using Google AI

Google Analytics - The Google Analytics Spreadsheet Add-on makes it easier for Google Analytics users to access, visualize, share, and manipulate their data in Google Spreadsheets. The add-on gives you the full power of the Google Analytics Core and Multi-Channel Funnels Reporting APIs without requiring you to know or write any code.

With this tool, we can do following things:

- Query data from multiple views.
- Create custom calculations from your report data.
- Create visualizations with the built-in visualization tools, and embed those visualizations on third-party websites.
- Schedule your reports to run and update automatically.
- Easily control who can see your data and visualizations by leveraging Google Spread sheet's existing sharing and privacy features.

## VI. RESULTS

The user-friendly and intuitive interface of Google Analytics Sheets makes it possible to analyze in detail information regarding the resources involved in the production process, like machines/departments/work centers, operators/cost centers/work orders/sales orders/material, etc., based on company structure.

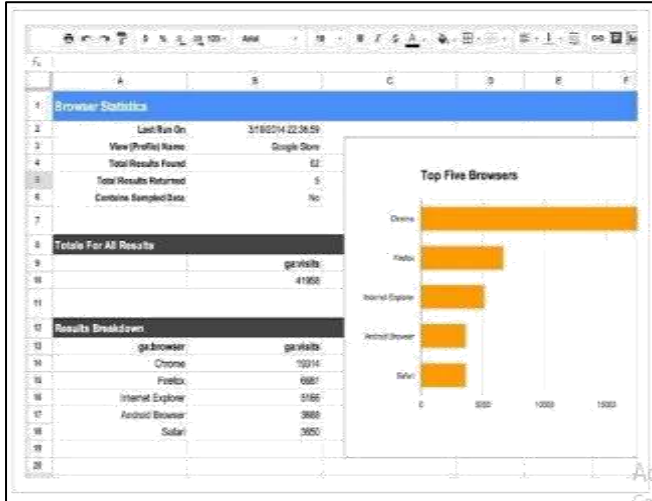


Fig. 3: Results of Analysis

## VII. CONCLUSION

In this project, we have a tendency to area unit managing the commercial machine mistreatment the advanced technology below embedded systems mistreatment raspberry pi 3 B+, we have a tendency to did management the stepper motor mistreatment is to control the motive force and if any human movement or unbroken the hand close industrial machine suddenly pir motion sensing element sight and stop or on alarm. The Industrial machine control and monitoring system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. The client was successfully tested on a multitude of different mobile phones from different manufacturers, thus proving its portability and wide compatibility. Thus a low-cost Industrial machine control and monitoring system was successfully designed, implemented and tested.

Conventional PLCs offer capabilities typically beyond the requirements and budgets of smaller industrial operations in small scale manufacturing, machining, and prototyping shops. For these applications, operators typically face more modest requirements that lie well within the capability of the Raspberry Pi 3. Using Raspberry Pi 3 and appropriate add-on boards, developers can rapidly implement dedicated industrial automation systems capable of meeting requirements for a wide range of small shop operations.

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