An RFID Based Arduino Controlled Coffee/Tea Vending Machine

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***Abstract* – Most of the people drink coffee/tea which is made by ordinary coffee maker machine. So use of coffee maker machine by interfacing hardware and software will be an initial step to enter the new automated technological world. In ordinary coffee maker machine any one can get coffee by manual hand to hand transaction, but in An RFID Based Arduino Controlled Machine, only a registered member can get coffee/tea automatically. In this process a person registers humself/herself in a database by depositing some amount of cash balance and he/she is being given a Radio Frequency Identification (RFID) card. When people wish to enjoy drink, they just have to scan their RFID tag/card to get it without the help of any human operator. The balance will be automatically deducted from their a/c.**

***Keywords:* Main operational circuit, Registration circuit, Power circuit, Flowchart of operation, Testing and results.**

I. INTRODUCTION

Here an arduino mega board is being used as a heart of the project. At first the RFID tag of a user is scanned by an RFID reader module connected to the arduino mega board. Then the arduino sends the unique RFID tag number ((HEX code) to the database to check its availability. After checking, the database sends tthe data regarding the tag UID to arduino and arduino displays it on the LCD connected to it.

Two buttons- 'START' and 'RESET' are placed on the machine to control the operations. After a successful scan of RFID, if the user presses the START button, then the coffee making operations will start. The Reset should be pressed after any invalid conditions like 'Low Balance' or 'Unauthorized user' to rest the machine.

Sensors are used to sense and maintain the water level and to sense dry coffee mixlevel.

A separate temperature controller module is used to maintain the temperature of the water at a desired value.

The main objective of this project is to step forward towards digitalization and automation. This machine is a replica to show how automatic transaction works and how it makes life easier.

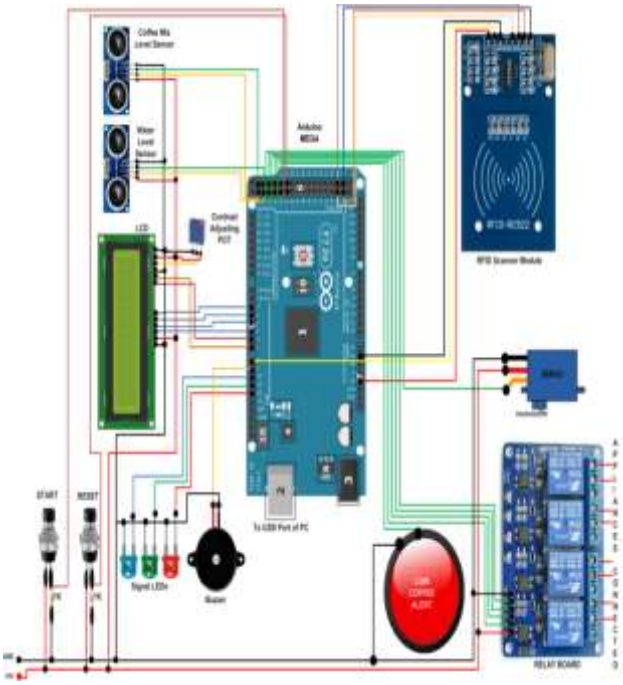

Fig.1: Main operational circuit diagram

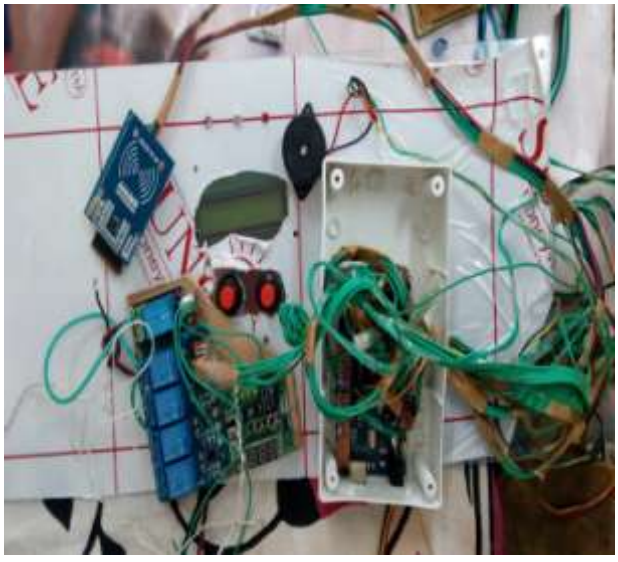

Fig.2: Inside view of the main operational circuit.

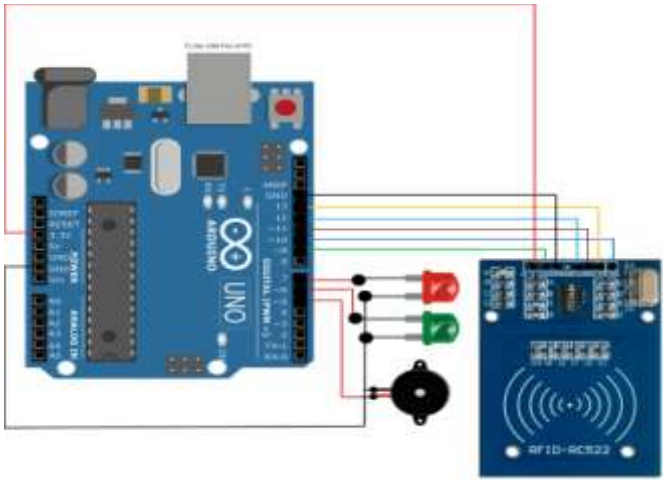

Fig.3: Diagram of the Registration circuit.

Fig.4: Inside view of the Registration circuit.

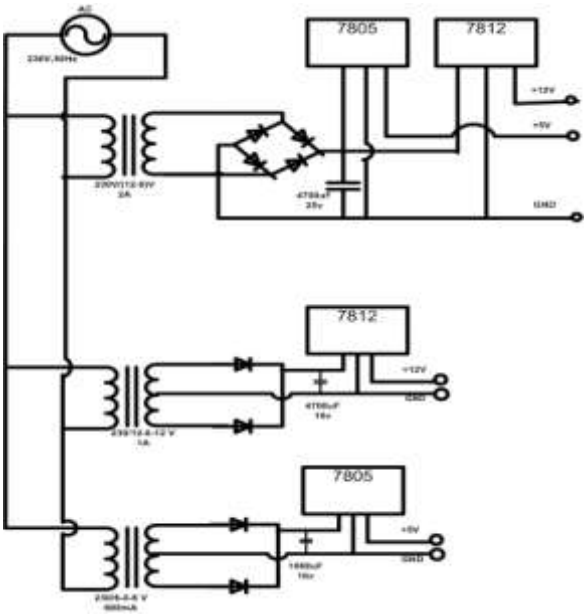

Fig.5: Diagram of the Power circuit.

This circuit is used for providing power to the different electrical and electronic equipments (dc motor, air pump, temperature controller etc.) and peripherals of Arduino (e.g. RFID reader, Ultrasonic sensor etc.). It contains three transformers with rectifier circuits. The whole power circuit is divided into three parts. From the first one, we get two output buses of 5 volts and 12 volts. The second one is a dedicated 12 volts bus and the third one is a dedicated 5 volts bus.

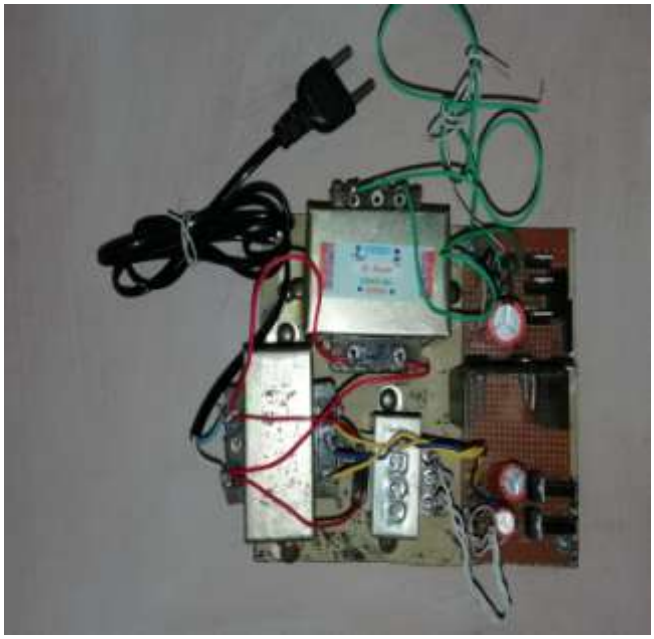

Fig.6: Hardware of the power circuit.

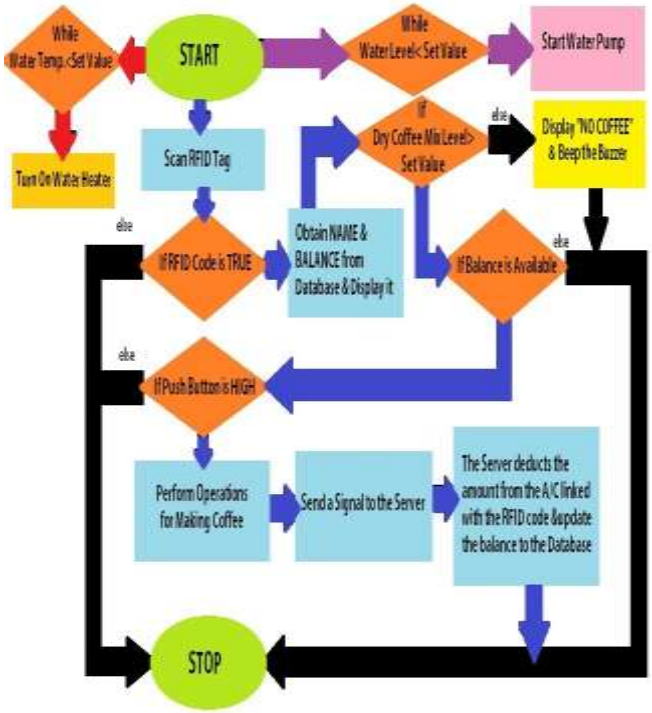

Fig.7: Flowchart of the operation

Fig.7 shows the flowchart of **An RFID Based Arduino Controlled Coffee/Tea Vending Machine.** Explanation of this flowchart is given step by step as follows:

After starting the machine & connecting it to the Database, display shows "Scan Your Card". After reading the card of a user, the RFID reader & Arduino Mega sends the UID of the user to the database to check either the user is registered or not. If the user is not registered, then the display will show "Unauthorized User" & the process will stop. If the user is registered, then the Dry-Coffee-Mix level &A/C Balance of user are checked respectively. If the Balance & Dry-Coffee-Mix are available,then only it will proceed to the next step in which display will show "Press Start"; otherwise if any of the conditions does not satisfy, then the process will stop& the Display will show "Low Coffee" or "Low Balance" according to the conditions. Now if the user presses the Start button within a set value of time, then the coffee making operations will start inside the machine, otherwise if the set time for pressing the Start button is passed, then also the system will stop. After a successful coffee making operation, the set value of the price of coffee will be deducted from the account of the user.

An independent loop to maintain the water level inside the Water Container is always running by sensing the Water Level &turning on or off the Water Pump.

Another independent loop to maintain the temperature of the water inside the water container is running by sensing the temperature & turning on or off the Water Heater according to the Set Value of Temperature.

II. TESTING AND RESULTS

For vending one cup of coffee,

- Temperature of the Digital Temperature Controller is Set to a value of 60°C in which hot beverages are served generally. Delay value of the temperature is set to 2°C. So, it will turn off the relay through which Immersion Water Heater is connected at the temperature of 62°C turn it on when temperature falls at 60°C.
- The open time of the mechanical valve attached to the servo is set for 3 seconds to pour the dry coffee mix into mixer container.
- The On time of the Submersible Pump which transfers the hot water from hot water container to mixer container is set to 2 seconds.
- The On time of the Mixer Motor which mixes up the coffee is set to 3 seconds.
- The On time of the Submersible Pump which transfers the hot coffee from mixer container to coffee cup is set to 3 seconds.

❖ *Registration of a New Card:*

1. Log in to the software
2. Connecting to the right COM port.
3. Scan the card and edit information
4. Connecting to the COM Port for operation in Auto Mode Operation
5. System at initial stage:

Fig.12a

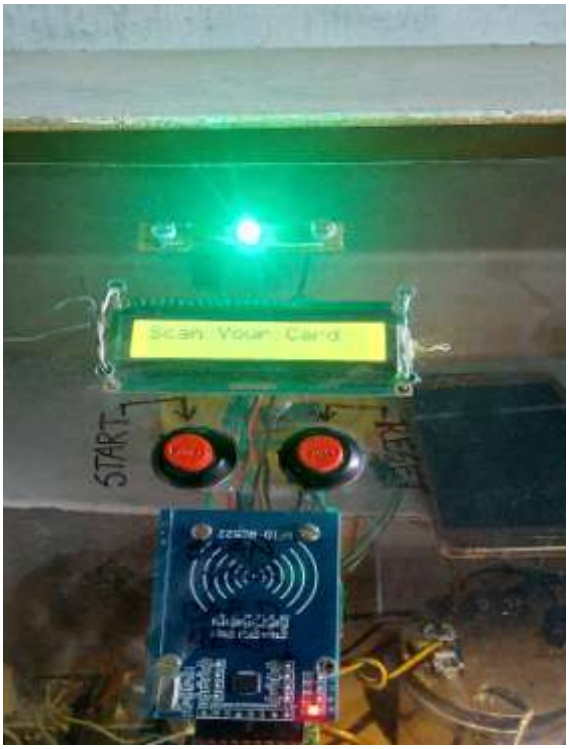

Fig.12b

6. Scanning the card and starting the operation

Fig.13a

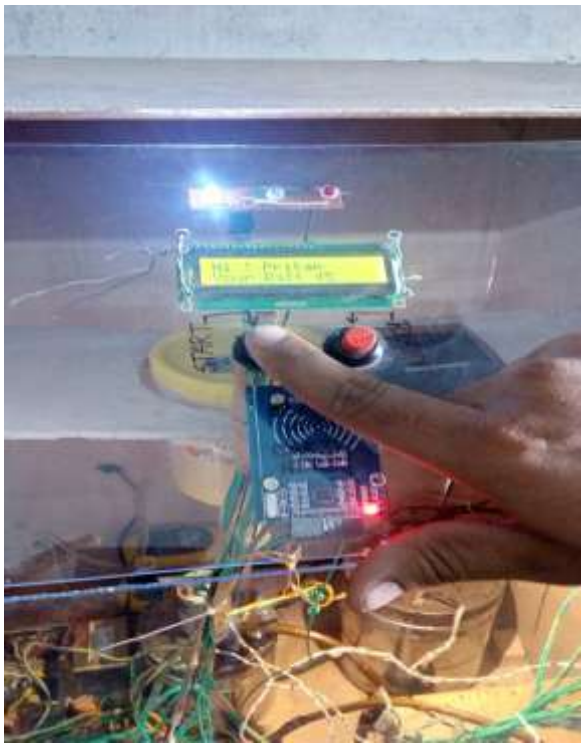

Fig.13b

Fig.13c

7. Invalid conditions:

Fig.14a

Fig.14b

8. Resetting the system:

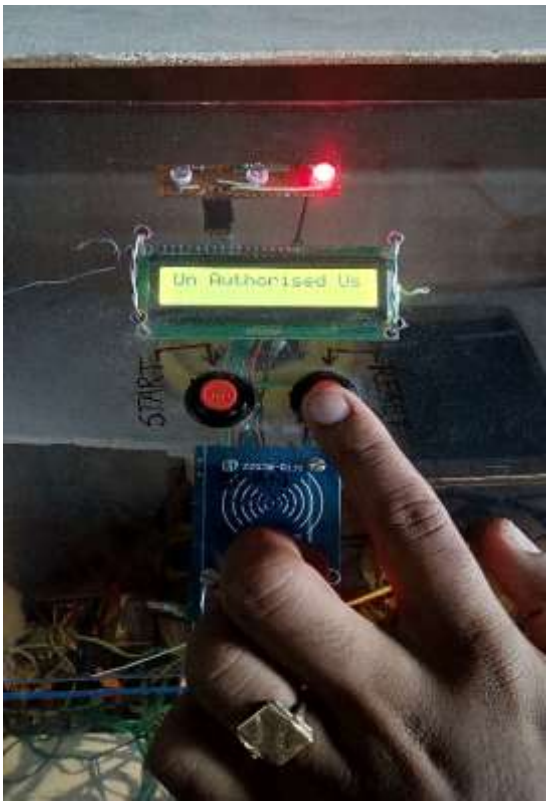

Fig.15a

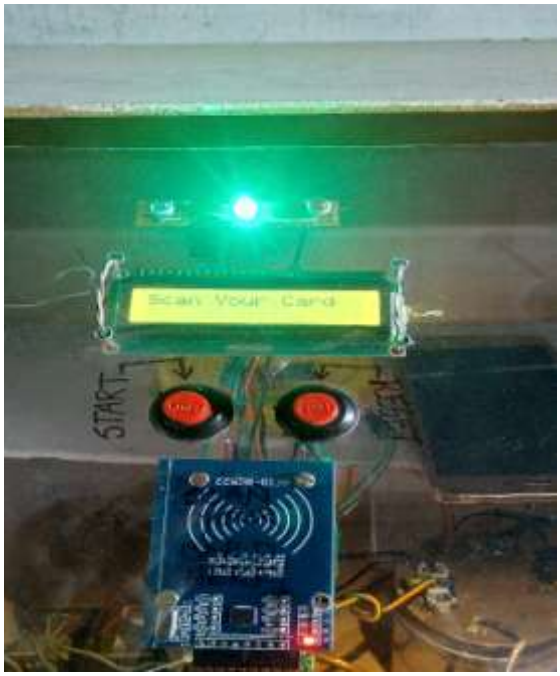

Fig.15b

III. BRIEF LAYOUT OF THE HARDWARE SECTION

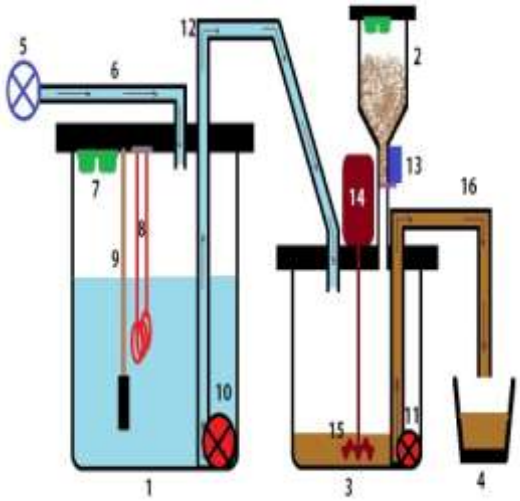

Fig.16

Description:

1. Hot Water Container.
2. Dry Coffee Mix Container.
3. Mixer Container.
4. Coffee Cup.
5. Cold Water Pump.
6. Cold water inlet to hot water container.
7. Water Level Sensor.
8. Water Heater.

9. Water Temperature Sensor.
10. Submersible Pump1 to push the hot water from container1 to container3.
11. Submersible Pump2to push the hot water from container3 to coffee cup.
12. Hot Water Outlet from Hot Water Container &Inlet to Mixer Container**.**
13. Servo Operated Gate to control the flow of coffee dry mix from coffee dry mix container to mixer container.
14. Mixer Motor.
15. Mixer Blade.
16. Hot coffee Outlet.

IV. A BRIEF DESCRIPTION OF THE OPERATION

Supply water is coming through Cold Water Pump in Hot Water Container. Water is heated up by water heater as desired value by sensing the temperature with temperature sensor& processing the temp. value through a closed loop. The ultrasonic sensor senses the level of water & by processing it through a closed loop, maintain the level of water. Submersible Pump1 is pushing hot water from the Hot Water Container to the Mixer Container.

Pouring of Dry Coffee Mix to the Mixer Container is controlled by a mechanical valve or gate attached to the servo motor. An Ultrasonic Sensor senses the coffee dry mix level and start the alarm & deactivate the system when the level is low.

Inside the Mixer Container, the Mixer Motor rotates to mix the coffee finally. Then Submersible Pump2 pushes the coffee made in the Mixer Container to pouring it in the coffee cup from Mixer Container.

Inside view of the container:

V. APPLICATION AND FUTURE SCOPE

Though there is a great scope to make automated appliances based on Arduino, but eye catching technological innovation has not been made yet. So we can implement the idea to make such appliances which will be based on Arduino & RFID in our daily life.

This project can be used in restaurant, hotel, coffee shop where customers drink coffee in a daily basis. It can also be used in industry houses where employers drink coffee.

- The Idea came in our mind after getting trouble with a plenty varieties of cards, fees book & payment methods in our institution.
- We thought to centralise the payment as well as identity system.
- One RFID UID card will be given to each of the student at the time of admission.
- Linking Accounts, Libraries, Canteen, Hostel, Mess etc. with a common Database.
- Introducing Self Service Vending Machines (Coffee, Tea, Cola, and Snacks) to give 24*7 food facilities to the students.
- RFID based attendance System can be made.
- RFID based Door Lock System can be made.
- Make a proposal to the Govt. of India to implement RFID in AADHAAR UID instead of barcode or QR code.

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