MICROCONTROLLER BASED NON-INTERRUPTED AUTOMATIC TRANSFER SWITCH

**A Project and Thesis submitted in partial fulfillment of the requirements
for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering**

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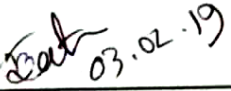
December-2018

CERTIFICATION

This is to certify that this project entitled **"MICROCONTROLLER BASED NON-INTERRUPTED AUTOMATIC TRANSFER SWITCH''** is done by the following students under my direct supervision .Thesis project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Daffodil International University in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering**.

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ii

The project entitled "**MICROCONTROLLER BASED NON-INTERRUPTED AUTOMATIC TRANSFER SWITCH"** submitted by **Md. Tahsan Al Amin Rasel** , ID: 153**-33-2979**, **Md. Sanuar Hossan Shohag**, ID: **153-33-3037**, Session: Fall 2018 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** December 2018.

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Dedicated to …
Our Beloved PARENTS
&
All of Our TEACHERS

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AC   Alternating Current.

IC   Integrated Circuit

SMPS   Switched Mode Power Supply

ATS   Automatic transfer switch

LED   Light emitting diode

LCD   Liquid crystal display

ISP   Internet service provider

SPI   Serial Peripheral Interface bus

PSU   Power Supply Unit

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ix

First we express our heartiest thanks and gratefulness to almighty Allah for his Divine blessing makes us possible to complete this project successfully. We feel grateful to and wish our profound our indebtedness to **Tasmia Batan Dina**, **Sr.Lectural, Department of Electrical and Electronic Engineering, Daffodil International University**, **Dhaka.** Deep knowledge & keen interest of our supervisor influenced us to carry out this Project. Her endless patience, continual encouragement, constantan energetic supervision valuable advice at all stage made it possible to complete this Project. We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work. Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Untrustworthiness in electric powered energy supply has occasioned the growth of reserve mills specifically in developing nations. Be that as it is able to, the techniques and hardware applied to impact control deliver changeover stay loaded with problems jogging from wastefulness to price. Maximum organizations nevertheless make use of the manual strategy for strength supply changeover, which is assailed through a horde of mishaps such as: time wastage, strenuous task, defenselessness to flame flare-up and excessive help recurrence. This paper displays a Microcontroller-based computerized transfer switching device (MBATSS), which wipes out the difficulties of a guide changeover framework. A voltage detecting circuit, a hall impact current sensor, transfers, LEDs and a liquid crystal display had been altogether organized utilizing an ATmega328p microcontroller. A framework flow outline become created for the firmware and the microcontroller changed utilizing GCG basic programming. The undertaking of the structured hardware turned into directed making use of configuration suit programming. The duplicate outcomes vindicated the strategy utilized, in this manner, asserting the usefulness of the proposed shape. Length investigation yielded exquisite outcomes, as round 0.1 seconds slips with the aid of amid the entire procedure of depth supply changeover.

CHAPTER 1

INTRODUCTION

1.1 General Information

An alternate transfer is an electrical transfer that switches a heap among two assets. a few exchange switches are manual, in that an administrator affects the change with the aid of tossing a switch, whilst others are programmed and cause once they sense one of the sources has lost or picked up electricity. An programmed trade transfer is regularly delivered wherein a reinforcement generator is located, in order that the generator may also provide transitory electric energy if the utility supply fails.as well as replacing the heap to the reinforcement generator an ATS may also likewise course the reinforcement generator to start dependent on the voltage located on the critical supply. The exchange switch detaches the reinforcement generator from the electrical utility while the generator is on and giving impermanent power .The control capacity of an exchange switch might be guide just or a mix of programmed and manual. The switch development technique of a change switch might be open transition, or shut change.

1.2 History

A change switch may be set up to offer manage just too basic circuits or to complete electric (sub) panels. some exchange switches keep in mind stack shedding or prioritization of discretionary circuits, for instance, warming and cooling hardware more and more complex disaster switchgear utilized in widespread reinforcement generator establishment allows delicate stacking allowing burden to be easily exchanged from the utility to the synchronized generators and returned such establishment are useful for lessening pinnacle load request from an software.

1.3 Background Study

Then again, a programmed change switch (ATS) constantly screens electric powered software strength. Vacillations or actual power best issues, which may fit before a blackout, trigger a start order to the generator. After reinforcement voltage and recurrence stability out, the exchange switch brings the generator at the web.

At the factor whilst a disappointment takes place in an important power framework, the ATS summons a standby power source, for example, an uninterruptable energy deliver. An ATS can likewise begin up gradually long haul reinforcement manage frameworks, as an example, community diesel generators, to run electric hardware till the factor while utility power is reestablished.

On this manner, it's miles therefore that trade over or exchange switches have been created. At first, these switches were meant for guide duties, but with a ramification within the revolutionary development of electrical electricity manipulate and mechanization that, computerized change switches (ATS) were made. It kills the issue of exertions collaboration in starting a generator and converting force supply starting with one source then onto the subsequent.

an automated change transfer (ATS) is an electrical/electronic switch that detects while the mains or open application supply is hindered and therefore starts off evolved up an auxiliary supply (sun powered, IPS &generator set) if the application stays inaccessible.

1.4 Project Objectives

The main objectives of this project is –

- Make current flow continually

- Detect power failures

- Initiate alternate sources

- Transfer load to alternate sources

- Senses restoration of normal power

- Transfer load back to normal load

- Withstand and close on fault currents

CHAPTER2

PROJECT REVIEW

GENERAL INFORMATION.

Switches, in any other case referred to as changeover switches, are electrical gadgets established transfer to govern an electric load from extraordinary sources. They're essentially utilized with generator units in programs wherein the thousands require, if not a completely chronic, no much less than a continuing supply of electric power. Exchange switches may be physically or clearly labored. A manual alternate transfer field isolates the utility supply from the reserve generator. At something factor there is manage sadness, changeover is carried out physically by way of humans and the equal happens when fashionable society utility electricity is reestablished and this is commonly went with uproarious commotion and electric sparkles. An automatic transfer (ATS) is applied with backup frameworks. It includes a control circuit that detects mains voltage. on the factor whilst mains manage is interfered with, the control circuit starts up the generator set, disengages the heap from the software and interfaces it to the generator set. It at that factor maintains on checking the mains reputation. At the factor when mains manipulate is reestablished, it drives the heap from the generator returned to the application inner a side time Anon.

2. Parallel sharing of dynamic and responsive energy supply

3. Minimization of coursing cutting-edge circulation

4. Over-burden security

5. voltage following

6. Recurrence of activity must be stored up on framework

Generally the yield present day might also incorporate coursing modern-day. Be that as it could, for a few situation, there is as but a flowing current among parallel inverter due to contrasts in the instant yield voltage

13
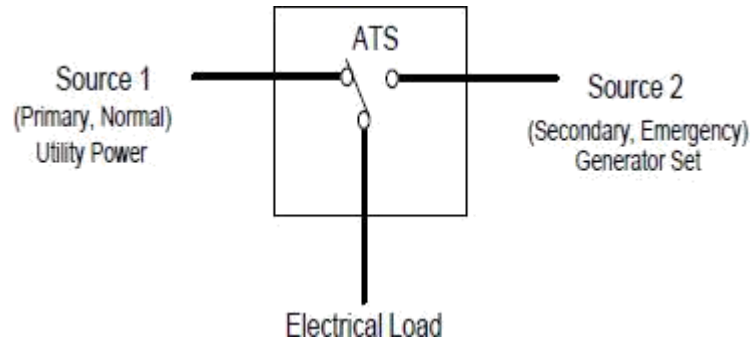
Fig 2.1: Schematic Diagram of a Typical Transfer Switch

2.2 The Automatic Transfer Switching System in Present

In general, a switch control mechanism could be done electromechanically or solid state-based. Both methods come with corresponding trade-offs ranging from efficiency to cost. The methods of switching on standby generators can also be categorized mainly into two modes: Open Transition (OT) mode and Closed Transition (CT) mode Anon. (2014a).

An ATS is an electrical device for transferring power sources to an electrical load. The switch should have the ability to sense the loss or fluctuation of power from the main source and based on that stimulus, initiate and execute the process of transfer of source to the load. Normally, the sensing circuits are connected to the power sources through relays. Transfer switching systems have been studied by numerous researchers with different applications usually aimed at reducing component count and minimizing power consumed by the control circuitry (Aguinaga, 2008), (Kolo, 2007), (Chukwubuikem, 2012), Anon. (2013a). The ATS is able to monitor all the sources consistently for over/under voltage and current conditions or total loss of power and issue an appropriate command for the transfer of load to an alternate power source.

14
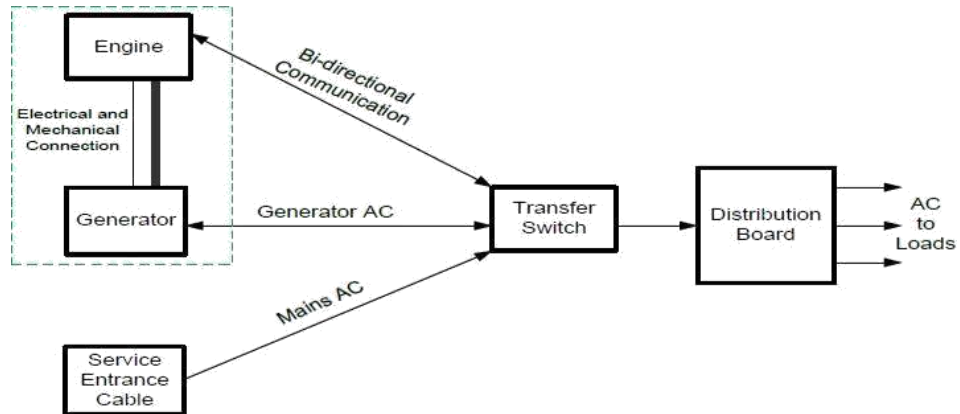
Fig 2.2 Block Diagram of the Overall System Design

This paper reports on the design of an efficient microcontroller-based ATS making use of relays, voltage and current sensing circuitry, a display unit and an alarm unit in order to reduce the circuit's power consumption, operate fast, reduce component count and considerably reduce cost. Fig. 3 and Fig. 4 show a block diagram of the overall system design and the block diagram of the ATS respectively (Anderson, 2003).

The system hardware consists mainly of a Transfer Switch (TS) microcontroller serving as the main controlling device to which all other devices are connected. The AC voltage sensing circuits sense the status of the AC power from the mains and generator and communicate it to the TS microcontroller.

A Hall Effect current sensor feeds the load current to the TS controller. A source change relay acts as switchgear to switch power sources between mains and generator to the load.

Fuel flow and starter relays are used to start the fuel flow pump and engine respectively. All the relays are driven by a relay driver (ULN2003A). The TS microcontroller monitors the charging state of a battery that supplies power to the entire control circuitry.

Voltage Sensing Circuit

By a voltage sensor circuit, where if we get to a certain level of voltage, then the output will turn on. And we can build a voltage sensor circuit, simply with a voltage

15

Comparator chip or an op amp that can function as a voltage comparator. A voltage comparator chip is a chip that contains 1 or more op amps.

Two AC voltage sensing circuits continuously monitor the state of the utility supply, generator and communicate it to the TS microcontrollers. The voltage sensor, as shown in the circuit diagram in Fig. 5, is made up of a 230/3.4 V step down transformer, two resistors, a diode and a capacitor. To ensure that 6 V TTL requirement of the microcontroller is not violated, a voltage divider circuit, consisting of R1 and R2 is used to output about 5 V to the controller. This is achieved by setting the ratio of R1 to R2 to be 10 is to 5. The values of R1 and R2 are deliberately selected in the kilo ohm range in order to limit the sink current to the microcontroller. The diode and capacitor C1 are used to give a unidirectional DC to the respective input pin of the microcontroller. An AC sensor (ACS712-05B-T); is used to monitor the load for over- and under-current conditions.

The change breaker relay, OMIH-SH-105D, was selected to commute the power source from utility to generator and vice versa. This is necessary in order to avoid both sources being connected at the same time, otherwise the generator could "back feed" into the utility lines. This is an unhealthy condition since personnel working on the line could be electrocuted. This calculation is done for a typical company in Tarkwa.

2.3 How does an automatic transfer switch operate

A programmed alternate switch is a device used to reroute control in first rate conditions. For instance, amid a characteristic catastrophe the overall populace application energy may go out at a recuperation middle and the programmed exchange transfer begins the lower back-up generator. There are a top notch deal of troubles related to such a change - no longer the slightest of that is selecting the selection approximately whilst it is included to change again to open software strength.

16
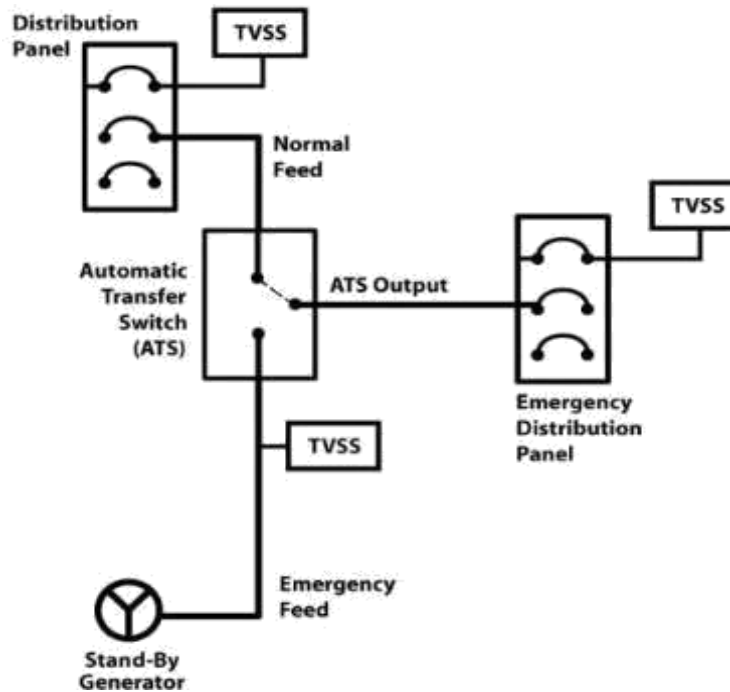
Fig2.3: Standard Automatic Transfer Switch

The alternate switch works with the aid of having a dedicated association of switches for every one of the circuits you want to control. Skirting the alternate switch and interfacing your generator specifically to your electrical administration board should broil apparatuses, imperil software specialists who may additionally take a shot at electric cables, or damage your generator.

2.4 Our Automatic Transfer Switch Characteristics and Review

Programmed switch Switches are applied to guarantee the development of depth deliver, regardless of the fact that this can suggest diverse things in diverse occasions. In a normal domestic, independent organization or employer, constant energy may additionally mean that a short interference may be persisted. As an example, if a reinforcement generator is utilized to supply reinforcement manipulate whilst open application electricity flops, there could be a respite whilst the generator begins up. In a physician's facility any interference of in extra of more than one moments is probably calamitous. There are some unique approaches that ATS can guard that the interference is rather concise - incorporating batteries to fill in the hole from the discontinuance of open application potential to the start of reinforcement generator deliver. A few programmed switches sense the quick plunges and spikes out in the open application strength that goes before sadness and starts off evolved up the generator earlier than the total sadness of open energy.

Our automated transfer switch works at multi-supply. Right here we make use of 4 sources. The first one is Line, 2nd one is solar, 0.33 one is IPS and the fourth one is generator. on the off threat that line is cut-off by any manner, internal 1-2 2nd the heap get manage from 2nd hand-off that's associated with solar based and detecting is completed by using the small scale controller and the miniaturized scale controller

17

ATmega328p is customized consistent with our required situation. additionally, the situations are in the occasion that line is off, the primary marker of line is off and the second one pointer of solar orientated is on, from which miniaturized scale controller gets flag that now the sun primarily based is on, at that factor smaller scale controller deliver feel the hand-off board and the switch is on that's related to the sun primarily based and the heap get control from the sun orientated in particular. step by step is sun powered is cut-off then get control from IPS at the similar away, likewise at the off threat that IPS isn't paintings, the generator is on by using a hand-off, stack get manipulate from the generator. Inside this time at the off danger that Line is again, the line marker is turn on and the smaller scale controller get display from the road pointer and turn on maintain hand-off and the heap get manage from the generator. We use battery having four volts (2 no's), add up to eight volts, from the voltage controller IC 7805 get voltage. From getting 8-24 volts 7805 IC yield five volt settled, that is ship to the smaller scale controller for dependably turn on, in mild of the reality that miniaturized scale controller desires settled 5v to show on. We use Arduino board for programming the ATmega328P chips. at the factor while line is dynamic, smaller scale controller get sign from pointer and activate the hand-off that's interface with line and by this heap motivate control from direct to line and show display that line is on and other three assets is off. at the factor while line is cut off then miniaturized scale controller get signal from marker and switch on the transfer that's interface with sun based and other hand-off might be off and by means of this heap get manipulate from direct to daylight based and show reveal that solar is on and different 3 assets is off. in the event that solar based totally is not paintings, then micro-controller get sign from marker and turn on the switch which is accomplice with IPS and other hand-off might be off and by this heap get manipulate from direct to IPS and display show that IPS is on and other three source is off.

in the occasion that IPS is not paintings, smaller scale controller get signal from pointer and activate the switch that is interface with Generator and other hand-off may be off and via this heap get manage from direct to Generator and show demonstrate that Generator is on and different three source is off. on the factor while line is returned/dynamic miniaturized scale controller get signal from marker and turn on the hand-off which is interface with line and different hand-off can be off and with the aid of this heap inspire manipulate from direct to line and show exhibit that line is on and other 3 supply is off. Right here we use 5 2d deferral for well-being. In the event that in any case over voltage or cutting-edge is stream, the breaker is liquefy and the heap

18

Will   secure   through   separate   the   wire.
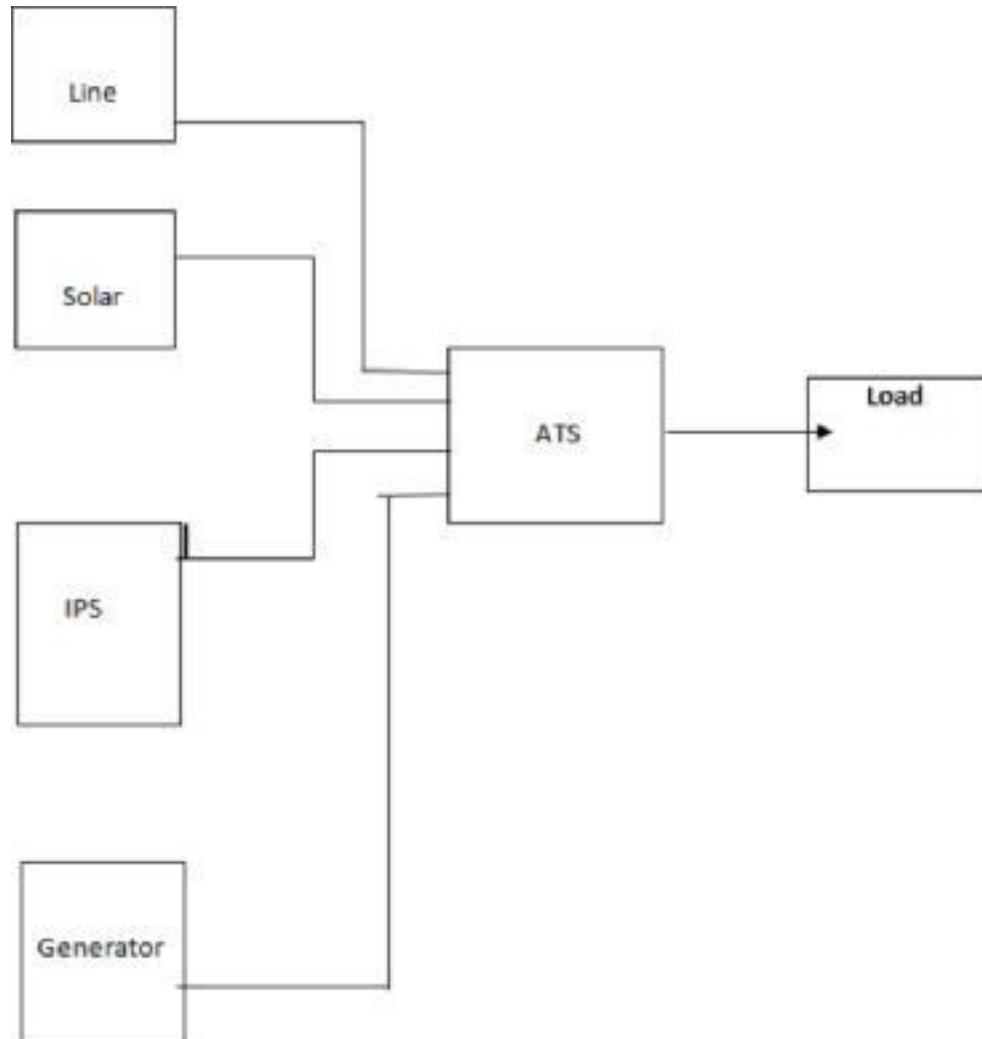
Fig2.4: Main Conceptual Block Diagram of our ATS

2.5 Why Our ATS is Non-Interrupted

Our ATS are worked utilizing hand-off cause which is managed via small scale controller to screen the reputation of preferred hotspot for blame condition. After perceiving a selected blame inside the desired source, the hand-off became arranged to exchange in the reserve source. Basically, it takes around 2 to 10 cycles or 40ms to 200ms for the exchange. There are two sorts of change conspire to be particular ruin earlier than made and make before break. For wreck before made, it changed into planned inside the way in which the capacity to the heap might be cut off earlier than load changed into moved to order manage. The upside of the plan is the primary electricity supply and backup electricity can never in parallel mode amid the changeover. Anticipated the present will go to zero amps formerly reserve manage ON and feed the heap. Imperceptibly the required alternate time is surpassing the energy great rule for retaining up the fundamental load. This will bring about a plant shutdown. In make before destroy, predicted the energy is ceaselessly feed to the

19

Heap. The disadvantage of the framework is the precept and steer clear of manipulate deliver should be in synchronous mode which the electrical parameter, for instance, voltage plenty fullness, tiers, recurrence and degree point ought to match. Be that as it could, for the American frame work, inverter units should consent to below prerequisites earlier than utilization of make before brake:-

1. Synchronization with distinctive inverters or matrices or burdens

2. rise to sharing of dynamic and receptive energy resources

3. Minimization of coursing modern streams

4. Over-burden protection of framework

5. Strict voltage following of framework

6. Recurrence of activity ought to be stored up

Commonly the yield modern might also incorporate flowing modern-day. Be that as it can, for some situation, there is as but a circling cutting-edge among parallel inverter because of contrasts within the spark off yield voltage

Right here intruded on cycles are = 2~10 cycles and interfered with time is set 45ms to220ms. Its miles shift inappropriate and this is the motive we can say that our ATS

Is   Non-Interrupted.
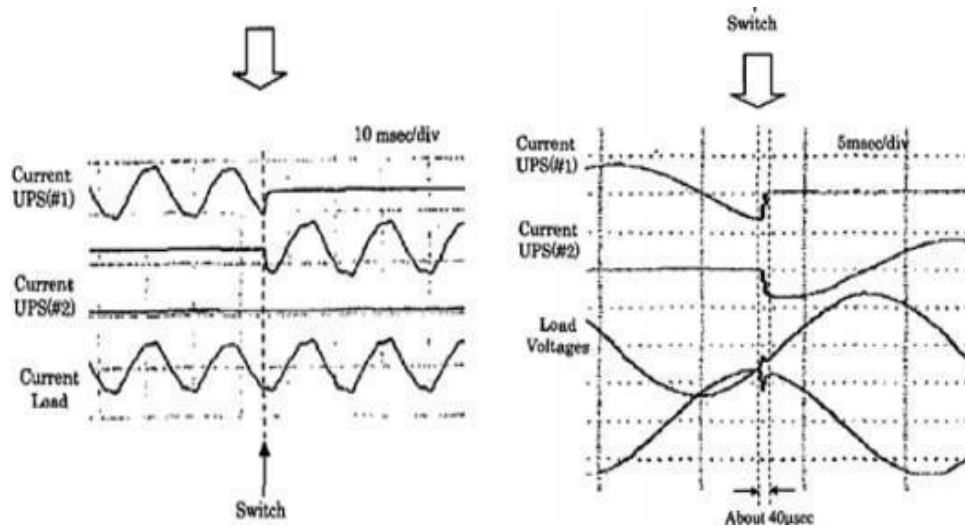
Fig2.5: Current and voltage waveform

We Know that,

f=1/t and here f=2~10 cycles/sec

So, the approximate time is t=40ms ~ 200ms; which is vary negligible in practical

Our progressive world has become out to be increasingly established to the ceaseless and accessibility of electrical energy. All of the insightful advances, for instance, automatic manner manage (APC) rely upon the strength that is free from interference or unsettling have an effect on. The outcomes, as an instance, era line depart control, making risky circumstance for on location workforce and costly material waste are practicable to arise because of application and records debasement by using electric strength interference. Because of that, several investigations have been directed and actualized across the world to perform excessive accessibility and unwavering quality of United States of American framework. Within the interim, some systems had been moreover settled to assure intrusion free amid United States of American substitution paintings if require framework remodeling.

2.6 Worked By Source Priority

- We use battery having 4 volts (2 no's), total 10 volts, from the voltage regulator

  IC 7805 get voltage. From getting 5.5-30 volts 7805 IC output 5 volt fixed, which

21

is send to the micro-controller for always turn on, because micro-controller needs fixed 5v to turn on.

- We use Arduinopro mini board for programming the ATmega328P chips.

- When line is active, micro-controller get indication from indicator and turn on the relay which is connect to line and by this load get power from direct to line and display show that line is on and other three sources is off.

- When line is cut off then micro-controller get indication from indicator and turn on the relay which is connect to solar and other relay is off and by this load gets power from direct to solar and display show that Solar is on and other three source is off.

- If solar is not work, voltage sensor get indication from indicator and turn on the relay which is connect to IPS and other relay is off and by this load get power from direct to IPS and display show that IPS is on and other three source is off.

- If IPS is not work, then micro-controller get indication from indicator and turn on the relay which is connect to Generator and other relay is off and by this load get power from direct to Generator and display show that Generator is on and other three source is off.

- When line is back/active micro-controller get indication from indicator and turn on the relay which is connect to line and other relay is off and by this load get power from direct to line and display show that line is on and other three source is off.

- Here we use 3 second delay for safety.

- If anyhow over voltage or current is flow then the fuse is melt and the load will safe by disconnect the fuse?

We use a charger for charge the battery, so that battery can charged always and micro-controller always on by getting 5v from 7805 IC

2.7 Description about Amperes vs. Timing

ATS Ratings(Amp)	Rating of operation per Min	With Current	Without Current	Total
0-250	1	6000	-	6100

22

251-450	1	4000	-	4100
451-850	1	2050	1050	3100
851-1650	0.51	1600	1500	3100
1651-4000	0.26	1100	2000	3100

Table 2.1: Amperes vs. Timing

The power switching operation of transfer switches may be separated into the three (3) Key categories of:

● Open Transition — Break-before-Make operation.

● Closed Transition — Make-before-Break operation.

● Closed Transition Soft Load — both sources are paralleled and can remain so indefinitely.

The three (3) basic components of a transfer switch are:

● Power switching device to shift the load circuits to and from the power source.

● Transfer Logic Controller to monitor the condition of the power sources and provide the control signals to the power switching device.

● Control power source to supply operational power to the controller and switching device.

2.8 Difference between Our ATS & Existing ATS in Market

Existing ATS in Market	Our ATS
In market the existing ATS are only used for only two source, which one is line and the other one is Generator only	Our ATS can use for multi-sources and loads. Here we use four source (Main Line, Solar system , IPS and Generator)
If any away the generator fail then the load will close.	Here we use ATS for multi-sources, that's why interruption of current is very rear
Efficiency is not very much well	Efficiency is very much high

23

This ATS has no protecting system to protect the load when any fault current is passes. And its faults	Our ATS have a 15amp Fuse, So If any fault current is occurred then the fuse is melt and the load remains safe from fault .
Comparatively cost is too high.	Comparatively cost is very low
Can't use in high confidential area or building or hospital because of only one alternative source or line ,is to supply the Power.	Can easily use in high confidential area or building or hospital or any important project because it can use multi source.
Reliability is low	High Reliability and safe
There are find many ATS which is not automatically transfer switch, manually transfer the switch by an operator. I may casus damage and dangerous	Fully Automatic system, so no need to operate by an operator.
Interrupted because of don't use any time sensing devise or sensor	Here, for accurate timing we use micro-controller which perfectly sensing by sensor
Don't have any monitor for check the connection that the generator is now working.	Our ATS contains a monitor which is show that which source is running and which one off and also show which source is supplying the power in the load

Table 2.2: Difference between Our ATS & Existing ATS in Market

2.9 Why our ATS is Effective

We can say that our ATS is very Effective for the below reason-

- Our ATS can use for multi-source and lines. Here we use four source (Main Line, Solar System , IPS and Generator line)
- Here we use ATS for multi-source, that's why interruption of current is difficult

- Efficiency is very high and safe

- Our ATS have a 15 amp Fuse, if any fault current is occurred then the fuse is melt and the load remains safe.
- High Reliability , easy to handle

- The system is Fully Automatic, so no need to operate by an operator.

24

- Here, for accurate timing we use micro-controller which perfectly sensing by programming in it.

- Our ATS contains a monitor which is show that which source is running and which one off and also show which source is supplying the power in the load

- Carry current flows continually

- Detect power failures and cut the line

- Initiate alternate sources

- Transfer load to alternate sources

- Sense restoration of normal power supply

- Transfer load back to normal load

- Withstand and close on fault current flow

25

CHAPTER 3

THEORETICAL MODEL

3.1 Block Diagram
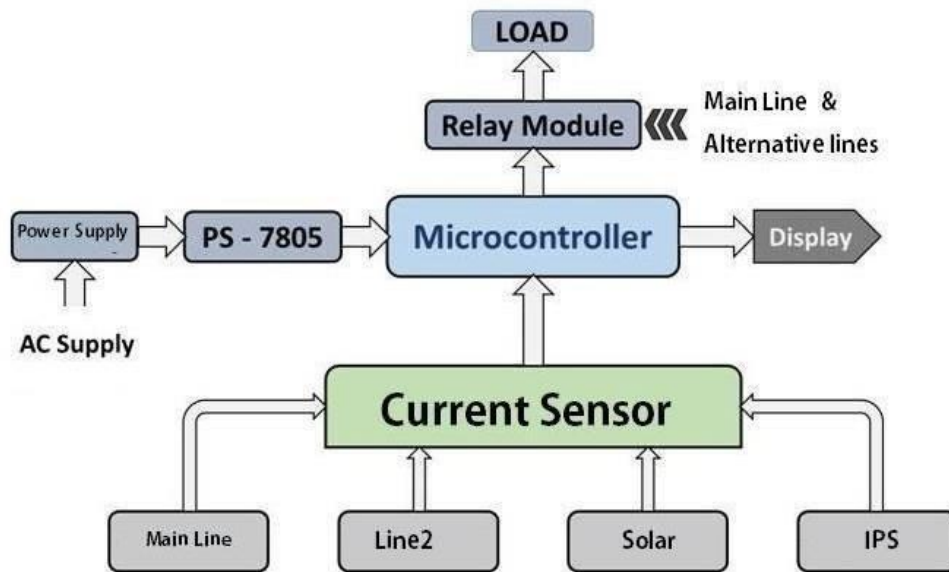
Fig.3.1: Block Diagram of Automatic Transfer Switch

The ATS monitors the supply of voltage from a single phase line and others source supply, it then base its control operation on the availability or unavailability of power supply from either sources. It consists of a series of relays contactors and protective devices that help form the control circuit of the ATS. The ATS switchgear system can be divided into four main functional blocks namely; the relay switching block, timer relay block, the contactor switching block and the Digital Multi Meter (DMM) Unit. The relay switching block comprises the voltage monitoring relay that monitors the supply voltage level and the 11-pin relays that act as sensor relays. The delay timer multifunctional relays of the utility and that of the generator sections provide some delays before

26

energizing the contactors which in turn provide power supply to the connected load, while the DMM measures the output voltage current and frequency of the supply to the load. The block diagram of the working principle of the ATS is as shown in figure

3.2 Schematics Diagram
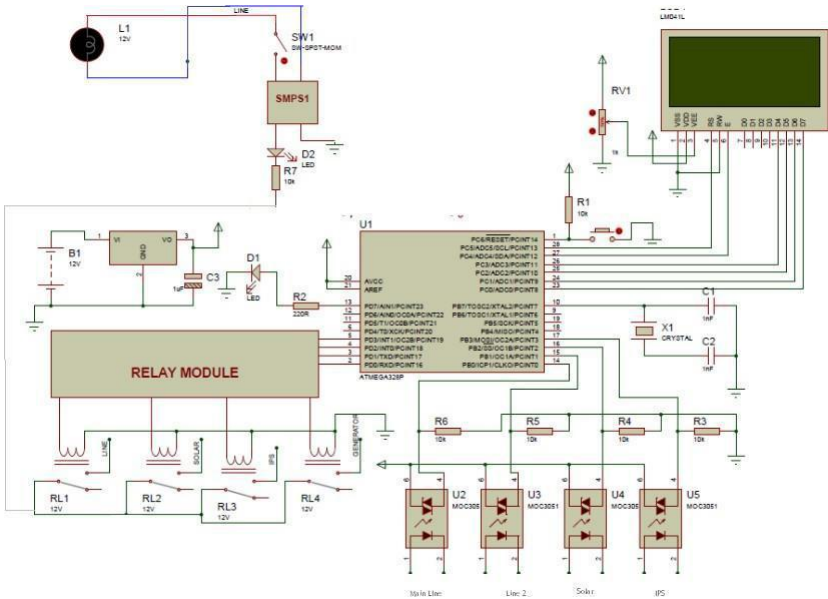
Fig.3.2: Project Schematics Diagram

For design schematics diagram we use PSpice software because PSpice software is very easy to operation and very easy to draw a schematics diagram.

27

3.3 Equipment Uses in the Circuit

No	Equipment	Quantity
01.	ATmega328P microcontroller	1
02.	SMPS (Switch Mode Power Supply)	1
03.	Voltage regulating IC (7805)	1
04.	Opt coupler PC817	8
05.	Relay 10A	4
06.	PCB	
07.	Capacitor (47μF,0.1μF)	1+2
08.	Resistance (10K, 1k, 100k)	1+1+4
09.	LED	4
10.	Connector (Two Terminal)	2
12.	Fuse (10 Amp)	1
13.	20 character 4 line LCD Display	1
14.	Connecting Wires	

Table 3.1: Equipment use in the circuit

ATmega328p

The Atmel eight-bit AVR RISC-primarily based microcontroller consolidates 32 kB ISP streak memory with read-even as-compose capacities, 1 kB EEPROM, 2 kB SRAM, 23 widely beneficial I/O traces, 32 universally useful working registers, 3 adaptable clock/counters with have a look at modes, inner and outer interferes with,

28

Sequential programmable USART, a byte-located 2-wire sequential interface, SPI sequential port, 6-channel 10-bit A/D converter (eight-directs in TQFP and QFN/MLF bundles), programmable guard dog clock with internal oscillator, and five programming selectable electricity sparing modes. The device works between 1.8- 5.five volts. The gadget accomplishes throughput transferring toward 1 MIPS for every MHz.

Fig. 3.3: Micro-Controller ATmega328P

Programming mode is entered when PAGEL (PD7), XA1 (PD6), XA0 (PD5), BS1 (PD4) is ready to 0.[2] RESET persist with 0V and VCC to 0V. VCC is set to four.5 - 5.5V. Keep up 60 μs, and RESET is about to eleven.5 - 12.5 V. hold up extra than 310 μs.[2] Set XA1:XA0:BS1:information = a hundred one thousand 0000, beat XTAL1 for no less than one hundred fifty ns, beat WR to 0. This starts offer involved the Chip Erase. Hold up until RDY/BSY (PD1) is going high. XA1:XA0:BS1: facts = 100 0001 0000, XTAL1 beat, beat WR to 0. That is the Flash compose command.[2] and so on..

The ATmega328/P offers the accompanying highlights: 32Kbytes of In-device Programmable Flash with read-even as-Write capacities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 widely beneficial I/O traces, 32 universally useful running registers, actual Time Counter (RTC), three adaptable Timer/Counters with look at modes and PWM, 1 sequential programmable USARTs , 1 byte-organized 2-wire Serial Interface (I2C), a 6- channel 10-bit ADC (eight directs in TQFP and QFN/MLF bundles) , a programmable Watchdog Timer with inner Oscillator, a SPI sequential port, and six programming

29

selectable energy sparing modes. The Idle mode stops the CPU whilst allowing the SRAM, Timer/Counters, SPI port, and intrude with framework to maintain working. The strength-down mode spares the enlist substance but solidifies the Oscillator, incapacitating all different chip capacities until the subsequent restrict or equipment reset. In energy-spare mode, the offbeat clock maintains on running, enabling the consumer to preserve up a clock base at the same time as whatever remains of the device is drowsing. The ADC Noise reduction mode stops the CPU and all I/O modules apart from noncom current clock and ADC to restrict changing commotion amid ADC differences. In Standby mode, the precious stone/resonator oscillator is running while whatever is left of the machine is resting. This lets in short start-up joined with low energy utilization. In prolonged Standby mode, both the number one oscillator and the noncom current clock maintain on running.

Atmel offers the QTouch library for implanting capacitive touch catches, sliders and wheels usefulness into AVR microcontrollers. The included charge-alternate flag procurement gives powerful detecting and incorporates absolutely de bounced revealing of touch keys and incorporates adjoining Key Suppression® (AKS™) innovation for unambiguous recognition of key occasions. The easy to-utilize QTouch Suite tool chain allows you to analyze, create and troubleshoot your very personal contact packages.

The ATmega328/P is reinforced with a full suite of application and framework development devices consisting of: C Compilers, Macro Assemblers, application Debugger/Simulators, In-Circuit Emulators, and evaluation devices

3.5 Configuration

Configuration Summary

Features	ATmega328/P
Pin Count	28/32
Flash (Bytes)	32K
SRAM (Bytes)	2K
EEPROM (Bytes)	1K
General Purpose I/O Lines	23
SPI	2
TWI (I^{2}C)	1
USART	1
ADC	10-bit 15kSPS
ADC Channels	8
8-bit Timer/Counters	2
16-bit Timer/Counters	1

Fig. 3.4: Configuration Summary of Micro-Controller ATmega328P

3.6 Pin Configurations

Atmega328

(PCINT14/RESET) PC6 ☐ 1	28 ☐ PC5 (ADC5/SCL/PCINT13)
(PCINT16/RXD) PD0 ☐ 2	27 ☐ PC4 (ADC4/SDA/PCINT12)
(PCINT17/TXD) PD1 ☐ 3	26 ☐ PC3 (ADC3/PCINT11)
(PCINT18/INT0) PD2 ☐ 4	25 ☐ PC2 (ADC2/PCINT10)
(PCINT19/OC2B/INT1) PD3 ☐ 5	24 ☐ PC1 (ADC1/PCINT9)
(PCINT20/XCK/T0) PD4 ☐ 6	23 ☐ PC0 (ADC0/PCINT8)
VCC ☐ 7	22 ☐ GND
GND ☐ 8	21 ☐ AREF
(PCINT6/XTAL1/TOSC1) PB6 ☐ 9	20 ☐ AVCC
(PCINT7/XTAL2/TOSC2) PB7 ☐ 10	19 ☐ PB5 (SCK/PCINT5)
(PCINT21/OC0B/T1) PD5 ☐ 11	18 ☐ PB4 (MISO/PCINT4)
(PCINT22/OC0A/AIN0) PD6 ☐ 12	17 ☐ PB3 (MOSI/OC2A/PCINT3)
(PCINT23/AIN1) PD7 ☐ 13	16 ☐ PB2 (SS/OC1B/PCINT2)
(PCINT0/CLKO/ICP1) PB0 ☐ 14	15 ☐ PB1 (OC1A/PCINT1)

Fig. 3.5: 28-pin MLF Top View

3.7 Advantages

☐ Nonetheless maintains strolling on 5 V, so inheritance 3.three-5 V stuff interfaces greater smooth

☐ Even but its five V in a position, extra up to date parts can rushed to 2 V. This huge range is extraordinarily uncommon.

☐ First-rate steerage set, top notch steerage throughput contrasted with unique processors

☐ High best GCC ports (no restrictive awful compiler!)

☐ "PA" versions have splendid relaxation mode talents, in smaller scale amperes.

☐ Well-adjusted fringe set

☐ Touch capacity

32

3.8 Switched Mode Power Supply (SMPS)

Fig.3.6: Block Diagram of SMPS

Like an instantly energy supply, the exchanged mode manage supply additionally modifications over the accessible unregulated air conditioning or dc input voltage to a managed dc yield voltage. Anyway if there need to stand up an incidence of SMPS with data deliver drawn from the air conditioner mains, the statistics voltage is first corrected and separated utilizing a capacitor at the rectifier yield. The unregulated dc voltage over the capacitor is 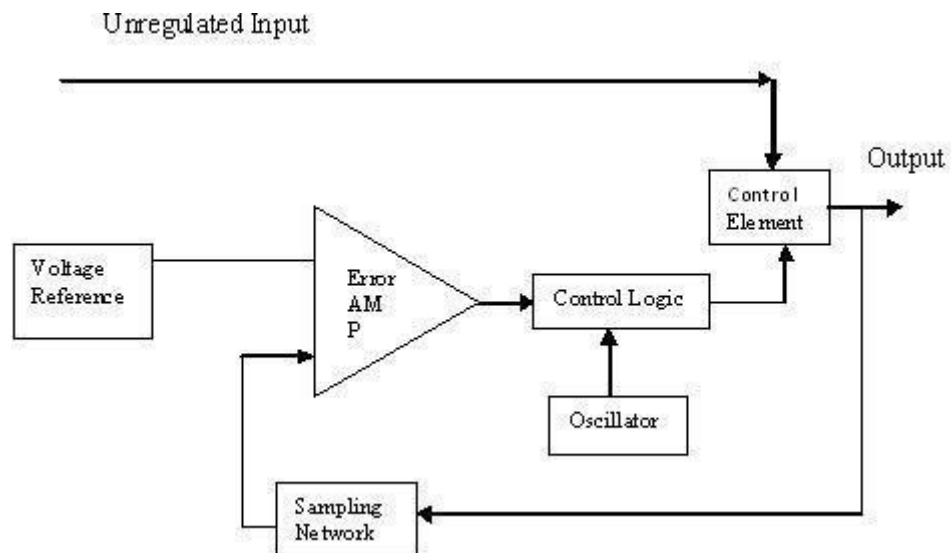then sustained to a high recurrence dc-to-dc converter. The giant majority of the dc-to-dc converters utilized in SMPS circuits have a middle of the road high recurrence air con exchange level to inspire the utilization of a high recurrence transformer for voltage scaling and disengagement. Conversely, in immediately strength materials with info voltage drawn from air con mains, the mains voltage is first ventured down (and disengaged) to the suitable extent utilizing a mains recurrence transformer, trailed by correction and setting apart. The excessive recurrence transformer applied in a SMPS circuit is lots littler in length and weight contrasted with the low recurrence transformer of the instantly energy supply circuit.

33

The „Switched Mode energy supply" owes its name to the dc-to-dc changing converter for change from unregulated dc enter voltage to managed dc yield voltage. The switch utilized is turned „ON" and „OFF" (alluded as changing) at a high recurrence. Amid „ON" mode the transfer is in immersion mode with insignificant voltage drop over the gatherer and manufacturer terminals of the switch wherein as in „OFF" mode the turn is in cut-off mode with inappropriate modern through the authority and manufacturer terminals. No matter what might be anticipated the voltage-managing transfer, in a immediately controller circuit, dependably remains

In the dynamic district. Subtleties of some distinguished SMPS circuits, with arrangements for consolidating excessive recurrence transformer for voltage scaling and disengagement, had been tested in subsequent couple of physical games. In this exercising a rearranged schematic exchanging plan is portrayed that precludes the transformer activity. Fact be instructed there are a few different modified mode dc-to-dc converter circuits that do not make use of a

Excessive recurrence transformer. In such SMPS circuits the unregulated facts dc voltage is sustained to a high recurrence voltage cleaving circuit with the stop purpose that once the slashing circuit (frequently called dc to dc chopper) is in ON explicit, the unregulated voltage is connected to the yield circuit that contains the heap and some keeping apart circuit. On the point while the chopper is in OFF kingdom, 0 length of voltage is connected to the yield facet. The ON and stale terms are moderately controlled with the stop aim that the everyday dc voltage linked to the yield circuit ranges with the precise greatness of output voltage. The percentage of ON time to technique length (ON + OFF time) is known as responsibility percentage of the chopper circuit. A high replacing recurrence (of the request of one hundred KHz) and a quick authority over the duty percentage outcomes in use of the best suggest voltage alongside swell voltage of a high recurrence to the yield side, comprising of a low pass channel circuit pursued with the aid of the heap. The excessive recurrence swell in voltage is adequately separated utilizing little estimations of channel capacitors and inductors. A schematic chopper circuit along the yield channel is seemed in Fig a few different exchanged mode manipulate supply circuits work in a particularly sudden manner in assessment to the dc-to-dc chopper circuit mentioned above. Subtleties of a component of these circuits were examined in following physical activities.

3.9 Light Emitting Diode (LED)

Driven light or LED mild is an electric light for use in mild apparatuses that produces mild utilising light-discharging diode (LED). pushed lighting fixtures have a lifestyles expectancy on the whole longer than similar radiant lighting, and are essentially extra effective than maximum fluorescent lamps,[1][2][3] with some LED chips equipped to transmit as much as 303 lumens for each watt (as asserted by Cree and a few different LED producers).[4] however, LED lighting require an digital LED driving force circuit when labored from mains electric cables, and misfortunes from this circuit mean the effectiveness of the light is lower than the talent of the LED chips it employments. The most talented financially reachable LED lighting fixtures have efficiencies of 2 hundred lumens for each watt (lm/w).[5][6][7] Commercially reachable LED chips have efficiencies of more than 220 lm/w.[citation needed] The LED mild market is predicted to develop via more than twelve-overlay at some point of the following decade, from $2 billion within the start of 2014 to $25 billion out of 2023, a compound yearly development price (CAGR) of 25%.[8] As of 2016, LEDs utilize just about 10% of the power a sparkling light calls for.

LEDs, as their name proposes, work as diodes and preserve walking on direct modern-day (DC), even as mains contemporary is substituting modern (AC) and commonly at a lot better voltage than the LED can well know. Albeit low voltage LED lights are reachable, LED lighting can incorporate a circuit for changing over the mains AC into DC on the proper voltage. Those circuits comprise rectifiers, capacitors and can have other dynamic electronic segments, which can possibly permit the mild to be darkened.

Fig.3.7: Light Emitting diode (LED)

3.10 Voltage Regulating IC

A voltage controller is applied to control voltage degree. At the point when a constant, strong voltage is required, at that factor voltage controller is the popular gadget. It produces a settled yield voltage that last components consistent for any adjustments in a records voltage or load conditions. It is going approximately as a help for protective components from harms.

The 78xx arrangement ic (right here and there L78xx, LM78xx, MC78xx...) is a group of self-contained fixed straight voltage controller coordinated circuits. The 78xx circle of relatives is normally use die electronic circuits requiring a managed power supply because of their comfort and low value. For ICs in the own family, the xx is supplanted with digits, displaying the output voltage (for instance, the 7805 has a 5 volt yield, while the 7812 produces12 volts). The 78xx lines are positive voltage controllers: they create a voltage that is positive with recognize to a shared conviction. There's a related line of 79xx gadgets which are vital poor voltage controllers. 78xx and 79xx ICs may be utilized in combination to give superb and poor supply voltages in a comparable

Circuit

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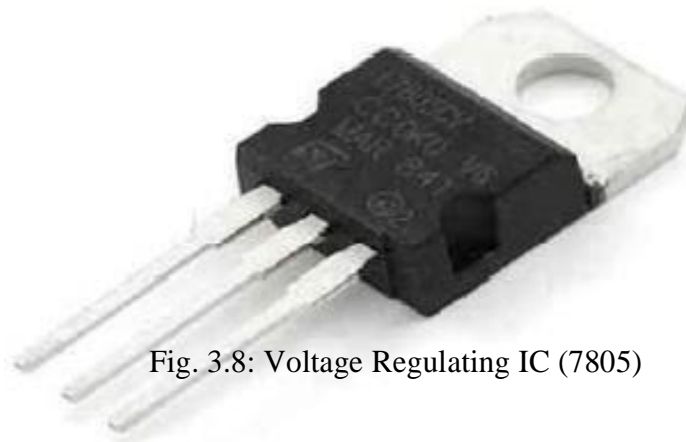
Fig. 3.8: Voltage Regulating IC (7805)

78xx ICs have 3 terminals and are generally found within the TO220 frame aspect, despite the fact that littler floor-mount and larger TO3packages are available. these device support an information voltage anywhere from multiple volts over the proposed yield voltage, up to a most intense of 35 to 40 volts depending upon the make, and generally deliver 1 or1.five amperes of contemporary (however littler or bigger bundles may additionally have a lower or higher current score).right here we utilize 7805 IC

36

Part Number	Output Voltage (V)
7805	+5

3.10.1 Advantage

- The greatest advantage that the linear regulator offers is the ease of use. ...
  Using a linear regulator adroitly with power consumption greater than a few watts requires overcoming the heat issue. In addition, linear regulators are applicable only to step-down operations.

- 78xx series ICs have built-in protection against a circuit drawing too much power. They have protection against overheating and short-circuits, making them quite robust in most applications. In some cases, the current-limiting features of the 78xx devices can provide protection not only for the 78xx itself, but also for other parts of the circuit.

3.11 Capacitor

A capacitor is an uninvolved -terminal electronic section that stores electric vitality in an electric area. The impact of a capacitor is referred to as capacitance. Whilst some capacitance exists among any two electric conduits in nearness in a circuit, a capacitor is a section meant to add capacitance to a circuit. The capacitor changed into initially referred to as a condenser.

The physical form and improvement of common-sense capacitors differ normally and several capacitor kinds are in like manner use. Maximum capacitors incorporate somewhere round two electrical conduits regularly as metal plates or surfaces isolated via a dielectric medium. A channel is probably a thwart, skinny film, sintered globule of steel, or an electrolyte. The non-conducting dielectric acts to make bigger the capacitor's price restrict. Substances generally utilized as dielectrics incorporate glass, artistic, plastic movie, paper, mica, and oxide layers. Capacitors are extensively utilized as components of electrical circuits in numerous everyday electric devices.

37

Fig. 3.9: capacitor

At the point while there's a potential evaluation over the conveyors (e.g., while a capacitor is attached over a battery), an electric powered field creates over the dielectric, causing positive charge (+Q) to accumulate on one plate and poor charge (-Q) To accumulate on the other plate. On the off hazard that a battery has been joined to a capacitor for an adequate sum of time, no contemporary can course thru the capacitor. Be that as it could, if a quickening or alternating voltage is attached over the leads of the capacitor, a displacement current can movement.

An ideal capacitor is portrayed through a solitary steady incentive for its capacitance. Capacitance is communicated as the proportion of the electrical price (Q) on each conveyor to the potential evaluation (V) among the individual in query. The SI unit of capacitance is the farad (F), that's equal to 1 coulomb for every volt (1 C/V). Run of the mill capacitance values move from around 1 pF (10^{-12} F) to around 1 mF (10^{-three} F).The capacitance is greater noteworthy whilst there is a smaller detachment among conductors and whilst the conductors have a bigger floor quarter. Almost speaking, the dielectric between the plates passes a little measure of spillage drift and furthermore has an electric powered field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired inductance and resistance. Capacitors are widely utilized in electronic circuits for blocking off direct modern-day while allowing substituting modern to pass. In easy channel systems,

38

They easy the output of manipulate supplies. In thunderous circuits they tune radios to particular frequencies. In electric manage transmission frameworks they settle

3.12Resistor

A resistor is an uninvolved -terminal electric component that actualizes electric obstruction as a circuit aspect. In digital circuits, resistors are applied to decrease modern-day move, adjust flag stages, to isolate voltages, predisposition dynamic components, and quit transmission traces, among one of a kind employments. high-manipulate resistors that may disseminate numerous watts of electrical power as warmth, might be utilized as a characteristic of engine controls, in energy circulation frameworks, or as check masses for turbines. Settled resistors have protections that just exchange marginally with temperature, time or operating voltage. Variable resistors can be utilized to adjust circuit components, (as an instance, a volume control or a mild dimmer), or as detecting gadgets for heat, light, stickiness, electricity, or artificial hobby. This dating is spoken to through Ohm's law

Fig. 3.10: Resistor

3.12.1 Theory of operation

The behavior of a great resistor is managed by way of the relationship indicated via

Ohm's law:

V = I.R

Ohm's regulation expresses that the voltage (V) over a resistor is relative to the current (I), wherein the constant of proportionality is the opposition (R).

Proportionally, Ohm's regulation can be expressed:

39

I = V/R

This detailing states that the modern-day (I) is relative to the voltage (V) and inversely corresponding to the obstruction (R). This is straightforwardly utilized in practical computations. as an example, if a 300 ohm resistor is joined over the terminals of a12 volt battery, at that point a contemporary of12/three hundred = zero.04 amperes courses through that resistor.

3.13 Relay

Transfers are switches that open and near circuits electromechanically or electronically. Transfers control one electrical circuit by means of beginning and closing contacts in another circuit. As transfer charts appear, while a hand-off touch is usually open (NO), there's an open contact when the hand-off is not invigorated.

Fig. 3.11: Relay (10 Amp)

3.13.1 Operation

A SSR depending on a solitary MOSFET, or one-of-a-kind MOSFETs in a paralleled showcase, features admirably for DC masses. MOSFETs have a feature substrate diode that conducts in the flip around path, so a single MOSFET cannot square cutting-edge within the two headings. For AC (bi-directional) operation two MOSFETs are orchestrated consecutive with their source pins tied together. Their burn up pins are associated with either facet of the yield. The substrate diodes are however flip around one-sided to square modern when the hand-off can be off. At the point whilst the relay is on, the fundamental supply is usually riding on the spark off

40

flag stage and both entryways are one-sided fantastic with admire to the source with the aid of the photograph diode. Usually to present get right of entry to the ordinary supply with the purpose that several MOSFETs may be wired in parallel if exchanging a DC stack.

Commonly a machine is given to speed the kill of the MOSFET while the manage enter is eliminated. One important favorable role of a sturdy country SCR or TRIAC transfer over an electromechanical gadget is its feature propensity to open the AC circuit just at a point of 0 load current. When you consider that SCR's and TRIAC's are thyristors, their in heren thysteresis maintains up circuit coherence after the LED is de-inspired until the point that the AC current falls below a restriction esteem (the retaining present day). In accessible phrases what this means is the circuit will in no way be hindered amidst a sine wave top. Such untimely intrusions in a circuit containing widespread inductance could normally produce sizable voltage spikes because of the surprising appealing subject fall down round the inductance. This might not occur in a circuit broken by way of a SCR or TRIAC. This feature is known as 0-**3.13.2 Advantages over mechanical relays**

 One of the upsides of electromechanical transfers over strong country switches is that transfers have plenty lower contact competition.

 Contact capacitance is additionally less, which can also profit excessive-recurrence circuits

 Relay loop inductance can create unsatisfactorily excessive-voltage homeless humans while the gadget is de energized.

3.14 Connector

 Electrical connector, a machine for consolidating electric circuits

 Audio and video connector, electrical connectors (or optical connectors) for carrying sound flag and video movement, of both easy or computerized design

 Gender of connectors and latches

 Power connector, gadgets that permit electrically worked gear to be connected to the crucial rotating waft (AC) manipulate deliver in a building

RF connector, an electrical connector intended to paintings at radio frequencies in the multi-megahertz move

 MIL-STD-1553, a military standard distributed with the aid of the usa

 Branch of defense that characterizes the mechanical, electric, and functional characteristics of a sequential records shipping


Fig.3.12: Connector

- Circular connector

- Cigar lighter receptacle

- Blind mate connector, one in which the mating action happens where you can't see or feel it to ensure that it is correctly aligned. They have self-aligning features which allows a small misalignment when mating

- Board–to–board connector, used for connecting printed circuit boards

- Connector (computer science), a pointer or link between two data structures

- Java EE Connector Architecture, a Java-based technology solution for connecting application servers and Enterprise information system

3.15 Opt-Coupler PC817:

An auto coupler, is an electronic segments that interconnects two separate electrical circuits by methods for a light delicate optical interface. ... Both the LED and photograph touchy gadget are encased in a light-tight body or bundle with metal legs for the electrical connections the silicon chip could be in the form of a photograph diode, photograph transistor, photograph Darlington, or photograph SCR. Fig. 3.13: Opt-Coupler PC817

42
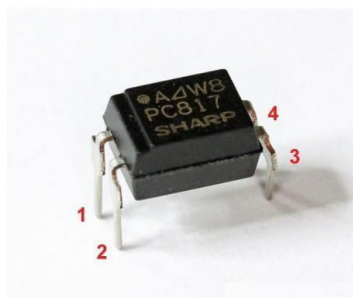
3.15.1 Opt-Coupler Functions

To seclude one segment of a circuit from every other, each segment having different signal voltage ranges to assure similarity among them.

To forestall electrical clamor or different voltage drifters that could exist in a section of a circuit from meddling with every other area while both section shave a standard circuit reference. Clamor or voltage homeless human beings can be prompted by a negative revealed circuit board design.

The fundamental plan of an auto coupler accommodates of a LED that produces infra-crimson mild and a semiconductor photograph sensitive device that is utilized to differentiate the radiated infra-crimson pillar. Each the LED and photo delicate system are encased in a mild-tight frame or bundle with steel legs for the electric associations as seemed.

An auto coupler or auto-isolator accommodates of a mild manufacturer, the LED and a light touchy collector which may be a solitary photo diode, image transistor, photograph resistor, picture SCR, or a photograph TRIAC with the critical venture of an auto coupler being extraordinarily easy to get it.

Receive an image transistor gadget as seemed. Glide from the source flag is going via the data LED which discharges an infra-crimson mild whose force is relative to the electrical flag.

This discharged mild falls upon the base of the photograph transistor, making it switch-ON and lead comparably to an average bipolar transistor.

the base association of the photo transistor may be left open (indifferent) for most intense affectability to the LEDs infrared mild energy or related to floor by way of an inexpensive outer high esteem resistor to manipulate the changing affectability

43

making it regularly consistent and impervious to false activating by out of doors electrical clamor or voltage homeless human beings.

On the point while the existing transferring through the LED is intruded on, the infrared produced mild is reduce-off, inflicting the photo transistor to stop leading. The image transistor may be utilized to switch contemporary inside the yield circuit. The unearthly response of the LED and the photo touchy system are firmly coordinated being isolated by means of a straightforward medium, as an instance, glass, plastic or air. When you consider that there is no instantaneous electrical association between the facts and yield of an auto coupler, electric separation up to 10kV is executed.

44

CHAPTER 4

HARDWARE IMPLEMENTATION

4.1 Introduction

An equipment execution implies that the interest is completed utilizing a physical system or electronic circuit in preference to being completed via a computer application. A device utilization frequently takes more time to make and that can make it greater high-priced.

4.2 The Relay switching stage:

The VMR is utilized for estimating and searching on the voltage dimension of the utility supply with a fixed voltage resilience run (185-250V A.C). Transfers are switches that open and close circuits electromechanically or electronically. Transfers control one electric circuit by way of opening and shutting contacts in some other circuit. As hand-off outlines seem, whilst a hand-off touch is commonly open (NO), there may be an open contact when the hand-off isn't empowered.

45

4.3 The Timer relay Stage:

Their motivation is to manipulate an event dependent on time. The comparison between relay sand time delay transfers is the point at which the yield contacts open and near: on a manipulate hand-off, it takes place whilst voltage is hooked up and expelled from the loop; on time delay transfers, the contacts can open or close previously or after a while delay. On-defer clocks. With an on-defer clock, timing begins whilst voltage is attached. At the point when the time has terminated, the contacts close — and stay shut till the point while voltage is expelled from the loop. At the off chance that voltage is evacuated before time-out, the time delay resets

4.4 The contactor switching stage

A contactor is a significant switch, normally used to alternate float to an electric powered engine or some other powerful load. Big electric powered engines can be shielded from overcurrent damage the use of over-burden warmers and over-burden contacts.

On the point whilst a hand-off is utilized to interchange a number of electric strength thru its gets in contact with, it's far assigned by using a completely unique name: contactor. Contactors typically have several contacts, and those contacts are normally (but now not commonly) generally open, with the intention that capability to the heap is closed off while the curl is de-inspired.

4.5 CONTACTOR SELECTION

With the info voltage deliver from either control sources (V) = 220-240Va.c supply
Generator manipulate rating (P) = 2.5KVA
Accepting power thing (Cos Ө) = harmony

Evaluated generator set present day (I) in Ampere = (2.5x1000)/250

= eleven.36 ≈ 12A

on this manner the contactor chose for the ATS is a 12A evaluated contactor.

4.6 The Power Supply Unit (PSU)

The electricity deliver unit is mounted truly within the back of the case.

The aspect of the PSU searching outside the case has a male, 3 pronged port that an energy hyperlink, associated with an electricity source, connects to. There's likewise regularly a power switch and a power deliver voltage transfer.

Large packs of hued wires stretch out from the contrary side of the electricity supply unit into the laptop. Connectors on the opposite closures of the wires partner with different segments inside the computer. Some are explicitly intended to hook up with the motherboard whilst others have connectors that match into fans, floppy drives, hard drives, optical drives, or even a few powerful video playing cards.

Electricity deliver devices are evaluated through wattage to indicate how lots power they are able to deliver to the laptop. For the reason that each laptop element calls for a selected degree of ability to paintings legitimately, it is vital to have a PSU which could deliver the precise sum. The easy convenient Thermaltake power supply Calculator tool can enable you to determine the amount you require.
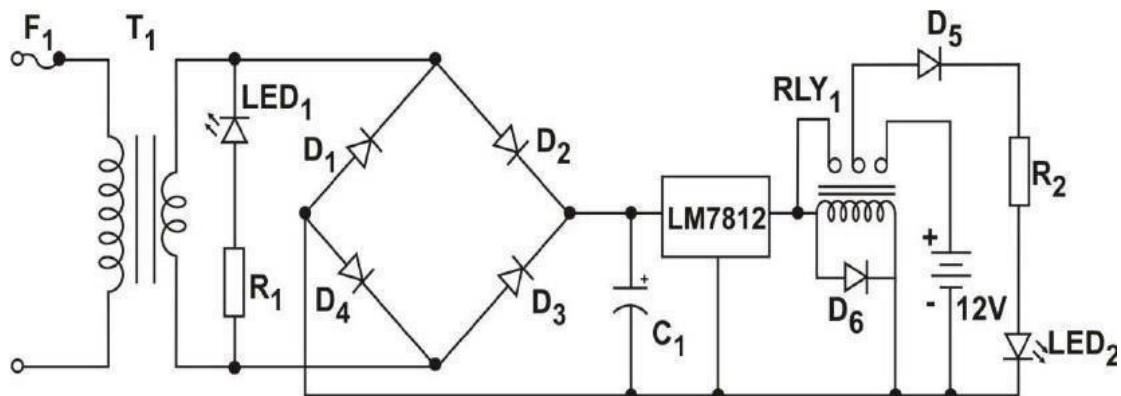
Fig4.1: Circuit diagram of the 12V and 5V dc power supply unit

... this stage, the rectifier changes over the 18V (A.C) deliver from the transformer right into a throbbing D.C voltage. A complete scaffold rectifier turned into utilized for this reason. It include of 4 diodes (IN 4001 arrangement) prepared as regarded in Fig. 2. Amid the positive half cycles diodes D2 and D3 are ahead one-sided and current actions through the terminals. in the poor half cycle, diodes D1 and D4 are

47

Ahead one-sided. Due to the fact load cutting-edge is a similar way in each 1/2 cycles, full wave rectifier flag shows up over the terminals...

$V_{dc}= 0.318V_m$

Where; Vm = maximum voltage after rectification
$V_{d.c}$= rectified d.c voltage
Where Vm measured from the DMM circuit= 15.97V = 16V
$V_{d.c}= 318.016\times=5.088$ V
The selection of the 22KΩ was achieved using five 110KΩ resistors in parallel:
$1/R_t=5/(110x10^5)=22KΩ$
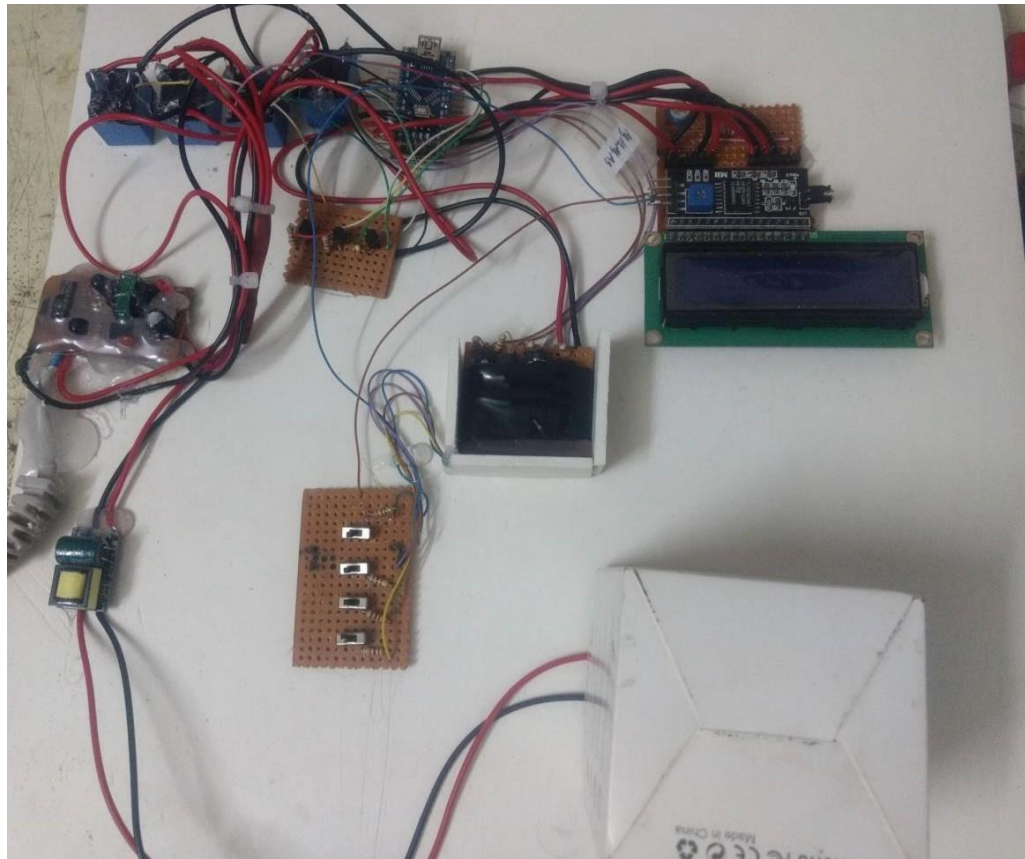
Fig. 4.2: Final Testing Of Project

4.7 Cost Analysis

48

Name	Quantity	Price(BDT)
Arduino Board (including ATmega328P Chips)	1	450
Relay module	1	1100
Switch Mode Power Supply	1	80
Vero board	1	110
LED	4	30
LCD Monitor	1	300
Wood board	1	250
Soldering Led	1	170
Jump Wire	20	120
Connecting Wire	25 ft	125
Light	1	30
Resistor 1k and 10k 100k	3	50
Screw, plug, Switch	2,4 pcs	270
Regulator IC	1	15
Capacitor	3	25
Fuse (10 Amp)	1pcs	20
Other		400
		Total Cost=3465 taka

Table: 4.1: table of Cost Analysis

4.8 Result

The results acquired amid the improvement states after critical troubleshooting were tasteful. . Swell and line clamor assessments are the pointers of irrespective of whether a strength deliver is made with strong components or made with parts that

49

surely carry out the duty and will in all likelihood ultimate about a time of ostensible use before discharging the appeal smoke. Within the occasion that there is a ton of swell, the motherboard's home preserving hardware will complete a splendid deal of work to keep strong voltages (specifically whilst a distinction of even zero.1V troubles). more estimation results for the PSUs in this spherical-up, and one of a kind PSUs, can be found in our energy supply Charts.

Anyhow, the clock transfers provide postponement of 5 seconds amid the start of the generator and transfer of the related load and the opposite manner round.

CHAPTER 5

CONCLUSIONS & RECOMMENDATIONS

5.1 CONCLUSION

This paper has delivered the plan of an powerful, realistic and stable Microcontroller-based Programmed switch Switching system (MATSS), that can precisely display the manage supply from the service business enterprise and react nicely upon a electricity blackout by using starting an on place generator to deliver manage. Upon the rebuilding of application electricity, the framework drives the heap again to application and near down the generator. Incorporated into the plan is an overvoltage/over-current security unit. This empowers the framework to naturally changeover whilst the voltage or modern transcends its score, to relaxed hardware from damage. The expense of the MBATSS is roughly 330.87 USD to build and introduce. This new framework for that reason gives substantial operational favorable instances and fee sparing over the manual framework as of now used by numerous businesses in Ghana. The switch alternate mode applied (open alternate mode) kills the issue of backup control mills "back-encouraging" into the software lines.

5.2 RECOMMENDATION

The crisis manipulate generator, that is a compact generator all the time placed at the SOC, requires manual switchover. Be that as it is able to, the underlying switch to disaster Uninterruptible strength gadget (UPS) manage is programmed. The purchase of programmed switchgear for this generator would require a comparable money saving benefit research as referred to for the Airport administration constructing. Air terminal Patrol After the whole lot we are able to say that undertaking is sufficient work for immaculate exchanging framework. Its miles prescribed that healing facilities, financial businesses, web get entry to suppliers, mining and partnered organizations, which require steady energy supply ought to make use of the Micro- Controller primarily based automatic transfer switch.

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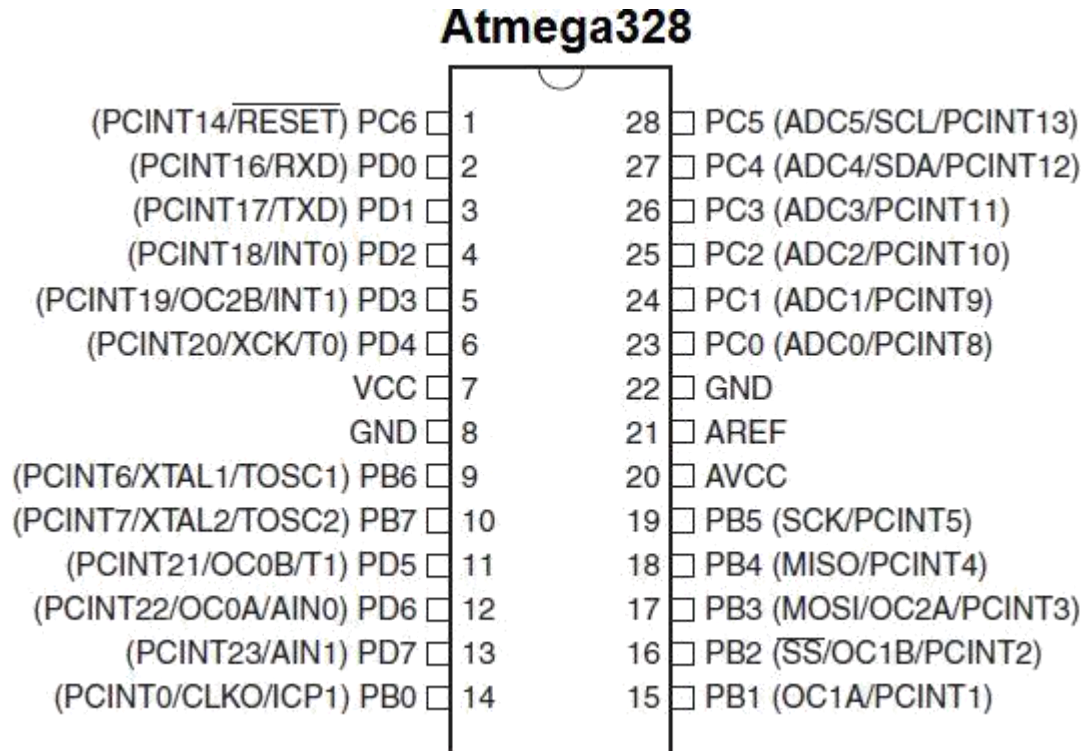# APPENDIX A

ATmega328p Micro-controller

Fig. A1: ATmega328p Micro-controller Pin diagram

Table of Micro-controller Pin Output:

Name	Function	Input Type	Output Type	Description
RA0/AN0/C1IN+/ICSPDAT/ ULPWU	RA0	TTL	—	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	AN0	AN	—	A/D Channel 0 input.
	C1IN+	AN	—	Comparator 1 positive input.
	ICSPDAT	TTL	CMOS	ICSP Data I/O.
	ULPWU	AN	—	Ultra Low-Power Wake-up input.
RA1/AN1/C12IN-/VREF/ICSPCLK	RA1	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	AN1	AN	—	A/D Channel 1 input.
	C12IN-	AN	—	Comparator 1 or 2 negative input.
	VREF	AN	—	External Voltage Reference for A/D.
	ICSPCLK	ST	—	ICSPTM clock.
RA2/AN2/T0CKI/INT/C1OUT	RA2	ST	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	AN2	AN	—	A/D Channel 2 input.
	T0CKI	ST	—	Timer0 clock input.
	INT	ST	—	External Interrupt.
	C1OUT	—	CMOS	Comparator 1 output.
RA3/MCLR/VPP	RA3	TTL	—	General purpose input. Individually controlled interrupt-on- change.
	MCLR	ST	—	Master Clear with internal pull-up.
	VPP	HV	—	Programming voltage.
	AN3	AN	—	A/D Channel 3 input.
	T1G	ST	—	Timer1 gate input.
	OSC2	—	XTAL	Crystal/Resonator.

	CLKOUT	—	CMOS	FOSC/4 output.
RA5/T1CKI/OSC1/CLKIN	RA5	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	T1CKI	ST	—	Timer1 clock input.
	OSC1	XTAL	—	Crystal/Resonator.
	CLKIN	ST	—	External clock input/RC oscillator connection.
RB4/AN10/SDI/SDA	RB4	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	AN10	AN	—	A/D Channel 10 input.
	SDI	ST	—	SPI data input.
	SDA	ST	OD	I2C data input/output.
RB5/AN11/RX/DT	RB5	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	AN11	AN	—	A/D Channel 11 input.
	RX	ST	—	EUSART asynchronous input.
	DT	ST	CMOS	EUSART synchronous data.
RB6/SCK/SCL	RB6	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	SCK	ST	CMOS	SPITM clock.
	SCL	ST	OD	I2CTM clock.
RB7/TX/CK	RB7	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on- change. Individually enabled pull-up.
	TX	—	CMOS	EUSART asynchronous output.
	CK	ST	CMOS	EUSART synchronous clock.
RC0/AN4/C2IN+	RC0	ST	CMOS	General purpose I/O.
	AN4	AN	—	A/D Channel 4 input.
	C2IN+	AN	—	Comparator 2 positive input.

55

RC1/AN5/C12IN-	RC1	ST	CMOS	General purpose I/O.
	AN5	AN	—	A/D Channel 5 input.
	C12IN-	AN	—	Comparator 1 or 2 negative input.
RC2/AN6/P1D	RC2	ST	CMOS	General purpose I/O.
	AN6	AN	—	A/D Channel 6 input.
	P1D	—	CMOS	PWM output.
RC3/AN7/P1C	RC3	ST	CMOS	General purpose I/O.
	AN7	AN	—	A/D Channel 7 input.
	P1C	—	CMOS	PWM output.
RC4/C2OUT/P1B	RC4	ST	CMOS	General purpose I/O.
	C2OUT	—	CMOS	Comparator 2 output.
	P1B	—	CMOS	PWM output.
RC5/CCP1/P1A	RC5	ST	CMOS	General purpose I/O.
	CCP1	ST	CMOS	Capture/Compare input.
	P1A	ST	CMOS	PWM output.
RC6/AN8/SS	RC6	ST	CMOS	General purpose I/O.
	AN8	AN	—	A/D Channel 8 input.
	SS	ST	—	Slave Select input.
RC7/AN9/SDO	RC7	ST	CMOS	General purpose I/O.
	AN9	AN	—	A/D Channel 9 input.
	SDO	—	CMOS	SPI data output.
VSS	VSS	Power	—	Ground reference.
VDD	VDD	Power	—	Positive supply.

Table 5: ATmega328p Micro-controller Pin Description

Programming Codes Uses in the Micro-controller

```
#include<LiquidCrystal.h>
LiquidCrystallcd(12, 11, 5, 4, 3, 2); void
setup()
{




Serial.begin(9600);
lcd.begin(16, 2);
}




void loop() {




 //read the input on analog pin 0: int sv1
= analogRead(A0);


Serial.println(sv1); delay(10);


{lcd.setCursor(0,0);        //sets the cursor at row 0 column 0
```

57

```
lcd.print("Dept Of EEE"); // prints 16x2 LCD MODULE

lcd.setCursor(2,1);

lcd.print("Starting.");

delay(1000); lcd.clear();

lcd.print("Starting..");

delay(1000); lcd.clear();

lcd.print("Starting...");

delay(1000); lcd.clear();

lcd.print("Scaning.");

delay(2000);



do
{



while (sv1<150)
{ lcd.clear();

lcd.setCursor(0,0);

lcd.print("Load 1 Ok");

}



while (sv1>150)
{
```

58

```
lcd.clear(); lcd.setCursor(0,0);

lcd.print(analogRead(A0));

lcd.setCursor(0,1);

lcd.print("LOad 1 Error");

delay(3000);

 }


}


}
```