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Superalloys: An Introduction with Thermal Analysis

By Raza, Syed Shehzad
Allama Iqbal College of Technology, Pakistan

Abstract- Nickel based superalloys are commonly used materials in the aero industry and more specifically in the hot section of aero engines. These nickel and nickel iron based superalloys are precipitation strengthened alloys with a face centered cubic gamma matrix. Alloy 718, Allvac 718Plus and Waspaloy have been of great interest in the present study. Alloy 718 is a precipitation strengthened nickel-iron based alloy having gamma double prime phase (Ni_3Nb) as a main strengthening phase up to 650 °C. Waspaloy, another precipitation strengthened nickel base superalloy, has a very good strength at temperatures up to ~750 °C whereas Allvac 718Plus is a newly developed nickel based precipitation strengthened superalloy which retains good mechanical properties at up to ~700 °C. These three alloys were investigated in terms of how their respective solidification process reveals upon cooling.Latent heat of soloidification has been estimated for all three alloys. Differential thermal analyses (DTA) have been used to approach the task. It was seen that Waspaloy has the smallest solidification range whereas Allvac 718Plus has the largest solidification interval in comparison.

Keywords: *superalloys, phase reactions, differential thermal analysis, latent heat of solidification.*

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Superalloys: An Introduction with Thermal Analysis

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Keywords: superalloys, phase reactions, differential thermal analysis, latent heat of solidification.

I. Introduction

A superalloy is a type of alloy that retains excellent mechanical properties at elevated temperature (super good properties at elevated temperatures). This includes excellent creep resistance, corrosion and oxidation resistance. The base metal is usually nickel, cobalt or nickel- iron. These alloys are commonly used in the aerospace or gas turbine industry, in parts that requires excellent mechanical properties at elevated temperatures. Superalloys are also utilized in the chemical and petrochemical industries apart from the gas turbine industry. In aircraft gas turbine components these superalloys may find their applications in disks, bolts, shafts, cases, blades, vanes, combustors, afterburners etc (basically anywhere where the temperature is above ~500 °C).

a) Applications

The major applications of superalloys are categorized below; the bulk of tonnage is used in gas turbines:

- In aircraft gas turbines they find their applications in disks, combustion chambers, bolts, casings, shafts, exhaust systems, cases, blades, vanes, burner cans, afterburners and in thrust reversers.
- In steam turbine power plants bolts, blades, stack gas re-heaters are made from these alloys.
- In reciprocating engines; turbochargers, exhaust valves, hot plugs and valve seat inserts are made from these alloys.
- During metal processing; hot-work tools and dies and casting dies are made from these alloys.
- In medical applications, dentistry uses and prosthetic devices are made from these alloys.
- In space vehicles: aerodynamically heated skins and rocket engine parts are made from these alloys.
- In heat-treating equipment; trays, fixtures, conveyor belts, baskets, fans, furnace mufflers are made from them.
- In nuclear power systems; control rod drive mechanisms and valve stems, springs, ducting are made.
- In chemical and petrochemical industries; bolts, fans, valves, reaction vessels, piping and pumps are mde from these alloys.
- In pollution control equipment they are utilised in scrubbers.
- In metals processing mills they are used in ovens, afterburners and exhaust fans.
- In coal gasification and liquefaction systems they are used in heat exchangers, re-heaters and in piping systems.

b) Chemical Composition

The nickel-base superalloys discussed below are considered to be complex because they incorporate as many as a dozen of elements. In addition, deleterious elements such as silicon, phosphorus, sulfur, oxygen, and nitrogen must be controlled through appropriate melting practices. Other trace elements such as selenium, bismuth, and lead, must be held to a very small (ppm) levels in critical parts. Many wrought nickel-base superalloys contain 10 to 20% Cr, up to about 8% Al and Ti combined, 5 to 15% Co, and small amounts of boron, zirconium, magnesium, and carbon. Other common additions are molybdenum, niobium, and tungsten, all of which play dual roles as strengthening solutes and carbide formers. Chromium and aluminum are also necessary to improve surface stability through the formation of Cr_2O_3 and Al_2O_3, respectively.

Author: Department of Materials Science and Engineering, KTH, the Royal Institute of Technology, Stockholm, Sweden.
e-mail: sshahzadraza@hotmail.com

c) Microstructure

The major phases that may be present in nickel-base alloys are:

- Gamma matrix, γ, in which the continuous matrix is an FCC nickel-base nonmagnetic phase that usually contains a high percentage of solid-solution elements such as cobalt, iron, chromium, molybdenum, and tungsten. All nickel-base alloys contain this phase as the matrix.
- Gamma prime, γ', in which aluminum and titanium are added in amounts required to precipitate FCC γ' (Ni_3Al, Ti), which precipitates coherently with the austenitic gamma matrix. Other elements, notably niobium, tantalum, and chromium, also enter γ'. This phase is required for high-temperature strength and creep resistance.
- Gamma double prime, γ'', in which nickel and niobium combine in the presence of iron to form body centered tetragonal (BCT) Ni_3Nb, which is coherent with the gamma matrix, while including large mismatch strains of the order of 2.9%. This phase provides very high strength at low to intermediate temperatures, but is unstable at temperatures above about 650 °C (1200 °F). This precipitate is found in nickel-iron alloys.
- Grain boundary γ', a film of γ' along the gain boundaries in the stronger alloys, produced by heat treatments and service exposure. This film is believed to improve rupture properties.
- Carbides, in which carbon that is added in amounts of about 0.02 to 0.2 wt% combines with reactive elements, such as titanium, tantalum, hafnium, and niobium, to form metal carbides (MC). During heat treatment and service, these MC carbides tend to decompose and generate other carbides, such as $M_{23}C_6$ and/or M_6C, which tend to form at grain boundaries. Carbides in nominal solid-solution alloys may form after extended service exposures.
- Borides, a relatively low density of boride particles formed when boron segregates to grain boundaries.
- Topologically close-packed (TCP) type phases, which are plate-like or needle-like phases such as σ, and μ that may form for some compositions and under certain conditions. These cause lowered rupture strength and ductility.

d) Strengthening Mechanisms

The strengthening mechanisms in superalloys are usually governed by solid solution and/or precipitation strengthening [1]. These alloys can be used up to a higher fraction of their melting points than any other commercially available alloy system. Refractory materials have higher melting points than superalloys but don't have the desired characteristics and consequently not as widely used. It should be noted that the superb strength of superalloys are not only related to its chemistry but also to the primary melting, forming and casting techniques. Heat treatment procedures may considerably improve the properties. Many alloying elements are added to these alloys, all with different purposes, and these may be as many as 14 in some cases [2].

e) Phase Transformations

During the solidification process of the present nickel and nickel iron base superalloys, there are three main reactions:

1. Liquid → Gamma
2. Liquid → Gamma + MC
3. L → Gamma + Laves (not applicable for Waspaloy)

In Alloy 718 the first thing to take place apart from nucleation of nitrides is the Gamma matrix phase to nucleate. During solidification the liquid becomes enriched in niobium and carbon which result in formation of a non-invariant Gamma/MC eutectic reaction proceeding with more enrichment of Nb while depleting C resulting in a final reaction, Liquid through Gamma/Laves eutectic reaction which is not encountered in Waspaloy [3].

Experimental Part

II. Test Procedure and Experimental Setup

a) Differential Thermal Analysis Setup

Thermal analysis is a method used to measure a physical property of a material as a function of its temperature. The obtained measurements are the basis for calculations of thermodynamic properties such as enthalpy and specific heat.

Through differential thermal analysis (DTA) studies it is possible to determine phase reactions and solidification phenomenon of alloys. The heat loss to the surrounding and the influence of the thermocouple wires can more or less be neglected [4].

b) Experimental Methodology

DTA experiments have been carried out on Alloy 718, Allvac 718Plus and Waspaloy. Each thermal cycle had a heating, soak and cooling part in which the samples have been heated up to the liquidus temperature, soaked at that temperature and then cooled down to a temperature below the solidus temperature. The starting temperature was set to 25 °C and 1400 °C as the maximum soak temperature since all of the present alloys were fully liquid at this temperature.

The samples were subjected to thermal cycle with cooling rate of 6 K/min. The soak temperature was 1400 °C for a dwell time of ~300 s. This dwell time was selected in accordance with a previous study on Alloy 718 [5].

Before testing, all samples were weighed. The ceramic tube was cut by a high speed steel cutter to fit the sample where after the sample was placed in an alumina crucible which was covered by a ceramic lid. Another crucible and thermocouple was used for the graphite reference. The whole sample assembly was covered by a ceramic shielding tube to ensure protection from contamination.

At testing, the power was switched on and start mode was initiated. The recording unit was set to heating mode. Argon and water was tapped on before starting experiments. When the temperature reached the maximum limit, after 300s of dwell time, cooling mode was initiated whereas the sample cooled to room temperature. Argon inert gas protection and water cooling were shut off and stop mode was initiated by end of experiment. The recorded data was collected and exported to an excel data sheet. Two different graphs were derived; one graph revealing the reference and furnace temperature and a second one showing their respective differential curves for analyzing the experiments.

c) Experimental Analysis

Thermal analysis is generally carried out to investigate the melting, solidification and phase reactions for different alloys [6]. Cooling curves can be used to determine the liquidus, solidus temperatures and also the total time of solidification [7].

The cooling curves are generally presented in a temperature and time plot. A change in slope of the curve indicates a phase reaction. Different cooling rates influence phase reaction temperatures and can be analyzed by plotted thermographs [4].

Calculation of the heat of fusion for a sample is based on the law of energy. The law of energy gives, for the case when no phase transformation is going on, i.e. before and after the solidification process. The heat of fusion can be estimated by the following equations:

$$dQ_l/dt = V\rho^l C_p^l \ [dT_l/dt] \quad (1)$$

$$dQ/dt = V[\rho^l (1-f_s) C_p^l \ [dT_l/dt]] + \rho^s [f_s C_p^s dT_s/dt + \Delta H \ df/dt] \quad (2)$$

$$[dT_s/dt] \ \rho \ C_p^s V_s + \Delta H \ \rho V_s \ df/dt = h[T_s - T_f] \quad (3)$$

$$dQ_s/dt = dQ_l/dt \rightarrow V\rho^l C_p^l [dT_l/dt] = V[\rho^l (1-f_s) C_p^l [dT_l/dt] + \rho^s [f_s C_p^s \ dT_s/dt + \Delta H \ df/dt]] \quad (4)$$

where

dT_s/dt = Cooling and heating rate of the sample

Cp = Specific heat of the sample

V_s = Volume of the sample

ΔH = Heat of fusion or latent heat of solidification

df/dt = solidified fraction rate

T_s = Sample temperature

T_f = Furnace temperature

h = heat transfer coefficient

Heat of fusion can be estimated by using the above equations. A DTA-apparatus measures the cooling curve in terms of cooling rate of the sample, solidification time and temperature of the surroundings. The heat of fusion can be estimated by the following relation:

$$-\Delta H_s = \frac{C_p dT/dt}{T_s - T_{ref}} \int_s^e \left(T_s - T_{ref}\right) dt \quad (5)$$

where

T_s = Temperature of the sample

T_{ref} = Temperature of the reference

$\eta = (Ah + A\sigma\varepsilon T_f^3)$

ρ_s = Density of the sample

V_s = Volume of the sample [8]

d) Determining the Latent Heat of Solidification

The latent heat is determined for respective alloys through four different steps, as follows:

1. To determine the area underneath the thermograph
2. To determine the cooling rate
3. To determine the temperature difference in between T_s and T_{ref}
4. Finally perform the calculation using equation no. 5 above

e) Estimation of Latent Heat of Solidification

The heat of fusion means the amount of energy needed to melt a unit mass or a mole of the substance; i.e. the total amount of energy needed to break the bonds between the atoms in a crystal lattice.

The heat of fusion values are lower for Alloy 718 and higher for Waspaloy and Allvac 718Plus. The cooling rates used in present investigation have not affected the values. The latent heat value for Alloy 718 is on a lower side as investigated in literature. For Alloy 718 Hasse and Antonsson estimated the value to 170 KJ/Kg [5].The estimated values and the respective intervals are reported in table 1.

Table 1: Latent heat of solidification and solidification range of Alloy 718, Allvac 718Plus and Waspaloy

.Parameter	Alloy 718	Allvac 718Plus	Waspaloy
Latent heat of solidification [kJ/kg]	152	346	227
Solidification interval [°C]	175	190	100

III. Results and Discussions

The solidification sequence of the investigated nickel based superalloys starts with a primary precipitation of γ-phase, followed by one or two final reactions. The first reaction to take place after primary γ-phase is the formation of MC precipitates which in turn is followed by presumably Laves phase in Alloy 718 and Allvac 718Plus. The evaluation is based on the temperature difference between the sample and the reference, as a function of the temperature of the sample. Figure1 shows the DTA thermograph for Alloy 718 during the cooling sequence as plotted in Microsoft Excel. The differential curve is denominated by the right hand side axis. An abrupt deviation in the slope of the differential curve is around ~1325 °C and is disclosed at a cooling rate of 6 °C/min. This is most probably associated with the primary nucleation of the γ phase and the start of solidification for Alloy 718.

The second noticeable deviation (a peak) is around 1250 °C for Alloy 718 which corresponds to the precipitation of MC as shown in figure1. The final precipitation event; i.e. the precipitation of Laves phase occurs below 1170 °C depicted by a solid hump in figure1.

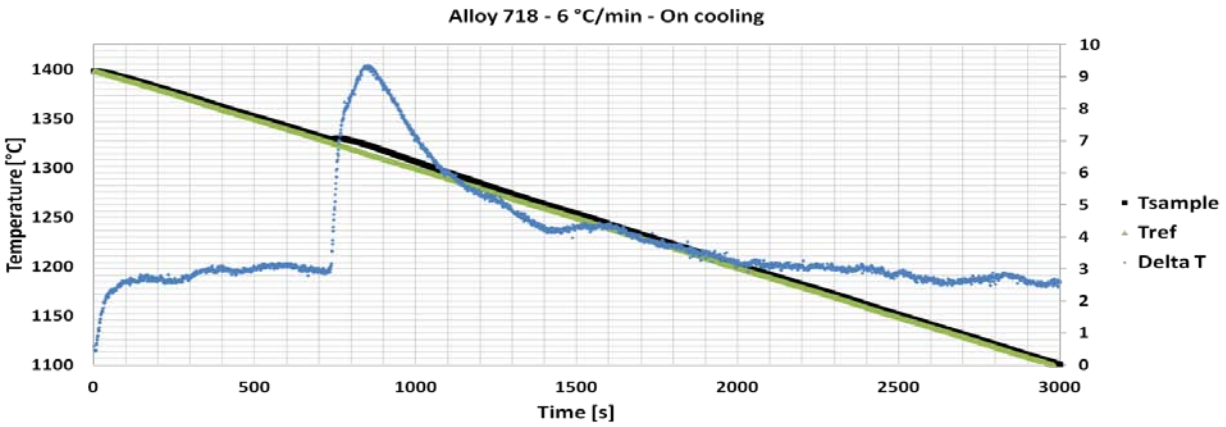

Figure 1 : Cooling and differential curve for Alloy 718 at a cooling rate of 6 °C/min

In Allvac 718Plus and Waspaloy the first deviation is at a higher temperature. Especially Waspaloy has a higher liquidus temperature compared to Alloy 718 which can be noticed in figure 2 through 3. Allvac 718Plus do as well as Alloy 718 reveal both MC and Laves reactions upon solidification. The MC reaction takes place at around 1280 °C followed by the Laves reaction at 1150 °C.

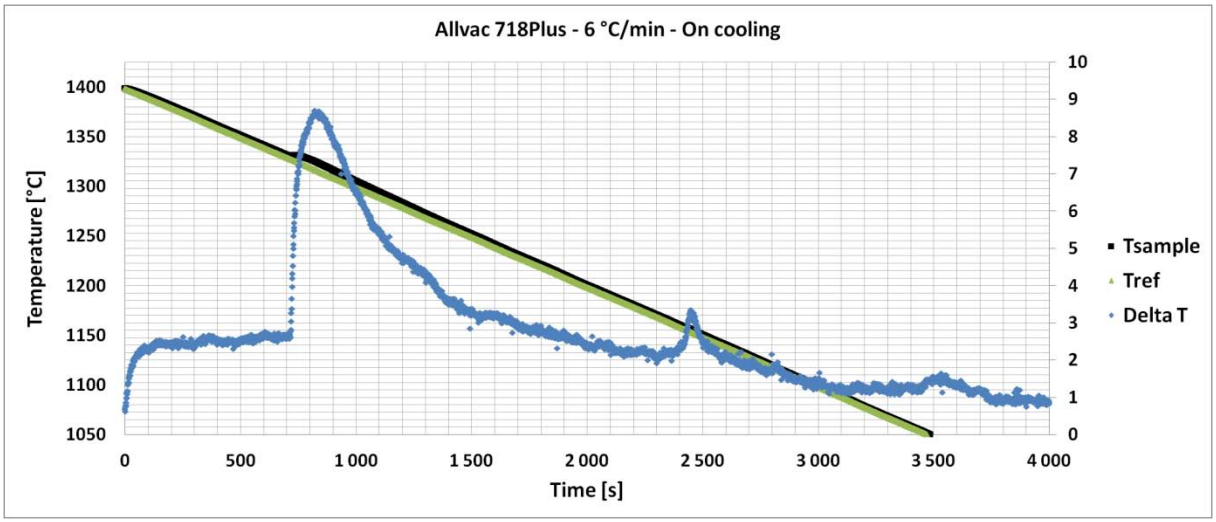

Figure 2 : Cooling and differential curve for Allvac 718 Plus at a cooling rate of 6 °C/min

The thermographs for Waspaloy as revealed in figure 3 are smoother in comparison with Alloy 718 and Allvac 718Plus. It is therefore not as easy to determine any relevant phase reaction taking place during the cooling sequence. However, apart from the primary γ phase revealed by the main peak in the thermograph a small indication of what is presumable believed to be MC is disclosed in figure 3.

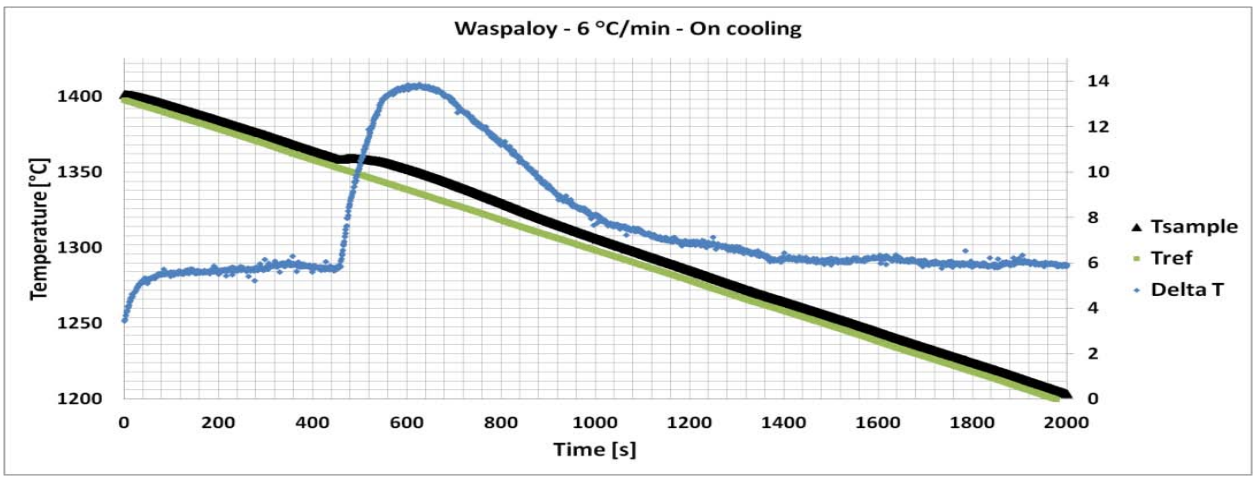

Figure 3 : Cooling and differential curve for Waspaloy at a cooling rate of 6 °C/s

IV. Conclusions

The main conclusions are:

1. Alloy 718 and Allvac 718Plus reveal two exothermic reactions upon solidification whereas Waspaloy reveals one reaction.
2. Alloy 718 (175 °C) and Allvac 718Plus (190 °C) have a larger solidification interval in comparison with Waspaloy (100 °C).
3. The latent heat of solidification is lowest for Alloy 718 and largest for Allvac 718Plus with Waspaloy in between.
4. No effects of cooling rate were seen to affect the solidification process of Alloy 718, Allvac 718Plus and Waspaloy in the present study.
5. The exothermic reactions for Waspaloy are difficult to determine as compared to the other two alloys as the differential curve is smoother.

V. Acknowledgments

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Designing of Home Automation based Switching System in PLC Applications using Phone Accelerometer

By Prashant Kumar

Abstract- With the reference for implement the useful things of old human beings which provide the concept for operating the system as Motion Sensing Based Switching Device. This project is an endeavour to help the old and paralysed human beings with reference to implement a new electronic gadget on home automation switching system which is controlled through gesture of human body parts. This project provides the very low cost implementation and easy handling for running this project in old and human beings.

Keywords: *introduction, industrial automation description, advantages and description of PLC applications, description of avr microcontrollers, practical and working analysis of project, program coding and circuit description, result and conclusion.*

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Designing of Home Automation based Switching System in PLC Applications using Phone Accelerometer

Prashant Kumar

Abstract- With the reference for implement the useful things of old human beings which provide the concept for operating the system as Motion Sensing Based Switching Device. This project is an endeavour to help the old and paralysed human beings with reference to implement a new electronic gadget on home automation switching system which is controlled through gesture of human body parts. This project provides the very low cost implementation and easy handling for running this project in old and human beings.

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I. Introduction

The introduction for this project is based on the technology for Motion Sensing and Motion Detection System. The Motion Sensing Device plays a very important role as adventure, switching and various terminologies for implementing various projects. The motion sensing and detection based device enables the future for help the old and paralyzed people. This technology provides the helpfulness and user friendly for old human beings. This project also provides this technology which related as Automatic Switching in Home Appliances through Phone Accelerometer as Motion Sensing Device.

The Phone Accelerometer has treated as Motion Sensing Device for controlling the lights and home appliances through Cell Phone which might be connected as Bluetooth Connection for interfacing the device. The Bluetooth Connection will be treated as communication for connecting the device between Cell Phone and Automatic Switching in Lights and Home Appliances through Android Based Cell Phone as Android Application. The Android Application will connect the Home Automation Device and provide the Automatic Switching in the motion of Cell Phone. This project is also useful for helping the old and paralyzed people. This motion requires the very slow motion which is present on old and paralyzed people for help and guide to doing any things in the very small motion of his body parts.

This project responds to ATMEGA 8 Microcontroller which controls the all things and relates to controlling the all things. The Controlling Action is sent by Cell Phone for the motion and receives at Home Automation Switching Device for the controlling action of switches respond by Cell Phone. The Cell Phone is Android Based for connecting the device through BT Robot Controller Application for responding the action on device. This device provides the LCD Display which relates the things and displayed the present task for the memory purpose.

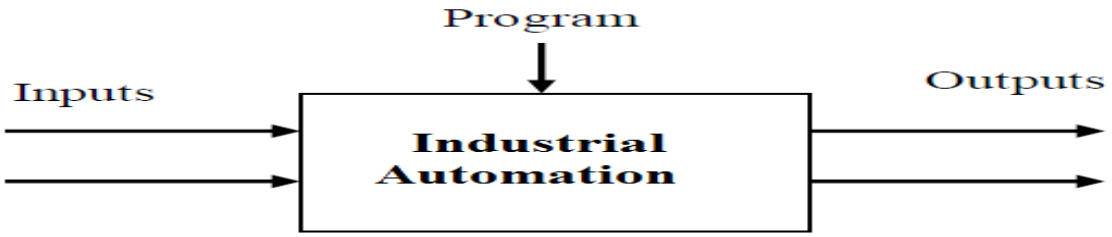
The LCD Display shows the things for the present task and provides the information for live project response. This project responds the motion of Cell Phone and provides the limited time for the motion given by Old and Paralyzed People. This project provides the working details for connecting this project with Bluetooth Range as 50-100 metre even while there is wall here. This project also tests the operations which might be done on another location for connecting the device through Home Automation Switching Purpose.

This project related and completed the all things which might be helpful for connecting the device and making this project better for old and paralyzed people. This project also responds the characteristics and provides the better life of old and paralyzed person for using this technology in Cell Phone as Home Automation Switching Based Device. This project also correspond the various terminologies which might be helpful for helping the old and paralyzed people to making his life better for connecting the world.

a) Industrial Automation Description

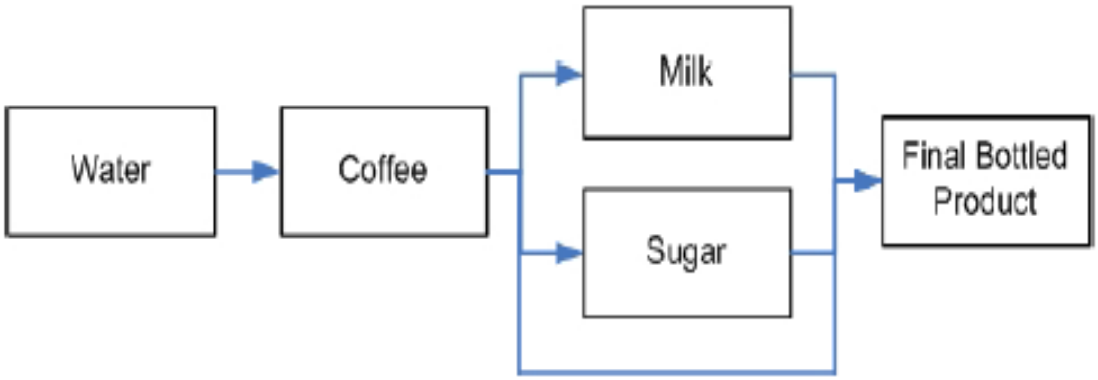
Industrial automation is the use of robotic devices to complete manufacturing tasks. In this day and age of computers, it is becoming increasingly important in the manufacturing process because computerized or robotic machines are capable of handling repetitive tasks quickly and efficiently. Machines used in this field are also capable of completing mundane tasks that are not desirable to workers. In addition, the company can save money because it does not need to pay for expensive benefits for this specialized machinery purpose.

Author: e-mail: prashantkumar.farse@gmail.com



II. Industrial Automation System

Industrial Automation the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated.



Basic Flow Diagram of Coffee Bottling Plant in Industrial Automation

III. Advantages and Description of plc Applications

A PLC is a microprocessor based controller with multiple inputs and outputs. It uses a programmable memory to store instructions and carry out functions to control machines and processes.

The PLC performs the logic functions of relays, timers, counters and sequencers. It has the following advantages:

a) Low Cost
b) Reliability
c) Programmability

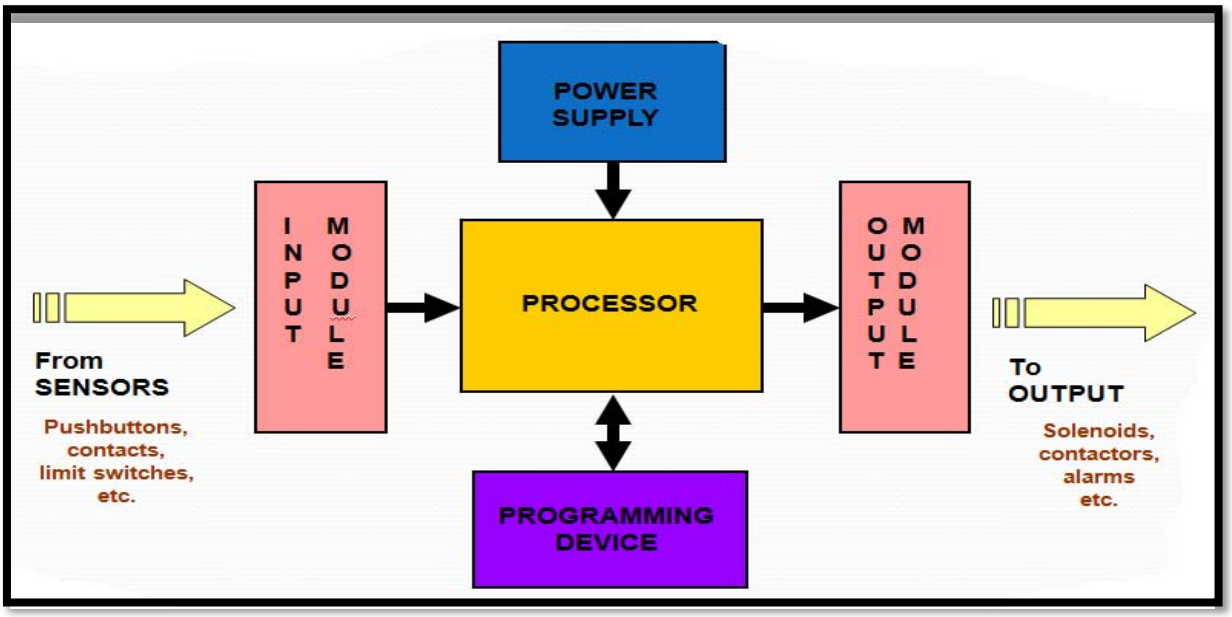


Diagram of Programmable Logic Controller

The PLC inputs give it information about the machine or process that it is controlling. These are typically switches and sensors. The switches are connected to an input module that provides the interface between the switches or sensors and the PLC.

The PLC Outputs are connected directly or indirectly to actuator controls. Examples include Solenoids on Directional Control Valves, Motors, Alarm and Warning Lights. There are three main type of Output Module:

a) *Relay:*-The Signal from the PLC operates a relay within the output module controlling connecting the control voltage to the output port and hence to the actuator.
b) *Transistor:*-A transistor is used to switch the output. This is faster than a relay output but is only suitable for low power direct current applications.
c) *Triac:*- This Solid State Device is used for switching alternating current devices. It requires some form of over current protection.

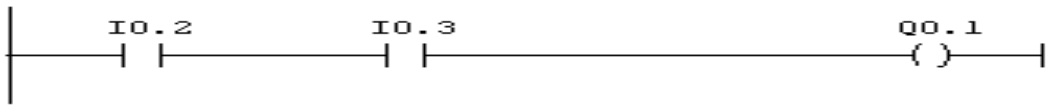
PLC will operate any system that has output devices that go on and off (Discrete, or Digital, outputs). It can also operate any system with variable (dynamic) outputs. The Programmable Logic Control can be operated on the input side by ON/OFF devices or by variable (dynamic) input devices.

A PLC or Programmable Logic Controller is a user friendly, microprocessor specialized computer that carries out control functions of many types and levels of complexity. Its purpose is to monitor crucial process parameters and adjust process operations accordingly. It can be programmed, controlled and operated by a person unskilled in operating computers. Essentially, a PLC's operator draws the lines and devices of ladder diagrams with a keyboard onto a display screen. The resulting drawing is converted into computer machine language and run as a user program.

Examples on PLC Applications Based Controlled Devices:

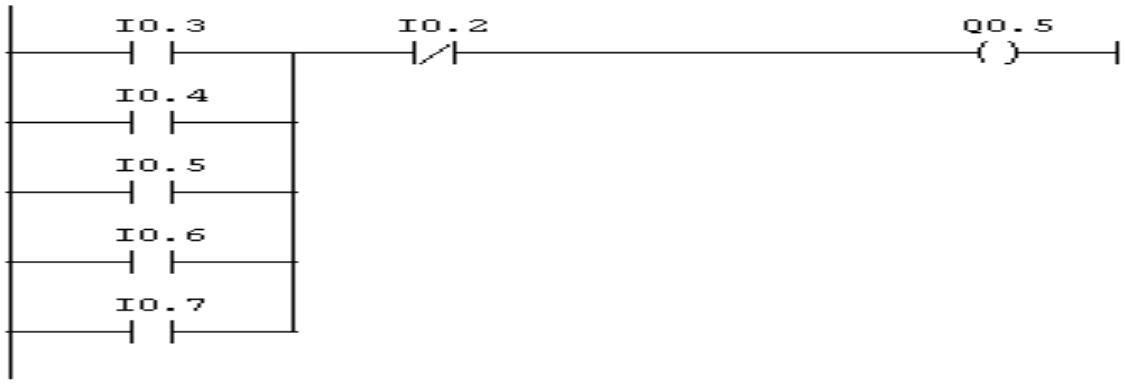
1. Develop ladder logic for a Car Door / Seat Belt Safety System. When the car door is open, or the seat belt is not up, the ignition power must not be applied if all is safe the key will start the engine.

Answer:



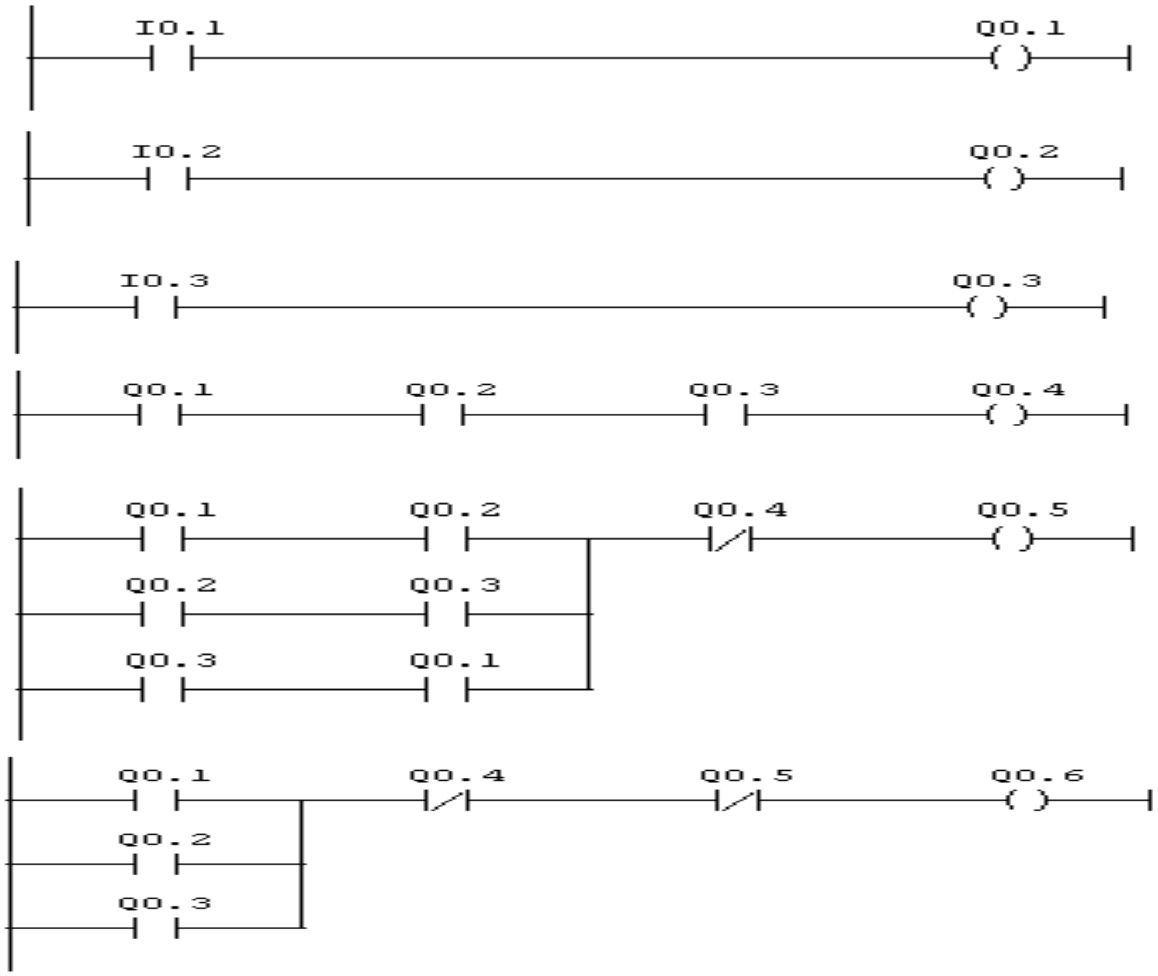
2. Develop Ladder Logic for a Car Door and inside light system if any Car Door. If any of the Car Door, out of the four doors is opened or a switch S1 inside the car is made ON, a lamp L1 inside the car gets ON. When all the four doors are closed and switch S1 is kept open the lamp inside the car gets OFF. If all the four doors are opened and switch S1 is made ON. The lamp inside the car can be made OFF by pressing another switch S2. If all the car doors are closed then the inside lamp can be made ON by switch S1 and can be made OFF by switch S2.

Answer:



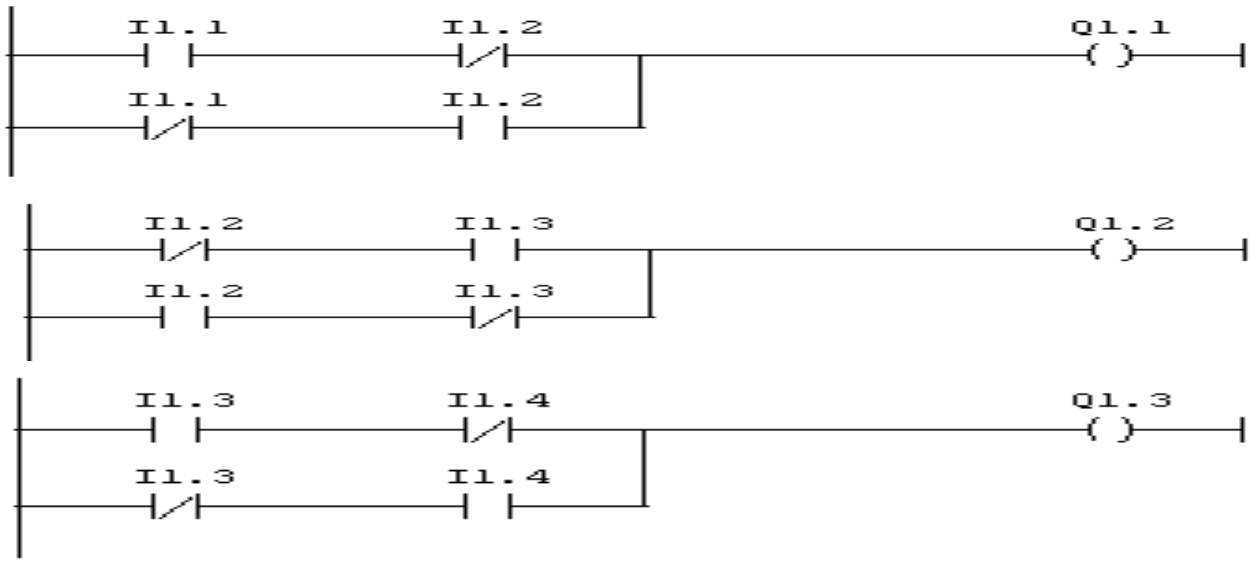
a) There are three fans in a room and are controlled by individually toggle switches there is a panel board outside the room. Draw logic in LAD such that when the following conditions are satisfied the indicator light should glow in panel board.If all the three fans are running the RED lamp L1 glows in panel board at that time L2 and L3 should off.
b) If any two fans are running the YELLOW Lamp L2 glows at that time L1 and L3 should off.
c) If any one fan is running the GREEN Lamp L3 glows at that time L1 and L2 should off.

Answer:



3. In a corridor there are four switches and three bulbs. When a man enters from one side to the corridor and press switch 1, bulb 1 gets ON. When the man presses switch 2, bulb 2 gets ON and bulb 1 gets OFF. When the man presses switch 3, bulb 3 gets ON and bulb 2 gets OFF. When the man presses switch 4, bulb 3 gets OFF. The same thing can happen if at any instance a man enters from any side.

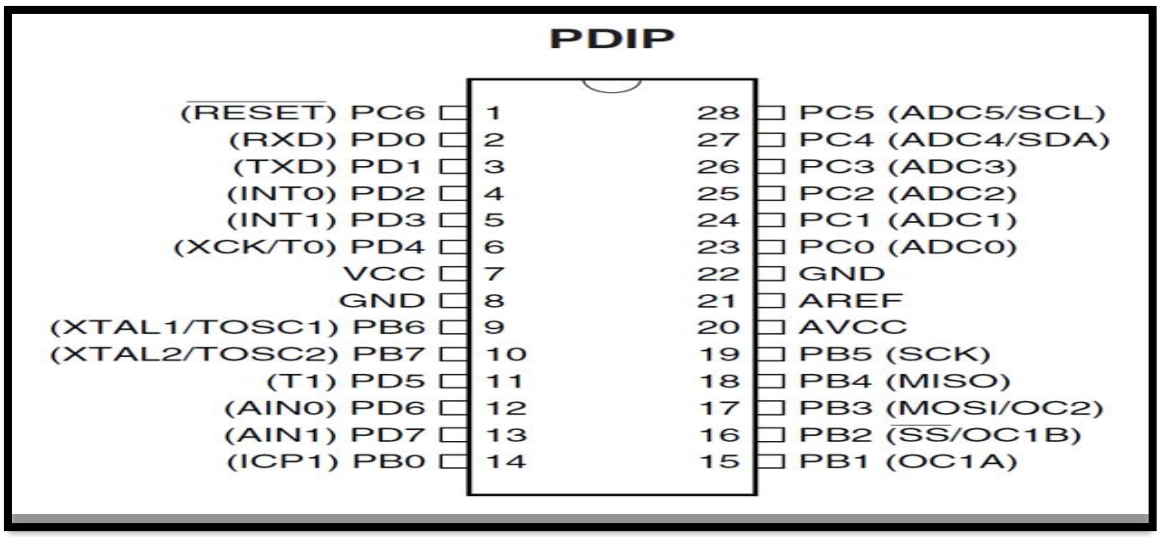
Answer:



Description of AVR Microcontrollers: Atmel microcontrollers (MCUs) deliver wireless and security support solution based devices. The specification of various ATMEL Microcontrollers which tends to provide the different features and range of operations are:

- Atmel AVR 8- and 32-bit Microcontrollers:- Atmel AVR 8- and 32-bit Microcontrollers deliver a unique combination of performance, power efficiency and design flexibility. They are based on the industry's most code-efficient architecture for C and assembly programming language. The extensive AVR portfolio, combined with the seamlessly-integrated Atmel Studio development platform, makes it easy to reuse knowledge when improving your products and expanding to new markets.
- Atmel SMART ARM-based Microcontrollers:- The broad portfolio of 32-bit Atmel ARM Microcontrollers based solutions can meet the needs of virtually any device. Atmel SMART ARM-based solutions are designed to optimize system control, wired and wireless connectivity, user interface management, low power and ease of use for human interfacing of devices.

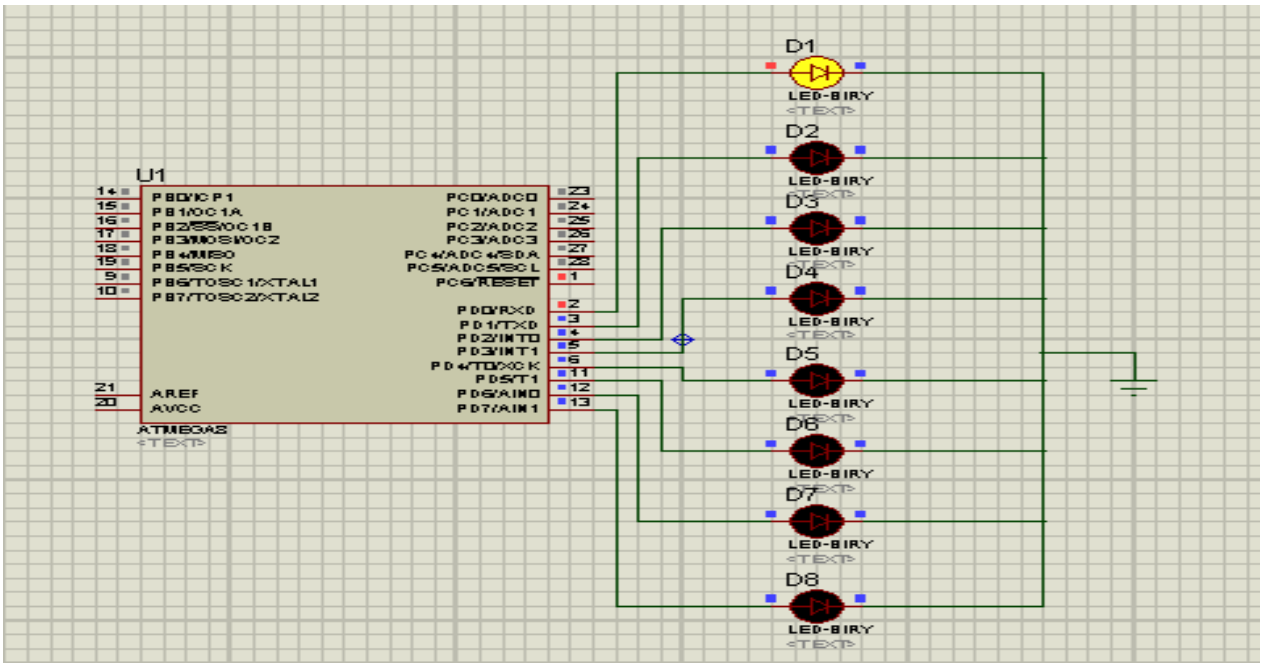
Pin Diagram of ATMEGA 8 Microcontroller



Examples on AVR Microcontrollers Devices based on Real Applications:

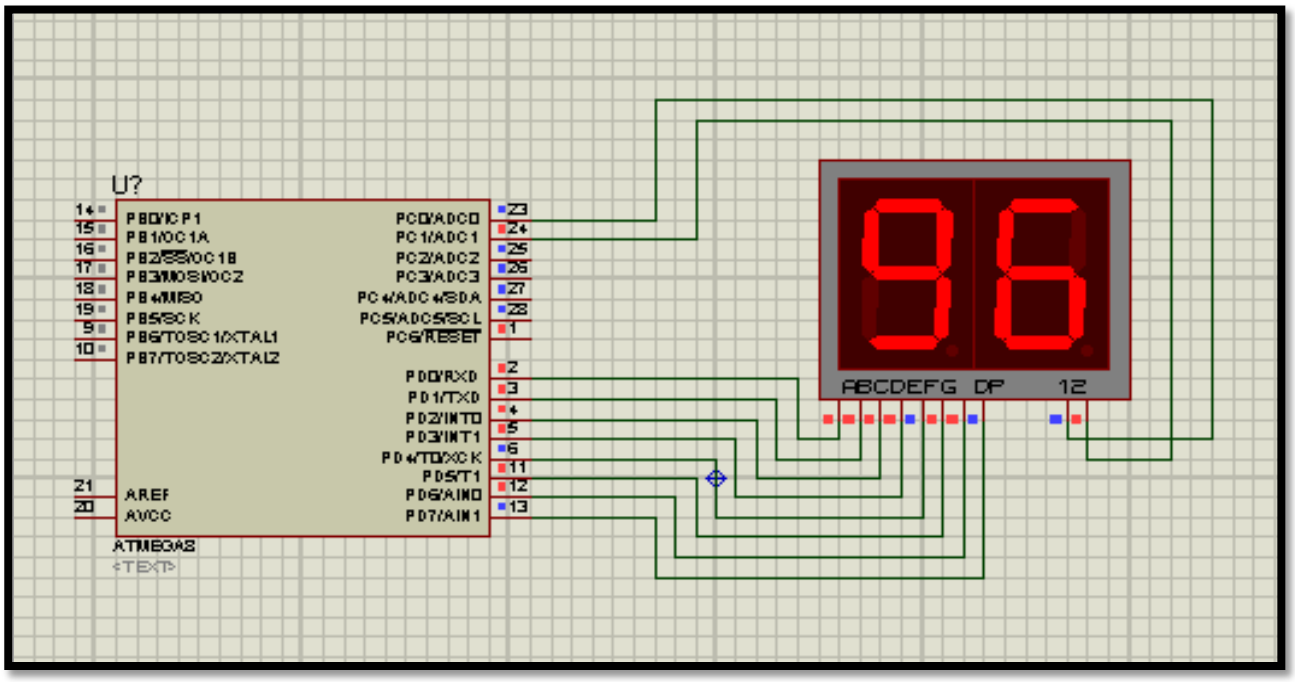
1. Program for design the Sand Glass or Light Attraction through ATMEGA 8 Microcontroller.

Answer:



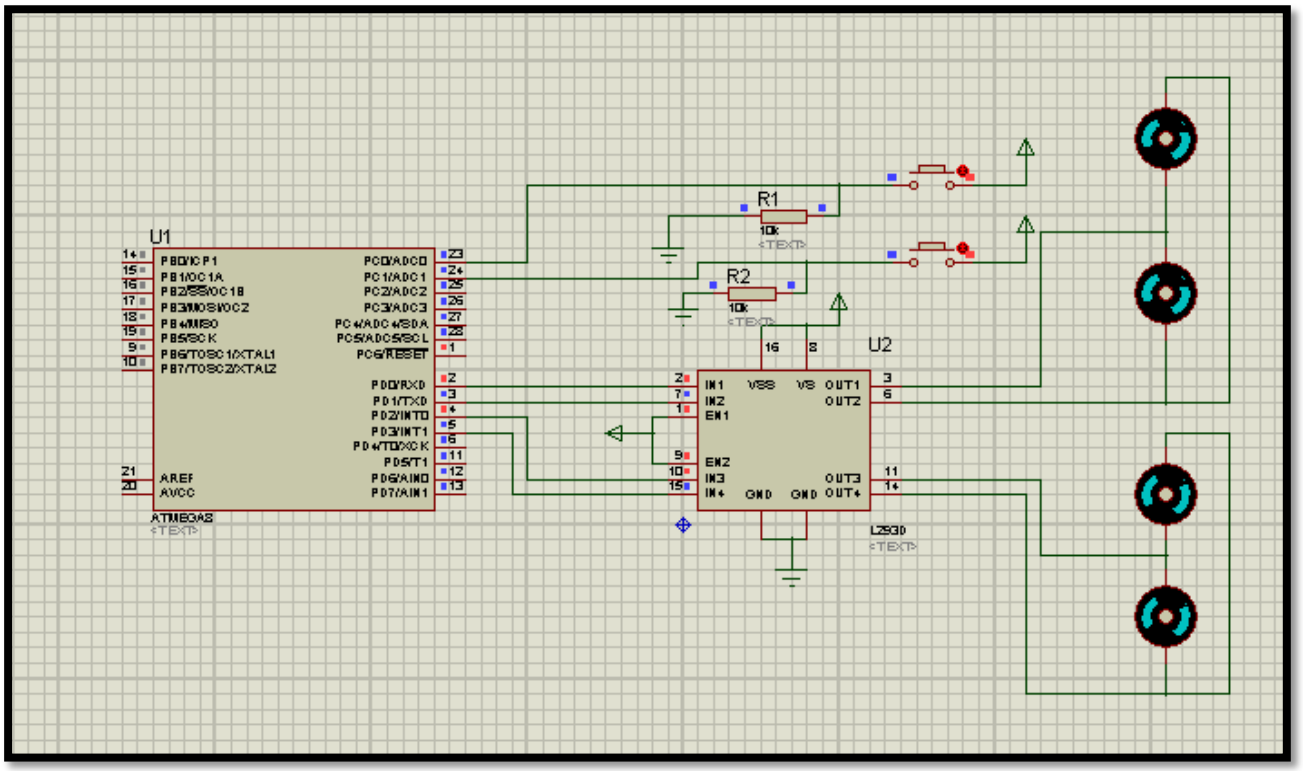
2. Program for increment or decrement the Seven Segment through Switch in ATMEGA 8 Microcontroller.

Answer:



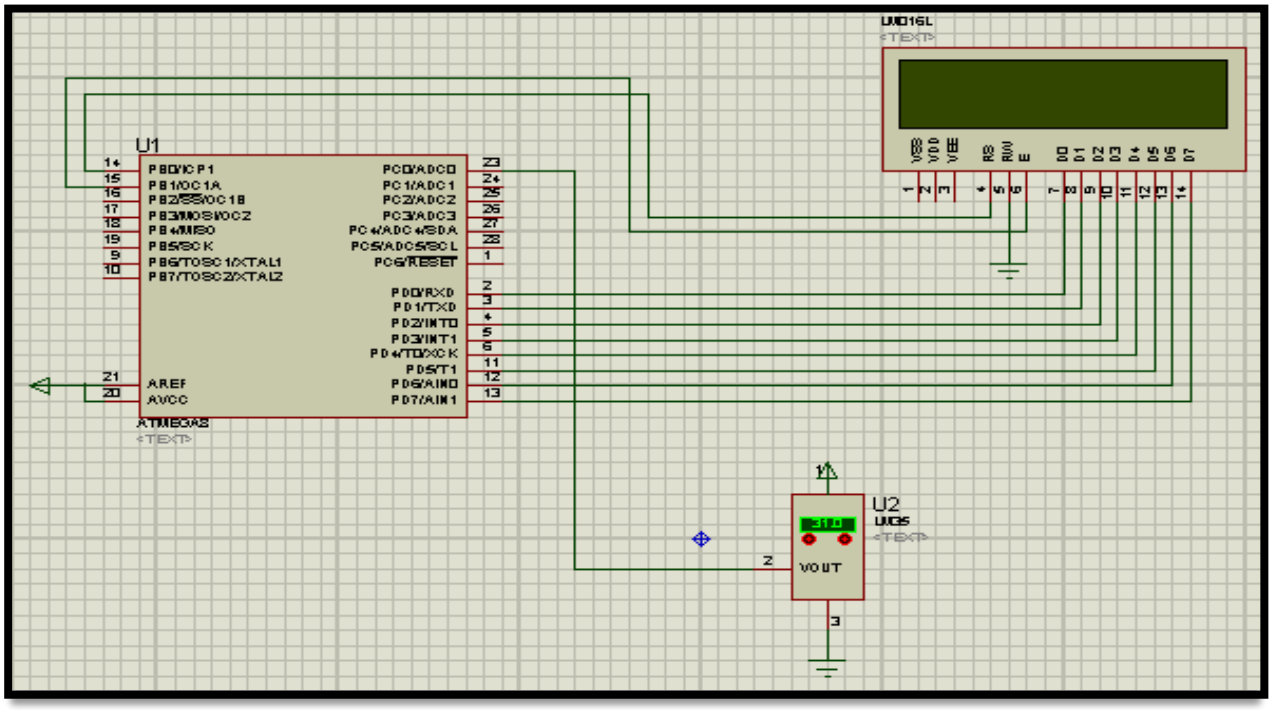
3. Program for making the Object Follower Robot in ATMEGA 8 Microcontroller.

Answer:



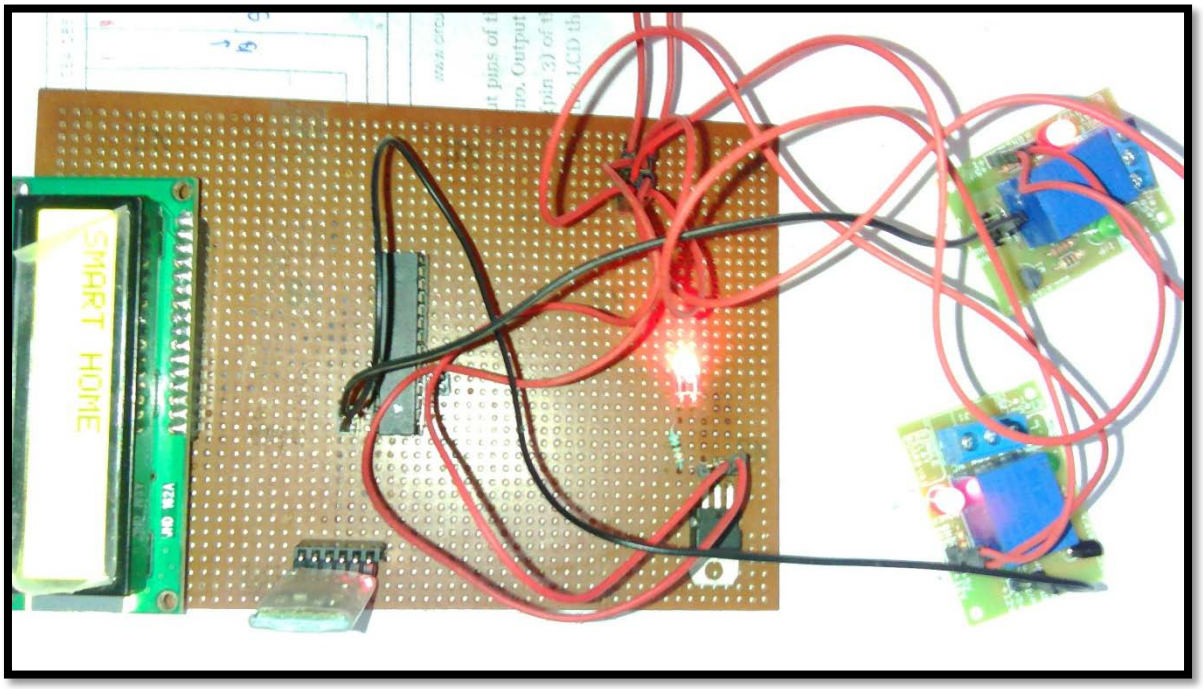
4. Program for design the Temperature Sensor in ATMEGA 8 Microcontroller.

Answer:



Practical and Working Analysis of Project: The methodology of this project is based on the concepts for designing the module and Coding Part for creating the idea and describes this for practical implementation process. The practical implementation process follows the various processes which tend to Reliability and Adaptability of Project. This project corresponds for designing the modules and then performs the coding on this project. The Coding Project performs the various concepts for designing the circuit in Proteus 7.8 Software Version.

The completion of Project Coding assigned as module for designing the Circuit and operated through ATMEGA 8 Microcontroller. The operations of this project are done and provide the concept of Hardware Implementation for this project. The Hardware Implementation of this project starts from soldering and mounting the components. The components are soldered and assigned to make a circuit. These things provide the testing of this circuit is to make or run the project and it has completed for testing all the things and working analysis for running this project as Automatic Motion Switching through Bluetooth Interfacing in Cell Phone Devices.



Hardware Implementation of Project Work on Home Automation Switching in PLC Applications Using Phone Accelerometer

Program Coding and Circuit Description: This project implements the concept of Embedded Systems as the basic need to control the ATMEGA 8 Microcontroller which deals to controlling the all functions of this project. This project can also be interfaced with LCD Module and Bluetooth Wireless Module. In this project there is a switch which is connected with two devices to implement the motion sensing. Now, the controlling this device with Cell Phone through Bluetooth Interfacing with an Android Application for the Motion Sensing Detection System.

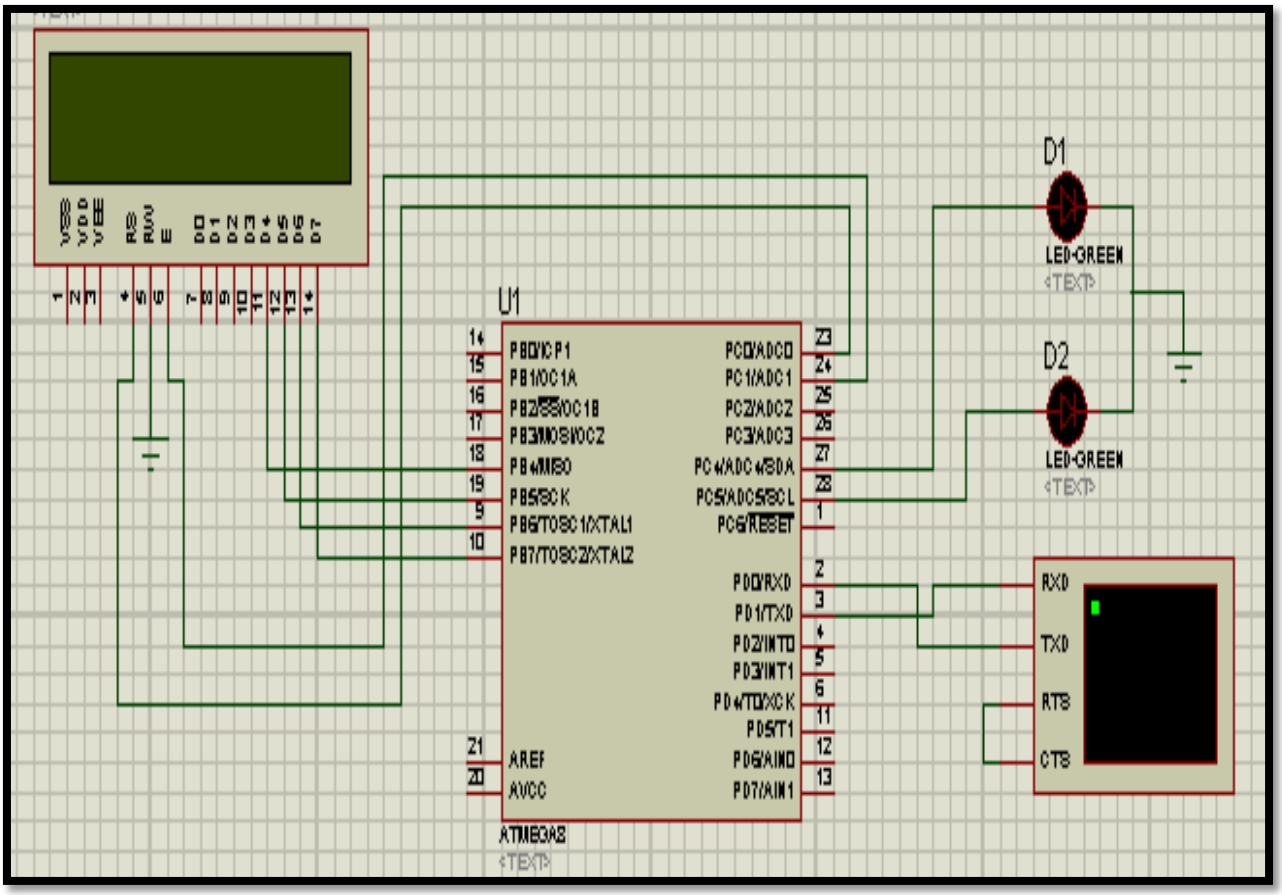
The implementation of this project is done by the module of Embedded System which shows the application of Switching and Home Automation using Lights, Fans, Machines and Other Equipments through Old People and Paralyzed Person in terms of Physically Disabled Person for the human mankind and development resources which provide the Circuit Description and Coding Part of this project that tends to following features:

Program Coding for implement this project through ATMEGA 8 AVR Microcontroller

```
#include<avr/io.h>
#include<util/delay.h>
void LCD_Init()
{command(0x32);
command(0x28);
command(0x06);
command(0x0C);
command(0x01);
}
void command(unsigned char a)
{PORTB=a;
PORTC&=0XFE;
_delay_ms(30);
PORTC|=0X02;
_delay_ms(30);
PORTC&=0XFD;
_delay_ms(10);
a=a<<4;
PORTB=a;
PORTC&=0XFE;
_delay_ms(30);
PORTC|=0X02;
_delay_ms(30);
PORTC&=0XFD;
}
void display(unsigned char a)
{PORTB=a;
PORTC|=0x01;
_delay_ms(30);
PORTC|=0X02;
_delay_ms(30);
PORTC&=0XFD;
_delay_ms(10);
a=a<<4;
_delay_ms(10);
PORTB=a;
_delay_ms(10);
PORTC|=0X01;
_delay_ms(30);
```

```
PORTC|=0X02;
_delay_ms(30);
PORTC&=0XFD;
}void string(unsigned char *a)
{while(*a!='\0')
{display(*a);
a++;
}}
void USART_Init()
{UBRRL=51;
UCSRB=(1<<TXEN)|(1<<RXEN);
UCSRC= (1<<URSEL)|(1<<UCSZ1)|(1<<UCSZ0);
}void USART_Transmitter(unsigned char data)
{while(!(UCSRA&(1<<UDRE)));
UDR=data;
}
unsigned char USART_Receiver(void)
{while(!(UCSRA &(1<<RXC)));
return UDR;
}
void main()
{DDRC=0XFF;
DDRB=0XFF;
USART_Init();
LCD_Init();
unsigned char a;
command(0x01);
string("SMART HOME");
while(1)
{command(0x80);
a=USART_Receiver();
if(a=='A')
{command(0x01);
PORTC|=0X10;
_delay_ms(10);
string("BULB1 ON");
_delay_ms(40000);}
else if(a=='B')
{command(0x01);
_delay_ms(10);
PORTC&=0XEF;
string("BULB1 OFF");
_delay_ms(40000);}
else if(a=='C')
{command(0x01);
_delay_ms(10);
PORTC|=0X20;
string("BULB2 ON");
_delay_ms(40000);}
else if(a=='D')
{ command (0x01);
_delay_ms(10);
PORTC&=0XDF;
string("BULB2 OFF");
_delay_ms(40000);
}}}
```

Circuit Description for Home Automation through USART Communication in PLC Application Using Phone Accelerometer



IV. Result and Conclusion

There are various facilities required for this Project Work which might be present as various Electronic Components, Proteus 7.8 Software, Atmel AVR Software, Solder in Zero PCB and other required components. The Project can be designed on the idea which might be required for the concepts then it has started the program and coding of this project in USART Module for working at ATMEGA 8 Microcontroller.

The Project had required the circuit design which would be done by Proteus 7.8 Software for designing the circuit. This process requires the implement on Hardware for the running stage and version of this project. These things arise the running stage which would be done by the need for developing the project in running implementation for development of this project.

The facilities would be required for developing the project based on the concept of Embedded Systems. The Embedded Systems of facilities would be assigned as Software in Program Coding and Circuit Design then the facilities would be required as Hardware for the components in Electronics and the Soldering Components for which the Circuit can be assigned that would be designed by this project.

These proper facilities provide the working details of this project which may be detail as provide the running details of this project. The running project provides the various features which may be seen for the completion of this project work. This project work provides the very limited resources with the very smart idea for the reduction cost of this project. This feature may avail the cheap price for the design of this project and provide very limited resources for this project. The result work of this project provide the important result and practical application as live project for implementing the electronic device controlled by old and paralyzed human beings through monitor the human body parts as to manage the Home Automation System using Phone Accelerometer in Electronic Devices.

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Linear Programming Model to Optimize Water Supply and Cropping Area for Irrigation: A Case Study for Kalihati

By Hasan Symum & Mohammad F Ahmed
Florida State University, United States

Abstract- In this paper, an optimization model was formulated to maximize profit from cultivation while satisfying several factors like cropping area, irrigation water supply, cropping cycle, market demand. The model was applied at Kalihati, Tangail, Bangladesh for the Agricultural year 2012-2013. The cropping area available at the location was 17750 hectors and maximum irrigation water available was 1267983700 cubic meter. The crops selected for the model were most traditional for the studied area and produced in large proportions compared to others. The model provided optimum value for cropping area and irrigation water depth that maximize the objective function.

Keywords: *linear programming, optimization, water supply, irrigation depth, crop yield, net profit.*

GJRE-G Classification: *FOR Code: 290502p*

Strictly as per the compliance and regulations of:

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Abstract- In this paper, an optimization model was formulated to maximize profit from cultivation while satisfying several factors like cropping area, irrigation water supply, cropping cycle, market demand. The model was applied at Kalihati, Tangail, Bangladesh for the Agricultural year 2012-2013. The cropping area available at the location was 17750 hectors and maximum irrigation water available was 1267983700 cubic meter. The crops selected for the model were most traditional for the studied area and produced in large proportions compared to others. The model provided optimum value for cropping area and irrigation water depth that maximize the objective function.

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I. Introduction

Economy of Bangladesh is largely dependent of agriculture and the total yields in agriculture is largely depends on irrigation water and rainwater. The average annual rainfall is lowest in the northwest part and highest in the northwest part. In the post-monsoon (October -November) and winter period (December - February) only 10 percent of the annual rainfall is available (WB, 2000). Rainfall is extremely unreliable in the subsequent pre-monsoon period (March - May). On an average there is about 10 percent of the annual rainfall in this period (WB, 2000). [1]. Water is very scarce in the south and northwest region of Bangladesh during the winter. [2] In order to plan the water supply distribution for irrigation, in relation to the production level and to the water needs, the factors that are necessary are seasonal and monthly needs of water supply, crop production and crop selection.

In addition to water supply facility, availability of fertilizer also plays a great role for on time production of seasonal crops.The demand is based on the type of area of cultivation, type of crops and growth rate.

There are different types of irrigation project that have been undertaken for proper irrigation management which includes ground water irrigation, surface water irrigation through public and private ventures. But due to scarcity of resources, it is found that such projects cannot always manage to satisfy farmer needs for proper yield. That is why farmers often face shortage of water and in many cases they use empirical way to maximize profit.

Different crops have different cropping cycle. These cycles are distributed throughout the year with overlapping periods. A particular land can be used for a particular crop whereas others can be used for two or three crops in succession. This leads to multiple choices available to select from for crop area selection. Each choice have different impact on the producer's net income. In order to find the best possible combination for maximum net income, cropping pattern and crop area allocation should be brought into consideration.

So there is scope for improvement of the situation of the farmers by distribution of water resource for each areaand land allotment for particular crop through the help of optimization tool. This optimization problem can be represented bya profit maximization function. The function is the difference between gross income and production cost subject to land availability, water supply, cropping pattern, market demand and other specific restrictions.[3,6]

In this paper, the location that had been selected for evaluating and formulating the model is KalihatiUpazilla, Tangail, Bangladesh.

II. Mathematical Model

The objective is specified as net profit maximization equation as a function of cropping area based on cropping pattern and irrigation water supply. Net profit is the difference of gross income and production cost.

$$Net\ income = Gross\ income - Production\ cost$$

Gross income can be expressed as follows

$$G_I = \sum_{i=1}^{n} P_i X_i Y_i \quad (1)$$

Where,

$G_I = Gross\ income, BDT$

$P_i = Sale\ price\ of\ crop\ i, BDT/kg$

$X_i = Cropped\ area\ of\ crop\ i, ha$

$Y_i = Production\ rate\ of\ crop\ i, kg/ha$

Author α σ : Department of Industrial & Manufacturing Engineering Florida State University, Tallahassee, FL 32310, USA.
e-mail: hs13b@my.fsu.edu

$i = an\ integer\ representing\ each\ crop$
$(1, 2, 3 \dots \dots \dots n)$

Production cost is divided into two components. One is for fixed cost related to each crop and the other one is variable cost proportional to irrigation depth. Fixed cost excludes irrigation cost. It includes labor, fertilizer, seeds, maintenance cost etc.

$$Production\ cost = Fixed\ cost + Variable\ cost$$

$$PC = \sum_{i=1}^{n} C_i X_i + \sum_{i=1}^{n} C_w W_i X_i \quad (2)$$

$PC = Total\ Production\ Cost, BDT$

$C_i = Fixed\ roduction\ cost\ of\ crop\ i, \frac{BDT}{ha}$

$C_w = Water\ cost\ for\ irrigation, \frac{BDT}{mmha}$

$W_i = Irrigation\ depth\ for\ crop\ i, mm$

The objective function can be expressed from equation (1) as follows

$$Maximize, Z = \sum_{i=1}^{n} P_i X_i Y_i - \left[\sum_{i=1}^{n} C_i X_i + \sum_{i=1}^{n} C_w W_i X_i\right] \quad (3)$$

Where,

$Z = Net\ income, BDT$

This maximization functions is restricted by some constraint equations pertaining to total water supply availability, maximum crop area availability, irrigation depth range, seasonal and market demand restrictions.

Total water supply availability constraint

$$\sum_{i=1}^{n} W_i X_i \leq V_w \quad (4)$$

Where,

$V_w = Annual\ irrigation\ water\ volume, mmha$

Maximum crop area availability constraint

$$\sum_{i=1}^{n} X_i \leq A_m \quad (5)$$

Where,

$A_m = Area\ available\ for\ month\ m, ha$

Irrigation depth constraint has upper and lower bound. Too low irrigation water depth can cause the production to fall drastically and too much water depth can also flood the land which in turn again drops the crop productivity. Valid range for this irrigation depth were collected from Agricultural Specialist.

Irrigation depth constraint

$$W_{imin} \leq W_i \leq W_{imax} \quad (6)$$

Where,

$W_{imin} = Minimum\ water\ depth\ required, mm$

$W_{imax} = Maximum\ water\ depth, mm$

Different crops have varied monthly basis demand pattern which depends on seasonal and market requirements. Some crops may also have location restriction for high or low land cultivation. These restrictions can be addressed as follows

$$X_i \leq B_i \quad (7)$$

Where,

$B_i = Demand\ for\ crop\ i, ha$

Non-negativity constraint

$$X_i \geq 0 \quad (8)$$

III. Application of the Model: A Case Study at Kalihati

The model was applied to KalihatiUpazilla Irrigation System which is located at Kalihati, Tangail, Bangladesh. The required data was collected from "Monitoring Report for the Agriculture Year 2012-2013" which is published by Department of Agricultural Extension, Bangladesh.

For application of the model, the crops that were selected are the most traditional ones in the stated region. Also, in order to keep the model simple, not all the crops were included in the study as some of them had very little land allocation requirements. The selected crops are Aman(Transplanting), Aus, Aman(Broadcast), Boro Potato, Wheat, Mustard seeds, Jute, Onion and Garlic of which first four fall into rice category. These crops have different cropping cycle throughout the year which is summarized in Table 1.[4]

The production rate of crops (Y_i) were collected from the report as well. The selling price (P_i) were collected from online database of Department of Agricultural Marketing, Ministry of Agriculture, Government of the People's Republic of Bangladesh.[5] These data are stated in Table 2.

Table 1 : Cropping calendar for Kalihati Irrigation Project

Month	Crops									
	T-Aman	B-Aman	Boro	Aus	Potato	Mustard seeds	Wheat	Jute	Garlic	Onion
Jan			√			√	√		√	√
Feb			√			√	√		√	√
Mar			√			√	√		√	√
Apr			√					√	√	
May			√					√		
Jun				√				√		
Jul		√		√				√		
Aug	√	√		√				√		
Sep	√	√		√	√					
Oct	√	√			√				√	
Nov	√	√			√		√		√	
Dec						√	√		√	√

Table 2 : Production rate and selling price of different crops

	Crops									
	T-Aman	B-Aman	Boro	Aus	Potato	Mustard seeds	Wheat	Jute	Garlic	Onion
Production Rate, Y_i (kg/ha)	1980	1666	4033	1600	12450	1063	2735	3670	7178	9155
Selling Price, P_i (BDT/kg)	32	33	38	43	12	45	23	36	45	19

The water depth requirements as well as production cost (C_i) were collected from the Monitoring report. The cost of irrigation (C_w) was acquired from Irrigation Institutions of Bangladesh: Some Lessons.[2]The cost of irrigation is 8.56 BDT/mmha. These data are represented in Table 3.

The water volume capacity (V_w) for irrigation was calculated and found to be 126798372 mmha. The data

for this calculation are provided in Table 4.The Data were taken from Irrigation "Manual for Farmer and Monitoring report for the agricultural year 2012-13". The table shows the different types of water pump and their maximum irrigation capacity. Pumps can run 12 hours a day due to Electricity problem and maintenance of the water pump. Annual volume water supply for the KalihatiUpazilaIrrigation project is 1.2679837e+12 Liter or 1267898372mmha.

Table 3 : Water depth limits and Production costs for different crops[7,8]

	Crops									
	T-Aman	B-Aman	Boro	Aus	Potato	Mustard seeds	Wheat	Jute	Garlic	Onion
Maximum depth, W_{imax} (mm)	600	200	1500	860	220	100	200	50	150	120
Minimum depth, W_{imin} (mm)	550	60	1300	650	180	10	150	10	100	100
Production Cost, C_i (BDT/ha)	37560	30250	70510	25620	64680	41950	58628	50000	68210	40330

Table 4 : Water volume calculation for the observed year[2,9]

Type	Number	Capacity (Lt/s)	Total (Lt/s)
Deep Tube well	59	56.64	3341.76
Shallow Tube well	5327	14.16	75430.20
Power Pumps	58	28.32	1642.56
		Total	80415.00

The objective function for this case study can be extended after calculating all the available data

$$Maximize, Z = 25800X_1 + 24728X_2 + 82744X_3 + 43180X_4 + 84720X_5 + 5885X_6 + 4277X_7 + 82120X_8 + 254800X_9 + 133615X_{10} - 8.56(W_1X_1 + W_2X_2 + W_3X_3 + W_4X_4 + W_5X_5 + W_6X_6 + W_7X_7 + W_8X_8 + W_9X_9 + W_{10}X_{10})$$

The restrictions for the cropped area are following

a) *Constraints for water supply availability*

$$W_1X_1 + W_2X_2 + W_3X_3 + W_4X_4 + W_5X_5 + W_6X_6 + W_7X_7 + W_8X_8 + W_9X_9 + W_{10}X_{10} \leq 126798372\ mmha$$

b) *Constraint for maximum crop area availability*

$$X_3 + X_6 + X_7 + X_9 + X_{10} \leq 17750\ ha$$

$$X_3 + X_7 + X_8 + X_9 + X_{10} \leq 17750\ ha$$

$$X_3 + X_8 + X_9 \leq 17750\ ha$$

$$X_3 + X_8 \leq 17750\ ha$$

$$X_4 + X_8 \leq 17750\ ha$$

$$X_2 + X_4 + X_8 \leq 17750\ ha$$

$$X_1 + X_2 + X_4 + X_8 \leq 17750\ ha$$

$$X_1 + X_2 + X_4 + X_5 \leq 17750\ ha$$

$$X_1 + X_2 + X_5 + X_9 \leq 17750\ ha$$

$$X_1 + X_2 + X_5 + X_6 + X_7 + X_9 \leq 17750\ ha$$

$$X_6 + X_7 + X_9 + X_{10} \leq 17750\ ha$$

c) *Constraint for irrigation depth*

$$550 \leq W_1 \leq 600$$

$$60 \leq W_2 \leq 200$$

$$1300 \leq W_3 \leq 1500$$
$$650 \leq W_4 \leq 860$$
$$180 \leq W_5 \leq 220$$
$$10 \leq W_6 \leq 100$$
$$150 \leq W_7 \leq 200$$
$$10 \leq W_8 \leq 50$$
$$100 \leq W_9 \leq 150$$
$$100 \leq W_{10} \leq 120$$

d) Particular high land requirement for mustard seeds

$$X_6 \leq 1860\ ha$$

e) Market demand constraint for

T-Aman has a minimum requirement of 3000 hector due to market demand

$$X_1 \geq 3000\ ha$$

B-Aman also has a minimum requirement of 1600 hector due to market demand

$$X_2 \geq 1600\ ha$$

f) Particular land constraint for Aus and Potato

Aus and Potato can be cropped in a particular area of land which have the following limit

$$X_4 \leq 1850\ ha$$
$$X_5 \leq 400\ ha$$

g) Local demand and available land constraint for Garlic and Onion

Both of them have limits for available land due their particular cropping procedure. But considering the need of local markets they have minimum bounds

$$50 \leq X_9 \leq 100\ ha$$
$$60 \leq X_9 \leq 120\ ha$$

h) Non-negativity constraints

$$X_6 \geq 0\ ha$$
$$X_7 \geq 0\ ha$$
$$X_8 \geq 0\ ha$$

IV. Results and Discussion

After carrying out the study for irrigation project at Kalihati with yearly water availability of 126798372 mmha and land availability of 17750 ha, optimum crop planning and recommended values for water depth for different crops were identified using the maximization function while satisfying maximum and minimum crop area requirements. The problem was solved using Lingo, an optimization modelling software. The results of the model obtained from the software after going through 34 iterations and 0.21s elapsed time are shown in Table 5. The T-Aman crop was indicated a recommended area for cropping of 3000 ha associated with its lowest bound. B-Aman represented an area of 10920 ha with 150 mm water depth requirements. While Boro and Aus had greater impact on objective function having high net volume coefficient, only Boro seemed to achieve highest cropped area (i.e. 15670 ha). This is due to the land allocation limit for Aus crop which is 1850 ha. As Potato and Mustard seeds have upper bounds they were found to have reached that bound with minimum water depth requirements. Even though Wheat and Jute had no upper bounds, Wheat had no area allocated for production whereas Jute had 1980 ha allocation. Such scenario can also be attributed to the difference in their net income factor in maximization function. Garlic and Onion had good productivity but production were limited to their restriction for availability of land. The net income worth for this project was 1,856,910,000BDT.

Table 5 : Result obtained by optimizing the objective function

Crops	Area(ha)	Water depth(mm)	Sowing time
T-Aman	3000	550	August
B-Aman	10920	150	July
Boro	15670	1300	January
Aus	1850	650	June
Potato	400	180	September
Mustard seeds	1860	10	December
Wheat	0	-	-
Jute	1980	10	April
Garlic	100	100	October
Onion	120	120	December

V. Conclusion

The model applied to the studied area found to be suitable for irrigation and cultivation decision making which gave optimum result for required variables such as irrigation water depth and cropping area allocation. The land area limitation and constraints of water supply became effective restriction for the model. The local market demand also significant impact in setting the production requirements.

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To Estimate the Standard Minute Value of a Polo-Shirt by Work Study

By Dr. Mohammad Abdul Jalil, Md. Tanjim Hossain, Md. Mazharul Islam, Md.Moshiur Rahman & Prashanta Kumar Roy
Mawlana Bhashani Science and Technology University University, Bangladesh

Abstract - This study is based on calculation of standard minute value of Polo-shirt. An experimental investigation for the distribution of SMV for each and every operation require for making a Polo-shirt and provides a clear and details concepts for determining line balancing, machine requirements, man power allocation for setting a definite target within a reasonable efficiency. This study is a details discussion and distribution of SMV which will assist to minimize SMV by having a better synchronization with man, machine, materials and methods to achieve higher efficiency.

Keywords: polo-shirt, smv, line balancing, performance rating, stitch type, allowances, work study.

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To Estimate the Standard Minute Value of a Polo-Shirt by Work Study

Dr. Mohammad Abdul Jalil [α], Md. Tanjim Hossain [σ], Md. Mazharul Islam [ρ], Md. Moshiur Rahman [ω] & Prashanta Kumar Roy [¥]

Abstract- **This study is based on calculation of standard minute value of Polo-shirt. An experimental investigation for the distribution of SMV for each and every operation require for making a Polo-shirt and provides a clear and details concepts for determining line balancing, machine requirements, man power allocation for setting a definite target within a reasonable efficiency. This study is a details discussion and distribution of SMV which will assist to minimize SMV by having a better synchronization with man, machine, materials and methods to achieve higher efficiency.**

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I. Introduction

The polo shirt would be better named the tennis shirt, since it was first designed by Jean René Lactose, a world-class tennis player who was fondly called the alligator or crocodile because of his vicious playing tactics. Lactose, like many tennis players in the early 20th century, felt tennis garb was restrictive, as players had to wear long sleeved shirts and ties. In 1929, Lactose made the polo or tennis shirt out of pique cotton in a loose knit, with a button down collar that could be flipped up for extra sun protection, and thankfully no tie [1].

As dressing became less formal for men, the polo shirt migrated into popular culture as semi-casual wear. Ralph Lauren's brand Polo was helpful in setting the style of the polo firmly in place in the 1950s. These shirts have even become popular in school uniforms for private and often Catholic schools. While most private schools in the 1970s insisted on boys wearing the more standard non-knit cotton button down, now many simply require a polo shirt in the color the school wears. In the 1980s, Lactose brand polo shirts were for a time, a status symbol for both young men and women.

Though anybody could certainly get less expensive pools, wearing the Lactose with its tiny alligator insignia on the chest was considered highly fashionable. It was associated with the 1980s "Preppy" look [2]. Today's business climate for clothing manufacturers requires low inventory and quick response systems that turn out a wide variety of products to meet customers demand. It is especially in the apparel industry that managers are trying to develop their current systems or looking for new production techniques in order to keep pace with the rapid changes in the fashion industry.

Therefore, to develop a new system, good observation is needed. However, to observe real manufacturing systems is very expensive and sometimes cumbersome [3].

In garment production, until garment components are gathered into a finished garment, they are assembled through a sub-assembly process.

The production process includes a set of workstations, at each of which a specific task is carried out in a restricted sequence, with hundreds of employees and thousands of bundles of sub-assemblies producing different styles simultaneously [4].

The joining together of components, known as the sewing process which is the most labor intensive part of garment manufacturing, makes the structure complex as the some works has a priority before being assembled [5].

Furthermore, since sewing process is labor intensive; apart from material costs, the cost structure of the sewing process is also important. Therefore, this process is of critical importance and needs to be planned more carefully [6].

Assembling process flows from one station to another. In assembly line balancing, allocation of jobs to machines is based on the objective of minimizing the workflow among the operators, reducing the throughput time as well as the work in progress and thus increasing the productivity. Sharing a job of work between several people is called division of labor. Division of labor should be balanced equally by ensuring the time spent at each station approximately the same [7].

Since the late 1970s, the RMG industry started developing in Bangladesh primarily as an export-oriented industry and the domestic market for RMG has been increasing fast due to increase in personal disposable income and change in life style.

The sector rapidly attained high importance in terms of employment, foreign exchange earnings and its contribution to GDP.

Author α: Department of Textile Engineering, Mawlana Bhashani Science and Technology University, Tangail (Bangladesh).
Author σ, ρ, ω: Department of Textile Engineering, Northern University Bangladesh, Dhaka (Bangladesh). e-mail: tanjimseu@yahoo.com
Author ¥: Department of Textile Engineering, European University Bangladesh, Dhaka (Bangladesh).

The major importers are European Union, USA and Canada. Knit garments are exported to 148 countries and woven garments are exported to 132 countries [8]. The major buyers are Wal-Mart, target, Marks and Spencer, Tesco, Levi's, Zara, JC Penny, GAP, C &A, UNIQLO etc. It contributes more than 80% of total export earnings.

Since buyer comes to this region for the lowest labor price ($0.11 per shirt for Bangladesh, $0.26 for India, $0.79 for Srilanka), the quality of the garments, efficiency and productivity of Bangladesh RMG sector remain ignored even in the tough competitive market.

Factories in Srilanka operate at 80% - 90% of efficiency, whereas in Bangladesh, according to some experts, productivity is between 35% and 55% of efficiency with very few exceptions. For the RMG sector in Bangladesh, productivity alone can make a difference between life and death [9].

II. Objectives of the Study

The main objective of the study is to determine the manpower and machine allocation for particular target. It is also designed to address the following issues:

- To determine line balancing
- To determine operational sequence of the manufacturing process of Polo-shirt
- To develop the target of the manufacturing process
- To increase the productivity of the company
- To make proper distribution of SMV
- To make better utilization of man, machine and materials

III. Methodology

We have done this experiment in SM Knitwear Ltd. Bangladesh. We attempted this study for proper utilization of man and machine. We made a little bit change of existing line balancing and process layout for number of operations that was done by man power. In this experiment we used auto machines in some operations instead of man power and also find out the performed SMV after the modification of operations.

a) Anatomy of a polo-shirt

A polo shirt, also known as a golf shirt and tennis shirt, is a form of shirt with a collar, a placket with typically two or three buttons, and an optional pocket. Polo shirts are usually made of knitted cloth (rather than woven cloth) usually piqué cotton or less commonly silk, merino wool, or synthetic fibers. A dress-length version of the shirt is called a polo dress.

Figure 1: Polo-shirt outline

Table 1: Different components of Polo-shirt

Sl. No.	Parts of a Polo-shirt
01	Collar
02	Placket
03	Front Part
04	Back Part
05	Sleeve
06	Hem

Making process of Polo-shirt

Placket Rolling
↓
Placket Join
↓
Nose Tuck
↓
Shoulder Join
↓
Collar Join
↓
Collar Piping
↓
Upper Placket Top Stitch
↓
Lower Placket Top Stitch
↓
Back Neck Top
↓
Placket top
↓
Placket Box
↓
Sleeve Cuff Join
↓
Cuff Top Stitch
↓
Sleeve Join
↓
Arm Hole Top
↓
Side Seam

↓
Body Hem
↓
Sleeve tuck

↓
Button Hole
↓
Button Stitch

IV. Results And Discussion

Table 2 : Process layout and line balancing of Polo- shirt (Before study)

Sl. No.	Operations	Machines	Stitch type	Man power	
				Helper	Operator
1	Placket position mark	Helper	–	1	
2	Placket fusing	Iron man	–	1	
3	Body scissoring	Helper	–	1	
4	Both placket joint on front part	LS	1N Lock Stitch		2
5	Placket nose tack	LS	1N Lock Stitch		1
6	Placket raw edge cut	Helper	–	1	
7	Lower placket close	LS	1N Lock Stitch		1
8	Upper placket close	LS	1N Lock Stitch		1
9	Placket security tack	LS	1N Lock Stitch		1
10	Placket box	LS	1N Lock Stitch		2
11	Body match	Helper	–	1	
12	Shoulder joint with piping	OL	Over edge Stitch		1
13	Shoulder top stitch	FL	Chain / Flat bed Stitch		1
14	Collar mark	Helper	–	1	
15	Collar over lock	OL	Over edge Stitch		1
16	Collar joint	OL	Over edge Stitch		2
17	Neck piping	FL	Chain / Flat bed Stitch		1
18	Neck top stitch	LS	1N Lock Stitch		1
19	Main label joint	LS	1N Lock Stitch		2
20	Sleeve match and shoulder piping cut	Helper	–	1	
21	Sleeve joint	OL	Over edge Stitch		2
22	Thread cut	Helper		1	
23	Bottom hem	FL	Chain / Flat bed Stitch		1
24	Care label joint	LS	1N Lock Stitch		1
25	Placket servicing	OL	Over edge Stitch		1
26	Side seam	OL	Over edge Stitch		3
27	Thread cut	Helper		1	
28	Side slit tape measure and cut	Helper	–		1
29	Side slit tape attach	LS	1N Lock Stitch		3
30	Side slit tape top stitch	LS	1N Lock Stitch		2
31	Slit security tack	LS	1N Lock Stitch		1
32	Button attach and hole mark	Helper	–	1	
33	Button hole	BH	1N Lock Stitch		1
34	Button attach	BS	1N Lock Stitch		1
				10	34
				Total man= 44	

Table 3 : Process layout and line balancing of Polo- shirt (After study)

Sl. No.	Operations	Machines	Stitch type	Man power	
				Helper	Operator
1	Placket position mark	Helper	–	1	
2	Placket fusing	Iron man	–	1	
3	Body scissoring	Helper	–	1	
4	+Both placket joint on front part	LS	1N Lock Stitch		2
5	Placket nose tack	LS	1N Lock Stitch		1
6	Placket raw edge cut	Helper	–	1	
7	Lower placket close	LS	1N Lock Stitch		1
8	Upper placket close	LS	1N Lock Stitch		1
9	Placket security tack	LS	1N Lock Stitch		1
10	Placket box	LS	1N Lock Stitch		1
11	Body match	Helper	–	1	
12	Shoulder joint with piping	OL	Over edge Stitch		1
13	Shoulder top stitch	FL	Chain / Flat bed Stitch		1
14	Collar mark	Helper	–	1	
15	Collar over lock	OL	Over edge Stitch		1
16	Collar joint	OL	Over edge Stitch		2
17	Neck piping	FL	Chain / Flat bed Stitch		1
18	Neck top stitch	LS	1N Lock Stitch		1
19	Main label joint	LS	1N Lock Stitch		1
20	Sleeve match and shoulder piping cut	Helper	–	1	
21	Sleeve joint	OL	Over edge Stitch		2
22	Bottom hem	FL	Chain / Flat bed Stitch		1
23	Care label joint	LS	1N Lock Stitch		1
24	Placket servicing	OL	Over edge Stitch		1
25	Side seam	OL	Over edge Stitch		2
26	Side slit tape measure and cut	Helper	–		1
27	Side slit tape attach	LS	1N Lock Stitch		2
28	Side slit tape top stitch	LS	1N Lock Stitch		2
29	Slit security tack	LS	1N Lock Stitch		1
30	Button attach and hole mark	Helper	–	1	
31	Button hole	BH	1N Lock Stitch		1
32	Button attach	BS	1N Lock Stitch		1
				8	30
				Total man= 38	

Earlier line was not balanced properly and non-value added helper was used. After study line has been balanced by time and capacity study according to target such as SMV for placket box 0.484, main label joint 0.396, side seam 0.77 and side slit tape attach 0.66. For which operation to achieve target need 1, 1, 2 and 2 operators consecutively but before balancing they used 2, 2, 3, 3 operators and also after over lock operation used helper. After study auto thread trimmer over lock machine has been set for those operations and two helpers have been reduced. Before study man power was 44 and after study man power is 38. Ultimately keeping the target same 6 persons have been saved.

Estimate assembles time of polo-shirt:

Let,

Performance rating = 110%

Machine and personal allowances = 20%

Table 4 : Standard Minute Value (SMV) Calculation

Sl. No.	Operations	Average cycle time in second	Performed SMV
1	Placket position mark	17	0.374
2	Placket fusing	18	0.396
3	Body scissoring	15	0.33
4	Both placket joint on front part	43	0.946
5	Placket nose tack	21	0.462
6	Placket raw edge cut	21.33	0.469
7	Lower placket close	19	0.418
8	Upper placket close	19	0.418
9	Placket security tack	18	0.396
10	Placket box	22	0.484
11	Body match	15	0.33
12	Shoulder joint with piping	20	0.44
13	Shoulder top stitch	20	0.44
14	Collar mark	18	0.396
15	Collar joint	36.66	0.806
16	Collar over lock	19	0.418
17	Neck piping	20	0.44
18	Neck top stitch	20	0.44
19	Main label joint	18	0.396
20	Sleeve match and shoulder piping cut	15	0.33
21	Sleeve joint	31	0.682
22	Bottom hem	16	0.352
23	Care label joint	17	0.374
24	Placket servicing	16	0.352
25	Side seam	35	0.77
26	Side slit tape measure and cut	15	0.33
27	Side slit tape attach	30	0.66
28	Side slit tape top stitch	32	0.704
29	Slit security tack	13	0.286

30	Button attach and hole mark	14	0.308
31	Button hole	13.5	0.297
32	Button attach	14	0.308
	Total Estimated SMV		≈14.552

There are different kinds of polo shirt available in market and sewn in the ready-made garments manufacturing companies such as, polo shirt with single collar, polo shirt with double collar, polo shirt having rib cuff and without rib cuff, short sleeve and long sleeve polo shirt, polo shirt with slit band and without slit band, polo shirt with button and without button. Number of man power required to stitch a garments against a particular line target vary according to the type and style that is selected to stitch hence SMV of the polo shirt vary according to the style and number of operations carried out. And according to the style we can define as basic or critical.

The estimated results have been presented in Table 1, 2, 3 and 4. From the Table 1 we have worked centering a basic polo shirt which contains the parts as front part, back part, placket, sleeve, collar and hem.

Again from the Table 3 it is found that the number of single operations required to stitch the polo shirt is 32 (including operators and helpers) that was 34 before the study (Table 2). And required total number of man power is 44 (34 operators and 10 helpers) before study and 38 (30 operators and 8 helpers) after study.

In the table 4, consider 110 % performance rating and 20% machine and personal allowances. Finally we have got the SMV 14.552 from the Table 4 for the above mentioned polo-shirt.

V. Conclusion

This present study is based on an effective layout model of polo shirt where to use balancing process using short cut method. Here we have suggested following pitch diagram method to identify bottleneck operations and to solve the problem by 100 percent balancing.

During the study we have seen thread trimming is being done manually using helper which is non value added unnecessary operation can be removed by setting auto trimmer along with machine or by using auto machine. The study shows that this balanced layout model has brought a better synchronization among man machine and materials increasing the efficiency and productivity. Traditionally operated garment industries are facing problems like unnecessary operations, wastage, rejection, poor line balancing etc. This problem can be eradicated by getting used with 5S method and making the working environment totally visualized [10]. Here to achieve better quality and cost effective production we can follow Standard Operation procedure (SOP) .When we will follow SOP we will be able to find unnecessary operations and due to follow standard procedure wastage and rejection will gradually come down at a tolerable level or zero. Thereafter in this way we can reach to our expected productivity and efficiency which is the main goal of our study.

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4. Manuscript's Category,

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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