An IOT based industrial machine monitoring and controlling system using raspberry pi

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Abstract:Internet of Things (IoT) is propagating and blooming technology, now days. IoTis a network of interconnected things, objects, devices, sensors and systems. That collect and transmit data and exchange data between them. 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 Constrains. This paper shows one of the application of IoT by controlling and monitoring the industrial machine. The system uses the raspberry pi as the main controller, the programing is done in the python language. The webpage is designed using HTML, CSS, JQuery, and Java script as framework for rendering the HTML template in python. All sensor data are collected in raspberry pi and stored at local as well as cloud server storage. This system demonstrates successful measurement of temperature, motor speed, pressure and location of the machine.

Keywords:IoT, Industrial Internet of Things(IIOT), Server, Raspberry Pi, Automation, Controlling, Monitoring.

I. INTRODUCTION

A large range of industrial IoT application are developedwithin last few years. It was initiated from RFID technology,where microchips transmit the identification information to areader through wireless communication. And furthertechnology goes to the wireless sensor networks (WSNs),which mainly use interconnected intelligent sensors to senseand for monitoring. Internet of Things (IoT) is a concept thatconsiders pervasive presence in the environment of a varietyof things/objects that through wireless and wired connectionsand unique addressing schemes are able to interact with eachother and cooperate with other things/objects to create newapplications, services and reach common goals. The IoTapplications are; smart cities, smart energy and the smartgrids, smart transportation and enabling traffic managementand control.The Raspberry Pi, is a single-board computer which uses Linux based operating system and that can be directly used in electronics projects 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. This project is a demonstration of how to design and build a multipurpose remotely controlled system with Raspberry pi, which is programmed to control and monitor the machine remotely from anywhere. The person gets allinformation of machine on phone. The system also provide alert indicating current state of the system stopped or functioning.

II. OJECTIVE

One of the aims of industry especially in manufacturing enterprises is to produce high-qualityproducts characterized by no defects. It is also requested that the machine tool can maintainhigh overall equipment efficiency (OEE), without compromising the company's profitbecause of prolonged shutdowns. A part of the research aim is to provide support tocompanies that do not have a remote maintenance system for machine tools. The occurrenceof a machine downtime is transformed into a loss of competitiveness on the market, loss ofmoney and time. A company is required to immediately contact servicing, to reduce machine downtime. However, in many cases, there could be a significant delay before returning the machinery to operational status. During this time, the service engineer will perform an initialdiagnosis to understand the underlying problem, extending the machine downtime. Ideally, a company is configured with a remote maintenance system for machine tools. In this case, themajor problems arise to ensure long life to the maintenance system, evaluating the reliability of all the connected devices. The main objective of this paper is to develop an IOT based embedded system which can control and monitor the industrial application.
The system, from which we can controlall the parameters of the machine and can monitor them remotely, which can reduce the maintenance cost as well.

III. SYSTEM OVERVIEW

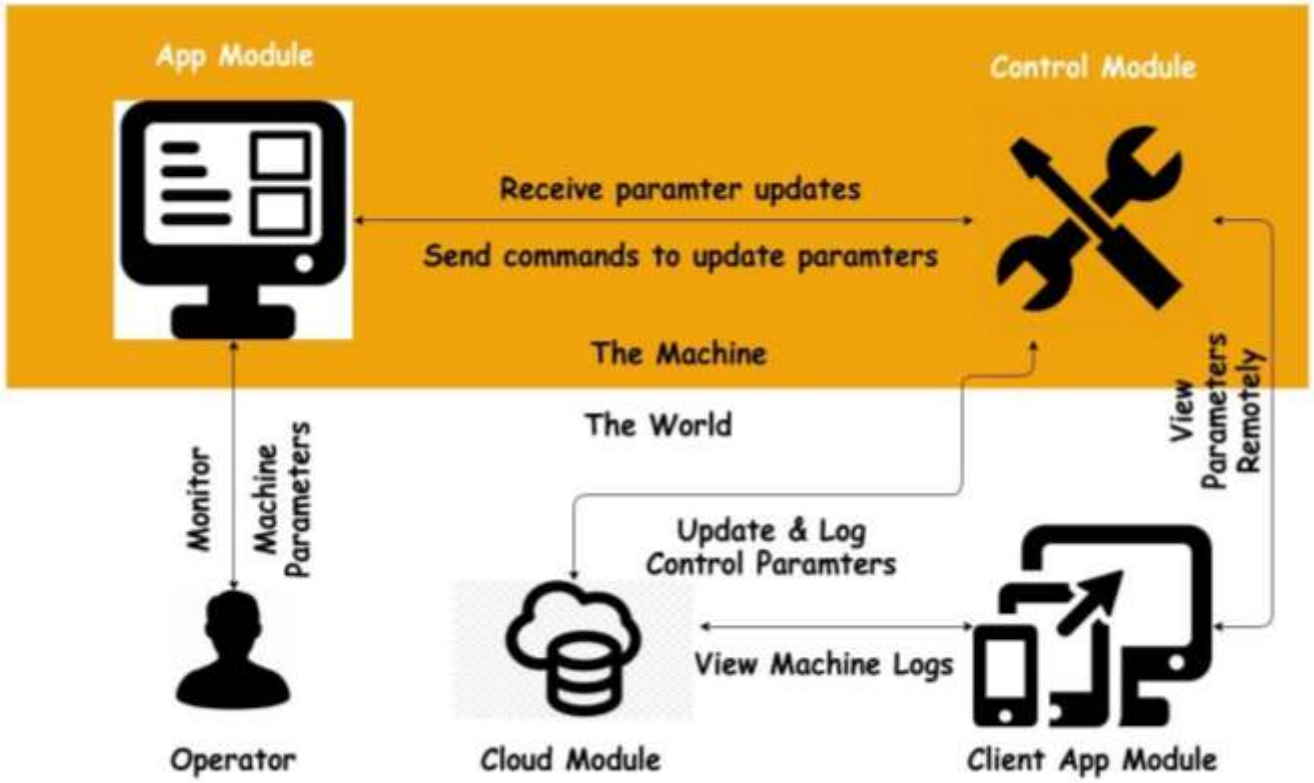

Figure 1: System Overview

The Machine: The IoT Machine built on Raspberry PI consists of 2 modules. Their collective task is to,

- Collect data from interfaced hardware devices
- Display data on the Desktop GUI Application
- Store the data locally
- Dump unsynchronized data stored locally to cloud if internet is available
- Dump live data to all connected clients

Operator: The operator powers up the IoT Machine & monitors the inputs from thehardware live on the screen, either the one mounted to the Raspberry PI, or a HDMIconnected display or from a device running VNC Display. All inputs are streamed live to thedisplay in real time. They're logged if enabled. All system activity status is also efficientlydisplayed on the GUI with a graph for analytical view of data as well.

Cloud: The cloud module stores the data of every IoT machine uniquely identified by its machine ID. It also stored the login information of all users & their privilege information aswell. It stores the data received from the machines, validates login requests & sends data toclients for analysis & review when requested by client.

Client: The client can access the application from any web browser. Upon successful login, he can,

- View all IoT Machines
- Add / Remove IoT Machines
- View data collected from the machines
- Generate reports from this data
- View the interface of the machine live in Real Time if the machine is online

IV. SOFTWARE USED

1.Python2.HTML/CSS/JQuery 3.CSV format. 4. Node JS
The overall programing is done with python, the sensors data is extracted using this software and stored on local device and cloud server. The HTML and CSS is used to design the web page of the system. The JQurey is small Java Script that is to fetch the data from Python. Node JS is used to manage all the information between server and the local storage.

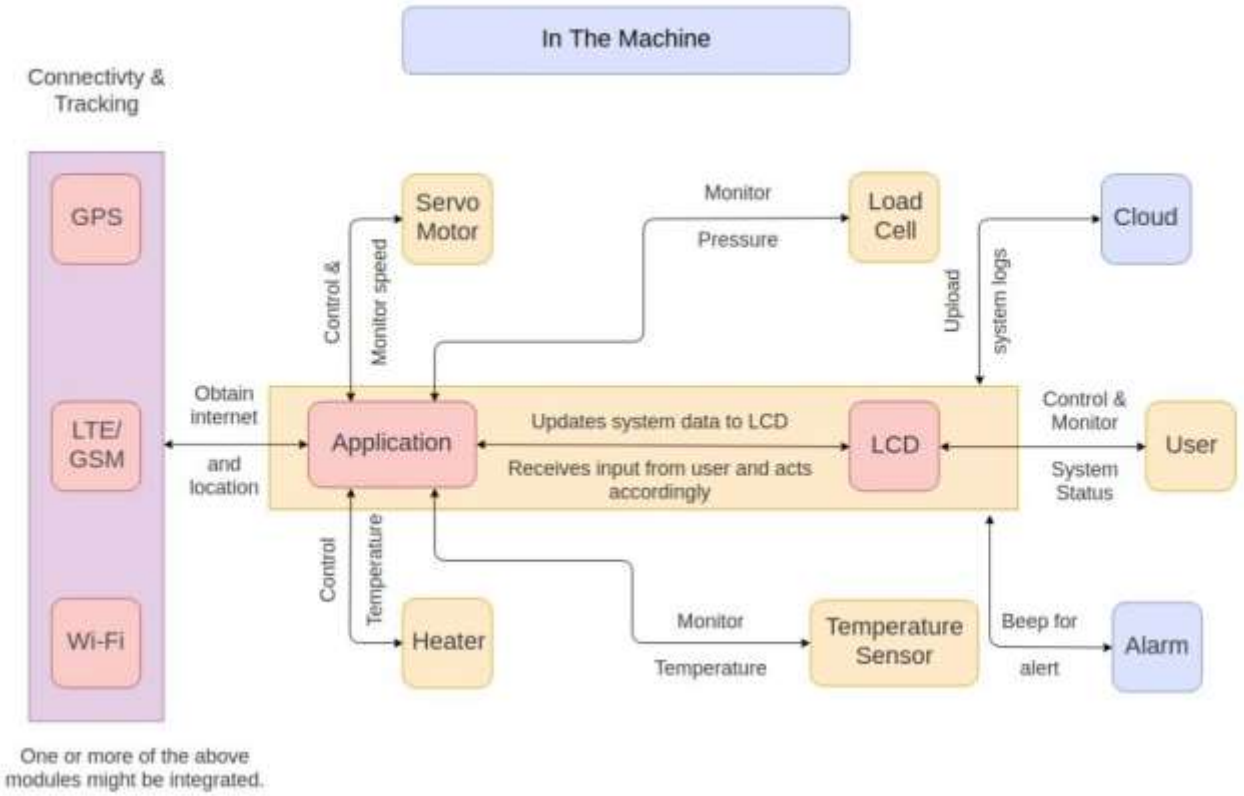

Figure 2: Software layout

The software planning layout can be divided in to major four divisions namely user section,internet connectivity section, cloud server section and hardware section. The user section isthe main controlling and monitoring section from which we can give input to the hardwareand can also get output from the hardware. The user section will collect the data from thehardware and store the data on local storage. When the internet connection is provided to themachine the locally stored data will be transmitted and stored on the cloud server. The motorwill be control from the application and the output of motor will be stored on the local andcloud storage. The alarm is used to alert user when the set value for the heater, motor andpressure goes above or below the set value.

V. EXPERIMENTAL RESULTS

On the system side Raspberry Pi board operates as a main control board in which all the sensor data are collected and stored in local storage and it also transmit the data on the server. It collects datafrom Temperature sensor, Pressure load cell, motor and GPS. This data is then sent to the client side using HTTP protocol. On client side real-time data can be seen from anywhere in the world on webpage. Internet connection to the board is given by using inbuilt WiFi. Results on webpage are shown in graphical format. On thiswebsite one channel is created and all four fields are placed in this channel. Field 1 shows temperature, Field 2 shows motor speed, Field 3 shows pressure and Field 4 shows GPS location. Realtime data of all four fields can be seen on the webpage as shown in the figure 3.

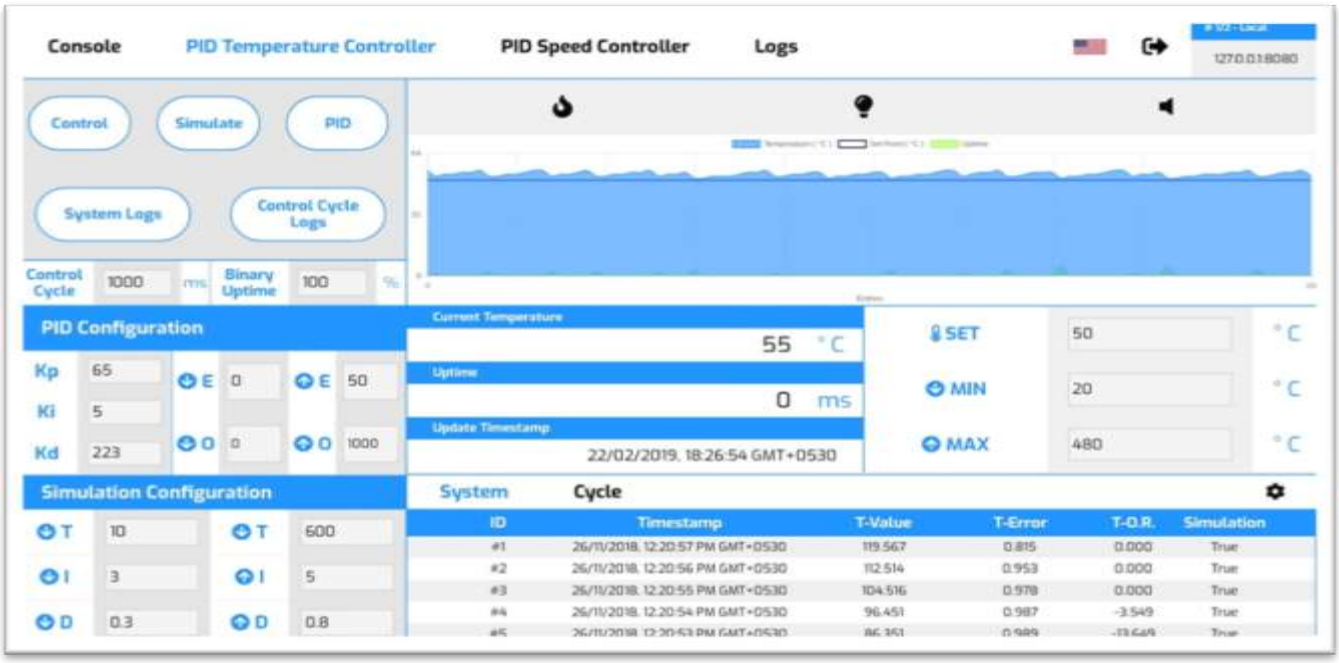

Figure 3: Webpage layout

VI. CONCLUSION

The major goal of this thesis was to identify the key benefits, as well as the challenges, anindustry can expect, if it decides to invest in Internet of Things. Achieving this would help closing the knowledge gap which exists between the IoT solution providers and the potential adopters of the technology. The results have highlighted certain benefits but also some critical barriers which industry might experience. The summary of the research results can be, Higher customer satisfaction – With the new digital factories, both supply chain and production will become much more agile. Out-of-stock problems will be minimized and realtime responding to demand will be possible. This will enable the customers to request more tailor-made products, which would significantly improve the customer satisfaction rate. Securing a competitive advantage – The above-mentioned benefits will have a considerable impact on the firm's competitive advantage. Being an early-adopter might secure an industry leading position in the future. The existing machine can be upgraded into and IOT machine by adding some sensors and collecting its data, which can improve the efficiency, security, reliability, low maintenance etc.

Acknowledgment

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