



# AUTOMATIC JUICE VENDING MACHINE BASED ON COIN SLOT AND RFID TAG

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## ABSTRACT

In the near future with unanticipated concerns like covid-19 which proved a great challenge to each individual, it is important to switch to an automatic system and to provide contactless services. The juice vending machine discussed in this paper is a combination of both a physical coin-based mechanism and a Wi-Fi modulated RFID -based system. Automatic Juice Vending machine is a machine that dispense juice as and when valid input is inserted. It can work 24/7 as it is monitored automatically by integrated sensor and real time updates are given to user. This can empower small vendors as the size of the machine is small and it could be easily placed at any public place. This machine can accept the coin and then detect whether it is valid or not. If coin is valid Juice is given to the user and if not so then user will get coin back. These smart vending machine enables a more interactive user experience and reduce operating cost. As an overall outcome, this system can be adopted over a wide range of communities, such as villages in rural areas, railway stations, companies, factories, malls, small windows in urban areas, to name a few.

*Keywords*—juice, vending machine, coin slot, Wi-Fi modulated RFID, health.

## 1. INTRODUCTION

In recent times owing to development, globalization, and the presence of novel coronavirus, utilizing technological advancement, we are headed towards automation. The automatic vending machine is an illustrated example of automation through which items such as snacks, chocolates, drinks, lottery tickets, cigarette, tea, coffee, packaged food items, water, etc are provided to the consumer on the insertion of card or cash or token or tag without the human intervention. It is said that the first vending machine was developed in 1880 in England which dispensed postcards. Today, vending machines are being used in many countries and are being constantly adapted to new technologies. these machines gain their prevalence more in locations, such as airports, railway, movie theatres, companies, etc. New technologies that are involved range from face recognition, fingerprint, retina scan, RF tag, coin or credit-based to voice modulated system.

## 2. NEED OF THE STUDY

During summers due to scorching heat, a person's body needs some amount of fluid for the thorough functioning of the body. The fluid can be in the form of a soft drink, juice, water, milk, tea, coffee, smoothies, etc. Similarly, during winters to avoid any sort of dehydration, any human body must have a continuous intake of fluid. To cater to the basic necessity of fluid intake, this paper deals with an automatic juice vending machine that satisfies the above-mentioned criteria. Through this mechanism, we aim to provide a simple juice that not only fulfills the basic criteria of hydration but is also relished by many. Most importantly, when the

world is moving towards Industrial Revolution 4.0, it is inevitable for us to be in isolation with automation. In a developing country like India where more than 60% people live in rural area with slow pace of automation, a vending machine based on automation can be a huge source of revenue. Due to their flexible size and convenient use, vending machines can be easily installed in crowded areas, like near construction sites, public places such as school, temples, railway station to ensure hygiene.

### 3. RELATED WORK

Automatic juice vending machine [1] focuses primarily on Removing juice from fruits using a pneumatic system. It is a microcontroller-based system. The varied advantages are less power consumption, faster response, and low instalment cost.

Automatic lemonade dispenser machine [2] based on microcontroller and mixing motor assembly provides for the mixing of liquid at adequate speed for a specified amount of time. Ease of use, easy installation, variety of taste option are some of the advantages of this system. Same as the first paper, this system also contains some disadvantages, like not indicating that the juice container is empty when it is, and putting the motor inside the liquid for its rotation hence resulting in nearly no suction power.

Smart coffee vending machine using RFID [3] installed in companies which only gives access through RFID that's avoiding the miss use of a machine. In this system, the small RFID reader is fixed in the machine. If ID is matched, the IR sensor will identify the cup and coffee will start dispensing.

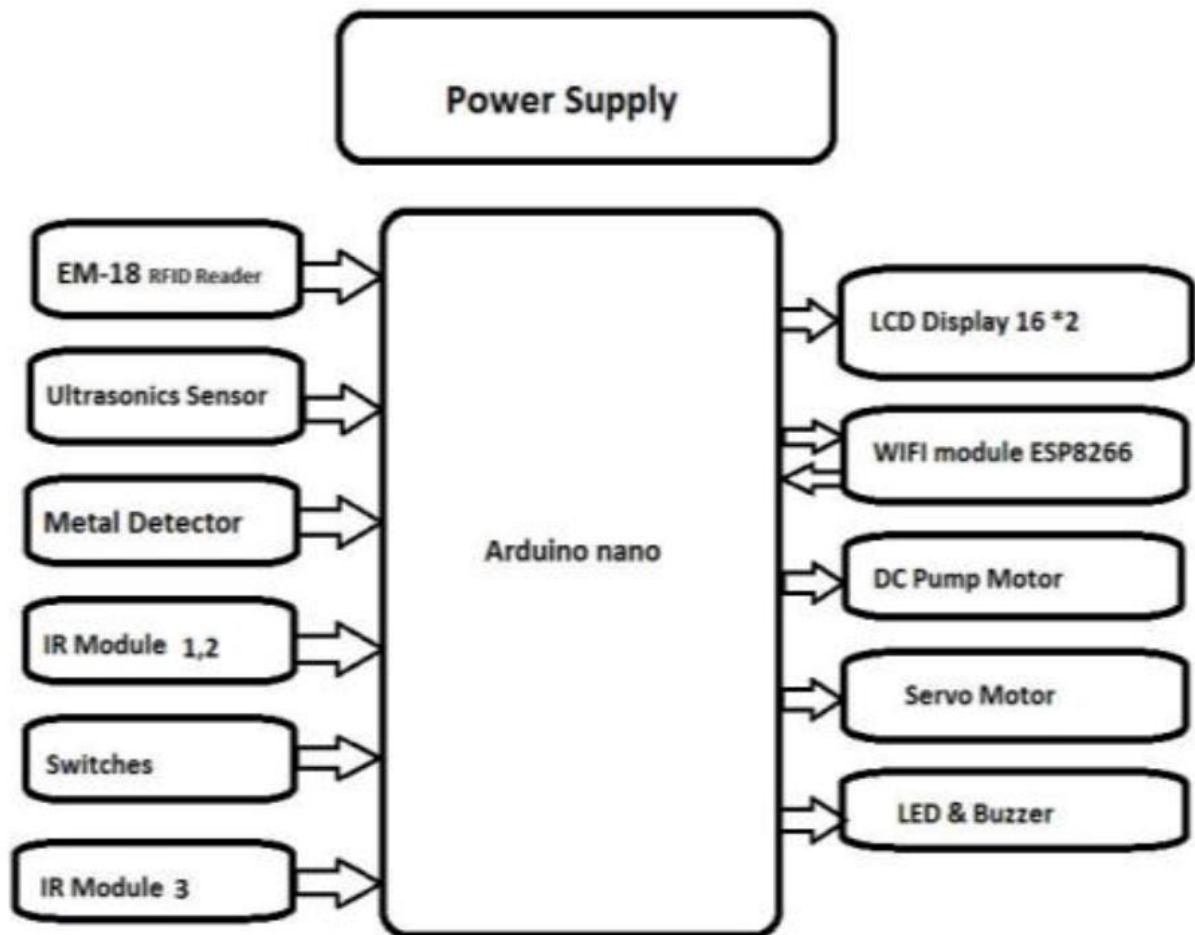
### 4. METHODOLOGY

#### 4.1 Implementation

We have decided to use the microcontroller Arduino nano ATMEGA 328p (30pins). It uses the same processor as Arduino Uno, can share the same program too. However, it is much smaller in size. Besides, its main advantage is that it is breadboard friendly and the program can be coded with a mini USB cable. It operates at 5 V/7 to 12 V with a CPU speed of 16 MHz which comprises 8/0 analog in/out and 14/6 digital IO. In terms of memory capacity, it holds 1/2 (kB) EPROM/SRAM and 32 flashes. If you have a regulated +5V supply, you can directly provide it to the Nano.

In the automatic vending machine secretary, to the controller, the features that we are implementing are:

- IR sensor,
- Metal detector,
- Fire sensor, switches,
- LCD display 16×2,
- Wi-Fi module ESP – 8266,
- DC pump motor,
- Servomotor,
- Ultrasonic sensors,
- EM– 18 RFID reader



Figure

1: Block Diagram of Automatic Juice Vending Machine

The whole system can work in two ways whereby a user may choose to operate either of them.

#### Part A :

**Coin-based mechanism** Once the object is entered, the IR sensor detects some kind of movement. In response, the object is then passed through the metal detector which ensures the validity of the object by recognizing it as a metal. However, if the object is not detected as a metal, it will be returned to the user. This machine is equipped in such a manner that only a specific value of coin ie Rs.10 will pass, and coins of other value and variations will be thrown out of the system as they are marked invalid. To maintain efficacy and to avoid extortion and deceit, the coin slot is designed in a slope structure to execute the above-mentioned needful procedure.

Once the coin successfully passes the detection phase, the servo motor will further validate the coin by rotating itself 180° clockwise to activate the microcontroller. However, if the coin is invalid then the server motor rotates 90° to throw out the coin back to the user. The rotation of the servomotor will depend on the limit switch that is either coin will be collected in the collection box or thrown out the user. On activation of the microcontroller, the pump motor will get triggered to pressurize the juice from a juice time for a specific amount of time as mentioned in the code (around 100 ML). Most importantly, the juice will be dispensed only when the IR sensor fitted above the nozzle will detect the presence of a container.

#### Part B :

**RFID-based mechanism** As an alternative to the coin based mechanism, the RFID based system has been implemented to provide juice without any physical intervention of coin. Each user will be assigned a unique RFID tag containing the user's balance. With the utilization of radio-frequency technology, the data is

transmitted from the tag to the reader which is then decoded by the program written in the microcontroller. Once the RFID tag is verified successfully, and Rs.10 is withdrawn, the pump motor will be triggered to dispense juice on the placement of a container which will be detected by the IR sensor. The same information is updated on the app through WiFi module ESP 8266.

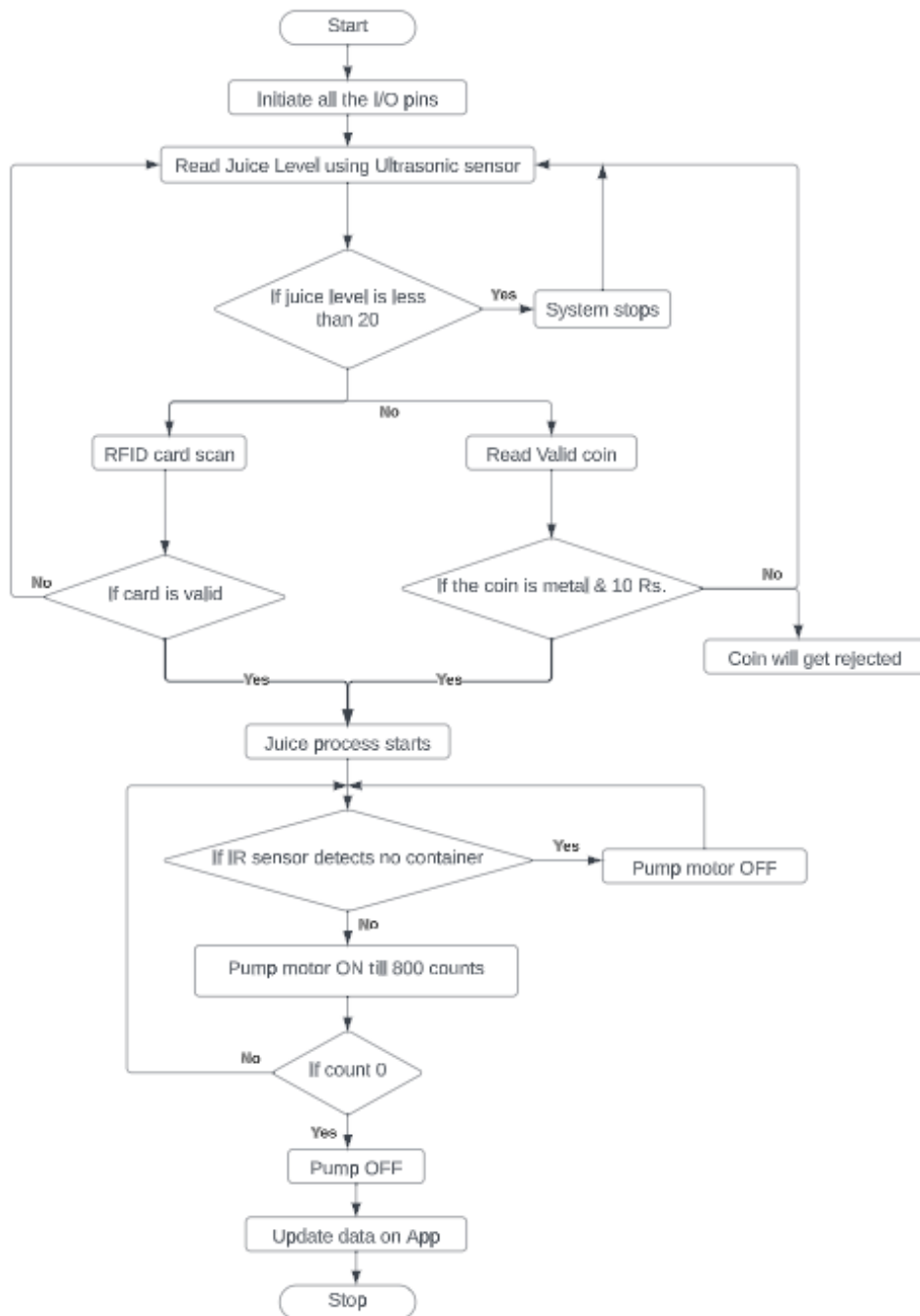


Figure 2: Flow Automatic Juice Machine

Chart of Vending

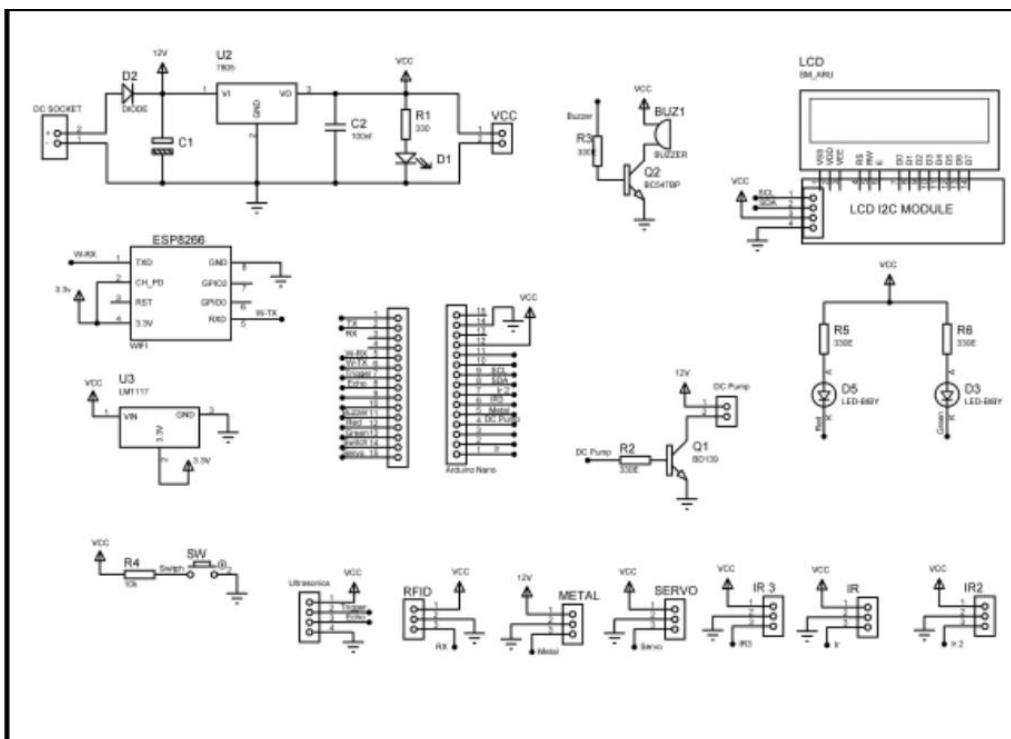


Figure 3: Schematic Diagram of Automatic Juice Vending Machine

The circuit diagram emphasizes the connections between various sensors, which helps in the operation of the Automatic Juice Vending Machine.

The coin slot and RFID reader help the customer to obtain juice from the AJWM. The various sensors and motors are connected to the GPIO pins of the processor. The coin inserted in the coin slot will get rejected if the size of the coin is smaller than 10 rupee coin, as the servo motor will rotate in an anticlockwise direction or if it is particularly a 10 rupee coin then it will reach the second level where the metal detector is attached to verify whether it is metal or not after that servo motor will rotate in the clockwise direction and throw the coin inside the coin box. If the inserted coin is valid then the processor will acknowledge the pump motor to rotate which results In the distribution of juice.

The RFID reader is used as the second option for payment, as a valid card is inserted consumer will get the desired output. The LCD display is used to notify every activity with the AJWM. The WiFi module is used to notify the owner of the status of the container. An ultrasonic sensor is used to measure the level of juice and an IR sensor is attached at the nozzle to detect whether the glass is placed or not. Fire sensor is used for safety purposes in case if there is fire or heat it can provide early warning notification. While operating the AJWM the procedure follow the flow starting from Coin slot or RFID reader to metal detector and servo motor, then Arduino nano after that Pump motor.

## 5. OUTCOME :

### 5.1 Observation -Test Cases Outcome

#### True Cases

Rs.10 coin	System Delay in Seconds	True RFID Card	System Delay in Seconds
1	4	1	4.3
2	4.2	2	4.2
3	4.2	3	4.3
4	4.2	4	4.3
5	4.1	5	4.3
6	4.2	6	4.2
7	4.2	7	4.3
8	4.1	8	4.3
9	4.2	9	4.2
10	4.2	10	4.2

#### False Cases

False coin i.e., Rs.1/2/5	System Delay in Seconds	False RFID Card	System Delay in Seconds
1	3.3	1	2
2	3.2	2	2.1
3	3.4	3	2.2
4	3.3	4	2
5	3.3	5	2
6	3.3	6	2
7	3.3	7	2.2
8	3.3	8	2
9	3.3	9	2
10	3.3	10	2

## 5.2 Calculations :

$$\text{Error of true coin} = \frac{\text{Accepted Value} - \text{Expected Value}}{\text{Accepted Value}}$$

$$\text{Error of true coin is} = \frac{9-10}{9} = -0.11$$

Considering an input of 10, Rs.10 coins there is an error of 11%.

$$\text{Accuracy of System} = \frac{\text{Correctly detected Coins}}{\text{Total Number of Reference Coin}}$$

$$\text{Accuracy of System} = \frac{9}{10}$$

Therefore, the accuracy of the System is 90%.

## 5.3 Result :

### Part A: Coin-based mechanism

- 1) After the insertion of 10 rupees coin, the coin scanning mechanism will detect the coin. The IR sensor will scan the glass is placed in the right place. And then according to the program motor will start and fill the glass & when the glass is filled with the juice motor will stop.
- 2) If a false coin or anything that has the same shape or size is inserted into the machine, it will not react to it and the motor will not run. Test cases outcomes: 1) True cases Error=-0.11 With respect to a coin-based mechanism, the system only accepts 10 rupees coin while rejecting other coins such as 1/2/5 rupee. While inserting 10 rupees coin many times, we observed that the error of the overall system lies in the range of -0.10 and -0.11.
- 3) False case Error=0 The system has been structured and programmed to reject all the other coins but 10 rupees coin. While performing the test cases, it was found that the machine does not accept other coin than 10 rupees.

### Part B: RFID-based mechanism

- 1) When the RFID tag is scanned by the reader, the data transmitted by the tag to the reader will be decoded by the microcontroller. When the RFID tag is verified, the amount of 10 rupees is deduced from the user's account.
- 2) Then the IR sensor will scan the position of the glass. If the position of the glass is correct, then the motor will run according to the program and fill the glass with juice.
- 3) When the glass is filled with juice motor will stop.

## 6. FEATURES

- 1) LCD display 16×2: it is used to display the real-time update of the process involved in the juice vending machine.
- 2) Ultrasonic sensor: Used to indicate when the Juice level is below the minimum threshold.
- 3) Fire sensor: The sensor response to any abnormal activities such as fire, smoke, heat. etc that could occur within the device.
- 4) Buzzer and LED – activities concerning ultrasonic sensor and Fire sensor which will be indicated using buzzer and LED.

## 7. ADVANTAGES

- 1) 24x7 Available to customer.
- 2) Automatic juice vending machine is very easy & secure to use.
- 3) No need of human intervention.

## 8. DISADVANTAGES

- 1) Only one type of coin is accepted.
- 2) Users need to have either RFID smart card or an acceptable coin to get the juice.
- 3) If there is a piece of metal that is in the exact shape of a Rs.10 coin, then it will get detected.

## 9. CONCLUSION :

Implementation of an Automatic juice vending Machine is the step towards future technology and it is a step to enter the eco-friendly world. This machine is straightforward to use and may be easily accessed by any person. Due to the time-saving feature, people can use the vending machine in busy areas. This proposed system is often implemented almost everywhere even in remote areas. This system is Portable, affordable, consumes less power, and may be made easily available so that the user can use this technique whenever and wherever. It will also help in reducing the diseases which are being spread because of using contaminated or unhygienic juice by people.

## 10. FUTURE WORK :

There is no limitation for improvisation, different ideas can reflect the changes in the way it is implemented. Some of the potential work could be :

- 1) Designing the coin slot in that way so it accepts multiple types of coins.
- 2) A touch screen system use to vend particular vending items.
- 3) The current performance of this machine can be grown further in IOTs by using the web-based system to store and process big consumer's data online.
- 4) An increase in diameter of the juice valve and pipes would increase the flow rate. Hence, taking lesser time to fill in the glass.
- 5) An UPI based system for a contactless delivery of the product.

## 11. REFERENCES :

- [1] Rajas Sangamnerkar, Yogesh Patil, Shubhankar Honrao, Dipali Shende, "Automatic Juice Vending Machine" IJSRR, Volume 08, Issue 5, 2019
- [2] Ashish Kaushik, Dhruv Bava, and Vandana Khanna, "Automatic Lemonade Dispenser Machine" International Journal of Innovative Research in Computer Science & Technology (IJIRCST) ISSN: 2347-5552, Volume 5, Issue 2, October-2018 DOI: 10.21276/ijircst.2017.5.2.2
- [3] Rahul Jadhav, Mrunali Jejurkar, Pranita Kave & Prof. H.P. Chaudhari, "Smart Coffee Vending Machine Using RFID" IJARSE Volume no 06, issue no 05, 2017
- [4] Shweta Dour, Rishikesh Shukla, Dishita Makwana, Neelima Satuluri, Lakshmi Mahiwal, "Vending Machine Using 8051microcontroller" Volume no 05, issue no 03, May 2017
- [5] Kamalnathan, Ahmed, Aamir, Kaliselvan, "Automatic Paper Vending Machine," International journal of science, engineering and technology research (IJSETR), vol.4, issue 4, April 2014
- [6] Suhail, Beg, "Implementation of FSM Based Automatic Dispense Machine with Expiry Date Feature Using VHDL," International Journal Of Modern Engineering Research (IJMER), vol. 4, p.p. 1-5, April 2014.
- [7] Higuchi, Y., "History of the Development of Beverage Vending Machine Technology in Japan", 7, 2007; pp. 1-69.
- [8] Jeremy Blum, "Arduino Tools and Programming", 3rd Edition, (2018)
- [8] "Arduino Nano | Arduino Official Store", Store.arduino.cc, 2021.[Online].Available: <https://store.arduino.cc/usa/arduino-nano>. [Accessed: 25- Mar- 2021].



[9] "Vending machine", Encyclopedia Britannica, 2021. [Online].Available: <https://www.britannica.com/topic/vending-machine>. [Accessed: 25- Mar- 2021].

[10] "ThStoryBehind- Vending Machines", Knowledgetribe.in, 2021.[Online].Available: <https://www.knowledgetribe.in/get-to-know/storybehind-vending-machines>. [Accessed: 25- Mar2021].

