Design and Fabrication of Automatic Fuel Control Valve for Two Wheeler Automobiles

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Abstract:*The main idea behind this paper is to remove the conventional system into an automatic system. The necessity for the safety and prevention of fuel in two-wheeler automobiles is essential since there are lots of fuel theft and vehicle theft occurring day by day in a conventional system. The automatic fuel control valve can be used in this situation because this system is a digitally password operated locking system. Thus the operation of the fuel control valve mainly depends upon the digital password operated locking system. This system has greater safety and control of the valve. The automatic fuel control valve has been fabricated for the simple operation.For the fabrication of the fuel control valve, the design of the fuel control valve, modeling of fuel control valve by using rapid prototyping and actual fabrication of the valve isdone. This paper contains namely three systems: digital indication of fuel, digitally password operated locking system and automatically operated fuel cock which is used in the safety and prevention of two-wheeler automobiles.*

Keywords:*Fuel Control Valve, Fuel Indicator, Digital Locking System, PIC16F877A, L293D Motor Drive, Rapid Prototype.*

I. Introduction

In day to day life, new technologies are introduced in two-wheeler automobiles. Automation is mandatory to handle all types of systems one of themis the fuel cock.The fuel cock below the fuel tank on the motorcycle helps in managing the fuel in your tank. When fuel cock in 'Off' condition, it cuts off the fuel supply to the engine and if the motorcycle is not scheduled to run for a long period, turning off the petcock must be followed to prevent trickling down of fuel into the carburetor float bowl and finally into the engine and building up. When fuel cock in 'On' condition along with enough fuel in the tank it keeps supplying the fuel through the carburetor and if the engine starts snatching or losing power, turn it to 'Reserve' and head to the nearest fuel station to fill up.

Conventionally, a general-purpose engine used in an operating machine or the like adopts a carburetor to supply a mixture of fuel and air to the engine. To start the engine, it is necessary to turn on the engine switch with an opened fuel cock to allow fuel supply to the engine. On the other hand, even when the fuel cock is closed the engine is simply turned off to stop the ignition, hence restricting the operation of the engine. Therefore, it is likely that when the engine is stopped but the fuel cock is mistakenly left open. In this case, the fuel may diffuse into the air or flow into the engine because of which accidents may happen with riders.

Design of fuel control valve

In this paper, the conventional fuel cock has been examined. From the observation of the conventional fuel cock, the design and specification of the fuel cock are identified. According to the specification, the outer diameter of the conventional fuel cock is 5mm and the inner diameter of the fuel cock is 4mm. Through this fuel is passing to the carburetor. For the design of the fuel cock creo 3.0 parametric is used. The first step is creating a block having two pipes with an internal diameter of 4 mm and an outer diameter of 5mm. Fuel cock having a rectangular shape is 25 X 20 mm. Fuel cock having a hole of 9 mm to the height of 16 mm in the top view which is used to fit the rod into the block for rotating motion. Rod diameter of the hole is 4 mm.
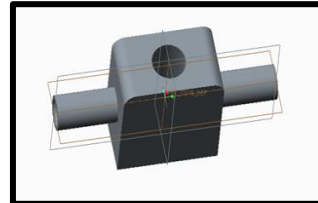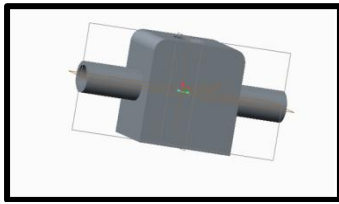
Figure.1.1 CAD model of the fuel control valve (Side View)**Figure.1.2** CAD model of the fuel control valve (TopView)
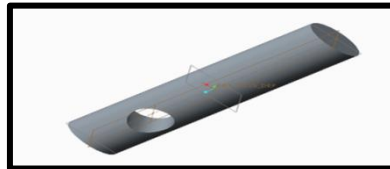

Figure.1.3 CAD model of rod

Fabrication of a fuel control valve with Rapid Prototype Machine

Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer-aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing.

Rapid prototyping systems use this data to build fabrications layer by layer in very thin cross-sections. Each layer is stacked upon a previous layer until the model is complete. Rapid prototyping systems build intricate and complex shapes much quicker and more simply than conventional modeling methods.

The design of fuel cock in the creo file converts into stereolithography. The rapid prototype machine examines the design of the fuel cock. The total idea about the design and specification of fuel cock is acquired. The layer by layer process of making a model with ABS plastic.
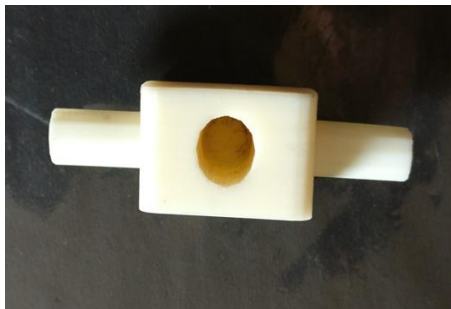

Figure.2.1 Top View of Fuel Cock makes in Rapid Prototype Machine   **Figure.2.2** Rod make in Rapid Prototype Machine

Fabrication of fuel cock in Metal

For manufacturing fuel cock, the Mild Steel rectangular block has taken the dimension of 60 X 25 mm. This block first marks 17 mm from the right side of the block. The left side is fixed in the chuck of the lathe machine. After marking, the turning operation is performed on the lathe machineand outer diameter is reduced up to 5mm on the right side. The similarly right side of the block is fixed in the chuck of the lathe machine and a mark is created on the left side. Then turning operation is performed on the left side up to 5 mm of outer diameter. After turning operation, remove the work piece from the chuck of the lathe machine. Mark on the top view of a rectangular block to find the center for the drilling operation. Drilling operation is performed on top view at a center of 12.5 mm. With a height of 16 mm and diameter of the drill, the beat is 9 mm. Drilling operation is performed on a circular pipe. The diameter of the hole made in the pipe is 4 mm. For manufacturing Rod, a cylindrical rod is taken of outer diameter 15 mm and height of 35 mm. then it is fixed on the chuck of the lathe machine. Turning operation is performed up to 9 mm outer diameter. After that facing operation is performed up to 2 mm from the right side as well as the left side. After facing operation, the Drilling operation will be performed with a diameter of 4 mm and at the center of 8 mm from the bottom.

The actual views of Fuel Cock after fabrication are as follows:-

Figure.3.1 Rod make in metal

Figure.3.2 Top view of Fuel Cock make in metal
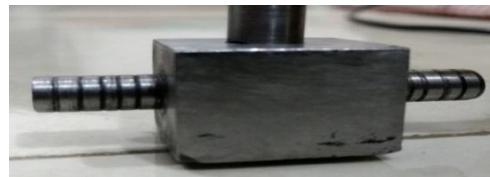

Figure.3.3 Assembly of Fuel Cock

Figure.3.4 Back view of Fuel Cock make in metal

II. Components and Description:

1. Ignition Switch

An ignition switch or starter switch is a switch in the control system of an internal combustion engine motor vehicle that activates the main electrical systems for the vehicle. The ignition switch usually requires a key be inserted that works a lock built into the switch mechanism. It is frequently combined with the starter switch which activates the starter motor.

2. DC Motor

DC Motor is the actuators which are powered by the DC source of the bike battery. DC motors convert the electrical energy into mechanical energy and which is given to the shaft. The torque produces by DC motor is0.3 kg-cm. The speed of the motor is 3.5 rpm. The weight of the DC motor is 145 gm.

3. Float

Figure.4 Float

The float has the two sections one is arm section and another is ball sections. As soon as the level increases ball moves upwards and arm will move upwards. Due to this, the potentiometer creates rotational motion therefore resistance is changed. The change in resistance and current is directly proportional to the fuel gauge. Fuel gauge gives reading in an analog meter. The Analog system is converting into a digital system. The floating wire is connecting to the programmable integrated circuit. PIC connection is giving to liquid crystal display. It is having 16 characters and 2 line display.

5. Programmable Integrated Circuit (PIC16F877A)

The PIC microcontroller PIC16F877A is one of the most renowned microcontrollers in the industry. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output.

6. LCD Display

It is used to indicate the level of fuel in the fuel tank. The level of fuel in a fuel tank is sensed by the potentiometer connected to the arm of float and gives readings change in resistance. Change in

resistanceanalyzed by a potentiometer and analog measurement is given to Programmable Integrated Circuit. PIC converted it into digital form and displays on Liquid Crystal Display**.** It has sixteen characters and two lines. A 16x2 LCD is a very basic module and is very commonly used in various devices and circuits.

7. RegulatorLM7805

The LM78XX series of three-terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on-card regulation eliminating the distribution problems associated with single-point regulation. The voltages available allow these regulators to be used in logic systems instrumentation and another solid state electronic equipment.

8. L293D Motor Drive

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive in either direction. L293D is a 16-pin IC that can control a set of two DC motors simultaneously in any direction.

Concept

It works on the concept of H-bridge. H-bridge is a circuit that allows the voltage to be flown in either direction. The voltage needs to change its direction for being able to rotate the motor in a clockwise or anticlockwise direction. In a single L293D chip there are two H-Bridge circuits inside the IC which can rotate two dc motors independently. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high.Given below is the pin diagram of an L293D motor controller.
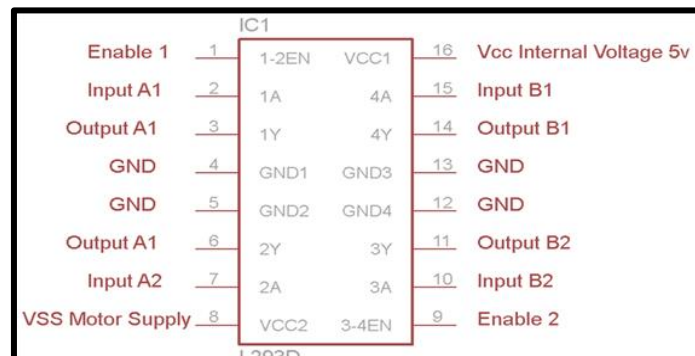

Figure.5 IC of L293D

9. Relay

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized.

10. Transistor

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal.
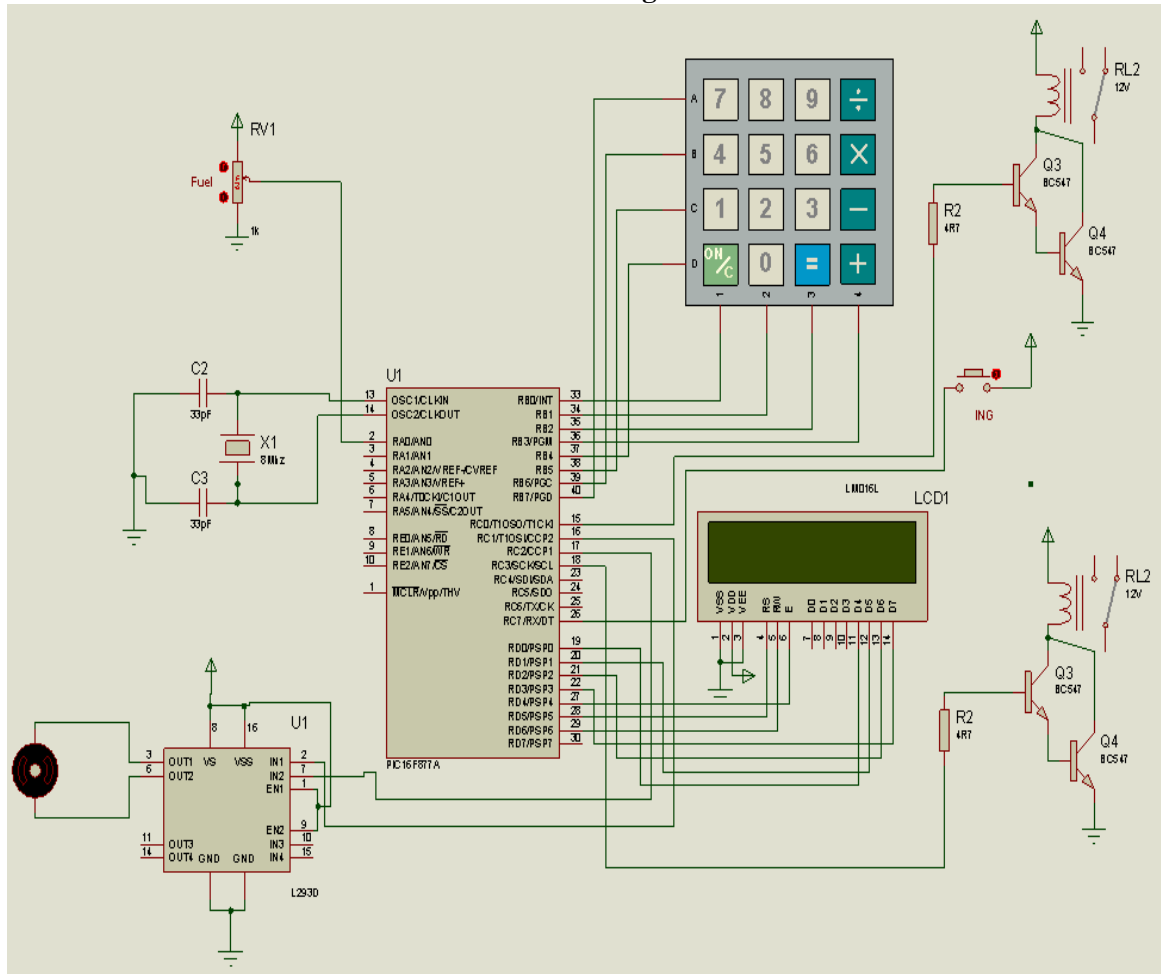
III. Circuit Diagram:

Figure.6 Circuit diagram of Assembly

Firstly the four wires of ignition switch are connected to the PIC Microcontroller and the two wires of the battery are connected to the PIC for the completion of the circuit. The eight wires of the keypad are connected to the PIC from the pin no.33 to the pin no.40.The four wires of the keypad are for giving the input and another four wires are for balancing the high or the low input. For the motor drive pin no.2, 7, 10, 15 are used for the input and the pin no.3, 6, 11, 14 are used for the output. Pin no.16, 17 of the PIC is connected to the Motor drive. For the LCD connection pin no.19, 20, 21, 22, 27, 28, 29 of the PIC are connected to the LCD. The output of the PIC is shown on the LCD. For the connection of the Relay, pin no 15 of the PIC is connected to the first relay. Another relay no 2 is connected to the pin no.18 of the PIC. Float wires are connected to the pin no 2 of the PIC.

The keypad is available in various sizes. The common sizes include 3×3, 3×4 and 4×4. In this paper, interface a numeric keypad of 4×4 matrix with the PIC microcontroller 16F877A. The keypad is connected to PORTD of the PIC microcontroller 16F877A. The four rows, namely A, B, C, and D, are connected to the lower significant bits of the PORT (RD0-RD3) and the four columns, numbered as 1, 2, 3 and 4, are connected to the MSB of the PORT (RD4-RD7). To interfaces LCD with PIC16F877A and display the text. LCD comes in different sizes and shapes. In this paper 16×2 character selected as an alphanumeric LCD. It contains 2 rows of 16 characters.
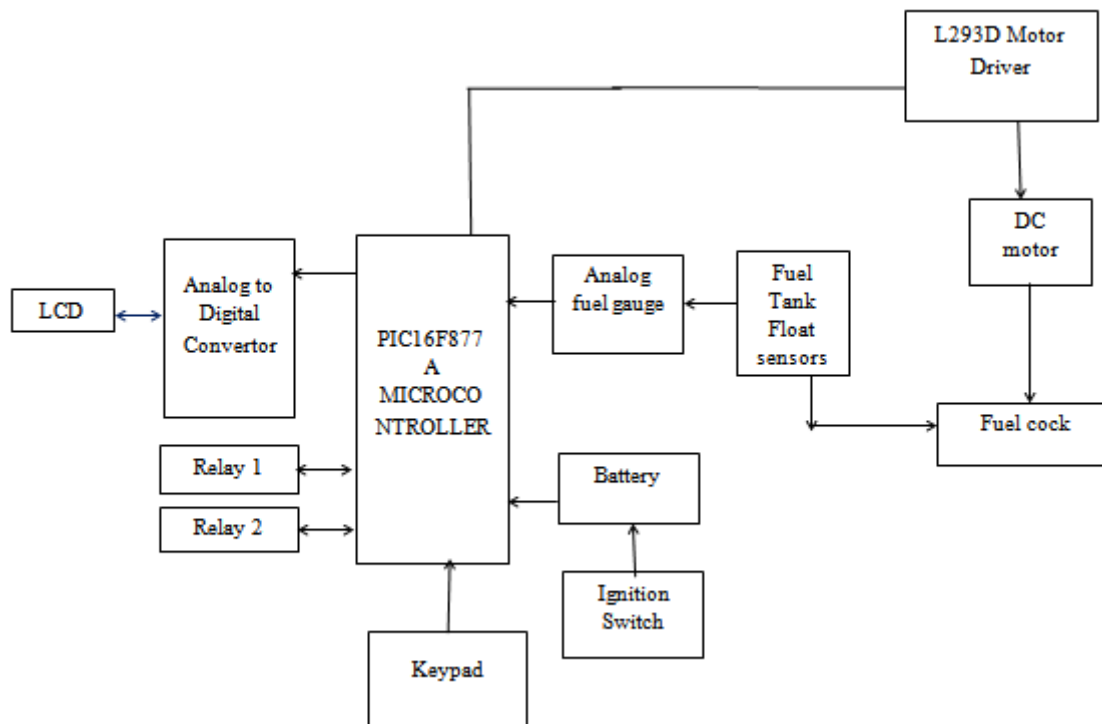
IV. Methodology:

Figure.7 Block diagram of the Automatic Fuel Control System

When the key is turned into on position, voltage flows from the battery to the starter and distributor. The ignition switch also provides power to all of the engine's accessories and the engine control unit. It essentially routes power from the battery of the vehicle and to every other electrical component the ignitions switch having four wires. Two wires for ignition and two wires for the relay. Two wires are attached to the power supply when the ignition is on then supply power to various devices and the ignition switch is off the supply is present to reverse the motion of the motor. In an ignition circuit wherein a lead extends from a battery to an ignition switch, to an ignition coil and then to ground the improvement comprising a holding relay having an energizing coil operating the first armature to maintain a normally open switch open, and operating a second armature to maintain a normally closed switch closed, said energizing coils being series-connected in said ignition circuit; an indicator light; a normally closed manual switch; a control unit, comprising a conductive within said control unit adapted to make contact between said first lead and said second lead when said control unit assumes a predetermined level; the first circuit including said battery, said energizing coil and said control unit; and a second circuit including said first lead, said normally open switch, said normally closed manual switch. At the upper side, fuel Tank is provided in which the fuel is passed through fuel cock through the pipe connected to it. One end of the pipe is connected to the fuel tank and another end of the fuel tank is connected to the carburetor of the engine. From the carburetor fuel gets passed into the engine and the engine starts.

For the measurement of fuel level in the Tank, the float is inserted into the Tank. The movement of the float is either on the upper side or downside. Due to the movement of the Float, the potentiometer will rotate and this spring-type mechanism is used. When the fuel is inserting into the fuel tank, the movement of the float is in the upper direction. Due to this, the potentiometer will rotate and the spring type mechanism is used for changing the resistance. This change in resistance, it converts into the analog signal. This analog signal giving a command to PIC then PIC converts the analog into the digital fuel indicator. The reading of fuel present on the fuel tank is shown with the help of LCD. The value of fuel in liters will be shown after the password enters correctly. This will display the value of the fuel into the LCD.

When the ignition switch gives power to the PIC then the supply is passed through all the system. The keypad is attached to the PIC. When the password is entered, Then PIC is giving a command to the LCD. The password will be displayed on the screen of LCD. The set password is 6466. PIC has accepted the command and supplies the power to all devices. If we enter the wrong password then it will be displayed on the LCD. No voltage or current will be passed through the System. PIC is giving the command to the relay and Motor Drive Circuit. When current is passed through the motor driver circuit then the operation gets performed. But the L293D needs the supply of 5 volts and the dc motor wants the supply of the 6volts. Hence the L293D has the option for that power source distribution. It has the two-terminal for the operation that is +Vcc and the +Vss.

The +Vcc is the supply for the IC which is used for the input purpose and the +Vss is the supply that is given to the dc motor directly. So the two functions get performed with the help of the PIC circuit. The two relay connections are connected to the l293D circuit for the operation of the DC motor that is to rotate the motor in a clockwise direction or anticlockwise direction. When the ignition switch is 'ON' the battery gives the supply to the PIC and the motor drive circuit operation starts. The two relays are connected to the motor drive circuit. Relay 1 also connected to the PIC. As soon as the relay gets "ON" it acts as a switching device so it gives the connection to the motor drive circuit for the clockwise operation and the shaft of the dc motor gets rotated clockwise for a certain period of the time and the motor stops. As the motor stops the second Relay becomes on and breaks the circuit and motor stops. So it opens the fuel cock and the fuel supply starts and the first operation gets performed.

For the second operation, when the ignition switch gets "OFF" the supply from the battery becomes "OFF" and the PIC also stops after some time. The motor drive has the power for the first time so it utilized for the reversed operation. As soon as the motor drive gets OFF so the second relay which is on during the first operation comes into the picture for reversed operation. When the supply gets OFF the second relay gives a command to the motor driver circuit and the DC motor rotates in the reversed direction and the shaft rotates in reversed direction. So the fuel cock gets to the "OFF" position and the fuel supply gets cut off and stops feeding the supply.

V. Experimental Setup

The experimental setup consists of a rectangular bar used to make a model of two-wheeler type.The ignition switch is connected to a battery. The battery is connected to the PIC 16F877A microcontroller. Two relay switches are connected to the PIC. PIC is connected to the L293D motor driver. The motor driver is connected to a motor. The motor rod is coupled with the fuel cock rod. The keypad is connected to the PIC. Float sensors are in the fuel tank. To the float sensors, the analog gauge is connected to the PIC. PIC is connected to the LCD.

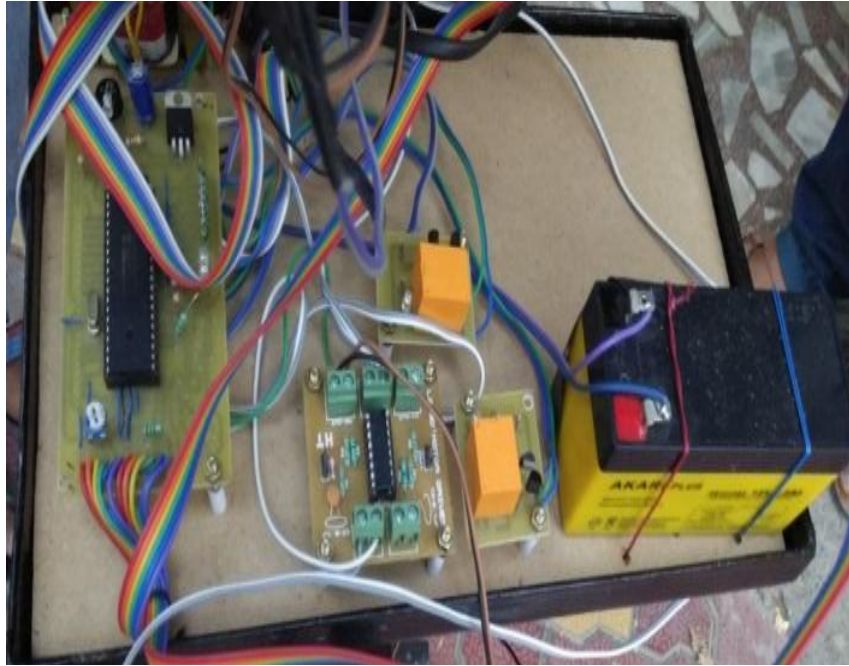**Figure.8.1** Top view of the control unit

Figure.8.2 Top view of the connected circuit

Figure.9 Actual view of the setup

VI. Advantages & Disadvantages:

6.1 Advantages

1. The assembly will be internally embedded in such a way that fuel cock can be operated with help of ignition and password system only. Thus it prevents the fuel theft.

2. In a conventional system, there is a continuous flow of fuel to the carburetor even when a vehicle is in off position and fuel cock is on. But here in this system, the flow to the carburetor is stopped when a vehicle is in off position. So it saves that minimum amount of fuel, anyway which is wasted due to losses.

3. A common strategy amongst thieves is that they often bypass the ignition system and turn on the vehicle with the help of wires. Because of the digital password operating system in the assembly, this phenomenon is prevented.

6.2 Disadvantages

1. The password cannot be changed manually unless it is connected to the computer system.

2. For the seamless transaction of float which is used to measure the amount of fuel in the fuel tank, the fuel must be of excellent quality. This is because the float system works on a potentiometer and potentiometer is sensitive to the density of the fuel. Thus a long and disturbing change in the fuel may cause harm to the potentiometer and it may get damaged.

VII. Conclusion:

The conventional system of the fuel control valve is manually operated but in the automatic system, it operatesautomatically. With the help of an automatic fuel control system, the automatic fuel control valve can be conveniently opened and closed. When the fuel in the fuel tank is reduced then digital Fuel indication system indicates the fuel level in the tank. The automatic fuel control system is prevented by vehicle theft and fuel theft by using a digital password operating system. Without the password movement of the fuel, the cock is not converted from off position to on position. When the ignition switch is on, then the motor is moving in the forward direction. Then fuel is started supply to carburetor and engine start. When the ignition switch is off, then the motor is moving in the reverse direction. Then fuel is restricted to move into the carburetor. That's why the System intends to stop the daily loss of fuel by changing a conventional system with an automatic system. It prevents the small amounts of fuel losses that occur when the fuel control valve is in 'ON' position in the conventional system and when the vehicle is in moving condition, but fuel cock is in off condition then fuel present in the carburetor start burning. After the sometime vehicle is in moving condition there is a sudden break in the gear position. So it also prevents accidents of riders.

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