AUTOMATIC FACEMASK VENDING MACHINE

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ABSTRACT

A vending machine is an electronic machine that dispenses a product to a consumer after accepting the required amount for the product especially coins. In this COVID-19 pandemic circumstance, there are several guidelines to be observed and followed to keep us safe. One of the most essential preventive measures is the use of a face mask, which prevent from infections and dusts. These mask vending machines give mask availability in places including clinics, bus stops, colleges, schools, densely crowded areas, and rural areas. To prevent the transmission of the infection it is required that the face mask is accessible at ease and without any human interaction. The basic thought of implementing this idea to help people with facemasks while on the go. Facemask vending machine was developed to make it easier for the public to have access to facemask and personal hygiene products in mass gathering areas. The facemask vending machine is completely automated. It can supply face masks upon the addition of coins.

Keyword – *Facemask, Vending Machine, Microcontroller, COVID 19, Automation*

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1. INTRODUCTION

In this pandemic circumstance, there are several COVID-19-related guidelines to observe. One of the recommended preventive methods to further prevent the spread of the virus is the use of a face mask or a shield. The mask vending machine provides access of mask to places that are inaccessible because of various factors, particularly in remote areas. It is also possible to save time by avoiding the need to visit a hospital or a pharmacy. In a country like India, the machine would be hugely beneficial and could be installed near schools, universities, clinics, and other heavily populated places.

Vending machine is extensively used in many nations like USA, UK, China, Japan and so on. Vending machine is generally an automated machine that provides items such as beverages, chocolates and other consumers products after the customer inserts the perfect value of coin into the slot. Because of the outbreak of covid-19, everyone has been urged to take precautions and stay safe. World Health Organization and medical authorities stated the importance of face masks in the prevention of this infection. Contacting viral diseases can be avoided only through wearing a face mask, especially when outdoors or in crowded places.

The primary idea behind executing this concept is to provide people on the road with face masks. Facemask vending machines were installed to make it easier for the general people to obtain facemasks without human interaction. The vending machine for face masks is totally automated so that when coins are inserted, it can dispense a face mask. The delivery mechanism is the spiral coil rotation mechanism which is responsible for the delivering the mask to the collection area. Coin acceptor is used for accepting and validating the genuine coins. Arduino Nano is the microcontroller used in the vending machine. The inputs from the user are forwarded to the Microcontroller for the process. The Microcontroller, with the assistance of the motor drivers, drives the Stepper Motor, which is further connected to a helical spring. This helical spring revolves a complete 360° turn. The mask is dispensed from the slot into the collection area by the rotational movements of this helical spring. The Micro Controller is connected to rechargeable batteries.

1.1 Literature survey

Vennan Sibanda, et al [1] investigated the design of a high-tech vending machine that can distribute a range of products while using fingerprint sensors and other high-tech security and user-friendliness features. Dimple Thakwani, et al [2] observed that the change vending machines are used to offer change to the user based on the denomination of note presented to the machine by the user. Various components or techniques such as transistors, transducers, sensors, and image processing algorithms can be used to construct a change dispensing vending machine utilizing a PLC. A. Krishna Kumar et al [3] investigated that the vending machines are now more accessible and practical than traditional purchase methods. The goal of the paper is to create a vending machine that can dispense three distinct items at varying costs, as well as 'return change' when a coin of a higher denomination is input and return money when a request is cancelled. Ping Li1a et al [4] suggested that vending machines must provide rapid service without any room for human error, undergo any user training and be available to a variety of people. B Jyothi, et al [5] investigated-on vending machines that automatically dispense products such as snacks, drinks, raffle tickets and consumer items to customers once they insert money or a RFID into the system. D Sridhar Raja, et al [6] observed that the core of the system is in the microcontroller. It connects all the peripherals and controls all the processes in the system based on its program. It is also observed that the Arduino board is the most popular and widely available microcontroller. Hay Man, et al [7] observed that stepper motors are the most widely used motor in vending machines. These are brushless DC motors that can move in discrete steps and have precision motion control applications. The overall system should be compact, economical and consume less power. S Natheesan, et al [8] studied that the internet and new technologies have brought about changing market dynamics that must be addressed though the new machines and such vending machine designs have seen a paradigm shift towards computing advances in technology. The vending machine offers quite a reliable system with fast response. K.R. Nimisha, et al [9] researched that the development of a universal, valid, and reliable vending machine assessment tool that is both comprehensive and user-friendly is recommended. The development of such a tool would help to support and implement public health policies and environmental changes that could improve health of the people. A. Solano et al [10] observed that the functional prototype should be in line with the design principles like cost affordable solution, user friendly and easy for operation. Spiral conveyor is preferred for vending machine because for its easy installation, low maintenance and less space. AP Bodhale et al [11] studied that the vending machine uses digital and mechanical energy or mechanisms to dispense items like medicines, food products, passes or licenses to users automatically without manpower by payment into slot. Different vending machines are designed with different aspects like area, power, and delay because of time, switching speed etc. Akanksha Dhurve et al [12] suggested that vending machines will be useful in the current COVID-19 situation to dispense essential products without any human contact, contamination at any place and any time while helping prevent spread of infection. Implementation of this machine in schools and colleges will help the students to take the facemasks whenever they need it. Zhang jianbo et al [13] observed that programmable logic controller (PLC) is a kind of digital computing based on electronic operating system and mainly used in industrial environment. PLC has characteristics of high reliability, wide adaptability, strong anti-interference ability, convenient programming, wide voltage range and convenient programming.

2.0 HARDWARE COMPONENTS USED

2.1 Arduino nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. It is an is an 8-bit AVR family microcontroller powered by ATmega328P. It has 14 digital I/O pins (out of which 6 provide PWM output), 8 analog input pins and a reset button.

Figure 1 - Arduino Nano

2.2 Coin Acceptor

The coin acceptor is used as one of the input devices for vending machine. This coin acceptor's sensors check the coin's breadth, diameter, and fall time to detect it, and it can be set to take coins from any country and denomination. The coin acceptor will check for valid coin profiles and indicate when each kind is entered, while rejecting other coins. We programmed this coin acceptor to accept coins of denomination namely 5Rs only.

Figure 2 - Coin Acceptor

2.3 LCD Display

Liquid Crystal Display (LCD) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a basic module commonly used in various devices and circuits. A 16x2 LCD display, can display 16 characters per line and there are 2 such lines. So, it can display (16×2=32) 32 characters in total. LCDs are economical, easily programmable, have no limitation of displaying special and even custom characters, animation and so on.

Figure 3 - LCD Display

2.4. Motor Driver IC

This L298N Motor Driver Module is a high-power motor driver module for driving DC and stepper motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N

Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.
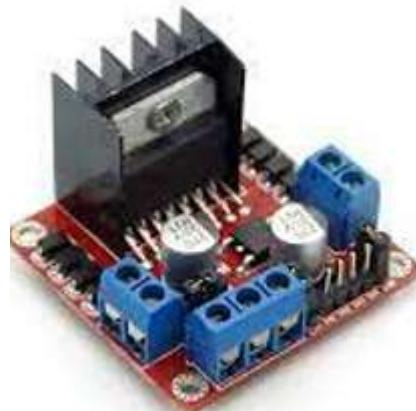
Figure 4 - Motor Drive IC

2.5 Stepper Motor

A stepper motor is an electromechanical device it converts electrical power into mechanical power. It is a brushless, synchronous electric motor that can divide a full rotation into an expansive number of steps. Stepper motors are so named because each pulse of electricity turns the motor one step. Stepper motors are controlled by a driver, which sends the pulses into the motor causing it to turn.

Figure 5 - Stepper Motor

3.0 SOFTWARE USED

3.1 Solidworks

SolidWorks is a solid modelling computer-aided design (CAD) and computer-aided engineering (CAE) tool. It employs the parametric design idea to create three types of interrelated files: the part, the assembly, and the drawing. As a result, any changes made to one of these three files will affect the other two.

3.2 Arduino IDE

Arduino IDE is a open source software, designed by Arduino.cc and mainly used for writing, compiling and uploading code to almost all Arduino modules. Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro, and many other Arduino modules are accessible. On t he
board of each of them is a microcontroller that has been programmed and takes data in the form of progra mming. The core code, also known as a sketch, written on the IDE platform will eventually generate a He x File, which will be copied and saved to the board's controller.

3.3 Proteus

Proteus is a design language developed for schematic capture, electronic circuit modelling and PCB design. It is frequently used to simulate digital devices like microcontrollers and microprocessors. It can replicate LEDs, LDRs and USB communication. In Proteus, the microcontroller simulation is accomplished by adding hex or debug file to the microcontroller portion on the schematic. The device as well as any analogue and digital devices linked to it, is then co-simulated. This makes it suitable for a wide range of project prototype applications, including motor control, temperature control and user interface design.

4.0 BLOCK DIAGRAM & 3D MODEL
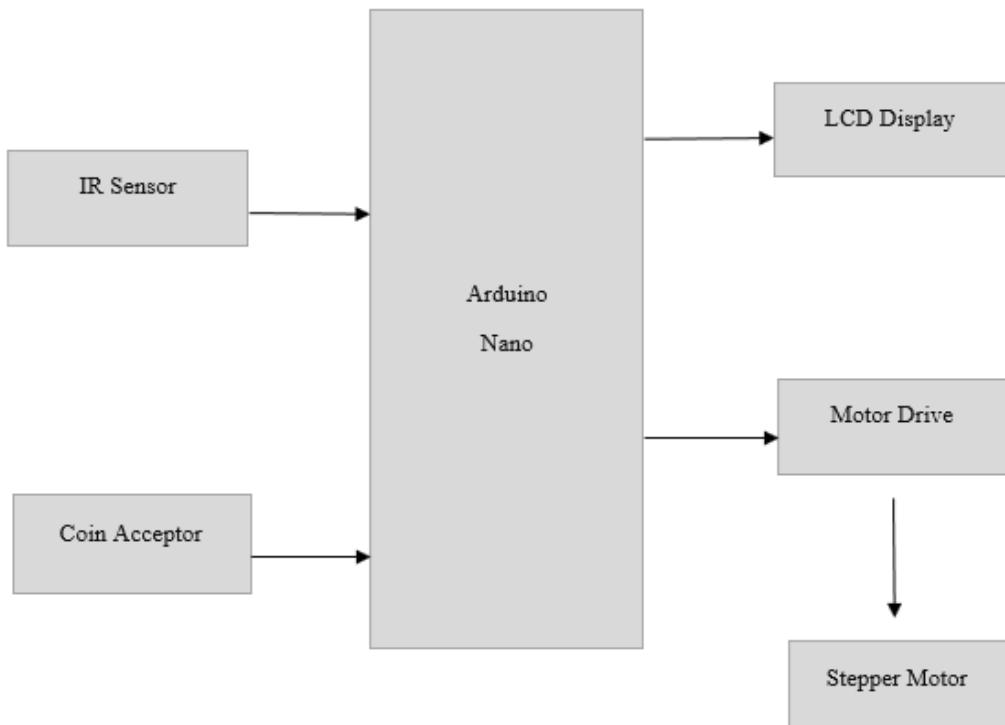

Figure 6 – Block Diagram
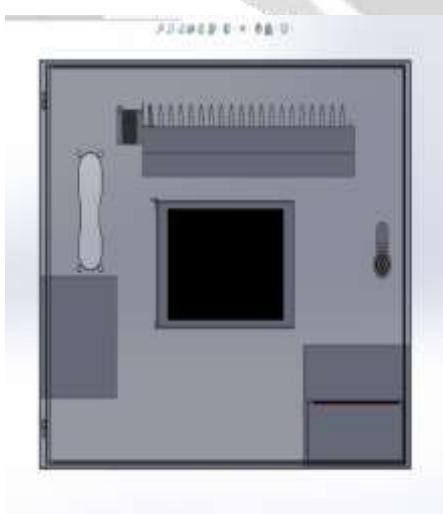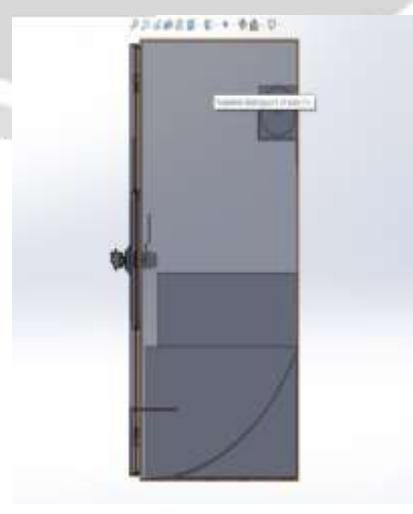
Figure 7- Front View   Figure 8- Right Side View   Figure 9- Isometric View
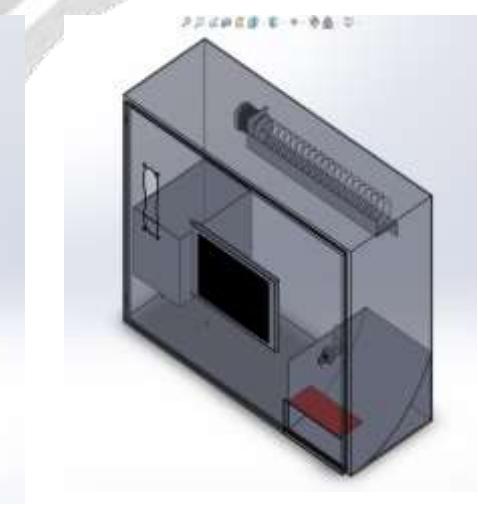
5.0 WORKING PRINCIPLE

When the consumer inserted the coin in the slot, the coin acceptor checks the genuine of the coin which was inserted through the sensors like IR sensor and electromagnetic sensor. If the coin is not genuine the coin is rejected.

Once the coin is verified as genuine, vending occurs then the coin is collected in the collection box and in LCD display shows as the collect the item**.**
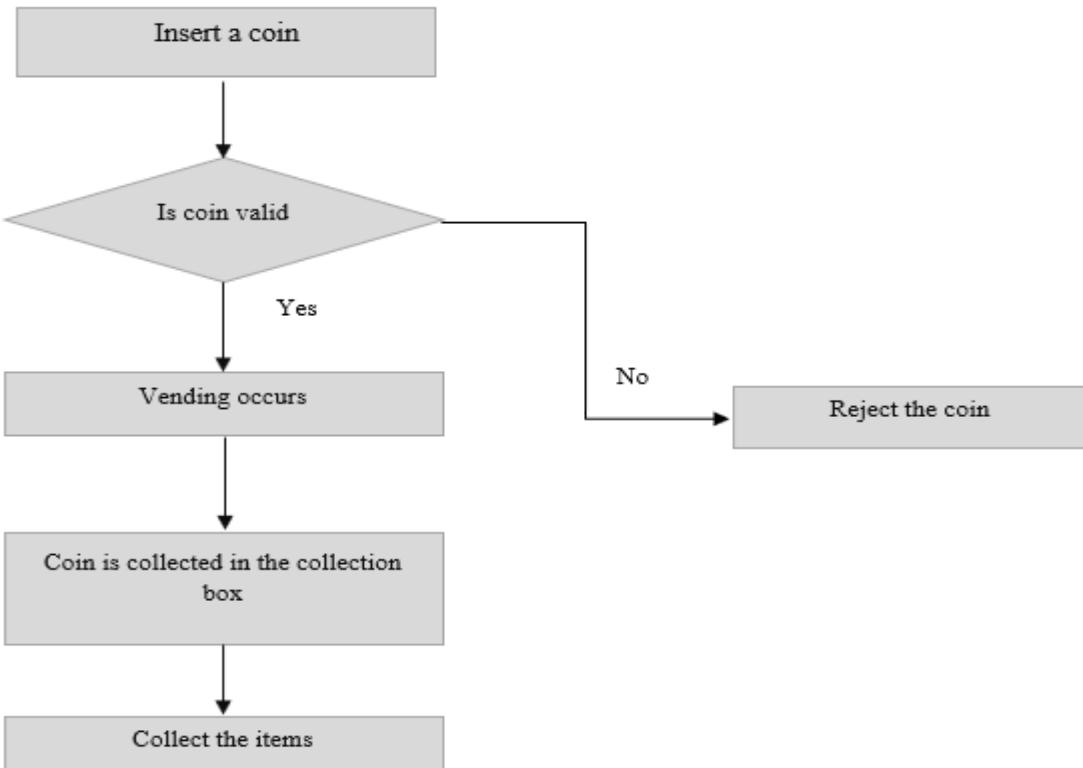

Figure 10 – Working of Vending Machine

6.0 CIRCUIT DIAGRAM

In the circuit diagram given below, we have displayed the actual structure and connections of the vending machine components. The diagram is made using Proteus software.
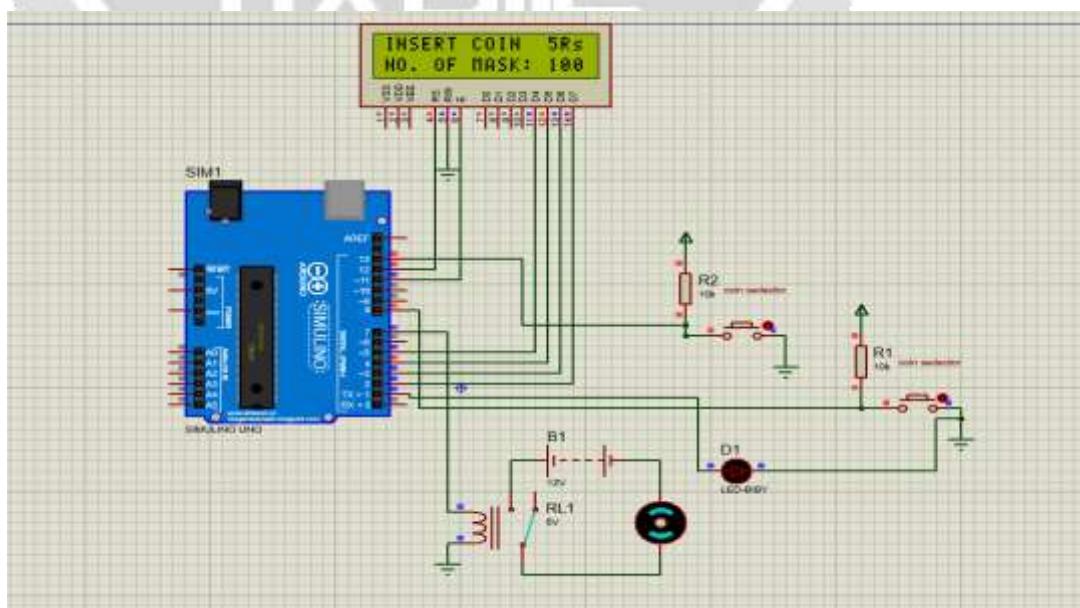

Figure 11 – Circuit Diagram

7. RESULT AND DISCUSSION

The 5-rupee coin serves as the mask vending machine's input denomination. The system will not accept any other denomination. When a coin is inserted into the coin input slot, the microcontroller verifies its validity. Rechargeable batteries are attached to the microcontroller. When the validity is defined, the motor connected to the spring begins to rotate and completes a 360° turn. The spinning motion of the spring causes the object to dispense, and the mask slips out of the machine slot. As a result, the user receives the required product. The machine is simple and easy to operate. The coin serves as the medium via which the detecting circuit is completed. The microcontroller is powered by a 5V power supply. The machine is easy and is extremely straight forward to control. In future the project can be extended with addition of few more variety of masks. Implementation of this machine in schools and colleges will help the students to take the facemasks whenever they need it. Coins were inserted and masks were vended successfully. This vending machine can also be useful in the current COVID-19 situation to dispense essential products without any human contact, contamination at any place and any time while helping prevent spread of infection.

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