A

Project Report

On

"SELF GENERATING ELECTRIC BICYCLE"

Submitted in partial fulfillment of the requirements

of the degree of

Bachelor of Engineering in Electrical Engineering

Submitted by

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CERTIFICATE

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During the academic year **2017-18** in partial fulfillment of the requirements for the award of degree of **Bachlor of Engineering in Electrical Engineering** from **University of Mumbai.**

Date-

Approved by- (Prof. SHRADDHA AMIN)

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CERTIFICATE OF APPROVAL

The foregoing disseration entitled **"SELF GENERATING ELECTRIC BICYCLE"** is hereby approved as a creditable study of Electrical Engineering presented by

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In a manner satisfactory to warrant is acceptance as a pre-requisite to their Degree in Bachelor of Electrical Engineering.

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declared that I have adhered to all principles of academic honesty and integrity and have not represented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission have not been taken when needed.

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ACKNOWLEDGEMENT

It gives me immense pleasure to present this project on “SELF GENERATING ELECTRIC BICYCLE” carried out at AIKTC , New Panvel in accordance with prescribed syllabus of University of Mumbai for Electrical Engineering. I express my heartfelt gratitude to those who directly and indirectly contributed towards the completion of this project. I would like to thanks Mr. Abdul Razzak, Principal, ACEM for allowing me to undertake this guide Prof. Shraddha Hule for continuous support. I would like to thanks all the faculty members, non-teaching staffs of Electrical Engineering of our College for their direct and indirect support and suggestion for performing the project.

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ABSTRACT

The main aim of the project is to control reduction in natural fuel and make the environment pollution free by using self generating electric bicycle. This is an advanced technology in the automobile. Now a day automobile industries are growing faster and they are launching new new cars every day for the users which runs on fuel and making environment polluted. So to make the environment pollution free and to save the fuel for the next generation the self generating electric bicycle should be adopted by automobile industries. In self generating electric bicycle the supply is fed to the hub motor of 250 watt 24 volt which is in front wheel of a cycle by a 1st set of battery each of 12 volt 12 amp at the same time back wheel is having hub motor which is of 500 watt it rotates due to inertia of front motor with a small electronic circuit the back wheel hub motor act as a generator and charges the 2nd battery bank which is of same rating as 1st battery bank. When 1st battery bank gets drains out it gets shown on indicator which shifts the battery bank 1st to get charge by back hub motor and 2nd bank to supply the front hub motor. The speed control and indication is done by a controller which perform certain task when they required

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

An electric bicycle, also known as an e-bike or booster bike, is a bicycle with an integrated electric motor which can be used for propulsion. There are a great variety of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e., pedelecs) to somewhat more powerful e-bikes which tend closer to moped-style functionality: all, however, retain the ability to be pedalled by the rider and are therefore not electric motorcycles. E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h (16 to 20 mph)

1.2 IMPORTANCE

This is the best option for motor bikes especially for those who are not fast riders and also for the children and aged people. The family with one car which is being used by the husband to go to the work, the housewife of such families now need not have to spend on the taxi or wait for the bus carrying the grocery shopping bags. The electric bikes are of great importance to such housewives. They can now drop their child to school, go to the post-office, bank and complete other domestic works by electric bikes. The best part is there is no need of going to the driving school to get the training as in case of motor bikes and cars. It is as easy as riding the conventional bicycle. Moreover, no licence or registration is needed for electric bicycles. This is the best weapon to defend the high rising price of petrol.

People who own conventional bicycles and commute daily by such bicycles have now replaced them with electric bikes. Even in the country like India, which has been ranked as highest motor bike manufacturing and selling country of world,

the motor bike owners who could no longer afford the consistently rising petrol prices have either replaced their motor bikes with electric bikes or at least buy one as a stand-by vehicle for local errands. Since the electric bikes run on a battery, there is no maintenance cost except the very low electricity consumption cost to charge the battery. The battery can be quickly recharged almost anywhere, or can be exchanged instantly with charged batteries from the authorized dealer. Some electric bikes come with pedals, and are so light weight that even if the battery runs down the rider can use the pedals to move the bike.

1.3 FEATURES

Self Generating Electric Bicycle is having different features which are :

1. Self charging unit - which charges the battery during working of bicycle through hub motor
2. Indicator – which indicates the speed and draining of battery banks
3. Controller – which controls the speed of hub motor and indicating part
4. Throttle system – is used as a accelerator for variation in speed
5. Battery bank – which stores the charge and gives the charge to the motor
6. Breaking system – it is used for stopping the motor

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CHAPTER 2

LITERATURE SURVEY

Portable Electric Bike (PEB). This was first developed in 1890's in US and those were documented within various US patents. On 31st Dec, 1895 Ogden Bolton designed a battery powered cycle. He designed using 6 pole brush and commuter DC hub motor connected to the rear wheel. He was then granted a US patent. Couple of years later, Hosea W. Libbey invented electric bike which was propelled by double electric motor. This motor was so designed that it was attached with the crank set axle. Later in 1990's torque sensors and power controls were developed including some modified versions of bike with Ni MH, Ni Cd and/or Li-ion batteries which offered lighter, density capacities batteries. But this bikes faced decrease in production when petrol and diesel resources came in existence [3][5][6][7].Taking considerations of recent events of meager resources and facilities at their disposal, over increasing traffic, snags problem of parking and the need to make automobile a more environmental friendly, designers of vehicles are back with a view to hit upon a novel concept that completely alter the conventional design .Recent developments on Electric bike which are pedal operated are tremendously increasing all over the world market. In China9 out of 10 Electric bikes are sold, thereby proving that they are not only energy efficient but also relative cheaper than other electric automobiles. It enables to ride in hilly areas and also in windy areas with much less human effort.

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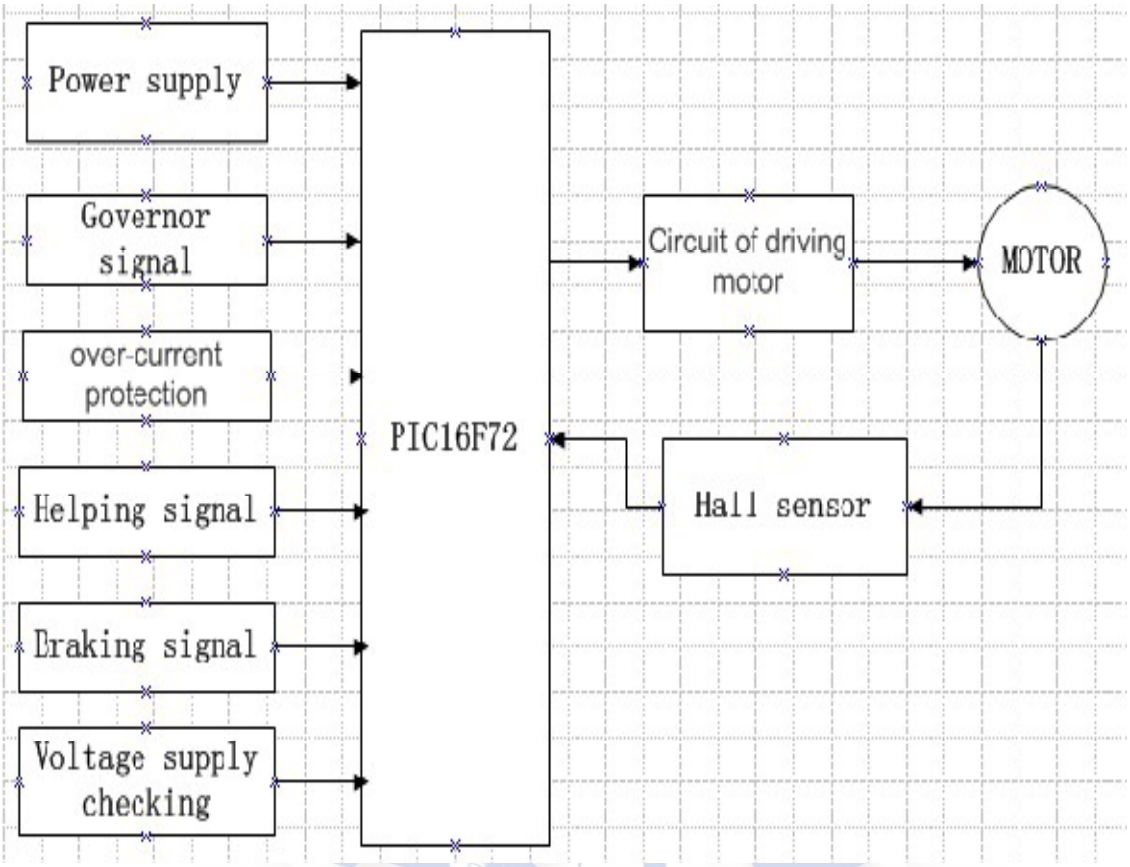
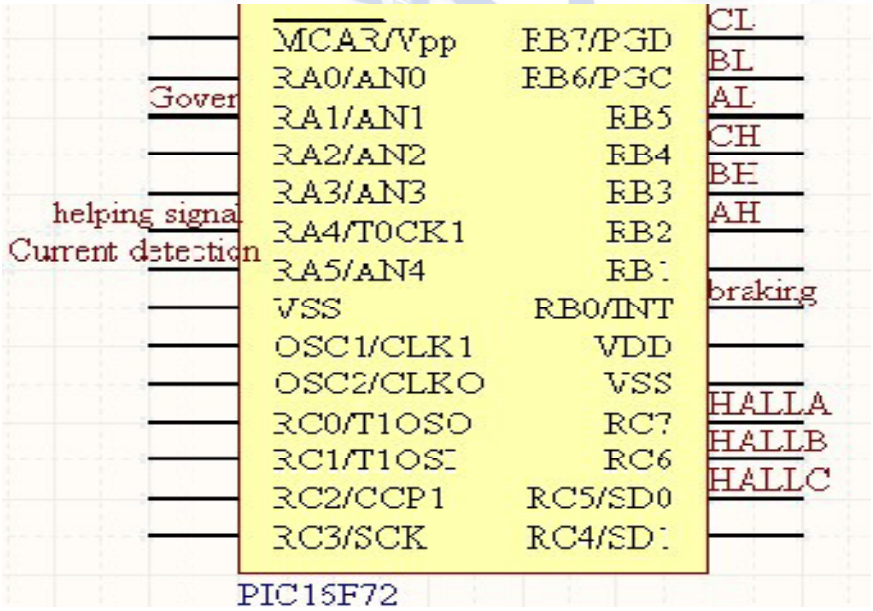
CHAPTER 3

BLOCK DIAGRAM DESCRIPTION





some signals such as speed controlled signal, current detection signal, brake signal , Helping signal and capacity detection signal were transmitted to pins of MCU respectively, after A/D conversion , the brushless DC motor was driven through this signals. Hall sensor was important component, it was used to detect position of the rotor.

MAIN CONTROL CHIP

Electric bicycle features high-performance PIC16F72 microcontroller core. PIC16F72 has 28 pins, include 22 8-bit I/O ports. The PIC16F72 supports PWM for motor control. CCP1 pin can output the maximum resolution of 10BIT adjustable PWM signal. AR0~AR4 pins support A/D conversion, they are used to detect changing of voltage and current when electric bicycle is running. As illustrated in Figure 2, speed controlled signal, helping signal, current detection signal were transmitted toRA1, RA4, RA5 respectively. Hall signals from hall sensor were transmitted to RC5, RC6. Signals of motor driving were transmitted to RB2 to RB7.

POWER SUPPLY

The power of this controller was divided into two parts 5V supply voltage to MCU and 12V supply voltage to drive MOSFET. External power source adopts 36V DC voltage. LM2576 series of regulators are monolithic integrated circuits, all circuits of this series are capable of driving a3.0A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3V,5V, 12V, 15V and adjustable output version. The maximum input voltage is 40V. LM2576 is best choice to this controller. As illustrated in Figure 3, to get 5V DC voltage, LM2576-5 was used. In the same way, to get 12V DC voltage, LM2576-12 was used.

INPUT OF HALL SIGNAL

Most motor used in electric bicycle today is brushless DC motor, there is no friction between electric brush and commutator inside the motor, there are no need to replace electric brush and some other vulnerable components. So it prolongs life of the motor. There are three hall sensors inside the brushless DC motor. They transmit signal of rotor position to PIC16F72.

GOVERNOR

When turning the electric bicycle handle bar, the voltage cross sampling resistance will be changed, passing the A/D conversion, then come into PWM comparative register. PWM will be changed at last.

CIRCUIT OF DRIVING MOTOR

The part number of power MOSFET is STP75NF75 in this controller design. It is N-channel. The basic parameter: maximum drain voltage VDSS= 75 V, on-resistance RDS<0.011 , maximum drain current (continuous) ID=80A, In order to improve the efficiency of system, reduce the power MOSFET consumption ,the smaller resistance the better, once power MOSFET worked. The smallest voltage used to make power MOSFET working V=10V, 12V voltage is used in this design. As illustrated in Figure 4, three-phase circuit to drive motor. A-phase driving circuit is shown, so do B-phase and C-phase. AH, AL is upper leg and lower leg input respectively in A-phase.

CURRENT DETECTION

There are some heavy-current situations when electric bicycle is running. Such as motor is starting and loading too much. Coil Winding and electric components will be damaged by heavy-current in controller. Through measure Voltage crossed Current-measure resistance, when voltage was measured exceed voltage which define d previous. It indicates current exceed safe range, power

MOSFET will be closed in short time. As illustrated in Figure 5, reference potential was transmitted to non-inverting input pin, the voltage cross R9 was transmitted to inverting input pin in LM358. When voltage was measured exceed reference potential, the output level will be changed and the data transmitted to MCU, MCU stop the motor.

BRAKE CIRCUIT

The electric bicycle should be brake, when some unexpected things happened. When driver brake, the power supply should be stopped. High-level is a brake signal in this controller. Hall sensor output low level in normal condition, low-level will be changed to high-level when braking. As illustrated in Figure 6, the level to base of transistor is conversed when braking, and output level will be conversed. This conversed level is transmitted to MCU finally. MCU closes the power supplied.

HELPING FUNCTION

Electric bicycle is also named moped, when people tread of foot pedal, the motor will run in small power, dynamic torque signal can be detected by torque sensor inside electric bicycle, when people tread of foot pedal. When dynamic torque signal transmitted to MCU, the motor will be driven in a short time. The function of helping does not only save electricity energy, prolong the life of battery, but also improve physical condition. The voyage of electric bicycle doubled than traditional electric bicycle. Because of smaller current, components damaged by strong current will be avoided.

CHECKING OF VOLTAGE SUPPLY

In order to avoid the low voltage supply, which affect the electric bicycle running normally. Controller should be provided with Capacity checking. The voltage crossed sampling resistance transmitted to MCU, signals the voltage supply to controller, when voltage is smaller than defined previous. it will reminder people to charge up the electric bicycle battery.

CHAPTER 4

HARDWARE IMPLEMENTATION

4.1 Printed Circuit Board (PCB)

4.1.1 PCB Diagram

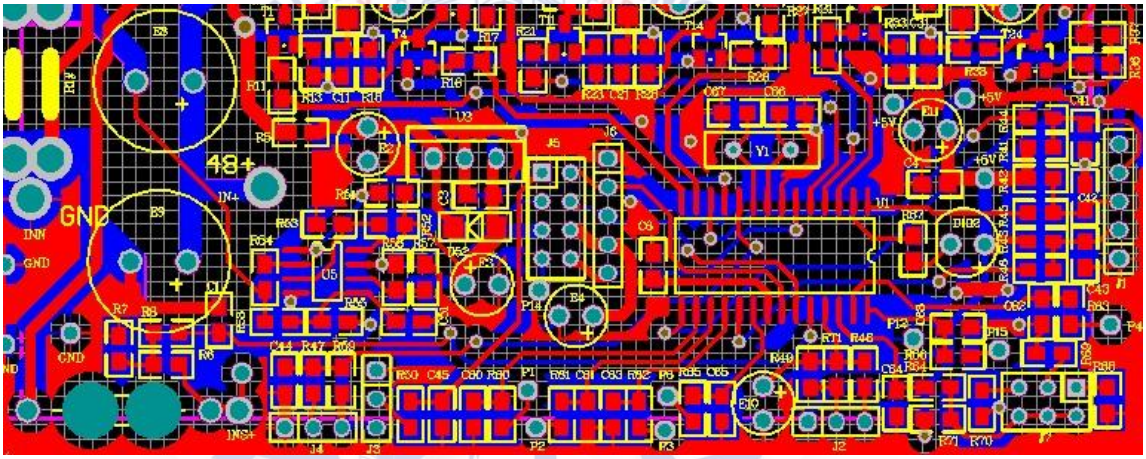


Fig: 4.1.1 PCB Diagram

4.1.2 FABRICATION OF PCB

P.C.B. MAKING

- P.C.B. is printed circuit board which is of insulating base with layer of thin copper-foil.
- The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board.
- The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.
- The resistance of copper foil will have an affect on the circuit operation.
- Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.
- It is possible to obtain a range of thickness between 0.5 mm to 3 mm.
- Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is “Formea” from paper assembly.
- Physical properties should be self supporting these are surface resistivity, heat dissipation, dielectric, constant, dielectric strength.
- Another important factor is the ability to wishstand high temperature.

◆ DESIGNING THE LAYOUT

- While designing a layout, it must be noted that size of the board should be as small as possible.
- Before starting, all components should be placed properly so that an accurate measurement of space can be made.
- The component should not be mounted very close to each other or far away from one another and neither one should ignore the fact that some component reed ventilation, which considerely the dimension of the relay and transformer in view of arrangement, the bolting arrangement is also considered.
- The layout is first drawn on paper then traced on copper plate which is finalized with the pen or permanent marker which is efficient and clean with etching.
- The resistivity also depends on the purity of copper, which is highest for low purity of copper. The high resistance path are always undesired for soldered connections.
- The most difficult part of making an original printed circuit is the conversion from, theretical circuit diagram into wiring layout. without introducing cross over and undesirable effect.
- Although it is difficult operation, it provides greatent amount of satisfaction because it is carried out with more care and skill.
- The board used for project has copper foil thickness in the range of 25 40 75 microns.

- The soldering quality requires 99.99% efficiency.
- It is necessary to design copper path extra large. There are two main reasons for this,
    i) The copper may be required to carry an extra large overall current
    ii) It acts like a kind of screen or ground plane to minimize the effect of interaction.
- The first function is to connect the components together in their right sequence with minimum need for interlinking i.e. the jumpers with wire connections.
- It must be noted, that when layout is done, on the next day it should be dipped in the solution and board is move continuously right and left after etching perfectly the board is cleaned with water and is drilled.
- After that holes are drilled with 1 mm or 0.8 mm drill. Now the marker on the P. C. B. is removed.
- The Printed Circuit Board is now ready for mounting the components on it.

◆ **SOLDERING**

- For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.
- Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.
- The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.

- When joint is completely covered with molten solder, the soldering iron is removed.
- The joint is allowed to cool, without any movement.
- The bright shining solder indicates good soldering.
- In case of dry solder joint, a air gap remains in between the solder matenal and the joint. It means that soldering is improper. This is removed and again soldering is done.
- Thus is this way all the components are soldered on P. C. B.

4.1.3 IMPLEMENTATION OF PCB MAKING

To make the Printed Circuit Board, following implement becomes necessary. The way of making the Printed Circuit Board is not only the way of introducing this time.

Table 4.1.3 Implementation of PCB making

Positive exposure printed board	The material which the ultraviolet rays change the nature to has been painted the copper foil of the PCB. It piles the film which pictured the mask pattern on the positive exposure printed board and it irradiates the ultraviolet rays. The part where the ultraviolet rays were irradiated changes in the quality. When putting the positive exposure

	printed board which finished irradiating the ultraviolet rays in the developer, the part where the ultraviolet rays were irradiated dissolves in the developer and the masked part doesn't dissolve. The part which wasn't dissolved in the developer is left as the mask pattern of the etching and doesn't dissolve in the etchant, too.
Development medicine of a sensitizer	It dissolves the sensitizer in the part where the ultraviolet rays of the positive exposure printed board were irradiated.
Mask pattern	It may picture the mask pattern in the black ink at the transparent sheet. In the case of me, I picture the mask pattern drawing by the software, "Visio", and am using it for the overhead projector (OHP) sheet, printing.
Ultraviolet ray exposure equipment	It is made even if it uses the fluorescence light desk stand. Because about 20 minutes of the light were necessary, I made the ultraviolet ray exposure equipment with the timer (the fluorescence

	light with the timer).
Clamp	It is the implement to hold for board and the mask pattern to stick when irradiating the ultraviolet rays to the positive exposure printed board with the ultraviolet ray exposure equipment.
Resist pen	It uses for the repair of the mask pattern. It is a kind of the oily dry ink.
Etching apparatus	It is the equipment to dissolve the copper(Etching) which the printed board is unnecessary to. Even if there is not such equipment, the etchant can be dissolved by putting it in the palette to use for the development of the photograph, too.
Quartz pipe heater	It is the heater which raises the temperature of the etchant at 40-43 degC. In the liquid temperature, when high, the copper melts early. It says that it must not raise at equal to or more than 45 degC.
Etching liquid	It is the solution which dissolves the copper. It is the solution of the Ferric Chloride.

Resist solvent	It uses to remove the mask pattern of the printed board that the etching was ended.
Battery style mini drill	It makes a hole which lets through the lead line of the part. The hand drill is good but I am using the mini drill of the electric formula because the bits of the drill is thin and it is easy to break.
Flux	It paints to prevent the copper of the printed board from the oxidation.
Solder resist	It paints the wiring surface of the printed board and extra solder makes not be stuck.

4.2 LCD

4.2.1 LCD MODULE

Various display device such as seven segment display. LCD display, etc can be interfaced with microcontroller to read the output directly. In our project we use a two line LCD display with 16 characters each.

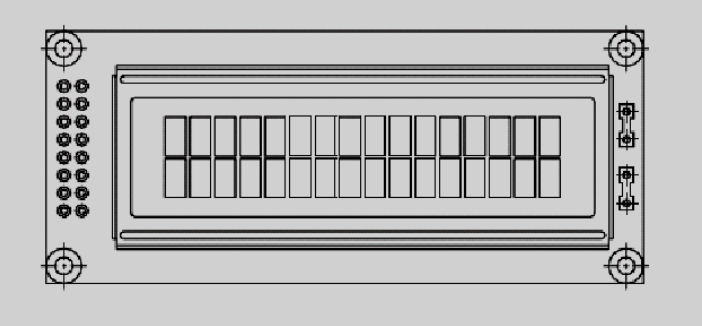


Fig:4.2.1 LCD Display

4.2.2 FEATURES

1. Built-in controller (KS 0066 or Equivalent)
2. + 5V power supply
3. 1/16 duty cycle
4. B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
5. N.V. optional for + 3V power supply
6. RS232 compatible serial interface (2400 & 9600 baud selectable)
7. Externally selectable serial polarities (Inverted & Non-Inverted)
8. Serially controllable contrast and backlight levels
9. 8 user programmable custom characters
10. 16 Byte serial receive buffer

4.2.3 PIN DIAGRAM

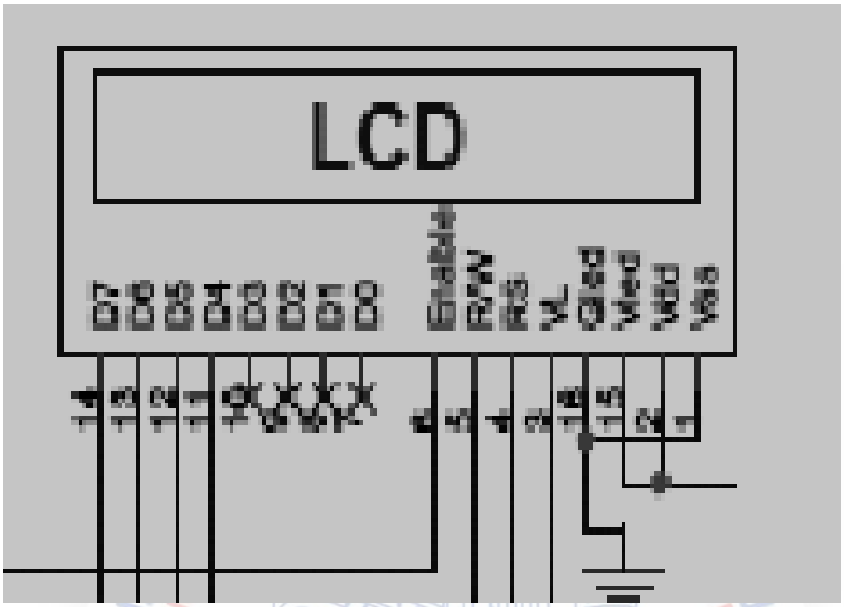


Fig: 4.2.3 LCD pin diagram

4.2.4 PIN DIAGRAM DESCRIPTION

Table 4.2.4 LCD pin diagram description

PIN NAME	PIN NO	DESCRIPTION
VSS	1	Gnd
VDD	2	+3V – +5V
V0	3	Contrast adjustment

RS	4	Register select signal
R/W	5	Read write signal
E	6	Enable signal
DB0	7	Data bus line
DB1	8	Data bus line
DB2	9	Data bus line
DB3	10	Data bus line
DB4	11	Data bus line
DB5	12	Data bus line
DB6	13	Data bus line
DB7	14	Data bus line
A/VEE	15	Negative voltage output
K	16	Power supply for B/L

4.2.5 TECHNICAL DATA

Table 4.2.5.a Electrical Characteristics

Item	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage for LCD	VDD-VO	Ta=0°C,Ta=25°C,Ta=50 °C	4.7	5.0	5.5	V
Input High Voltage	Vih		2.2		VDD	V
Input Low Voltage	Vil		0.3		0.6	V
Output High Voltage	Voh		2.4			V
Output Low Voltage	Vol				0.4	V
Supply Current	IDD	VDD=5V		1.5	2.5	mA
LED Backlight - Forward	Vf			4.2	5.0	V

Voltage						
LED Backlight - Forward Current	If	Vf=4.2V 25°C		110		mA

Table 4.2.5.b Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Units
Operating Temperature	Top	0		+50	°C
Storage Temperature	Tst	-20		+70	°C
Input Voltage	Vi	Vss		VDD	V
Supply Voltage for Logic	VDD-Vss	2.7	5.0	5.5	V
Supply Voltage for LCD	VDD-Vo	3.0		13.0	V

Table 4.2.5.cThickness

Version	T1	T2	Units
LED Backlight	8.5	13.5	Mm

Table 4.2.5.d Interface Pin Connections

No.	Symbol	Level	Function	No.	Symbol	Level	Function
1	Vss	聽	GND (0V)	9	DB2	H/L	Data Bit 2
2	Vdd	聽	Vcc(+5V 卤 5%)	10	DB3	H/L	Data Bit 3
3	Vo	聽	Contrast ADJ	11	DB4	H/L	Data Bit 4
4	RS	H/L	Register Select	12	DB5	H/L	Data Bit 5
5	R/W	H/L	Read/Write	13	DB6	H/L	Data Bit 6
6	E	H/L	Enable Signal	14	DB7	H/L	Data Bit 7
7	DB0	H/L	Data Bit 0	15	LEDA	BKL+	Backlight - Positive

Table 4.2.5.e Display Character Address Code

Character Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address - Row 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
DD RAM Address - Row 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

4.3 PIC MICROCONTROLLER 16F877A

4.3.1 DESCRIPTION

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have many application in digital electronics circuits.

Fig:4.3.1.a PIC16F877A

PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. Its flexible and can be used in areas where microcontrollers have never been used before as in coprocessor applications and timer functions etc.

PIN 1: MCLR

The first pin is the master clear pin of this IC. It resets the microcontroller and is active low, meaning that it should constantly be given a voltage of 5V and if 0 V are given then the controller is reset. Resetting the controller will bring it back to the first line of the program that has been burned into the IC.

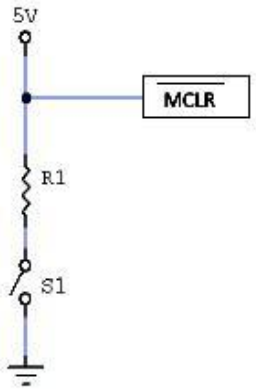


Fig:4.3.1.b MASTER ClEAR

A push button and a resistor is connected to the pin. The pin is already being supplied by constant 5V. When we want to reset the IC we just have to push the button which will bring the MCLR pin to 0 potential thereby resetting the controller.

PIN 2: RA0/AN0

PORTA consists of 6 pins, from pin 2 to pin 7, all of these are bidirectional input/output pins. Pin 2 is the first pin of this port. This pin can also be used as an analog pin AN0. It is built in analog to digital converter.

PIN 3: RA1/AN1

This can be the analog input 1.

PIN 4: RA2/AN2/Vref-

It can also act as the analog input2. Or negative analog reference voltage can be given to it.

PIN 5: RA3/AN3/Vref+

It can act as the analog input 3. Or can act as the analog positive reference voltage.

PIN 6: RA0/T0CKI

To timer0 this pin can act as the clock input pin, the type of output is open drain.

PIN 7: RA5/SS/AN4

This can be the analog input 4. There is synchronous serial port in the controller also and this pin can be used as the slave select for that port.

PIN 8: RE0/RD/AN5

PORTE starts from pin 8 to pin 10 and this is also a bidirectional input output port. It can be the analog input 5 or for parallel slave port it can act as a ‘read control’ pin which will be active low.

PIN 9: RE1/WR/AN6

It can be the analog input 6. And for the parallel slave port it can act as the 'write control' which will be active low.

PIN 10: RE2/CS/A7

It can be the analog input 7, or for the parallel slave port it can act as the 'control select' which will also be active low just like read and write control pins.

PIN 11 and 32: VDD

These two pins are the positive supply for the input/output and logic pins. Both of them should be connected to 5V.

PIN 12 and 31: VSS

These pins are the ground reference for input/output and logic pins. They should be connected to 0 potential.

PIN 13: OSC1/CLKIN

This is the oscillator input or the external clock input pin.

PIN 14: OSC2/CLKOUT

This is the oscillator output pin. A crystal resonator is connected between pin 13 and 14 to provide external clock to the microcontroller. ¼ of the frequency of OSC1 is outputted by OSC2 in case of RC mode. This indicates the instruction cycle rate.

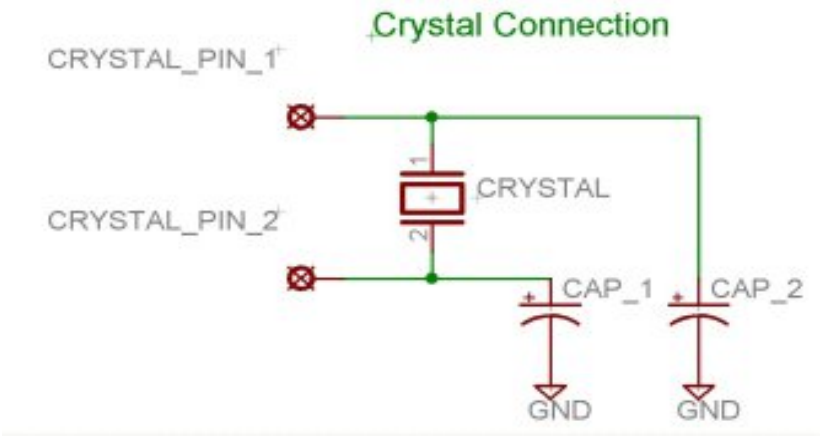


Fig:4.3.1.c Crystal Connection

PIN 15: RC0/T1OCO/T1CKI

PORTC consists of 8 pins. It is also a bidirectional input output port. Of them, pin 15 is the first. It can be the clock input of timer 1 or the oscillator output of timer 2.

PIN 16: RC1/T1OSI/CCP2

It can be the oscillator input of timer 1 or the capture 2 input/compare 2 output/ PWM 2 output.

PIN 17: RC2/CCP1

It can be the capture 1 input/ compare 1 output/ PWM 1 output.

PIN 18: RC3/SCK/SCL

It can be the output for SPI or I2C modes and can be the input/output for synchronous serial clock.

PIN 23: RC4/SDI/SDA

It can be the SPI data in pin. Or in I2C mode it can be data input/output pin.

PIN 24: RC5/SDO

It can be the data out of SPI in the SPI mode.

PIN 25: RC6/TX/CK

It can be the synchronous clock or USART Asynchronous transmit pin.

PIN 26: RC7/RX/DT

It can be the synchronous data pin or the USART receive pin.

PIN 19,20,21,22,27,28,29,30:

All of these pins belong to PORTD which is again a bidirectional input and output port. When the microprocessor bus is to be interfaced, it can act as the parallel slave port.

PIN 33-40: PORT B

All these pins belong to PORTB. Out of which RB0 can be used as the external interrupt pin and RB6 and RB7 can be used as in-circuit debugger pins.

4.3.2 PIC16F887A Pin Diagram

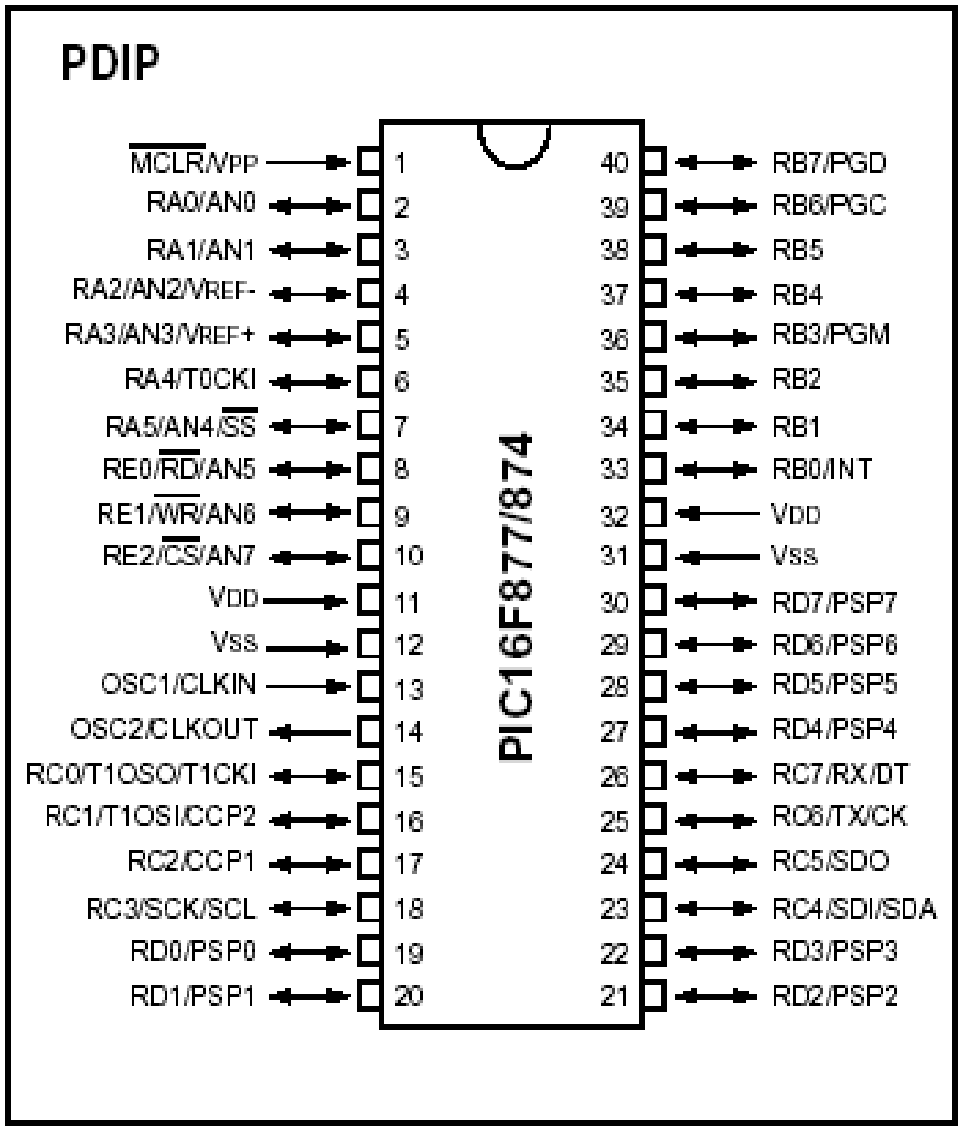


Fig:4.3.2 PIC Pin Diagram

4.3.3 Programming Input and Output ports of PIC16F877A

As we have studied 5 input and output ports namely PORTA, PORTB, PORTC, PORTD and PORTE which can be digital as well as analog. We will configure them according to our requirements. But in case of analog mode, the pins or the ports can only act as inputs. There is a built in A to D converter which is used in such cases. Multiplexer circuits are also used.

But in digital mode, there is no restriction. We can configure the ports as output or as input. This is done through programming. For PIC the preferable compiler is mikro C pro which can be downloaded from their website.

There is a register named as 'TRIS' which controls the direction of ports. For different ports there are different registers such as TRISA, TRISB etc.

1. If we set a bit of the TRIS register to 0, the corresponding port bit will act as the digital output.

2. If we set a bit of the TRIS register to 1, the corresponding port bit will act as the digital input.

For example to set the whole portb to output we can write the program statement as:

TRISB=0;

Now the port will act as the output port and we can send any value on the output such as

PORTB=0XFF;

FF represents all 1's in binary i.e. FF=11111111, now all the pins of port b are high. If we connect LEDs at all the pins then they will all start glowing in this condition.

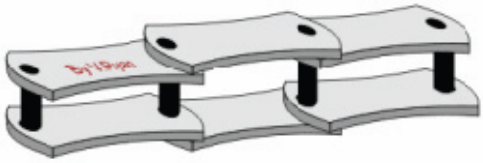
COMPONENTS OF E – BIKE

BLDC MOTOR

The motor is having 250 watt. Or 500 watt capacity with maximum 2100 rpm. Its specifications are as follows:

Current Rating: 7.5amp
Voltage Rating: 24 Volts
Cooling: Air – cooled

CHAIN DRIVE- A Chain is an array of links held together with each other with the help of steel pins. This type of arrangement makes a chain more enduring, long lasting and better way of transmitting rotary motion from one gear to another. The major advantage of chain drive over traditional gear is that, the chain drive can transmit rotary motion with the help of two gears and a chain over a distance whereas in traditional many gears must be arranged in a mesh in order to transmit motion.

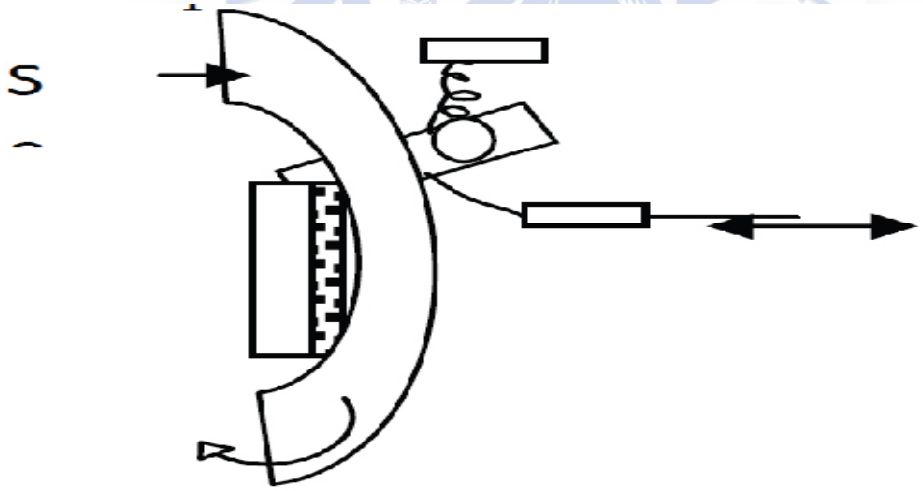


FRAME - The Frame is made up of M.S. along with some additional light weight components. The frame is designed to sustain the weight of the person driving the unit, the weight of load to be conveyed and also to hold the accessories like motor. Also it should be design to bear and overcome the stresses which may arise able to due to different driving and braking torques and impact loading across the obstacles. It is drilled and tapped enough to hold the support plates.

PLATFORM - The Platform is designed with robust base so that it can hold the load along with the weight of the driving person uniformly. It is fabricated from Mild Steel at a specific angle in cross section and welded with a sheet of metal of specific thickness. The platform's alignment is kept horizontal irrespective whether it is loaded or unloaded and this is directly bolted and welded to the frame.

BATTERY- The battery also acts as a condenser in a way that it stores the electric energy produced by the generator due to electrochemical transformation and supply it on demand. Battery is also known as an accumulator of electric charge. This happens usually while starting the system.

BRAKING SYSTEM- For the braking system it is convenient to use braking system used in band brake system which consist of spring loaded friction- shoe mechanism, which is driven with the help of hand lever.



SPROCKETS- The chain with engaging with the sprocket converts rotational power in to rotary power and vice versa. The sprocket looks like a

gear but differs in three important ways: Sprockets have many engaging teeth • but gears have only one or two.

• The teeth of a gear touch and slip against each other but thereis basically no slippage in case of sprocket
• The shape of the teeth are different in gears and sprockets.

DESIGN OF ELECTRIC BIKE- Here we have used permanent magnet self generating motor with 250 watt power and 2100rpm. The motor runs on 48volts and7.5amps power source. This motor can reach a peak current during starting equal to 15 amps [2-3].
P = 2 x 3.14 x N x T /60
250 = 2 x 3.14 x 2100 x T /60
T = 1.13 N m = 1136 N-mm
Reduction in chain drive
R chain = 66/11 = 6:1
Torque at wheel shaft = T x R chain = 1136 x 6 = 6820 N mm
Speed of wheel shaft = 2100 /6 = 350 rpm

DESIGNING OF SHAFT

BENDING: The force which develops across a specific cross section of the shaft, it generates stress at that point of cross section that are subjected to maximum loading. This internal or resisting moment gives rise to the stress called as bending stresses.

TORSION: When the shaft which is twisted by the couple such that the axis of that shaft and the axis of the couple harmonize, that shaft is subjected to pure torsion and the stresses generated at the point of cross section is torsion or shear stresses.

Combined Bending and Torsion: In actual practice the shaft is subjected to combination of the above two types of stresses i.e .bending and torsion. The bending stresses may occur due any one of the following reasons:

1. Weight of belt
2. Pull of belts
3. Eccentric Mounting of shafts/gears
4. Misalignment of shafts/gears

On contrary, the torsional movement occurs due to direct or indirect twisting of the shaft. Hence at any given point on cross section of the shaft, the shaft is subjected to both bending and torsional stresses simultaneously. Following stresses are taken inconsideration while designing the shaft:

Design of Sprocket and Chain for Electric Bike

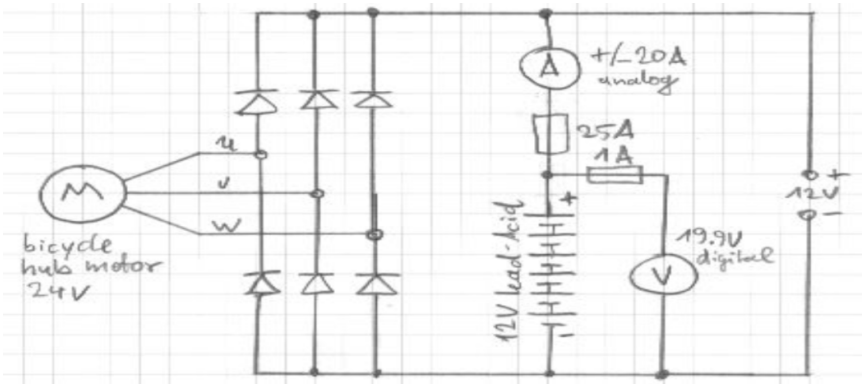
We know,

Transmission ratio = Z2 / Z1 = 66/11 = 6

For the above transmission ratio number of teeth on pinion and the number of teeth sprocket is in the range of 21 to 10, so we have to select number of teeth on pinion sprocket as 11 teeth.

So, Z1 = 11 teeth

RECTIFIER CIRCUIT



3-PHASE HUB GENERATOR

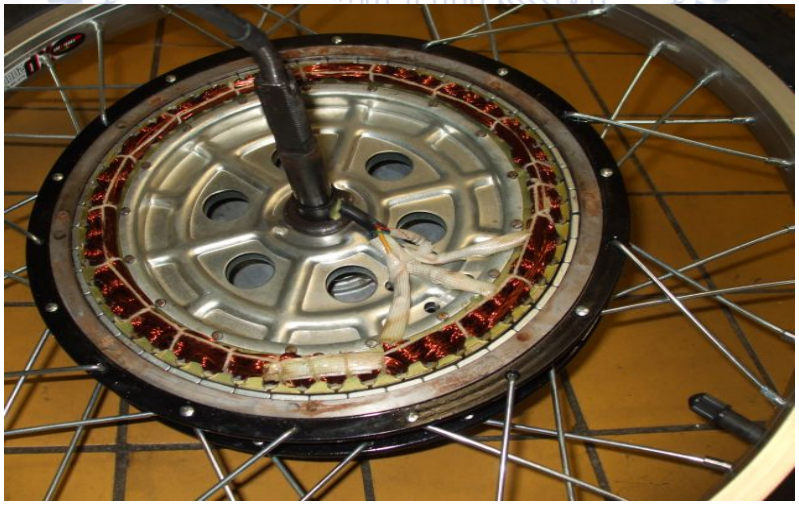
The electrical circuit

Input is the motor / generator on the left of the schematic, output (+12V-) is on the very right. Any load could be connected to the output: Light bulbs, fluorescent ballast, LED lighting fixtures, radio, cell phone charger, TV & satellite receiver, power inverter. Obviously all connected devices must be designed for 12V operation

In detail: The motor delivers 3-phase AC so it's output must be turned into DC before it can be used. A 3-phase rectifier can either be made from 6 diodes or bought as an integrated component (used in wind energy applications). These look like the typical bridge rectifier, only they are fitted with 5 instead of 4 terminals. The rectifier should have a rating of min 100V and 35A. Individual diodes each need to withstand the same voltage but half the current (20A). Some cooling is required for the rectifier, I've mounted it to a large metal part. Now the rectifier output cannot directly power a lamp or a TV, as pedaling action is not producing a constant voltage. It will be fluctuating between 0 and way above the desired output voltage, likely doing damage to the equipment it feeds. The solution is to connect a battery across the rectifier output. This will absorb any extra power that the generator provides and it will fill the gap when the generator doesn't provide enough power or even stops for a short while. The battery doesn't have to be very big or special, any lead-acid battery is fine. If the battery is big (high Ah-rating), it's no harm though. For my own build, I've used an old 12V

16Ah computer backup battery. A sealed battery is recommended for indoor use, so that no gas can escape.

The schematic shows a few more components. One is the battery fuse. This part is mandatory because in case of short-circuit, the battery could drive such a high current that the cables go up in fire. I recommend 2.5sqmm cabling and a fuse of max 30A. Finally there are two instruments win the circuit (not on the photo): One voltmeter (with its own fuse) and one ammeter. While the pedal generator will work without these instruments, the voltmeter is highly recommended for the sake of battery health. A digital voltmeter is best. As the instrument reads 14V (in a 12V system), the pedaling should be stopped. 15V should never be exceeded. The voltage also should not drop below 10.5V. The ammeter is an analog zero-center instrument. While it's not essential, it indicates to the person pedaling if he's putting energy into the battery (eventually leading to a fully-charged battery) or if the load is drawing more current than the generator provides (leading to a discharged battery). A digital ammeter cannot be used here, as the current changes too much to allow for a stable reading. The range of the ammeter depends on the current that will be drawn by the load and supplied by the generator (whatever is higher). I picked an instrument with a +/-20A range.



The picture shows the guts of the motor that I've picked. It's a 24V, 500W rear hub motor made by Golden Motor / Jiangsu and it will charge a 12V battery for me.

Selecting the right motor:

1. The motor will be driven on a stationary bike, so has to be a rear hub motor (front wheel of stationary bike obviously not being driven).

2 .For good efficiency, the motor should employ state-of-the-art rare-earth permanent magnets and it should be brushless To achieve the best flywheel effect, the motor should be heavy and put in a wheel.

3. To minimize mechanical losses, the motor should be direct drive / not use internal gears.

4. To cope with the power of a physically-fit pedaler for longer periods of time, the motor should be rated for at least 200W, more is better (reduces losses, increases weight).

5. The voltage of the motor should exceed the desired output voltage, so that there's useful output even when not pedaled full-steam.

ADVANTAGE

• Easy to commute with low fatigue.
• Less maintenance cost.
• Normal Drag/Pedal is possible when power is not in use.
• Deployable batteries – can be taken inside house.
• Cost of the unit is very low.
• Easy to carry since it is portable.
• Less energy consumed.

• High efficiency can be obtained if inverter is used.
• If using solar panel, free utilization of energy can be done

DISADVANTAGES

1. High intensity of wind load
2. High centre of gravity.
3. Cannot tolerate drastic changes in environment.
4. Needs Periodic Monitoring

CONCLUSION

With the increasing consumption of natural resources of petrol ,diesel it is necessary to shift our way towards alternate resources like the Electric bike and others because it is necessary to identify new way of transport. Electric bike is a modification of the existing cycle by using electric energy and also solar energy if solar panels are provided, that would sum up to increase in energy production .Since it is energy efficient, electric bike is cheaper and affordable to anyone. It can be used for shorter distances by people of any age. It can be contrived throughout the year. The most vital feature of the electric bike is that it does not consume fossil fuels thereby saving crores of foreign currencies. The second most important feature is it is pollution free, eco – friendly and noiseless in operation. For offsetting environmental pollution using of on – board Electric Bike is the most viable solution. It can be charged with the help of AC adapter if there is an emergency. The Operating cost per/

km is very less and with the help of solar panel it can lessen up more. Since it has fewer components it can be easily dismantled to small components, thus requiring less maintenance.

FUTURE SCOPE

As there is synchronization between the electric motor and battery, less petrol consumption can be seen with less charging cycle of batteries (long life per charge).If one vehicle can save about an average of 30% of petrol fuel, then an average of about 40%-60% of national fuel can be conserved by using this type of vehicle. Also electric bill can also be saved, as the batteries last long per charge. The durability and convenience to consumer can be improved by using this type of vehicle. depending on the driving cycle the fuel efficiency of the vehicle can be much improved.

PROJECT PHOTOS

Chapter 6

REFERENCES

[1] Aikenhead, G. S., "Bicycle Applications for On-Board Solar Power Generation", pp. 9-10, 2011.

[2] Barve, D. S., "Design and Development of Solar Hybrid Bicycle", International Journal of Current Engineering and Technology, pp. 377-380, 2016.

[3] Barve, D. S. ,"Design and Development of Solar Hybrid Bicycle", International Journal of Current Engineering and Technology, pp. 378-379, 2016.

[4] Barve, D. S., "Design and Development of Solar Hybrid Bicycle", International Journal of Current Engineering and Technology, pp. 380, 2016.

[5] FOGELBERG, F., "Solar Powered Bike Sharing System", Goteberg, Sweden: Viktoria Swedish ICT, 2014.

[6] FOGELBERG, F.,"Solar Powered Bike Sharing System with", Goteborg, sweden: Viktoria Swedish ICT, 2014.

[7] GOODMAN, J. D. ,"An Electric Boost for Bicyclists", The New York Times, 2010.

[8] Prof. Palak Desai, P. D. ,"Design And Fabrication Of Solar TRI Cycle", International Journal of Engineering Sciences& Research, pp. 664, 2016.

[9] T .Bhavani, "Novel Design of Solar Electric Bicycle with Pedal", International Journal & Magazine of Engineering, pp. 108, 2015.