VELLORE INSTITUTE OF TECHNOLOGY

AMRAVATI

INDUSTRY AUTOMATION

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SUMMARY

Using internet of things (IoT) to connect things, service, and people for intelligent operations has been discussed and deployed in many industry domains such as smart city, smart energy, healthcare, food and water tracking, logistics and retail, and transportation. However, nothing of this sort is available for IoT usage in industrial automation domain for reliable and collaborative automation with respect to Data, its processing and analysis for e.g., enabling scalable collaboration between heterogeneous devices and systems, offering predictable and fault-tolerant, real-time, closed-loop control, and inclusion of intelligent service features from edge devices to the cloud devices. We want to specify quality constraints within industrial automation, present specific industrial IoT challenges due to these constraints and solve them using automation as a lot of these are due to excess of human involvement.

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BACKGROUND

The aim of this project to develop a system that will control the Industrial machines and also provide data on the go to the manager and help monitor and control activities. We have also developed a predictive model using multiple Linear regression using R. It is used to save the electric power and human energy as well as making the whole company economically viable.

This project is made with help of Raspberry Pi 3 and Relay driver circuit. The various appliances are connected to the relay circuit and the Raspberry Pi3 and a computer system. We set up a Server-Client system for this purpose and make one compute system as master of all other small computers (Raspberry Pi3's).

So, one raspberry Pi controls a set of operations and similarly other Raspberry Pi will control other set in sync as set by the master computer. Raspberry Pi3's act as small servers and the master Computer acts as Client which pushes for a function or a set of functions to be performed. Through this, we make sure that the control remains with the device manager and as soon as the

command reaches the server the execution is set on High and through a master switch board the power can be provided.

This helps as it creates a control over the whole process and it can be monitored as well as corrected when required. For eg. If the angle of rotation of a certain servo motor is to be changed it can be directly reset from the client side.

PROBLEM DEFINITION

In India, Industries are performing well beyond their capabilities in terms of quantity but what we as a nation are lacking is quality backing up the quantity, according to certain textbooks which are published quality and quantity can never go hand in hand but that is where we lack innovation and respectively we lack performance is quality. Automation today faces three basic problems and also leads to creation of a paradox which is as follows:

- Current technology is unable to automate all the desired tasks.
- Many operations using automations have large amounts of invested capital and produce high volumes of product, making malfunctions extremely costly and potentially hazardous. Therefore, some personnel are needed to ensure that the entire system functions properly and that safety and product quality are maintained.
- As a process becomes increasingly automated, there is less and less labour to be saved or quality improvement to be gained. This is an example of both diminishing returns and the logistic function.

Lab Management and Prediction Studies involves a management system of various laboratory equipment to have a better study, it implements Machine learning to use the existing and the incoming data to train the algorithm for predicting the results and increasing cost efficiency.

Industrial Impact:

- Many roles for humans in industrial processes presently lie beyond the scope of automation.
- Human-level pattern recognition, language comprehension, and language production ability are well beyond the capabilities of modern mechanical and computer systems.
- Tasks requiring subjective assessment or synthesis of complex sensory data, such as scents and sounds, as well as high-level tasks such as strategic planning, currently require human expertise.
- In many cases, the use of humans is more cost-effective than mechanical approaches even where automation of industrial tasks is possible. Overcoming these obstacles is a theorized path to post-scarcity economics.

The Paradox:

- The paradox of automation says that the more efficient the automated system, the more crucial the human contribution of the operators. Humans are less involved, but their involvement becomes more critical.

- If an automated system has an error, it will multiply that error until it's fixed or shut down. This is where human operators come in.

Laboratory Impact

- The Labs in today's world do not utilise the data they have at hand and they dispose of the data after storing hence we provide an alternative.
- The Program which we are using gives a predictive analysis which reduces the economical cost of the Research and Development department which makes it better for the company

OBJECTIVE

Our objective in this product comes from the problem definition of automation and is aimed at solving it through usage of Internet of Things.

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, and connectivity which enables these objects to connect and exchange data and control. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet or network infrastructure.

Now, our projects nature is three-fold Industry, Laboratory and Automation. These two terms are the basis of our motivation and objective for the project.

Industry- Refers to any kind of Industry we have just made a miniature scale Industry with the help of available resources and want to show what basically can be done to automate our production industries, manufacturing industries, process industries.

Automation- Refers to the word in its most literal sense as it includes automation of everything in the Industry and still maintaining efficiency and enhancing productivity.

It is also our objective to improve on this design and design a software compliment of this mechanical and electrical automation. Which will automate the data collected at various test centres/stages is there in which will then be computed and can be used for analysis.

METHODOLOGY

Software Part and Integration with electronic component

This project is made with help of Raspberry Pi 3 and Relay driver circuit. The various appliances are connected to the relay circuit and the Raspberry Pi3 and a computer system. We set up a Server-Client system for this purpose and make one compute system as master of all other small computers (Raspberry Pi3's).

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Hardware Components

Grinder, Mixer, Binder feed, conveyer belt and a pelletizing machine is set up to show a miniature industry. These components are basically found in any power plant which is working on biofuel energy.

Integration of all three components

This is done through use of relay drivers, raspberry pi 3 and L293D and one L298N servo motor and 5V DC motors and the code on both the system as well as the raspberry pi. The raspberry pi code is listening to the client which is the system in this case through the network which when a message is sent accepts and executes the called function.

6.4 LAB Software Component

An R script has been written which is based on various datasets extracted from a larger dataset. First the Datasets are extracted on the basis of the location from where the Raw Material are then sorted on the base of the Raw Materials.

Then, once we have sorted Dataset, we sort it into a data frame called UseData this has the value of the Moisture, Ash, GCV(BD Basis),Potash, Chloride and silica.

Overall Software Component—For Company

We need to make it economically viable. For this first transportation needs to be economically viable.

We collect raw material from 11 regions in Punjab for eg. Manewal,Noorpur,Fatehgarh, Kurali, Mansaur, Mohali.

From these regions we collect the raw materials and we supply to 4 different locations for the processing part of the industry.

4 Places are

1. Pilot Plant
2. Research Development
3. Pre-Processing Facility
4. Dump Factory (for Non-Re usable Material

F/R	Region A	Region B	Region C	Region D	Supply
Farm 1					
Farm 2					
Farm 3					
Farm 4					
Farm 5					
Farm 6					
Farm 7					
Farm 8					
Farm 9					
Farm 10					
Farm 11					
Demand					

The constraints here are on supply's and Demand of each facility

Demand of each Facility in kgs is

A >=20000

B>=1000

C>=50000

D>=100000

We will find best of regions from which to get the raw material and eliminate the others

The Job Assignment Problem Solving Using Optimization Techniques

The job Hours of the labor needs to be reduced at the pilot plant and hence forth we need to solve it we have 6 machines and 20 laborers' so in the cost matrix we have number of hours and the constraint is on the amount of hours a machine needs to be operated to yield an output

M1>=12

M2>13

M3>=10

M4>11

M5>21

M6>=23

Now the Cost of each laborer working also is distinguished hence we will have to find a way to minimize it hence we will solve the minimizing Hungarian Problem Method to solve

RESULT

The model is automated with use of various components as mentioned above and everything is in working condition there are a few precautions which are to be noted though as of now the port number through which the Raspberry Pi is connected is always changing and is not static it needs to be checked through your system (look for SSH port).

FUTURE SCOPE

We plan to carry forward this project and make it better by actually using the machines built after improving the design and including more hardware components to actually create Rice Straw pellets and to be able to show case Testing of pellets (like calorific value, density etc.)

Also, we aim to make a better interlocking system for the industry using various sensors so that in case of breakdown we can make sure to cut our losses at minimal damage.

Example: For a process running during night when there is no one to monitor, if there is breakdown at the conveyer belt, the dumping through the initial feed will go on and hence it will create big losses in large scale Industries where there is metric tonnes of load to be moved so to cut our losses there we want to develop an interlocking system.

CODE

SERVER CODE

```
import socket
import sys
import os
import RPi.GPIO as GPIO
import time
import subprocess
import threading



GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)
GPIO.setup(19,  GPIO.OUT)      #EXAMPLE:  GPIO.setup(4, GPIO.OUT)
GPIO.output(19, True)  #EXAMPLE: GPIO.output(4, True)
m11=16
m12=12
m21=21
m22=20
GPIO.setup(m11, True)
GPIO.setup(m12, True)
GPIO.setup(m13, True)
GPIO.setup (m14, True)
```

```
def servoOn():

        while True:

            if data == ('servoOn'):
                GPIO.output(19, True)
                p=GPIO.PWM(19,50)
                p.start(7.5)
                while True:
                    p.ChangeDutyCycle(2.5)
                    time.sleep(6)
                    p.ChangeDutyCycle(9.5)
                    time.sleep(6)
                    print("working")
            GPIO.output(19, False)
            time.sleep(2)
def MotorOn():
        while True:

            if data == ('MotorOn'):
                    GPIO.output(m11, 1)
                    GPIO.output(m12, 1)
```

```
                GPIO.output(m13, 1)
                GPIO.output(m14, 1)
                c = time.strftime('|%I:%M:%S| ', time.localtime())

HOST = 'raspberrypi'
PORT = 5901
print(HOST)

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
print(c + 'TCP Local Socket Created')

while True:
    try:
        s.bind((HOST, PORT))
    except socket.error as msg:
        print('ERROR: Socket bind has failed.')
        sys.exit()

print(c + 'Socket Bind Complete, Port: ' + str(PORT))
```

```
while True:


        s.listen(1000)
        print(c + 'Socket(pi) now listening for connections')
        conn, addr = s.accept()
        if addr[0] == ('169.254.0.155'):    #EXAMPLE: if addr[0] ==
(192.168.1.___):
            print(c + 'Connected with ' + addr[0] + ':' + str(addr[1])
+ (' ("NAME OF WINDOWS PC")'))
        elif addr[0] == ('1'):
            print(c + 'UNIDENTIFIED CONNECTION')
            break
        data = conn.recv(1024).decode('ascii')
        print(c + 'Client says: ' + data)


        reply = ('Reply from Server(pi)
received.'.encode('ascii'))
        conn.sendall(reply)



        if data == ('motorOn'):
            motorOn()
        elif data == ('servoOn'):
            servoOn()
```

Client code for one of the devices example servo

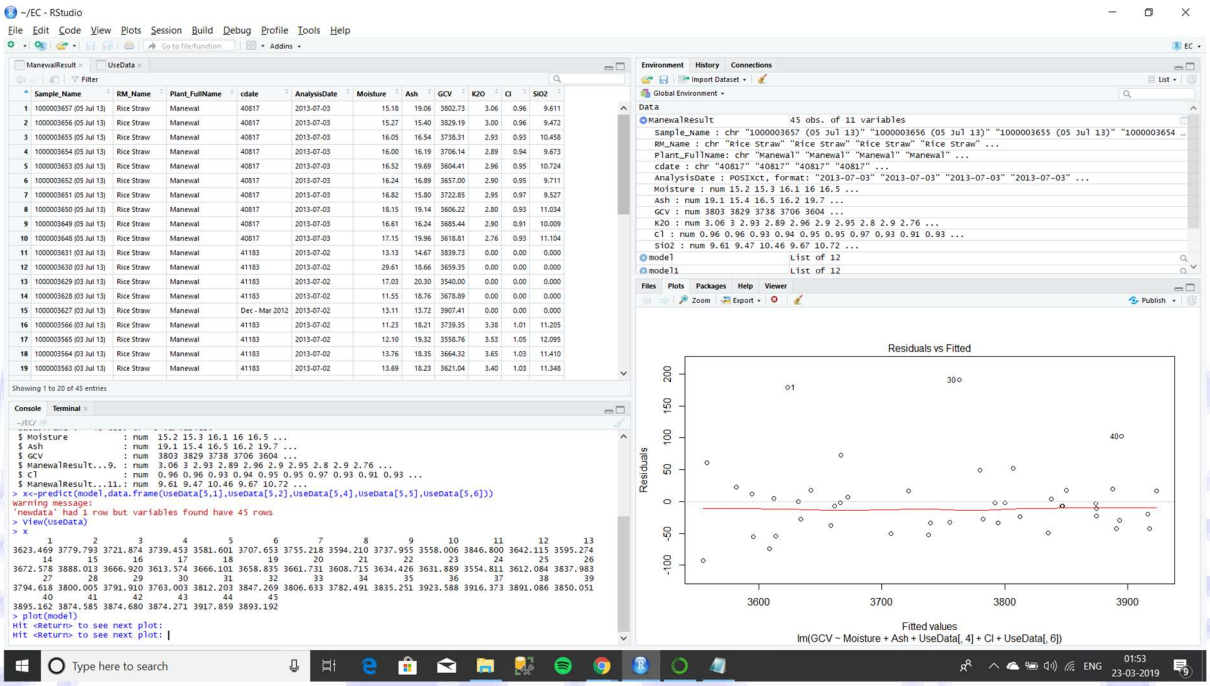
```
import time
import socket
import sys
a=1
while a==1 :
    try:

        s=socket.socket(socket.AF_INET,
socket.SOCK_STREAM)
    except socket.error as msg:

        print('Failed to create socket. Error code:' +
str(msg[0]) + ' Error Message: ' + msg[1])
        sys.exit();

    print('Socket Created')
    a=a+1

    host = '169.254.0.155'
    port = 5901
    print(host)

    try:
```

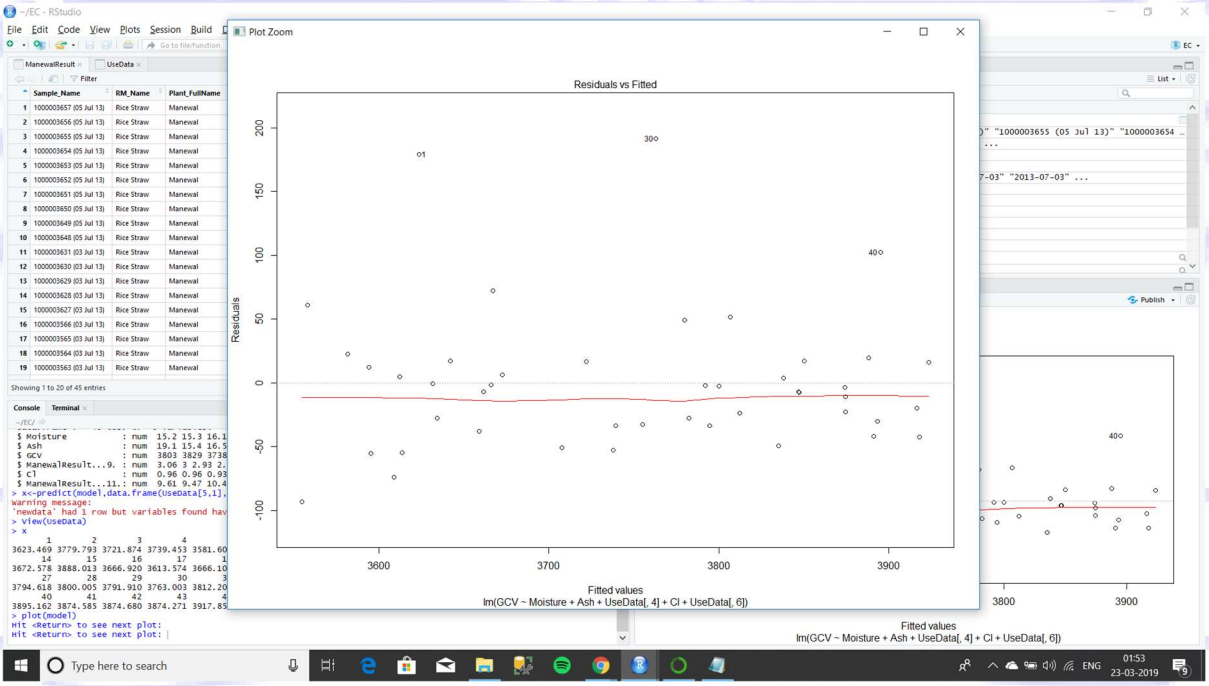
```
        remote_ip =(host)

    except socket.gaierror:
        print('Hostname could not be resolved. Exiting')
        sys.exit
    print('IP adress of PiServer is ' + remote_ip)

    s.connect((remote_ip, port))

    print('Socket Connected to ' + host + ' on ip ' + remote_ip)

    message = ('servoOn'.encode('ascii'))

    try:
        s.sendall (message)
    except socket.error:
        print('Send failed')
        sys.exit()
    print('Message was sent successfully')
    reply = s.recv(4096).decode('ascii')
    print(reply)
    s.close()
    time.sleep(500)
```

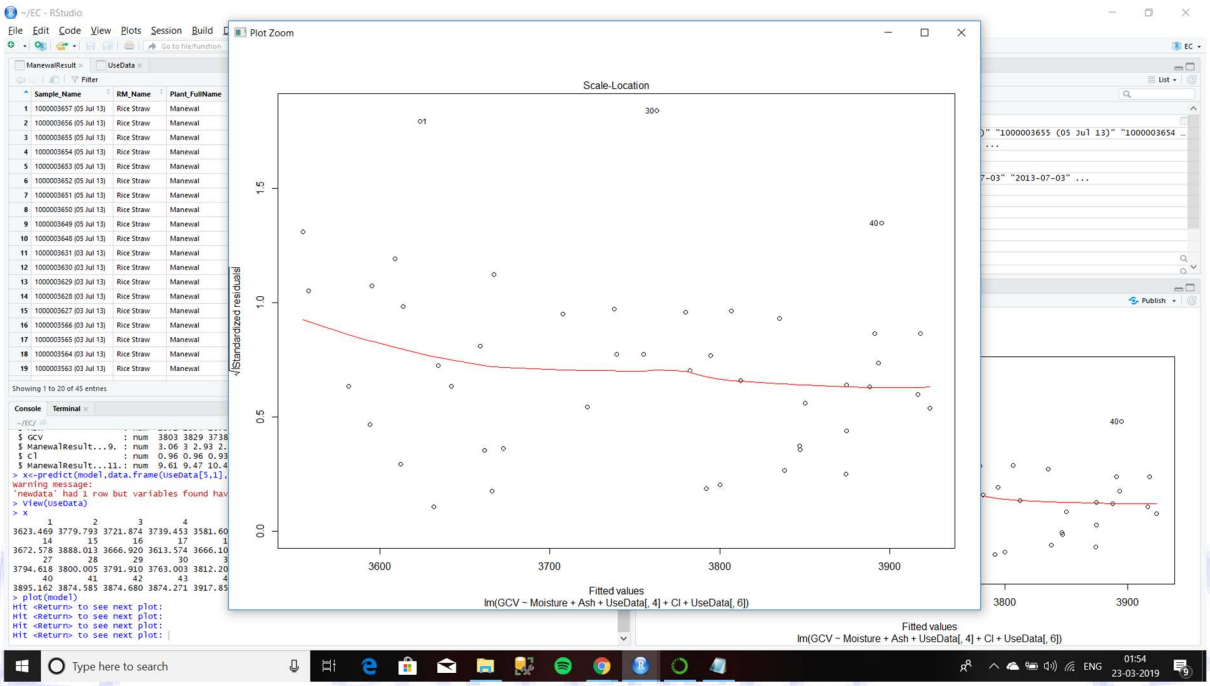
Servo Code Separately

```
import RPi.GPIO as IO
import time
IO.setwarnings(False)
IO.setmode (IO.BCM)
pin numbers. (like PIN29 as‘GPIO5’)
IO.setup(19,IO.OUT)
p = IO.PWM(19,50)
p.start(7.5)
while 1:
        p.ChangeDutyCycle(2.5)
        time.sleep(6)
        p.ChangeDutyCycle(9.5)
        time.sleep(6)
        print("working")
        break
```

R – Program Analysis Results







The analysis of Noorpur Data