CHAPTER 1

INTRODUCTION

When you buy fresh vegetables and fruits, one of the first steps you may take is to wash them. Most obviously, there are thousands of microscopic organisms living on produce. Some of them including harmful bacteria, mold, fungi, and animal waste. Washing your vegetables is an extra measure that prevents food-borne illnesses, including those caused by bacteria such as Salmonella, Listeria and E. coli. In addition, washing vegetables can eliminate any residue left by harmful pesticides. When vegetables are grown in the ground, such as potatoes, they are at increased risk for coming in contact with contaminants that can commonly live in the soil. Vegetables also can become contaminated in their various production phases before arriving at your local grocery store. From preparation to storage time, there are opportunities for contaminants, especially bacteria, to live on your vegetables. If you do buy all-organic produce, certified organic farms are allowed to use some approved pesticides and chemicals. According to our own government's regulations, these include copper sulphate, lead salts, arsenic, streptomycin, and tetracycline. Water won't remove the residues of those “government-approved organic” chemicals, and it won't kill *E. coli* or any other dangerous bacteria either.

Softer-skinned vegetables like tomatoes can be washed under cool running water while you rub the skin to manually remove bacteria. Drying them carefully also can remove extra bacteria. But don’t use soaps or detergents on your vegetables. These are often are not made for consumption and can make ill. Traditional technology utilizes water with or without a sanitizing agent to wash fresh fruits and vegetables. Chlorine is the most widely used sanitizing agent available for fresh produce, but it has a limited effect in killing bacteria on fruit and vegetable surfaces.

In this project, introducing a system which sterilizes and wash the fruits and vegetables scientifically. The washing machine is designed in kitchen environment. This system is excellent blending of bio-chemistry and electronics engineering. The dissolved ozone and diluted white acetic acid (white vinegar) act as a good sterilizer and then the vegetables are dehydrated to reduce the effect of pesticides. Vinegar is very good at removing the waxes or “films” on produce like apples. It is even more effective at this than either bleach or peroxide.Heat sterilization is the most effective process of food preservation. By

this method all microorganisms are completely destroyed due to high temperature. One of the traditional methods of preserving process of fruits and vegetables is a thermal treatment, which involves the use of heat, i.e. increased temperatures. Heat treatment is carried out by methods of sterilization, pasteurization and blanching, thus hermetically sealed packaging is used (usually made of metal, glass or plastic). Fruits, vegetables and their products represent a significant segment of the human diet, as they create the preconditions of proper nutrition. From a global point of view fruits and vegetables are present in the human diet all over the world, but it is also interesting that the relatively large producers of fruits and vegetables are developing countries.

Also the system can check the quality, fat, water content in the milk. This makes the system more efficient for kitchen purpose. Before the cow is even milked, pathogens in the surrounding environment can get into the cow's feed or water. During milking, bacteria on the inside or outside of the cow's udder can get into the milk. If the milking device (human or mechanical) hasn't been properly sanitized it may contaminate the raw milk. Gastric problems are one of the common problems caused due to consumption of adulterated milk. These chemicals harm the tender inner line of the intestine. This injures the digestive system. There are no immediate effects of consuming adulterated milk but it takes its own time. Indian Council of Medical Research reported that long term use of adulterated milk can also cause kidney failure or heart problems or even death. Patients suffering from blood pressure should avoid sodium. Consumption of milk with neutraliser may have an adverse effect on such patients.

With changing time and development in technology, we have considered designing such an instrument that will be useful to everyone. This is a portable washing machine that removes minute dust, residual agricultural pesticides and bacteria on surface of fruits and vegetables by producing ozone and ultrasonic wave simultaneously. It effectively cleans off contaminants in curved or hard-to-reach parts in fruits and vegetables than when rinsing off with just water, and other materials thereby keeps food safe and fresh.

CHAPTER 2
LITERATURE REVIEW

2.1 PREVIOUS SYSTEMS

It is important to wash vegetables prior to cutting them. If vegetables have tough skins -- like potatoes or bell peppers we can wash them under running water and use a scrub brush to remove contaminants. But it cannot be considered as an effective one. So a survey was done among different proposals and this includes survey among current approaches for washing fruits and vegetables. As the technology is developing day by day effective methods can be found out easily. Various designs were proposed and have advantages as well as disadvantages. Also the survey is extended to the milk analyzer too.

2.1.1 OZONE/ULTRASOUND DEGRADATION EFFECT ON RESIDUAL PESTICIDES IN COMMERCIALLY AVAILABLE APPLES

Ozone/ultrasound process is a promising method for treating refractory organics. Nevertheless, little is known about the ozone/ultrasound degradation effect on residual pesticides in fruits and vegetables. In this work, the presence of residual pesticides and the ozone/ultrasound degradation effect on pesticides in commercially available apples were investigated. Four pesticides, i.e. malathion, diphenylamine, carbendazim, and chlorothalonil were found in the assayed apples. Three of them were post-harvest pesticides except for malathion, a organophosphorus pesticide which was the residue of field spraying. The data obtained in the degradation assays showed that the effect of ozone/ultrasound treatment was better than single ultrasound and single ozone water process. This study suggests that this ozone/ultrasound process is a promising degradation method for residual pesticides in commercially available apples.

From the data obtained in this study, it could be concluded that ozone concentration of 16 mg/L in water and treating time of 20 min were the suitable conditions for residual pesticides degradation in commercially available apples. The ozone/ultrasound process which shows higher degradation efficiency on pesticides than single ozone and single ultrasound treatment is a promising method for residual pesticides degradation in commercially available apples.

Ozone (O_3) is the natural substance in the atmosphere and one of the most potent sanitizers against a wide spectrum of microorganisms . O_3 is generated by the passage of air or oxygen gas through a high voltage electrical discharge or by ultraviolet light irradiation, then has a strong oxidative power, and is used for sterilization, virus inactivation, deodorization, bleaching (decolouration), decomposition of organic matter, mycotoxin degradation and others. In addition, O_3 is changed to oxygen by autolysis and does not harm the flavour of vegetables and fruits. Therefore, O_3 is considered to be most suitable for removing residual pesticides from vegetables and fruits and controlling microbes of food safety concern. The threshold concentration of O_3 for continuous human exposure is 0.075 μL/L.

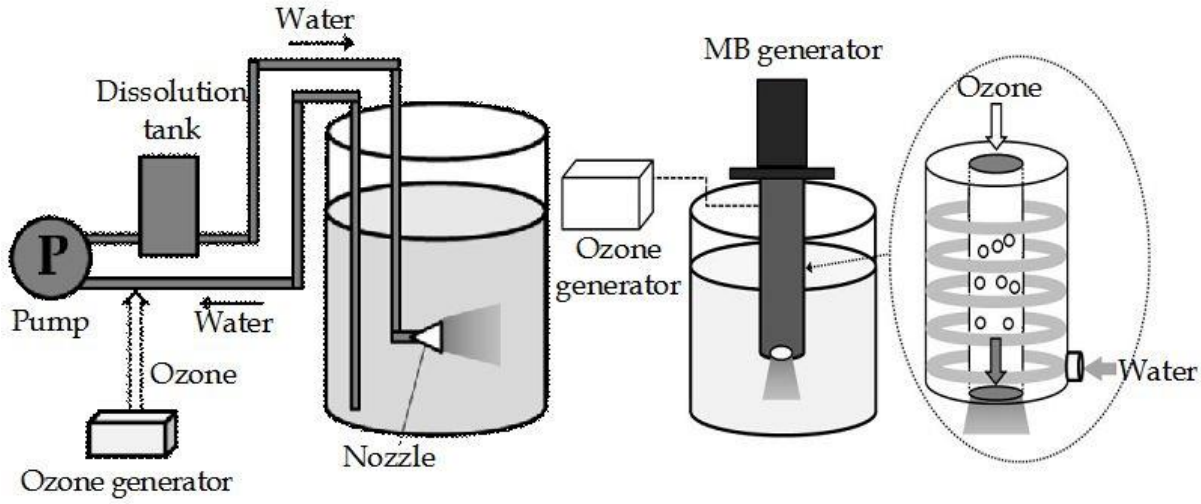

Fig 2.1 Removal of Residual Pesticides in Vegetables Using Ozone Micro bubbles

2.1.2 VEGETABLE SURFACE STERILIZATION SYSTEM USING UVA LIGHT EMITTING DIODES

Surface sterilization of fresh produce has been needed in the food manufacturing/processing industry. It is a UVA-LED (Ultra Violet A-Light Emitting Diode) system for surface sterilization that is safe, efficacious, low cost, and apparently harmless to fresh produce. To test the system, Escherichia coli strain DH5α was spot-inoculated onto vegetable tissues, and treated under UVA-LED. Tissues were homogenized and bacteria quantified by colony-forming assay. Bacterial inactivation by UVA-LED radiation was observed after a 10 min treatment and increased with increasing time of irradiation. The log survival ratio reached -3.2e3 after a 90 min treatment. Bacterial cells surviving treatment grew slowly compared to norn-irradiated control cells. Cabbage tissue lost weight over time after treatment, and weight loss increased with increasing incubation temperature, but there

was no difference between losses by UVA-LED treated and control tissues at any temperature tested.

In addition, no differences of Vitamin C content in cabbage tissue were detected by HPLC after UVA-LED treatment. These results suggest that UVA-LED treatment has great potential for vegetable surface sterilization in the food manufacturing/processing industry. The UVA-LED equipment was contained within a Carbon-Graphite covered acrylic box inside an incubator. During irradiation for various time periods, the temperature in the box was maintained at constant; control samples were kept in a completely dark environment at the same temperature for the same periods of time. The distance from the UVA-LED device to the surface of the vegetable tissue sample was set at 10-50 mm. Here used a high-power UVA-LED to construct a sterilization device; nine UVA-LEDs were connected in series to a DC [direct-current] power supply. Voltage and current of the circuit were set at constant 40.5 V and 0.5 A. UV light intensity was measured by an UV meter. The distance between the UVA-LED and the floor upon which vegetable tissue rested varied among experiments; the distance to the surface of the vegetable was 10-50 mm.

2.1.3 DUAL-FREQUENCY ULTRASONIC WASHING MACHINE FOR FRUITS AND VEGETABLES

Synthetic pesticide is an important invention of the 20th century, which has made great contribution to increasing crop yields. But the problems of pesticide residues and pesticide wastewater pollution have become much more serious. Sonolysis is widely reported as effective method in pesticide wastewater treatment. Ultrasonic waves travel in water, instantaneous negative pressure is generated in liquid when the ultrasonic power is large enough. When the medium molecular spacing increases, it crosses over critical molecular spacing and forms the cavitations' bubbles. The moment of bubbles explode can produce local high temperature, and high pressure environment. The water molecules crack and become strong oxidants such as OH, HO2 and O2. They can decompose the organic pesticides in water instantly.

The ultrasonic wave generator is a steel frame which contains many ultrasonic transducers with a total power of 400W. Size of the steel frame is fit to most washing pool in kitchen, and it should be put into the pool and filled with water until water went over its top edge. More water is also allowed unless the pool starts to overflow. Fruits and vegetables are put into the water without any detergent all of electronic modules are controlled by a MCU, and working parameters are set from control panel by people. The ultrasonic power supply

includes two signal generating circuit (low and high frequencies respectively), which generate sine waves and switched by a relay. The output of the signal generator is imported to power amplifier through signal-isolated circuit, which is used to avoid interference from strong electricity system. High power signal should be connected with impedance-matching balance transformer and matching inductor (low and high frequencies are different). Then the high power signal can drive ultrasonic transducers to generate ultrasonic waves. The control panel can shows time remaining and set working time or mode. What's more, there is a small ozonator in the machine case, and ozone is pumped through a long slender tubed into washing water. Sonolysis and ozonation have a synergy effect in the combined system. Ultrasonic wave breaks O3 into micro-bubbles and improved the solubility of O3 in solution. Meanwhile, micro-bubbles enhance the intensity of ultrasonic cavitation.

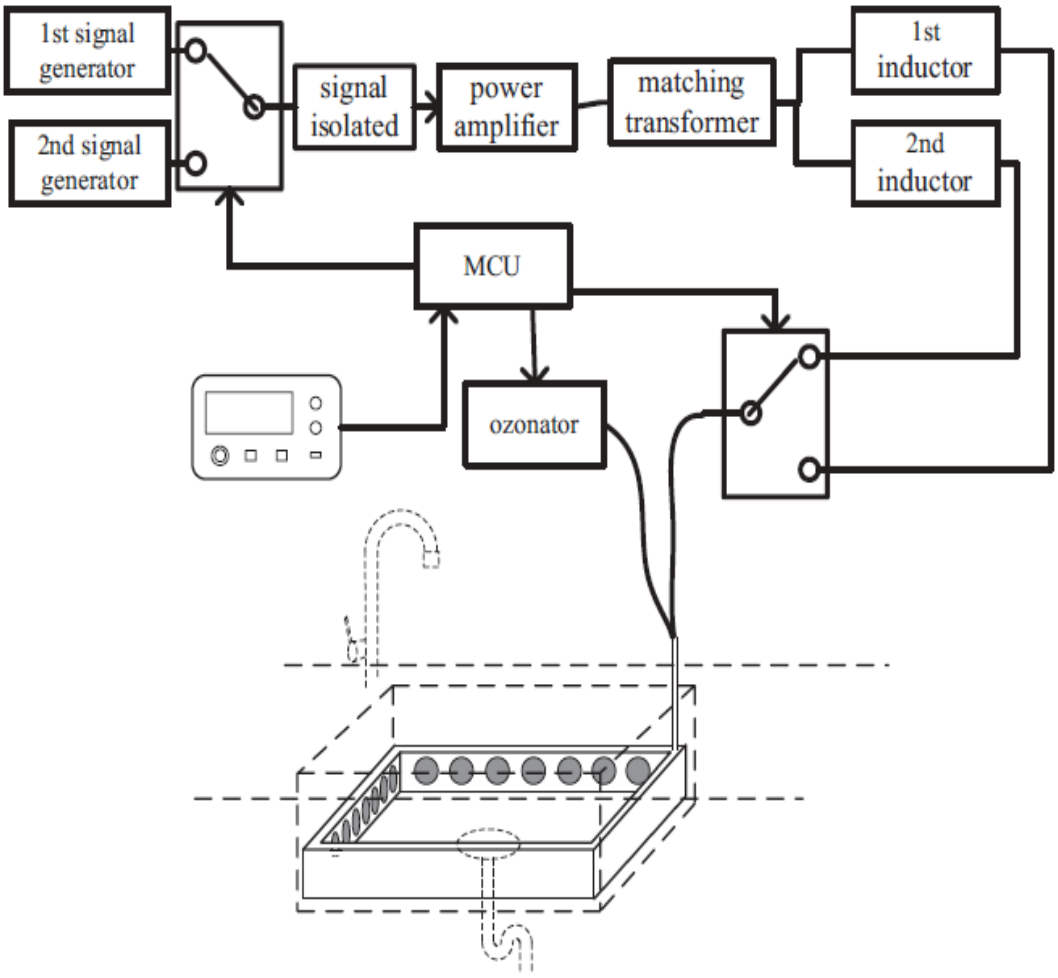

Fig 2.2 Structure of ultrasonic washing machine

2.1.4 DESIGN OF MILK ANALYSIS EMBEDDED SYSTEM FOR DAIRY FARMERS

In many dairy farms, computer aided control of physiological and sanitary parameters are already used and lead to a productivity increase and the elimination of some tedious operations. Embedded Technology is now in its prime and the wealth of knowledge available is mind-blowing. An embedded system can be defined as a control system or computer system designed to perform a specific task. Embedded systems are playing important roles in our lives every day, even though they might not necessarily be visible. This paper describes one of the applications of embedded system as "milk analyzer". It is Small compact, embedded in a single unit, requires less power and measure milk parameters like SNF (Solid but Not FAT), FAT, CLR, WEIGHT, PH, with less cost. The scattering of a beam of light by the fat globules present in the homogenized milk is the principle in the milk analyzer. The amount of light scattered by the milk sample is a measure of the fat content in the milk.

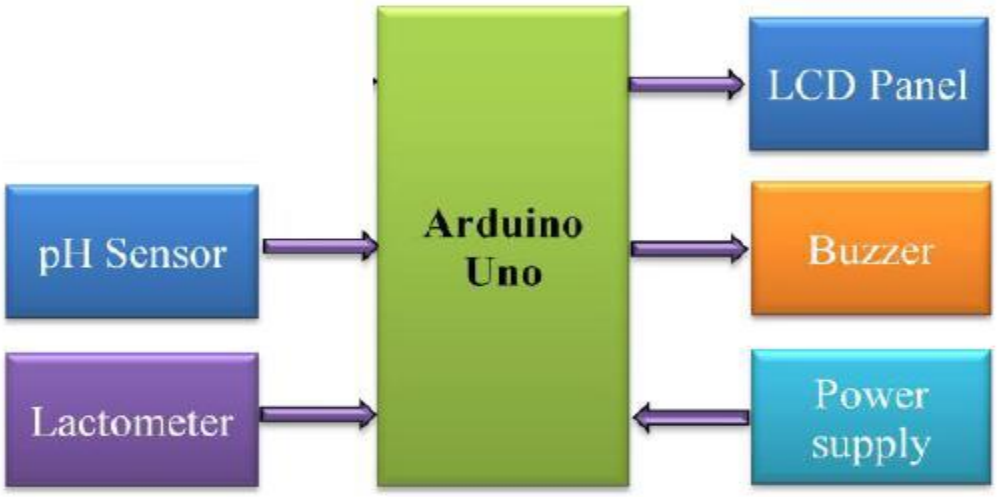

Fig 2.3 Block diagram of Milk parameter measurement system.

2.1.5 MICROWAVE COPLANAR SENSOR SYSTEM FOR DETECTING CONTAMINATION IN FOOD PRODUCTS

The accurate determination of the contamination in the food products such as milk, oil etc. is quite important for all the health programs especially in the developing part of the world. The detection of contamination is not very straight forward since the adulterated items are quite often of similar type as that of the base product, which makes it quite difficult to be detected using any simple approach. In this work, it is explored to detect the contamination in various food items with the help of a specially designed microwave sensor system, which is based on measuring the dielectric properties of the contaminated products and comparing these values with the reference dielectric property data of the pure samples.

The microwave coplanar sensor system is capable of measuring the dielectric properties of various liquid samples like milk and oil in a non-invasive way. It may be mentioned here that the most common approach for the broadband extraction of the permittivity of samples in the RF/microwave frequency band is the reflection/transmission method. This approach usually requires the measurement of reflection and transmission coefficients of the sample by placing the test specimen either in a section of transmission line such as the rectangular waveguide, the coaxial airline , or in free space. This work explores measurement of permittivity of liquids samples using multilayered conductor backed coplanar waveguide (MCCPW) configuration. A conductor backed coplanar sensor is designed for 50 ohms having the even mode field, and the air gap between the conductor and the ground is kept small so that most of the fields confine into the air gap. The designed sensor is placed over the sample container filled with the liquid whose permittivity is to be measured. The main advantage of the proposed approach as compared to previous methods based on planar lines is that the sample holder is not glued to the designed sensor, and hence the test specimen is not deep in touch with the sensor. In the present setup, a disposable liquid container is used, which can be directly placed below the sensor, after filling with the test liquid for extraction of the permittivity of test specimen.

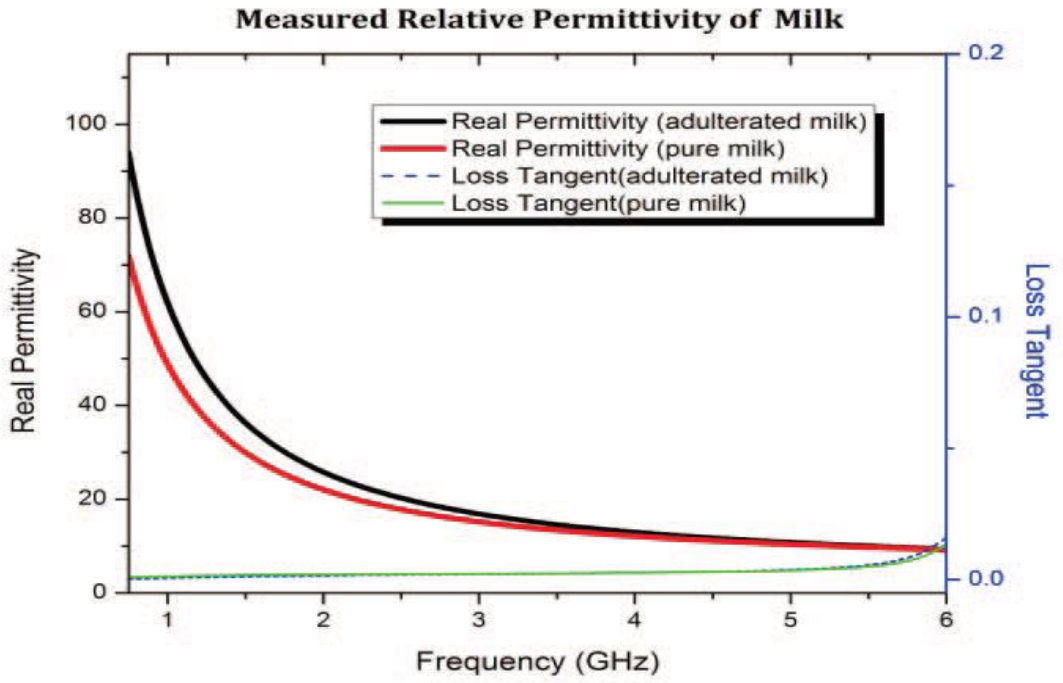

Fig 2.4 Permittivity of the pure and adulterated milk

The sensor setup consisting of the designed coplanar line along with the liquid filled container is connected to two ports of the vector network analyzer (VNA) to measure the

scattering parameters in the designated frequency band. The matrix approach is used to obtain the S parameters at the sample interface from the scattering parameters measured at the reference plane. The effective permittivity of the structure is calculated in terms of measured scattering coefficients using the modified version of the transmission/reflection theory.

2.2 LITERATURE SUMMARY

All the previous approaches to the vegetable washing and milk analyzer systems have its own advantages and disadvantages. Here the automatic vegetable and fruit washing concept is not completely satisfied. So by taking all the merits of current approaches and including extra features results the formation of FAVR. The primary approaches to vegetable washing are not fully automated and it is not much efficient. Lack of scientifically washing methods leads to less efficiency to them. In the milk analyzer system has no sensors to find the microbial activities. The microbial activities are an important part of milk quality checking. It can be detected by simple sensors. Microwave coplanar sensor system is highly expensive. Thus it has limitation for the commercial applications. Some previous systems are making side effects after sterilising the food particles. Thus a better and simple system is needed in this field.

From the survey on current washing systems we observed that those are not smart and inefficient. So we insisted to make a better replacement in such systems gives birth to FAVR. It is a complete smart system for washing vegetables and sterilizes it.

CHAPTER 3

FRUIT AND VEGETABLE RINSER (FAVR)

Pesticides are the most common agents in the struggle against pathogens, insects, rodents, and weeds for increasing productivity. Although the utilization of these pesticides can increase agricultural production, the misuse of them may result in the presence of residual pesticides in the agricultural products. Furthermore, they will pose a threat toward human being by bioaccumulation through the food. The food manufacturing/processing industry needs a surface sterilization method that eliminates pathogenic microorganisms but does not influence the taste or smell of food. Freshly harvested fruits and vegetables are considered high risk in terms of food safety.

The conventional ideas based on the vegetable and fruit washing system leads to the formulation of FAVR. This system sterilizes the vegetables scientifically with ozone and white acetic acid. In the second section it sterilizes the vegetables with appropriate temperature by the help of the blower. An exhaust fan is used to remove vapour and other dust content in the system. Simply the system should be very useful in washing and sterilizing the fruits and vegetables. The third section is especially for the milk consumers, in which we can detect the water content in the milk, fat and microbial activities in the milk. The ozonation process has been used as an effective method for removing residual pesticides in raw water during drinking water treatment and in agricultural products.

Pesticides are often expected to be destroyed by ozonation for ozone can selectively react with pesticides contained heteratoms such as S, N, O, and Cl . While other researchers found that the reactivity of pesticides with ozone varies largely due to their diverse structural features . At present, the ozone/ultrasound process is the most promising method for treating refractory organics in waste water. The milk analyser makes the system to another level. From this we can reduce the content of chemicals up to 90%. Then dealing with the dewatering and drying the food products under controlled atmosphere. By using blowers we can dehydrate the fruit and vegetables. The device will setup based on this method for measuring the milk quality. The device will observe to have almost negligible amount of delay for measuring and processing. The fat measurement will found to be very accurate and precise within the range of sample values.

3.1 HARDWARE DESCRIPTION

Since it is an embedded system project the main part of the FAVR is AVR microcontroller atmega 328.the system is specially designed for the kitchen purpose. To make it as a user friendly system, the design is important. The whole system is first designed by the software solid works. The detail about solid works is explained in the software section. The below figure shows that the mechanical covering of the FAVR. The chassis is planned to make with wood and plastic. A shuffling rotor is placed in the centre of the barrel. There is special chamber for white acetic acid and blower. An exhaust fan is provided at the top of the system for dehydration purpose.

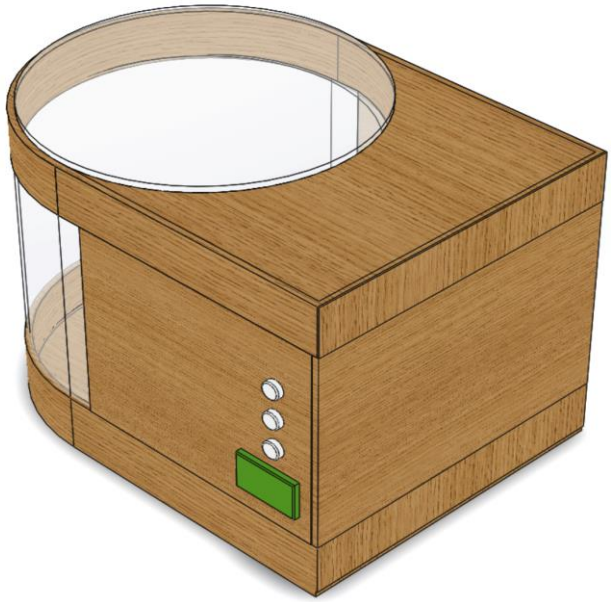

Fig 3.1 Isometric view of FAV-R.

The LCD displays the current status of the system. And buzzers and leds are placed as the status indicators. The shuffling motor is a motor with high torque and low rpm. It rotates in both clockwise and the anti-clockwise direction. The vegetables can put through the top and pick after rinsing. All of electronic modules are controlled by a MCU, and working parameters are set from control panel by people. By this method all microorganisms are completely destroyed due to high temperature. Microbial spoilage of food products is also controlled by using chemical preservatives which do not include salt, sugar, acetic acid, oils, alcohols, etc. thus the acetic acid act as a good preservation too.

3.2 BLOCK DIAGRAMS

The FAVR can be divided into two sections. First one is a vegetable washing section and the second one is the milk analyser section. The block diagram of vegetable washing section in the FAVR is shown below,

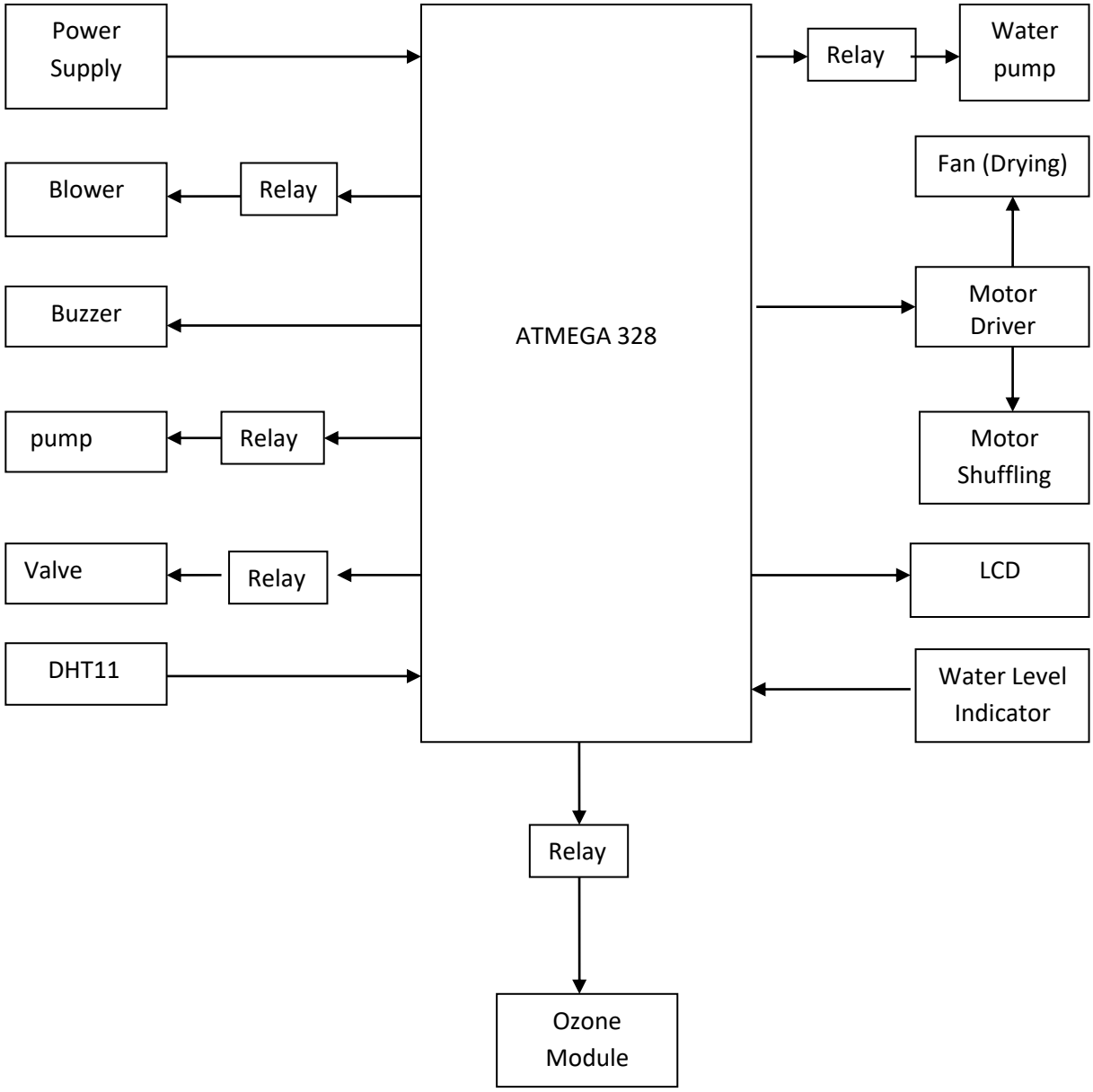

Fig 3.2 Block diagram of vegetable washing section.

With changing time and development in technology, we have considered designing such an instrument that will be useful to every milk consumers. Milk tester (called MILKOTESTER) is a very versatile device and is easily available in the form of palm hold, having input for analyzing milk, which shows in the form of LCD display. This is fully microcontroller based instrument low weight and easily accessible to the farmer. The block diagram of the milk analysing section is given below,

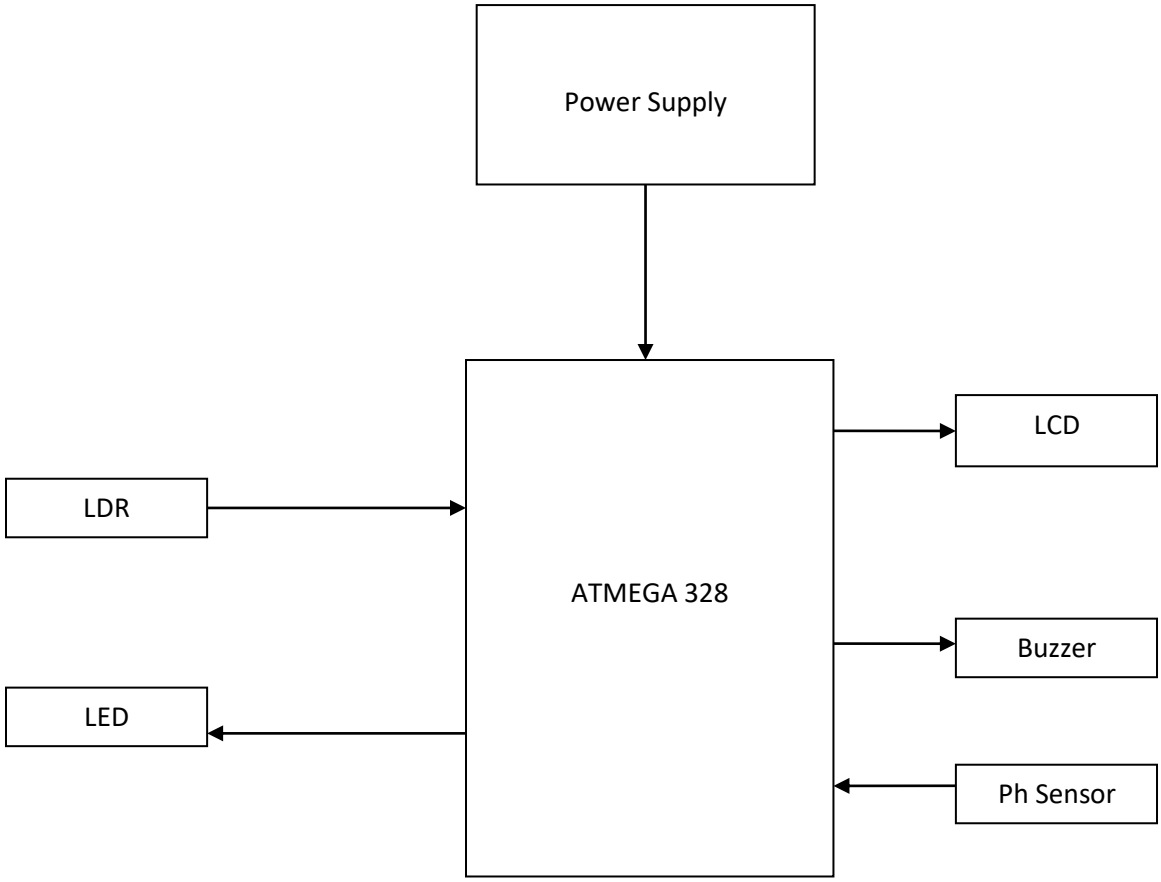

Fig 3.3 Block diagram of milkotester.

A high intensity LED is used as a light source. The light beam is made to pass through the sample solution (of milk) contained in the test tube. A LDR is placed exactly on the opposite side of the test tube to detect the amount of light passing through the test tube unscattered. To obtain maximum sensitivity the test tube is covered in wooden shield which has opening only for LED and LDR to pass through.

The combination of these two systems (vegetable washer & milkotester) is collectively called as the FAV-R. This project is excellent blending of bio-chemistry and electronics engineering.

3.3 CIRCUIT DIAGRAMS

3.3.1 THE MILKOTESTER

The complete circuit diagram of the milkotster is given as in the figure 3xxx . the LDR and ph sensor gives better result. Thee atmega 328 is used as the microcontroller. For both LDR and ph sensor the analogue pins are used.

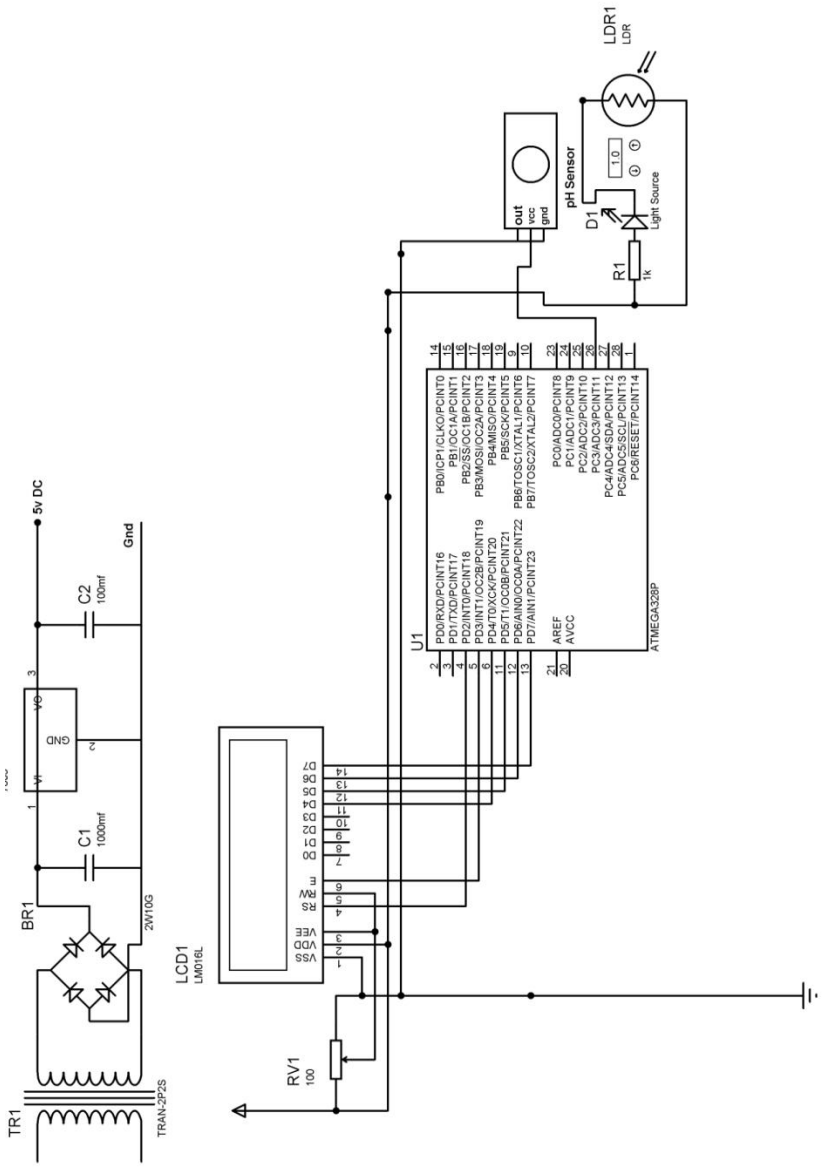

Fig 3.4 circuit diagram of milk section.

3.3.2 THE WASHING SECTION

In the washing section ozone, blower and other components are interfaced with the atmega328 controller by using relays. Here relay act as either switch or current amplifiers. Since, we are using ac devices with the controller, some precautions to be taken. Ozonizer

can work up to 30 minutes. And blower shut downs after temperature sensor achieves 55℃. The shuffling motor and DC pumps are placed as per the design. The complete circuit diagram of the washing section is given in the figure xxxxxx

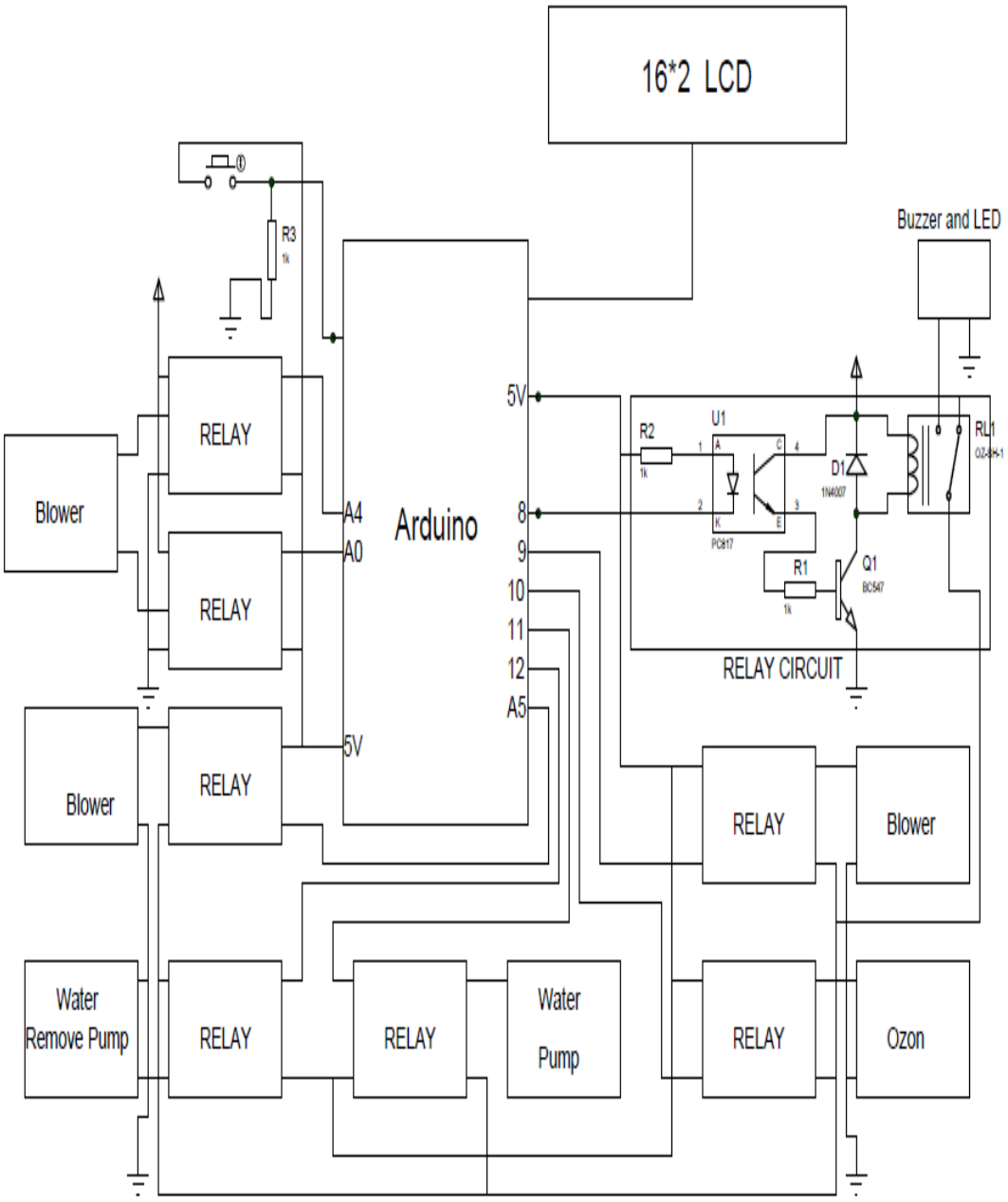

Fig 3.5 circuit diagram of washing section.

3.4 SOFTWARE DESCRIPTION

3.4.1 EMBEDDED SYSTEMS

An embedded system is a special purpose computer system, which is completely encapsulated by the device it controls. It is called “embedded” because the micro controller is

inside some other system. An embedded system has specific requirements and performs predefined tasks unlike a general purpose personal computer. An embedded system is a combination of computer hardware and software and perhaps additional mechanical or other parts, designed to perform a dedicated function.

Features of Embedded Systems:-

- It is a combination of software and hardware.
- It is a system that has a computing device embedded into it.
- They are designed around a micro controller which integrates memory and peripherals.

Characteristics and benefits of Embedded Systems:-

- Sophisticated functionality.
- Real time operation.
- Low manufacturing cost.
- Low power consumption.
- Eliminates necessity of complex circuitry.
- Smarter products.
- Smaller size.

3.4.2 ARDUINO IDE

A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio.

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages *Processing* and *Wiring*. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.A program written with the IDE for Arduino is called a *sketch*. Sketches are saved on the development computer as text files with the file extension *.ino*. Arduino Software (IDE) pre-1.0 saved sketches with the extension *.pde*.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

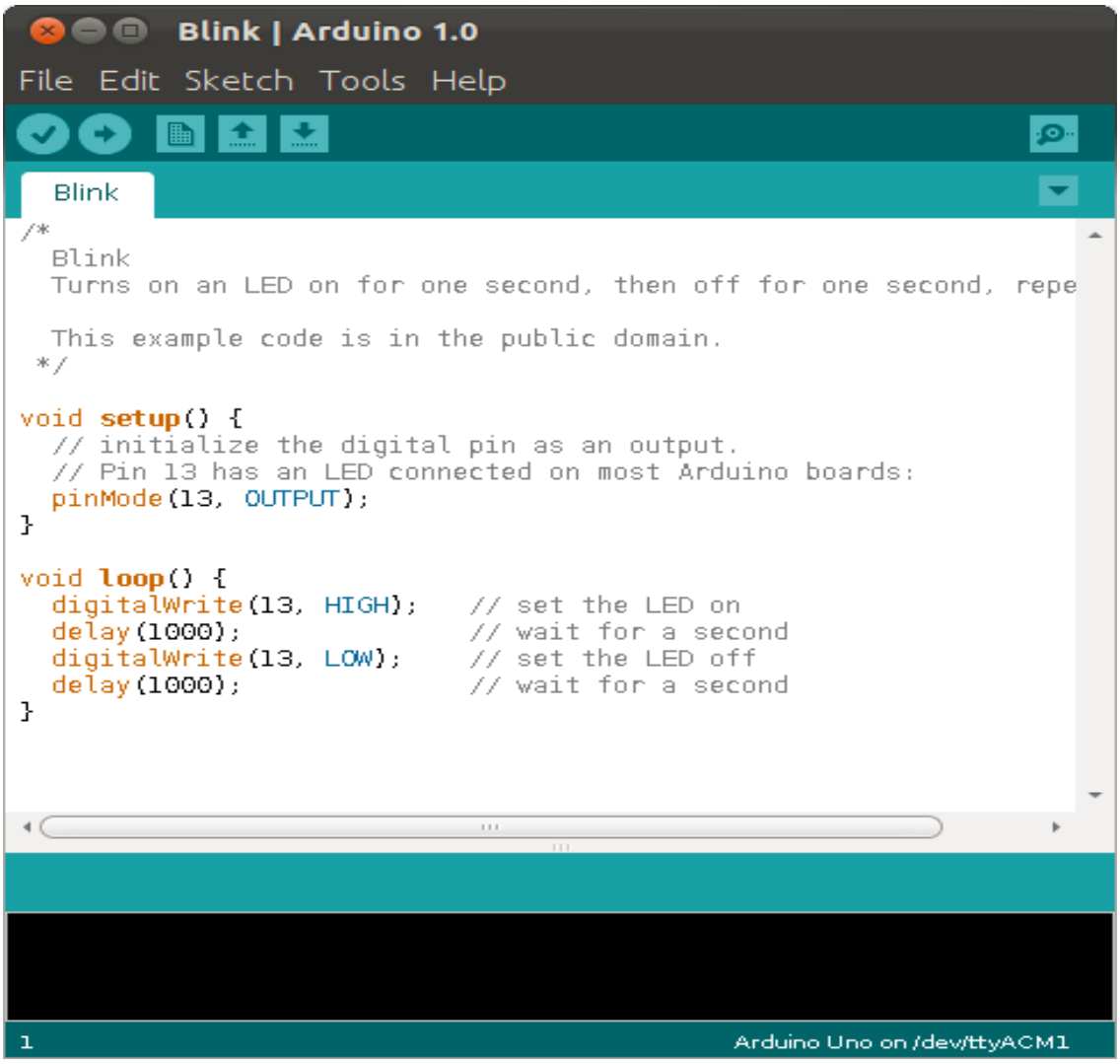

Fig 3.6 Screenshot of the Arduino IDE showing the simple beginner program

This program uses the functions *pinMode()*, *digitalWrite()*, and *delay()*, which are provided by the internal libraries included in the IDE environment. The program is usually loaded in the Arduino by the manufacturer. Arduino IDE and C language allow the programming of the low level registers in the atmega328P.

3.4.3 PROTEUS 7.9 SIMULATOR

Proteus developed by Labcenter Electronics, is software with which you can easily generate schematic captures, develop PCB and simulate microprocessor. It has such a simple yet effective interface that it simplifies the task required to be performed. This one aspect has attracted many users to select this tool amongst many others offering the same services. Proteus provides a powerful working environment.

The user can design different electronic circuits with all the necessary components easily accessible from the simple yet effective interface like signal generators, power supply, simple resistor and a different microcontroller or microprocessor. VSM (Virtual System Modeling) feature allows the real time design simulation. It is armed with the mixed-mode SPICE simulation. ARES (Advanced Routing and Editing Software) is another powerful feature that permits you to route or edit the different components which are used for producing printed circuits.

The application is extensively used in the educational institutions as it is easy to use. Novices can operate it with ease and start producing simulation, board designs and schematics of higher level. Al in all Proteus 7.9 is a user friendly tool that can be used for making some high level schematics and simulation. An ideal application for the students who want to master their skills relating circuit designs and schematics.

Features of Proteus 7.9:-

- Easy to use tool.
- Simple but effective interface.
- Circuit designing and schematic making made easy.
- Provides a powerful working environment.
- Real time design simulation with VSM.
- Can route and edit different components using ARES feature.

3.5.4 SOLID WORKS

Solid Works is a solid modelling computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows. Solid Works is published by Dassault Systèmes. Building a model in Solid Works usually starts with a 2D sketch (although 3D sketches are available for power users). The sketch consists of geometry such as points, lines, arcs, conics (except the hyperbola), and spines. Dimensions are added to the sketch to define the size and location of the geometry. Relations are used to define attributes such as tangency, parallelism, perpendicularity, and concentricity. The parametric

nature of Solid Works means that the dimensions and relations drive the geometry, not the other way around. The dimensions in the sketch can be controlled independently, or by relationships to other parameters inside or outside of the sketch.

Fig 3.7 Side view of FAVR designed by solid works.

3.5 COMPONENTS

3.5.1 MICROCONTROLLER- ATmega328/P

The Atmel picoPower ATmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328/P achieves throughputs close to 1MIPS per MHz. This empowers system designed to optimize the device for power consumption versus processing speed. The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The detailed pin description of atmega 328p is given in appendix A.

The pin out diagram of atmega 328p is shown below; it is a 28 pin IC. The device operates between 1.8-5.5 volts.

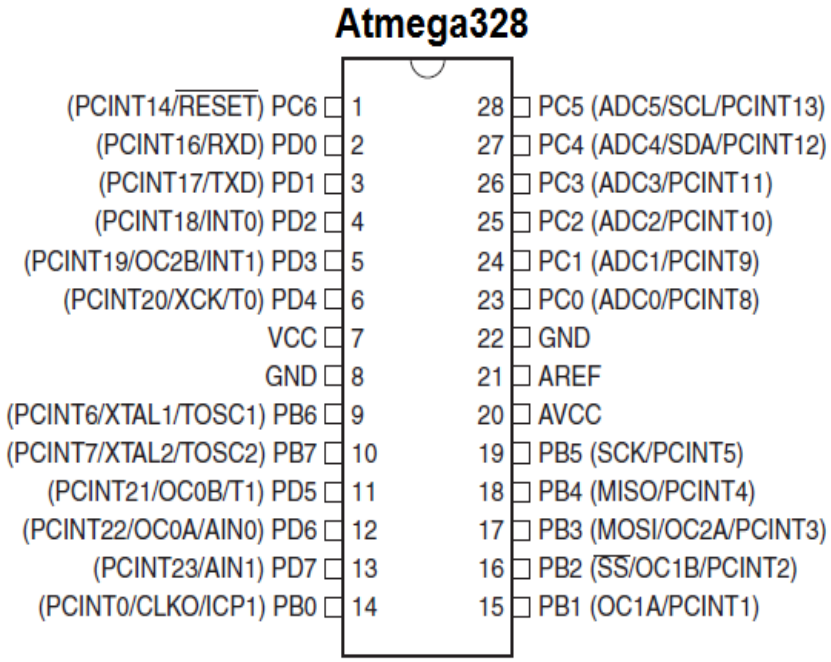

Fig 3.8 Pin out diagram of atmega 328.

Features:-

- High Performance, Low Power Atmel AVR 8-Bit Microcontroller Family
  - Advanced RISC Architecture
    - 131 Powerful Instructions.
    - Most Single Clock Cycle Execution.
    - 32 x 8 General Purpose Working Registers.
    - Fully Static Operation.
    - Up to 20 MIPS Throughput at 20MHz.
    - On-chip 2-cycle Multiplier.
  - High Endurance Non-volatile Memory Segments
    - 32KBytes of In-System Self-Programmable Flash program Memory.
    - 1KBytes EEPROM.
    - 2KBytes Internal SRAM – Write/Erase Cycles: 10,000 Flash/100,000 EEPROM.
    - Data Retention: 20 years at 85°C/100 years at 25°C (1).
    - Optional Boot Code Section with Independent Lock Bits.

3.5.2 LIQUID-CRYSTAL DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals. The LCD sub module we have is 16x2 CP162A. The module operates in two modes (4-bit and 8-bit). Since we were using 4 data bits, we use the LCD in 4-bit mode. Since we are only writing data to LCD memory we have grounded the R/W bit (0 for Write) this is realized by sending certain command signals to the LCD sub module when it powered on and initialized. This is followed by a series of commands for clearing the display and initializing the position of the cursor on the LCD. Delay is added between successive commands for stable operation of LCD. The LCD displays the message supplied as input in a marquee fashion. In addition to all of the above, a variable resistance is needed in order to change the contrast of the LCD.

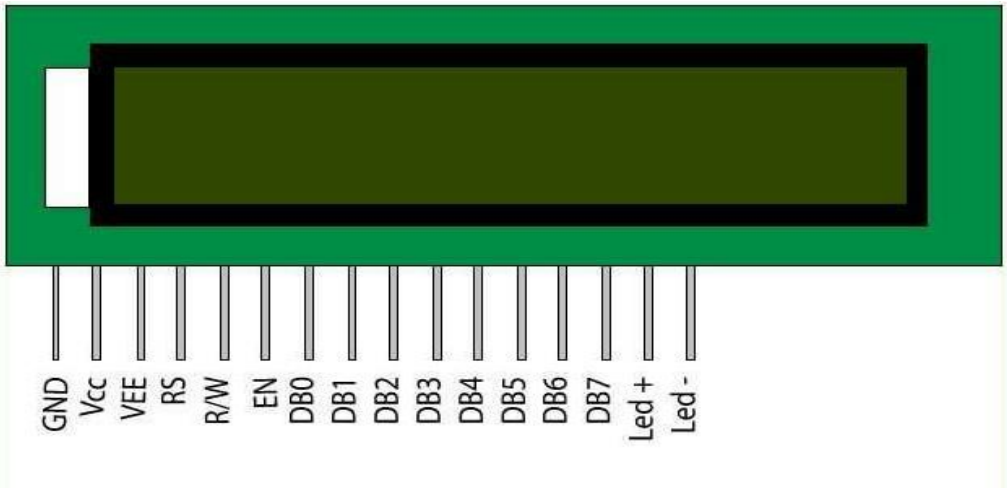

Fig 3.9 Pin diagram of LCD

3.5.3 DHT11-TEMPERATURE SENSOR

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old. Other features are given by,

- Low cost
- 3 to 5V power and I/O
- 2.5mA max current use during conversion (while requesting data)

- Good for 20-80% humidity readings with 5% accuracy
- Good for 0-50°C temperature readings ±2°C accuracy
- No more than 1 Hz sampling rate (once every second)
- Body size 15.5mm x 12mm x 5.5mm

3.5.4 RELAY

A relay is an electrically operate switch. Many relays use an electromagnet to operate a switching mechanically, but other operating principles are also use. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. It takes relatively small amount of power to turn on a relay but the relay can control something that draws much power. First relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and retransmitting it to another.

Fig 3.10 Relay.

3.5.5 BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

3.5.6 DC POWERED PUMP

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power. The main advantage of DC (direct current) pumps over AC (alternating current) pumps is that they can operate directly from a battery, making them more convenient and portable. They are easier to operate and control, since AC systems typically require a controller to manage speed. DC pumps also tend to be more efficient. However, AC pumps

usually are designed for higher speeds and larger bursts of power. They also have a longer working lifespan than DC pumps.

Fig 3.11 Dc powered water pump.

3.5.7 LM7805/12

IC 7805 is a DC regulated IC of 5V. This IC is very flexible and is widely employed in all types of circuit like a voltage regulator. It is a three terminal device and mainly called input, output and ground. Pin diagram of the IC 7805 is shown in the diagram below.

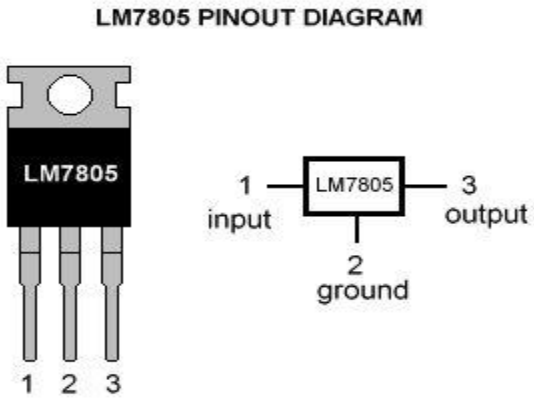

Fig 3.12 Pin diagram of LM7805

3.5.8 LIGHT EMITTING DIODE

A Light emitting diode (LED) is essentially a pn junction diode. When carriers are injected across a forward-biased junction, it emits incoherent light. Most of the commercial LEDs are realized using a highly doped n and p Junction. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing the energy in the form of photons. This effect is called electroluminescence, and the color of the light is determined by the energy band gap of the semiconductor.

3.5.9 POWER SUPPLY

This is a simple approach to obtain a 12V and 5V DC power supply using a single circuit. The circuit uses two ICs 7812(IC1) and 7805 (IC2) for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer T1, rectified by bridge B1 and filtered by capacitor C1 to obtain a steady DC level .The IC1 regulates this voltage to obtain a steady 12V DC. The output of the IC1 will be regulated by the IC2 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained.

Such a circuit is very useful in cases when we need two DC voltages for the operation of a circuit. By varying the type number of the IC1 and IC2, various combinations of output voltages can be obtained. If 7806 is used for IC2, we will get 6V instead of 5V.Same way if 7809 is used for IC1 we get 9V instead of 12V.

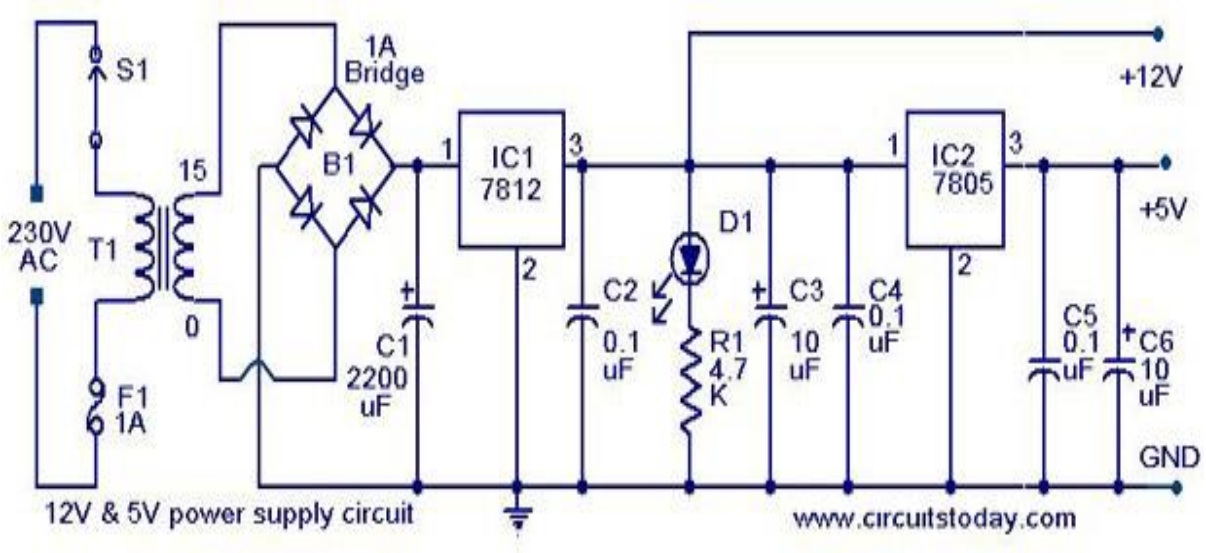

Fig 3.13 Power supply circuit.

3.5.10 DC MOTOR

It is an electric motor that converts electrical energy into mechanical energy and it is called a DC Motor, because it works on direct current. 8V DC power supply is required for the DC Motor for its operation. In this project DC Motor is used to operate shuffle the vegetables.

Fig 3.14 Geared 8v/10 rpm DC motor.

3.5.11 SWITCHES

In each cabins we are provided switches for giving the instructions. Push buttons are used because of its simple structure and low cost. There are three cabins provided in this project. A switch is provided for resetting the system if there is any working problem. The power switch is related with a buzzer.

Fig 3.15 Push button

3.5.12 OZONE GENERATOR

Because of its relatively short half-life, ozone is always generated on-site by an ozone generator. The two main principles of ozone generation are UV-light and corona-discharge. Ozone generation by corona-discharge is most common nowadays and has most advantages. Advantages of the corona-discharge method are greater sustainability of the unit, higher ozone production and higher cost affectivity. An ozone production unit with corona-discharge consists of the following parts: oxygen source, dust filters, gas dryers, ozone generators, contacting units and torch destruction. In the ozone generator, the corona-discharge element is present, which provides a capacitive load. In here ozone is produced from oxygen as a direct result of electrical discharge. This corona-discharge ruptures the stable oxygen molecule and forms two oxygen radicals. These radicals can combine with oxygen molecules

to form ozone. To control and maintain the electrical discharge, a di-electric is present, carried out in ceramic or glass. The excessive heat of the electrodes is often cooled.

Purify the water and rise oxygen to sterilize. Degraded pesticide residues and keep Fruits and Vegetable fresh. Reduce and resolve chemical medicine on the surface of fruits and vegetables. Remove all kinds of bad smell in refrigerator very quickly. Clean the air and remove the odor. Make air clean in room. Increase ozone in fish jar and purify the water. Resolve hormone in meat and make it nutrient and healthy. Beriberi therapeutic health care. Specifications: Model :- PX-902 Type: Ozone Purifier Material: ABS Timer: 1-30mins: 5, 10, 15, 20, 25, 30mins Ozone Output: 400mg/h Rated Voltage: AC 220V 50Hz Rated Power: 15W.

Fig 3.16 ozone generator

3.5.13 BLOWER

An air heater or blower is placed for the dehydration purpose. The water content ion the surface of the vegetables and fruits can be reduced by this method. But the actual purpose of the blower is it is a part of the heat process which is a sterilization method. The only way to prevent condensation is to reduce the dewpoint temperature which is only possible by installing a

suitable compressed air dryer. Summits with its rich experience provides innovative solutions to produce dry air by means of using desiccant adsorption technology.

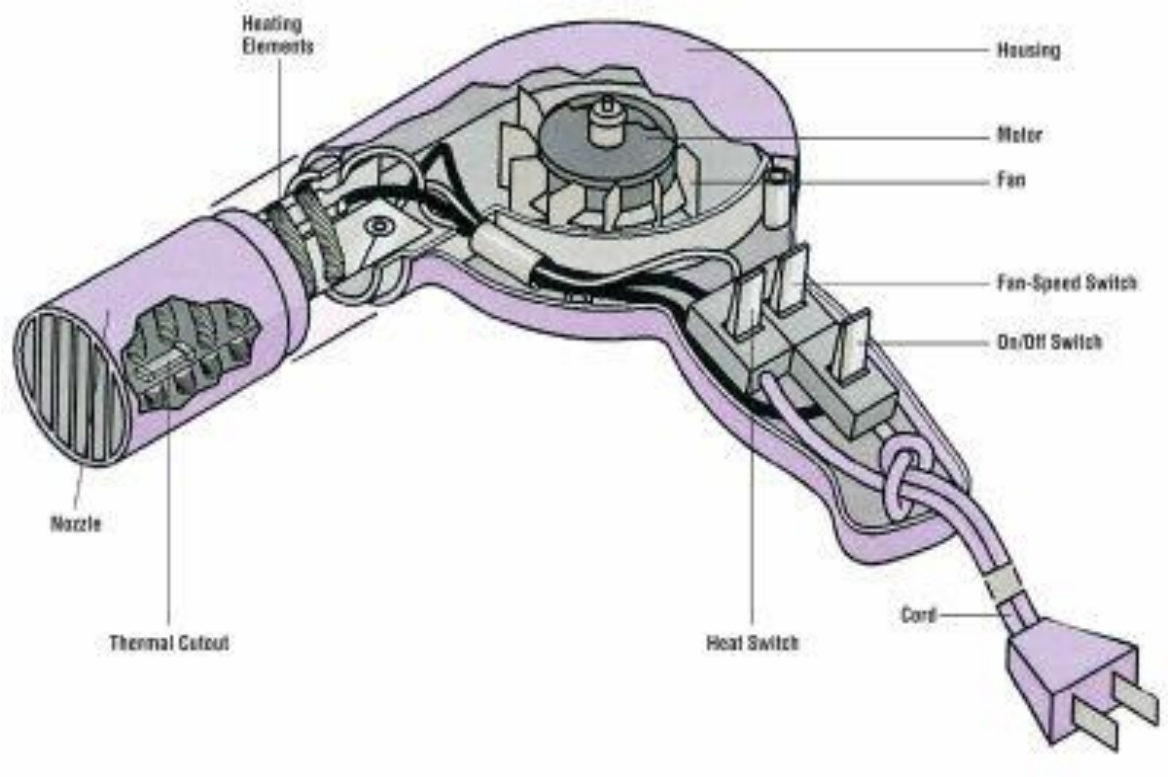

Fig 3.17 Blower internal structure.

CHAPTER 4

RESULTS

4.1 DESIGNED BY SOLID WORKS

The entire chassis or covering of the FAVR is completed by using the CAD software called solid works. The chassis is planned to make with wood. The barrel is planned to make with plastic which is low cost. The below figure is the side view of the FAVR which is designed with solid works,

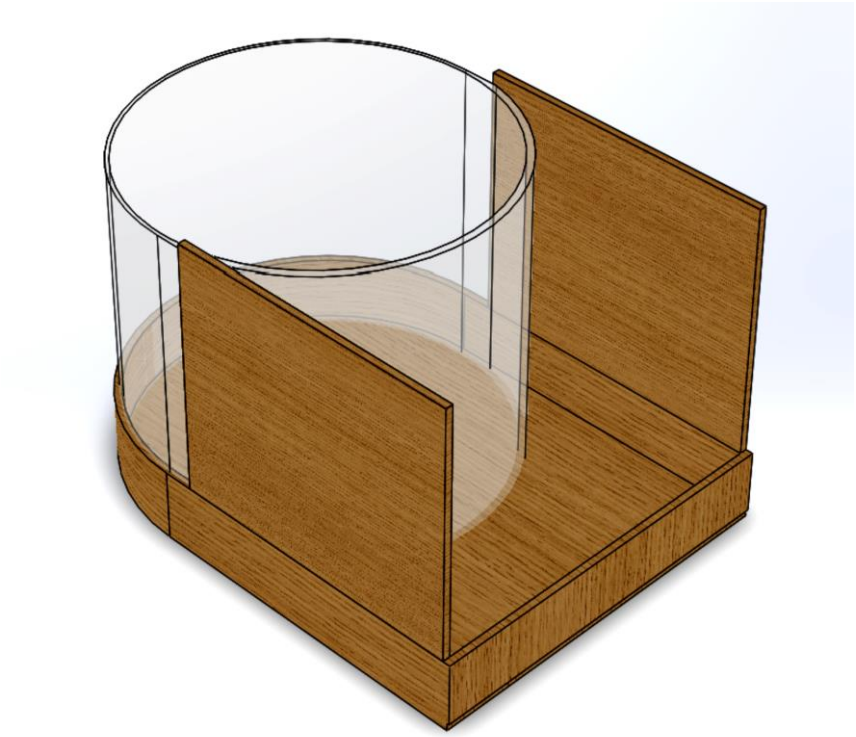

Fig 4.1 Design using solid works.

4.2 SIMULATED RESULT

Completed development of working model of “fruit and vegetable rinser-FAVR” and successfully implemented programming and simulation of system with the help of Proteus and arduino software. It is impossible to add simulation of the ozone generator and blower in the simulation. Thus it is indicated by simple LEDs and motors. Since, the arduino IDE is used the arduino uno board is used for simulation purpose. Actually atmega 328 is planned to use. Due to lack of boot loader arduino uno is used and simplified the simulation.

The below circuit diagram is only prepared for the simulation purpose. It is not the actual circuit diagram. For simplification ozone, blowers are indicated as LEDs in the below system.

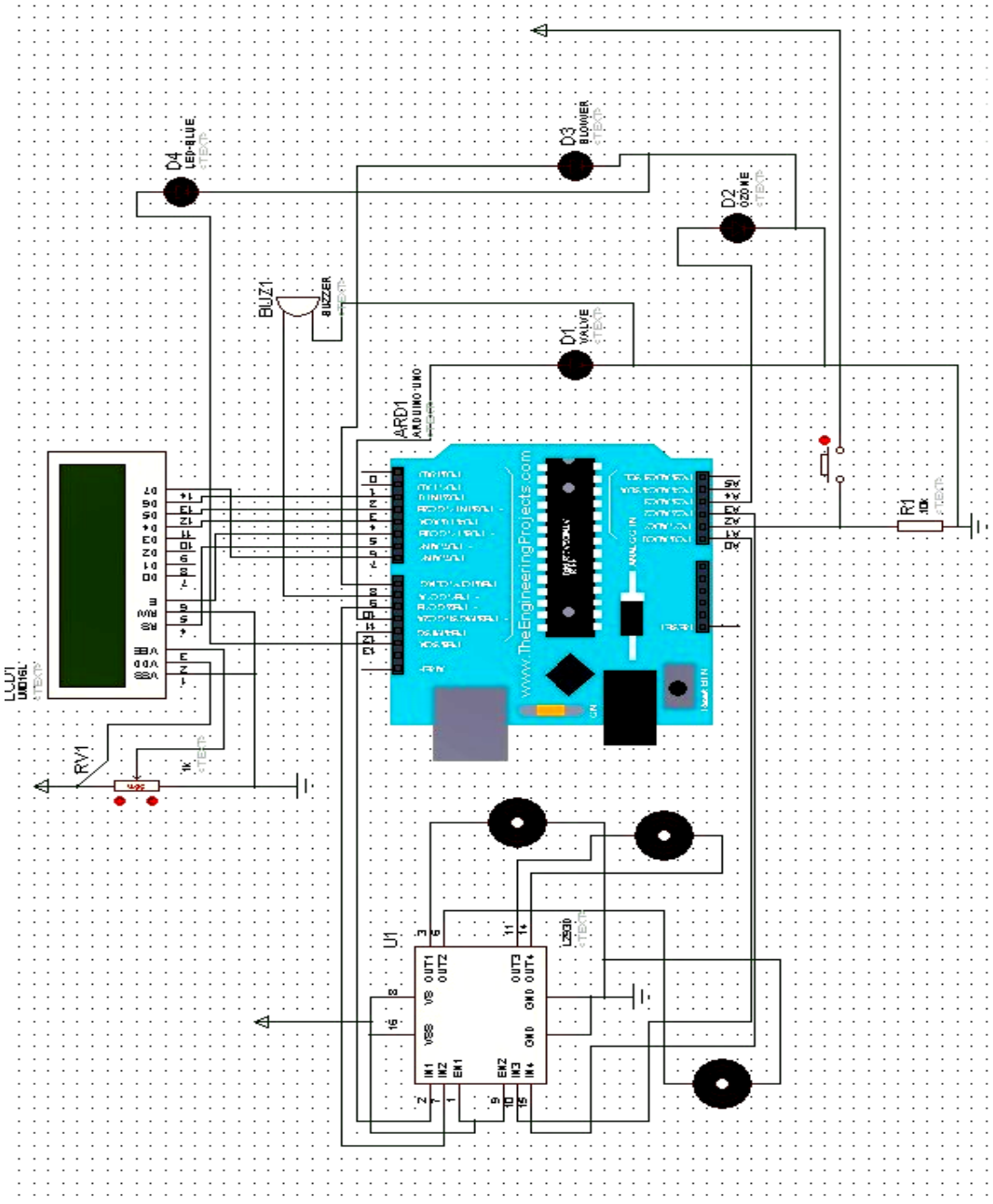

Fig 4.2 Simulation circuit diagram of vegetable washing section.

4.3 HARDWARE RESULT OF MILK SECTION

Just completed the hardware parts and software of the milk section. It gives approximately accurate value of water content and fat in the milk. The hardware section of the milkotester is shown in figure 4.3. and the LCD which indicating the quality of the milk is given in the figure 4.4

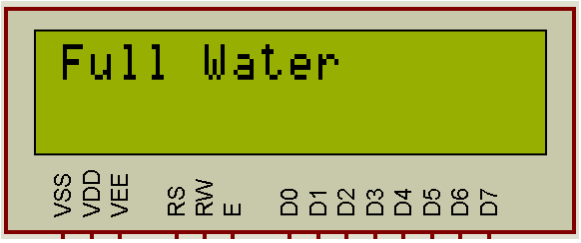

Fig 4.3 LCD monitor of washing section

4.4 HARDWARE RESULT OF WASHING SECTION

The chassis is planned to make with wood and plastic. A shuffling rotor is placed in the centre of the barrel. There is special chamber for white acetic acid and blower. The entire device is shown in the figure 4.5. The picture of the monitoring section (LCD)is given as in figure 4.6

Fig 4.4 Fruit and vegetable rinser (FAVR)

Fig 4.5 LCD monitor of washing section

CHAPTER 5

ADVANTAGES

The FAV-R is a fully automated system for sterilizing and washing of the fruit and vegetables. The biggest advantage of this system is that it does not have any side effects to the human body. The system is scientifically best in all nature. It removes the pesticides, fertilizers and other chemicals within minutes. The milk analyser part of the system is very useful in checking quality of milk and its contamination. It is a user friendly system. Also it reduces the human work force and save money as well as time. The blower makes the system hygienic and it is a part of heat sterilisation, which is a best treatment process for the veggies and fruits. When compared to other system it is more efficient and reliable. It is small in size, thus utilisation of installing space is reduced. FAV-R is portable to anywhere. It surely satisfies all the targeting consumers.

CHAPTER 6

APPLICATIONS

As we know that the system is designed for the kitchen environment. It is very useful in kitchen, hotels and other food industries to wash and sterilize the food products. The milkotester is very useful for the dairy farmers and it is useful in small scale industries. The system is designed as very small. But it is also applicable in large scale too. For example, in the whole sale stalls of vegetables and fruits. It surely becomes a revolution in the agricultural field. Simply it improves the health of the generation and reduces food related diseases. Meat can also washed through this machine, but it is not advisable due to the hygienic reasons.

CHAPTER 7

CONCLUSION

FAV-R is a simple washing machine for the fruits and vegetables. It has the facility to check quality of the milk and can give accurate values. The system is designed and a simulation is implemented successfully in first phase of the project.. Nowadays it is very important to wash the food products, because of use of pesticides, fertilizers and other chemicals. FAV-R always promotes vegetarians and veg products. Since, the vegetables are a common food item which we consume in real life. The conventional ideas based on the vegetable and fruit washing system leads to the formulation of FAVR. This system sterilizes the vegetables scientifically with ozone and white acetic acid. This machine is going to be a vital part of the kitchens, hotels and other food industries on coming days.

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APPENDIX A

PIN DESCRIPTIONS OF ATMEGA 328p

- VCC:-

  Digital supply voltage.

- GND:-

  Ground.

- Port B (PB[7:0]) XTAL1/XTAL2/TOSC1/TOSC2:-

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier.

If the Internal Calibrated RC Oscillator is used as chip clock source, PB[7:6] is used as TOSC[2:1] input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.

- Port C (PC[5:0]) :-

Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC[5:0] output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- PC6/RESET:-

If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C.

If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a Reset.

The various special features of Port C are elaborated in the Alternate Functions of Port C section.

- Port D (PD[7:0]):-

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- AVCC:-

AVCC is the supply voltage pin for the A/D Converter, PC [3:0], and PE [3:2]. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC[6:4] use digital supply voltage, VCC.

- AREF:-

AREF is the analog reference pin for the A/D Converter.

- ADC[7:6] (TQFP and VFQFN Package Only):-

In the TQFP and VFQFN package, ADC [7:6] serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.