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CONTROL OF DIFFERENT INDUSTRIAL LOADS THROUGH THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Bhagirathi Bai V[1], Dr. H G Chandrakanth[2] , Adithya R[3]

[1] *Department of Mechatronics Engineering, Acharya Institute of Technology, Bengaluru, India,*

[2] *Principal and Professor, Sambhram Institute of Technology, Bengaluru, India,*

[3] *Department of Mechatronics Engineering , Acharya Institute of Technology, Bengaluru, India,*

ABSTRACT

The main aim of the project is to automate the different operations used in an industry through the implementation of the different concepts of artificial intelligence, algorithms of machine learning, robotics , machine vision, Speech Analysis and Convolution Neural Networks by providing a unified controlling interference for all the operations and hence to achieve maximum efficiency by reducing human effort, introduction of parallel processing helps to reduce the time required to manufacture/produce/work on a specific product and also minimizing product damage and product rejection as the machine is trained to perform the operations on a particular material only based on its specific parameters which are per-programmed in the machine.

In addition to this the concept of prediction and error-detection using machine learning further helps to provide continuous improvement as machine learning algorithms gain experience, they keep increasing the percentage and accuracy which in turn helps them in making better decisions. As the amount of data generated keeps increasing, the algorithm learns to make more predictions faster. Since the machines are provided with the ability to learn, it not only helps them to make predictions, but also to improve the algorithms on their own This also helps to deliver a much customer-specific application. Further, machine learning algorithms are good at handling data that are multidimensional and multi-variety and have the perform these operations in dynamic environments.

Keywords: *Machine learning, Artificial Intelligence, control of loads, Chabot, Dialog flow.*

I. INTRODUCTION

Our project is mainly based on the use of technologies such as Artificial Intelligence, Machine Learning, Convolution Networks, Robotics and their respective algorithms for the overall control and processing of the diverse operations involved in an industry such as the continuous temperature monitoring of the furnace, control of the hydraulic and electric drives, speed control of AC/DC, stepper motors used in robots along with the monitoring of the current and voltage values and hence predicting the output of the operations well in advance

and thereby providing a means of efficient as well as cost effective industrial process which would prove to be beneficial in both technical and business aspects for an organization.

The importance of this project can be related with the need for automation in industries that has exponentially increased in the last few years. The prime cause for this is due to need for a cost-efficient method for control of operations which is both automated and would be able to provide close to ideal results with comparatively reduced number of errors when compared to manual operations.

This has led to steady increase in the number of industries that have adopted these technologies. The importance given to data that is both user-feed and those received from the machines is one of the key factors in the use of Artificial Intelligence and Machine Learning algorithms which help to solve the complexities related to the project structure and also provides an efficient method to identify patterns in the data which are important parameters in the application of Convolution and Deep Neural Networks [8].

Sector-by-sector adoption of AI is highly uneven currently, reflecting many characteristics of digital adoption on a broader scale. According to the McKinsey Global Index survey, released in June, larger companies and industries that adopted digital technologies in the past are more likely to adopt AI [9]. For them, AI is the next wave. Other than online and IT companies, which are early adopters and proponents of various AI technologies, banks, financial services and healthcare are the leading non-core technology verticals that are adopting AI. According to the McKinsey survey, there is also clear evidence that early AI adopters are driven to employ AI solutions in order to grow revenue and market share, and the potential for cost reduction is a secondary idea [5].

Further, the use of UI and UX with the help of Chat bot provide a well-defined approach while dealing with the algorithms of Artificial Intelligence which undergo continuous training and will be able to predict the need of the user.

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The primary aim of using machine learning is to allow the computers to learn automatically without human intervention or assistance and adjust actions accordingly.

Traditionally machine learning has been prioritized, even monopolized, by companies which drive the technology sector. Companies like Google, Microsoft, Amazon, Apple, Facebook, Tesla, among others. Businesses with rich sources of data can use machine learning to solve complex problems, recognize patterns, discover new information and even make intelligent decisions based on that data.

Because of new computing technologies, machine learning today is not like machine learning of the past [5]. It was born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in artificial intelligence wanted to see if computers could learn from data [6]. The iterative aspect of machine learning is important because as models are exposed

to new data, they are able to independently adapt. They learn from previous computations to produce reliable, repeatable decisions and results. It's a science that's not new – but one that has gained fresh momentum.

II. Objective And Methodology

2.1 Objective:

The operations that are currently being performed in the industry, if not entirely, but to a certain extent are dependent on human calculations and classifications which sometimes leads to the operations not completely being performed by taking into account, all the necessary parameters.

With the implementation of Artificial Intelligence and Machine Learning and Machine Vision, the above problem can be solved. The proposed method is to make a machine or a system performing these operations intelligent by training these machines/systems by providing them the parameters, data, threshold values for a specific operation and for a object such as the Maximum Bending Moment of a Bar of Iron, its maximum shear stress, the speed at which the motor should be run. The values measured by the PLCs would be continuously made available to the Machine to train the machine for further operations. Speech analysis and Natural Language Processing are performed to ease the controlling of these operations.

2.2 Methodolgy:

- The Chabot used as a UI/UX is implemented using Google's Dialog flow which implements NLP to determine and process the requests, control signals from the user.
- The Machine Learning part of the project will be implemented through the K-means or Random forest algorithm for detecting patterns in the data.
- The machine/objects responsible for the generation of random variables consist of Robots, Motors, Sensors, Transducers, Machine data and various other parameters.
- A H-Base database is used for the purpose of storage of both user data as well as the machine data along with the different commands used for the control of Robots, Motors, Sensors, Supply Chain and for the monitoring of automated operations. This database is virtually placed over a Hadoop Distributed File System(HDFS).
- The use of HMI (Human Machine Interference) provides a better monitoring and controlling features of the different operations. Though the entire the process would be operated, the control capabilities to intervene any specific operation at any point of time during the process is provided to the user through the HMI.
- A MCU (Master Control Unit) is used to ensure the operations are independent of each other and also at the same, provide the status of completion of the various operations at point of time, hence providing a better approach towards providing solutions in case such as the failure of one or more components at the same time or the occurrence of numerous errors resulting in the disruption of work.
- The final application of the different algorithms would be the continuous control of motors, sensors, robots and supply chain management.

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III. FLOW CHART AND CONTROL FLOW

3.1 Flowchart:

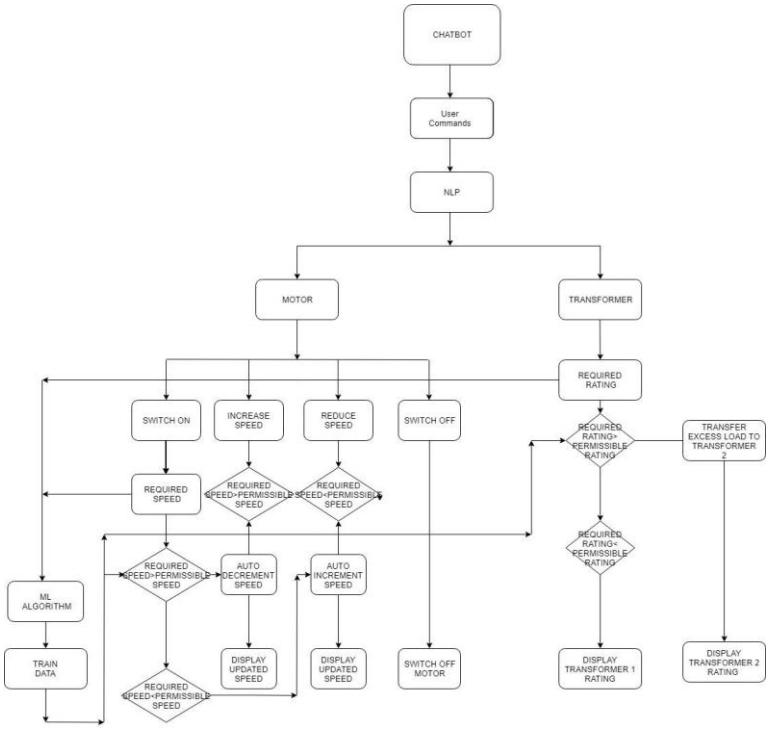

Fig 1: Flowchart of Motor and Transformer Control

- Initial step - Receive commands from user through Chabot.
- Commands are in the form of speech input.
- Use of NLP to perform speech to text conversion.
- Classification of type of operation based on the command received.
- Simultaneous training of ML algorithm for further processing.
- Test the input values with the threshold values.
- Perform operations - auto-correction of input values to match the threshold values.

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3.2 Controlflow:

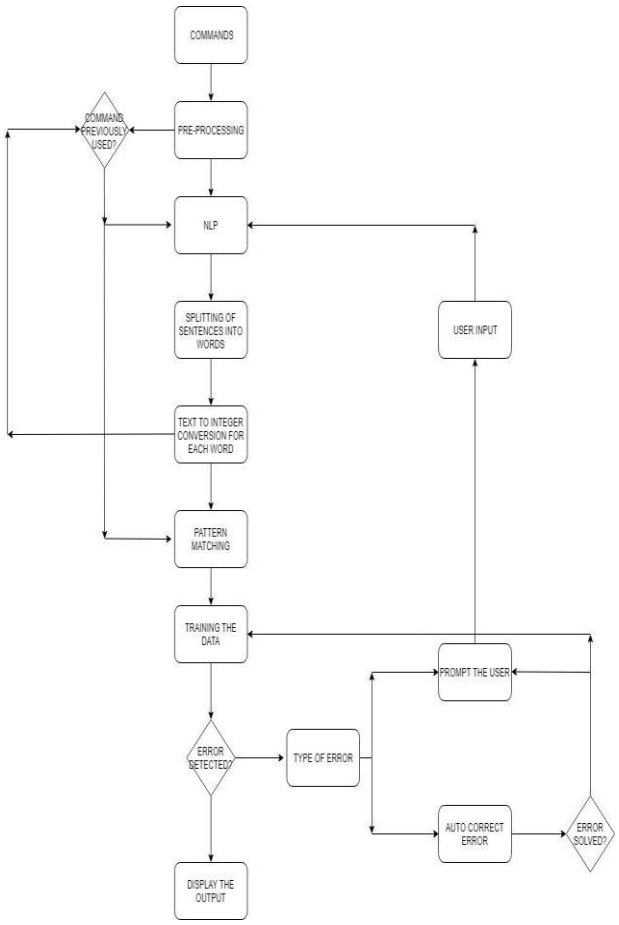

Fig 2: Control Flow for Motor and Transformer Control

IV. WORKING:

4.1 Dialog Flow:

- It is the platform used for the development of Chat bot.
- Agents: These are the Natural Language Understanding modules.
- Intents: When user provides a command to the Dialog flow, the agent matches the command to a particular intent.

4.2 Json Object:

- It is an Open - standard file format that uses human - readable text to transmit data objects consisting of attribute value - pairs and array data types.

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- The importance of JSON object is that it exists as a string which is useful since it is possible to include the same basic data types inside JSON similar to that in a standard JavaScript object — strings, numbers, arrays, booleans and other object literals.
- This allows the programmer to construct a data hierarchy.
- It is portable and can also be used in other languages also.

4.3 .Entities:

- These are the properties that allow agents to extract information about a wide range of concepts without any additional configuration.

4.4. Chat Bot

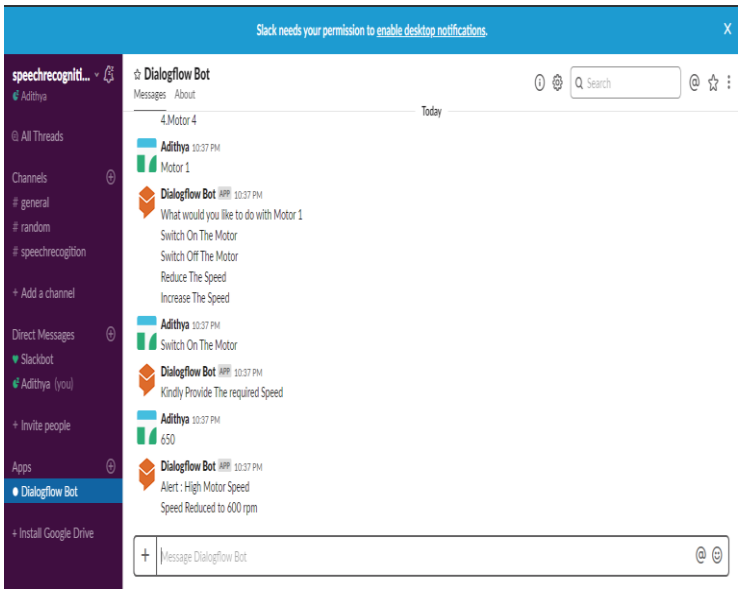

Fig 3: Chat bot Integration in Slack

- The most intuitive definition of a Chat bot is that it is basically a software that can have a conversation with a human. For example, a user could ask the bot a question or give it an instruction and the bot could respond or perform an action as appropriate.
- The intelligence of the Chat bot depends upon how precise is the response of the Chat bot towards a range of questions that are asked by the user.
- This can be achieved by training the Chat bot continuously for various commands and making it to understand the context of the conversation.
- Chat bots have started to take on real human support agents.
- It is more convenient and also less time consuming especially when the Chat bot is trained well.
- One of the advantages of using a Chat bot is that it is possible to have a smooth conversation, without any interruptions.
- This is mainly because it uses A.I to find the appropriate response for the user's queries.

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4.5 Text To Binary Value Conversion:

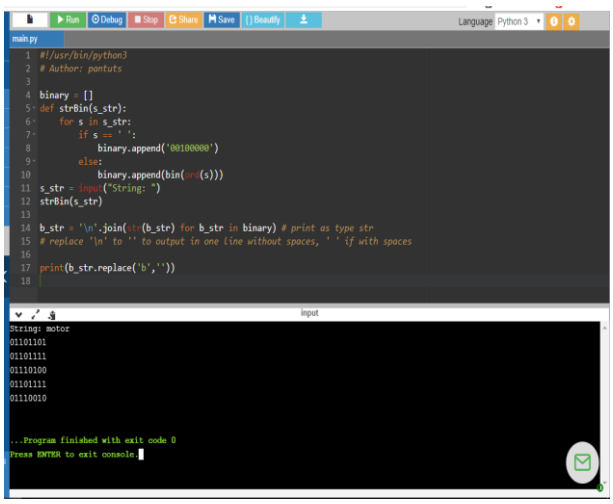

Fig 4: Text to Binary Conversion of User Input

- Computer stores all characters as numbers stored in binary data.
- Binary code uses digits of 0 and 1 to represent computer instructions or text. Each instruction or symbol gets a bit string assignment.
- The strings can be instruction, letters or symbols.
- Conventional method which was used earlier helped in conversion of a text to a binary value.
- Binary values are difficult to understand and takes more execution time for lengthy text.

4.6 Text To Integer Conversion

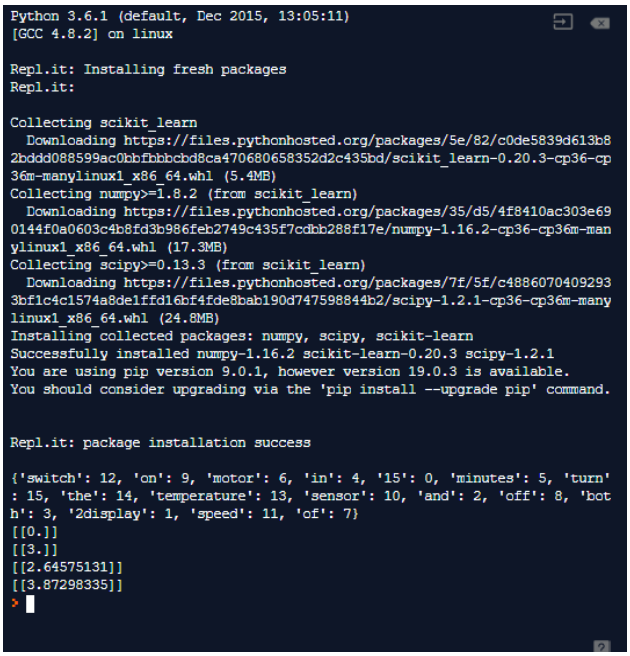

Fig 5: Text to Integer Conversion of User Input

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- Sicker library is imported which helps in assigning integer values to text.
- Each word in a sentence is assigned with unique integer value.
- Most repeated integer is sent to an array.
- Array is used for pattern recognition.
- Reduces execution time.

V. RESULTS:

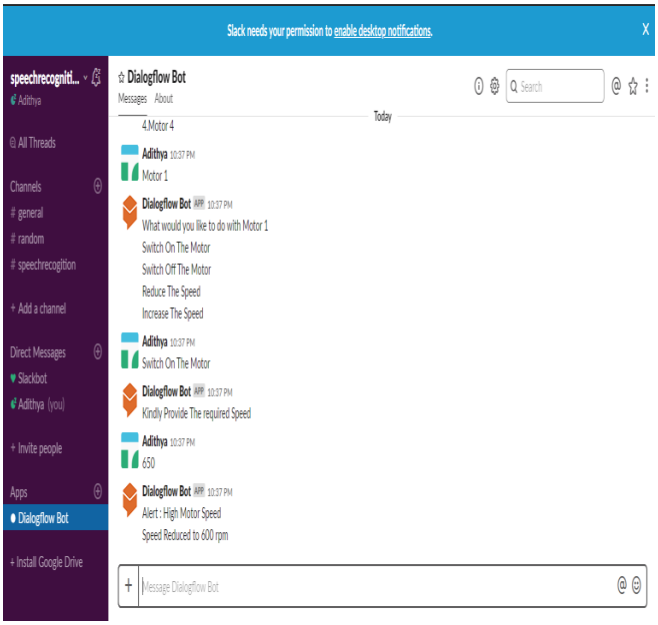

Fig 6: Scenario of High Input Speed

In the above figure 6, we observe that when the user provides a speed input to the chat bot, which is above a permissible limit, the chat bot prompts a high motor speed alert message to the user. This is done by programming the chat bot to continuously monitor the input from the user and train itself to alert the user of the high speed, whenever the input speed increases above a pre-defined threshold speed.

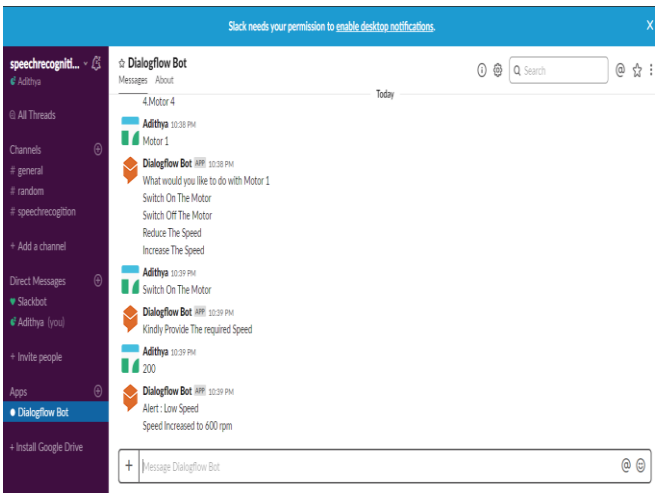

Fig 8: Scenario of Low Input Speed

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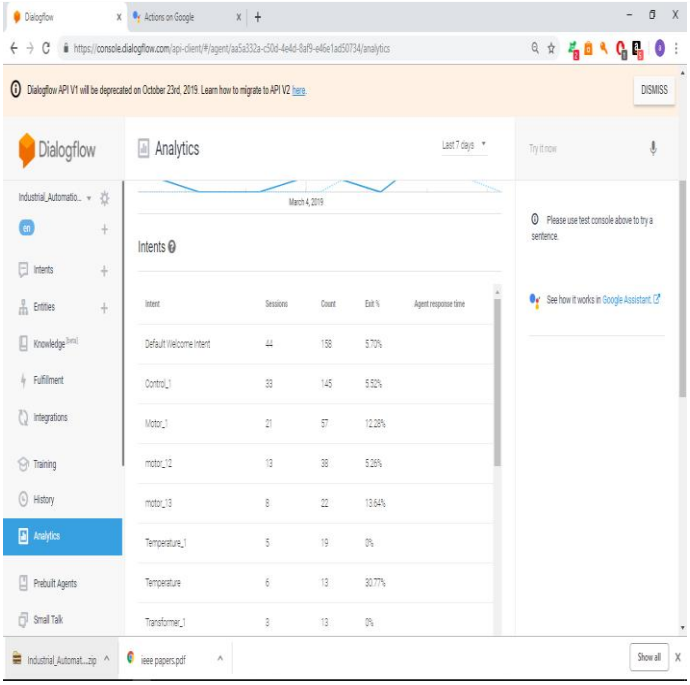

Fig 7: Total Count of Training Sessions

In the above figure 7, we observe that when the user provides a speed input to the chat bot, which is below a permissible limit, the chat bot prompts a low motor speed alert message to the user. This is done by programming the chat bot to continuously monitor the input from the user and train itself to alert the user of the low speed, whenever the input speed decreases below a pre-defined threshold speed

VI. ADVANTAGES:

- Reduced Human effort and human error.
- Increased quality of the manufactured products due to improved error detection methods.
- Reduce in the percentage of product fatigue and failures.
- Increase in the number of products produced in a given time due to the implementation of parallel processing.
- Better classification of the materials due to the use of image processing algorithms.
- Faster response time.
- Use of pattern detection through NLP results in high efficiency
- Various classes of elements help us to simply the control flow.
- Well defined error detection and correction mechanisms.
- Auto - correction of commands upon error detection.
- Periodic information provided to the user on the status of the system.
- Ease of control by providing a voice-controlled User Interface.

VII CONCLUSION

With the increase in the level of automation and with the industries moving towards the Industry 5.0 which aims as at reducing the human intervention, this speech controlled automation system is a perfect example for the same. It is need for monitoring the large amount of data being generated for every process in an industry that provides the need for the using Machine Learning at a large scale. In addition to this, the use of a chat bot provides a user-friendly environment for controlling the critical process in the industry.

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