## Theme: Automation the pouring process of the sikaflex to automobile window.

# Plan:

1. Introduction
2. Modeling
3. Structure of diagram
4. Functional diagram
5. Economic productivity
6. The safety of life activity
7. Conclusion
8. Literature

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# INTRODUCTION

The practical mechanisms in stimulating the development and introduction of the outcomes of scientific and applied research works and innovations into the processes of modernization, technical and technological renewal of production capacities, securing more closer connection of science and production were epitomized in the resolution of the **President of the Republic of Uzbekistan "On Additional Measures to Encourage the Introduction of Innovation Projects and Technologies into the Production Process" linked 15 July 2008.(1)** In accordance with this document, annual national fairs of innovation ideas, technologies and projects are being held in Uzbekistan with an enthusiastic participation of scientific, educational and production institutions.Our educational system is sharply rising step by step in every year. Definitely, we have several conditions for new generation. In every possession huge of opportunity for everyone. In our country under the leadership of our President Islam Karimov are centered on shaping an innovation-based economy built on the intensification and evaluation of competitiveness of production capacities by the way of qualitative renewal with the help of cutting-edge technologies.From the first years of independence, the adaptation of the Academy of Sciences to new socio-economic realities, the arrangement of starting conditions for the production of science intensive goods that meet the requirements of the domestic economy and capable of competing in the world market, the formation of academic specialists of new generation who wield an innovation oriented thinking – all this has been accompanied by the adoption of a range of normative documents. **These have included the resolutions of President of the Republic of Uzbekistan "On Measures to Boost the Coordination and Management in the Promotion of Science and Technologies" signed 7 August 2006.(1)** Our country has been making remarkable achievements on this front. Uzbekistan is pursuing an active industrial policy designed to provide sustainable, high rates of economic growth and a shift of focus from the production of raw materials to finished products with higher added value. The industrial policy involves the selection of priority sectors whose development can generate not only a direct effect by increasing production and creating jobs but also a multiplier effect.

The latter is derived from the fact that the sector's products are used by other sectors or that the sector increases demand for the products of other sectors. In other words, priority should be given to the sectors that are capable of creating and extending the multiplier effects to the whole economy.(2)The development of Uzbekistan's own engineering and R&D capability is an essential condition for realizing the potential of intersectorial cooperation. The R&D sector should initially be developed at the laboratory attached to the local branch of Turin Polytechnic University, which must be encouraged to realize the potential of R&D not only for the automobile complex but in other, allied sectors as well. Achieving the objective of increasing the indirect benefits from the auto making sector also requires reform of the administrative system in the industry. Specifically, the current model, in which the majority of auto-complex enterprises are subsidiaries of the auto industry, does not create sufficient incentives for these enterprises to introduce innovations and expand and diversify their products. In order to create the necessary incentives and, therefore, favorable conditions for the development of allied sectors, a system should be created in which these enterprises will have a large measure of autonomy and the auto industry will be able to choose its contractors (e.g. on the basis of competitive bidding).(2) Given these facts, the main objective of industrial policy is to activate this potential and transform the auto industry into a driver of growth for the priority sectors and, therefore, Uzbekistan's entire economy. Uzbekistan has already taken the first step to achieve this objective. At this stage the auto industry has managed to become a driver of growth for enterprises inside the automaking cluster. For example, the auto industry complex today has more than 200 localizing enterprises, has set up processes for more than 260 new types of components, and the level of localization exceeds 50% for new models and 80% for the Nexia and Matiz models. For all of the pluses, its main deficiency is that the entire benefit is confined to the auto making complex and is not providing the necessary impetus for the development of other sectors.(2) I study at Andijan Machine Building Institute. My direction is Automation and Management of Technological Process of Production. I am interested in Industrial robots. When I practiced in GM Uzbekistan. I took a lot of information about several kinds of industrial robots.

For example, Fanuc M- 20iA this robot is pouring of the sikaflex to automobile window. Fisrt of all, Fanuc mechanism was difficult but after some time I understood how it  works. I have had new idea about new version of  upside-down. I decided to take this researching work because of  robot technology gives people many benefits including the opportunity to improve one's knowledge and be more persistent and experienced in this world. What is the robot industry and what are robots?

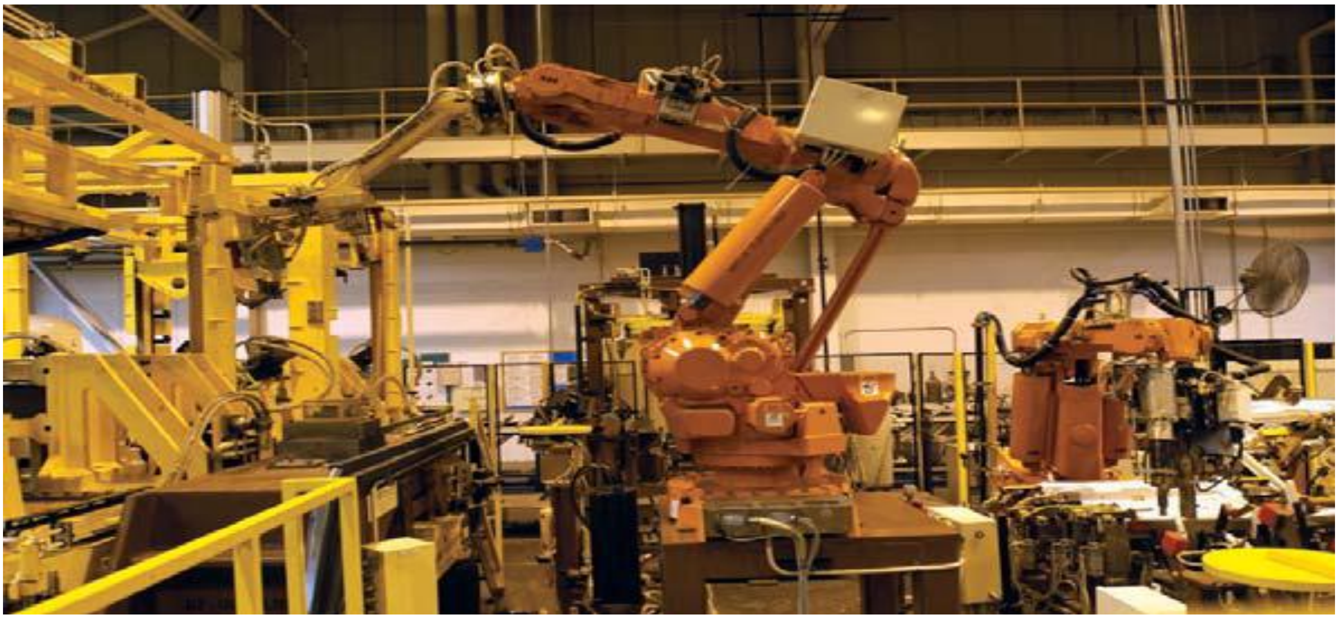
Nowadays we can not imagine our life without new technologies.In automobile manufacture  Technological Processis increasing by industrial robots.In the last 10 years new entrence  to the robot market have started to changing things.

## ROBOT FANUC

The medium size industrial robot is rarely used in the automative industry but is used in many others including die casting, plastics and handling. Because of their combination of useful payload and compact size they are becoming more popular. Both sides have their advantages and disadvantages.Used a great deal in food processing they are often equipped with vision system to allow the robot to pick scattered parts from a high speed conveyor. Most delta robots have a low capacity and a small work envelope. However there is now some variation, with lower and higher capacity deltas available from Collaborative robots are the latest big thing in the robotics industry.

These robots are designed to work alongside the human workforce and there are several ways in which this can be done.Joints are compliant and flexible, the arm is taught through the leading it to each position manually. Although this type of teaching has been about for many years, especially for paint robots, it is unusual that this is the prime programming tool.Lowering the acceleration and power of the arm, laser scanners to detect people, having force feedback to detect collisions and even padding the arm allow the robots to be safer to work around.(3) The main benifit of collaborative robots is they do not need the guarding and other safety systems required on a traditional robot. This saves space and cost but is also very valuable in modern production where flexibility is important. Collaborative robots are also usually very easy to reprogram so they can be repurposed within minutes.

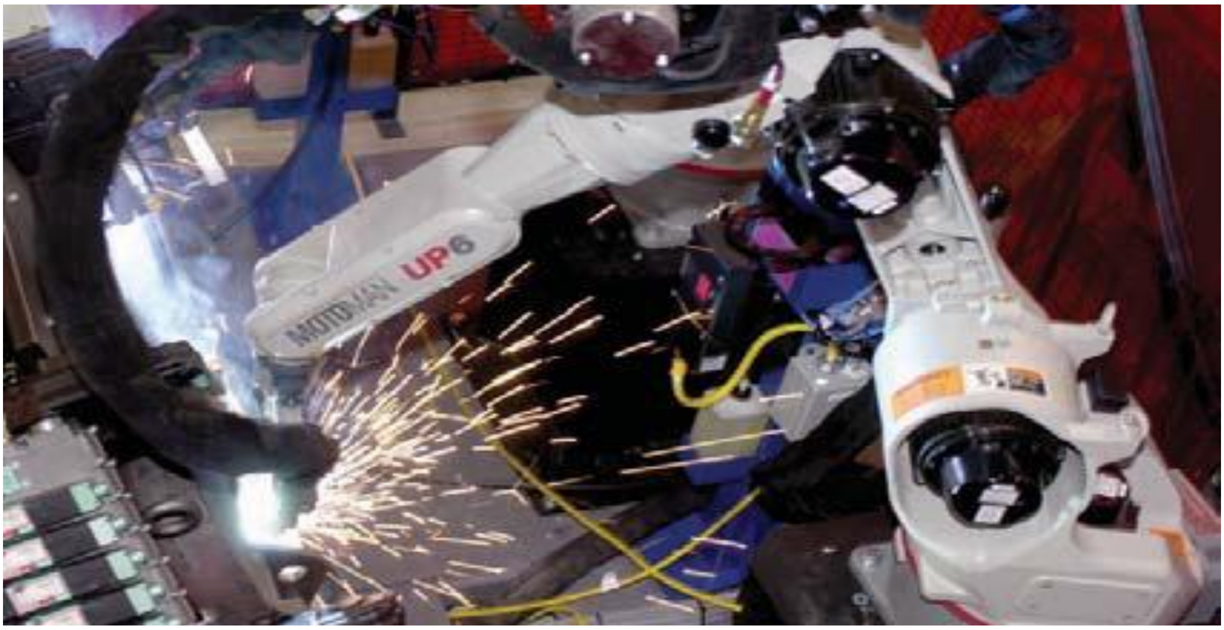
## ROBOT ABB



They have historically made big strategic partnerships such as GMF (General Motors Fanuc)in the North American Merket. This has led to some issues such as having different software and programming in different parts of the world as well as different space on cabling and controllers. There are also local differences in business strategy, with some regions being keen to offer full installation services while other regions are more helpful to third party integrators. Fanuc have been historically thought of as being secretive, closed off and obsessed with the colour yellow!

This is gradually changing not least because of increasing foreign investment in the company specifically Third Point.They have recently launched a series of green collaborative robots.(3) These have a foam padding over the arm, to help protect human colleagues and have some features seen in other collaborative machines.Recently Fanuc Japan has taken control of GMF andthere seems to be a drive to homogenise their products and company strategy somewhat.One noticeable thing is that while most robots of this type are very small with sub 15kg capacity fanuc has some collobrative robots in the 50kg range.

## ROBOT Motoman




So what's next for the industry? Well there are some other factors to consider. There are too few good engineers already and the demand for robotics is increasingly rapidly. The cost of robotic hardwere is still dropping rapidly and processing power is obviously getting much cheaper too. So the chage will happen here. Robots must become even easier to install for new customers.I'm sure the existing types of integrators and programmers will still have a very substantial role in many applications and they will still be in massive demand. But many robots will have to be installed without them.So we will have an increasing number of a new type of robot user. Well actually there is already a huge number of them, people that simply work with robots.

. As programming and integration becomes more intuitive, cost barriers to entry come down and industries face the fact that automation is essential, there will be many more robot users that feel confident to program and install.One of the common surprises to new users of industrial robots is that the robot is sensors and of course programming to make it work.They generally know their own production environment better then anyone else so it is often easier for them to implement a robotic installation. In short the robot users of tomorrow will be us, me, everyone and anyone that wants to automate somethig.(4)

There are many types of industrial robot available today. Although some are fairly specialised most are highly adapteble.The most common, the 6 axis anthropomorphic arm, is widely recognised as the standartrobot arm and available in a range of size but even then there are significant variations to be aware of.


These are the mainstay of the industrial robot industry and are found in almost every car plant in the world, usually in lines of 100 or more. Capable of carrying a heavy, water cooled spot welding gun and positioning it to within 0.1 mm they have become strong, fast and exeptionally reliable.Robots are classified according to a number of features but the main two are reach and payload. The payload is simply how much the robot can carry on the end of the arm, note this includes any gripper or tool. The reach is obviously the area the robot can get to and is measured to the faceplate of the last axis as the tool can vary.So a robot must beautomatic, reprogrammable, multipurpose and multi-axis.

This makes robots separate from single purpose machines such as CNC mills although in terms of components and controls they may be very similar. There are Beam robots which are multi axis linear actuators, but here we are looking at robot arms.There are several large well established robot manufacturers and an increasing number of new entrance to this rapidly expanding market. Some try to offer the complete range of automation solutions and some specialise in specific areas.(4) One thing is for sure, some are better at some things then others. Knowing this and therefore which company to choose is an important and occasionally costly decision.

Industrial **robot** as **defined** by **ISO 8373:** An automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more asex, which may be either fixed in place or mobile for use in industrial automation applications.


INTERNATIONAL STANDARD

ISO 10218-1

Robots and robotic devices — Safety requirements for industrial robots —

Part 1:
Robots

**Safety Standards for Applications of**

**Industrial Robots**

*ISO 10218-1, ISO 10218-2

*Related standards and directives

*Safety Functions of Industrial Robot

Controller

*Review of basic safety-related functions

*Supervision functions

The robot industry has been traditionally dominated by the big 4 – ABB, Kuka, Yaskawa and Fanuc.

ABB,Fanuc, Kuka, Yaskawa, Comau, Kawasaki and Nachi all have models. They are ot just used for welding, they are also used for assembly, machine tending, packing and a thousand other applications. Becouse they are produced in such large numbers these are among some of the best value robots, especially on the burgeoning second hand market.Frustrated by the limitations of existing robots they decided to throw out the status and start from a different perspective, making a light easy to program robot.Using an intuitive display it can be programmed easily even by complete novices. This significantly reduces the costs of installation and makes the robot more quickly adapted to new tasks. In the picture the controller is on the move tab.(4) On the left of the large colour touchscreen are various linear movements that the robot can make. On the right is a real time image of the robot's position and the positions of each axis, again these can be moved individually. A move can be simulated before it is executed if required. Although none of these functions is individually groundbreaking the combination with the very easy to understand interface is a significant improvement.

**Asea Brown Boveri** is one of the big industrial robot companies. They have a world wide presence and were one of the pioneers of the industrial robot industry. ABB Group is a very large multinational with orders of $41.5 Billion in 2014. The manufacture of Robots is just part of their business but is considered a core business and central to their corporate identity.(5)

Although Gomtec were only just launching on the market they have a very interesting product that will benefit significantly from having ABB's might behind it.

**Fanuc** are one of the big 4 robot companies, possibly the biggest in the world presently, and have supplied many automotive manufacturers. Their robots are generally very well made, accurate and long lived. Their programming is quick for experts but not especially easy for novices. Fanuc have shown good profitability as a company and have a great track record.

**Kawasaki**are a household name for their motorcycles but they also make bridges, ships and industrial robots. They are not technically always the most adventurous but they are dependable and affordable machines. Their core market has been automotive but are increasingly diversifying into new areas. Their slogan “Simple Friendly” does quite a good job of summing up their robots.

**Kuka** (Keller und Knappish, Augsberg) originally supplied gas equipment especially for welding and cutting. This expertise in welding led them to develop the first electrical spot welder. Kuka have been at the forefront of much of industrial robot development. The S shaped arm design that Kuka originated has now been widely used as it allows a compact, lightweight, arm with a large reach.Kuka were also the first to use a Windows based controller and to use carbon fibre extensively in a mass produced robot arm.(5)

Mitsubishi have a dedicated fan base in many industries and so have gradually improved, rather than revolutionised, their product line. Widely used in the automotive industry they have a good range of 6 and indeed 7 axis robot arms. The 7th axis is in the the vertical part of the robot arm giving a great deal of additional, if not always useful, flexibility. Now,  global workforce of over 4,000.Sawyer is a simpler single armed robot with a more industry biased remit, going after the relatively safe and easy machine tending sector. A nice touch is that the robot’s names are historical profession names, an acknowledgement that times change and jobs are created and made obsolete

Real world applications include transferring automotive bodies from line to line and moving large drums of chemicals. Palletisingrobots, or indeed palletizing robots are robots designed specifically for handling work. This usually involves stacking onto shipping pallets- however they are also commonly used for unstacking and transfer from line to line of items. The key feature is that the top arms of the robot forms a parallelogram.

This keeps the end of the robot horizontal in all positions and eliminates two axis of movement. This makes the robot cheaper to produce, simpler to program and most importantly reduces weight allowing increased payload and speed. In many palletizing applications cycle time is critical and one specialist palletizer robot can be as fast as two "standard" 6 axis machines. Suction grippers could also be used in an application such as this and would allow the robot to more easily pick up varying sizes of item, but with two disadvantages; suction cups wear over time and cannot hold on as tightly as a mechanical grip, sometimes limiting the acceleration that the robot can use in an application- hence limiting cycle time.(5)

# Modeling

Mankind has always been interested in creating a better life-conditions, preventing natural disasters as far as he existed. Thus, it is natural for humans to learn the natural phenomena.

People interpret the outer world differently, and have different perceptions about it. That's the reason why it is used different methods in understanding the real world and its phenomenon. There is a unique theory that learns and applies the formal problems of modeling.

The experts of exact sciences learn only the certain properties of processes which they are interested in. For instance, geologists learn the history of lands, how and they were developed, what kinds of animals lived, what kinds of plants grew, and how the climate has changed over the years, so forth. That helps them to find natural resources. However, they do not deal with human evolution - which is learnt by historians.

By learning the world that surrounds us we may get some incomplete and unclear information about it. But this does not bother us to fly into outer space, identify atomic nuclear secrets, and learning the laws of social development and so on. Taking that into account, a model of a process or an object is created. That model should depict the properties of those processes as complete as possible.(6)

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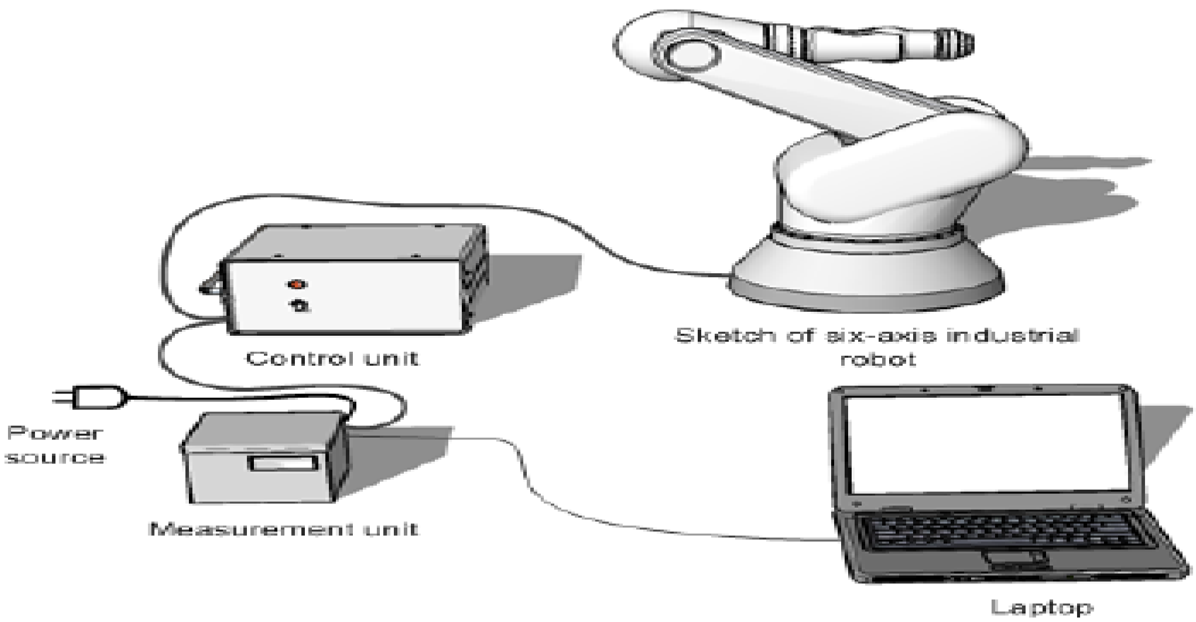
Object is an item or a process which we pay attention. The model's character of approximation can be seen in different shapes. As the accuracy of used instruments during the experiment influences how accurate the result will be.

Modeling is applying the objects with their models, creating and learning the models of objects and processes. Nowadays, modeling is widely used in science. Modeling makes the process of scientific experiments easy, sometimes it becomes a unique method in learning complex objects. The significance of modeling so high in learning the abstract objects, or objects that are far away, or micro objects. Modeling method is also used in the field of physics, astronomy, biology, and economics and it is used in defining only exact properties and interactions of objects. Nowadays, there is a technology of modeling via computers the purpose of which is to accelerate the process of understanding, clarifying, and identifying the changes in society, incidents in the nature that surrounds us through modern methods.




Learning modeling through computers requires knowledge of computer systems and the ability of using technologies of modeling. Using programming languages in computers has had a huge impact on mathematical modeling methods.

With the help of the latest computers with "Pentium" processor of XX century, it is possible to create different shapes of models, to learn the processes in computers such as: graphics, diagrams, animations, multiplications, so on. There is an opportunity of animating model on display with different shapes. Modeling real existing systems plays the main role in scientific and practical experiments. The point of Modeling is that there established an interaction of similarity between the two real-existing or abstract systems. Of these two systems, if the first one is simpler compared to the other one to apply, then it is possible to make a conclusion by observing the characterization of the first system about the properties of the second system. In this case, the system used for experiment is called a model. Learning the properties of objects through mathematic models, is called mathematical modeling. Its purpose is to identify optimal conditions of processes, managing through mathematic models, and to apply the results into an object. We can divide models into 3 groups regarding their application category: abstract, physic and biologic.(6)

Abstract models include mathematic, mathematic-logic models and etc. Physic models include diminished mock-ups, different instruments, training instruments and so forth.Structure of living organisms includes mathematic and mathematic-logic characterization of regulations concerning mutual relations and tasks. This started approximately starting from XVIII century. F. Kene tried to show the formation of the first intact social, repeated-manufacturing process in his "Economical tables".Various models are used while learning the direction of different functions of economical systems. The most essential regulations of economical development are checked with the help of the models of national economy. To analyze and foretell different complex indexes, such as: national income, employment, consumption, savings, funds, correlation and dynamics of investment indexes, - huge economical models are used. To control exact household status, small economic systems are used, to control complex economical systems, basically, mathematic models are used. The conception "Mathematic model" is the main definition of mathematic modeling method. *Mathematic model* is approximate description of any event or the process of outer world and is expressed with the help of mathematic symbols.

Mathematic modeling includes 3 interrelated steps:

1. Organizing mathematic characterization of the object which is being studied.
2. Choosing solving method of equation system of mathematic characterization, and applying that as modeling program.
3. Determining adequacy of the model into the object.

In the step of organizing mathematic characterization, the main elements and event are separated beforehand, then their interrelations are specified. Afterwards, an equation or a system of equations are made up that reflects functionality for every single element and event that were separated. Besides, for mathematic characterization, related equations are introduced for the interval of different separated events.

According to the ratio of the process, mathematic characterization can be expressed as the system of algebraic, differential, integral and Integra-differential equations.

## Robot workspace estimation algorithm in a space with obstacles

The main objective of the proposed algorithm is to estimate the modified WS of a given robot due to obstacle presence in its accessible region depending on its shape and relative position to the robot base. This problem is formulated as an optimization problem performed using genetic algorithm for which a brief note is given in the next sub-section.

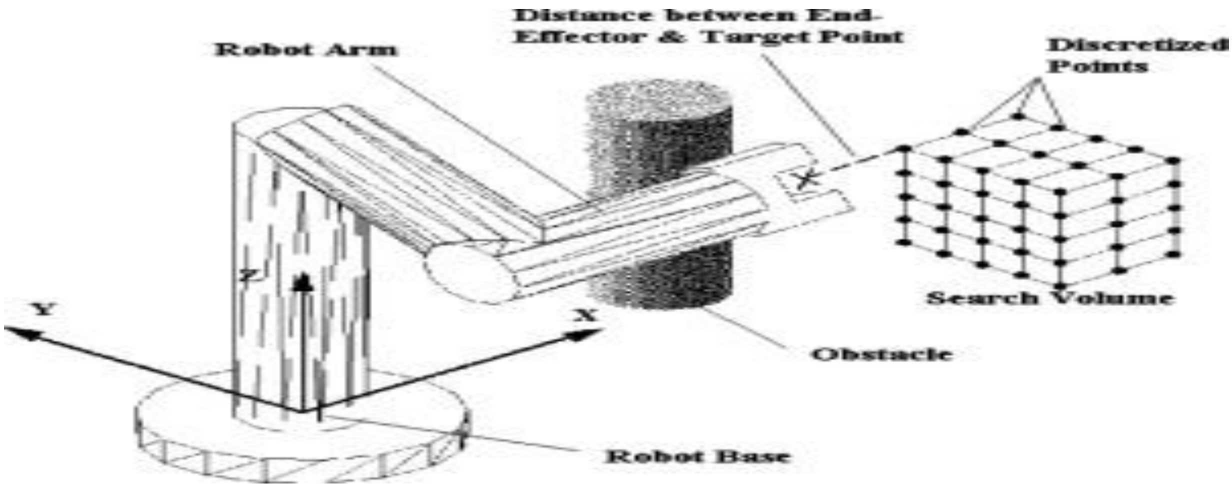
### Basic technique employed

The predefined search volume (SV) is discretized as a group of finite points as shown in Every point in the SV is considered as a target point for the robot to reach and the evaluation of each target is made based on the capability of the robot to reach such a point without having any of its links interfering with obstacles.

Search volume discretization.

The proposed algorithm can be effectively used to solve the inverse kinematic position model (IKPM) by formulating the problem as an optimization problem. The objective function of the optimization problem is to minimize the distance between the robot end effector and the target points with a constraint of not having any of the links interfering with any of the obstacles present in its working space.

The optimization problem is solved using real-coded variables genetic search. The objective function to be minimized is described in Eqs. (1) and (2),




Equation(1)

$$\text{Minimize} \quad f(x) = \{(x_{\text{TCP}} - x_{\text{Target}})^2, (y_{\text{TCP}} - y_{\text{Target}})^2, (z_{\text{TCP}} - z_{\text{Target}})^2\}$$

Equation(2)

$$\text{Subject to:} \quad \sum_{i=1}^{n} \{(x_{\text{link}} - x_{\text{obstaclej}})^2, (y_{\text{link}} - y_{\text{obstaclej}})^2, (z_{\text{link}} - z_{\text{obstaclej}})^2\} \geqslant V_{\text{avoid}}, \; j = 1, \ldots, n$$

Where:

$x_{\text{TCP}}$ is the x position of the robot end effector

$y_{\text{TCP}}$ is the y position of the robot end effector

$z_{\text{TCP}}$ is the z position of the robot end effector

$x_{\text{Target}}$ is the x position of the target point

$y_{\text{Target}}$ is the y position of the target point

$z_{\text{Target}}$ is the z position of the target point

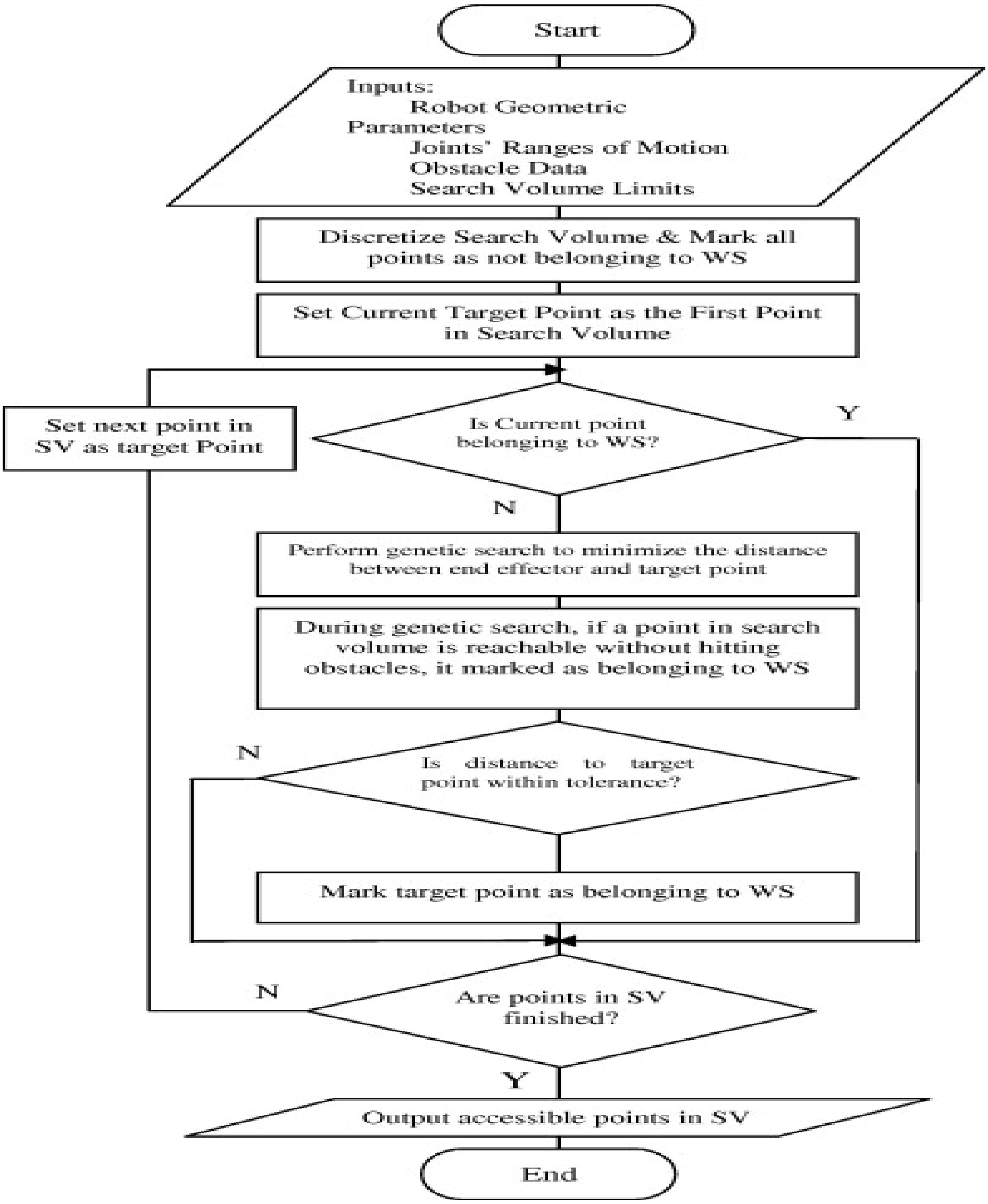
$j$ is the total number of obstacles

$V_{\text{avoid}}$ is the minimum distance to avoid robot collision with obstacles

In this figure shows the flow chart explaining the computational rational of the proposed algorithm. Inputs to the program include robot’s geometric parameters and joints’ ranges as well as obstacle data.

Verification of WS estimation technique

To verify the developed computational algorithm and judge its efficiency and capabilities, two types of industrial robots are used the SCARA and the PUMA robots. The SCARA robot is used for its simple WS shape, which will enable the detection of any bugs or errors in the developed algorithm. The obstacle in the SCARA robot accessible region is chosen to have a simple cylindrical shape to study its effect on the whole robot WS, while for the PUMA robot, the obstacle is chosen to have a rectangular cross section with a height exceeding the robot maximum and minimum limits.(6)



Computational algorithm flow chart.

Initially, all points are marked as inaccessible points. The algorithm then repeats a genetic search for each target point trying to find a combination of joint positions that minimize the distance between the robot end effector and the target point without interfering with any obstacles.

Industrial robots are programmable, multi-function manipulators designed to automate tasks such as welding or the movement of materials through variable programmed motions. Robots are capable of performing a wide variety of tasks and are an integral part of automated manufacturing systems.The headquarters of the company originally known as Asea Brown Boveri is located in Zürich, Switzerland. The company focuses on automation and power while building industrial robots.(6)

**Acceleration-Level** - The measure of variation of joint speeds over time. Double and single differentiation of this level gives the overall change in position and change in position overtime, respectively. Refer to position-level and velocity-level.

**Accuracy** - A measure of a robot's capability to repeat the same task multiple times without changing the closeness to a certain point.

**Actuator** - A piece of equipment that allows a robot to move by conversion of different energy types such as electrical or mechanical processes using liquid or air.

**Algorithm** - A list of steps used to find a solution to a given problem.

**Analytical Methods** - A mathematical way to solve problems without repetitive attempts to approximate an answer.

**Application Program** - A sequence of steps that specifies what jobs the robots will perform. The program can be personalized by the owner to fit specific designs.

**Attended Continuous Operation** - Robots are observed while carrying out assigned applications at a minimum speed.

**Attended Program Verification** - A worker in the restricted area checks the robots assigned jobs at the specified speed to ensure proper working conditions.

**Automatic Mode** - The state when the robot begins self-moving operations.(7)

**Automatic Operation -** The robot executes the programmed jobs without worker involvement.

**Computer-Aided Design -** (CAD) Computer software is used to develop and/or alter all aspects of design such as the end product, the system, machinery used etc.

**Computer-Aided Manufacturing -** (CAM) Computer software is used to design and/or alter the manufacturing process.

**Conservative motion -** The end-effector and joints always move in their specific route.

**Control Device -** An instrument that allows a person to have control over a robot or automated system for times such as startup or an emergency.

**Control Program -** The control information built into the robot or automated system that allows for possible behaviors. The control information is not expected to be altered.

**Coordinated Straight Line Motion -** The Tool Center Point follows a specific path allowing the axes of the robot to come to their specified end points at the same time. This allows for a smooth operation of movement.

**Cylindrical Robot -** The axes of the robot correspond to a cylindrical coordinate system.

**Degrees of Freedom -** The amount of values in a system possible of variation. A robotic joint is equal to one degree of freedom.

**Device -** Hardware used to control various parts of a system.

**Interface -** The separation between robots and the equipment not nearby. The sensors that are required for communication between the devices use signals relaying input and output data.

**Interlock -** The control of a device starting or stopping is dependent upon the action of another device.

**Internal Sensor -** An apparatus within the manipulator arm that sends information on motion to a control unit.

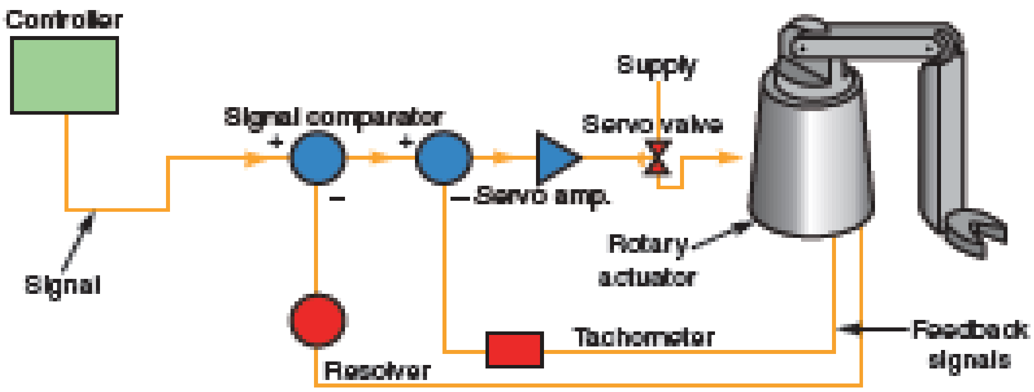
**Inverse Kinematics -** Determination of a joint's overall change in position based on restrictions on the end-effector’s motion of a robot.(7)

**Maintenance** - Ensuring that robots and manufacturing systems are working properly and repairing any problems observed.

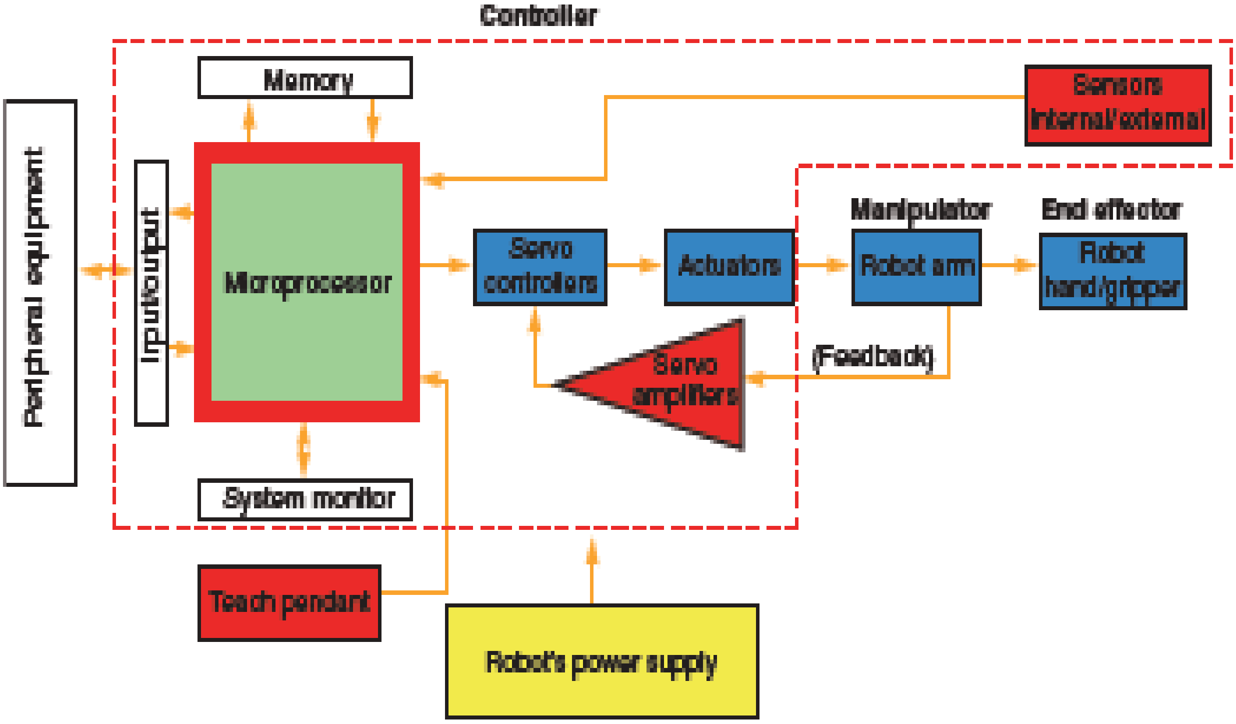
**Manipulator** - Allows for movement of a part through multiple joints on the mechanical device also known as the arm of the robot.

**Manual Programming** - The user physically sets specific tasks and limits on the robot

## Functional diagram




## Structure diagram



An **Upside down robot** is a manipulator designed to move materials, parts and tools, and perform a variety of programmed tasks in manufacturing and production settings. Industrial robots are reshaping the manufacturing industry. They are often used to perform duties that are dangerous or unsuitable for human workers. Ideal for situations that require high output and no errors, the industrial robot is becoming a common fixture in factories.

The Upside down robot is a good fit for many applications. It is most often used for arc welding, material handling, and assembly applications. They are grouped according to number of axes, structure type, size of work envelope, payload capability, and speed. A robot controller provides the interface for programming and operating the industrial robot. A device called a teach pendant is used to plot the motions needed to perform the application. An Upside down robot arm includes these main parts: Controller, Arm, End Effector, Drive, Sensor The **controller** is the "brain" of the industrial robotic arm and allows the parts of the robot to operate together. It works as a computer and allows the robot to also be connected to other systems.

The robotic arm controller runs a set of instructions written in code called a program. The program is inputted with a teach pendant. Many of today's industrial robot arms use an interface that resembles or is built on the Windows operating system. **Upsidedown robot arms** can vary in size and shape. The Upside down robot arm is the part that positions the end effector. With the robot arm, the shoulder, elbow, and wrist move and twist to position the end effector in the exact right spot.(8)

Each of these joints gives the robot another degree of freedom. A simple robot with three degrees of freedom can move in three ways: up & down, left & right, and forward & backward. Many industrial robots in factories today are six axis robots.

The ***controller*** is the part of a robot that coordinates all movements of the mechanical system It also receives input from the immediate environment through various sensors.

# Upside down robot

The heart of the robot's controller isgenerally a microprocessor linked to input/output and monitoring devices.

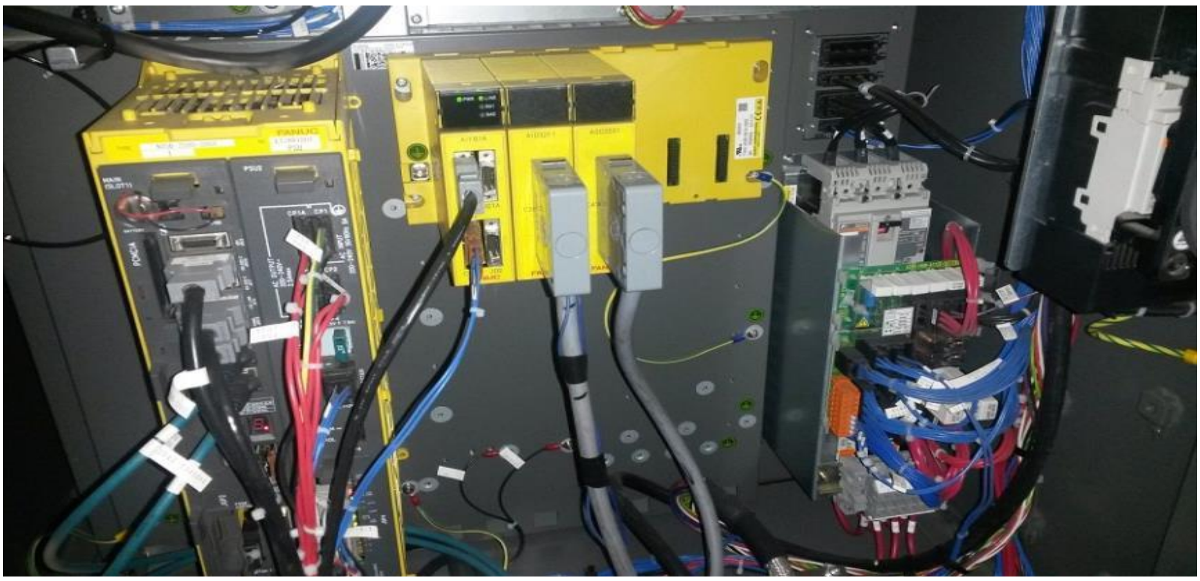
The commands issued by the controller activate the motion control mechanism, consisting of various controllers, amplifiers, and actuators. An *actuator* is a motor or valve that converts power into robot movement. This movement is initiated by a series of instructions, called a ***program***, stored in the controller's memory. The controller has three levels of ***hierarchical control***. Hierarchical control assigns levels of organization to the controllers within a robotic system. Each level sends control signals to the level below and feedback signals to the level above. The levels become more elemental as they progress toward the actuator.

Each level is dependent on the level above it for instructions. The means for programming is used to record movements into the robot's memory. A robot may be programmed using any of several different methods.

The ***teach pendant***, also called a teach box or handheld programmer, teaches a robot the movements required to perform a useful task. The operator uses a teach pendant to move the robot through the series of points that describe its desired path.(8)

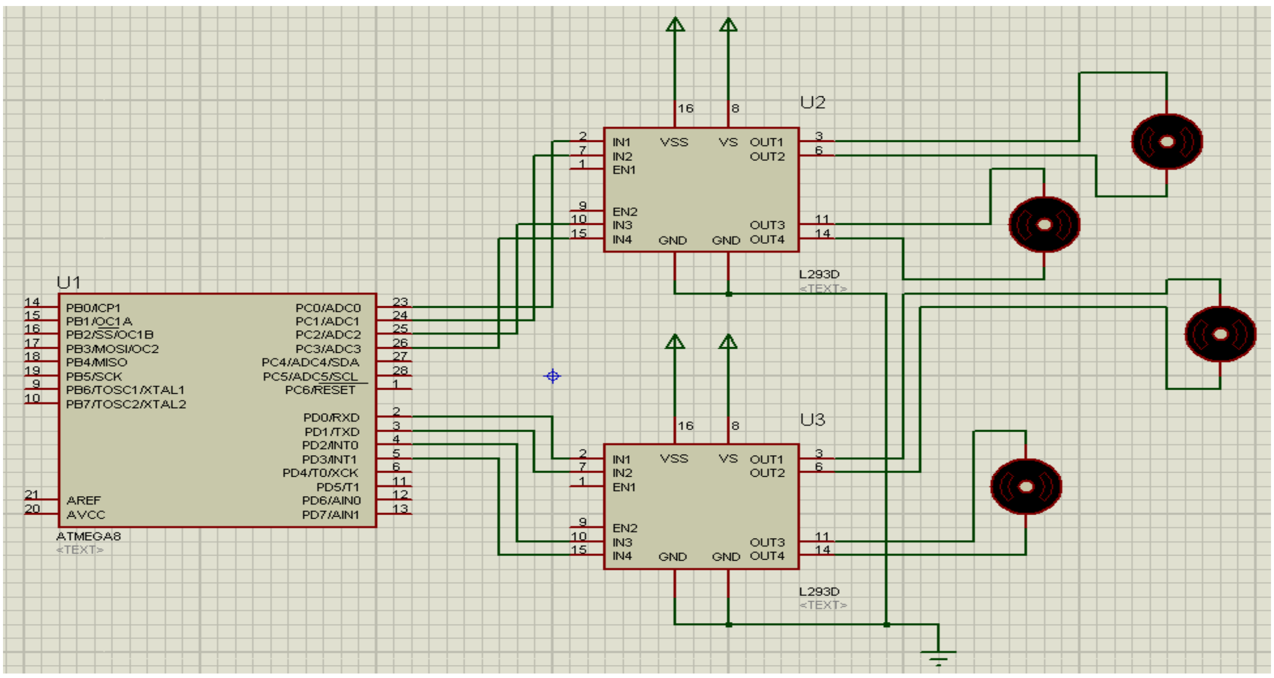
These robots are dedicated to performing repetitive manufacturing tasks that are often unsafe or unpleasant for human workers.

They are designed to repeat the same process over and over without change. Modern industrial robots can easily be programmed to perform new applications.



While not necessary for every robot work cell, a PLC is recommended for many robot systems, especially those that are more complex.

A valuable interfacing component, PLCs manage the communications between controllers, parts positioners, robots, safety peripherals, and more. Industrial robots are programmable, multi-function manipulators designed to automate tasks such as welding or the movement of materials through variable programmed motions. Robots are capable of performing a wide variety of tasks and are an integral part of automated manufacturing systems.(8)



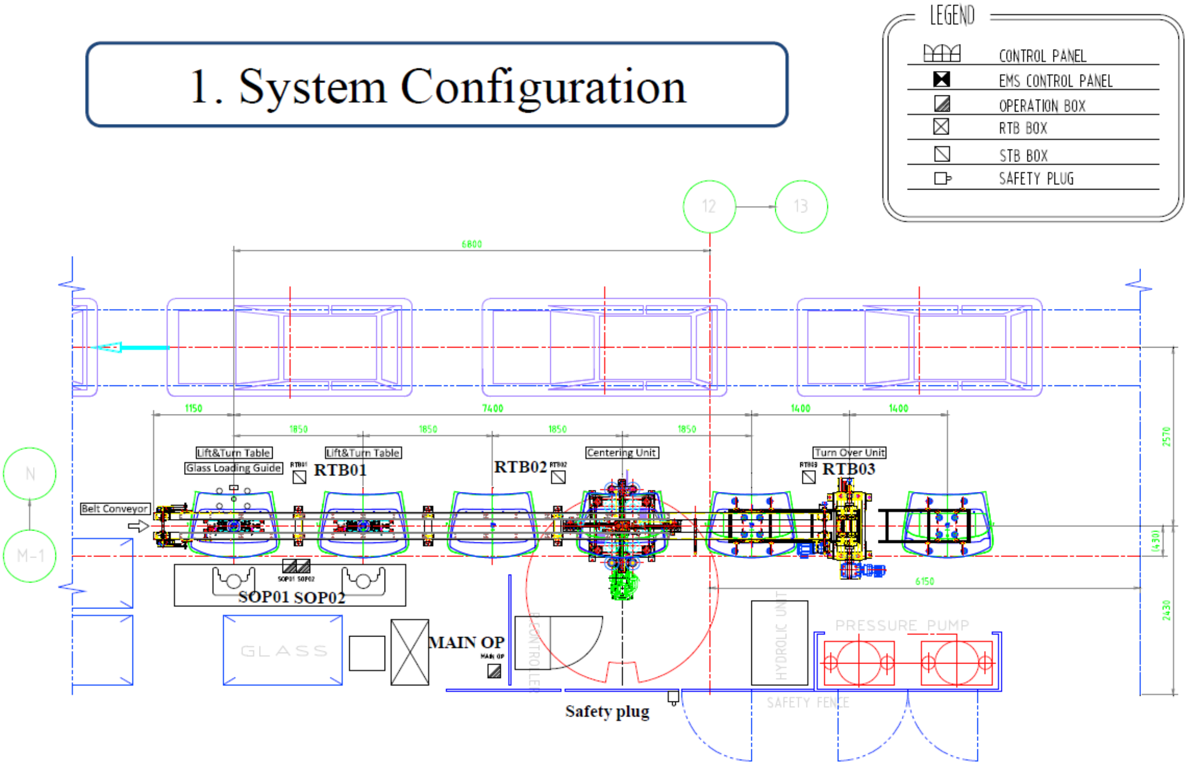
Code

```
#include <mega8.h>
#include <delay.h>
void main(void)
{
PORTB=0x00;
DDRB=0x00;
PORTC=0x00;
DDRC=0xff;
TCCR0=0x00;
TCNT0=0x00;
TCCR1A=0x00;
TCCR1B=0x00;
TCNT1H=0x00;
TCNT1L=0x00;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;
ASSR=0x00;
TCCR2=0x00;
TCNT2=0x00111110;
OCR2=0x00;
MCUCR=0x00;
TIMSK=0x00;
UCSRB=0x00;
ACSR=0x80;
SFIOR=0x00;
```

```
ADCSRA=0x00;
SPCR=0x00;
TWCR=0x00;
while (1)
      {
PORTC.0=1;
delay_ms(333);
PORTC.0=0;
PORTC.2=1;
delay_ms(333);
PORTC.2=0;
PORTD.0=1;
PORTC.0=1;
delay_ms(400);
PORTD.0=0;
PORTC.0=0;
PORTD.2=1;
delay_ms(300);
PORTD.2=0;
PORTD.6=1;
delay_ms(300);
PORTD.6=0;
delay_ms(500);
```

| | |
|---|---|
| **Functional diagram** | List |

# Structure diagram




# UrethaneSealingEquipment

# HighViscositySealPump

| Size | 1000×650×1580H (MAX 2555 H) | Elevator | Twin |
|---|---|---|---|
| Weight | 265kg | Elevator Press Force | Force 1100kg (Air Pressure 0.5 Mpa) |
| Ratio | 70:1 | Pumping Mechanism | Reciprocating Double Action |
| Capacity | 190 ml/st | Air Motor Diameter | ϕ240mm |

## Sikafleks Material storage condition

Adhesive chemicals are comparable with paint therefore the storage condition must be between 20°C and 25°C. Before you use the material put the drums 2 days at the line.

**What to do in case of application breaks**

Depending on the duration of a break it is recommended to follow the instructions below:

**Interrupt < 5 minutes**

Further applications can be carried out without flushing or cleaning the system

**Interrupt < 20 minutes**

The adhesive begins to cure in the nozzle. Flushing the system with approx. 250ccm of Sikaflex®-250 UZ 1 is recommended

**Interrupt - 1 hour**

The adhesive in the nozzle can be cured in a small area. It has to be removed (can be done by flushing). Recommended is approx. 250ccm of adhesive.

**Interrupt - 8 hour**

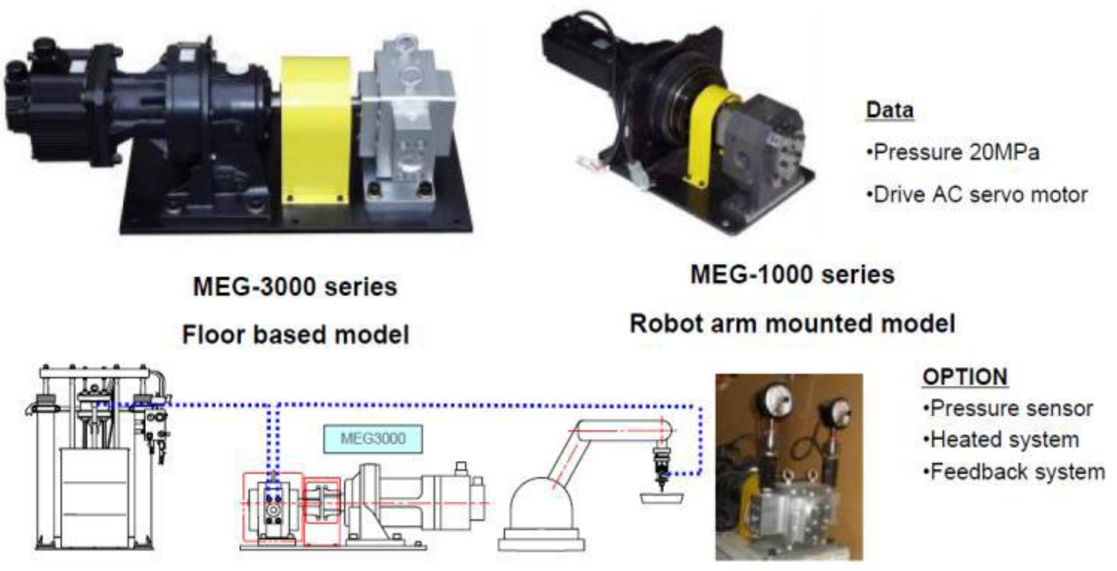
The adhesive in the nozzle is cured and has to be removed (manually). It has to be ensured that the nozzle doesn’t break the flow of the adhesive through cured parts in the nozzle. Flush the system with 500ccm once or twice.

**Interrupt > 24 hour**

Setback the temperature to 30°C – 35°C The adhesive in the nozzle is cured and has to be removed (manually). It has to be ensured that the nozzle doesn’t break the flow of the adhesive through cured parts in the nozzle. Flush the system with 500ccm two of three times.

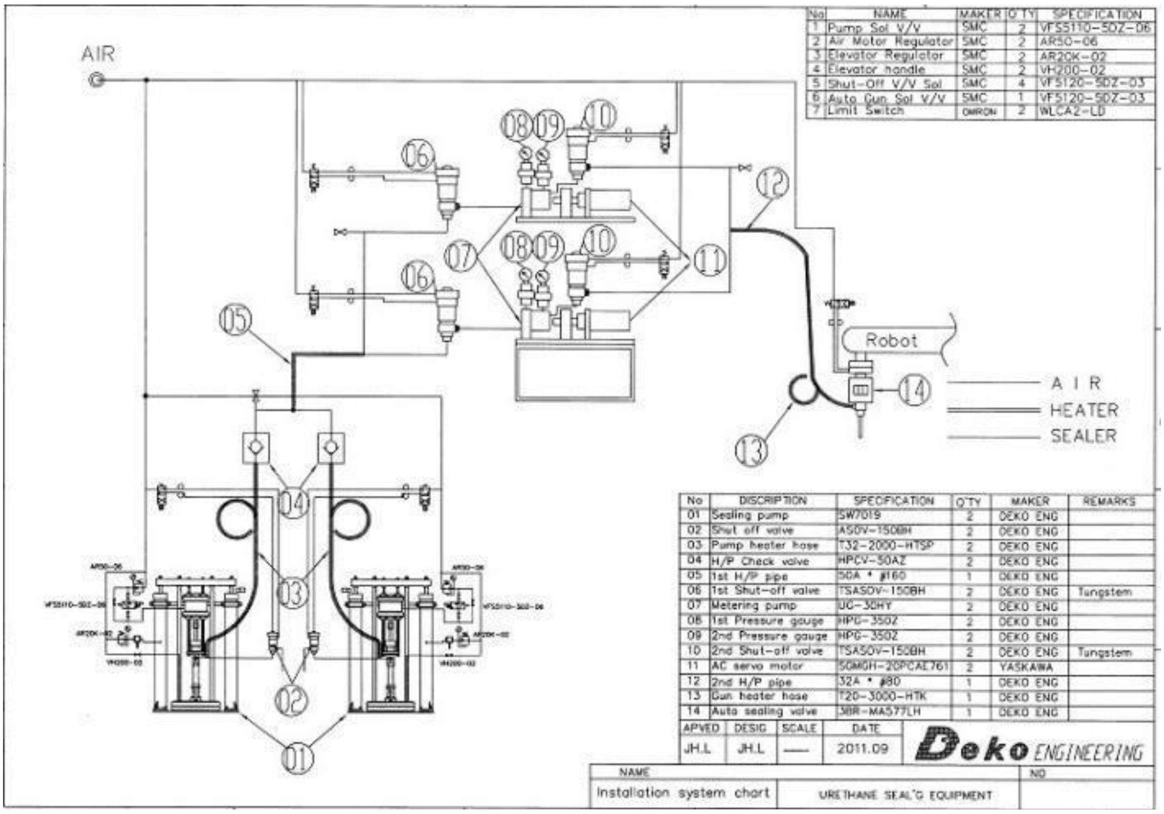
**Breaks of 2 – 4 weeks (vacation, company holidays)**

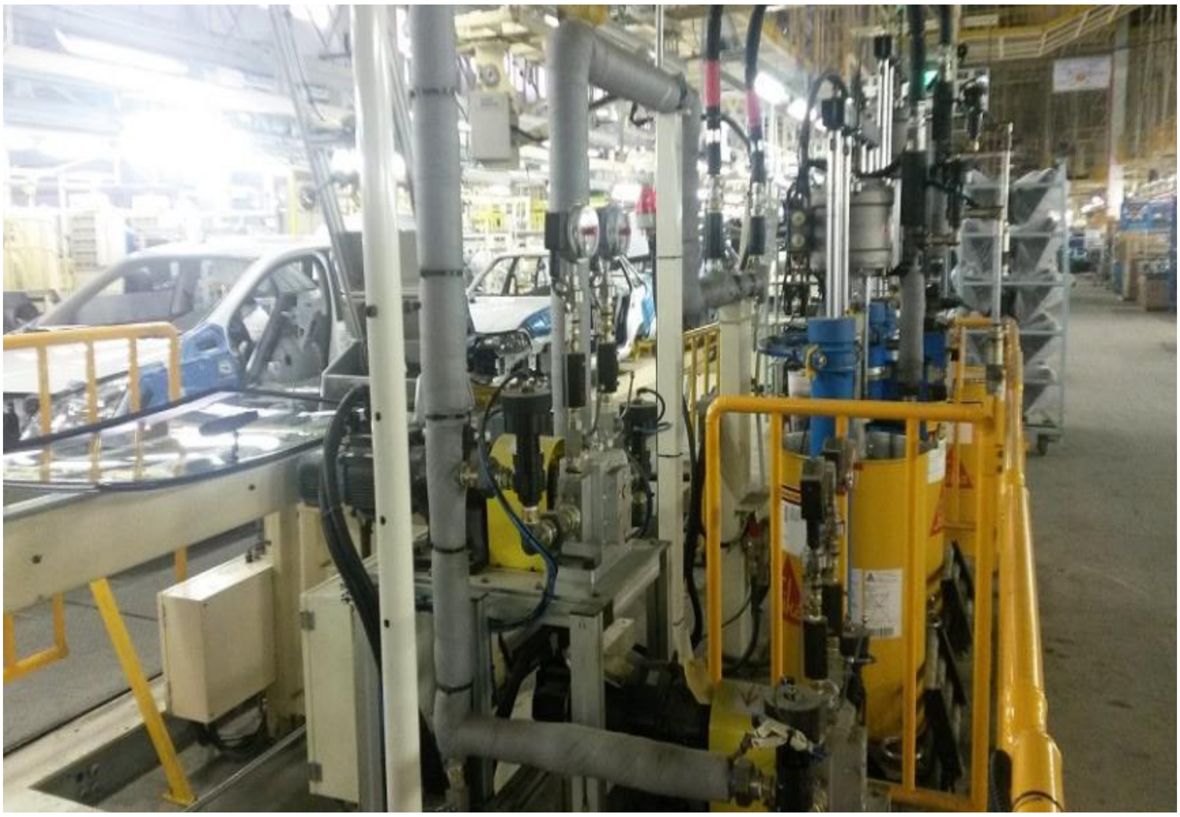
Switch off the heating devices. Remove the pump pressure and conserve the application head by using a plastic nozzle. As long the adhesive is within shelf life the drum can be left under the pump. For preserving a system for a longer time (such as several months, several years) it can be flushed with Sika®Cleaning-Paste HV. To reuse the system it has to be flushed thoroughly with adhesive again (see cleaning instruction).




| Model | Capacity | Flow rate | Motor capacity | Weight |
|---|---|---|---|---|
| MEG-3000 | 30ml/rev | 1560ml/min | 1800 W | 130Kg |
| MEG-1000 | 10ml/rev | 900ml/min | 400 W | 14Kg |

# Functional diagram



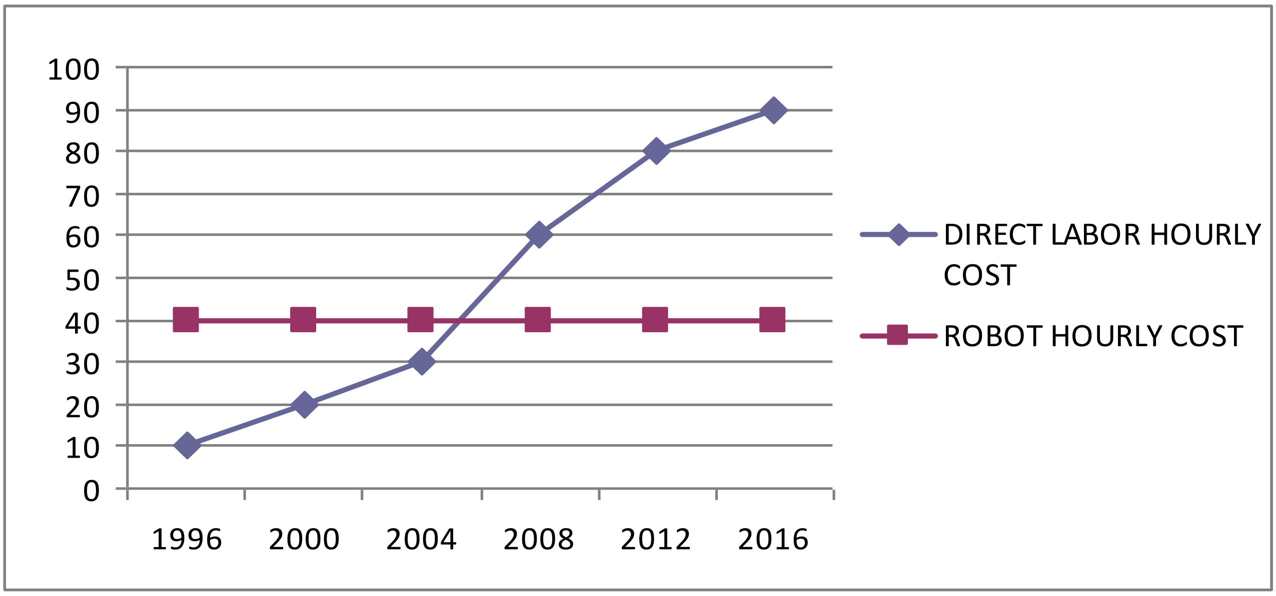



## Economic productivity

In most cases, the major factors justifying the use of robotic technology for manufacturing are economic. An industrial robot manufacturing system represents a sizable capital investment and, it is hoped, an even more sizable return on investment. Noneconomic factors provide certain intangible benefits that may justify using robotic technology. Some of these factors are increased productivity, improved quality and utilization of materials, performance of hazardous operations and undesirable tasks, advancement of manufacturing technology, adaptability, competitive and management direction.(9)

## Noneconomic factors

In most cases, increased productivity results from the robotic ability to maintain a constant pace throughout the entire work shift, rather than the robotic ability to perform tasks faster than a person. In some cases, a person can outperform a robot in the speed with which a task is completed especially in some complex manipulative tasks. However, a person usually cannot maintain this performance level for an entire shift because of fatigue. Generally, robotic technology provides a tireless worker and increased productivity by maintaining a constant rate of production for extended periods of time. The average cycle time for parts tends to be lower for robots. The result is that more parts are produced per shift, and this increased productivity represents an economic gain as shown in Fig HOURLY COST



These advantages are realized through the consistent operation of the robot. Once an optimum procedure is defined and programmed into the robot for a particular task, that task will be consistently performed in the optimum manner every time. The result is fewer bad parts that have to be scrapped, less material waste, and measurable economic gains.

Robots are frequently used to perform operations that are potentially hazardous to human workers, usually to comply with safety regulations. These hazardous operations include press loading and unloading and working in toxic atmospheres or extremes of ambient temperatures. Improved safety can result in reduced operating costs and provide some economic justification. However, a robotic solution to safety problems may not always be economically desirable, and wisdom dictates that alternatives also be investigated.(9)

Robots can be used to perform some undesirable tasks, and the result is additional cost savings. If ignored, workers complaints about poor working conditions (excessive noise, dust, fumes, heat, dirt, heavy loads, fast pace, or monotony) can lead to work stoppages or slowdown, uncompleted operations, poor workmanship, high labor turnover, absenteeism, grievances, or sabotage and can result in higher-than-normal operating costs. Compensation may require overtime to make up production losses, rework and repair, and expenses for processing grievances, hiring replacement personnel.

A robot may be introduced for the advancement of technology. In such applications, one or a limited number of robots may be installed for developmental purposes. The intent here is to gain knowledge and expertise required to implement similar robotic applications in an actual production setting where economic benefits are more direct. Economic returns are usually realized in the follow on production applications. In fact, the costs of a developmental implementation are often factored into the cost of the follow on production application.

Industrial robots are adaptable whether programmable or not, most have a degree of adaptability that allows them to be moved around or used in different types of tasks. There by increasing their usefulness and potential return on investment.

However, few mangers will accept the adaptability of a robot as a justification for installing one without a plan for how it can and will be used as a justification factor unless a serious implementation plan is established. Usually the feasibility of adapting to other applications will diminish as development progresses owing to the enhancements specifically designed for the primary application (tooling, facilities layout). Adaptability is an intangible asset that may become useful in a contingency situation.

Enhancement of competitive position has both direct and indirect economic implication. Direct benefits are obvious. Lower production costs resulting from the use of robots give a manufacturer a pricing advantage over his or her competitors. The inherent flexibility of robot manufacturing systems indirectly affects the economics. Shifting market demands are easy met by increasing or decreasing production rates on various products without changing the size of the work force. New products also can be introduced quickly and easily, often with little change to production facilities.(9)

Occasionally, a robotic implementation may be made on the basis of management direction. This alone is a poor justification for implementation, especially if the determination is not based on economic considerations. Projects based solely on this type of impetus tend to have a low success rate. Efforts to comply with a directive may result in careless choice of robot or application. The application may become more complex than first anticipated, or the robot may not have the necessary capabilities to perform the tasks. Aside from the obvious waste of capital, a bad experience may discourage management from further attempts to implement robotic technology, even when other potentially successful applications may exist.

Although the previously discussed factors should pay a key role in the evaluation of robotic installation, the weight of the final decision should rest on a firm economic foundation. Economic considerations fall into two major categories: cost avoidance and cost savings.

## Economic analysis

There are numerous methods of economic analysis for any capital investment. The selection of a method depends on the size of the investment, the amount of risk involved, the projected life of the investment, company financial condition, whether or not the investment is for new or replacement equipment, management policy, and many other criteria determined by the situation.

An economic analysis is basically a systematic examination of a complex business activity that will aid in making a decision about a capital investment by providing a basis upon which to make a decision. If the analysis is undertaken to justify a decision already made, the true purpose of the analysis is misguided.

In general, there are two situations for which an economic analysis is used. The first situation involves investment in equipment for a new application or to avoid costs: the second involves an investment to replace an existing method.(9)

In the first case, the purpose of the analysis is to be based on investment cost compared to savings over  the an exiting method. There is no absolute measure of profitability because the savings depend as much on how bad the present method is as on how good the proposed method is.

The life cycle of a capital investment will typically follow a pattern, as shown in Fig . Initially, money flows out until the project comes on line. From then on, savings first recover the investment and then produce net earnings. The project first breaks even and later recovers all of the earlier negative cash flows to produced net earnings.

# The safety of life activity

In machine tending applications the Fanuc M-20iA offers better handling possibilities compared to conventional solutions as it can access machines either from the top or the side. In addition, overhead rail mounted robots provide open access in front of machines for maintenance work, handling of short batches and quick changeovers, etc. As a result, personal safety is improved, as the robot is not present when operating the machine manually.(10)

Safety requirements for collaborative Robots and Applications

**Safety Standards for Applications for industrial robots**

ISO 10218-1, ISO 10218-2

Related standards and directives

**Safety functions of Industrial Robot Controller**

Review of basic safety-related functions

Supervision function

**Present Standardization projects**

ISO/TS 15066 – Safety of collaborative robots

Biomechanical criteria

**Safety Standards for Applications of Industrial Robots**

ISO 10218-1

**Robots and robotic devices – safety requirements for industrial robots**

Scope Industrial use, controller, manipulator, main references ISO 10218-2-Robot systems and integration.(10)

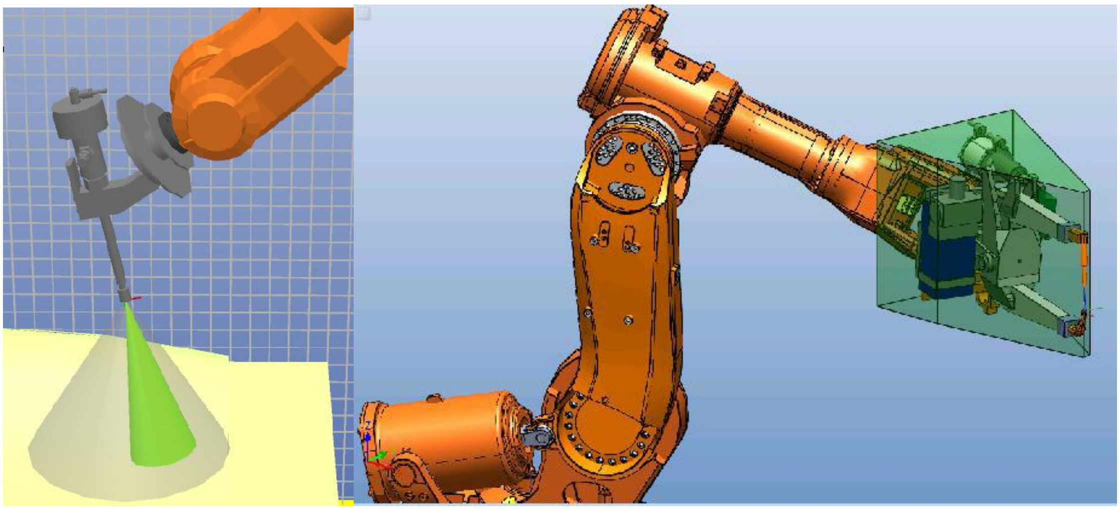
Common references

ISO 13849-1 / IEC 62061 – Safety- related parts of control systems

IEC 60204-1- Electrical equipment (stopping fnc.)

ISO 12100- Risk assessment ISO 13850- E-stop

ISO 10218-2



Robots and robotic devices – Safety requirements for industrial robots – Scope:Robot , Tooling, Work pieces, Periphery, Safeguarding.

Main references

ISO 10218-1-Robot

ISO 11161-integrated manufacturing systems

ISO 13854- Minimum gaps to avoid crushing

ISO 13855- Positioning of safeguards

ISO 13857- Safety Distances

ISO 14120 – Fixed and movable guards

Safety functions of  Industrial Robots controller  Supervision Functions

Basic supervision of robot motion, i.e. motion executed corresponds to motion commanded.(10)

Supervision of  kinematic quantities

Position

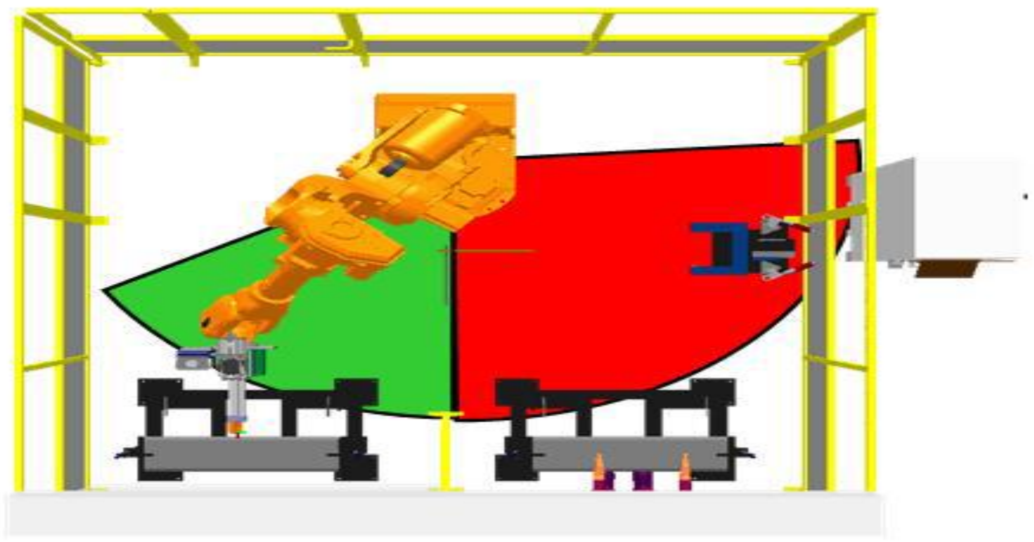
TCPs, elbow, solid modelof  manipulator, tool

Speed : TCPs, elbow, Acceleration, Braking

Possibility: supervision of dynamic quantities, esp. for collaborative operation.

Torques, Forces

Possibility: Application- related / User -  defined supervision functions.



**Present Standardization Activities ISO / TS 15066 – Safety of  collaborative Robots**

Design of collaborative work space

Design of collaborative operation : Minimum separation distance S / maximum robot speed Kr: Static (worst case)or dynamic (continuously computed) limit values: Safety-Rated sensing capabilities : Ergonomics

Methods of collaborative working

Safety-rated monitored stop: Hand-guiding; Speed and separation monitoring; Power and force limiting (biomechanical criteria). Changing between: Collaborative / non-collaborative

**Collision Sensor -** A sensor that detects and informs the controller to stop the robot prior to or during a crash. Other terms for this device include crash protection device, robot safety joint, and robotic clutch among others.(10)

Short Introduction to HRC definition of Collaborative Operation

ISO 10218 -1

Collaborative Operation state in which purposely designed robots work in direct cooperation with a human within a defined workspace.

Degree of collaboration : 1 Once for setting up (lead-through teaching). 2 Recurring isolated steps(manual gripper tending ). 3 Regularly or continuously(manual guidance).

Review of Basic Safety-Related Functions

E-stop; Protective stop; Stop categories(cat. 0 cat.1, cat. 2 per IEC 60204-1) Operating modes: Automatic / manual / manual high –speed. Pendant Controls: Enabling; Start / restart; hold-to-run; Limit switches; Muting functions;

| ISO 10218-1, clause | Type of collaborative operation | Main means of risk reduction |
|---|---|---|
| 5.10.2 | Safety-rated monitored stop (Example: manual loading-station) | No robot motion when operator is in collaborative work space |
| 5.10.3 | Hand guiding (Example: operation as assist device) | Robot motion only through direct input of operator |
| 5.10.4 | Speed and separation monitoring (Example: Replenishing parts containers) | Robot motion only when separation distance above minimumseparationdistance |
| 5.10.5 | Power and force limiting by inherent design or control (Example: Robot collaborative assembly robot) | In contact events, robot can only impart limited static and dynamicsforces |

(ISO 10218-1, 5.10.2, ISO/TS 15066)

*Reduce risk by ensuring robot standstill whenever

a worker is in collaborative workspace

*Achieved by

*Supervised standstill - Category 2 stop (IEC 60204-1)

*Category 0 stop in case of fault (IEC 60204-1)

*Application

*Manual loading of end-effector with drives energized

*Automatic resume of motion(10)

# Conclusion

The sectors must become the primary reference points for industrial policy and the drivers of sustainable economic growth of at least 8% per year. Now it is important to determine how most effectively to stimulate the development of the selected priority industries as drivers. It is worth noting here that each priority sector has its own locomotives, its own engines, that maximize their development. The calculations done during the study helped to identify these locomotives for each priority sector.Modern industrial robots are true marvels of engineering. A robot the size of a person can easily carry a load over one hundred pounds and move it very quickly with a repeatability of +/- 0.006 inches. Furthermore these robots can do that 24 hours a day for years on end with no failures whatsoever. Though they are reprogrammable, in many applications (particularly those in the auto industry) they are programmed once and then repeat that exact same task for years.

This paper presents a new and efficient numerical technique for the estimation of the working space of any open chain robot arms with different types of joints and orientations. Also, a computational algorithm for the robot workspace estimation in presence of obstacles is developed.

The numerical technique proposed is based on a new approach. This approach suggests the discretization of the search volume into a finite number of points in order to minimize the computational time. This discretization is performed according to the desired accuracy and search volume size. A sweeping process of an existing surface through the active joint range of motion is then performed. The closest point in the discretized search volume to the swept one is added to the WS and this procedure is repeated for all points on the existing surface to obtain a new one. An incremental increase in the joint position from its initial value to the final one creates the final WS. This sweeping process is then repeated for all the robot joints beginning from the last one till the ground to obtain the whole WS of the robot. Two industrial robots of different configurations are used for the verification of the developed technique and show the similarity between the estimated WS obtained by the algorithm and the WS provided by the robot manufacturer.

For the same problem in the presence of obstacles, judgment of search volume points as accessible or inaccessible is formulated as an optimization problem that is solved using genetic search. The genetic search is thus used to classify the points in this search volume into accessible points and inaccessible points which cannot be reached by the robot without one of the robot links interfering with any of the present obstacles. Two case studies are presented to demonstrate the effectiveness of the proposed technique. The proposed technique is tested for the cases of single open chain robot arms but can be generalized to more complex robot configurations. The generalization however, requires the methodology of computing the position and orientation of all the robot links to be available.

The major advantage of the proposed algorithm is that it provides detailed information about the whole robot WS and not only the outer work envelop as provided by the robot manufacturers. Most of the available software provides only means of path planning of robot arms in the presence of obstacles which no robot manufacturer offers. The proposed algorithm is generalized in the means that it can adapt to obstacles geometry changes as well as obstacle position changes relative to the robot base which can alter the resulting robot accessible region drastically and change the WS shape. Robot manufacturers do not offer this type of information and the available software will only provide a path plan for the arm movements and will need to be checked every time the robot is required to perform a different task or go to new positions. Path planning is an important step but it becomes next to selecting the suitable robot for a certain job. In order to do so, we have to provide the end-user with the robot type and the corresponding working space to determine if it can serve in a certain location with some constraints or not.

Robots provider provides only the working envelop of each industrial robot that consists of the maximum reach in the 3 main planes. They do not provide software or a method for altering the workspace in the presence of obstacles. Our paperprovides a method for the users to produce the working space and the changes that happen to it when changing the obstacle position and/or shape.

Some limitations are induced by the genetic search. Genetic search generally requires a large number of objective function evaluations which is time consuming especially if the required accuracy level demands the discretization of the search volume to produce a large number of finite points. A key factor in the genetic search is the choice of population size and maximum number of generations till convergence. Choice of a relatively large number for both population size and number of generations produces better optimization accuracy at the expense of longer computational time. While using relatively small population size and number of generations reduces the computational time but can lead to some faulty results; difficult locations to reach (such as at the boundary or close to obstacles) may be incorrectly judged as inaccessible. On an average scale, the modified technique can result in reduction of the total computational time to less than half.

Nowadays, prognosticating the future is being too important for Kingman. Today, the future generation's fortune is related to prognosticating in many ways. Social extents give opportunity for getting knowledge about the future and sending social predictions from "utopies" to subject specialty. Prognosticating the future is learning reception with subjects. It may be profitable while uniting humanitarian, natural, scientific and technical knowledges. The most important direction of bazaar interactions is to make free the economics. It is significant to widen economical liberty and independence which are necessary for being active completely subjects who have connection with that economy. Creating legal and economical surroundings for their activity is economical system trend of using mechanism of market while ordering this activity. Limiting factories and firms interference to economy activity and things on protecting private property are too necessary. Power and supervision organs of state must provide with any abilities for developing private business and they must not interrupt to people's work who work or do business on economy. Supplying wish answering to bazaar attitude of managing organizational structure of economy and improving reproving reproducing system and preparing sequences for controlling production are playing the main role. The information that I have just mentioned shows that the new system of robot which I am inviting is very profitable for GM Uzbekistan company.

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