

Thesis Report

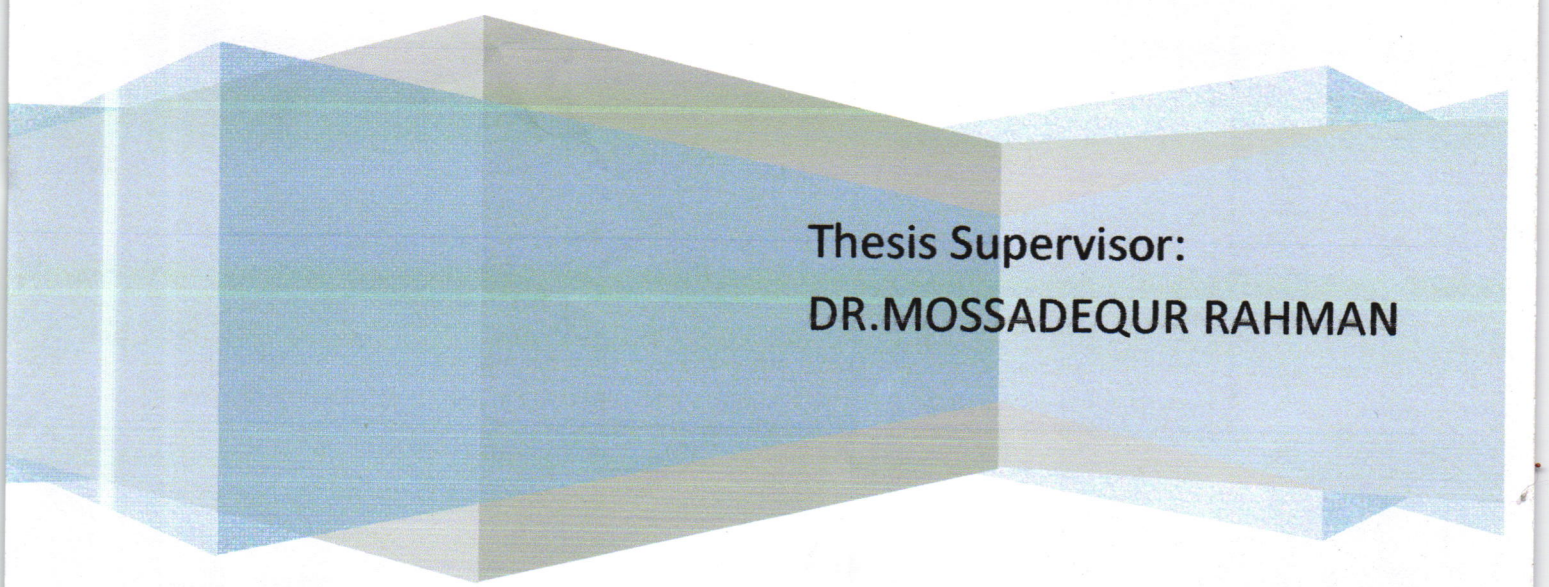
Design of a charge controller circuit for multilevel solar panels for solar home system

**A report submitted to the department of
Electrical & Electronic Engineering (EEE), BRAC
University.**

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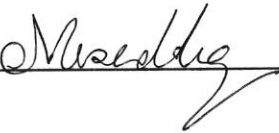
CIRCUIT DIAGRAM

Declaration

We do hereby declare that the thesis titled "Design of a charge controller circuit for multilevel solar panels for solar home system" is submitted to the Department of Electrical and Electronics Engineering of BRAC University in partial fulfillment of the Bachelor of Science in Electrical and Electronics Engineering. This is our original work and was not submitted elsewhere for the award of any other degree or any other publication.

Date: 4th September, 2012

Supervisor





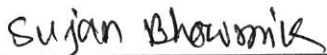
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Abstract

This work aims to design an efficient charge controller circuit for a multilevel solar panel systems intended for its use in urban residential solar home system. The stacked panel system will consist of panels stacked on top of one another to minimize the floor area and maximize the power generation. The charge will control the flow of charge from the panels to the battery as well as from the battery to the load.

Acknowledgement

We are greatly thankful to our supervisor Dr. Mosaddequr Rahman for his proper guidance and support during this project. His inspiration, support and encouragement made it easier for us to finish the thesis work properly in proper time.

1.Introduction:

Photovoltaic (PV) or more commonly known as solar power, is one of the renewable energy resources that recently has become broader in nowadays technology. PV has many benefits especially in environmental, economic and social.

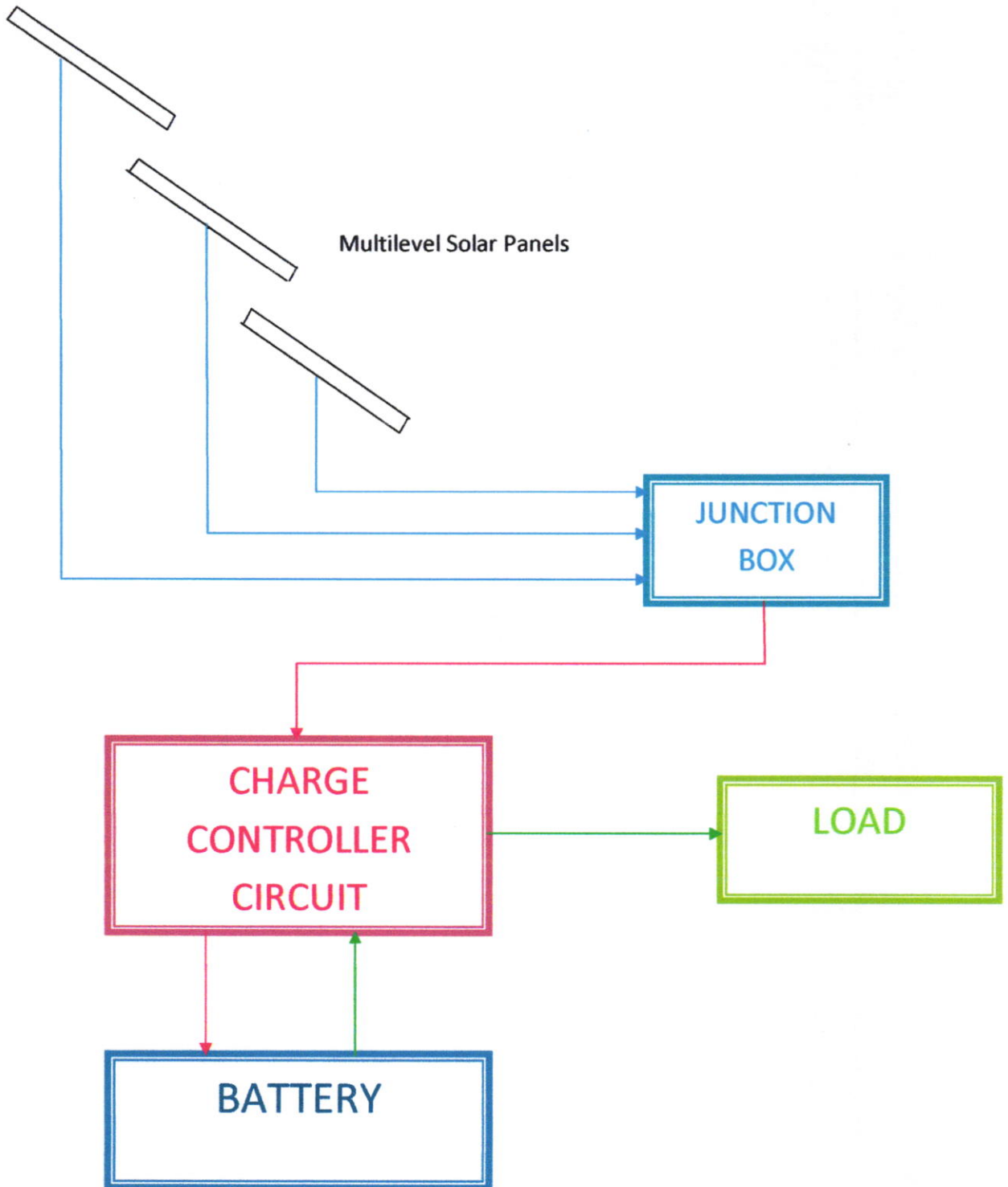
In general, a PV system consists of a PV array (solar panel/s) which converts sunlight to direct-current (DC) electricity, a control system (Charge controller) which regulates battery charging by the PV array and discharging by the load.

A charge controller is one of the key major components in PV systems. A good, efficient and reliable PV charge controller is crucial for any PV battery charging system to ensure greater battery life and smooth operation to achieve the maximum benefit that user can get from it.

The main function of a charge controller in a PV system is to regulate the voltage and current from PV solar panels into a rechargeable battery. The minimum function of a PV charge controller is to disconnect the array when the battery is fully charged and keep the battery fully charged without damage. A charge controller is important to prevent battery overcharging, excessive discharging, reverse current flow at night and to protect the life of the batteries in a PV system.

In this project, we have designed a charge controller circuit consisting of a microcontroller (PIC16F876A) which is able to carry out the above mentioned functions in a sequential manner. A block diagram of the overall system is illustrated in the next page.

2. BLOCK DIAGRAM OF OVERALL SYSTEM



3. System Components:

3. Solar Panel:

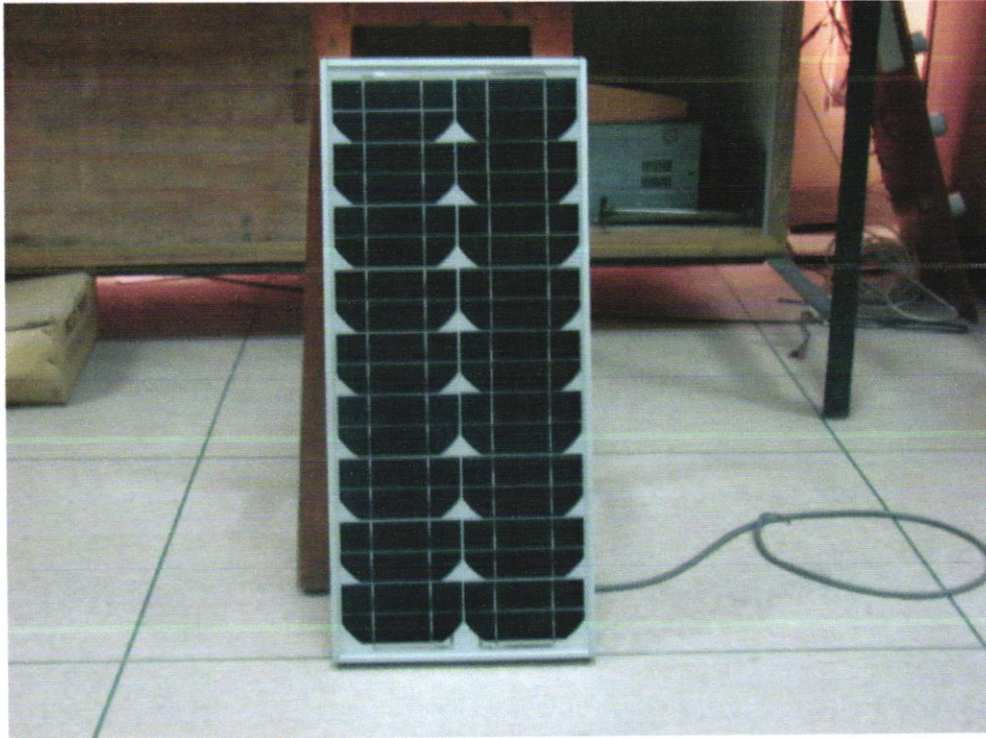


Figure 1 : Solar panel

The type of solar panel used is a mono-crystalline solar panel manufactured by Akash Solar. It is composed of 18 crystalline cells connected in series. The rating of the solar panel is as follows:

Open circuit voltage (Voc) = 21.8 Volts

Short Circuit Current (Isc) = 1.15 Amperes

4. Battery:

The battery used to carry out the experiment is a 12V *sealed lead-acid* rechargeable battery of capacity of 7.5 ampere-hours (Ah).

This project mainly emphasizes on constructing an efficient charge controller circuit. The battery used is only for testing and experimental purposes of the charge controller, hence a smaller capacity battery is included rather than large lead acid battery so that charging and discharging time of the battery is sufficiently smaller.

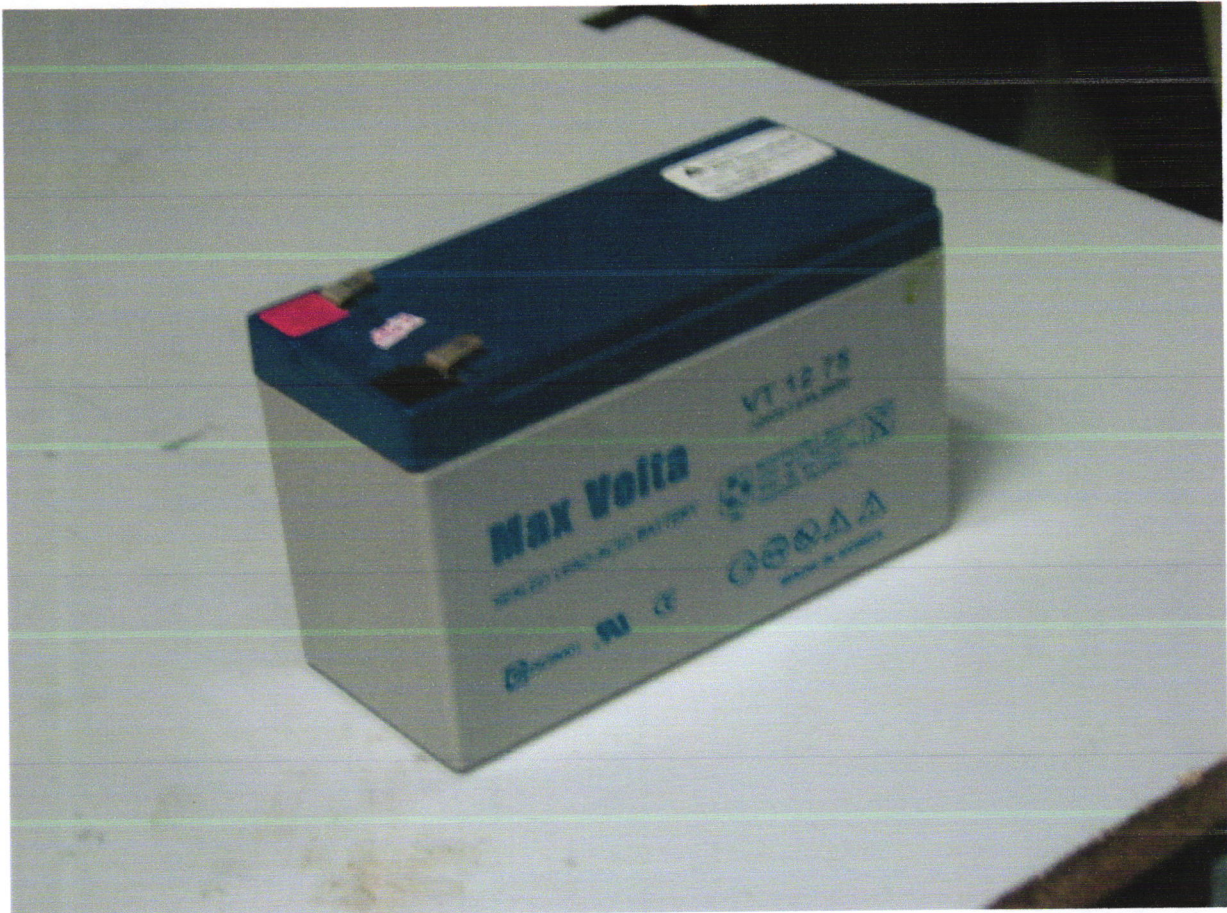


Figure 2: 12V Sealed Lead-Acid rechargeable battery

4.1 Charging Stages of Battery (Lead-acid):

A solar re-chargeable lead-acid battery consists of certain set of methods of charging to ensure optimum service when supplying to a load connected across it. It is not charged by a fixed voltage and current supply. The charging stages of a battery regime as shown below, the stages are:

- Bulk charge (Constant Current)
- Absorption (Constant Voltage)
- Float

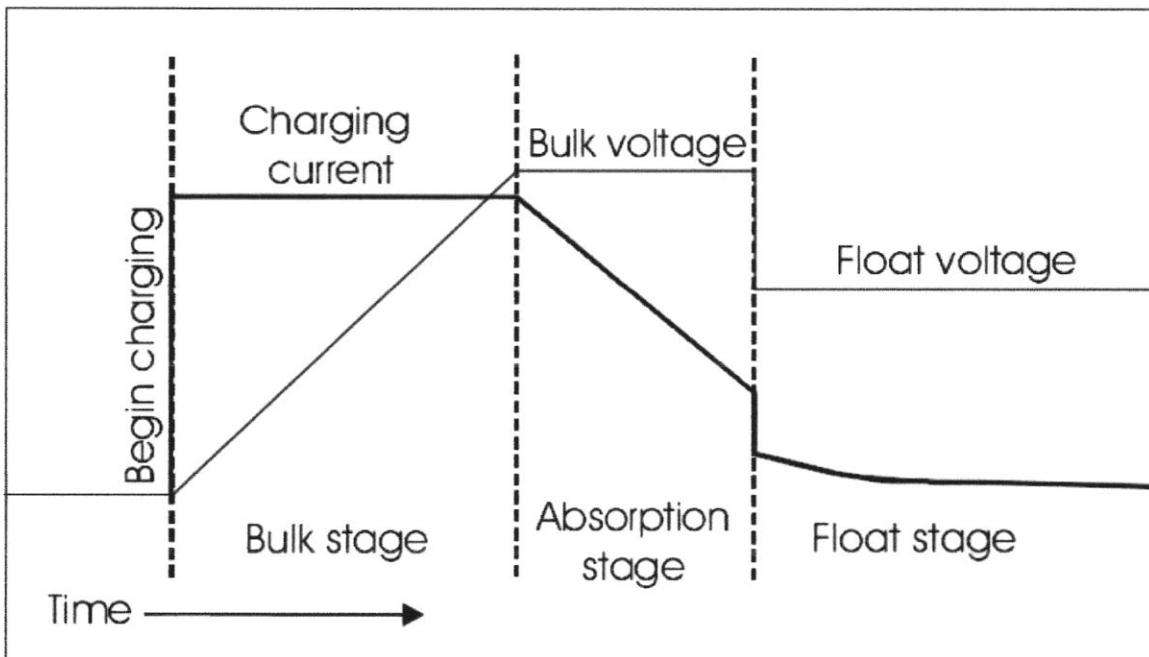


Figure 3: Three state charging system of a battery.

Bulk Charge:

The initial stage of the 4-stage battery charging is **bulk charge** also referred as **constant current (fast)** charging. In this stage the battery is charged with a constant current up to a certain voltage level. During the bulk charge, 40 percent of the total Ah (amp-hour) capacity should be used to charge the battery.

Absorption:

The 2nd stage of the 4-stage battery charging is **absorption charge or constant voltage charging**. In this stage the voltage across the battery remains constant while the current flow in the battery is varied. The current used here in this stage should be 20 percent of the total Ah (amp-hour) capacity of the battery. The constant voltage regulation prevents overheating and excessive battery out-gassing.

Float:

The 3rd stage of battery charging is **float charge**. This constitutes 90-100 percent charge state. After batteries reach full charge, charging voltage is reduced to a lower level to reduce gassing and prolong battery life. The current used in this stage should be only 5 percent of the total Ah (amp-hour) capacity of the battery.

Battery testing was carried out by connecting the battery to a power supply through a 50-ohms rheostat and a switch while a constant 1 ampere current was allowed to flow while charging the battery and while discharging, the battery was connected directly connected to the rheostat through a switch. Again, the rheostat was adjusted to make sure that no more than 1 ampere current was flowing through it.

A series of readings of the battery charge and discharge voltages as well as the open circuit voltages were taken at 10 minute intervals by opening the switch. The corresponding data was matched with the above State of charge (SOC) vs. percentage graph and also with the state of discharge (SODC) vs. percentage graph (in next page) to calculate the cut-off voltages of the battery and restrict overcharging and over discharging of the battery. The respective cut-off voltage while discharging is 11.6 Volts and while charging is 14.4 Volts.

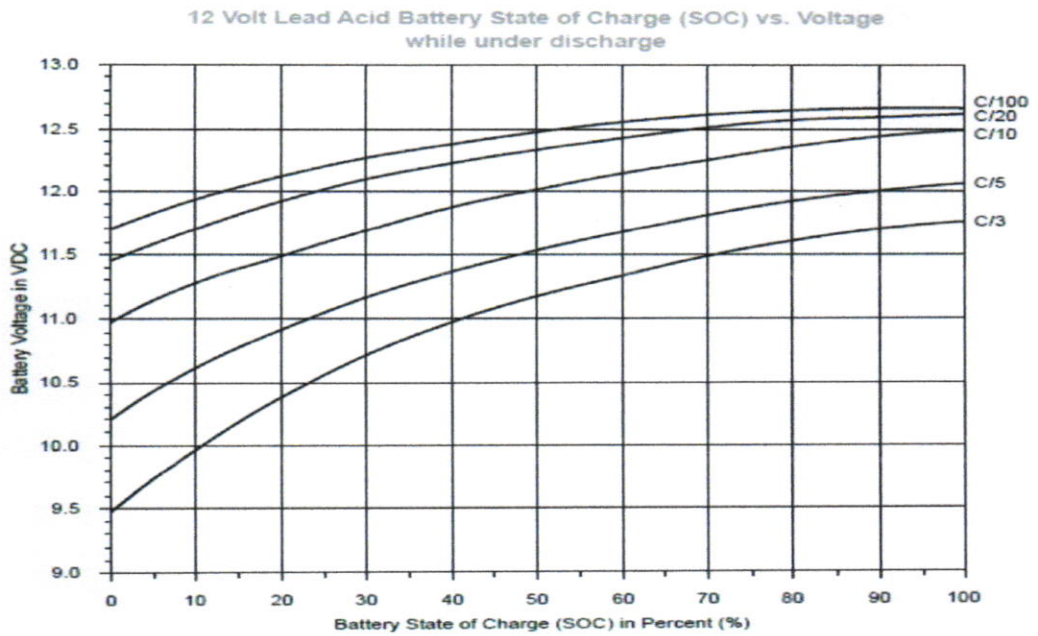


Figure 4: A standard graph for **discharging** a lead-acid battery.

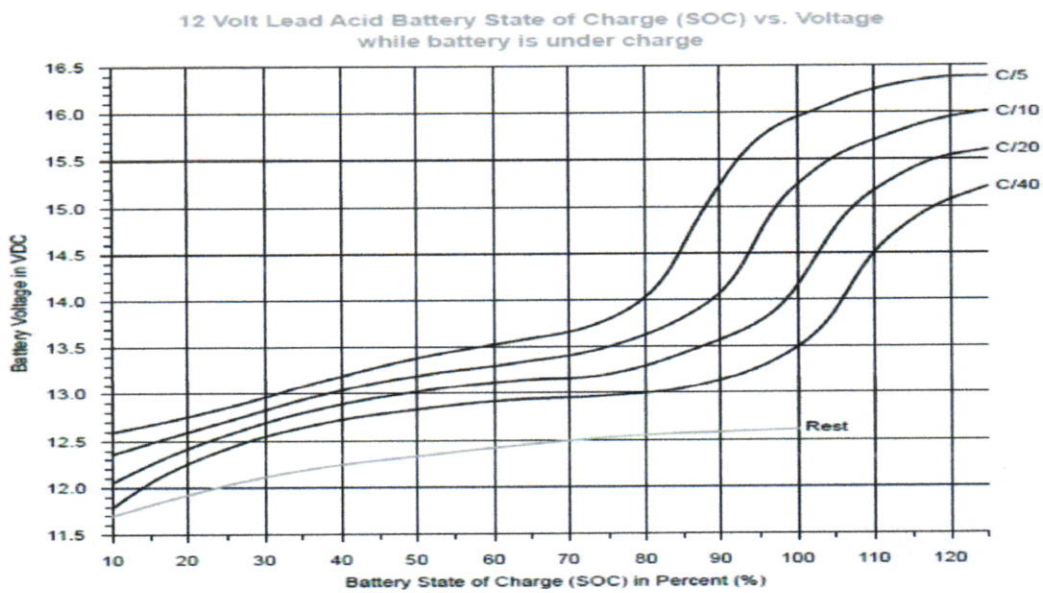
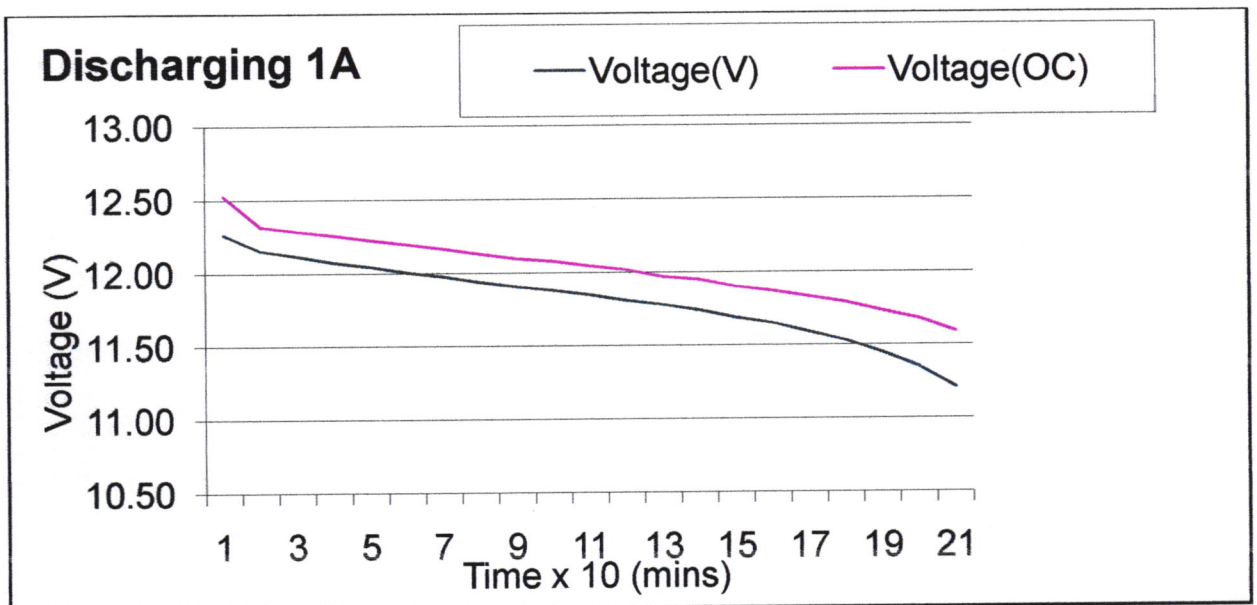
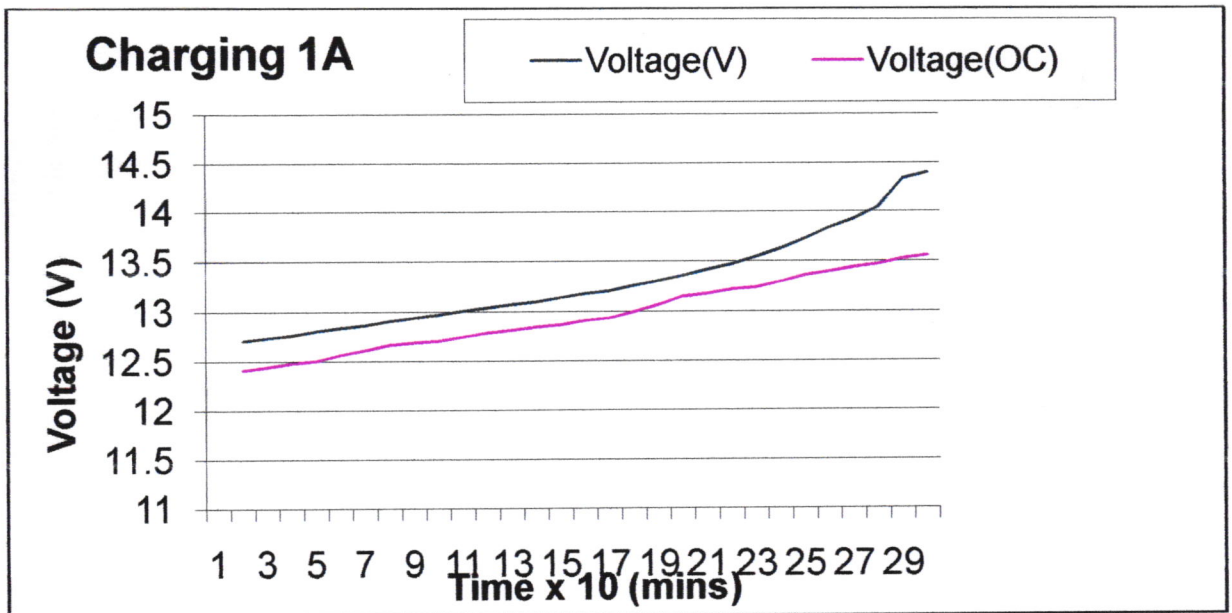


Figure 5: A standard graph for **charging** a lead-acid battery

4.2 The following results were obtained after battery testing:



5. Charge Controller

5.1 Reason for Charge Controller and its functions:

The primary function of a charge controller in a stand-alone PV system is to maintain the battery at highest possible state of charge while protecting it from overcharge by the array and from over discharge by the loads. The algorithm or control strategy of a battery charge controller determines the effectiveness of battery charging and PV array utilization, and ultimately the ability of the system to meet the load demands. Additional features such as temperature compensation, alarms, meters, remote voltage sense leads and special algorithms can enhance the ability of a charge controller to maintain the health and extend the lifetime of a battery, as well as providing an indication of operational status to the system caretaker.

Important functions of battery charge controllers and system controls are:

- ***Prevent Battery Overcharge:***

To limit the energy supplied to the battery by the PV array when the battery becomes fully charged.

- ***Prevent Battery Overdischarge:***

To disconnect the battery from electrical loads when the battery reaches low state of charge.

- ***Provide Load Control Functions:***

To automatically connect and disconnect an electrical load at a specified time, for example operating a lighting load from sunset to sunrise.

5.2 Reason for Microcontroller:

A microcontroller is a sophisticated microchip which allows the direct interface of the software program and the hardware operation. It enables the circuit components to carry out the commands of the program embedded inside with accuracy and simultaneously. The program embedded in the microcontroller is designed by the user and then compiled and written. It also includes other features such as voltage & current sensing, conversion, switching, etc.

5.3 Charge Controller Set Points:

To execute the charge controller functions, it is programmed to connect and disconnect the solar panels as well as the load at certain voltage levels of the battery. The voltage levels at which this cut-off and reconnection occurs are called **set points**. All solar charge controllers are associated with certain **set points** for safe and efficient operation of the system.

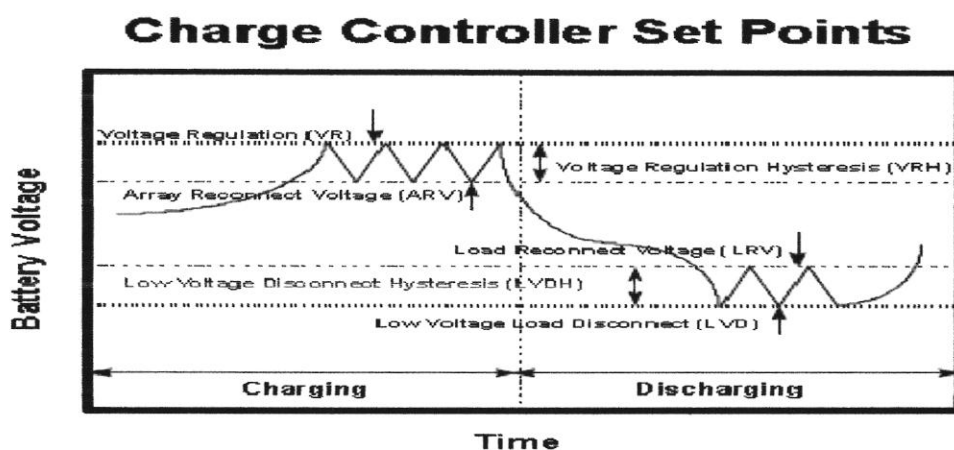


Figure 11. Controller set points

Figure 6: A graph of different charge controller set points and their variations with time.

Set points are an important factor while designing a solar charge controller circuit. The charge controller set points for thesis circuit are:

Array Disconnect Voltage: 14.4V

Array Reconnect Voltage: 13.8 V

Load Reconnect Voltage: 12.6V

Load Voltage Disconnect: 11.6 V

6. Circuit Components:

The following components were used to construct the circuit:

- Microcontroller (PIC16F876A)
- Voltage Regulator (LM7805)
- Bi-polar Junction Transistor (BJT) npn-type (BC547)
- MOSFET p-type (IRF9540N)
- 12V DC relay
- Darlington pair BJT npn-type (TIP122)
- 24V Zener diodes
- 3A schott-key diode
- 5A semiconductor diode
- Resistors (1k, 4.7k, 8.2k, 10k, 47k & 100k)
- Capacitors (1uf, 47uf, 100uf)
- LED indicators
- 20 MHz crystal oscillator.

7. Circuit Operation:

7.1 Voltage Sensing:

The basic operation of the circuit is to sense the voltage provided by the solar panel and also the battery voltage. If the panel voltage is sufficient enough and the battery is required to be charged, then the battery is allowed to be charged by the panel, else not. Similarly, if the battery voltage is enough to operate a load then the relay is activated to connect the load to the battery.

All the above functions are carried out by a specific defined program burned inside the microcontroller (PIC16F876A). It can be said that the microcontroller is the heart of the whole charge controller circuit. Its function includes sensing both the panel and battery voltages and take decisions to activate different components of the circuits such as, transistors, relays and LED indicators. It is powered up by the lead-acid battery connected to it through a voltage regulator (LM7805) which converts the 12V into 5V and is connected at pin no.1 (through a 10k resistor) and 20 (directly connected to the regulator). Pin 19 & 8 is ground and pin 9 & 10 is connected to the crystal oscillator.

The microcontroller (PIC16F876A) consists of a built-in analog to digital converter (ADC). Two out of 6 of these ports are required to sense the voltages. One is for sensing the panel voltage and the other for battery voltage. The panel and battery voltages are fed to the microcontroller in the same manner. The panel is connected to a series of resistance network of (47k and 8.2k) and the battery to another separate and similar network of resistances (4.7k and 1k).

The ADC of the microcontroller divides 5V into 1024 quantized levels. The node voltage in between the two resistances is fed as input to the microcontroller ADC ports from the battery and also from the panel. Hence, in this manner both the panel and the battery voltage sensing are achieved.

For example, if battery voltage is 11.6V the corresponding node voltage can be found by applying voltage divider rule i.e. $\{(1k \times 11.6V)/5.7k\}$ which is 2.03 V. Now the corresponding quantization level is $\{(2.03 \times 1024)/5\}$ or 416.

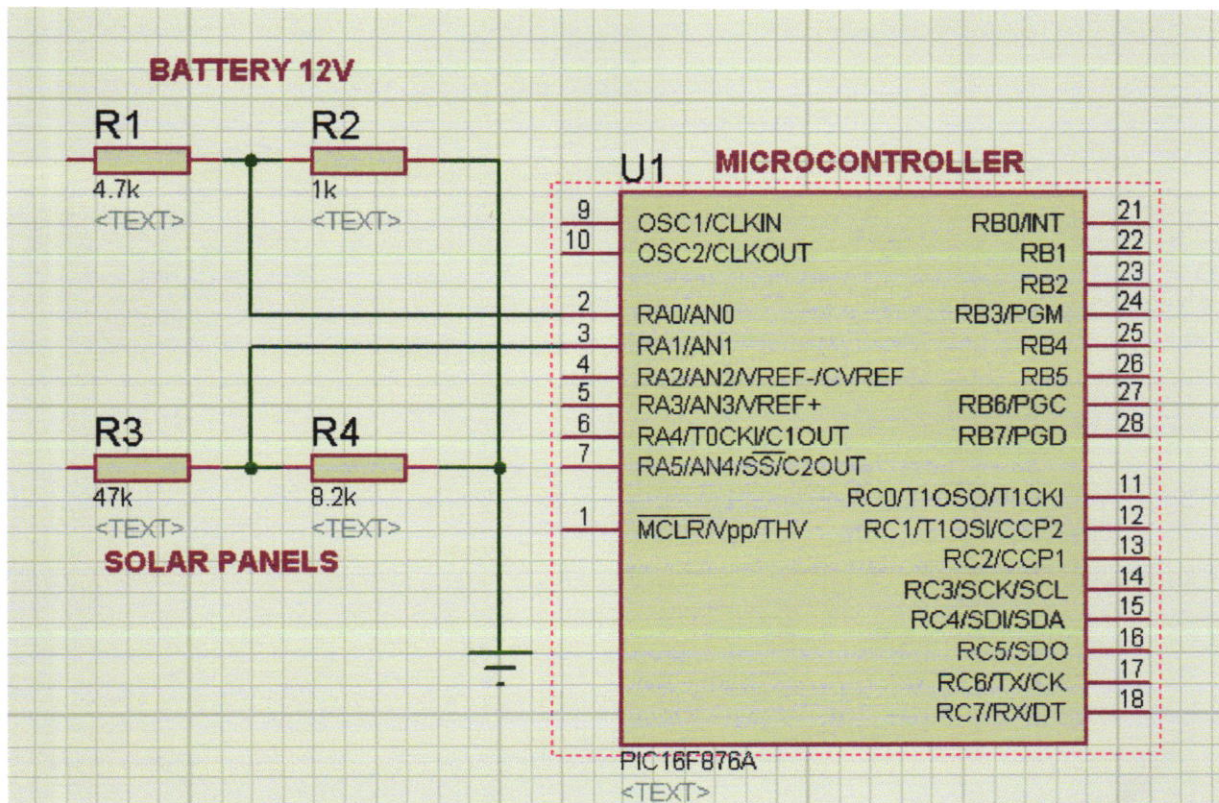


Figure 7: Circuit diagram for the voltage sensing. The battery (+) is connected with the 4.7k resistor and the panel (+) is connected with the 47k resistor. The negative terminals are connected to ground.

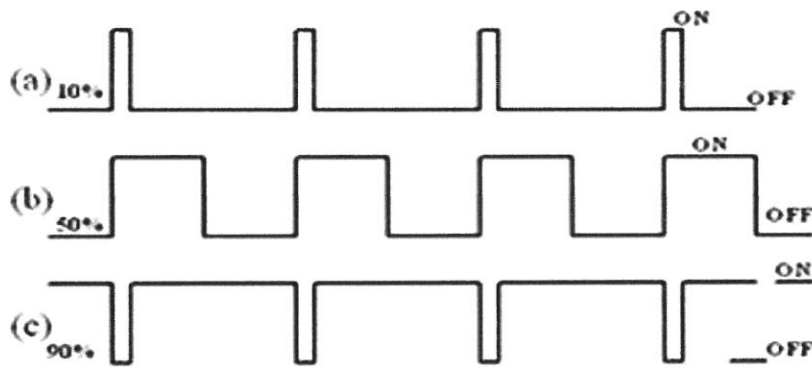
The node voltages are taken as input in the ADC ports **AN0** and **AN1** of the microcontroller.

7.2 Battery Charging Operation:

The battery is charging is carried out by the process of pulse width modulation (PWM), instead of direct charging from the panel. There are three different charging methods to be followed while charging a lead-acid battery. They are:

- Bulk Charging
- Absorption
- Float

These three different states of charging of the battery require different voltage and current levels. Therefore, by varying the pulse width i.e. duration of the on and off times of the signals, the requirement of different of current and voltage are achieved.



1. Pulse width modulation signals for 10% (a), 50% (b) and 90% (c) duty cycles. The maximum duty cycle for most available PWM ICs is usually from 50% to 100%.

Figure 8: An example of how the pulse of the signal varies according at different duty cycles.

In a periodic event, duty cycle is the ratio of the duration of the event/pulse to the total period of a signal.

$$\text{duty cycle } D = \frac{\tau}{T}^{[3]}$$

where,

τ is the duration that the function is active.

T is the period of the function.

If the battery is in need of charging, it only charged if the panel voltage is greater than 15V and less than or equal to 21V. The panel voltage and current flows to the source terminal of the MOSFET (IRF9540N). The Gate terminal of the MOSFET is activated according to pulse width signal provided by the microcontroller. The Gate terminal of the FET is connected through a bi-polar junction transistor (BJT – BC547) to the microcontroller.

Here both the MOSFET's and the BJT's switching function is applied. The BJT is used to switch the Gate of the MOSFET and the Gate in turn activates or deactivates the MOSFET Drain controlling the flow from Source to Drain. The Drain of the MOSFET is directly connected to the positive terminal of battery and hence charging from the solar panel to the battery is achieved.

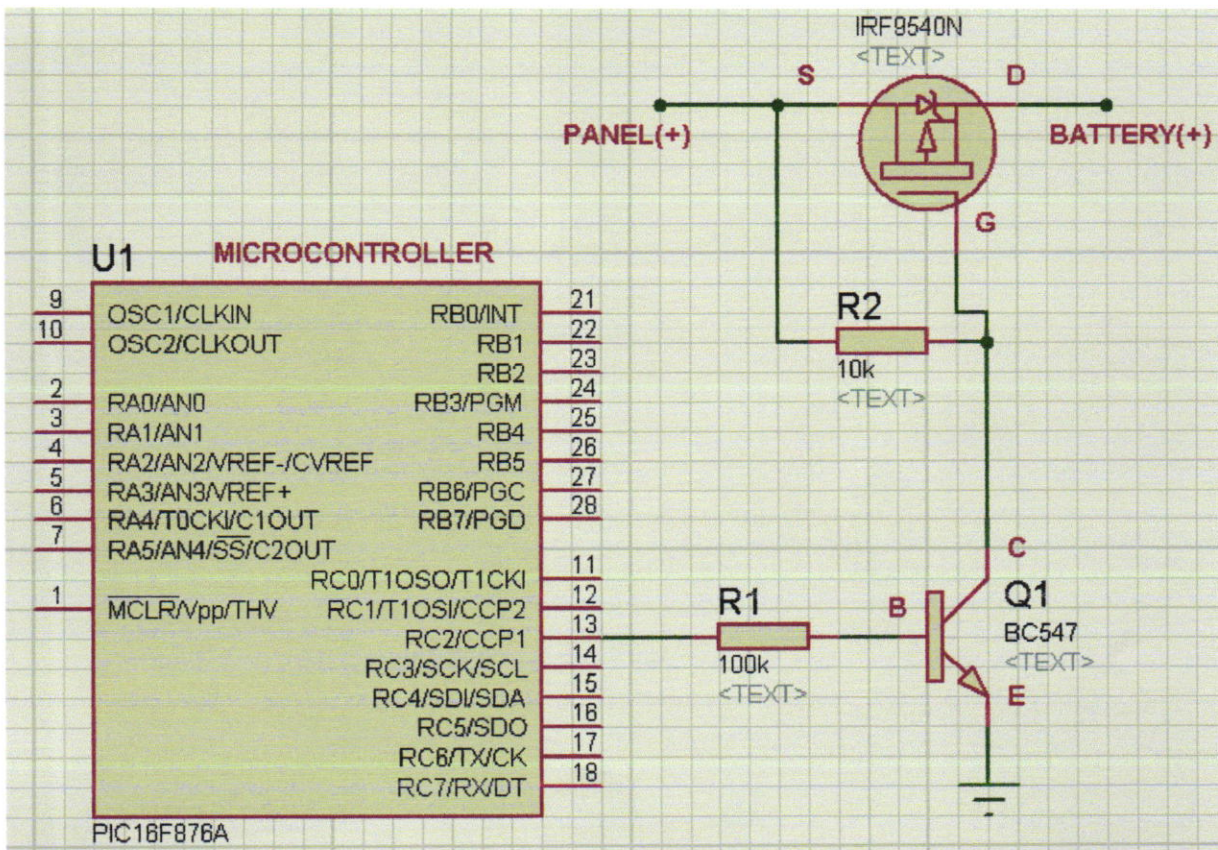


Figure 9: Switching operation of the charging process from the panel to the battery via MOSFET. The panel(+) is connected at the source and the battery(+) is connected at the drain. The gate is controlled by the BJT, where is base is connected to the CCP1 (pin 13) port or the PWM port of the microcontroller. When the base of BJT is switched on the gate of the MOSFET is switched off and the source to drain channel is active.

7.3 Battery Discharging Operation:

When a load is required to be operated by the battery, a relay is used for providing the battery voltage and current to the load. One end of the relay coil is connected to the positive terminal of the battery. The other end is connected to the collector of the darlington pair BJT (TIP122). The emitter is connected to ground and the base is controlled by a microcontroller port.

If the battery voltage is sufficient enough to run a load, the base of the BJT is turned on and the current from the relay coil flows through the transistor and hence the relay is activated or said to be switched on, to turn on the load.

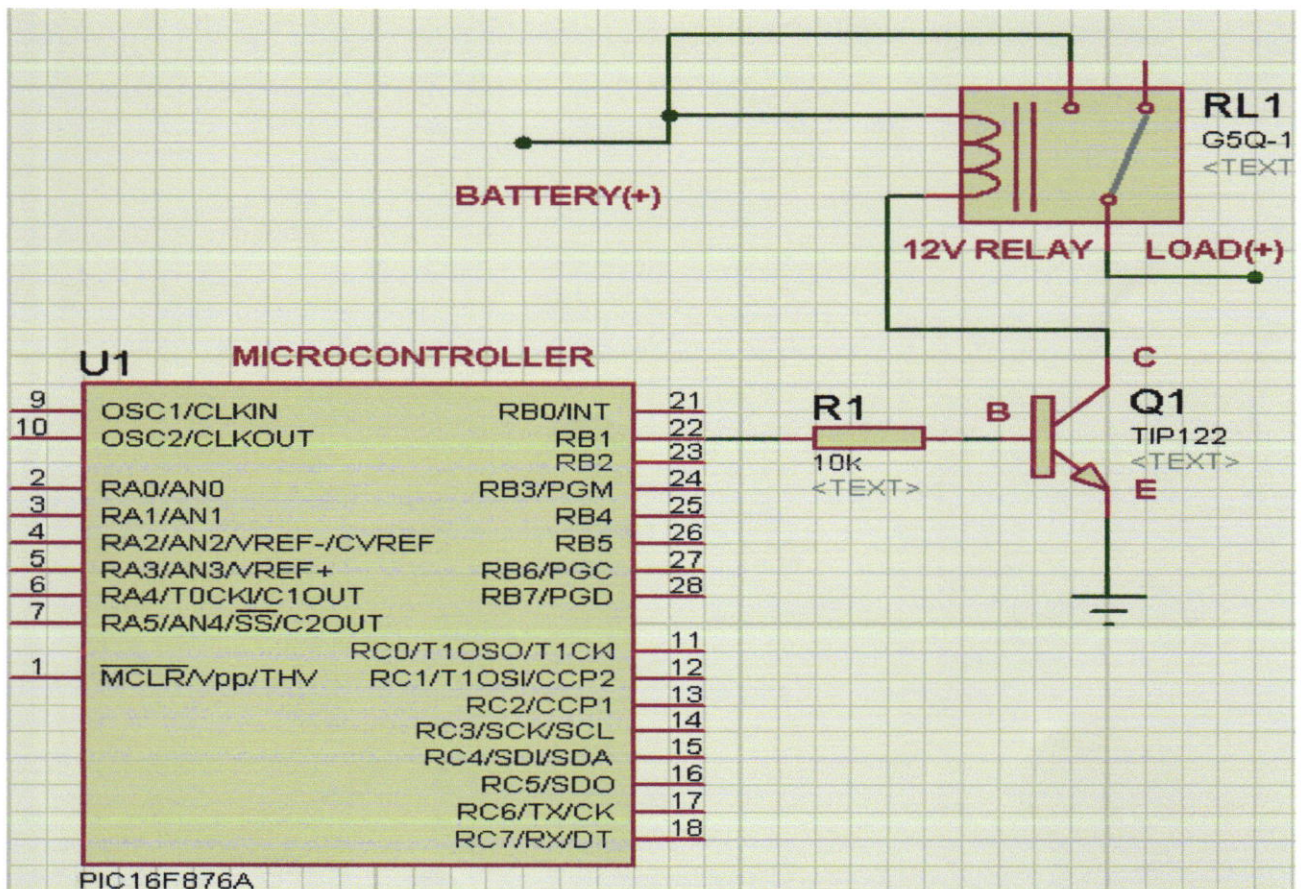


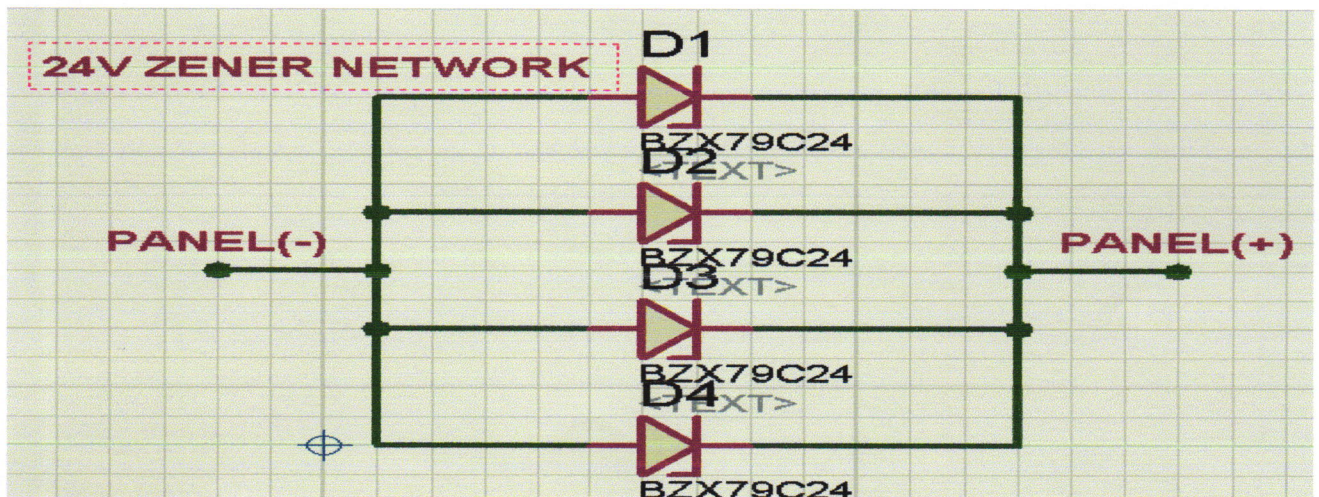
Figure 10: Battery discharging operation of the circuit. When the RB1 (pin 22) is powered on the transistor base is activated. Hence, the coil is energized and the relay is switched on.

8. Circuit Protection:

The voltage or current exceeding a certain limit can be harmful for the system as a whole. It can be said that the most impact of these irregularities is incident on circuit components. Therefore, a circuit protection is necessary. Some circuit protection is stated below:

8.1 Over Voltage Protection:

This can be achieved by connecting zener diodes in parallel with each other to limit the circuit from exceeding a certain voltage level as shown below:

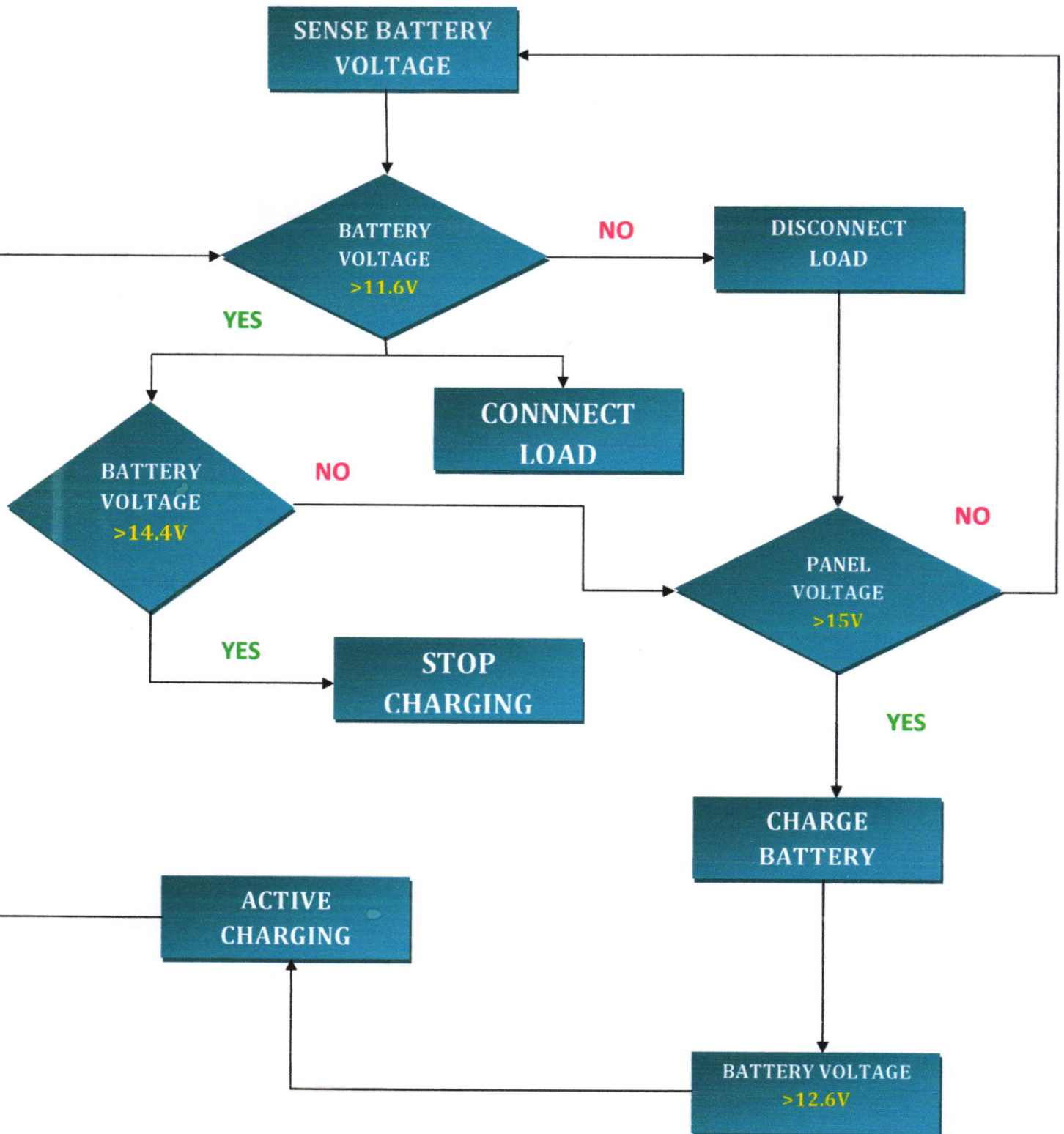


8.2 Reverse Current Flow Protection:

In solar power system, there are times such as night where the panel voltage is sufficiently lower than the battery voltage. So, there is a high chance for flow of current from the battery to the panel (reverse current). The solution to this problem is placing a diode in between the panel and the battery (preferably a Schottky diode of suitable current rating).



FLOWCHART OF CIRCUIT OPERATION



9. EXPERIMENTAL RESULTS & CIRCUITRY:

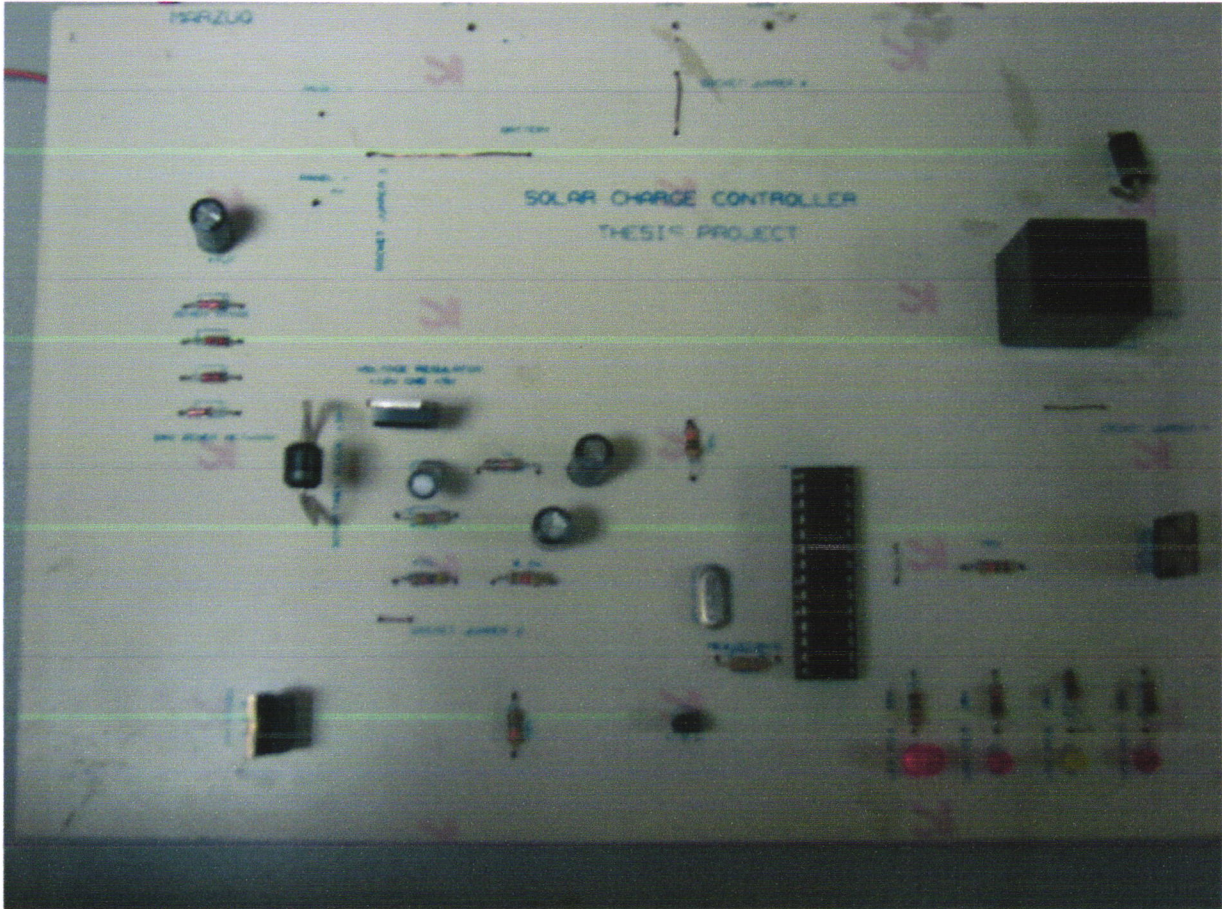


Figure 11: A complete form of the charge controller circuit in PCB.

On connecting with a DC power supply terminals (used as panel source) a voltage of 16V was applied. The sealed lead acid battery terminals were connected as well as a rheostat (used as load for the system) a perfect charging and discharging mechanism was obtained justifying the circuit operation.

As the drain of the MOSFET is connected to the battery, the charging process was not completed fully by the PCB due to time constraint. Therefore, the same circuit was implemented on a breadboard and assuming the two supply ports of the DC power supply as a panel and a battery, the circuit operation is shown by LED indicators. One of the LED is

connected to the Drain and the other to the relay output. The results at different voltage level are shown below with their corresponding Pulse Width Modulation (PWM) levels.

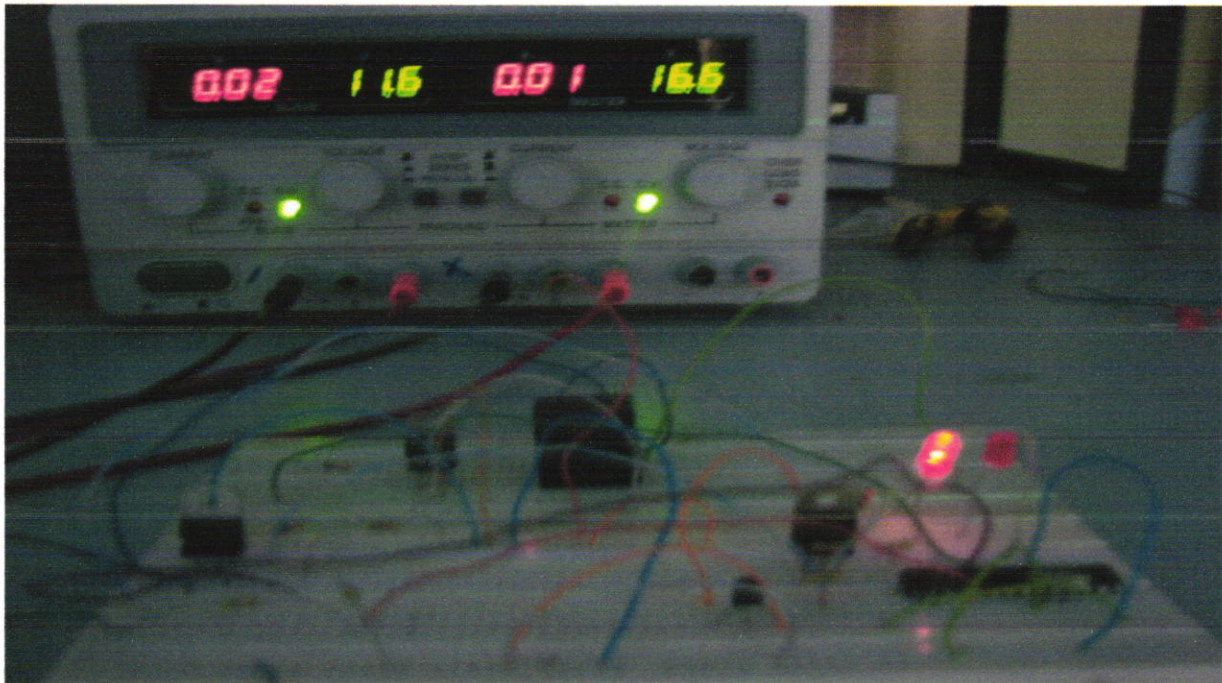


Figure12 : The left side LED is connected to the MOSFET Drain. It shows that at when the battery voltage is 11.6 the load is disconnected which is indicated by the LED on the right connected to the relay output.

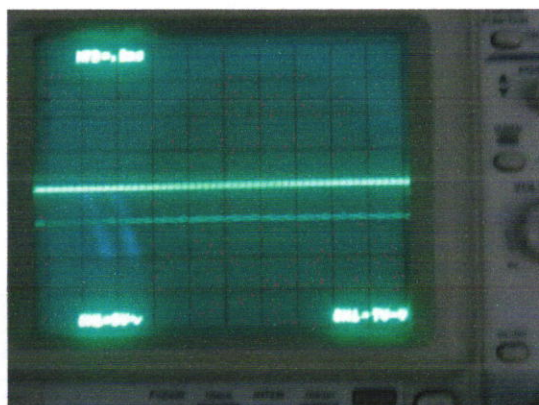


Figure 13: When the battery voltage is at 11.6V it is charged at 95% duty-cycle of the pulse width, i.e. 95% the total duration is switched on.

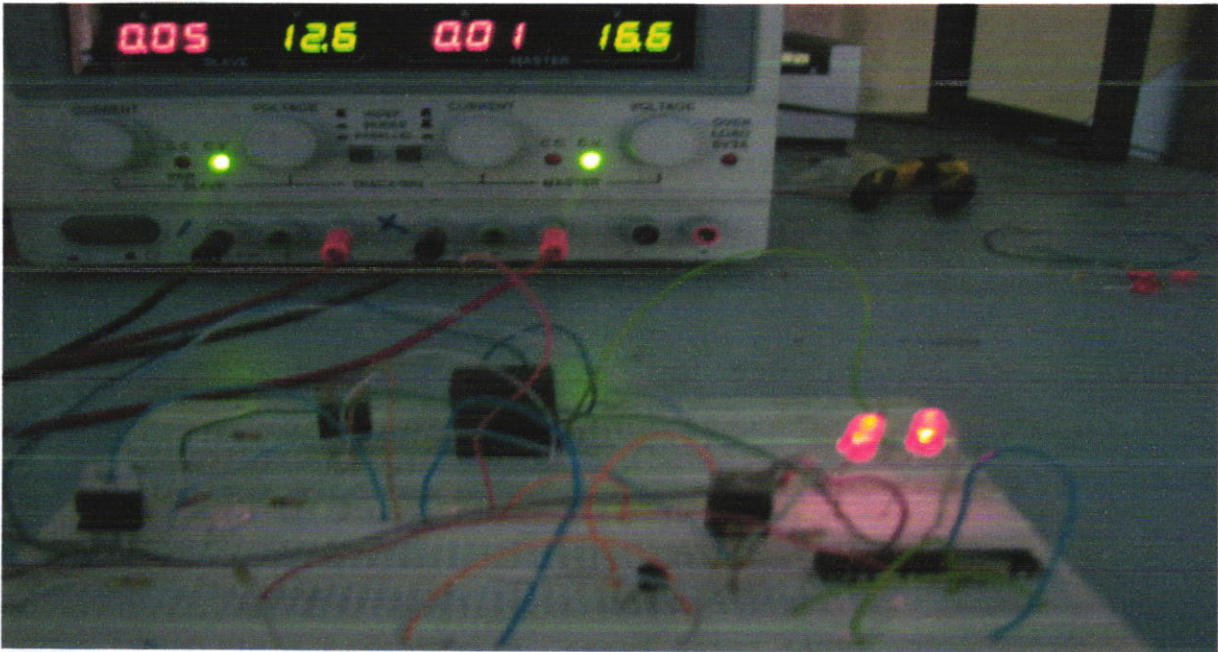


Figure 14: The left side LED is connected to the MOSFET Drain. It shows that at when the battery voltage is 12.6 the load is switched on which is indicated by the LED on the right connected to the relay output. The battery is not yet fully charged. At this stage the PWM width is still 95%.



Figure15: When the voltage of battery is at 13.8V is switches to the absorption state of charging. In this state the PWM duty cycle is reduced to 70% of the total duration, i.e. 70% on.

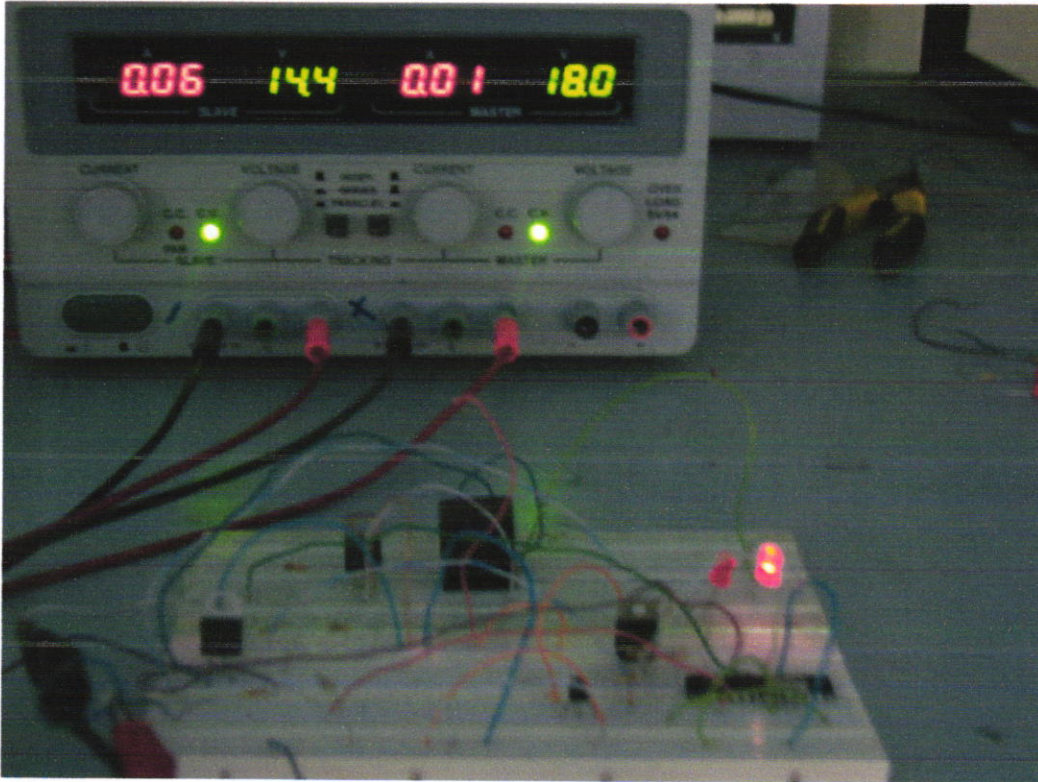
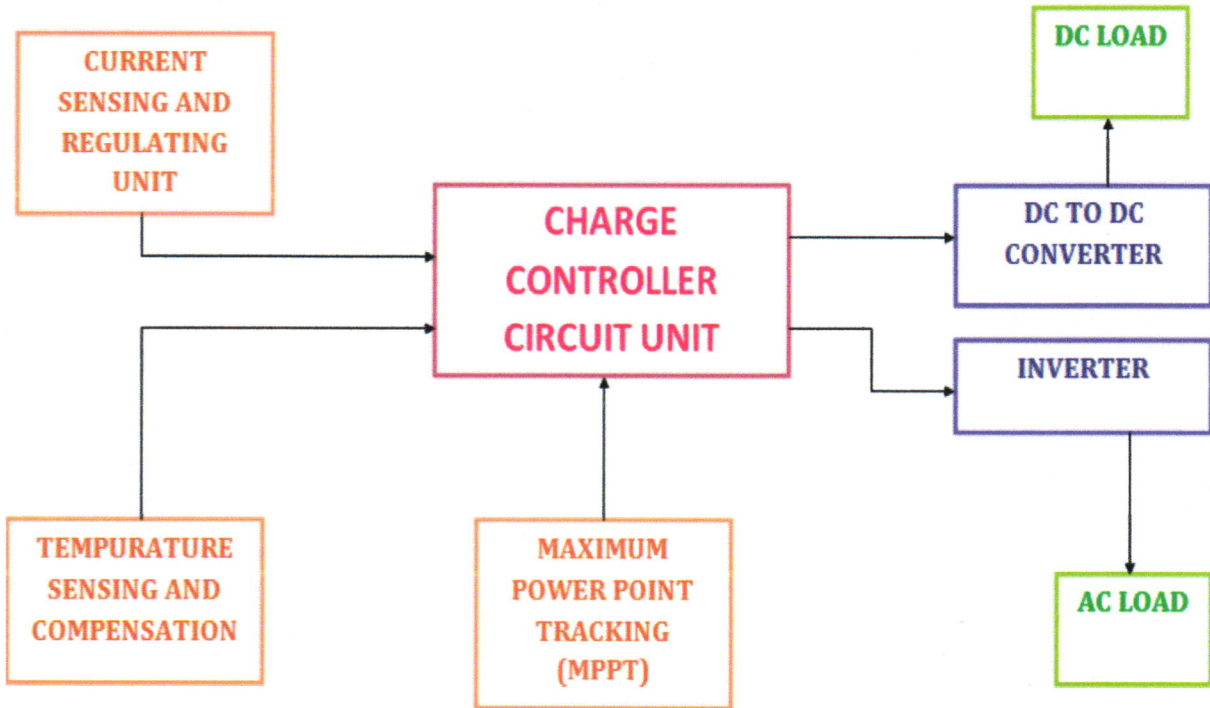


Figure 16: At voltage rises to 14.4V the battery is said to be fully charged. Therefore the charging process is stopped and the left-side (connected to Drain) is also switched off indicating PWM is 0%.



Figure 17: For the battery voltage level 14.2 -14.4 V it enters into the float charge state of charging where current has to be significantly low. Hence the duty cycle of the PWM is reduced to 5% at this state.

FUTURE WORK OF CHARGE CONTROLLER DESIGN



Although, throughout this entire project the circuit design is only composed of charging of the battery in 3 states by PWM, voltage sensing and the discharging of the battery by relay functions. It is not limited for further developments.

Additional features such as **current sensing and regulation controls** as well as **temperature compensation** and **maximum power point tracking (MPPT)** can also be included for more efficient charging of the battery.

Furthermore, different types of loads (AC and DC) can also be operated by implementing **DC-DC converter** and **inverter** systems.

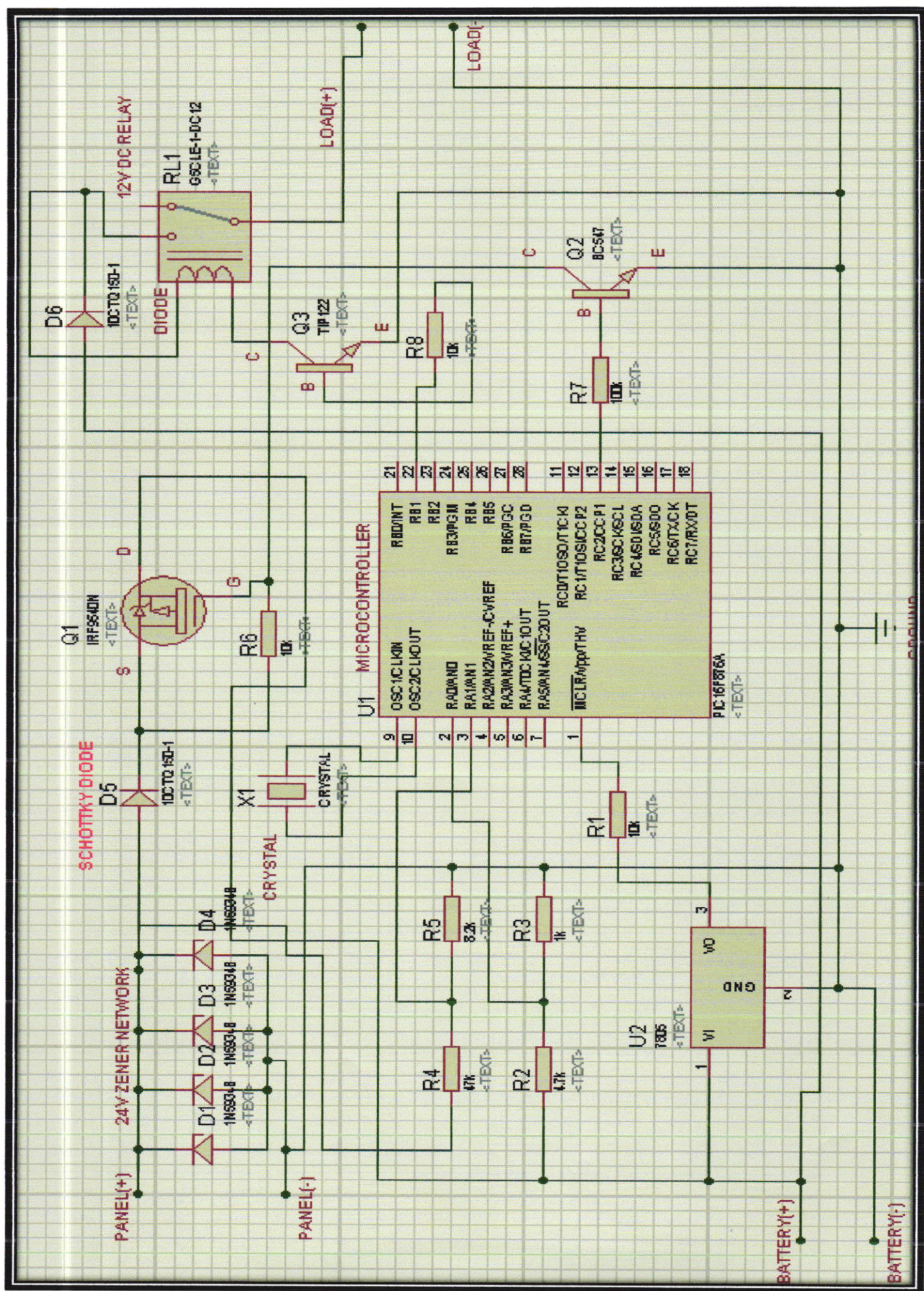
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Internship Report
On
Nestlé Bangladesh Limited
Digital Marketing
Of
Nescafé


Mohammad Razaur Razzak
Associate Professor &
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BRAC Business School
BRAC University





Inspiring Excellence

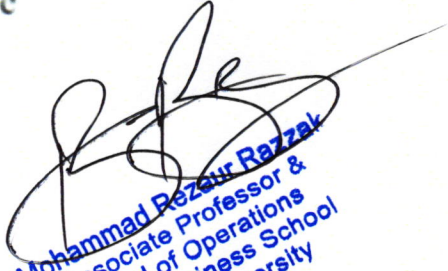
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Submission Date:

17/12/15



Letter of Transmittal

December 17th, 2015

Mr. Mohammad Rezaur Razzak,

Associate Professor,

BRAC University,

Subject: Internship report on Nestlé Bangladesh Limited Digital Marketing of Nescafé

Dear Sir,

It gives me immense pleasure in presenting the internship report on “**Nestlé Bangladesh Limited Digital Marketing of Nescafé**”, which was assigned to me as a partial fulfillment of the BBA program, BRAC University. The three months of internship program at Nestlé Bangladesh Ltd gave me the opportunity to have an insight on the renowned brands and their digital marketing strategies. The work on the project also enriched my knowledge about the corporate environment of an organization. Overall, it was a great experience for me to work for Nestlé - the world's largest Nutrition, Health and Wellness Company.

I hope that the report would be meeting your expectations and standards; I have tried to follow every guideline that you had advised. Your kind consideration and cooperation will be highly appreciated. Thanks again for your guidelines and support to prepare this report.

Sincerely,

Anika Mozammel

ID: 11204096

BBS, BRAC University


Mohammed Rezaur Razzak
Associate Professor &
Head of Operations
BRAC Business School
BRAC University



Acknowledgement

At the very beginning, I am thankful to almighty Allah for giving me strength and ability to accomplish my internship program at Nestlé Bangladesh Ltd. as well as the internship report in a scheduled time in spite of various difficulties. It gives me immense pleasure to thank every individual for their cordial cooperation and encouragement which has contributed directly or indirectly in preparing this report. I would first like to express my deep sense of gratitude and sincere thanks to my faculty advisor, Mohammad Rezaur Razzak Sir, Associate Professor, BRAC University for guiding me during my internship period with Nestlé Bangladesh Ltd. Then I would like to thank my supervisor Farzana Ferdous (Manager, Consumer Engagement Service, Digital Marketing and E-Commerce) and Mr. Ashikur Rahman (Category Business Manager-Coffee and Beverage), they supported me at every stages of my internship program with knowledge and resources and devisers my heartfelt thanks for their cooperation. Ms. Daraksha Hossain (Champion Consumer Engagement) was my immediate supervisor during the full internship attachment and helped me with all my tasks and job responsibilities. I am also very grateful for her cooperation in understanding Nestlé culture, work environment, and also preparing my report. I am grateful to my other colleagues from different functions- Farah Sharmeen Aolad (Manager Corporate Affairs), Mr. Rifaquat (Senior Executive Officer of E-Commerce), their active participation in my job responsibilities, approvals and queries during my internship has made this journey a successful one. Last but not least, I want to thank BRAC university authority for sorting out the internship in Nestlé Bangladesh Limited.

Executive Summary

In 1994, Nestlé started its operation in Bangladesh with a factory situated in Sreepur, Gazipur. Nestlé Bangladesh employs more than 650 people and more than 1000 people are employed by suppliers and distributors in connection to Nestlé. Immensely sold products in Bangladesh are Nescafé, Maggi noodles and soup, Maggi Shad-e-Magic, Nido, breakfast Cereals such as Corn Flakes and Koko Crunch, Coffee-Mate, Munch rolls and many more.

Nestlé is present around the globe, on all continents, with around 230,000 people working in more in an 84 countries with 466 factories and with sales representatives in at least another 70 countries. It is the world's largest food group, not only in terms of its sales but also in terms of its product range and its geographical presence. Nestlé covers nearly every field of nutrition: infant formula, instant coffee, milk products, chocolate and confectionery, mineral water, ice-cream, culinary products, etc.

Being an intern in the Digital Marketing Department of Marketing Function, I got a splendid opportunity to see how marketing of brands work in the real world and how this new digital medium of promotion helps to effectively reach more consumers to improve the business as a whole. Details of all these are discussed on this paper.

I hope that my report gives a through insight to all these responsibilities carried out during my tenure as an intern. With limited access to data due to confidentiality, I have tried to provide as much information as were possible about the works involving the digital marketing department at Nestlé Bangladesh.

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1. Introduction

1.1: Company Profile

Nestlé - the world's largest nutrition, health and wellness company, not only in terms of its sales but also in terms of its product range and its geographical presence: Nestlé covers nearly every field of nutrition and food business : infant formula, baby food, milk products, chocolate and confectionery, instant coffee, ice-cream, culinary products, frozen ready-made meals, mineral water etc. Nestlé is also a major producer of pet food. In most of these product groups and in most markets, Nestlé is the leader or at least a strong number two. Nestlé is a much focused Company, with more than 94 percent of the sales coming from the food and beverage sector. Nestlé is present around the globe, on all continents, with around 230,000 people working in more than in 84 countries with 466 factories and with sales representatives in at least another 70 countries. Many of their brand names are familiar to almost everyone: NESCAFÉ, NIDO, MAGGI, POLO, MILO, KITKAT, KOKO KRUNCH....Some of our products have broken records: 3,000 cups of Nescafé are consumed every second. And Kit Kat merited an entry in the Guinness Book of World Records as the world's best-selling chocolate bar with 418 Kit Kat fingers eaten every second around the world!

1.2: History of Nestlé

1866-1905

In the 1860s Henri Nestlé, a pharmacist, developed a food for babies who were unable to breastfeed. His first success was a premature infant who could not tolerate his mother's milk or any of the usual substitutes. People quickly recognized the value of the new product, after Nestlé's new formula saved the child's life, and soon, Farine Lactée Henri Nestlé was being sold in much of Europe.

1905-1918

In 1905 Nestlé merged with the Anglo-Swiss Condensed Milk Company. By the early 1900s, the company was operating factories in the United States, Britain, Germany and Spain. World War I created new demand for dairy products in the form of government contracts. By the end of the war, Nestlé's production had been doubled.

1918-1938

After the war Government contracts dried up and consumers switched back to fresh milk. However, Nestlé's management responded quickly, streamlining operations and reducing debt. The 1920s saw Nestlé's first expansion into new products, with chocolate the Company's second most important activity.

1938-1944

Nestlé felt the effects of World War II immediately. Profits dropped from \$20 million in 1938 to \$6 million in 1939. Factories were established in developing countries, particularly Latin America. Ironically, the war helped with the introduction of the Company's newest product, Nescafé, which was a staple drink of the US military. Nestlé's production and sales rose in the wartime economy.



1944-1975

The end of World War II was the beginning of a dynamic phase for Nestlé. Growth accelerated and companies were acquired. In 1947 came the merger with Maggi seasonings and soups. Crosse & Blackwell followed in 1960, as did Findus (1963), Libby's (1971) and Stouffer's (1973). Diversification came with a shareholding in L'Oréal in 1974.

1975-1981

Nestlé's growth in the developing world partially offset a slowdown in the Company's traditional markets. Nestlé made its second venture outside the food industry by acquiring Alcon Laboratories Inc.

1981-1995

Nestlé divested a number of businesses 1980 / 1984. In 1984, Nestlé's improved bottom line allowed the Company to launch a new round of acquisitions, the most important being American food giant Carnation.

1996-2002

The first half of the 1990s proved to be favorable for Nestlé: trade barriers crumbled and world markets developed into more or less integrated trading areas. Since 1996, there have been acquisitions including San Pellegrino (1997), Spillers Pet foods (1998) and Ralston Purina (2002). There were two major acquisitions in North America, both in 2002: in July, Nestlé merged its U.S. ice cream business into Dreyer's, and in August, a USD 2.6bn acquisition was announced of Chef America, Inc.

2003-2009

The year 2003 started well with the acquisition of Mövenpick Ice Cream, enhancing Nestlé's position as one of the world market leaders in this product category. In 2006, Jenny Craig and Uncle Toby's were added to the Nestlé portfolio and 2007 saw Novartis Medical Nutrition,



Gerber and Henniez join the Company. Meanwhile Nestlé entered into a strategic alliance with the Belgian chocolatier Pierre Marcolini at the end of 2009.

2010 to onward

From the mid-2010 Nestlé finalized the sale of Alcon to Novartis and at the same time Nestlé bought Kraft's frozen pizza business.

1.3: Nestlé's Mission & Vision Corporate Mission

Corporate Mission

At Nestlé, we believe that research can help us make better food so that people live a better life. As consumers continue to make choices regarding foods and beverages they consume, Nestlé helps provide selections for all individual taste and lifestyle preferences. Research is a key part of our heritage at Nestlé and an essential element of our future. We know there is still much to discover about health, wellness and the role of food in our lives, and we continue to search for answers to bring consumers Good Food for Good Life.

Corporate Vision

Nestlé has an aim to meet the various needs of the consumer every day by marketing and selling food of a consistently high quality. Good Food is the primary source of Good Health throughout life. We strive to bring consumers foods that are safe, of high quality and provide optimal nutrition to meet physiological needs. In addition to Nutrition, Health and Wellness, Nestlé products bring consumers the vital ingredients of taste and pleasure. Confidence that consumers have in our respected brands, is a result of our company's many years of knowledge in marketing, research and development, as well as continuity – consumers relate to this and feel they can trust our products. The objectives are to deliver the very best quality in everything we do, from primary produce, choice of suppliers and transport, to recipes and packaging materials.



1.4: About Nestlé Bangladesh Ltd.

Nestlé Bangladesh Limited started its first commercial production in Bangladesh in 1994 successfully. In 1998, Nestlé S.A. took over the remaining 40% share from our local partner when Nestlé Bangladesh became a fully owned subsidiary of Nestlé S.A. Nestlé Bangladesh's vision is to be recognized as the most successful food and drink Company in Bangladesh, generating sustainable, profitable growth and continuously improving results to the benefit of shareholders and employees. Factory Location: Their factory is situated at Sreepur, 55 km north of Dhaka; the factory produces instant noodles, cereals and repacks milks, soups, beverages and infant nutrition products. Today Nestlé Bangladesh Ltd. is a strongly positioned organization in FMCG Industry. The Company is growing faster through its policy of constant innovation and renovation, concentrating on our core competencies and commitment to high quality, with the aim of providing the best quality food to the people of Bangladesh. Their human resources goal is to be recognized as the preferred employer in Bangladesh. Nestlé Bangladesh has currently 75 products of different Brands.



1.5: Products Portfolio of Nestlé Bangladesh

Local Manufacturing: Importing Raw materials and preparing at Bangladesh

Brand - CERELAC:

CERELAC is a range of nutritious, easily-digested instant cereals. It is suitable as a complimentary food for infants from six months onwards, when breast milk or formula alone no longer meet the baby's growing nutritional requirements. It is not a breast milk substitute. Worldwide, the brand was first registered in 1949. CERELAC in Bangladesh has following 4 stages for 4 kinds of children ages (starting from 6 months to 24 months). CERELAC in Bangladesh has below SKU's (Stock Keeping Units)

- CERELAC Wheat Mixed Fruit
- CERELAC Rice
- CERELAC 3. Fruits
- CERELAC Wheat Mixed Vegetable
- CERELAC Wheat. Apple Cherry
- CERELAC Khichuri
- CERELAC Honey
- CERELAC Chicken



Local Filling: Importing Semi finished bulks and packing in Bangladesh.

Brand- Nescafé:

Is a brand of instant coffee made by Nestlé. It comes in the form of many different products. The name is a portmanteau of the words "Nestlé" and "café". Nestlé's flagship powdered coffee product was introduced in Switzerland on April 1, 1938 after being developed for seven years by Max Morgenthaler and Vernon Chapman. Under the brand Nescafé there are two major segments one is Pure Soluble Instant Coffee more commonly known as Nescafé Classic Coffee and the other one is 3 in 1 Mix.

There are five SKUs (Stock Keeping Units) in Bangladesh, they are as follows:

- Nescafé 200gm Jar (Classic)
- Nescafé 100gm Jar (Classic)
- Nescafé 50gm Jar (Classic)
- Nescafé 1.5gm Sachet (Classic)
- Nescafé 3 in 1 Mix



Brand – MAGGI Noodles:

Maggi noodles are a brand of instant noodles manufactured by Nestlé. Maggi noodles and Maggi Soup are part of the Maggi family, a Nestlé brand of instant soups, stocks, and noodles. Maggi Noodles has following flavors in BD:

- MAGGI 2Minutes Masala Fortified
- MAGGI 2Minutes Curry Fortified



Brand - NIDO:

NIDO is Nestlé's brand in the milk food segment. NIDO targets kids above 3 yrs. and is positioned as a food for growing children. The USP for Nido is that it is fortified with Calcium and Vitamin D which helps the kids develops strong and healthy bones. Nido faces direct competition with the ordinary milk and milk based beverages. In Bangladesh NIDO has following SKU's:

- NIDO 1+
- NIDO 3+
- NIDO Fortified



Brand - MAGGI Soup:

Maggi Soup has exciting authentic flavors with a wide range of uses, Bain-Marie stable, and freeze/thaw stable. It is Microwaveable. It has 12 months shelf life. It is Easy to prepare, and gives consistent results and perfect as a base for sauces and pies or simply served as a soup:

- MAGGI Health Soup Chicken
- MAGGI Health Soup Thai
- MAGGI Health Soup Vegetable

Other Imported items:

- LACTOGEN, NAN
- Coffee Mate
- Corn Flakes, Koko Krunch

2. Overview on Digital Marketing of Nestlé

2.1: Digital Marketing Department

Digital Marketing Service is a very recent introduction to the Nestlé Bangladesh Ltd. It falls under Marketing Function at Nestlé Bangladesh Ltd; the organizational structure of Digital Marketing Department is described below:

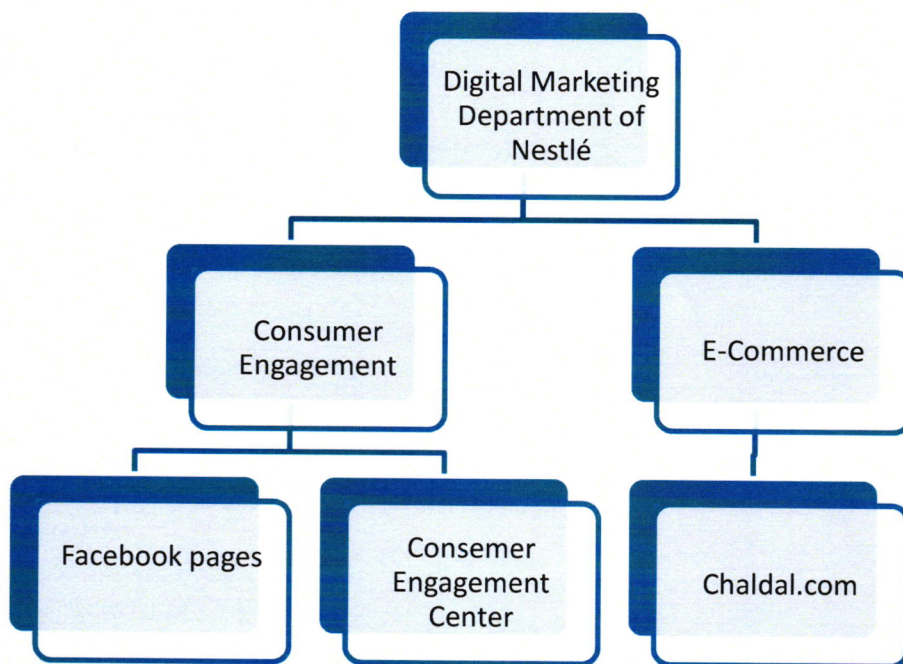


Table: Organizational Structure of Digital Marketing at Nestlé Bangladesh Ltd.

Digital Marketing was first introduced in March 2015; within a span of 9 months it was successful to significantly increase the reach towards the target consumers.

Consumer Engagement: is responsible for creating engagement strategies through social medias as such Facebook. Currently Nestlé Bangladesh Ltd. has four digital pages on Facebook

i.e. NESCAFÉ, Nestlé Corporate, Munch Rollz, Maggi. The responses from the pages are remarkable, number of page likes within such a short time and the consumer engagement rate is remarkably high. Consumer engagement also helps to tract quires and feedback from consumer comments. This not only helps to understand the brand better in this fast digital era but also saves a lot of time and cost on research. While the Consumer Engagement Center gives 24/7 care line assistance for consumer at Nestlé's Toll-free number for any questions based on its products or health, wealth and wellness. This directly helps to know how consumer feels about the products and give a chance to get exact feedback from them.

E-Commerce: is the part of planning strategic sales, where consumer can directly buy products online from Nestlé's chaladal.com page.

2.2: Digital Marketing of Nescafé

Strategy for Digital Marketing of Nescafé is to develop and promote coffee consumption of White Cup (Nescafé 3 in 1). It aims to reach more consumers and create awareness of the brand through most frequently used social network Facebook. As Nescafé's target consumers are between the age group of 18-35 years, it is a youth centric brand in Bangladesh. In addition recent statistics from Asiatic Advertisement Agency showed Nescafé was consecutively no. 1 in terms of youth engagement in Facebook fan page. Nescafé 3 in 1 mix is specially targeted for students and in-home segments such as working women. Thus, instant coffee 3 in 1 mix is most convenient for their consumption in today's lifestyle.

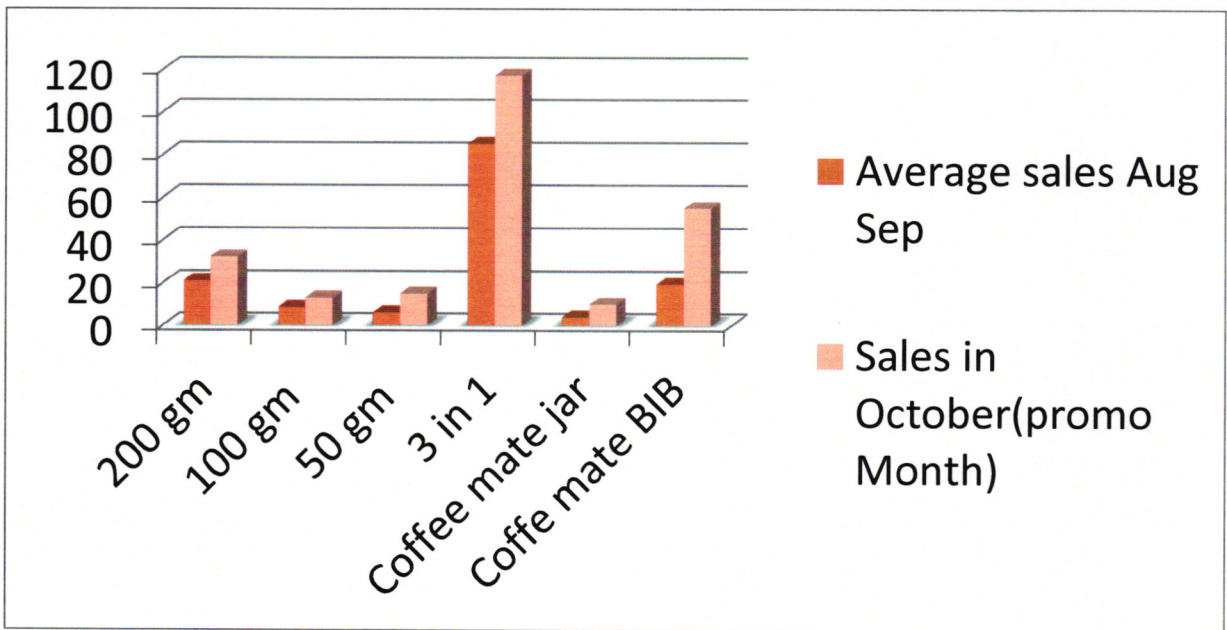


Table: Sales Statistic of Nescafé SKUs after introducing Digital Marketing.

2.3: Mediums used for Consumer Engagement

Software such as Radian6, Social studio, Sales Force are majorly used to keep track of consumer feedbacks and queries. This helps to get an easy and fast analysis about the brand and its perception from the target customers. While other social mediums such as Facebook, YouTube and Twitter help in indirect promotional activities and brand awareness. Moreover, these mediums also help in collecting and creating more consumer engagement among the targeted consumers.

3. Duties and Responsibilities

3.1: Job Responsibilities

As a Digital Marketing intern my job responsibilities were:

- Managing and dealing with Agencies for digital creative contents of Nescafé and Nestlé Corporate Facebook fan page.
- Supervising Facebook fan page Creative contents of Nescafé and Nestlé Corporate.
- Taking approvals of creative contents from brands, legal and head of marketing.
- Looking after and administrating both online and offline marketing promotional campaigns of brand Nescafé.
- Tracking Consumer Engagement through software such as Radian6 and Social studio.
- Organizing internal Marketing Events and managing awareness and promotional activities of Nestlé Corporate and as well as Nescafé.

3.2: Learning Experience

Learning Experience through Nescafé and Nestlé Corporate Facebook Fan page:

1. Content Marketing

After working for Nescafé and Nestlé Corporate Facebook fan page, I learnt that content marketing is a new influential medium through which an organization can become successful in the world of marketing since it provides two-way communication system where you are not only communicating with your target customers but also get their feedback. Thus, an organization is able to make a profitable relationship with its customers. Houghton (2013) states that there is a huge prospect for content marketing as three out of four small businesses plan to increase their content marketing efforts in 2013. So, it was a great learning experience for me where I

understood the importance of content marketing to survive in the competitive environment. Such as:

- **Creating Customers Awareness:** One of the objectives of content marketing is to create and distribute educational content which makes our target customers more intelligent and awareness helps them in purchase decision-making. So, I have learnt that through educating your customers you are actually increasing product awareness which will eventually result into sales generation.
- **Increased Engagement:** When you provide an informative or interesting post that delights your target customers, it will be liked, shared or both and soon after that the post will appear on their newsfeeds which will further liked and shared. Thus, like a virus it spreads over the network resulting into brand awareness and more visitors on your fan page.
- **Building Reliability:** One of the major learning was that if we can ensure valid content and also link an expert who has knowledge about the product, consumers will find our page more reliable. As a result higher trust levels are created among the customers and their purchase decisions can be influenced.
- **Creating Loyal Customers:** in order to survive in today's competitive market creating customer loyalty is the most important factor. To increase customer loyalty, I have learnt that you have to ensure that customers feel the bonding with the product. What we do through content marketing is we not only focus on the information that will make our target customers more intelligent about the product but also try to build relationship. Thus we try to create posts with emotional appeal which can capture attention and foster an attachment as customers can relate themselves with the content. Emotional appeal is viewed as a key to brand loyalty where customers feel more positive and attached to the brand.

2. Competencies Development:

While looking after Nescafé and Nestlé Corporate Facebook fan page, I have also developed the following competencies:

- **Community management:** Especially while working with Nestlé Corporate Facebook fan page, I have developed community management competencies as I was tasked to cover everything starting from creating and distributing content, supporting customers with the help of agencies, and monitoring and evaluating activities on the fan page.
- **Communication skills:** Keeping the management informed about the activities that are happening on Facebook fan pages and the outcomes of these activities, the agency determined to deliver their service on time and customers engaged means knowing the art of communication. Therefore, while working and interacting with different groups of people in order to make one particular task successful, I have developed my communication skill. While communicating with the management, I am humble and confident on the other hand communicating with the agency I am authoritative and assertive and communicating with the customers I am supportive and caring.

3.3: Projects and Event I Worked On

Working on different projects both online and offline was a very new and exciting experience for me. I have learnt and gained much strategic knowledge about digital marketing in the process. Few of the projects I have worked on are:

- **Stop motion vides of Nescafé-** It's an online promotional activity campaign through stop motion videos in both Facebook and YouTube, which promotes the hangtag (**#YouNeedNESCAFÉ**). This particular project was a great learning experience for me as I was involved from the very beginning. I had to coordinate various aspects of the event



from the beginning till the end. One of the challenging jobs was to maintain the deadlines for the event to take place smoothly as per the event planning. Developing the project, doing per and post analysis of the outcome and successfully delivering the idea to agency help me improve my planning and management event skills and competencies.

- **I Nestlé You Campaign-** This is an internal team building campaign by Nestlé Bangladesh Ltd. which will continue till 2017. Where different departments are divided into mixed groups in a dancing activity and each group will challenge the other, creating more interactions between all the departments. Working in this project helped me gain more confidence on team building skills and grow effective ability to work on teams. Communicating with colleagues from different departments and specially working with seniors have defiantly made be more professional as a young employee. More to that it helped in my personal development includes activities such as improving awareness and knowledge, becoming a self-leader.
- **World Diabetes Day-** Nestlé being world's largest nutrition, health and wellness organization, celebrates major awareness events. Recently on 14th November was World Diabetes Day, Nestlé organized an even to create more awareness on this regard. As a marketing intern I have closely worked on this event. This project helped me to identifying the target audience who will be a part of the event. It is important to know your target audience in order to have a successful event. Our event included internal employees from the head-office, factory, distribution points; employees from other organizations such as Philip Morris, ACI, Epyllion etc. So that everyone is aware of the consequences and prevent them from beforehand.

4. SWOT Analysis

4.1: SWOT Analysis on Digital Marketing of Nescafé

SWOT Analysis is a tool that identifies the strengths, weaknesses, opportunities and threats of any organization. It helps to assesses what an organization can and cannot do as well as its potential opportunities and threats. The method of SWOT analysis is to take the information from an environmental analysis and separate it into internal (strengths and weaknesses) and external issues (opportunities and threats). Once this is completed, SWOT_analysis determines what may assist the firm in accomplishing its objectives, and what obstacles must be overcome or minimized to achieve desired results. As Digital Marketing is a very recent introduction to Nestlé Bangladesh Ltd it still has many areas to improve and explore in the coming years. With just 9 months of digital marketing operations the brand Nescafé have been in top of consumer engagement in Facebook fan page.

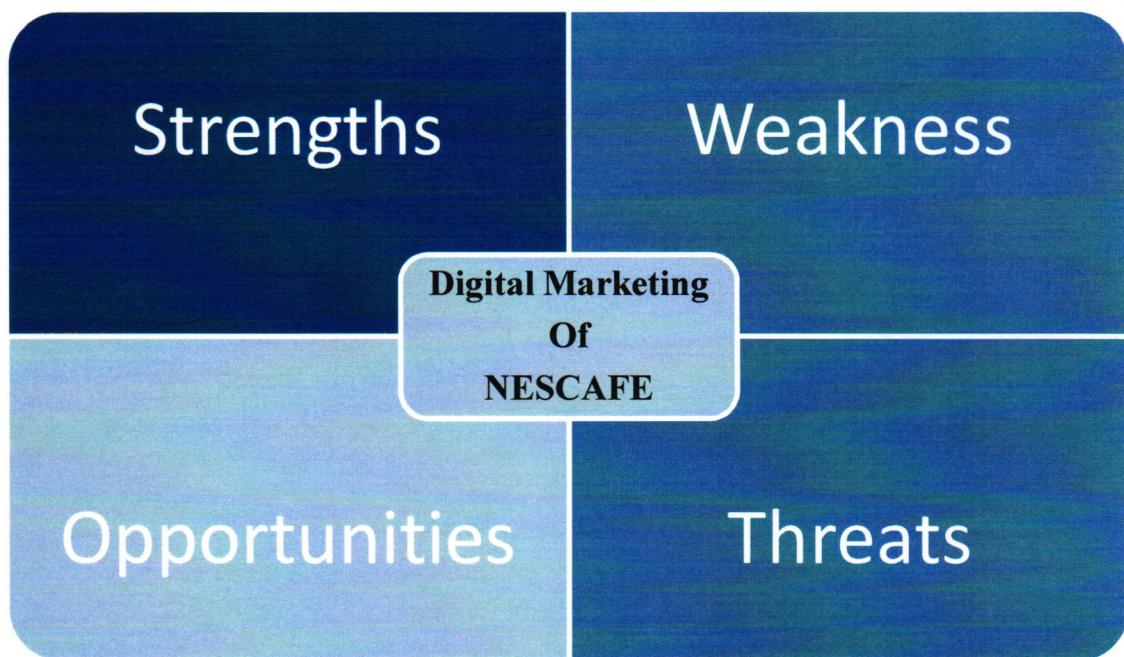


Table: SWOT Analysis of Digital Marketing of Nescafé

Some the strength, weakness, opportunities and threats are discussed below:

Strengths

- Nescafé is mainly consumed by In-House segment. Such as university students, working wives, offices and so on. It's strongly associated with keeping you energized and gives you a kick start.
- Nescafé has strong touch point booths at Universities as NSU, IUB, etc. specifically targeting their core consumers. Also in popular events and gathering places like Gulshan club, Golf Clubs and wedding venues.
- Strong brand name in the local and as well as global market compared to other competitors in the digital market.
- Frequent research and FGD conducted in order to stay alert about the upcoming threats.

Weakness

- However the price of per cup is still a major weakness for Nescafé. As targeted segment is students, they are reluctant to purchase TK15/- coffee whereas you can easily get tea at much lower price.
- Another prime challenge is to capture and stay competitive in Bangladeshi market. As Bangladesh is popularly known as tea loving nation, developing the taste of coffee is difficult among the mass market.
- Low rate of distribution points and venders.

Opportunities

- Nonetheless, Nestlé targets to overcome this challenge by exclusively promoting Nescafé 3 in 1(white cup coffee).



- Today's fast and convenient lifestyle instant coffee is perfect for daily consumption, thus creating more promotion through digital medium can help to reach target customers without any difficulty. As youth are most active in social mediums.
- As everyone is health conscious in the modern era, creating more awareness regarding the benefits of coffee consumption can also help to enter and explore new market segments.
- Digital Marketing is still a new concept in Bangladesh thus; the brand Nescafé can enjoy the advantages in the digital market arena compared to its competitors.

Threats

- Risk of new entrance in the market with better taste and lower pricing strategy.
- Weak out of home reach, Nescafé is not commonly available in local vender shops, thus lowering the rate of availability which is vital threat for the brand.
- Competition from grey market.

5. Recommendations

- After having spent 3 months in the organization, I understand its operations much more clearly. If I were to change anything about the organization I would suggest that they make the chain of command a bit more decentralized. At the moment before making any decisions in the Bangladesh Head office, they require clearance from the Indian head office. This in itself is a long process that requires a lot of paperwork and back and forth communication.
- Getting approvals of digital contents from different Brands Managers and especially from Legal department is very lengthy process as not everyone is always available in their desk thus, not finding anyone can delay the whole approval procedure. It would be great if a specific time could be allocated for all Brands and legal for approvals. This would not only save time but also speed up the whole approval procedure.
- Major consumers of Nescafé in Bangladesh are youth, university goers. Cost of per Nescafé 100mg jar is TK300/-, this is not very cost effective for students. Thereby, I feel the production of course keeping in mind the taxes involved, the prices can be decrease.
- The process of placing orders and rendering payment is also a very long one. It requires departments to mail certain finance in-charges in their Gurgaon India office. He then sends a purchase requisite to the functional head. The functional head then has to release the purchase requisite which then gets sent to one of the executives in the procurement department. The executive then needs to apply for a purchase order with the agency/vendor. Once the purchase order (PO) is formulated, it again gets sent to the functional head that needs to go through it and approve it. Once all these steps are completed, finally a work order is sent to the agency and they can finally deliver the ordered product or service. This process is not just very long and time consuming, it is also very problematic. If any of the involved parties are not available during any part of the process, the whole process immediately comes to a complete halt. I think that it is very

important for the company to simplify this order and payment process because it grossly slows the department and its work down.

- Moreover the company at the moment has a few registered agencies that are suppose to work for them. The agencies ridiculously overcharge them for work that is of quality that is not even up to par. In addition Advertising Agencies sometimes fails to provide creative contents in time thus; there should be proper instructions and documentation so that Nestlé does not face such slowdowns. I think that Nestlé should figure out a way to approach 3rd party vendors without the hassle of registering them with the company.
- The office hours at Nestlé are not very flexible even for the interns. Every day you have to put in a minimum of 8.5 working hours starting from 10am to 6:30pm. This sometimes gets very hectic because as interns you might finish all your work early. Therefore, I feel that the working hours should a bit shorter or more flexible at least for the interns.
- Finally one of the main problems that I think Nestlé should work on is the fact that they are being unable to reduce Intern turnover. The first three months of internship at Nestlé are usually completely unpaid. However the work pressure is intense as the interns are given almost as much work as the employees. The internship period itself is too long and somewhere in the middle the interns lose focus and interest. Most of the intern turnover usually takes place right after the 3rd month. Therefore I think that the interns should be paid from the very first month of the internship period even if it is a minimalistic sum.

6. Conclusion

My internship experience at Nestlé was truly an experience of a lifetime. I learned more than anything I would have learned by sitting through years of lectures. As a young professional I joined this renowned organization with dedication and enthusiasm. It gave me the taste of corporate culture and prepared me for my upcoming professional life. They give you an opportunity to rotate your functions and departments after every three months, that way you almost never get bored of your work. Unlike other MNCs, Nestlé gives most preference to its existing interns when it comes to employing for the permanent positions. It has given me the opportunity of implementing all the knowledge I have gained over the years and taught me how to deal with real life scenarios. I have made a lot of contacts by being a part of this organization, which I believe will help me a great deal over the year as I continue in my career. But most importantly I feel that by being a part of an organization like Nestlé that treats all its interns and employees like family, I will truly miss this experience and all the people in the organization when/if I finally have to leave.

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