Research Article

Literati Journals
Empowering Researchers

Survey on the Downtime of the CNC Machines and Usage of Raspberry Pi

Anil C N,[1]* Lalitha L.A,[1] Shekar K V[1]

Abstract: CNC machines are usually controlled by the computer instructions. These machines are usually used manufacturing sectors. Downtime means the total time of calculating how long the CNC machine is in idle condition. If the downtime of the CNC machine is less, then the machine can be able to produce more components. So the downtime plays an important role in the productions of components. Raspberry pi is a single board computer, which was developed mainly for the educational purposes. This device is usually used as processing unit. The main reason behind the usage of raspberry pi is it is very user friendly and it is available at low cost.

Asian Journal of Engineering and Technology Innovation
Volume 4, Issue 7
Published on: 7/05/2016

Cite this article as: Anil C N *et al.* Survey on the downtime of the CNC machines and usage of Raspberry Pi. Asian Journal of Enginnering Technology and Innovation, Vol 4(7): 159-161, 2016.

I. INTRODUCTION

CNC Machine

Now a days every one thinking and talking about the digitalization. By using digital technology we can perform more task in limited period of time. CNC stands for Computerized Numerical Control, CNC machines are first introduced in 1950's by the American people. Usually used in manufacturing sectors to produce the components based on the predefined instructions fed into the machine. These machines are controlled by the motors by using the normal computers.

Figure 1: CNC machine.

Downtime plays an important role in finding the effectiveness and productivity of the CNC machines. Downtime means how long the machine was in idle state.

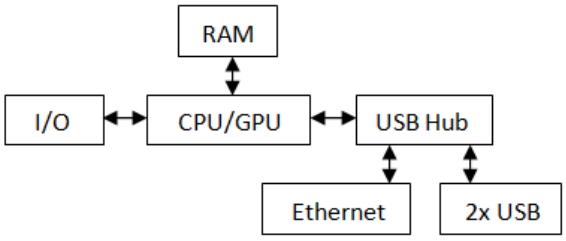
[1]Reva Institute of Technology and Management, Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Near Border Security Bustop, Bengaluru, Karnataka-560064, India.
E-mail: ashwin@revainstitution.org
*Corresponding author

Raspberry Pi

Raspberry pi is a single board computer. The size of this device is very small and looks like the ATM card. This device can be plugged into the normal monitors and we can connect standard keyboards and mouse through the USB cable and we can operate.

Figure 2: Raspberry pi device

Hardware configuration of this device



RELATED WORK

Now we will look into the related works carried out by using the CNC machine and the Raspberry Pi.

Working of CNC Machines

CNC machines usually acts as a controller unit of machine which comprises the both mini and microcomputers. The set

of instructions in the form of programs are fed into the computer. Programmers have the flexibility to edit the old program or can write the new program as per their requirements.

These machines works like the robots and it fallowall the instructions which are fed into it through the programmer. Based on the programmer's instructions, CNC machines produces the components and cutting process will carry out as per the requirements. Metal parts and plastic parts are best examples for the output of the CNC machines

Through the computer programming we can control the lathes, routers, grinders and mills.

With the usage of the CNC machines, the work of the operators are minimized. Operator just need to concentrate on the feeding of proper instructions on to the machine.

Patel Chintan Kumar et al [1] focused on the analysis of the of the standard procedures that can be implemented in the parallel way so that the downtime of machine is reduced. They concentrate on 'doing the right thing at the right time' concept. They suggested that by using the SMED (Single Minute Exchange of Dies), productivity of CNC machine can be improved.

Author also explained about why we need to have short set up time, he explained that now a day's technology improved a lot and machines are become faster and larger and one machine is capable of producing more than one component based on the changeovers from product one two another product.

Apart from SMED, author suggested few more alternative approaches for reducing the set up time reduction.

1. Planning on the production.
2. Grouping the related technologies.
3. Fix the standards for the designs.
4. Fallow the standard procedure.
5. Simplify the work.

In this paper author focused mainly on reducing the downtime of the machine so that the productivity of the machine will increase. For that author collected and calculated the downtime of the machine after implementing the SMED technique. As a result, in the period of one year, machine got extra 585h to produce the parts which means that 585h of downtime is converted as a machine working time. Because of decrease in the downtime, overall machine productivity is increased more than twice.

Janez Kušar - Tomaž Berlec - Ferdinand Žefran - Marko Starbek University of Ljubljana, Faculty of Mechanical Engineering, Slovenia et al [2] focused on reducing the set up time of the CNC machine so that machine can produce more parts. In this paper, author focused on the teamwork concept and the use of SMED method. SMED stands as Single Minute Exchange of Dies. SMED is one of the method used in manufacturing.

According to the Van Goubergen [3], Time place a important role in the field of manufacturing, because of the cost and the effort so it's important to reduce the overall machine setup time which results in producing more parts.

There are three parameters which need to consider for defining the quality of the machine setup.

1. How you setting up the machine.
2. Who is handling the machine and at what time
3. Other aspects like technical.

According to the author, the organization need to select the group of people as a team will participate in the SMED's execution. The team contains the Team Leader and the Team Moderator and other members. These team will carry out all works which are assigned to them by the organization.

As a result of the SMED technique and the use of dedicated people as team work to work with the machine, the setup time of the CNC machine is reduced so that the productivity of the machine increased.

Jie Gu, John S. Agapiou and Sheri Kurgin et al [4] gave importance to the tool accuracy and the repeatability. The most challenging aspect is the ability to identify the errors and apply the corrective measures to clear the error. There may occur errors in two ways

1. Static machine error
2. Dynamitic machine error.

Along with this, there are some other challenges associated with the above errors. It may be related to the cost in redesigning, maintaining the tools. By considering all the aspects, the author suggested that the global aspect for a machine is estimated by using a model and need to analyze the difference between the measured dimension and the nominal dimension.

Author tried to explain or summarize the regular types of work offset and propose a new method as a global method. By using this method, author tried to overcome the drawbacks of the inductive and deductive methods and explained the method to overcome all the draw backs by using a framework having potential to deal with nonlinear architectures.

The various methods used to reduce the errors in machine tools are:

1. Building a machine which is more accurate.
2. Find the error root cause and fix it.
3. Compensate the errors.

Finally author concluded that the use of the global offset, we can achieve more quality over the normal offsets and it has flexibility to adopt the local offsets also. Local offsetshelps in reduction of non – linearity problems which are caused by axes of the machine.

Er. Manpreet Singh, Er. SanjeevVerma, Dr. Sanjiv Kumar Jain et al [5] made a review on the different materials machining with the CNC machines. Finally author concluded that the

nose radius, feed and speed are the important parameters for the roughness of the surface.

Working of Raspberry Pi

Raspberry Pi is developed by Raspberry Pi foundation in UK. It is developed for the purpose of the stimulation. It can be used in teaching field or it may be experimental purpose. The main supporting programming languages is python. Raspberry pi usually operates on the LINUX platform. The OS Rasbian is used in this device which enables more flexibility in the software so it's easy to use the raspberry pi for the programming. The pi interacts with the devices and the sensors through the codes which are written in python.

Davinder Pal Sharma et al [6] explained the use of raspberry pi device for the home automation using the smart grid technology. Home automation can be done by using the web enabled automatic lighting system and the temperature controller that switches off or on automatically.By conducting the experiment, the author concluded that we can use raspberry pi, we can design the smart homes. It will convert the normal home into the smart home and also for the home security we can use the technology.

K Saravana Kumar,Jestin Thomas,Jose Alex,Raag Malhotra et al [7], explained about the usage of the raspberry pi device for monitoring the location of the mobile.Author implemented his own flowchart for the detecting the mobile location and send the location address as a text message to the pre-defined phone number. Finally author concluded that the use of raspberry pi is best example for the Do It Yourself (DIY), many applications can be implemented by using this device. The use raspberry pi device reduces the cost when compared to the other implementations.

Harshada Chaudhari et al [8] made a review on the raspberry pi and explained the importance of this device in the modern day of life. He explained about the history and the hardware configurations of the raspberry pi.Along with that, he explained the advantages and drawbacks of the device and the process of interfacing the raspberry with the different components.Finally he concluded that, this device is an innovative trend in the latest technology and the number of users using this device is increasing as the number of days proceeds.

Sejal V. Gawande, Prashant R. Deshmukh et al [9] a student made a research on the usage of the raspberry pi devices and explained about the connection between the two devices through this device.The author implemented a algorithm called RC4 to establish a connection between the two computers using the UART communication boards which are present in the raspberry pi device, one computer will send the encrypted message and one more computer will be used as a receiver. Receiver need to decrypt the message. Key scheduling algorithm is implemented to generate the keys for the encryption and the decryption. Finally author concluded that the raspberry pi is an innovative device which is very easy to handle and its very helpful for the people who wants to learn the computers and the electronics.

CONCLUSION

From the above survey on the CNC machines, we found that every manufacturing company is mainly focusing on producing the more parts within a less time and also make sure that the quality of the product is good. To achieve that, they mainly focus on reducing the downtime of the machine which occurs due to many internal problems.

Now a days, as the technology grows, many people are looking to use the innovative technologies, for that this raspberry pi is the nest example for the innovative technology. Few people are using it for the purpose of educational purpose and few for the experimental purpose.

The prosed system is to reduce the downtime of the machine by using the latest technology raspberry pi.

Acknowledgement

Authors would like to thank Mr Shekar, CTO, Tarka infotech private limited for providing the valuable inputs in preparing this survey.

REFERENCES

1. Patel Chintan Kumar (2012) - Set up Reduction – APerfect way for productivity improvement of computer numerical control (CNC) set up in manufacturing company.
2. Janez Kušar - Tomaž Berlec - Ferdinand Žefran - Marko Starbek University of Ljubljana, Faculty of Mechanical Engineering, Slovenia (2010) -Reduction of Machine Setup Time.
3. Van Goubergen, D., Van Landeghem, H.(2002).Rules for integrating fast changeover capabilities into New equipment design. Robotics and Computer Integrated Manufacturing, vol. 18, p. 205-214.
4. Jie Gu, John S. Agapiou and Sheri Kurgin (2015) - CNC Machine Tool Work Offset Error Compensation Method.
5. Er. Manpreet Singh, Er. SanjeevVerma, Dr. Sanjiv Kumar Jain (2014) - A literature review on machining of different materials with CNC.
6. Davinder Pal Sharma, Avatar Baldeo, Cassiel Phillip (2015) - Raspberry Pi based Smart Home for Deploymentin the Smart Grid.
7. K Saravana Kumar, Jestin Thomas, Jose Alex, Raag Malhotra - Surveillance System Based On Raspberry Pi for Monitoring a Location Through A Mobile Device
8. Harshada Chaudhari –(2015), Raspberry Pi Technology:A Review.
9. Ms. Sejal V. Gawande*, Dr. Prashant R. Deshmukh (2015)- Raspberry Pi Technology.