JUICE VENDING MACHINE USING 8051MICROCONTROLLER

MINIPROJECT REPORT

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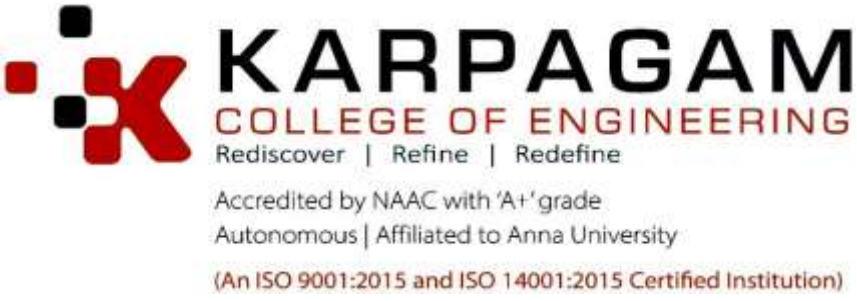
In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING



MAY 2023

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ACKNOWLEDGEMENT

We would like to show our gratitude to the Managing Trustee of Karpagam College of Engineering, **Dr. R. VASANTHAKUMAR, B.E (Hons)., D.Sc.,** Chairman and Managing Trustee, Karpagam Educational Institutions, for providing us with all sorts of supports in the completion of this project

It is the moment of immense pride for us to reveal our profound thanks to our respected principal, **Dr. P. KARTHIGAIKUMAR, M.E., Ph.D.,** who happens to be striving force in all our endeavors.

We express our sincere thanks to the Head of the Department of Electronics and Communication Engineering **Dr. S. DEEPA, M.E., Ph.D.,** for providing an opportunity to work on this project. Her valuable suggestions helped us a lot to do this project.

A word of thanks would not be sufficient for the work of our mini project guide **Dr.C.Priya,M.E.,Ph.D.,** Department of Electronics and Communication Engineering whose efforts and inspiration lead us through every trying circumstance.

We deeply express our gratitude to all the members of the faculty of the Department of electronics and communication engineering for the encouragement, which we recieved throughout the semester.

ABSTRACT

The 8051 microcontroller is a popular choice for controlling various automated systems due to its simplicity, versatility, and cost-effectiveness. In this project, we have developed a juice vending machine using the 8051 microcontroller. The 8051 microcontroller is a popular choice for controlling various devices due to its low power consumption and easy programmability. This project contains the design of a juice vending machine using the 8051 microcontroller. The system is designed to dispense juice automatically when the user places a cup in the vending machine. The system is designed to be user-friendly and efficient, making it suitable for use in various settings such as offices, schools, and public places. This project demonstrates the capability of the 8051 microcontroller in developing real-world applications that enhance user experience and convenience. Overall, this project demonstrates the capability of the 8051 microcontroller in designing and implementing automated systems.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO THE PROJECT

In recent years, vending machines have become an increasingly popular and convenient option for quick snacks and drinks. However, with the advancement of technology, vending machines have become more sophisticated and efficient. This project aims to design and develop a juice vending machine using the 8051 microcontroller, solenoid valve, relay, and ultrasonic sensor. The proposed juice vending machine will be a fully functional and automated system that can dispense juice in a quick and hassle-free manner. The machine will be controlled by the 8051 microcontroller, which will be responsible for managing the dispensing of juice. The machine's hardware will consist of a solenoid valve, relay, ultrasonic sensor, user interface, and other necessary components. The solenoid valve and relay will control the flow of juice, while the ultrasonic sensor will detect the presence of a cup to prevent spills. The target audience for this project includes businesses and individuals interested in providing a convenient and efficient way for customers to purchase juice. The project's outcome will be a fully functional juice vending machine that is easy to operate, reliable, and cost-effective. This project will showcase the integration of the latest technologies and the power of the 8051 microcontroller to automate a vending machine.

1.2 APPLICATION

The application of a juice vending machine using an 8051 microcontroller is to automate the process of dispensing juice to customers. The machine will be able to dispense a predetermined amount of juice, usually measured in milliliters, when the user selects their desired juice from the available options. The juice vending machine could be deployed in a variety of settings, such as in a cafeteria, a gym, or a public park.

It could offer a range of juice options, such as orange, apple, and grape, and could even offer custom juice blends based on user preferences. Overall, the application of a juice vending machine using an 8051 microcontroller is to provide a convenient and automated way for customers to access and enjoy fresh juice.

CHAPTER 2

PROPOSED THEOREM

2.1 8051 DEVELOPMENT KIT

The microcontroller like 8051 was designed in the year 1981 by Intel. The microcontroller is one kind of integrated circuit that includes 40-pins with dual inline package or DIP, RAM-128 bytes, ROM-4kb & 16-bit timers–2. Based on the requirement, it includes addressable & programmable 4 – parallel 8-bit ports. In the 8051 microcontroller architecture, the system bus plays a key role to connect all the devices to the central processing unit. This bus includes a data bus- an 8-bit, an address bus-16-bit & bus control signals. Other devices can also be interfaced throughout the system bus like ports, memory, interrupt control, serial interface, the CPU, timers.

With this board we can develop and prototype with any of 8051 40 pin microcontrollers. The RS232 driver on board allows easy connection with PC or other embedded hardware. The board have User buttons and status LEDs. The bridge rectifier allows this board to be powered with both AC and DC power supply adapters. The microcontroller like 8051 was designed in the year 1981 by Intel. The microcontroller is one kind of integrated circuit that includes 40-pins with dual inline package or DIP, RAM-128 bytes, ROM-4kb & 16-bit timers/counters–2. Based on the requirement, it includes addressable & programmable 4 – parallel 8-bit ports, namely port1,port 2, port 3 and port 4.In the 8051 microcontroller architecture, the system bus plays a key role to connect all the devices to the central processing unit. This bus includes a data bus- an 8-bit, an address bus-16-bit & bus control signals. Other devices can also be interfaced throughout the system bus like ports, memory, interrupt control, serial interface, the CPU, timers. The RS232 driver on board allows easy connection with PC or other embedded hardware.

2.2FEATURES

- RS232 TX, RX interface
- Quartz crystal 11.0592 MHz
- Reset button
- Power plug-in jack
- GND bus
- VCC bus
- MAX232 for RS232 serial port communication.
- Onboard LM7805 power regulator
- Power Indicating LED
- On board Regulated Power Supply 5V,12V,GND.
- High quality PCB FR4
- User LED
- User Switch.
- ZIF Socket for easy inserting and removing Microcontroller.
- A Serial Port for ISP.
- Ready Interface for LCD display 2x16.
- 24Cxx I2C EEPROM.
- Extension slot on every microcontroller pin with pull up resistor for port0.
- Four mounting holes 3,3 mm (0,13").
- 8 LED array.
- Easy to test with Burg Connecters wires.

2.3SPECIFICATION

- Size: 65 x 125 mm
- Supported Microcontroller: AT89SXXXX, AT89CXXXX, P89V51RD2

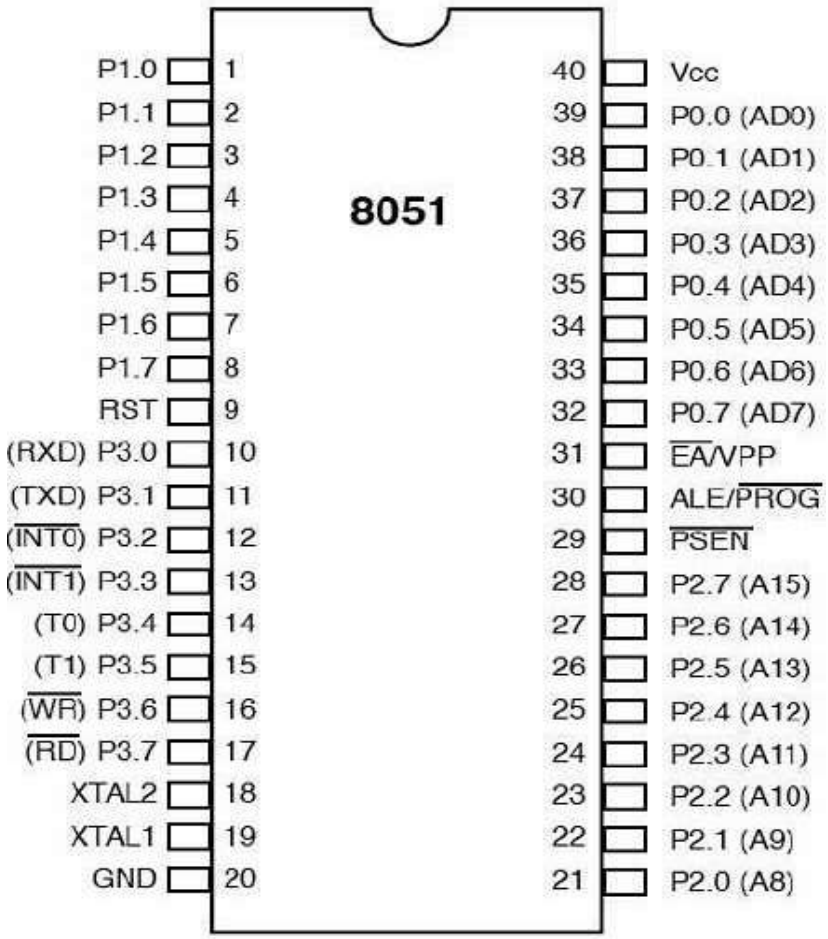

Fig - 2.1 PIN DESCRIPTION OF 8051 MICROCONTROLLER

2.4HARDWARE DETAILS

- JP2 - If this jumper is Short Than U_SW is connected with P3.7 and when you press Switch P3.7 become Low.
- JP3 - If this jumper is Short Than Green LED is connected with P2.0.

- JP4 - If this jumper is Short Than Serial communication is enable.
- P0 - is connected with PORT0 of AT89S52.
- P1 - is connected with PORT1 of AT89S52.
- P2 - is connected with PORT2 of AT89S52.
- P3 - is connected with PORT3 of AT89S52.
- JP1 - Which is use to program AT89S52 through USB ISP Programmer.
- COM1- DB9 for serial communication.
- Red LED for Power supply indication.

Fig – 2.2 8051 microcontroller development kit.

2.5 FEATURES OF 8051 IDE

- ✓ Mcu 8051 with many debugging features: register status, step by step, interrupt viewer, external memory viewer, code memory viewer, etc.
- ✓ Simulator for certain electronic peripherals like LEDs, LED displays, LED matrices, LCD displays, etc.
- ✓ Support for C language.
- ✓ Native macro-assembler.
- ✓ Support for ASEM-51 and other assemblers.
- ✓ Advanced text editor with syntax highlighting and validation.

- ✓ Support for vim and nano embedded in the IDE
- ✓ Simple hardware programmer for certain AT89Sxx MCUs.
- ✓ Scientific calculator: time delay calculation and eneration, base converter, etc.
- ✓ Hexadecimal editor.

Fig- 2.3 Sample Screenshot of MCU 8051 IDE

2.6 ULTRASONIC SENSOR

2.6.1 OVERVIEW

Ultrasonic sensors are in available for the past many decades and these devices continue to hold huge space in the sensing market because of their specifications, affordability, and flexibility. As the automation industry has been progressing, the employment of ultrasonic sensors in multiple domains such as drones, EV vehicles is emerging. In the year 1914, Fessenden developed the first modern transducer employed in sonar where it can be able to find the items in water but not the direction of items. And then in the year, 1915 Langevin introduced the contemporary model of ultrasonic which resolved the problem of Fessenden.

2.6.2 SPECIFICATION

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around $5^{0.}$
- It operates within the voltage range of 20 VDC to 30 VDC.
- Preciseness is ±5%.
- The frequency of the ultrasound wave is 120 kHz.
- Resolution is 1mm.
- The voltage of sensor output is between 0 VDC – 10 VDC.
- The ultrasonic sensor weight nearly 150 grams.
- Ambient temperature is -25^0C to $+70^0$C.
- The target dimensions to measure maximum distance is 5 cm × 5 cm.

2.6.3 ULTRASONIC SENSOR HC-05

Ultrasonic sensors are electronic devices that calculate the target's distance by emission of ultrasonic sound waves and convert those waves into electrical signals. The speed of emitted ultrasonic waves traveling speed is faster than the audible sound. There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component. To know the distance between the target and the sensor, the sensor calculates the amount of time required for sound emission to travel from transmitter to receiver. The calculation is done as follows:

$$\mathbf{D = 1/2\ T * C \quad ---------- \quad 1}$$

Where 'T' corresponds to time measured in seconds.

'C' corresponds to sound speed = 343 measured in mts/sec.

FIG – 2.4 ULTRASONIC SENSOR

2.7 4-CH 5V RELAY MODULE

A 2-channel 5V relay module is an electronic device that allows a low voltage signal to control a high voltage circuit. The module has two channels or switches, which means it can control two different circuits. Each channel has a normally open (NO) and a normally closed (NC) terminal. The 5V relay module is designed to work with a 5V DC power supply, and it operates using a digital signal, which means it can be controlled by a microcontroller or any other digital circuit. The module is equipped with an optocoupler, which provides electrical isolation between the controlling circuit and the relay, preventing any voltage spikes or surges from damaging the controlling circuit. When a digital signal is applied to the input pins of the relay module, it energizes the relay coil, which in turn switches the output pins of the module between the NO and NC terminals. This allows the high voltage circuit to be turned on or off depending on the state of the relay module. The 2-channel 5V relay module is commonly used in home automation, robotics, and industrial control applications where it's necessary to control two different circuits with a single module. It's also used in situations where it's important to isolate the controlling circuit from the high voltage circuit to prevent damage to the controlling circuit or to ensure the safety of the user.

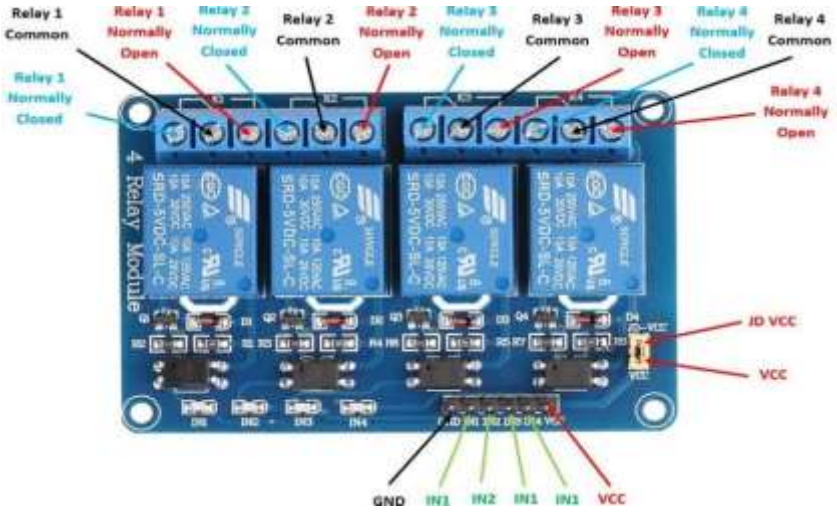

FIG – 2.5 4-CH 5V RELAY MODULE

2.8 SOLENOID VALVE

A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves.

2.8.1 FEATURES OF SOLENOID VALUE

Solenoid valves are used to close, open, dose, distribute or mix the flow of gas or liquid in a pipe. The specific purpose of a solenoid valve is expressed by its circuit function.

- **Low noise:** Valves have a damped design to reduce the noise during the closing of the valve.
- **Vacuum:** Valves that do not require a minimum pressure differential are suitable for rough vacuums. Universal direct acting or semi-direct acting solenoid valves are well suited for these applications.

- **Media separation:** Media separation design allows isolation of the media from the valve's working parts, making it a good solution for aggressive or slightly contaminated media.

FIG – 2.6 SOLENOID VALVE

2.9 SIMULATION SOFTWARE

The software which is used for simulation is inskape.

2.9.1ABOUT INSKAPE

Inkscape is a Free and open source vector graphics editor for GNU/Linux, Windows and macOS. It offers a rich set of features and is widely used for both artistic and technical illustrations such as cartoons, clip art, logos, typography, diagramming and flowcharting. It uses vector graphics to allow for sharp printouts and renderings at unlimited resolution and is not bound to a fixed number of pixels like raster graphics. Inkscape uses the standardized SVG file format as its main format, which is supported by many other applications including web browsers.

2.10 BLOCK DIAGRAM OF JUICE VENDING MACHINE

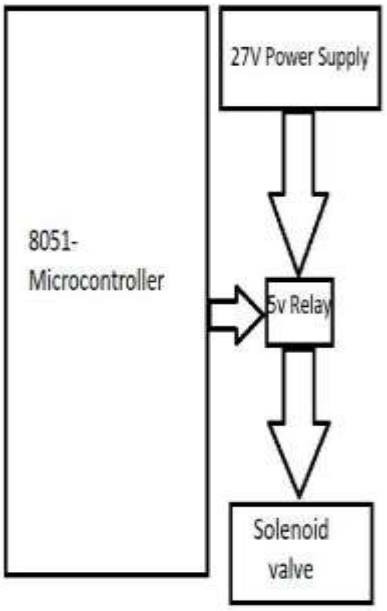

FIG – 2.7 BLOCK DIAGRAM OF JUICE VENDING MACHINE

The block diagram above illustrates the various components of the system and their interconnections. This juice vending machine is a system that refills the juice automatically. This system consists of a microcontroller, power supply, relay and solenoid valve. This system refills the juice after detecting the cup . The cup is detected by a ultra Sonic sensor . This system eliminates the need for manual intervention and provides automatic vending , thus saving both time and energy. The block diagram above illustrates the various components of the system and their interconnections. This juice vending machine is a system that refills the juice automatically. This system consists of a microcontroller, power supply, relay and solenoid valve. This system refills the juice after detecting the cup . The cup is detected by a ultra Sonic sensor which detects it by the varying distance between normal scenario and when a cup is placed. And then a signal is sent to microcontroller which provides the power supply through by controlling relay. This system eliminates the need for manual intervention and provides automatic vending , thus saving both time and energy.

CHAPTER 3
RESULT AND CIRCUIT DIAGRAM

3.1 CIRCUIT DIAGRAM OF JUICE VENDING MACHINE

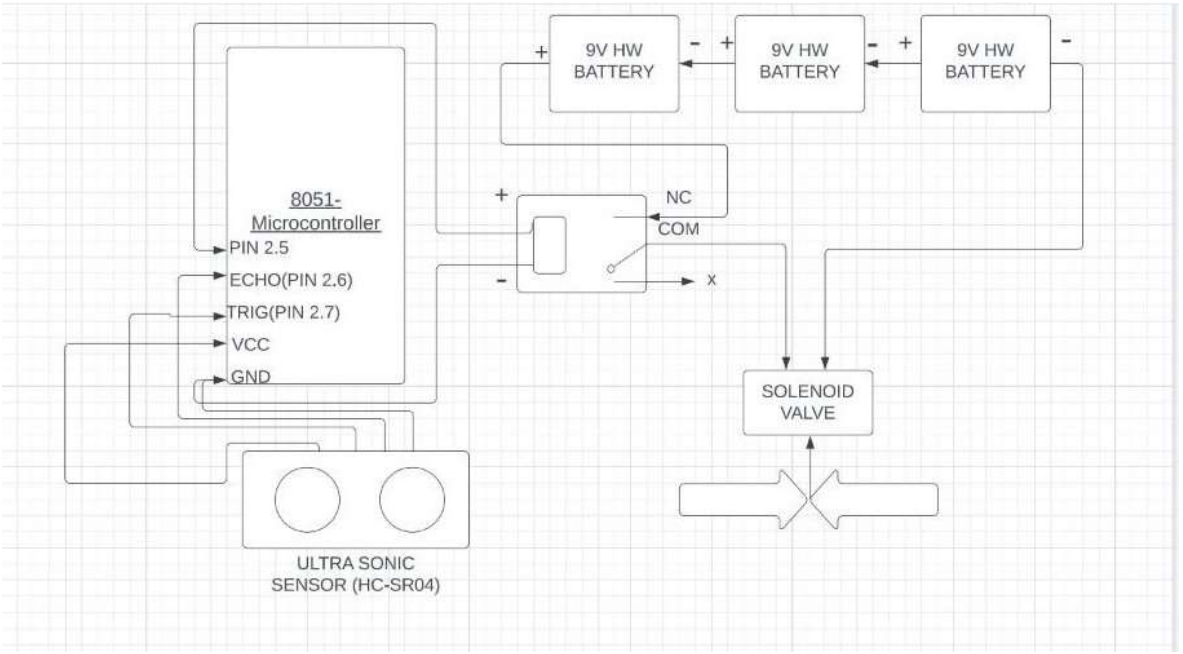

FIG - 3.1 CIRCUIT DIAGRAM OF JUICE VENDING MACHINE

The circuit diagram for the juice vending machine using 8051 is shown above:

Microcontroller: The microcontroller used in the circuit is the 8051(AT89S52). It is the brain of the system and controls the operation of the water pump. The microcontroller is programmed using the ProgISP. Relay module: The relay module is used to switch the water pump on and off. It is connected to the microcontroller's digital pin and the solenoid valve's power supply. Solenoid valve: The power supply used in the circuit is a 12V DC adapter and 3 - 9v hw battery. It provides the required voltage and current to the microcontroller, solenoid valve and relay module. Solenoid valve : The water pump used in the circuit is a 24V DC solenoid valve. It is connected to the relay module and controlled by the microcontroller. Ultrasonic sensor : The solenoid valve used is a HC - SR04 sensor. It is connected to and controlled by microcontroller. It detects the cup and sends a signal to the microcontroller.

3.2 RESULT

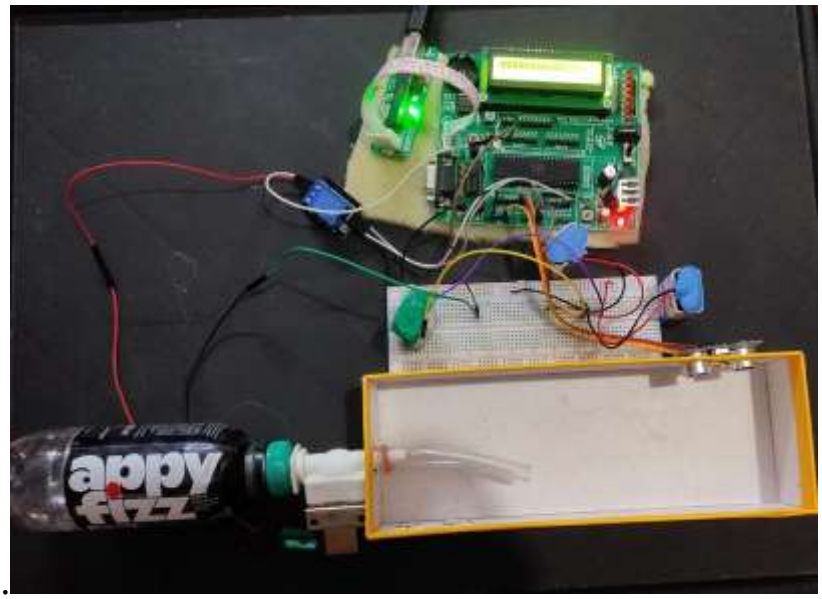

Fig 3.2.1

Figure 3.2.1 shows that Juice vending machine when not detecting any cup

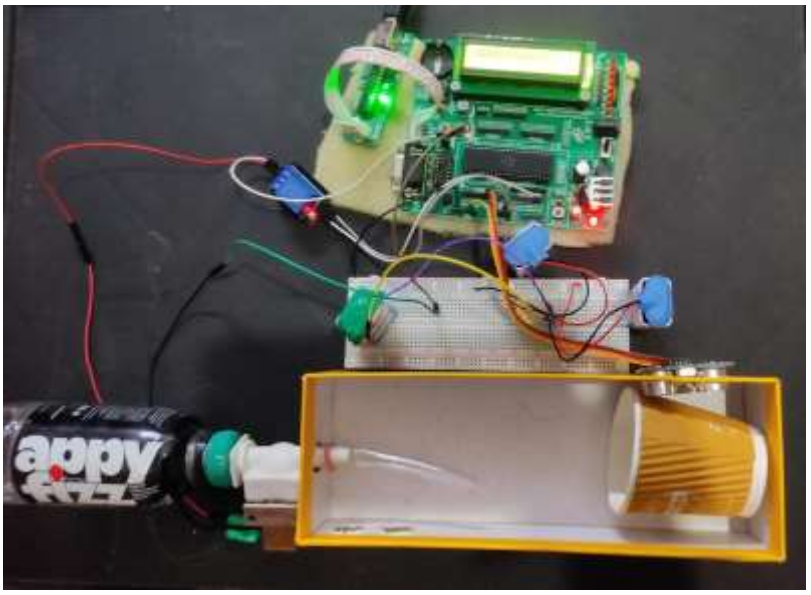

Fig 3.2.2

Figure 3.2.2 shows that Juice vending machine when it detects a cup and gives signal to relay by which the power supply goes to solenoid valve and the valve opens to full the cup.

CONCLUSION

In conclusion, a juice vending machine using an 8051 microcontroller is a convenient and efficient way to dispense fresh juice to customers. The microcontroller serves as the brain of the machine, controlling the dispensing mechanism and managing user input and output devices. The machine can be deployed in various settings, offering a range of juice options and even custom juice blends. Building a juice vending machine using an 8051 microcontroller can be a challenging project that requires technical knowledge and experience, but the end result can be a profitable and popular addition to any business or public space.

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APPENDIX

PROGRAM

```
#include <AT89S52.h>
#define FOSC 11059200
#define TCLK FOSC/12
#define SCLK TCLK/32
#define TRIG P2_7
#define ECHO P2_6
#define relay P2_5

void baud_rate(int);
int get_distance(void);

void main()
{
 baud_rate(9600);
 while(1)
 {
  char dist1,dist2;
  dist1=get_distance();
  delay(5);
  dist2=get_distance();
  if((dist1-dist2)>1)
  {
   P2_0=1;
   relay=1;
   delay(20000);
  }
  delay(10);
 }
}

void baud_rate(int baud)
{
 char b;
 SCON=0X50;
```

```
TMOD=(TMOD&0X0F)|0x20;
 b=(0xFF-(SCLK/baud))+1;
 TH1=b;
 TL1=b;
 TR1=1;
}

int get_distance(void)
{
 int ultra_dist;
 char ultra_q;
 TRIG=0;
 ECHO=1;
 TR0=0;
 TMOD=(TMOD&0xF0)|(0x01);
 TH0=0x00;
 TL0=0x00;

 TRIG=1;
 for(ultra_q=0;ultra_q<10;ultra_q++)
 {}
 TRIG=0;

 while(ECHO==0)
 {
 }
 TR0=1;
 while(ECHO==1)
 {
 }
 TR0=0;
 ultra_dist=((TH0*256)+TL0)/54;
 8return ultra_dist;
}
```