Implementation of Industrial Automation Systems using Raspberry pi by IOT with FIREBASE

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Abstract: This paper highlights the design and implementation of Industrial Automation Systems with the help of Raspberry Pi as a Gateway programmed by Python language addition with IoT and FIREBASE Google cloud computing. The system consists of one module that is Sensor module. The sensor module is the raspberry pi for monitoring and controlling the various parameters of an industrial plant and energy management. The coordinator module is implemented using the raspberry pi that is with sensor module. The raspberry pi is used at the sensor module and they are programmed using python. With the help of FIREBASE cloud computing which use to store data. The experimental results obtained demonstrate the usefulness of the proposed system in terms of the low power consumption. It is off low cost and targeted towards automation remote-control applications.

Keywords: Internet of things, Raspberry pi, Python scripting language, Firebase cloud computing

1 Introduction:

The 'Industrial Internet of Things' involves a range of technologies from semiconductors to cloud computing and artificial intelligence. Businesses can take advantage of this technology to make their processes more efficient, and they can use the digital technology of IoT to transform their businesses and industries. Exponential improvement in core digital technologies is fueling accelerated innovation. The cost-performance curve of three core digital technology building blocks—computing power, data storage, and bandwidth utilization—has been improving at an exponential rate for many years. As the rate of improvement accelerates, we are experiencing rapid advances in the innovations built on top of these core "exponential" technologies. The current pace of technological advance is unprecedented in history. The potential opportunities for IoT include customer and supplier relationships as well as internal processes. IoT projects can offer whole new business models such as product-as-a-service, so the right group of people needs to be involved to assess the opportunity and develop ideas to fit their organization's priorities, timescales, budgets and culture.

Electric power and electronic communication are one of the main technologies that changed rapid development of industry atmosphere in the 20th century. [1] The study shows that the world's electricity demand will be triple by 2050. This estimation underlines the present electrical power system and to increase robustness in thought and economy of design. It provides more optimal way to for routing the power to respond for a wide range situation.
Electrical power grid with automation, communication and IT signal systems that can handle power flows from unit of generation to point of end users consumption and monitor the power flow or manage the load to equate generation in real time or near real time [2].

This paper implements an power system which displays the power consumed by individual or mfm devices [3]. This can help a user to detect any errors in the electricity bill. Many a times the domestic electricity bill shows excess amount which causes consumer dissatisfaction and complaints. System can help a user to analyses the energy consumption data at device level and manage it rather than assuming it to be a fixed monthly expenditure. Also, it helps a user to replace the regular appliances by energy efficient ones. Importantly, the monitoring system can alert the user on unexpected excess consumption caused by equipment malfunctions, lack of proper maintenance and the like. Further, proper energy management can make proper budgeting possible. It comprises of information and communications technology, sensors, automation and computers for betterment of flexibility, grid security, reliability, power efficiency, and safety of the electricity system [4]. It provides an option to consumer to choose and control their electricity uses and respond to electricity bill changes by adjusting their time of consumption. A smart grid accommodates electric vehicle charging by providing diverse, dispersed and new energy source.

The implementation of smart industry concept still faces some of the challenges. A very few investors are still usages about the benefits by implanting of smart factory technologies at small scale. Therefore, it is necessary to list all the benefits of all smart factory technology. In next few years, the industry will not that limit to experience advanced metering infrastructure

application, but also new improved and fully controlled factory automation [5].
These monitoring, optimization and autonomy examples are happening inside a manufacturer's organization and can be local to the production groups. They can be transformational because they may open up the next step for lean manufacturing initiatives [6].

Predictive maintenance can be relevant both to machines in the factory, and also to products sold to customers. While predictive maintenance takes center stage in the industrial machinery sector, there are other highlights in other sectors [7]. The common theme is business justification based on achieving goals familiar to manufacturers since long before IoT:
–Reduce costs and improve operations
–Achieve competitive advantage by offering customers a better experience
–Open up new revenue streams
The balance of these goals varies, but they are always there, whether it's a connected industry in automotive, cloud services for control of consumer goods, or smart metering and smart grid architectures in utilities [8].
Implementation of a wireless automatic meter reading system (WAMRS) which incorporates the widely used GSM/GPRS network. The system includes a microcontroller, which periodically transmits power consumption values calculated from the sensed voltage and current values via an existing GSM/GPRS network, to a master station. The main disadvantage of this technology is distance factor [9]. A strong GPRS or a GSM network coverage at long distances may not be available whereas the other disadvantage might be speed of operation

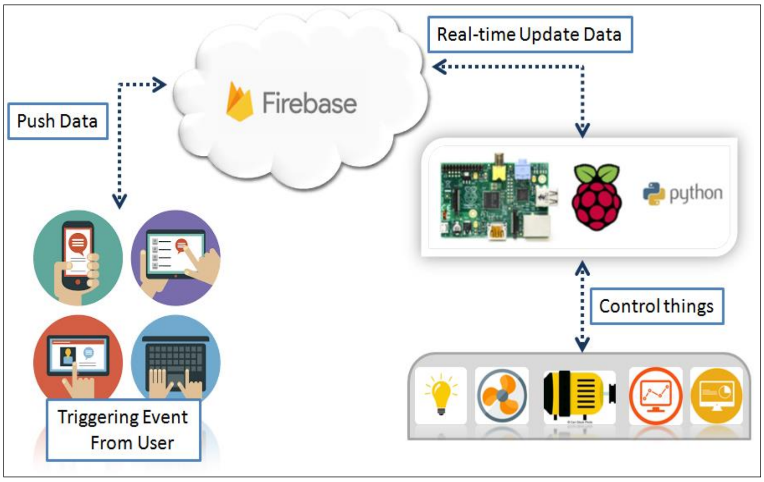


Figure 1 system architecture [4][6][10][15]

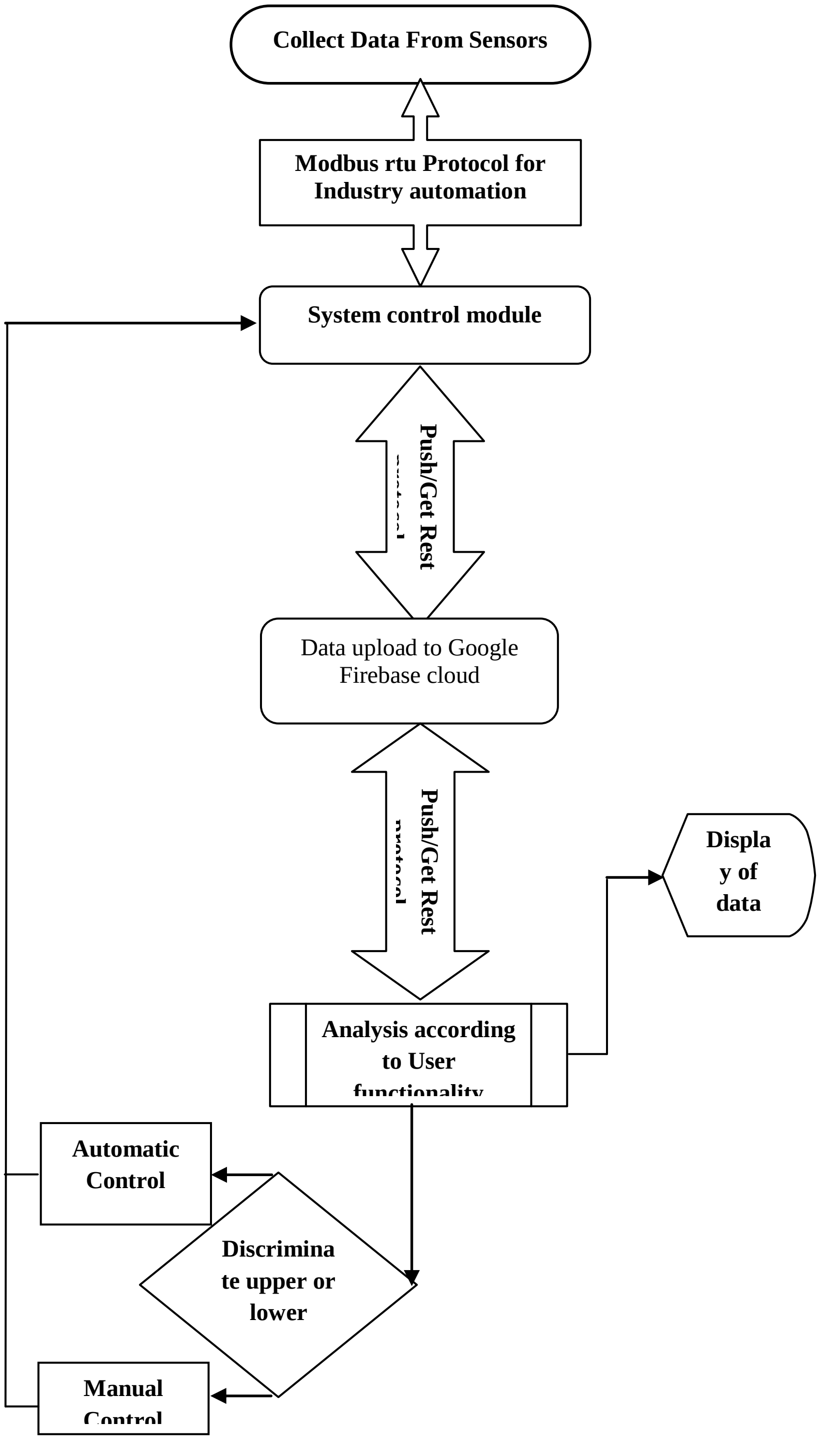
2 System Architecture Model:

In this figure of the industrial monitoring system consists of many main blocks, they are Sensors, Raspberry PI, DC Motors, USB Camera, WIFI Dongle, Buzzer, Cooling Fan, Power Supply, Firebase Cloud computing and User side mobile and web application. Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects.

Firebase is a mobile and web application development platform enveloped by Firebase, It help to build easy mobile app, it is easy to authenticate, user friendly cloud.

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. The very swift growth of various communication application propelled on the need for antennas that operating dual-band or multiband range. It will be prepared that an antenna has bandwidth in excess of frequency range from 800 MHz to 11 GHz or even more, to include all the existing wireless communication systems.

3 Methodology:



In this block diagram of the industrial monitoring system consists of many main blocks, they are Temperature Sensor, Gas Sensor, Ultrasonic Sensor, Raspberry PI, DC Motors, USB Camera, WIFI Dongle, Buzzer, Cooling Fan, Power Supply. All the blocks are described below. Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects.

4 Advantages

4.1 Energy savings through reducing consumption

One of the advantages of smart grids is that they can tell us the consumption at an energy meter at any time, so users are better informed of their real consumption. Moreover, with better consumption monitoring, contracted power can be adjusted to meet the real need of each consumer. These two factors result in users reducing their consumption and tailoring their contracted power to their real needs.

4.2 Better customer service and more accurate bills

Another key advantage offered by tele management systems is that bills are more accurate. They always reflect the real consumption of each month instead of estimates, reducing the cost of the old system of manual energy meter readings. In addition to being able to access information about the installation remotely, problems become easier to diagnose and solutions can therefore be implemented faster, improving customer service. Nowadays customers have to notify companies for them to take action. But with remote management the system itself automatically reports all incidents to the electric company so it can respond faster to users.

4.3 Fraud detection and technical losses

According to data from the Spanish National Commission for Markets and Competition, electricity fraud reached €150 million last year, equivalent to the consumption of Seville and Valencia combined. This does not negatively impact the utilities however, but rather translates into increased electricity bills for customers.
Tele management systems can detect fraud much more accurately, as the units do not contain any parts that are subject to mechanical wear. Moreover, the new energy meters with PLC PRIME communications have systems that detect the opening of the terminal strip cover and send an automatic alert to the managers of the grid warning of potential fraud.

4.4 Reduced balancing cost

Smart Grids can collect much more data than the manual energy meter reading system. This permits the use of data analysis techniques and the preparation of highly realistic consumption forecasts as many more variables are taken into account.
Utilities can then better tailor their production to consumption (balances) and reduce energy surpluses.

4.5 Increased competition

Having real load curve data invites marketing companies to adjust their prices based on energy demand. When the marketing companies have more data they can make better offers that are more in line with their customers' reality, increasing competitive options through a wider variety of offers (hourly tariffs, energy packages, etc.).
This benefits consumer in that more competition leads to more competitive pricing.

4.6 Levelling of the demand curve (Peak reduction)

Through the use of different pricing profiles, utilities can level out the daily demand curve to shift consumption peaks to times with lower demand, optimising usage of the electrical network. So customers can intentionally connect loads at off-peak times when each kWh is less expensive. As an example: a customer may decide to change their consumption habits by using the washing machine during off-peak hours, at night, instead of when each kWh is more expensive, saving money and helping the utility balance consumption and avoid line saturation during peak hours.

4.7 Reduction of carbon emissions

All the benefits above involve reducing consumption, which entails a reduction in CO_2 emissions.
We can thus say that Smart Grids lead to a more sustainable future. All this will directly contribute to the future integration of electric vehicle charging systems on the mains. The deployment of renewable energy systems is also made easier as utilities gain greater control of their grids.

Conclusion:

Implementation of Industrial Automation Systems with the help of Raspberry Pi as a Gateway which programmed by Python language addition with IOT and FIREBASE Google cloud computing is very convenient way to establish robustness network to industry automation from anywhere. The proposed system is very useful to any area of industry to control and monitoring the things. It is cheaper as compared to any other existing system. It is low of cost, reliable, easy to operate and popular in market.

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