COIN DETECTING AND COUNTING USING ARDUINO UNO

A mini project report submitted to

Jawaharlal Nehru Technological University Kakinada, Kakinada in the partial Fulfillment for the Award of degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

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(AUTONOMOUS)

An ISO 9001:2008 Certified institution, approved by AICTE & Reaccredited by NBA, NACC 'A' Grade

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CERTIFICATE

This is to certify that the Technical report entitled "COIN DETECTING AND COUNTING USING ARDUINO UNO" is a bonafide work of the following final B.Tech students in the partial fulfillment of the requirement for the award of the degree of bachelor of technology in ELECTRONICS AND COMMUNICATION ENGINEERING for the academic year 2018-2022.

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ABSTRACT

Now-a-days, manually coin counting is very difficult in this fast world. So, here is a model to make easy of this task. In this model, we can sort variety of coins with different sizes and shapes. Along with sorting different coins we can display the count of that collection. In this method, to avoid such duplicate materials, we can also identify the nature of inserted component using a sensor called IR proximity sensor.

Here, IR sensors are placed at different output paths of the coin sorting machine to sense the coins. When a coin is inserted into this Arduino coin counter, it enters the dedicated path as per the mechanical design and the respective IR sensor senses the coin and gives HIGH output value to the Arduino which can be read by the analog pins of Arduino. The IR sensor which is giving HIGH value, decides the coin value like Rupees 1/2/5/10.

Here a 16x2 Alphanumeric LCD is interfaced with Arduino using an I2C module, to display the number of coins inserted into the box. This LCD can also be connected to Arduino directly without using the I2C module, but this requires more number of connections. So to make it simpler, an I2C module is used along with LCD, which only uses 2 pins, i.e. SCL, SDA for connecting LCD with Arduino. For powering the Arduino, a 12VDC, 1 AMP AC-DC adapter is used, which can be directly connected to the power jack of Arduino.

CHAPTER-1
INTRODUCTION

A coin sorter sorts a different collection of coins into separate bins. Coin sorters are specific to the currency of certain countries, as the countries are issuing same sized coins for different value. Most of the coin sorters are armed with a screen which displaying the number of coins or the value of the coins that are passed through the machine. A "coin counter" refers to a device which sorts and counts coins simultaneously, or it only counts presorted coins which are of the same size. A coin counter of presorted coins uses a bowl which has a flat spinning disc at the bottom, which is used to distribute coins around the perimeter of the bowl. The opening at the edge of the bowl can accept only one coin at a time. The Coins can be either passed through a light-beam counter, or spring-loaded cam which only accepts one coin at a time. A coin counter's good standard is that it has a counting speed of 300 coins per minute. Separating, sorting and counting coins of the same is an activity that demands accuracy, security and reproducibility. When people have to separate, sort and count coins for multiple currency species, they have to be manually separated before identifying and counting the coins in this project, coin sorting is done based on coin dimensions, coin is identified and counted by infrared sensor and maker nano. The count will be displayed on LCD display.

1.1 Design Setting:

In the Philippines, the first coins were used in 1861. Until now, people still use coins in their everyday lives. There are those that deal with coins everyday like banks, transport groups, casinos, charitable institutions and the like. Daily, banks produce and receive coins which they deliver to other establishments to supply their need for coins. Charitable institutions like churches gather coins from donations during mass. And in public transport sector, coins are widely used whether as fares or change. These establishments' count and sort coins every day. Without the use of machines that can handle large operations regarding coins, an establishment needs to hire an extra employee just to deal with coins or just count them manually where it could take too much of his time which could be used for other work. The design was developed

to help the trade and industry in counting coins faster and easier. Using phototransistors, the design counts faster and more accurate because it is not sensitive to visible light. A PIC Microcontroller was used to determine the total number of coins, total amount per denomination and the total amount of all coins. A three-way switch is also used to stop the count every 50 or 100 coins or to continuously count.

It is surprising how people manage to sort and count coins especially in large quantity. The group thought of a design that would try to help and solve the problem of counting coins of large quantity. With the design, the group can help the trade and industry by providing a simple yet effective way of dealing with large quantity of coins and saving precious time which can be put to other work.

1.2 Statement of the Problem:

Persons who manually sort and count coins of large quantity usually take too much of their time and may refrain themselves from doing other tasks. There are available coin sorters and counters in the market but are very expensive. The main problem of the study is to find a way to count and sort Philippine coins of Different denominations in less time and with accuracy.

1.3 Objective of the Design:

The general objective of the design was to develop a coin sorting machine that sorts and counts Philippine coins. The other specific objectives were as follows:

- Use the Arduino Microcontroller to program the machine to stop every 50 or 100 coins counted.
- Provide more accuracy and reliability in counting coins.
- Create a design with less cost and simpler.
- Sort a variety of coins in less time.
- To contribute something beneficial to the trade and industry.

1.4 Significance of the Study:

This study is an improvement of the existing coin sorter being used in the country. The group wanted to share the design project to owners of establishments and small businesses by letting them try to use this kind of technology in their everyday dealings with sorting and counting coins. The proposed design will be affordable to ordinary people and can be applicable to various industries like banking, charitable institutions and etc. The design is also implemental because the equipment and materials to be used are locally available. The users also have an option to limit the coins to be sorted. To students, the design will be beneficial since it develops their creativity by improvising on their own way on how to sort and count different denominations of Philippine coin. The design would be helpful to students especially those who keep spare coins and store them in a piggy bank. Students will have an easier task of counting coins. The school especially the treasury department can directly benefit from the design since it can use the machine for its daily operation. A good example will be during the enrollment period when treasury personnel are handling large amount of coins. They can use the design to sort or count coins according to denomination.

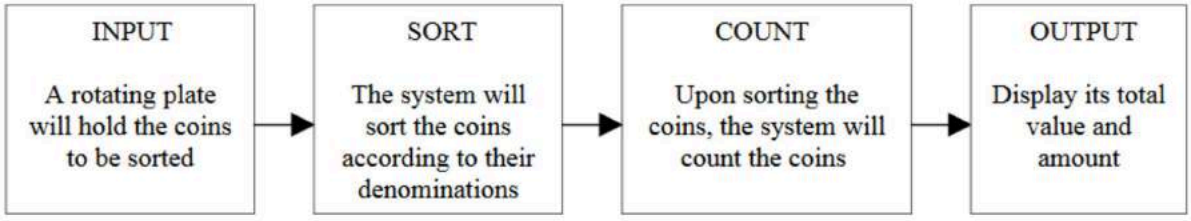

Figure 1 Block Diagram

The design will sort the coins according to its denomination and size, starting from the smallest to the largest coin. The designers thought that this is the best way to sort coins. A coin slot will be used to distinguish the difference between a 5 peso coin and a 10 peso coin since they are similar in size. A sensor will be used to count the sum total of the coins and display the value to a Liquid Crystal Display (LCD) panel.

1.5 Scope and Delimitations:

The features and capabilities of the design are the scope of the study:

The design can sort and count Philippine coin denominations, namely, 25 centavo coin, 1 peso coin, 5 peso coin and 10 peso coin only.

- The machine cannot accept deformed coins and cannot recognize whether the coin is fake or genuine. For example, if a token was placed instead of a coin in the machine, the system would still sort it as long as it is the same size as the coins.
- The display can only handle up to 4 digit numbers.
- The grand total also updates whenever any of the reset buttons is pressed. The sensor will count anything that passes through and count it.
- The design can also be fitted with a battery to save the data and retain its value, but cannot run the motor with just a battery.

CHAPTER-2

LITERATURE REVIEW

2.1 Definition of Terms

AC – (Alternating Current) is a current that varies sinusoid ally with time.
Accuracy – a measured value – that is, how close it is likely to be to the true value.
Capacitance – is the ratio of the charge on one plate of a capacitor to the voltage difference between the two plates.
Coin – is usually a piece of hard material, usually metal or a metallic material, usually in the shape of a disc, and most often issued by a government.
Counter - a program that counts and typically displays how many.
DC – (Direct Current) is a current that remains constant with time.

Diode - comprises a section of N-type material bonded to a section of P-type material, with electrodes on each end.

Flowchart – is a graphical representation of a process such as a manufacturing operation or computer operation, indicating the various steps that are taken as the product moves along the production line or the problem moves through the computer.

Infrared - refers to energy in the region of the electromagnetic radiation spectrum at wavelengths longer than those of visible light, but shorter than those of radio waves.

LCD – (Liquid Crystal Display) a low-power flat-panel display used in many laptop computers, calculators and digital watches, made up of a liquid crystal that is sandwiched between layers of glass or plastic and becomes opaque when electric current passes through it. The contrast between the opaque and transparent areas forms visible characters.

LED – (Light Emitting Diode) is a semiconductor device that emits visible light when an electric current passes through it.

Microcontroller - are "embedded" inside some other device (often a consumer product) so that they can control the features or actions of the product.

PCB – (Printed Circuit Board) used to mechanically support and electrically connect electronic components using conductive pathways, or traces, etched from copper sheets laminated onto a non-conductive substrate.

Power Supply – a device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU.

Rectifier – an electrical device that converts alternating current (AC) to direct current (DC).

Resistance – the ratio of voltage to current for a particular conductor.

Resistor – a circuit device made to have a specific value of resistance between its ends.

Voltage Regulator – is an installable module that senses a computer's microprocessor voltage requirements and ensures that the correct voltage is maintained.

2.2 Indian Coins Survey

Coins are as important as the inscription in history. They confirm the information derived from literature. They are of various metals –gold, silver, copper, or alloy and contain legends or simple marks. The coins are very important to the reconstruct of the ancient Indian history. It is a part of archaeological sources. Those with dates is probably very valuable for the framework of Indian chronology. Coins are almost our sole evidence with regarded to the Indo Scythian and Indo Bactrian King. The Bilingual coins had served as Rosetta Stones in deciphering the Ancient Indian writings. The purity of the metal reflects the financial conditions of the Gupta Empire. The inscription on the coin indicates territory over which the rulers ruled. Some coin throws significant light on the personal events of certain rulers. The discovery of the same kind of coins at different places helps up in fixing the coverage of various kingdoms in ancient India.

The most ancient coins of India are commonly acknowledged as 'punch-marked coins'. The Ashtadhyayi cites that the metallic pieces were stamped (ahata) with symbols (rupa). As the name indicates, these coins carry the symbols of assorted types, punched on pieces of silver of defined weight. Fascinatingly, the earliest Indian coins have no determined shapes and were

mostly unified. Secondly, these coins are deficient in any inscriptions scripted in contemporary languages and almost always struck in silver. These unique characters makes ancient Indian coins stand very much apart from their contemporaries in Greece. Punch-marked coins are marked with 1-5 (and at times more) marks, representing a choice of symbols. Two well acknowledged numismatists, D. B. Spooner and D.R. Bhandarkar, after careful study, independently had concluded that the punching of these umpteen symbols exemplifying animals, hills, and tree and human figures followed a definitive pattern and these coins were always issued under royal authority.

Figure 2 Indian Coins

The Government of India has the sole right to mint coins. The responsibility for coinage vests with the Government of India in terms of the Coinage Act, 1906 as amended from time to time. The designing and minting of coins in various denominations is also the responsibility of the Government of India. Coins are minted at the four India Government Mints at Mumbai, Alipore(Kolkata), Saifabad(Hyderabad), Cherlapally (Hyderabad) and NOIDA (UP).

The coins are issued for circulation only through the Reserve Bank in terms of the RBI Act.

2.3 Appeal to the Public

The Bank, with active co-operation from various agencies, has been endeavoring to distribute the coins in an equitable manner to all parts of the country. The mission cannot be successful without unstinting support from the people at large and the various voluntary agencies. Members of public are requested to avoid holding on to coins and instead, use them freely for transactions to ensure that there is a smooth circulation of coins. Voluntary agencies are requested to educate the public about the various facilities available in their areas for distribution of coins, exchange of soiled notes and proper handling of notes.

CHAPTER-3

HARDWARE REQUIREMENT

3.1 Components:

- Arduino UNO
- IR Proximity Sensor
- Photodiode Sensor
- 16X2 Display
- I2C Module
- Bread Board
- PCB
- Jumpers(Male to Male)(Male to Female)
- Power Supply 5V
- LED
- Resistor 1K
- Miscellaneous Tools

3.2 Arduino UNO:

The Arduino project started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller, at a cost that was a considerable expense for many students. In 2003, Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the Processing language. The project goal was to create simple, low-cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing, and library functions to easily program the microcontroller.[8] In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the

cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it Arduino. Early arduino boards used the FTDI USB-to-serial driver chip and an ATmega168. The Uno differed from all preceding boards by featuring the ATmega328P microcontroller and an ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

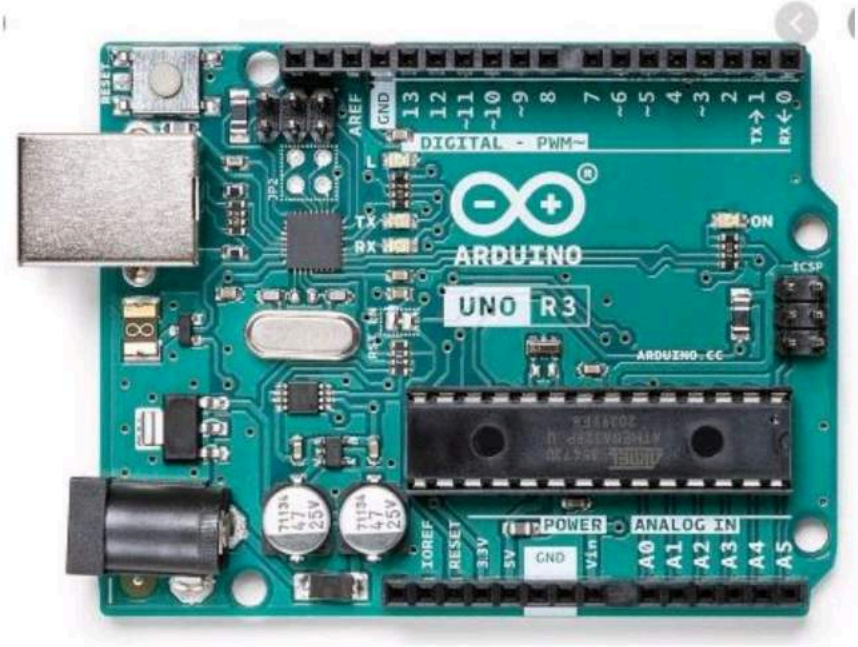

Figure 3 Arduino UNO

3.2.1 Technical speciation

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 can provide PWM output)
- UART: 1
- I2C: 1

- SPPI: 1
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

3.2.2 General pin functions

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V).
- **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

3.2.3 Special pin functions

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pin Mode(), digital Write(), and digital Read() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analog Reference() function.

In addition, some pins have specialized functions:

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.
- **SPI** (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) / I²C: pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog inputs.

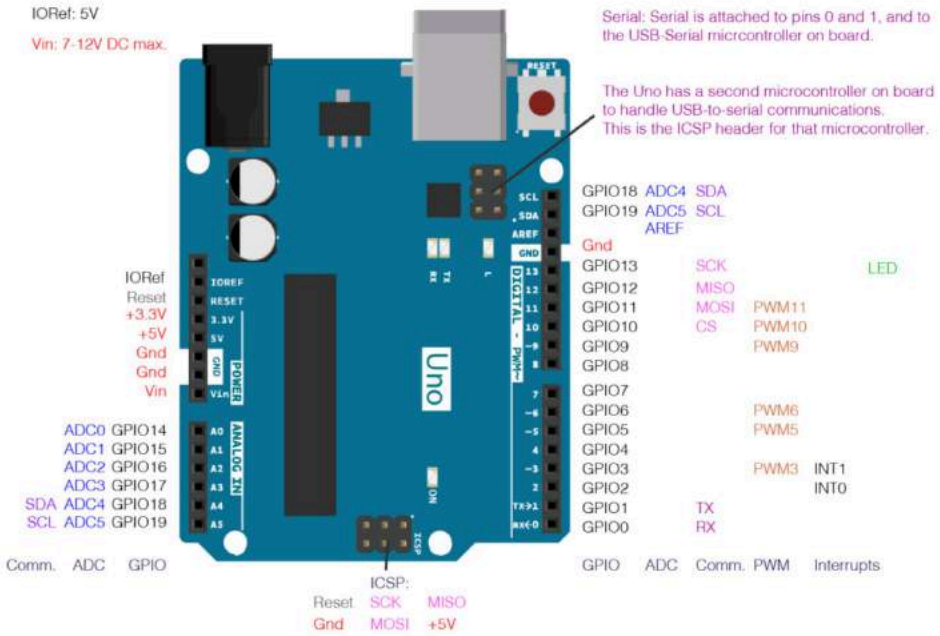

Figure 4 Arduino Uno Pinout

3.2.4 Automatic (software) reset

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 Nano farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

3.3 Proximity sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact.

A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve-type bearings.

A proximity sensor is a non-contact sensor that detects the presence of an object (often referred to as the "target") when the target enters the sensor's field. Depending on the type of proximity sensor, sound, light, infrared radiation (IR), or electromagnetic fields may be utilized by the sensor to detect a target. Proximity sensors are used in phones, recycling plants, self-driving cars, anti-aircraft systems, and assembly lines. There are many types of proximity sensors, and they each sense targets in distinct ways. The two most commonly used proximity sensors are the inductive proximity sensor and the capacitive proximity sensor.

An inductive proximity sensor can only detect metal targets. This is because the sensor utilizes an electromagnetic field. When a metal target enters the electromagnetic field, the inductive characteristics of the metal change the field's properties, thereby alerting the proximity sensor of the presence of a metallic target. Depending on how inductive the metal is, the target can be detected at either a greater or shorter distance.

Capacitive proximity sensors, on the other hand, are not limited to metallic targets. These proximity sensors are capable of detecting anything that can carry an electrical

charge. Capacitive sensors are commonly used in liquid-level detection. Possible targets for capacitive sensors include but are but not limited to: glass, plastic, water, wood, metals, and a myriad of targets of other materials.

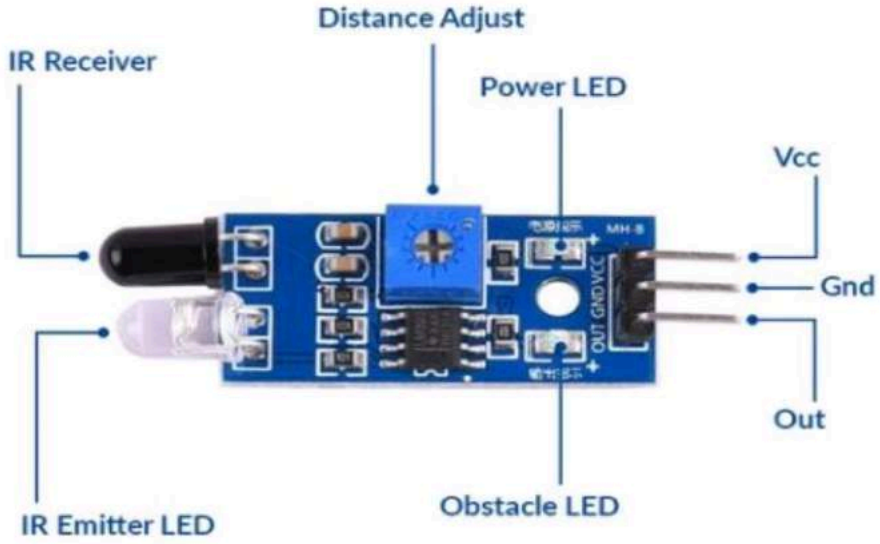

Figure 5 IR Proximity Sensor

Proximity sensors are commonly used on mobile devices. When the target is within nominal range, the device lock screen user interface will appear, thus emerging from what is known as sleep mode. Once the device has awoken from sleep mode, if the proximity sensor's target is still for an extended period of time, the sensor will then ignore it, and the device will eventually revert into sleep mode. For example, during a telephone call, proximity sensors play a role in detecting (and skipping) accidental touchscreen taps when mobiles are held to the ear.

Proximity sensors can be used to recognize air gestures and hover-manipulations. An array of proximity sensing elements can replace vision-camera or depth camera based solutions for hand gesture detection.

3.3.1 Applications

- Parking sensors, systems mounted on car bumpers that sense distance to nearby cars for parking

- Inductive sensors
- Ground proximity warning system for aviation safety
- Vibration measurements of rotating shafts in machinery
- Top dead centre (TDC)/camshaft sensor in reciprocating engines.
- Sheet break sensing in paper machine.
- Anti-aircraft warfare
- Roller coasters
- Conveyor systems
- Beverage and food can making lines
- Mobile devices
- Touch screens that come in close proximity to the face
- Attenuating radio power in close proximity to the body, in order to reduce radiation exposure
- Automatic faucets

3.3.2 Photodiode sensor

A photodiode sensor consists of a semiconductor p-n junction like the laser diode and led described in Laser Diode and LED Physics. Light falling on the junction causes the formation of electron-hole pairs. In photovoltaic mode, i.e., no applied bias, the electron-hole pairs migrate to opposite sides of the junction, thus producing a voltage (and a current, if the device is connected in a circuit). However, most photodiodes are operated in the photoconductive mode where a reverse bias is applied across the junction. Operating in this mode offers a few significant advantages. A reverse bias increases the width of the depletion region, which leads to a larger photosensitive area allowing more light collection. Furthermore, the bias produces a strong field in the junction that sweeps the carriers out quickly, making it less likely for recombination to occur. This ensures a large quantum yield or efficient conversion of photons to charge carriers. There are also advantages in terms of response time (see Photo receiver Physics). In reverse bias photodiodes, the current produced by the bias and charge carriers is proportional to the incident optical intensity over a wide dynamic range.

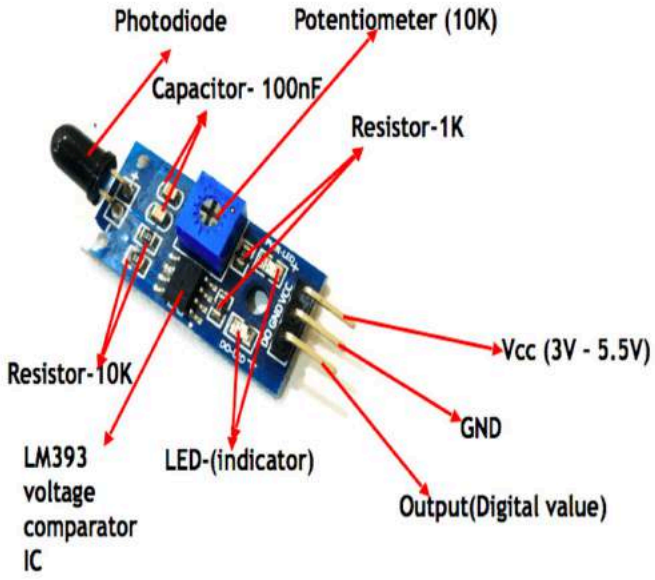

Figure 6 Proximity Pinout

One critical difference between a semiconductor photon source and a photon detector is that the former requires the use of a direct-gap semiconductor while the latter can utilize an indirect-gap semiconductor. While the simultaneous requirement for energy and momentum conservation makes photon emission much less likely in indirect-gap semiconductors, this is not the case for absorption. A readily-achievable two-step process occurs where an electron is excited to a high level in the conduction band followed by a relaxation process where its momentum is transferred to phonons. Since this process can be sequential, it is much more likely than an emission process where the two steps must occur simultaneously. A consequence of this is that Group IV elemental semiconductors such as Si and Germanium (Ge) can be efficient photon detectors similar to direct-gap III-V systems like GaAs or InGaAs. The ubiquitous presence of Si in electronic circuits and devices makes it unsurprising that Si photodiodes are the most common detectors of light used in instrumentation (see Figure 1 for a typical device architecture). The spectral responsivity of Si covers the UV, VIS, and the NIR. Coverage in other portions of the electromagnetic spectrum are possible with photodiodes of other semiconductor materials

3.4 16*2 Display

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your Arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

Figure 7 16X2 Display

Nowadays, we always use the devices which are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs. Cathode Ray Tubes use huge power when compared with LCDs,

and CRTs heavier as well as bigger. These devices are thinner as well power consumption is extremely less. The LCD 16×2 working principle is, it blocks the light rather than dissipate. This article discusses an overview of LCD 16X2, pin configuration and its working.

3.4.1 LCD pin diagram

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

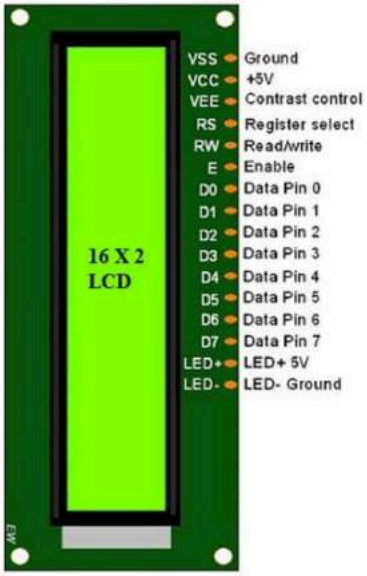

Figure 8 16X2 Pinout

3.4.2 Feature scope

The features of this LCD mainly include the following.

- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

3.5 I2C Module

I2C Module has an inbuilt PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display.

These modules are currently supplied with a default I2C address of either 0x27 or 0x3F. To determine which version you have check the black I2C adaptor board on the underside of the module. If there a 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.

The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly.

Figure 9 I2C Module & pinout

I2C combines the best features of SPI and UARTs. With I2C, you can connect multiple slaves to a single master (like SPI) and you can have multiple masters controlling single, or multiple slaves. This is really useful when you want to have more than one microcontroller logging data to a single memory card or displaying text to a single LCD.

With I2C, data is transferred in *messages*. Messages are broken up into *frames* of data. Each message has an address frame that contains the binary address of the slave, and one or more

data frames that contain the data being transmitted. The message also includes start and stop conditions, read/write bits, and ACK/NACK bits between each data frame.

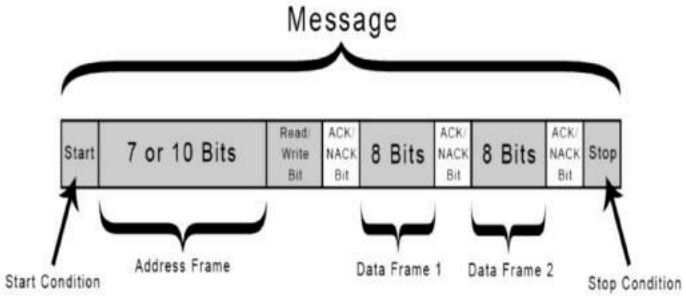

Figure 10 Data frame of I2C

Start Condition: The SDA line switches from a high voltage level to a low voltage level before the SCL line switches from high to low.

Stop Condition: The SDA line switches from a low voltage level to a high voltage level after the SCL line switches from low to high.

3.5.1 Features

- Operating Voltage: 5V
- Backlight and Contrast is adjusted by potentiometer
- Serial I2C control of LCD display using PCF8574
- Come with 2 IIC interface, which can be connected by DuPont Line or IIC dedicated cable
- Compatible for 16x2 LCD
- This is another great IIC/I2C/TWI/SPI Serial Interface
- With this I2C interface module, you will be able to realize data display via only 2 wires.

3.6 Breadboard

A thin plastic board used to hold electronic components (transistors, resistors, chips, etc.) that are wired together. Used to develop prototypes of electronic circuits, breadboards can be reused for

future jobs. They can be used to create one-of-a-kind systems but rarely become commercial products.

The breadboard contains spring clip contacts typically arranged in matrices with certain blocks of clips already wired together. The components and jump wires (assorted wire lengths with pins at both ends) are plugged into the clips to create the circuit patterns. The boards also typically include metal strips along the side that are used for common power rails and signal buses.

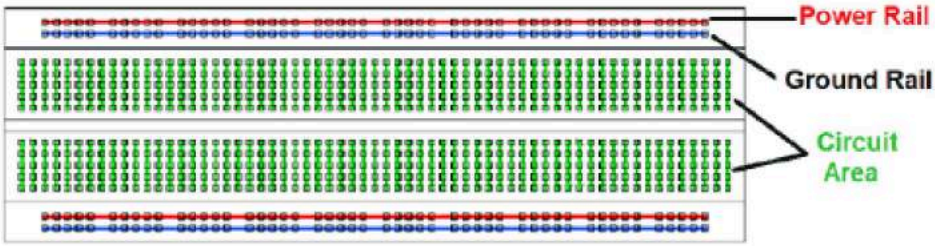

Figure 11 Breadboard

3.7 PCB

A printed circuit board (PCB) is a laminated sandwich structure of conductive and insulating layers. PCBs have two complementary functions. The first is to affix electronic components in designated locations on the outer layers by means of soldering. The second is to provide reliable electrical connections (and also reliable open circuits) between the component's terminals in a controlled manner often referred to as PCB design. Each of the conductive layers is designed with an artwork pattern of conductors (similar to wires on a flat surface) that provides electrical connections on that conductive layer. Another manufacturing process adds vias, plated-through holes that allow interconnections between layers.

PCBs mechanically support electronic components using conductive pads in the shape designed to accept the component's terminals, and also electrically connect them using traces, planes and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.[1] Components are generally soldered onto the PCB to

both electrically connect and mechanically fasten them to it. Printed circuit boards are used in nearly all electronic products and in some electrical products, such as passive switch boxes.

Figure 12 PCB

PCBs can be single-sided (one copper layer), double-sided (two copper layers on both sides of one substrate layer), or multi-layer (outer and inner layers of copper, alternating with layers of substrate). Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components. The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper planes was concurrent with the adoption of surface mount technology. However, multilayer PCBs make repair, analysis, and field modification of circuits much more difficult and usually impractical.

3.8 Jumpers

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the

slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

These set of 10 male to male connecting wires a.k.a jumper wires that can be used to make secure and fast connection for your prototypes. They can used on breadboard or on female berg sticks. Both the side of the wire has male pins. The color of all four wires will be different but the exact color might vary from that of the picture.

These good quality male to male jumper wires can be used multiple times, and has an approximate length of 20cm.

Figure 13 Jumpers

3.9 Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

3.10 LED

LED, in full light-emitting diode, in electronics, a semiconductor device that emits infrared or visible light when charged with an electric current. Visible LEDs are used in many electronic devices as indicator lamps, in automobiles as rear-window and brake lights, and on billboards and signs as alphanumeric displays or even full-color posters. Infrared LEDs are employed in autofocus cameras and television remote controls and also as light sources in fiber-optic telecommunication systems.

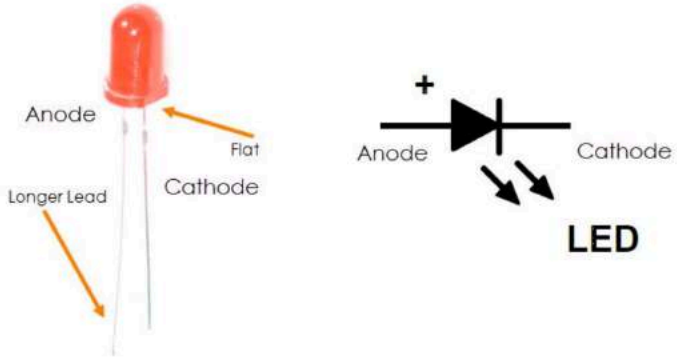

Figure 14 LED

Any LED can be used as a light source for a short-range fiber-optic transmission system—that is, over a distance of less than 100 meters (330 feet). For long-range fiber optics, however, the emission properties of the light source are selected to match the transmission properties of the optical fiber, and in this case the infrared LEDs are a better match than the visible-light LEDs. Glass optical fibers suffer their lowest transmission losses in the infrared region at wavelengths of 1.3 and 1.55 micrometers. To match these transmission properties, LEDs are employed that are made of gallium indium arsenide phosphide layered on a substrate of indium phosphide. The exact composition of the material may be adjusted to emit energy precisely at 1.3 or 1.55 micrometers.

3.11 Resistor 1K

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal

levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Count out loud from 0 up to 9. How many unique digits did you say? Right, there are 10 digits. If we agree on a unique color for each of the 10 digits, we can encode numbers of any size using sequences of colors, which brings us to the resistor color code.

Figure 15 Resistor

A resistor reduces (or resists) the flow of current. The value of the resistance is expressed as a number of ohms (the symbol Ω is used for "ohm"). The number of ohms is coded with a color and appears as a band on the device itself. Three color bands are used to represent the value because we only encode the first significant figure, the second significant figure and the number of zeros. In this lesson, we work this out for a 1k Ω resistor where "k" is the abbreviation for the prefix "kilo", meaning 1,000. So, a 1k Ω resistor has a value of 1,000 ohms and the number we will code is 1,000.

3.12 Miscellaneous Tools

- **Soldering Iron**

  Soldering is a technique for joining metal parts together. It involves melting a metal

known as solder into the space between two metal components. When this solder cools and hardens, it forms a permanent connection between the parts. Solder acts as a sort of metallic glue that joins elements together.

- **Hot Glue Gun**

  Hot glue also has the name of hot melt adhesives, which is the term typically used in industrial settings (or just "hot melt" for short). Indeed, what you may not know is that hot glue has many more uses than craft projects. Many industries use hot melt as part of the manufacturing and assembly process.

- **Sticking Tapes**

CHAPTER-4

SOFTWARE OVERVIEW

4.1 Software used

- Arduino ide
- Fritizing

4.2 Arduino ide:

Arduino IDE where IDE stands for Integrated Development Environment - An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go. In this post, I'll take you through the brief Introduction of the Software, how you can install it, and make it ready for your required Arduino module. Let's dive in and get down to the nitty-gritty of this Software.

- Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process
- .It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.
- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.
- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
- The IDE environment mainly contains two basic parts: Editor and Compiler where

former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.

- This environment supports both C and C++ languages.

4.2.1 Features

- Sketch Editing Tools
- Libraries
- Serial Monitor
- Programmer Functions
- Burn Bootloader
- Sketches Management
- Sharing
- Auto Format
- User Preferences
- Fix Encoding & Reload
- Board Selection & Management
- Project Documentation
- Sketch Archive
- Port Menu
- Sketchbook
- Sketches Management

4.2.2 Advantages

The main benefits of Arduino IDE can be seen in its ability to function as an on premise application and as an online editor, direct sketching, board module options, and integrated libraries. Specifically, here are the advantages users can expect from the system:

Board Module Options

The tool is armed with a board management module, wherein users can choose which board they want to use. If another board is needed, they can seamlessly select another option from the dropdown menu. PORT data is updated automatically whenever modifications are made on the board or if a new board is chosen.

Direct Sketching

Arduino IDE lets users can come up with sketches from within its text editor. The process simple and straightforward. What's more, the text editor has additional features that promote a more interactive experience.

Documentation

The tool gives users an option to have their projects documented. The feature makes it possible for them to track their progress and be aware of any changes made. In addition, documentation lets other programmers utilize the sketches on their very own boards.

Sketch Sharing

Arduino IDE allows users to share their sketches to other programmers. Each sketch comes with their own online link for users to share with their colleagues or friends. This feature is only available in the cloud version.

Integrated Libraries

The software has hundreds of integrated libraries. These libraries were made and openly shared by the Arduino community. Users can take advantage of this for their own projects without involving third-party installations.

External Hardware Support

While the tool itself is specifically intended for Arduino boards, it also has native connection support for third-party hardware. This ensures extensive use of Arduino IDE without being tied down to proprietary boards.

4.3 Fritzing

Fritzing is an open-source hardware initiative that makes electronics accessible as a creative material for anyone. We offer a software tool, a community website and services in the spirit of Processing and Arduino, fostering a creative ecosystem that allows users to document their prototypes, share them with others, teach electronics in a classroom, and layout and manufacture professional pcbs.

Fritzing is an open-source initiative to develop amateur or hobby CAD software for the design of electronics hardware, to support designers and artists ready to move from experimenting with a prototype to building a more permanent circuit. It was developed at the University of Applied Sciences Potsdam. The source code is open-source, but download of executable files is paid.

Fritzing software is an interesting open-source initiative to support designers, artists, researchers and hobbyists to work creatively with interactive electronics and develop electronic projects. Fritzing helps you learn more about electronic circuits, to document your projects and even let's you prepare them for production.

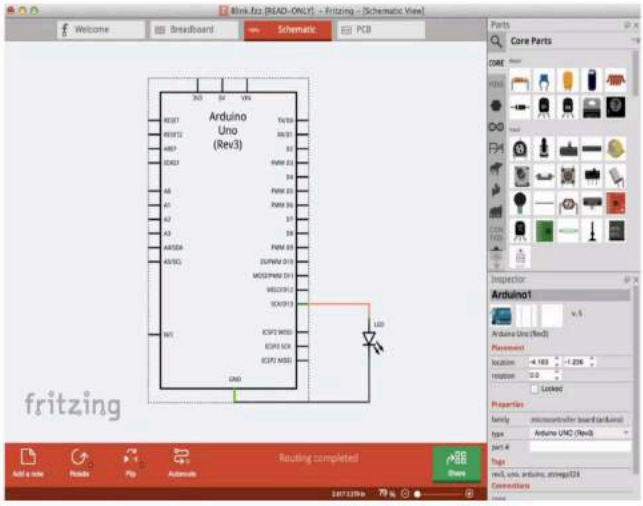

Figure 16 Fritzing

CHAPTER-5

IMPLEMENTATION & CIRCUIT DESIGN

5.1 Block Diagram:

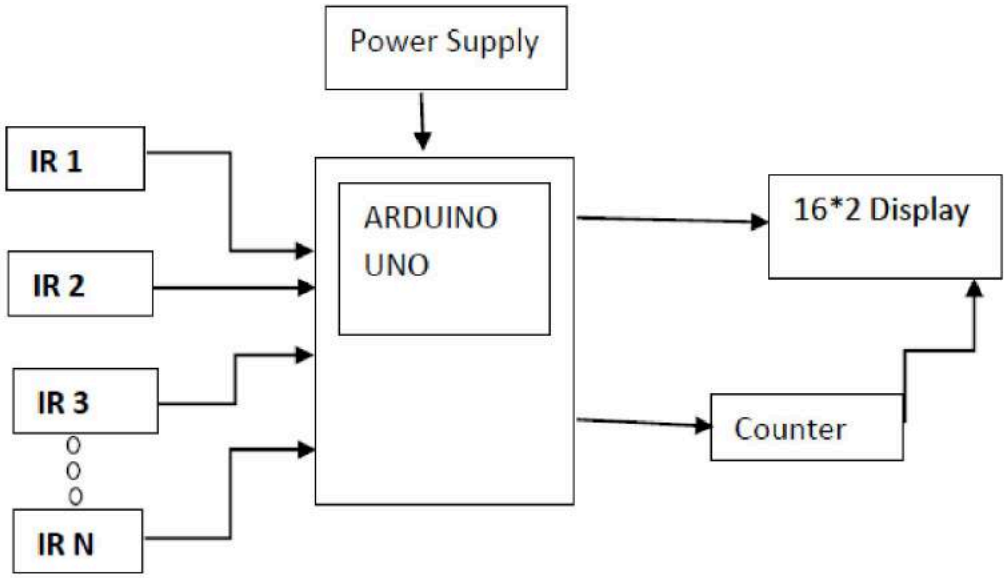

Figure 17 Block Diagram

5.2 Circuit Diagram:

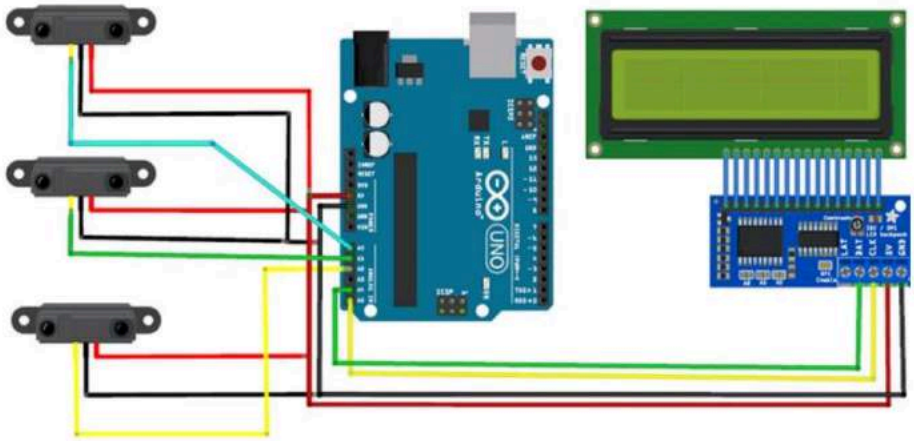

Figure 18 Circuit Diagram

5.3 Code implementation:

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);

int f1=0,f2=0,f3=0,f4=0;

int c1=0,c2=0,c3=0,c4=0;

void setup()

{

lcd.init();

lcd.backlight();
```

```
lcd.setCursor(0,0);
lcd.print("  ARDUINO BASED       ");
lcd.setCursor(0,1);
lcd.print("  COIN SORTING       ");
delay(2000);
lcd.clear();
}
void loop()
{
int s1=analogRead(A0);
int s2=analogRead(A1);
int s3=analogRead(A2);
int s4=analogRead(A3);


 lcd.setCursor(0,0);
 lcd.print("R10  R2  R5  R1");
if(s1>=200 && f1==0)
{
  f1=1;
```

```
}
else if(s1<200 && f1==1)
{
 f1=0;
 c1++;
}
if(s2>=200 && f2==0)
{
 f2=1;
}
else if(s2<200 && f2==1)
{
 f2=0;
 c2++;
}
if(s3>=200 && f3==0)
{
 f3=1;
}
```

```
else if(s3<200 && f3==1)
{
  f3=0;
  c3++;
}
if(s4>=200 && f4==0)
{
  f4=1;
}
else if(s4<200 && f4==1)
{
  f4=0;
  c4++;
}
lcd.setCursor(1,1);
lcd.print(c1);
lcd.setCursor(6,1);
lcd.print(c2);
lcd.setCursor(10,1);
```

```
lcd.print(c3);

lcd.setCursor(14,1);

lcd.print(c4);

}
```

CHAPTER-6

RESULTS

6.1 Result:

Figure 19 Output

The output of this methodology displays the number of coins inserted into the machine with respect to their representation.

CHAPTER-7
CONCLUSION

7.1 Conclusion:

The design of coin sorting machine with false detection function is finally realized, which can realize the coin sorting and have the functions of false identification and counting. The counting results will be displayed on the LCD screen through the operation of the single chip microcomputer.

The coin sorter is simple in design and easy to operate. It can solve the problem of difficult to recycle coins well in places with large coin circulation, such as bus companies, supermarkets and financial departments.

- Manual method can be completely replaced by this proposed method. Time consumption in counting the coins is much reduced. Proposed model can be used widely in donation boxes and other places like charities, where we have to separate and estimate the coins and currency.
- It can be specifically used in temples, where segregation and counting of coins plays a major role and is a vital and mandatory process to carry out.

CHAPTER-8

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