AUTOMACY BOYLE'S MACHINE CONTROL USING MY OPEN LAB AND PYTHON

A PROJECT REPORT

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

BIOMEDICAL ENGINEERING

Department of Biomedical Engineering

MAHENDRA INSTITUTE OF TECHNOLOGY

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JUNE 2022

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

To Start with, let we thank and praise our god almighty, who showered the blessings and grace upon us to accomplish the project work successfully. We render special thanks to Shri.M.G.BHARATH KUMAR, M.A., B.Ed., Chairman, Mahendra Educational Institution for the kind and great patronage.

We render special thanks to **Shri.Er.Ba.MAHENDRAN & Er.Ba.MAHA AJAY PRASAD**, Managing Director, Mahendra Educational Institution for the kind and great patronage.

We render special thanks to **Dr. R. SAMSON RAVINDRAN**, Executive Director, Mahendra Educational Institution for the kind and great patronage.

We wish to express my sincere thanks to our respected principal **Dr. T .ELANGO, M.E.,(Ph.D).,** who has been my constant source of inspiration.

We wish to express my sincere thanks to **Dr. M. PRABHU, M.Tech., Ph.D.,** Head of the Department Biomedical Engineering for this concept help and creative ideas over the period of project work.

We sincerely thank our Project Coordinator **Mr. M. HEMA KUMAR, M.E.,MBA.., (Ph.D),** Assistant Professor for coordinating our project work throughout the course. Our sincere and hearty thanks to our guide **MR. M. HEMA KUMAR, M.E.,MBA..,(Ph.D)** for giving his valuable suggestions, encouragement and enlightening thoughts and remarkable guidance that helped us in the successful completion of our project work.

We also like to thanks and express our deep regards to all other teaching and non-teaching staffs member of our department who cooperated with us in every deed of the project. Our sincere thanks to our friends and parents for their continuous encouragement and the untiring support rendered to us in all deeds and walk of this project.

ABSTRACT

Imparting pain-free surgery is possible only because of anesthesia. Delivering an precise amount of anesthesia to the patient plays a pivotal role in each and every major surgeries. Failing in providing an exact level of dosage to the patient may leads to negative impact and postoperative complications. Probably of major surgeries which could take prolonged period .The full dosage of anesthesia could not be administered in only one dose to the patient, for the reason it may show lethal complication. Administering less dose of the anesthesia to the patient it leads to consciousness and pain sensation during the operation, high dosage of anesthesia leads to the patient become coma, stupor, paralysis, paresthesia ,Migraine .It is very complicated to the anesthetist to providing the accurate quantity of anesthesia to the patient at regular interval of time. The patient monitoring system is connected with this device to identify the patient whether they are in hypo-tension /hypertension to rescue the patient from cardiac hypertrophy during surgery. To resolve this kind of problems during surgeries a computer -controlled jet injector is designed to deliver an accurate dose of anesthesia at regular intervals of time with constant speed. The proposed design aims to introduce an ”AUTOMACY BOYLE’S MACHINE CONTROL”. The embedded system make use of jet injector to deliver the precise amount of anesthesia to the patient with the help of switch control panel. once the patient weight and age is implied in the device it receive the signals and it activates the jet injector via motor drive, after administration of anesthesia the vital parameters are monitor by the help of patient monitoring system ,by the help of patient monitoring system the blood pressure is take it as input and finding the patient blood pressure whether they are in hypo-tension/hypertension and immediately alerts the condition by using python .This device will prevent the patient before they get seizure and fits, finally the vitals signs and history of anesthesia are saved using cloud computing technology for future reference. This device make the patient safer and helpful for anesthesiologist Keywords- Anesthesia, Jet-injector, Blood pressure, patient monitoring system

TABLE OF CONTENTS

CHAPTER NO	CHAPTER NAME	PAGE NO
	LIST OF TABLES	**IX**
	LIST OF FIGURES	**X**
	LIST OF ABBREVIATIONS	**XI**
1	**INTRODUCTION**	**1**
	1.1 ANESTHESIA	1
	1.2 ANESTHESIA MACHINE TYPE	1
	1.3 COMPONENTS	1
	1.4 ANESTHETIC GASES	3
	1.4.1 OXYGEN	3
	1.4.2 NITROUS OXIDE	3
	1.4.3 ENTRONOX	4
	1.4.4 MEDICAL AIR	4
	1.4.5 HELIOX	4
	1.4.6 CARBON DIOXIDE	5
	1.4.7 MEDICAL VACUUM	5
	1.5 BATTERY OF ANESTHESIA MACHINE	6
	1.6 FLOW METER	6
	1.7 VAPORIZER	6
	1.8 SPO2 MODULE	6
	1.9 CONTROL OF ANESTHESIA MACHINE	7
2	**LITERATURE REVIEW**	**8**
3	**PROPOSED METHODOLOGY**	**10**
	3.1 OVERVIEW	10
	3.2 TYPES OF PANEL	10
	3.2.1 FRONT PANEL	11
	3.2.2 BLOCK DIAGRAM	11
	3.3 CONTROLS AND INDICATORS	11
	3.4 HARDWARE AND SOFTWARE	11
	3.4.1 DAQ ASSISTANT EXPRESS VI	11
	3.4.2 NI- DAQMX	12
	3.4.3 DATA TYPE	12
	3.5 FEATURES OF Lab-View	13
	3.6 ADVANTAGE	13
	3.7 PROCESS FOR DRUG DELIVERY	13

	3.8 ANESTHETIC AGENTS USED	14
	3.9 BLOCK DIAGRAM	14
	3.10 WORKPLAN	14
	3.11 BLOCK DIAGRAM PANEL DESCRIPTION	14
	3.12 MAC VALUE	16
4	**SOFTWARE ENVIRONMENT**	**17**
	4.1 PYTHON TECHNOLOGY	17
	4.2 PRODUCTIVITY AND SPEED	20
	4.3 BROAD APPLICATION	21
	4.3.1 LIMITATIONS	22
	4.3.2 PYTHON ABSTRACT SYNTAX	22
	4.3.3 AST NOTES	22
	4.4 DEVELOPMENT ENVIRONMENTS, IMPLEMENTATION AND PEROFRMANCE	24
5	**TELEMEDICINE**	**29**
	5.1 IMPLEMENTATION OF TELEMEDICINE USING PYTHON	29
	5.1.1 INTEGRATED DEVELOPMENT ENVIRONMENT	29
	5.1.2 PACKAGES REQUIRED	30
	5.2 QRCODE GENERATION FOR SENDING INFORMATION BY USING PYTHON	30
	5.2.1 ADVANTAGES OF QR CODE	31
	5.2.2 QR SCANNER	31
	5.3 BMI CALCULATOR	31
	5.4 REMOTE MONITORING BIOMEDICAL PARAMETER OF A PATIENT USING PATIENT MONITORING SYSTEM BY PYTHON	31
6	**RESULT**	**32**
	6.1 RESULT	32
	6.2 FRONT PANEL	32
	6.3 BLOCK DIAGRAM PANEL	33
	6.4 QR CODE GENERATION	34
	6.5 SIMULATION USING PYTHON	35
	6.5.1 INITIALIZING ANESTHESIA MACHINE	35
	6.5.2 GETTING INPUT FROM QR CODE AND PASSING INPUT TO THE MACHINE	35
	6.5.3 SELECTING SURGERY	35

	6.5.4 SETTING MAC VALUE BY THE HELP OF ANESTHESIAN	35
	6.5.5 CHECKING BLOOD PRESSURE, HERAT-BEAT, SPO2, BODY TEMPERATURE	36
	6.6 FUTURE SCOPE	36
	6.7 RESULT AND DISCUSSION	36
7	**LIST OF PUBLICATION**	**37**
8	**CONCLUSION**	**40**
	REFERENCE	**41**

LIST OF TABLES

TABLE NO	TABLE NAME	PAGE NO
1.3	PROPERTIES OF MEDICAL GASES	5
3.1	ANESTHETIC AGENTS FOR SURGERY	16
3.2	ANESTHETIC AGENTS MAC	16
5.1	PACKAGES REQUIRED	30

LIST OF FIGURES

FIGURE NO	FIGURE NAME	PAGE NO
1.1	ANESTHESIA MACHINE	3
4.1(i)	A REPOSITORY ARCHITRUCTURE FOR AN IDE	18
4.1(ii)	PYTHON INTERPRETER	19
4.3.3(i)	ASTNODECHILDREN()	23
4.3.3(ii)	ASTCHILDNODE()	24
6.2	FRONT PANEL	32
6.3	BLOCK DIAGRAM PANEL	34
6.4	QR GENERATION	34
6.5.1	INITIALIZING ANESTHESIA MACHINE	35
6.5.2	GETTING INPUT FROM QR CODE & PASSING INPUT TO THE MACHINE	35
6.5.3	SELECTING SURGERY	35
6.5.4	SETTING MAC VALUE BY THE HELP OF ANESTHESIAN	35
6.5.5	CHECKING BLOOD PRESSURE,HEART-BEAT,SPO2,BODY-TEMPERATURE	36

LIST OF ABBREVIATIONS

DAQ	DATA ACQUISTION
IMAQ	IMAGE ACQUISITION
LAB VIEW	LABORATORY VIRTUAL INSTRUMENTAL ENGINEERING WORKKBENCH
LED	LIGHT EMITING DIODE
MAC	MINIMUM ALVEOLAR CONCENTRATION
NI	NATIONAL INSTRUMENTS
PXI	PCI EXTENSIONS FOR INSTRUMENTATION
TCI	TRANSISTOR CONTROLLED IGNITOR
VI	VIRTUAL INSTRUMENTATION
.PY	EXTENSION OF PYTHON

CHAPTER 1

INTRODUCTION

1.1 ANESTHESIA

Anesthesia is a state of controlled, temporary loss of sensation or awareness that is induced for medical purposes. Anesthesia enables the painless performance of medical procedures that would otherwise cause severe or intolerable pain to an un anesthetized patient, or would otherwise be technically unfeasible.

- An anesthetic machine is a medical device used to generate and mix a fresh gas flow of medical gases and inhalation anesthetic agents for the purpose of inducing and maintaining anesthesia.
- General anesthesia suppresses central nervous system activity and results in unconsciousness and total lack of sensation, using either injected or inhaled drugs.
- Sedation suppresses the central nervous system to a lesser degree, inhibiting both anxiety and creation of long-term memories without resulting in unconsciousness. Regional and local anesthesia, which blocks transmission of nerve impulses from a specific part of the body. Depending on the situation, this may be used either on its own (in which case the patient remains fully conscious), or in combination with general anesthesia or sedation. Drugs can be targeted at peripheral nerves to anesthetize an isolated part of the body only, such as numbing a tooth for dental work or using a nerve block to inhibit sensation in an entire limb. Alternatively, epidural and spinal anesthesia can be performed in the region of the central nervous system itself, suppressing all incoming sensation from nerves supplying the area of the block.

1.2 ANESTHESIA MACHINE TYPE

CONTINUOUS FLOW ANESTHESIA MACHINE

It is designed to provide an accurate supply of medical gases mixed with an accurate concentration of anesthetic vapor, and to deliver this continuously to the patient at a safe pressure and flow.

INTERMITTENT-FLOW ANESTHESIA MACHINE

It provides gas flow only on demand when triggered by the patient's own inspiration**.**

1.3 COMPONENTS

A modern anesthetic machine includes at minimum the following components

- Connections to piped oxygen, medical air, and nitrous oxide from a wall supply in the healthcare facility, or reserve gas cylinders of oxygen, air, and nitrous oxide attached via a pin index safety system yoke with a Bodok seal.
- Pressure gauges, regulators and 'pop-off' valves, to monitor gas pressure throughout the system and protect the machine components and patient from excessive rises
- Flow meters such as rota meters for oxygen, air, and nitrous oxide
- Vaporizers to provide accurate dosage control when using volatile anesthetics
- A high-flow oxygen flush, which bypasses the flow meters and vaporizers to provide pure oxygen at 30-75 liters/minute
- Systems for monitoring the gases being administered to, and exhaled by, the patient, including an oxygen failure warning device

Systems for monitoring the patient's heart rate, ECG, blood pressure and oxygen saturation may be incorporated, in some cases with additional options for monitoring end-tidal carbon dioxide and temperature. Breathing systems are also typically incorporated, including a manual reservoir bag for ventilation in combination with an adjustable pressure-limiting valve, as well as an integrated mechanical ventilator, to accurately ventilate the patient during anesthesia. Anesthetic machines are distinct from anesthesia carts, which hold various adjuncts for anesthesia such as intravenous medications, syringes, needles and other items of equipment that the anesthetist providing anesthesia might need.

In dentistry a simplified version of the anesthetic machine, without a ventilator or anesthetic vaporiser, is referred to as a relative analgesia machine.[5] By using this machine, the dentist can administer a mild inhalation sedation with nitrous oxide and oxygen, in order to keep their patient in a conscious state while depressing the feeling of pain.

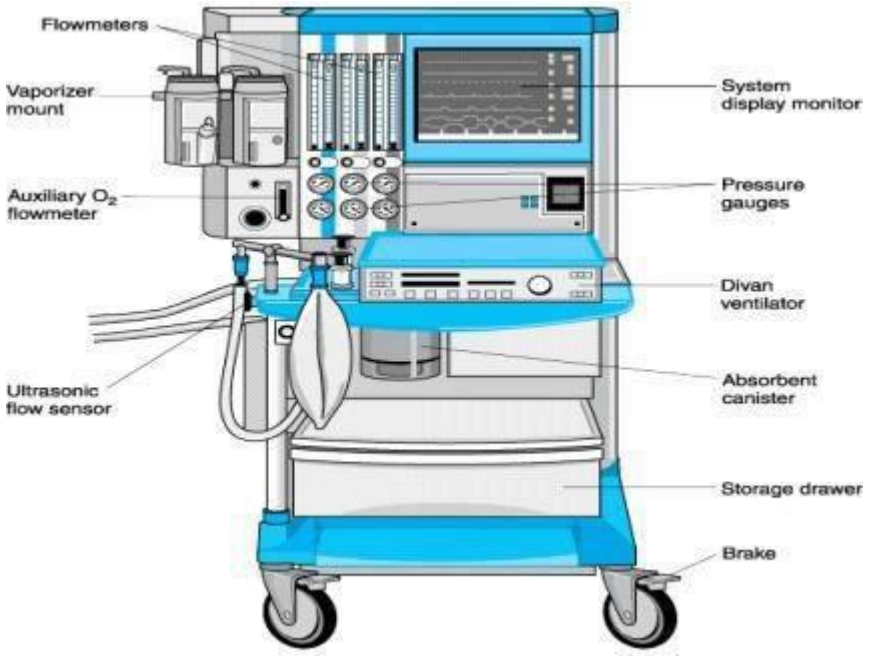


Fig 1.1 ANESTHESIA MACHINE

1.4 ANESTHETIC GASES

Anesthesia gas production, storage and delivery are a composite system. The medical gases commonly used for anesthesia and critical care are oxygen, nitrous oxide, medical air, entonox, carbon dioxide and heliox. Medical gases such as oxygen and air can be supplied in bulk and others such as nitrous oxide, medical air and entonox can be supplied from the cylinder manifolds. These gases are then delivered through pipelines to the wall outlets. Medical gases can also be provided directly from the portable cylinders.

1.4.1 OXYGEN

The process for separating atmospheric oxygen by distillation consists of two main phases, liquefaction of air and fractional distillation of the liquid air into its components. Air is compressed, cooled to ambient temperature and passed via a heat-exchanger to an expansion valve and changer. Joule-Thomson cooling occurs on expansion of gas and the cooled gas passes back through the heat-exchanger cooling the compressed gas flowing to the expansion chamber.

The method commonly employed for commercial production of large volume of oxygen is fractional distillation of air. Then, it is supplied to the site as a pale blue liquid oxygen cooled

to −183.1°C at 1 bar absolute pressure, which is either delivered as a cryogenic liquid system (CLS) or in smaller units as liquid cylinder installation. Alternatives to cylinder supply for small scale use are oxygen concentrator or chemical reactions such as oxygen candles (sodium chlorate and iron powder) used in submarines and in overhead emergency oxygen supplies as aircraft.(re-Fractional distillation of air involves cooling and compressing air into a liquid and separating it into its main component gases; oxygen, nitrogen and argon. Air is first filtered; impurities are removed and then cooled to −200°C. Carbon dioxide freezes at −79°C and so, is discarded at this point, but oxygen only liquefies at −183°C. At −200°C, liquid air (now free of carbon dioxide) is passed into the bottom of the fractionating column which is warmer at the bottom (−185°C) than the top (−195°C). Liquefied nitrogen (nitrogen liquefies at −195°C) boils and returns to its gaseous form and exits through the top of the column leaving liquid oxygen and argon. Both have similar boiling points and therefore require another fractionating column in order to produce pure oxygen.

1.4.2 NITROUS OXIDE

N2O is produced by heating ammonium nitrate at 250°C. If the temperature is controlled properly, there would be lesser production of ammonia and higher oxides of nitrogen. These impurities are removed by washing with water, acid, alkali and permanganate solutions before drying and insertion as liquid into cylinders. The nitrous oxide is supplied in cylinders containing between 450 and 18,000 L of gas.

Nitrous oxide has a critical temperature above the room temperature, so it is stored as a liquid in pressurized cylinders, with nitrous oxide vapor present in the space above the liquid. The actual pressure of the full cylinder lies between 4400 and 5000 kPa. For vaporization of the liquid, energy is provided from the local environment - the latent heat of vaporization. This results in the significant fall in temperature within the cylinders pressure regulator, thus freezing any water vapor

present and causing possible obstruction of the regulator outlet. This can be prevented by thermostatically-controlled regulators.

1.4.3 ENTONOX

It is a **50:50** mixture of oxygen and nitrous oxide supplied as a gas. Gas mixture is stored in cylinders or cylinder banks and delivered using a two stage pressure regulator, the second one incorporating a demand valve. Gas flow occurs with the inspiratory effort of the patient. It is manufactured by mixing these two separate components together utilizing the Poynting effect or lamination effect.

1.4.4 MEDICAL AIR

Medical air is mainly used in respiratory therapy as a power source for ventilators and for blending with oxygen. It is also used as the driving gas for nebulized drugs and chemotherapy agents. Surgical air is also used, at a higher pressure, to power a variety of surgical tools and other devices such as tourniquets pneumatic drills and saws (as an alternative, nitrogen can be used for this purpose). It is subject to European Pharmacopoeia standards even though it is derived directly from our surroundings in many cases. Medical air is provided by three methods: Compressed air, synthetic air and cylinder manifolds.

Compressed medical air is formed by drawing ambient air into the compressor. The system is so designed that if one compressor is non-functional, then the remaining pumps can maintain the service demand. The compressors provide this compressed air to a receiver and then to a series of filter driers and separators, which removes the condensed water, particulate matter and lubricating oil from the system before the compressed air enters the pipeline supply system otherwise oil and raised partial pressure of oxygen could be explosive. Regulators then reduce the pressure to 400 kPa. The surgical air required for equipment operation is supplied at 700 kPa through separate pipelines. Non-particulate impurities such as carbon monoxide and sulphur dioxide are not removed by the filtration system and in areas of high air pollution, may result in the supply of air of inadequate purity.

Although it is not sterile, medical grade air is clean and at standard temperature and pressure should not contain more than: A total of 0.5 mg of particulate oil mist/cubic meter of air,
5.5 mg of carbon monoxide/cubic meter of air, 900 mg carbon dioxide/cubic meter of air, no moisture, no bacterial contamination. Synthetic air is prepared by blending liquid nitrogen with liquid oxygen in the gaseous state. Its advantage is that no power supply is required and there are no contamination problems. Where such systems are installed to provide both oxygen and medical air, nitrogen can be used for the power source for surgical tools.

1.4.5 HELIOX

Over the last decade, a mixture of 21% oxygen and helium has become a focus of interest particularly in the treatment of acute exacerbation of bronchial asthma. The low density (0.1669) of helium allows mixtures that can be more easily breathed than natural air and hence reduces the work of breathing. Apart from being a noble gas, helium is the second most abundant element in the universe. It is produced by the fractional distillation of natural gas, where concentration is as high as 1%. The gas mixture, heliox is stored in cylinders with a black body and white/brown quarter shoulders at a pressure of 13,700 kPa in its gaseous state.

1.4.6 CARBON DIOXIDE

It is readily available as a by-product of the manufacturing process of hydrogen. Reaction of petroleum or natural gas with steam and/or oxygen gives a mixture of hydrogen and carbon monoxide, which can then be reacted with more steam to give hydrogen and carbon dioxide. The latter is then separated from hydrogen by absorption into an alkaline medium from which nearly pure CO_2 is regenerated. The by-product gas is then purified and dried prior to liquefaction and filling of the cylinders[10]. It is most commonly used as the insufflation gas during laparoscopy. It was however used as a respiratory stimulant in the 1930s during respiratory arrests and was initially incorporated into the anesthesia machines. Deaths related to its misuse led to initially the production of the flow meters capable of delivering only 600 ml/min, then to the blanking of cylinder yokes and finally to the abandonment of its use.

1.4.7 MEDICAL VACUUM

It is considered as a part of the gas-supply infrastructure although it is not technically a gas. The system consists of a pump, receiver and a filter. The pump is capable of creating a negative

pressure of −400 mm Hg and can accommodate an airflow of 40 L/min. Gas is sucked into the system via one or two traps to reduce its contamination and then into a reservoir with a pressure of −550 to −650 mm Hg. The vacuum is maintained by pumps that in common with the medical air system are able to provide a fully functional system if one is out of service.

	Oxygen	Nitrous oxide	Entonox	Air	Carbon dioxide
Physical state in the cylinder	Gas	Liquid	Gas	Gas	Liquid
Critical temperature (°C)	−118	36.5	−7 (pseudocritical temperature)	−141	31
Pressure at 15°C (kPa)	13,700	4400	13,700	13,700	5000
Critical pressure (kPa)	5079	7260	-	3773	7380
Flammability	Supports combustion	Supports combustion	Supports combustion	Supports combustion	None
Boiling point at 1 atmosphere (°C)	−183	−89	-	−194	−79
US coding	Green	Blue	-	Yellow	Grey
ISO coding					
Body	White	Blue	Blue	Black	Grey
Shoulder	White	Blue	White/blue	White/black	Grey

ISO – International socialist organisation

Table 1.3 Properties of Medical Gases

1.5 BATTERY OF ANESTHESIA MACHINE

The anesthesia machine is equipped with a built-in rechargeable lithium battery to ensure that the anesthesia machine can still work when the power supply is cut off. When the anesthesia is connected to the AC power and switched on, the battery is charging if not already full charged. When the power supply is cut off, the system will automatically switch to the battery power supply, simultaneously, it will generate an AC power supply failure alarm to prompt users, and will not lead to interruption of the anesthesia ventilator work.

1.6 FLOWMETER

The flow meter displays the flow of the gas: O2, N2O and Air. Their flow can be read directly. The flow meter range: 0~10L; Accuracy: 0.1L; The unit: L/min. The user can adjust gases flow by the controlling knob, turn the flow meter controlling knob counterclockwise to increase the flow and clockwise to decrease.

- O2 and N2O knobs consist of a linkage device.(O2, N2O linkage device)
- While counterclockwise rotation of N2O knob and N2O flow is increased to a certain extent, O2 knob would be rotated together with N2O knob, and the O2 flow would be increased, such a system could ensure the O2 concentration in the fresh gas over than 25%.
- While clockwise rotation of O2 knob and O2 flow is decreased to a certain extent, N2O knob would be rotated together with O2 knob, and the N2O flow would be decreased, such a system could ensure the O2 concentration in the fresh gas over than 25%.

1.7 VAPORIZER

The vaporizer transmits the anesthetic to the patient respiratory system to anesthetize the patient. Different anesthetic should be used with the corresponding vaporizer; otherwise it will result in inaccurate output concentration. The anesthesia machine adopts 80/60 vaporizer designed by the company, and also the imported PENLON vaporizer.[3] The enflurane, isoflurane and sevoflurane are optional. The anesthesia machine is equipped with one vaporizer seating, and it can also support two vaporizer seating. When installing two vaporizers, it will only output one kind of anesthetic agent at the same time. The vaporizer used in this anesthesia machine should be accorded with the standard ISO8835-4. For the particular operation of the vaporizer please refer to the user manual provided by the vaporizer manufacturer.

1.8 SPO2 MODULE

The detection of SpO2 adopts Pulse Oximetry. That is a method of the durative and non traumatic detecting HbO2 saturation (functional saturation). The process is the light from the emitter to the receiver across the patient's part of the body like a finger or ear. The quantity of penetrable light is dependent on numerous factors, the much of light is constant. But the arterial blood changes regularly with time, because it is pulsant. The module can get HbO2 saturation, By means of detecting the receiving light in patient pulse time, moreover can receive “volume drawing” waveform and pulse rate.

1.9 CONTROL OF ANESTHESIA MACHINE

The basic pneumatic-mechanical design of the anesthesia gas machine had become familiar to a generation of providers. The basic design has been called upon to perform more complicated functions since 1990, with the advent of computer-controlled monitors into the operating room, especially pulse oximetry, capnography, and gas analysis[9]. Gas machines had become quite top- heavy in the 1990's, with the monitors that were added onto their basic design.

Modern machines have interlocked oxygen and nitrous oxide flow controls. This prevents inadvertent delivery of a hypoxic inspired gas mixture, as the ratio of oxygen to nitrous oxide concentrations never decreases below 0.25. This can be achieved by a mechanical, pneumatic or electronic mechanism.

CHAPTER 2

LITERATURE REVIEW

Tianyi Xu,Ming Xia,Hing Jiang 2021,they are concerned the diagnostic procedures are mostly automatic now days with the increase in development of the instrumentation in biomedical field. But during a surgery with major problem or minor problem, the delivery of anesthesia remains very crucial and has to be delivered with an accurate amount. This project can also be used when an anesthesia machine and ventilator are combined together. The vital parameter monitoring help in the surgical procedures. This is extremely very helpful to the anesthesiologist in monitoring the other important parameters as well. This project can be connected to EEG electrodes and also monitor the complete physiological parameters. Advantages of using the proposed system are physical presence of anesthetist isn't always required, the specified level of anesthesia is precisely calculated and administered in order that future side effects thanks to variations in anesthesia levels are eliminated. During the compete procedure the anesthesia will be regulated.

S.Raymond, S.Edagottu, L.Mawblei and M. Ahmed, "Automatic Anesthesia Control System," 2021 Seventh International conference on Bio Signals, Images, and Instrumentation" as the modern Technologies have developed automation in every sphere of biomedical instrumentation. This project is also based on automation drug regulation system will be very much useful to surgeon to check the current position of anesthesia so that the proper anesthesia will be injected to patients. This project on automatic anesthesia regularization system is one of the efficient protecting systems in medical industries. This system is very useful to the anesthetists who monitor the particular parameter for the patient and regularize the anesthesia.

Krishnakumar , 2018 reported the modern Technologies have developed automation in every sphere of biomedical instrumentation. This project is also based on automation drug regulation system will be very much useful to surgeon to check the current position of anesthesia so that the proper anesthesia will be injected to patients. Protection is intelligent than prevention and cure. This project on automatic anesthesia regularization system is one of the efficient protecting systems in medical industries. This system is very useful to the anesthesiologists who monitor the particular parameter for the patient and regularize the anesthesia. This module can be connected along with the syringe pump or the anesthesia ventilator for future implementation. They can also connect with the EEG parameters for major operations. Advantages of using the proposed system are physical presence of anesthetist is not always required, the required level of anesthesia is exactly calculated and administered so that future side effects due to variations in anesthesia levels are eliminated.IR detector is included in the present system for monitoring the total anesthesia level throughout surgery period.

Prashanth et, al. concluded The project provides a means of automating the anesthesia injection process by using the syringe mechanism and the infusion set mechanism. The proposed system shows a working prototype of the anesthesia administration system. Also, the system consists of a database which contains the drug dosage values for different modes of surgery. By introducing different modes of operation namely the induction phase and the maintenance phase, the various stages of the surgery are accounted for. By automating the induction process, the system plays a very important role of assisting the anesthesiologist there by reducing the risk

of anesthesia overdose. The user interface provides an easy way of interaction for the user. The database developed is easily scalable and can include more surgeries. The patient health monitoring feature is also included within the system which involves storing the vital parameters of the patient in a spreadsheet file. This later assists in the report generation and analysis. Future improvements include using a wireless mode of communication such as Zigbee, GSM to transmit the sensor values. Also by introducing more intelligence into the system, the system can be made autonomous.

Praveen et ,al .2012 proposed the use of Lab-View and PXI makes the whole system more flexible. More parameters can be added to the channels of the PXI DAQ card. Modern technologies have been developed that promotes comfortable and better life which implies a disease free world. "Automatic Medical Fluid Infusion System using Lab-View" is one of the efficient protecting systems.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 OVERVIEW

The main objective of this project is to avoid lethal effect of the patient by managing the high or low dose of anesthesia drug during surgery. The new design uses advanced electronics, software and technology to offer extensive capabilities for ventilation, monitoring and inhaled agent delivery. Our project aims to design an automated anesthesia machine to support the administration of anesthesia without the surveillance of the Anesthesiologists.

Lab-View (**Lab**oratory **V**irtual **I**nstrument **E**ngineering **W**orkbench) is a graphical programming environment which has become prevalent throughout research labs, academia and industry[1]. It is a powerful and versatile analysis and instrumentation software system for measurement and automation. It's graphical programming language called G programming is performed using a graphical block diagram that compiles into machine code and eliminates a lot of the syntactical details.

Lab-VIEW offers more flexibility than standard laboratory instruments because it is software-based. Using Lab-View, the user can originate exactly the type of virtual instrument needed and programmers can easily view and modify data or control inputs.

Lab-View programs are called virtual instruments (VI's), because their appearance and operation imitate physical instruments like oscilloscopes. Lab-View is designed to facilitate data collection and analysis, as well as offers numerous display options. With data collection, analysis and display combined in a flexible programming environment, the desktop computer functions as a dedicated measurement device. Lab-View contains a comprehensive set of VI's and functions for acquiring, analyzing, displaying, and storing data, as well as tools to help you troubleshoot your code.

Lab-View can acquire data using the devices like GPIB, Serial, Ethernet, Data Acquisition (DAQ), Image Acquisition (IMAQ), Motion Control, Real-Time.

To analyze your data Lab-View includes analysis functions for Differential Equations, Optimization, Curve Fitting, Calculus, Linear Algebra, Statistics and so on. Express VI's are specifically designed for measurement analysis, including filtering and spectral analysis. Signal Processing VI's for Filtering, Windowing, Transforms, Peak Detection, Harmonic Analysis, and Spectrum Analysis. Lab-View includes the following tools to help in presenting data on the computer; Graphs, Charts, Tables, Gauges, Meters, Tanks, 3D Controls, Picture Control, 3D .

3.2. TYPES OF PANEL

- Front Panel
- Block Diagram

3.2.1 FRONT PANEL

The front panel is the user interface of a VI. You build the front panel by using controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls and indicators are located on the Controls palette. Controls are knobs, push buttons, dials, and other input mechanisms. Controls simulate instrument input mechanisms and supply data to the block diagram of the VI. Indicators are graphs, LED's, and other displays. Indicators simulate instrument output mechanisms and display data the block diagram acquires or generates.

3.2.2 BLOCK DIAGRAM

The block diagram contains the graphical source code, also known as G code or block diagram code, for how the VI runs. The block diagram code uses graphical representations of functions to control the front panel objects[8]. Front panel objects appear as icon terminals on the block diagram. Wires connect control and indicator terminals to Express VI's, VI's, and functions. Data flows through the wires in the following ways: from controls to VI's and functions, from VI's and functions to indicators, and from VI's and functions to other VI's and functions. The movement of data through the nodes on the block diagram determines the execution order of the VI's and functions. This movement of data is known as data flow programming.

3.3 CONTROLS AND INDICATORS

- Controls allow users to input data.
- Indicators are used to display data, graphics, other information.
- To change an existing control to an indicator or vice versa right click the control or indicator and choose Change to Control or Change to Indicator
- Controls and Indicators can be placed from the Controls Palette on the Front Panel
    - When a Control or Indicator is placed on the front panel the corresponding block diagram element is created automatically.
    - Double clicking a control or indicator on the front panel will take you to the block diagram element for that control or indicator.
- Block diagram controls have data terminals on the right while indicators have data terminals on the left.

3.4 HARDWARE AND SOFTWARE

3.4.1 DAQ Assistant Express VI

A DAQ System consists of 4 parts:
(1) Physical input/output signals,
(2) sensors DAQ device/hardware,
(3) Driver software and
(4) software application (Lab-View).

Lab-View is well suited for creating DAQ applications and many hardware devices are supported.

The National Instruments USB-6008 is a low-cost, multi function data acquisition device (DAQ). It has 8 analog inputs, 2 analog outputs, and 12 digital input/outputs. The digital channels are divided into two ports. When one or more channels on each port is set to either input or output, the port is locked into that particular mode.

3.4.2 NI-DAQmx

In NI-DAQmx, a task is a collection of one or more virtual channels with timing, triggering, and other properties. Conceptually, a task represents a measurement or generation you want to perform. For example, you can configure a collection of channels for analog input operations. After you create a task, you can access the single task instead of configuring the channels individually to perform analog input operations. After you create a task, you can add or remove channels from that task. Refer to the Taking Measurements book on the Contents tab in the Lab-View Help for more information about channels and tasks.

3.4.3.DATA TYPE

On the block diagram of a VI, the terminals for the front panel objects are different colors. The color and symbol of a terminal indicate the data type of the corresponding control or indicator. Colors also indicate the data types of wires, inputs, and outputs. The color of inputs and outputs of Express VI's indicate what type of data the input or output accepts or returns. Data types indicate which objects, inputs, and outputs you can wire together. For example, a switch has a green border, so you can wire a switch to any Express VI input with a green label.A knob has an orange border, so you can wire a knob to any Express VI input with an orange label. However, you cannot wire a knob to an input with a green label. The wires you create are the same color as the terminal.

Express VI's generate and acquire data using the dynamic data type. The dynamic data type appears as a dark blue terminal, shown below. Most Express VI's accept or return dynamic data. You can wire dynamic data to any indicator or input that accepts numeric, waveform, or Boolean data. Wire dynamic data to an indicator that can best present the data. Such indicators include graphs, charts, and numeric indicators[4]. Most other VI's and functions in Lab-View do not accept dynamic data. To use a built-in VI or function to analyze or process dynamic data, you must convert the dynamic data to numeric, Boolean, waveform, or array data. Use the Convert from Dynamic Data Express VI to convert dynamic data to numeric, Boolean, waveform, and array data for use with other VI's and functions. When you wire dynamic data to an array indicator, Lab-View inserts the Convert from Dynamic Data Express VI on the block diagram. Use the Convert to Dynamic Data Express VI to convert numeric, Boolean, waveform, and array data to dynamic data for use with Express VI's.

3.5 FEATURES OF Lab-View

1.Design

- Signal and Image Processing
- Embedded System Programming
- Simulation and Prototyping

2.Control

- Automatic Controls and Dynamic Systems
- Mechatronics and Robotics

3.Measurements

- Circuits and Electronics
- Measurements and Instrumentation

3.6 ADVANTAGE

- **Graphical user interface:** Design professionals use the drag-and-drop user interface library by interactively customizing the hundreds of built-in user objects on the controls palette.
- **Drag-and-drop built-in functions:** Thousands of built-in functions and IP including analysis and I/O, from the functions palette to create applications easily.
- **Modular design and hierarchical design:** Run modular Lab-View VI's by themselves or as sub VI's and easily scale and modularize programs depending on the application.

- **Multiple high level development tools:** Develop faster with application-specific development tools, including the Lab-View State chart Module, Lab-View Control Design and Simulation Module and Lab-View FPGA Module.
- **Professional Development Tools:** Manage large, professional applications and tightly integrated project management tools; integrated graphical debugging tools; and standardized source code control integration.
- **Multi platforms:** The majority of computer systems use the Microsoft Windows operating system.

3.7 PROCESS FOR DRUG DELIVERY

The proposed process for Automated Anesthesia Control System using Lab-View delivers drugs with medical gases when needed. The process consists mainly of two sections

- Patient Input and MAC Value
- Automated Drug Delivery System

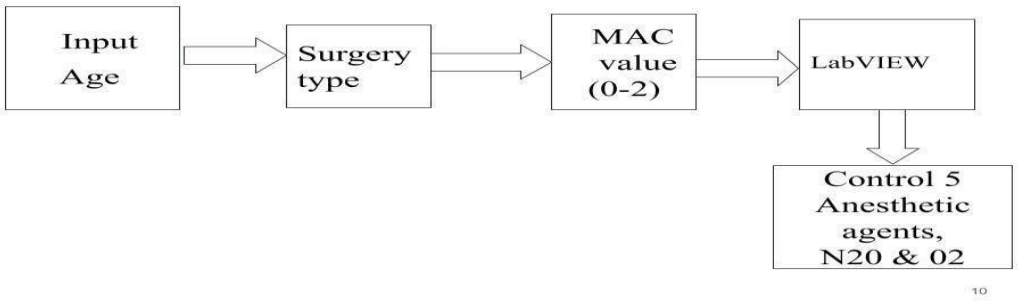
1st section - The Minimum Alveolar Concentration is setup by Anesthetic doctor and monitored patient details as Weight is also given as input.

2nd section - If any variation in dosage diluted then the drug or oxygen/nitrogen level is adjusted accordingly.

3.8 ANESTHETIC AGENTS USED

- N2O
- Desflurane
- Isoflurane
- Enflurane
- Sevoflurane
- Halothane

3.9 BLOCK DIAGRAM



3.10 WORKING PLAN

The inputs age and the associated MAC value with the 5 anesthetic agents required for the type of surgery is selected by the anesthetic doctor. Automatically the machine starts providing anesthesia. The intubation time and recovery O2 time also provided by the doctor at the time of selection. This procedure runs until the time specified by the Doctor.

3.11 BLOCK DIAGRAM PANEL DESCRIPTION

1.Divide Function

Owning Palette: Numeric Functions
Requires: Base Package
Computes the quotient of the inputs.

If the wire of two waveform values or two dynamic data type values to this function, error in and error out terminals appear on the function. The connector pane displays the default data types for this polymorphic function.

2.Case Structure

Owning Palette: Structures
Requires: Base Package

Has one or more sub-diagrams, or cases, exactly one of which executes when the structure executes. The value wired to the selector terminal determines which case to execute and can be Boolean, string, integer, or enumerated type. Right-click the structure border to add or delete cases. Use the Labeling tool to enter value(s) in the case selector label and configure the value(s) handled by each case.

3.Formula Express VI

Owning Palette: Arithmetic & Comparison Express VI's
Requires: Base Package

Uses a calculator interface to create mathematical formulas. This can use this Express VI to perform most math functions that a basic scientific calculator can compute.

4. Merge Signals Function

Owning Palette: Signal Manipulation Express VI's Requires:
Base Package
Merges two or more signals into a single output. Resize the function to add inputs. This function appears on the block diagram automatically when you wire a signal output to the wire branch of another sign.

5.Flat Sequence Structure Owning Palette: Structures Requires:
Base Package

Consists of one or more sub diagrams, or frames, that execute sequentially. Use the flat Sequence structure to ensure that a sub diagram executes before or after another sub diagram[2]. Data flow for the Flat Sequence structure differs from data flow for other structures. Frames in a Flat Sequence structure execute from left to right and when all data values wired to a frame are available. The data leaves each frame as the frame finishes executing. This means the input of one frame can depend on the output of another frame.

6.Time Delay Express VI

Owning Palette: Execution Control Express VI's and Structure Requires:
Base Package
Inserts a time delay into the calling VI.

7.While Loop

Owning Palette: Structures
Requires:Base Package
Repeats the sub diagram inside it until the conditional terminal, an input terminal, receives a particular Boolean value. The Boolean value depends on the continuation behavior of the While Loop. Right-click the conditional terminal and select Stop if True or Continue if True from the shortcut menu. You also can wire an error cluster to the conditional

terminal, right-click the terminal, and select Stop on Error or Continue while Error from the shortcut menu. The While Loop always executes at least once.

8.For Loop

Owning Palette: Structures

Requires: Base Package.

Executes its sub diagram n times, where *n* is the value wired to the count (N) terminal. The iteration (i) terminal provides the current loop iteration count, which ranges from 0 to *n*-1.

3.12 MAC VALUE

Minimum Alveolar Concentration is a basic index indicating the depth of inhaled anesthesia. The ISO 21647 defines MAC as alveolar concentration of an inhaled anesthetic agent and at equilibrium, prevents 50% of subjects from moving in response to a standard surgical stimulus.

SURGERY	DESFLURANE	ISOFLURANE	ENFLURANE	SEVOFLURANE	HALOTHANE	N20
CARDIAC	6.42%	1.11%	1.64%	2.02%	0.74%	101.47%
GYNECOLOGY	6.42%	0%	0%	2.02%	0%	101.47%
CATARACT	6.42%	1.11%	0%	2.02%	0%	0%
BRAIN	6.42%	1.11%	0%	2.02%	0%	101.47%
HAND	6.42%	1.11%	0%	2.02%	0%	101.47%
ORTHO	6.42%	1.11%	0%	2.02%	0.74%	101.47%
ENDOCRINE	6.42%	1.11%	0%	2.02%	0%	101.47%
NEURO	0%	1.11%	0%	2.02%	0%	0%
BREAST	0%	0%	1.64%	0%	0%	101.47%
UROLOGY	6.42%	0%	0%	0%	0%	0%

TABLE 3.1 ANESTHETIC AGENTS FOR SURGERY

Anesthetic agent	Desflurane	Isoflurane	Enflurane	Sevoflurane	Halothane	N2O
1 MAC	6.65%	1.15%	1.7%	2.1%	0.77%	105%

TABLE 3.2 ANESTHETIC AGENTS MAC

age = MAC 40 * 10 ^ (-0.00269*(age-40)).

CHAPTER 4

SOFTWARE ENVIRONMENT

4.1 Python Technology:

Python is an interpreted, high-level, general-purpose programming language. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. **Python** is often described as a "batteries included" language due to its comprehensive standard library.

Python Programming Language:

Python is a multi-paradigm programming language. Object-oriented programming and structured programming are fully supported, and many of its features support functional programming and aspect-oriented programming (including by meta programming and met objects (magic methods)). Many other paradigms are supported via extensions, including design by contract and logic programming.

Python packages with a wide range of functionality, including:

- Easy to Learn and Use
- Expressive Language
- Interpreted Language
- Cross-platform Language
- Free and Open Source
- Object-Oriented Language
- Extensible
- Large Standard Library
- GUI Programming Support
- Integrated

Python uses dynamic typing and a combination of reference counting and a cycle-detecting garbage collector for memory management. It also features dynamic name resolution (late binding), which binds method and variable names during program execution.

Rather than having all of its functionality built into its core, Python was designed to be highly extensible. This compact modularity has made it particularly popular as a means of adding programmable interfaces to existing applications. Van Rossum's Vision of a small core language with a large standard library and easily extensible interpreter stemmed from his frustrations with ABC, which espoused the opposite approach.

Python is meant to be an easily readable language. Its formatting is Visually uncluttered, and it often uses English keywords where other languages use punctuation. Unlike many other languages, it does not use curly brackets to delimit blocks, and semicolons after statements are optional. It has fewer syntactic exceptions and special cases than C or Pascal.

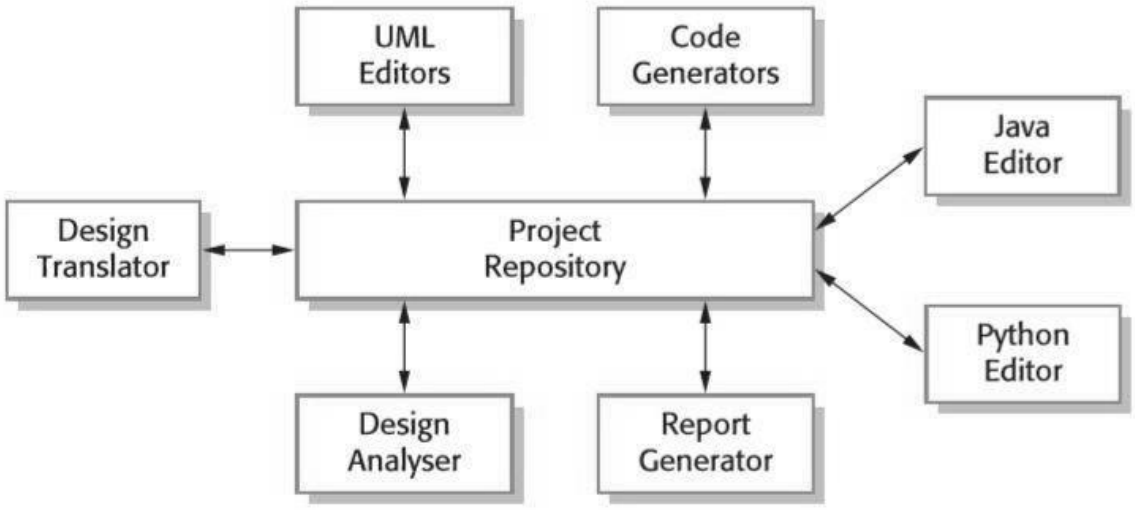


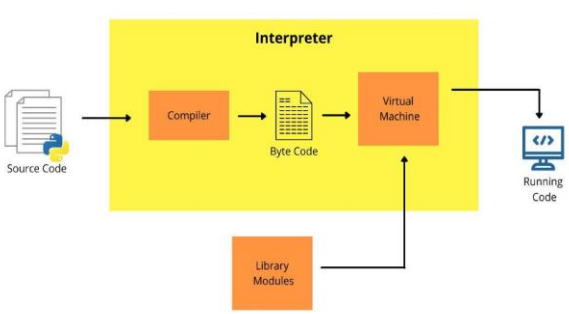
Fig 4.1(i) A Repository Architecture for An IDE

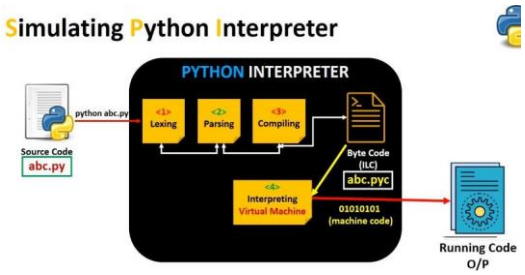
Python strives for a simpler, less-cluttered syntax and grammar while giving developers a choice in their coding methodology. In contrast to Perl's "there is more than one way to do it" motto, Python embraces a "there should be one and preferably only one obvious way to do it" design philosophy. “ Alex Martelli” , a Fellow at the Python Software Foundation and Python book author, writes that "To describe something as 'clever' is not considered a compliment in the Python culture."

Python's developers strive to avoid premature optimization, and reject patches to non-critical parts of the Python reference implementation that would offer marginal increases in speed at the cost of clarity. When speed is important, a Python programmer can move time-critical functions to extension modules written in languages such as C, or use PyPy, a just-in-time compiler. Python is also available, which translates a Python script into C and makes direct C-level API calls into the Python interpreter.

An important goal of Python's developers is keeping it fun to use. This is reflected in the language's name a tribute to the British comedy group Monty Python and in occasionally playful approaches to tutorials and reference materials, such as examples that refer to spam and eggs (from a famous Monty Python sketch) instead of the standard foo and bar.

Python uses duck typing and has typed objects but untyped variable names. Type constraints are not checked at compile time; rather, operations on an object may fail, signifying that the given object is not of a suitable type. Despite being dynamically typed, Python is strongly typed, forbidding operations that are not well-defined (for example, adding a number to a string) rather than silently attempting to make sense of them.





4.1 (ii) Python Interpreter

The Python Platform:

The platform module in Python is used to access the underlying platform's data, such as, hardware, operating system, and interpreter version information. The platform module includes tools to see the platform's hardware, operating system, and interpreter version information where the program is running.

There are four functions for getting information about the current Python interpreter. python_version() and python_version_tuple() return different forms of the interpreter version with major, minor, and patch level components. python_compiler() reports on the compiler used to build the interpreter. And python_build() gives a version string for the build of the interpreter.

Platform() returns string containing a general purpose platform identifier. The function accepts two optional Boolean arguments. If aliased is true, the names in the return value are converted from a formal name to their more common form. When terse is true, returns a minimal value with some parts dropped.

What does python technology do?

Python is quite popular among programmers, but the practice shows that business owners are also Python development believers and for good reason. Software developers love it for its straightforward syntax and reputation as one of the easiest programming languages to learn. Business owners or CTOs appreciate the fact that there's a framework for pretty much anything – from web apps to machine learning.

Moreover, it is not just a language but more a technology platform that has come together through a gigantic collaboration from thousands of individual professional developers forming a huge and peculiar community of aficionados.

So what are the tangible benefits the language brings to those who decided to use it as a core technology? Below you will find just some of those reasons.

4.2 PRODUCTIVITY AND SPEED

It is a widespread theory within development circles that developing Python applications is approximately up to 10 times faster than developing the same application in Java or C/C++. The impressive benefit in terms of time saving can be explained by the clean object-oriented design, enhanced process control capabilities, and strong integration and text processing capacities. Moreover, its own unit testing framework contributes substantially to its speed and productivity.

PYTHON IS POPULAR FOR WEB APPS

Web development shows no signs of slowing down, so technologies for rapid and productive web development still prevail within the market. Along with JavaScript and Ruby, Python, with its most popular web framework Django, has great support for building web apps and is rather popular within the web development community.

OPEN-SOURCE AND FRIENDLY COMMUNITY

As stated on the official website, it is developed under an OSI-approved open source license, making it freely usable and distributable. Additionally, the development is driven by the community, actively participating and organizing conference, meet-ups, hackathons, etc. fostering friendliness and knowledge- sharing.

PYTHON IS QUICK TO LEARN

It is said that the language is relatively simple so you can get pretty quick results without actually wasting too much time on constant improvements and digging into the complex engineering insights of the technology. Even though Python programmers are really in high demand these days, its friendliness and attractiveness only help to increase number of those eager

to master this programming language.

4.3 BROAD APPLICATION

It is used for the broadest spectrum of activities and applications for nearly all possible industries. It ranges from simple automation tasks to gaming, web development, and even complex enterprise systems. These are the areas where this technology is still the king with no or little competence:

- Machine learning as it has a plethora of libraries implementing machine learning algorithms.
- Web development as it provides back end for a website or an app.
- Cloud computing as Python is also known to be among one of the most popular cloud-enabled languages even used by Google in numerous enterprise-level software apps.
- Scripting.
- Desktop GUI applications.

Python compiler

The Python compiler package is a tool for analyzing Python source code and generating Python byte code. The compiler contains libraries to generate an abstract syntax tree from Python source code and to generate Python byte code from the tree.

The compiler package is a Python source to byte code translator written in Python. It uses the built-in parser and standard parser module to generate a concrete syntax tree. This tree is used to generate an abstract syntax tree (AST) and then Python byte code.

The full functionality of the package duplicates the built-in compiler provided with the Python interpreter. It is intended to match its behavior almost exactly. Why implement another compiler that does the same thing? The package is useful for a variety of purposes. It can be modified more easily than the built-in compiler. The AST it generates is useful for analyzing Python source code.

The basic interface

The top-level of the package defines four functions. If you import compiler, you will get these functions and a collection of modules contained in the package.

compiler.parse(buf)

Returns an abstract syntax tree for the Python source code in buf. The function raises Syntax Error if there is an error in the source code. The return value is a compiler.ast. Module instance that contains the tree.

compiler.parse File(path)

Return an abstract syntax tree for the Python source code in the file specified by path. It is equivalent to parse(open(path).read()).

4.3.1 LIMITATIONS

There are some problems with the error checking of the compiler package. The interpreter detects syntax errors in two distinct phases. One set of errors is detected by the interpreter's parser, the other set by the compiler. The compiler package relies on the interpreter's parser, so it get the first phases of error checking for free. It implements the second phase itself, and that implementation is incomplete. For example, the compiler package does not raise an error if a name appears more than once in an argument list: def f(x, x): ...

A future version of the compiler should fix these problems.

4.3.2 PYTHON ABSTRACT SYNTAX

The compiler.ast module defines an abstract syntax for Python. In the abstract syntax tree, each node represents a syntactic construct. The root of the tree is Module object.

The abstract syntax offers a higher level interface to parsed Python source code. The parser module and the compiler written in C for the Python interpreter use a concrete syntax tree. The concrete syntax is tied closely to the grammar description used for the Python parser. Instead of a single node for a construct, there are often several levels of nested nodes that are introduced by Python's precedence rules.

The abstract syntax tree is created by the compiler.transformer module. The transformer relies on the built-in Python parser to generate a concrete syntax tree. It generates an abstract syntax tree from the concrete tree.

The transformer module was created by Greg Stein and Bill Tutt for an experimental Python-to-C compiler. The current version contains a number of modifications and improvements, but the basic form of the abstract syntax and of the transformer are due to Stein and Tutt.

4.3.3 AST NODES

The compiler.ast module is generated from a text file that describes each node type and its elements. Each node type is represented as a class that inherits from the abstract base class compiler.ast.Node and defines a set of named attributes for child nodes.

class compiler.ast.Node

The Node instances are created automatically by the parser generator. The recommended interface for specific Node instances is to use the public attributes to access child nodes. A public attribute may be bound to a single node or to a sequence of nodes, depending on the Node type. For example, the bases attribute of the Class node, is bound to a list of base class nodes, and the doc attribute is bound to a single node. Each Node instance has a lineno attribute which may be None. XXX Not sure what the rules are for which nodes will have a useful lineno.

All Node objects offer the following methods: getChildren()

Returns a flattened list of the child nodes and objects in the order they occur. Specifically, the order of the nodes is the order in which they appear in the Python grammar. Not all of the children are Node instances. The names of functions and classes, for example, are plain strings.

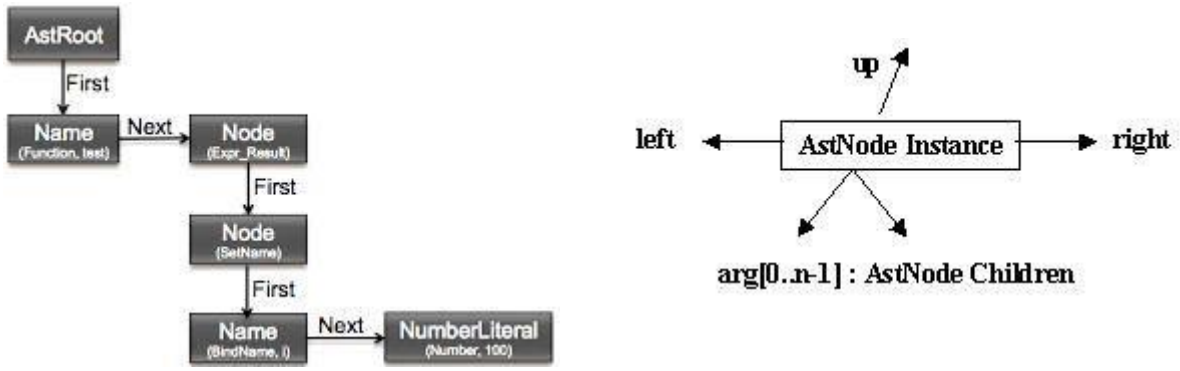


Fig 4.3.3 (i) AstNode Children()

getChildNodes()

Returns a flattened list of the child nodes in the order they occur. This method is like getChildren(), except that it only returns those children that are Node instances.

The While node has three attributes: test, body, and else_. (If the natural name for an attribute is also a Python reserved word, it can't be used as an attribute name. An underscore is appended to the word to make it a legal identifier, hence else_ instead of else.)

The if statement is more complicated because it can include several tests.

The If node only defines two attributes: tests and else_. The tests attribute is a sequence of test expression, consequent body pairs. There is one pair for each if/elif clause. The first element of the pair is the test expression. The second elements is a Stmt node that contains the code to execute if the test is true.

The getChildren() method of If returns a flat list of child nodes. If there are three if/elif clauses and no else clause, then getChildren() will return a list of six elements: the first test expression, the first Stmt, the second text expression, etc.

The following table lists each of the Node sub classes defined in compiler.ast and each of the public attributes available on their instances. The values of most of the attributes are themselves Node instances or sequences of instances. When the value is something other than an instance, the type is noted in the comment. The attributes are listed in the order in which they are returned by getChildren() and getChildNodes().

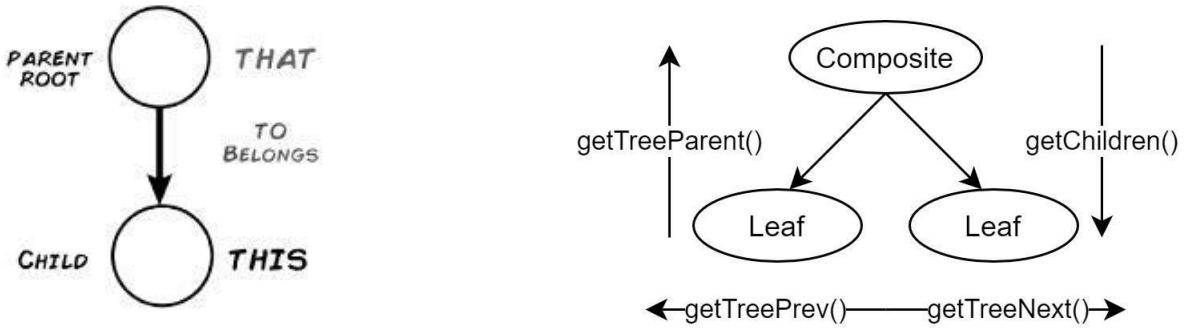


Fig 4.3.3(ii) AstChildNodes()

4.4 DEVELOPMENT ENVIRONMENTS, IMPLEMENTATION AND PERFORMANCE

Most Python implementations (including CPython) include a read–eval– print loop (REPL), permitting them to function as a command line interpreter for which the user enters statements sequentially and receives results immediately.

Other shells, including IDLE and IPython, add further abilities such as auto-completion, session state retention and syntax highlighting.

Reference implementation

CPython is the reference implementation of Python. It is written in C, meeting the C89 standard with several select C99 features. It compiles Python programs into an intermediate bytecode which is then executed by its virtual machine. CPython is distributed with a large standard library written in a mixture of C and native Python. It is available for many platforms, including Windows and most modern Unix-like systems. Platform portability was one of its earliest priorities.

Other implementations

PyPy is a fast, compliant interpreter of Python 2.7 and 3.5. Its just-in-time compiler brings a significant speed improvement over CPython but several libraries written in C cannot be used with it.

Stack less Python is a significant fork of C-Python that implements micro-threads; it does not use the C memory stack, thus allowing massively concurrent programs. PyPy also has a stack less version.

Micro-Python and Circuit-Python are Python 3 variants optimized for micro-controllers. This includes Lego Mind storms EV3.

Rust-Python is a Python 3 interpreter written in Rust.

Unsupported implementations

Other just-in-time Python compilers have been developed, but are now unsupported:

Google began a project named Unladen Swallow in 2009, with the aim of speeding up the Python interpreter five-fold by using the LLVM, and of improving its multi threading ability to scale to thousands of cores, while ordinary implementations suffer from the global interpreter lock.

Psyco is a just-in-time specializing compiler that integrates with C-Python and transforms byte code to machine code at runtime. The emitted code is specialized for certain data types and is faster than standard Python code.

In 2005, Nokia released a Python interpreter for the Series 60 mobile phones named PyS60. It includes many of the modules from the C-Python implementations and some additional modules to integrate with the Symbian operating system. The project has been kept up-to-date to run on all variants of the S60 platform, and several third-party modules are available. The Nokia N900 also supports Python with GTK widget libraries, enabling programs to be written and run on the target device.

Cross-compilers to other languages

There are several compilers to high-level object languages, with either unrestricted Python, a restricted subset of Python, or a language similar to Python as the source language:

- Jython enables the use of the Java class library from a Python program.
- Iron Python follows a similar approach in order to run Python programs on the .NET Common Language Runtime.
- The R-Python language can be compiled to C, and is used to build the PyPy interpreter of Python.

- Pyjs compiles Python to JavaScript.
- Cython compiles Python to C and C++.
- Numba uses LLVM to compile Python to machine code.
- Pythran compiles Python to C++.
- Somewhat dated Pyrex (latest release in 2010) and Shed Skin (latest release in 2013) compile to C and C++ respectively.
- Google's Grumpy compiles Python to Go.
- My HDL compiles Python to VHDL.
- Nuitka compiles Python into C++.

Performance

A performance comparison of various Python implementations on a non- numerical (combinatorial) workload was presented at EuroSciPy '13.

API Documentation Generators

Python API documentation generators include:

USES

- Sphinx
- Epydoc
- HeaderDoc
- Pydoc

Python has been successfully embedded in many software products as a scripting language, including in finite element method software such as Abaqus, 3D parametric modeler like Free CAD, 3D animation packages such as 3ds Max, Blender, Cinema 4D, Light wave, Houdini, Maya, modo, Motion Builder, Soft image, the Visual effects compositor Nuke, 2D imaging programs like GIMP, Ink scape, Scribus and Paint Shop Pro, and musical notation programs like score writer and capella. GNU Debugger uses Python as a pretty printer to show complex structures such as C++ containers. Esri promotes Python as the best choice for writing scripts in ArcGIS. It has also been used in several video games, and has been adopted as first of the three available programming languages in Google App Engine, the other two being Java and Go.

Python is commonly used in artificial intelligence projects with the help of libraries like TensorFlow, Keras and Scikit-learn. As a scripting language with modular architecture, simple syntax and rich text processing tools, Python is often used for natural language processing.

Many operating systems include Python as a standard component. It ships with most Linux distributions, AmigaOS 4, FreeBSD (as a package), NetBSD, OpenBSD (as a package) and macOS and can be used from the command line (terminal). Many Linux distributions use installers written in Python: Ubuntu uses the Ubiquity installer, while Red Hat Linux and Fedora use the Anaconda installer. Gentoo Linux uses Python in its package management system, Portage.

Python is used extensively in the information security industry, including in exploit development.

Most of the Sugar software for the One Laptop per Child XO, now developed at Sugar Labs, is written in Python. The Raspberry Pi single-board computer project has adopted Python as its main user-programming language.

LibreOffice includes Python, and intends to replace Java with Python. Its Python Scripting Provider is a core feature since Version 4.0 from 7 February 2013.

PANDAS

In computer programming, pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series. It is free software released under the three-clause BSD license. The name is derived from the term "panel data", an econometrics term for data sets that include observations over multiple time periods for the same individuals.

Library features

- Data Frame object for data manipulation with integrated indexing.
- Tools for reading and writing data between in-memory data structures and different file formats.
- Data alignment and integrated handling of missing data.
- Reshaping and pivoting of data sets.

- Label-based slicing, fancy indexing, and sub setting of large data sets.
- Data structure column insertion and deletion.
- Group by engine allowing split-apply-combine operations on data sets.
- Data set merging and joining.
- Hierarchical axis indexing to work with high-dimensional data in a lower- dimensional data structure.
- Time series-functionality: Date range generation and frequency conversion, moving window statistics, moving window linear regressions, date shifting and lagging.
- Provides data filtration.

CSV READER

CSV (Comma Separated Values) is a simple file format used to store tabular data, such as a spreadsheet or database. A CSV file stores tabular data (numbers and text) in plain text. Each line of the file is a data record. Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format. For working CSV files in python, there is an inbuilt module called "CSV"

CHAPTER 5

TELEMEDICINE

Telemedicine is a modality which utilizes technology to provide and support health care across large distances. It has redefined the practices of medicine in many specialties and continues to be a boon for clinicians on many frontiers. Its role in the branch of anesthesia remains largely unexplored but has shown to be beneficial in all the three phases: pre-operative, intra-operative, and post-operative. Now time has come that anesthesiologists across the globe reassess their strategies and utilize the telemedicine facilities in the field of anesthesia.

BENEFITS OF TELEMEDICINE

Telemedicine is a general term that covers all of the ways you and your doctor can use technology to communicate without being in the same room. It includes phone calls, video chats, emails, and text messages. People also call it “Tele-health”, ”Digital medicine”, “e-health”.

It has facilitated patient monitoring through computer or tablet or phone technology that has reduced outpatient visits. Now doctors can verify prescription or supervise drug oversight.

It has some distinct advantages, and can potentially lead to improved access, continuity of care, and reduced disparities. It can take place immediately if needed, minimizes travel costs for patients, and is decoupled from a specific location so that the surgeon and patient can be anywhere.

It is useful even in post-operative phase in intensive care unit and post-anesthesia care unit by providing virtual surveillance. It helps the clinicians in planning rehabilitation by recording post-operative milestones and careful planning of pain management, especially in day care surgeries.

5.1 IMPLEMENTATION OF TELEMEDICINE USING PYTHON

Python is a high-level, interpreted, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected.

It is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems.

5.1.1 Integrated Development Environment

PyCharm is an integrated development environment used in computer programming, specifically for the Python programming language. It is developed by the Czech company JetBrains.

It is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers, tightly integrated to create a convenient environment for productive Python, web, and data science development.

5.1.2 Packages Required

PACKAGES	USES
TERM COLOR	Termcolor is a python module for ANSII Color formatting for output in the terminal
TIME	The Python time() function retrieves the current time. The time is represented as the number of seconds since January 1, 1970. This is the point at which UNIX time starts, also called the “epoch
PLYER	Plyer is a platform-independent API to use features commonly found on various platforms, notably mobile ones, in Python. Plyer tries not to reinvent the wheel, and will call for external libraries to implement the API in the easiest way, depending on the current platform.
PYQRCODE	The pyqrcode module is a QR code generator that is simple to use and written in pure python. The module can automates most of the building process for creating QR codes. Most codes can be created using only two lines of code! Unlike other generators, all of the helpers can be controlled manually.
OPEN-CV	OpenCV is a Python library which is designed to solve computer vision problems.

Table 5.1 Packages Required

5.2 QR CODE GENERATION FOR SENDING INFROMATION BY USING PYTHON

A Quick Response Code or a QR Code is a two-dimensional bar code used for its fast readability and comparatively large storage capacity. It consists of black squares arranged in a square grid on a white background. Python has a library “Qrcode” for generating QR code images. It can be installed using pip.

QR is helpful to send the patient details and physical fitness certificate and it is in encrypted mode.

Encrypted QR codes are QR codes that everyone cannot scan and access. They are not too common, since many QR codes are used in marketing, the developers of those codes want them to be accessible by everybody. Secure QR codes can make the scanner enter a password to be able to access the content.

5.2.1 ADVANTAGES OF QR CODE

- QR codes promote sharing and networking. QR codes are far more than just digital barcodes.
- They can be used as a 'call-to-action'
- They can enhance your SMO and SEO
- You can really get creative.
- You can measure their effectiveness.
- They connect your online and offline media.

5.2.2 QR SCANNER

QR Codes can serve as an important tool in helping healthcare providers to keep the correct track of patients throughout their administration. QR Codes can be embedded in the patient's medical bracelet and their medical history datasheet to access the patient's information.

5.3 BMI CALCULATOR

A BMI Calculator accepts the weight and height of an individual and calculates the Body Mass Index (BMI) of that person. For Example, if the height and weight of a person are 155 cm and 57 kg. The BMI of that person will be 23.73 (approx.), which signifies that the person is healthy. Using python it is easy to find the patient’s BMI range by getting input from qr code.

5.4 REMOTE MONITORING BIOMEDICAL PARAMETERS OF A PATIENT USING PATIENT MONITORING SYSTEM BY PYTHON

Remote patient monitoring is a method of healthcare delivery that uses the latest advances in information technology to gather patient data outside of traditional healthcare settings such as Blood pressure, Heart Beat, Body temperature,Spo2,ECG and EEG.

It is helpful to find the abnormality of the patient and it made continuous monitoring possible.

CHAPTER 6

RESULT

6.1 RESULT

The Lab-View connection has been built as discussed in chapter 3 and the components are connected and tested. The following result has been obtained.

6.2 FRONT PANEL

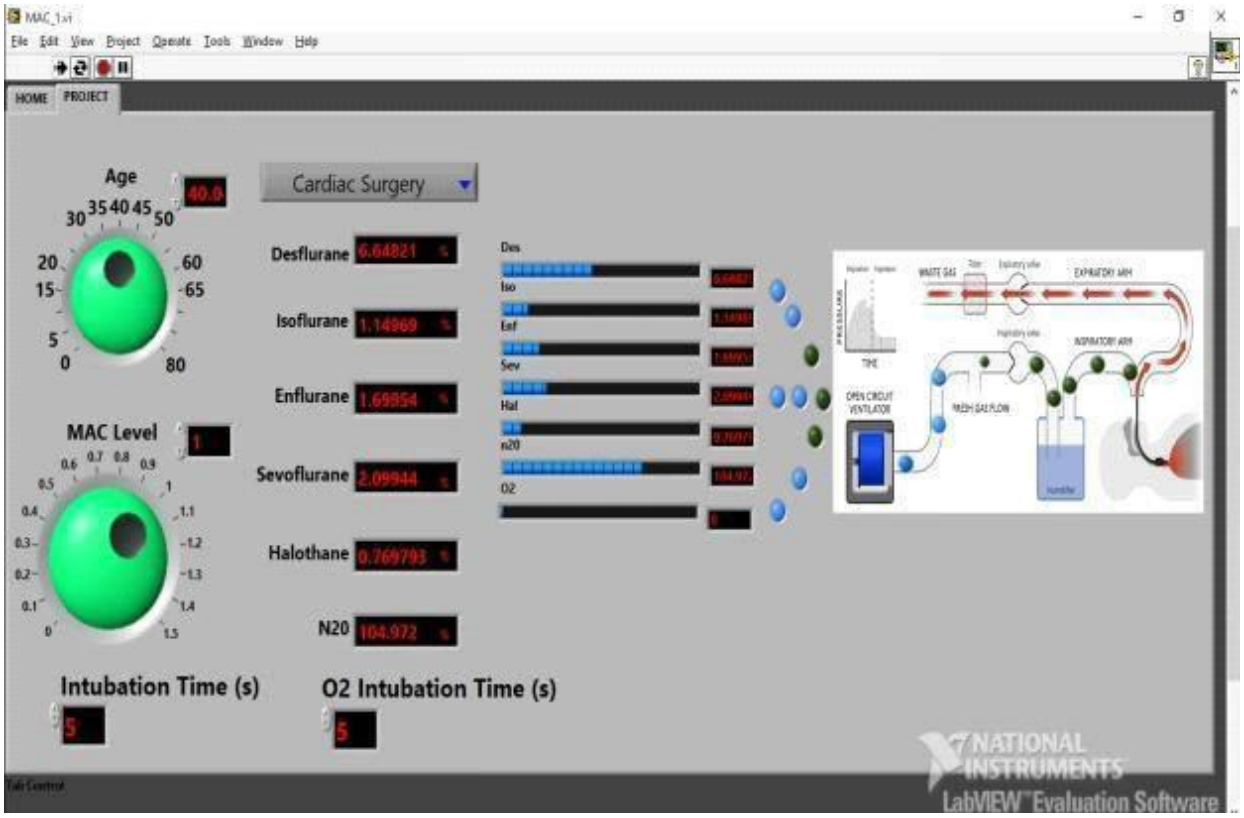
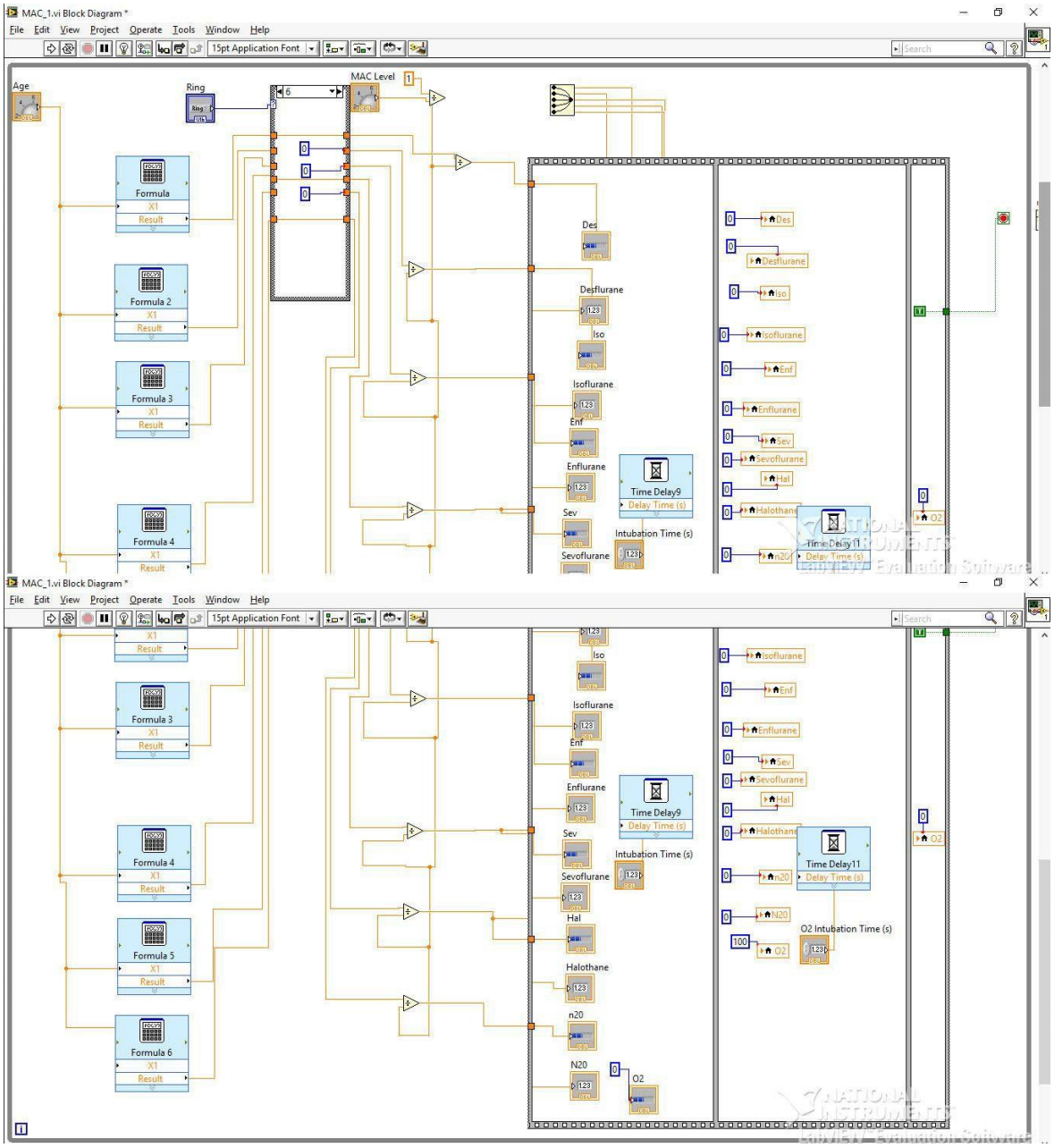


Fig 6.2 Front Panel

6.3 BLOCK DIAGRAM PANEL



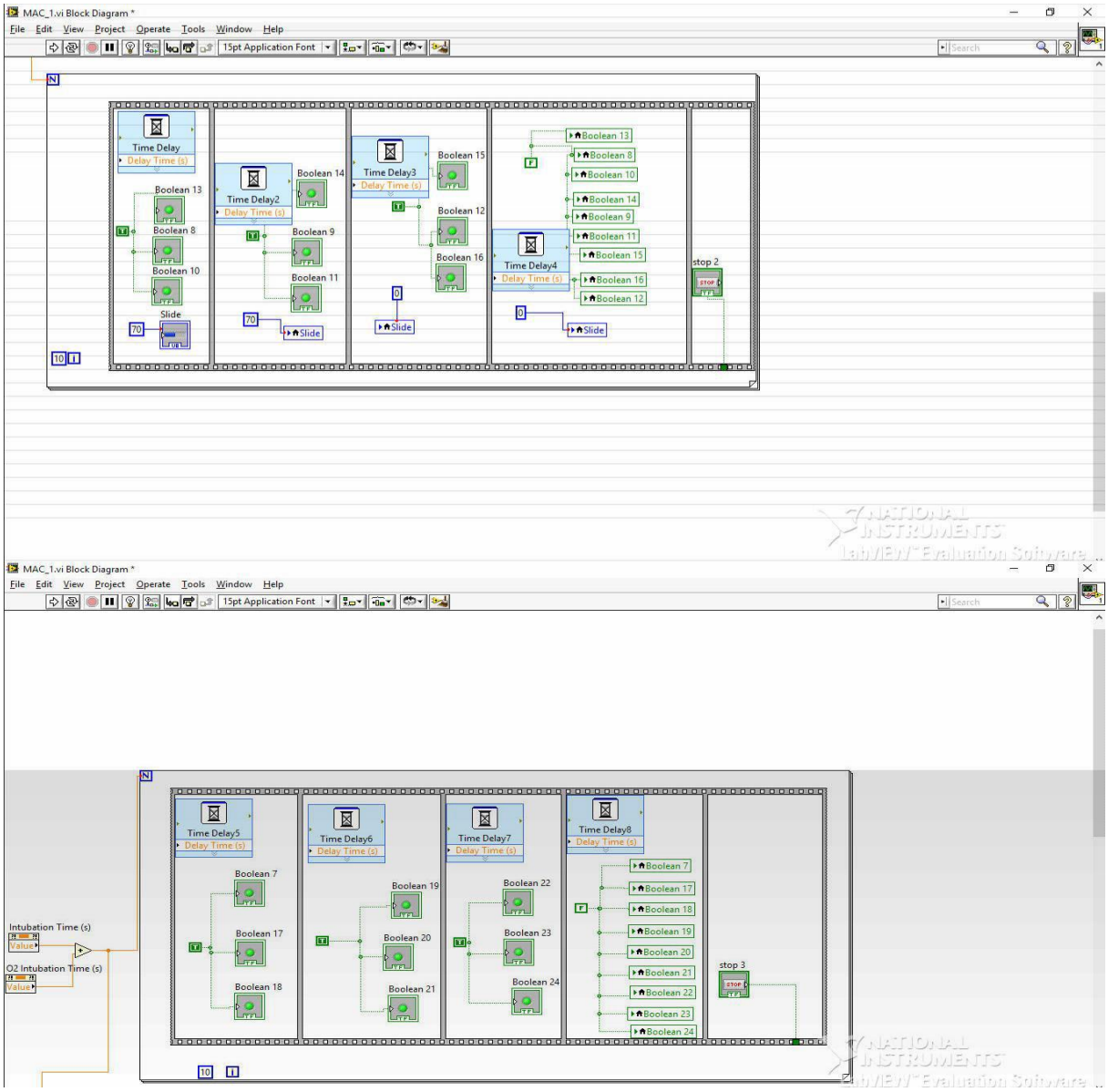


Fig 6.3 BLOCK DIAGRAM FOR PANEL

6.4 QR CODE GENERATION

DETAILS OF THE PATIENT:
1.NAME:
2.AGE
3.HEIGHT
4.WEIGHT
5.SURGERY DETAILS &PHYSICAL FITNESS CERTIFICATE

Fig 6.4 QR OF PATIENT DETAILS AND PATIENT DOCUMENTS

6.5 SIMULATION USING PYTHON

6.5.1 INITIALIZING ANESTHESIA MACHINE USING PYTHON

Fig 6.5.1 Turning on the Anesthesia Machine

6.5.2 GETTING INPUT FROM QR CODE AND PASSING INPUT TO THE MACHINE

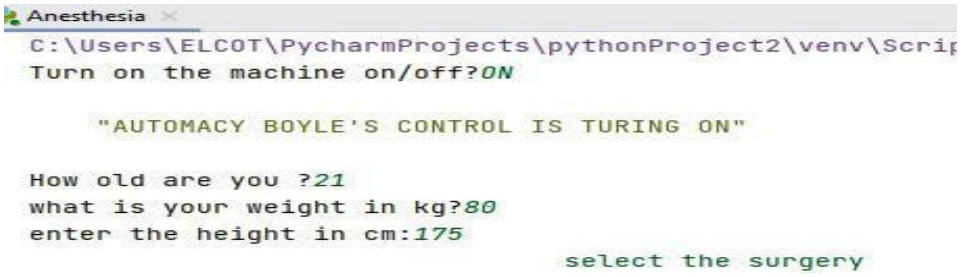


Fig 6.5.2 Implying inputs to the Anesthesia Machine

6.5.3 SELECTING SURGERY

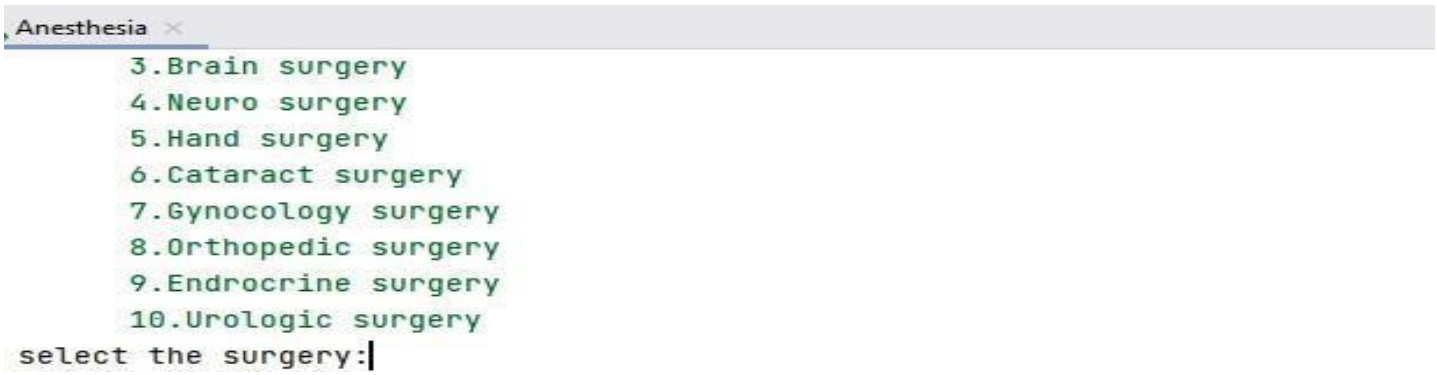


Fig 6.5.3 Selecting surgery type

6.5.4 SETTING MAC VALUE BY THE HELP OF ANESTHESIAN

Fig 6.5.4 Mac value implied by Anesthesian

6.5.5 CHECKING BLOOD PRESSURE ,SPO2 ,HEART BEAT,BODY TEMPERATURE

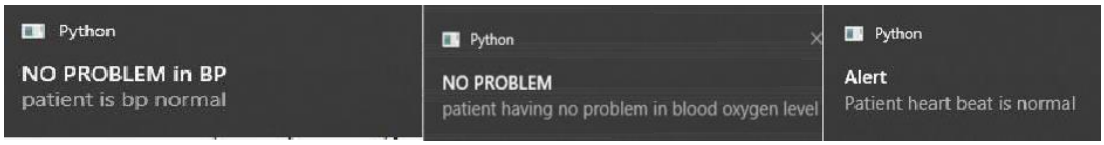


Fig 6.5.5 Imply MAC value and monitoring biomedical parameters

6.6 FUTURE SCOPE

- There have been many attempts to incorporate automation into the practice of anesthesiology, though none have been successful.
- Fundamentally, these failures are due to the underlying complexity of anesthesia practice and the inability of rule-based feedback loops to fully master it.
- Recent innovations in artificial intelligence, especially machine learning, may usher in a new era of automation across many industries, including anesthesiology
- It would be wise to consider the implications of such potential changes before they have been fully realized.

6.7 RESULT AND DISCUSSION

The proposed process for Automated Anesthesia Control System using My-Open-Lab delivers drugs with medical gases when needed without the overview of an Anesthesiologists. By incorporating this software in an anesthesia machine the workload of anesthesiologists will be greatly reduced and the lethal effect of the patient by managing uneven dosage of anesthesia can be avoided. Thus the proposed work is better in all ways compared with the existing systems.

CHAPTER 7

LIST OF PUBLICATION

7.1 PUBLICATION SUMMARY

We are participated in the ”international conference on science, innovation, sustainable, technology - safety, health and environment 2022 (SIST-SHE22)” conducted by Sathiyabama institute of science and technology on the title of “Automacy Boyle’s Machine Control using My Open Lab and Python.”

AUTHORS: S.Sridhar, S.Syed mohamed ,K.Dileep, S.Sathish

ISBN : 978-93-83409-70-9

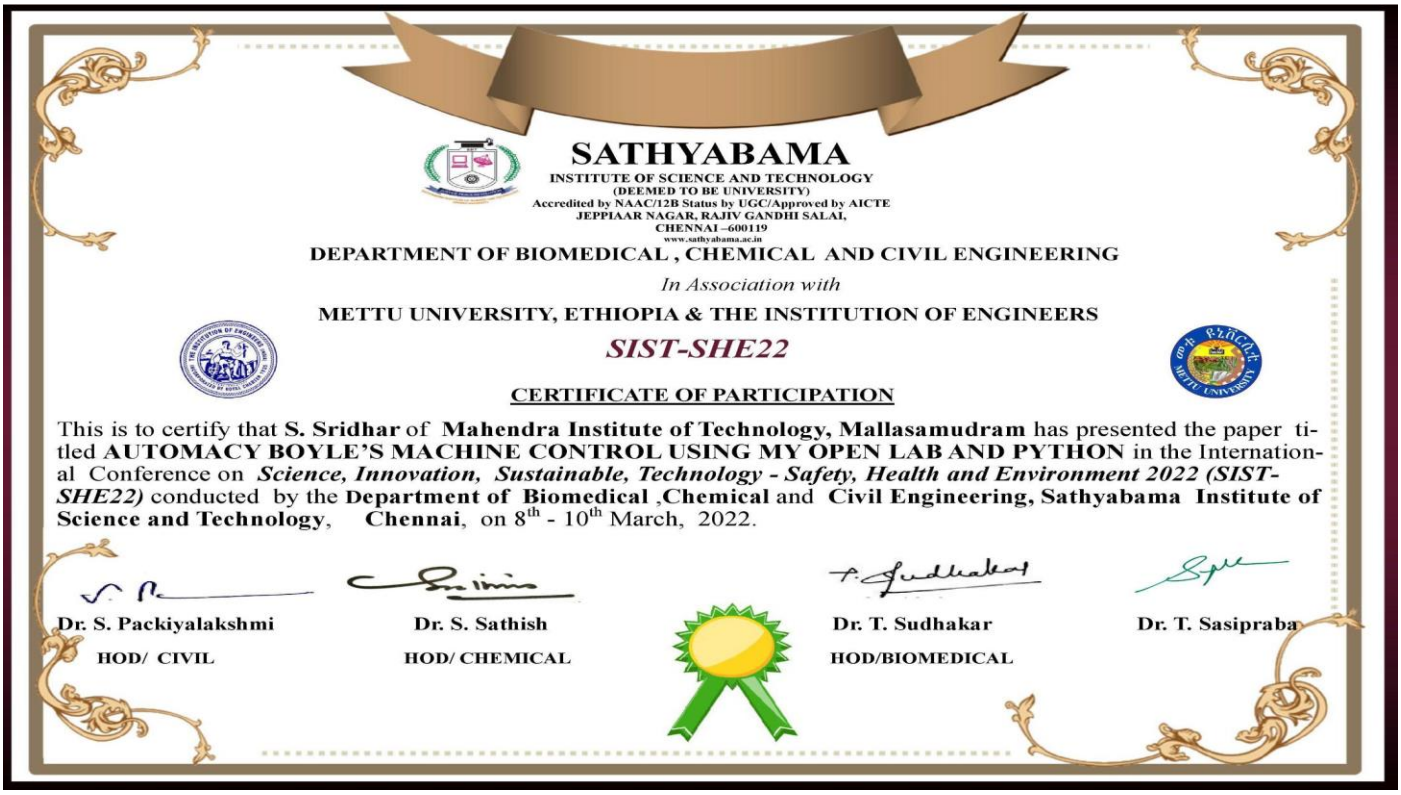
PAGE.NO:61

DATE:08/03/2022

7.2 CERTIFICATE ATTACHMENT

CERTIFICATE 1

POSITION: TEAM LEADER



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DEPARTMENT OF BIOMEDICAL , CHEMICAL AND CIVIL ENGINEERING

In Association with

METTU UNIVERSITY, ETHIOPIA & THE INSTITUTION OF ENGINEERS

SIST-SHE22

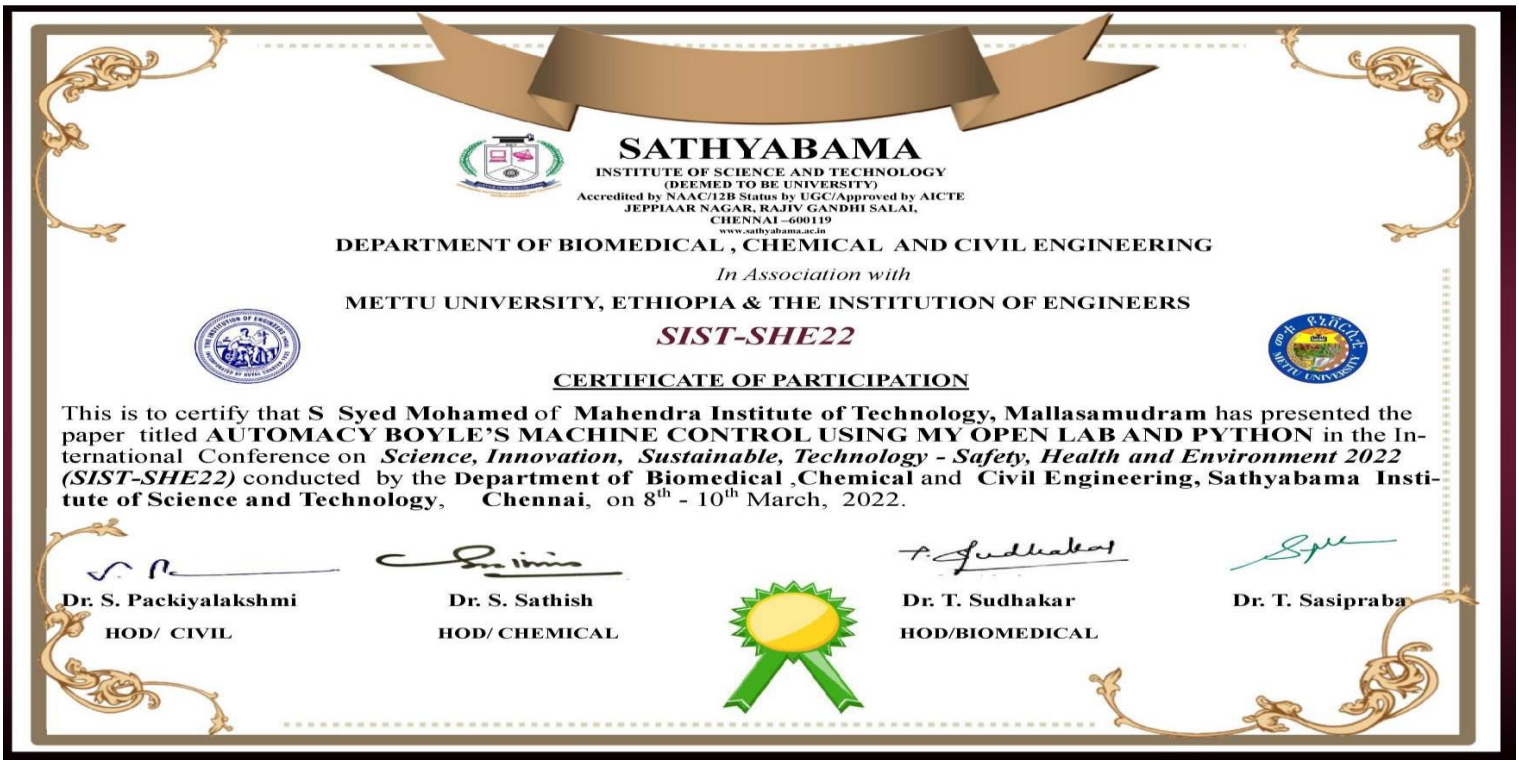
CERTIFICATE OF PARTICIPATION

This is to certify that **S. Sridhar** of **Mahendra Institute of Technology, Mallasamudram** has presented the paper titled **AUTOMACY BOYLE'S MACHINE CONTROL USING MY OPEN LAB AND PYTHON** in the International Conference on ***Science, Innovation, Sustainable, Technology - Safety, Health and Environment 2022 (SIST-SHE22)*** conducted by the **Department of Biomedical ,Chemical** and **Civil Engineering, Sathyabama Institute of Science and Technology**, **Chennai**, on 8th - 10th March, 2022.

Dr. S. Packiyalakshmi — HOD/ CIVIL
Dr. S. Sathish — HOD/ CHEMICAL
Dr. T. Sudhakar — HOD/BIOMEDICAL
Dr. T. Sasipraba

CERTIFICATE 2

POSITION: TEAM



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Dr. T. Sudhakar — HOD/BIOMEDICAL
Dr. T. Sasipraba

CERTIFICATE 3

POSITION: TEAM MATE

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Dr. S. Packiyalakshmi — HOD/ CIVIL
Dr. S. Sathish — HOD/ CHEMICAL
Dr. T. Sudhakar — HOD/BIOMEDICAL
Dr. T. Sasipraba

CERTIFICATE 4

POSITION: TEAM MATE

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HOD/ CIVIL	HOD/ CHEMICAL	HOD/BIOMEDICAL	

CHAPTER 8

CONCLUSION

In this chapter, the proposed design for software units are demonstrated in detail. The design is proposed in such a way to make it available and suitable to implement it in anesthesia equipment in future. There are exciting and challenging times for anesthesiologists and critical care specialists. Faced with the current and future challenges of their profession – global shortage, multitasking, medico legal issues, necessity for providing safe and efficient anesthesia in complex environments, increasing organizational and management tasks – anesthesiologists will have to turn to technologies to help them perform to the highest standards. Interoperability and connectivity of medical devices is necessary; international standards should be established to facilitate this. TCI systems decrease the workload and might have the potential to help anesthesiologists to provide better patient care. Closed-loop systems are the basis of automation in anesthesia. Once they overcome regulatory hurdles, they will provide automated anesthesia with very little human interaction and at distance (TELE ANESTHESIA).

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