Automatic Bhel Vending Machine

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***Abstract*—**

Technology is developing in food industry with the help of automation. Usually, there is tremendous crowd at Snack Centers, Bhel Stalls near gardens, hospitals, and colleges. It is required to deliver Bhel in time. However due to manual operation of preparing Bhel, it is not possible to deliver in time. This kind of scenario can be changed by providing Automatic Bhel Vending Machine that will work faster and can serve more people as compared to conventional Bhel makers. It has both mechanical and electronic systems. The works such as design, modeling, fabrication, assembly are included in mechanical engineering along with actuators, microcontroller and electronic circuits. It can be installed in malls, institute's canteen, hospitals; offices etc. It can be purchased by existing Bhel makers.

***Keywords*: Automation, Bhel, Vending Machine**

I. INTRODUCTION

In the conventional Bhel making process, there is much of human interface. It also takes more time in entire process. In case, if there is crowd at Bhel stall then the Bhel maker experiences fatigue and get confused. Sometimes, quality of Bhel also gets changed. In order to overcome these drawbacks Automatic Bhel Vending Machine is fabricated.

The main objectives of this work are to reduce human effort and innovation in food industry. Nowadays there is various type of automation has been done in various industries e.g. Manufacturing Industry, Food industry, Automobile Industry etc. In food industry lots of automation work has been done using Programming Logic Controller. In this work Microcontroller has been used to make this machine reliable.

II. RELATED WORKS

Kwangsoo Kim has developed automatic coffee vending machine using sensor and Actuator network. They have focused on how technologies contribute to making our daily life be more convenient. A lot of people buy coffee from coffee vending machines without knowing how clean they are. To know the cleaning status of them, they develop a sensor and actuator network and install it inside a vending machine. The network monitors the indoor environment of the machine and adjusts the taste of coffee according to personal preference of a customer [1].

Kamalanathan.P et.al. have been developed an Automatic Paper vending machine. The usage of Paper is inevitable and its demand is increasing steadily particularly in the places such as educational institutions, government offices, etc. At the same time, time is a precious thing that one does not want to waste in any way. In stationary shops it is quite difficult to buy papers during rush time period and the counting of the paper depending on the requirement would cause further time delay and there is a chance for the error in the manual counting of paper[2].

Zhang Wen and Zhang Xin Long have designed and implemented automatic vending machine based on the short massage payment. A design of vending machine based on the short massage payment with the main control module M68HC11 and GPRS module MC35 has been illustrated. They have described the working program of the system and especially the MDB bus and photoelectric conversing circuit and MC35 module are presented. A structure of vending machine is designed; the hardware ideas of bus conversion interface, the software protocol rules based on AT command and the way to use short message payment are given out [3].

Yavuz Ege et.al. have designed electromagnetic stirrer operating in double axis. A new rotating magnetic stirrer system that is controlled by a programmable-integrated-circuit (PIC) microcontroller and can stir in double axis is developed. In contrast to making a stirring action only at one point, as in the case of traditional electromagnetic stirrers, the system that is developed can rotate at two separate axes. One of the rotations is around the axis of the magnetic stir bar itself, and the other is over a circle defined by a rotating magnetic field. That is, the stirrer makes two rotational motions. This is the main contribution of them. The magnetic stirrer system is designed as a three-phase system, and a sinusoidal ramp signal is applied to the phases as the supply voltage. During the design stage, the mathematical model of the system was obtained, and the parameters affecting the design were determined. Based on these parameters, a parameter set was established. This parameter set can be used

for subsequent design studies of the system. A PIC-based control circuit is used to control the frequency of the supply voltage [4].

S.A.M. Matiur Rahman et.al. have made Design of Automatic Controlling System for Tap Water Using Floatless Level Sensor. Water is an essential resource in the world and currently household drinking water is an important asset to save the life due to shortage of water in the earth. They have described the design and development process of an automatic control system for tap water using floatless water level sensor which can save wastage of water without the presence of any operator physically. This sensing system utilizes a combination of a solenoid valve, electromagnetic relay (a type of electrical switch), floatless level controller (61F) and electrodes (used to sense the watery level electrically). The developed system can automatically control the water tap accordingly when level sensor can sense the lower level of water tank. Also, the system has ability to activate the relay which starts solenoid valve. The entire process can continue until sense the upper level of water [5].

Mathieu Grossard et.al. have proposed a system on Sensorless Force/Position Control of a Single-Acting Actuator Applied to Compliant Object Interaction. Force and motion control are necessary to perform manipulation tasks with object interaction of different stiffness's. The controller must ensure stability in a wide range of rigidity, particularly in soft contact cases. The approach proposed here is based on a force/position control scheme. First, a Nonlinear position controller is performed through a linear parameter-varying state feedback. A state observer is added to estimate immeasurable variables coming from an absence of terminal sensors. Subsequently, an output feedback force control is determined using an $H\infty$ framework. The controller is experimentally applied on a single-acting actuator to demonstrate the efficiency of this approach dedicated to compliant object interaction [6].

S.Tsai, S.C.Mukhopadhyay et.al. have been Presented instrumentation and interfacing between microcontroller and sensors/actuator for Roll-to-Roll system. Load cell, edge sensor and brake are commonly used sensors and actuator in the system. However, additional sensor calibration and linearization are required for mechatronic integration of the system. An experimental study was carried out to outline sensor characteristics before and after the signal conditioning. The sensors and actuator were linearized using straight line fitting and Taylor series expansion. Experimental results are illustrated and examined to be working [7].

Cui Wenshan et.al. have explained how time-consuming purchases and operation failures could often occur in the utilization of Vending Machines (VMs) due to the violations between human purchase behavior and design interfaces. An unhindered, clear and concise self-service shopping mood needs to be discovered under the study of human purchase behavior and characteristics of Human-Machine Interaction (HMI) process in order to solve these problems [8].

III. SYSTEM DESCRIPTION

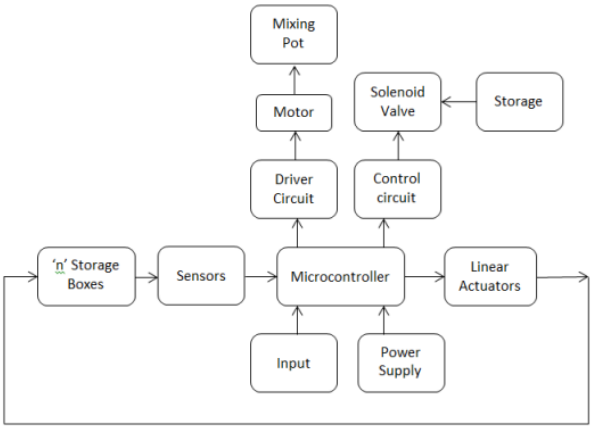


Fig. 1 Proposed Block Diagram

Fig.1 shows the proposed system block diagram. Here, the food material needed for making Bhel will be controlled through different types of sensors and PIC microcontroller. Food material could be puffed rice, onion etc.

Different inputs would be provided by operator depending upon the requirement of customer such as number of plates, Dry Bhel, Wet Bhel, etc. According to inputs the microcontroller will act through sensors and the signal will be given to the actuators to IN and OUT. All the needed food material will come at mixing pot; the liquid food material is controlled through microcontroller and the solenoid valve. Solenoid valve is connected to the mixing pot, where the motor is also connected to rotate the blades through which the food material is mixed and is ready to serve.

Material Selection:

There are numbers of engineering materials available in the market but plastic and stainless steel are the most suitable materials used in food processing industries. Stainless steel is selected as a material for this application because it is easily available in market, good formability and comparatively less cost.

Types of stainless steel:

a. Martensitic stainless steel

b. Ferritin stainless steel

c. Austenitic stainless steel

Among all the types of stainless steels, austenitic is selected. This machine is basically a combination of various parts and working of the machine depends on interlinking of these parts.Storage boxes are used to store various ingredients required for making of Bhel. It is the uppermost part of assembly in order to take advantage of gravity while operating of machine. For checking the level of ingredient in box, one side is made glass/plastic so that it can be easily visible to operator. When all the ingredients are poured from respective boxes, then to accumulate this content at proper place a common hopper is used. It gives required direction to all ingredients. It is in middle portion of machine which is situated at the outlets of all curvature part of boxes. Mixing Pot, Inside the mixing pot blade are fixed on shaft having certain profile so that it should mix the entire ingredient properly which are fallen from the hopper. There is certain provision so that it can be mounted on the motor easily. The material used for blade and mixing pot is also a stainless steel. Microcontroller is used to control all operations. The solenoid valve operates magnetically through the 12V coil. It is a type of two positions and two ports input and output of size half inch. It is fabricated in the stainless-steel material. The orifice of this valve is 16.5mm. Linear Actuator is operates on 24V DC voltage. It has a no load current rating of 1Amp and maximum current rating of 3Amp.It has a speed of 20mm/s input and output mechanism. It can operate on up to 500N load.

Relay is used to control higher voltage devices like Solenoid Valve and Linear Actuators. A relay can be easily interfaced with microcontroller using a transistor. Transistor is wired as a switch which carries the current required for operation of the relay. When the pin of the microcontroller goes high, Transistor turns on and current flows through the relay. The diode D1 is used to protect transistor and the microcontroller from Back EMF generated in the relays coil. Normally 1N4148 is preferred as it is a fast switching diode having a peak forward current of 450mA. This diode is also known as freewheeling diode.

IV. RESULTS

(a)

(b)

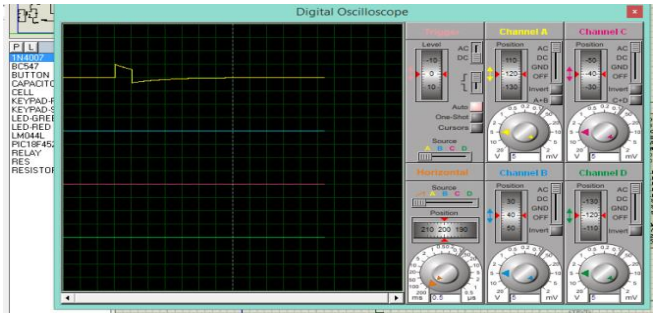
(c)

(d)

Fig.2 (a) (b) and (c) Fabrication and Interfacing of system

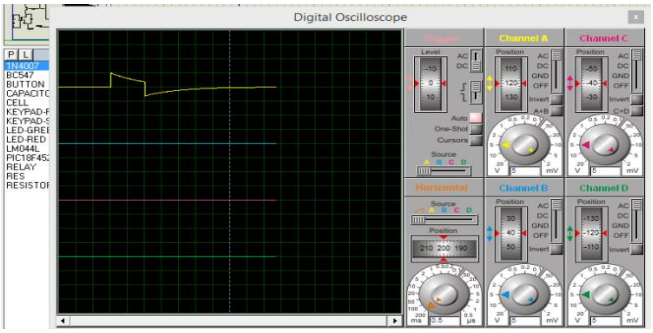
Fig.2 (a) (b) and (c) shows the Fabricated Storage boxes and the blades of mixing pot. It also shows interfacing of the DC motor with mixing pot and Linear Actuator with Storage Box.Fig.2 (d) shows tested Bhel mixing pot.

Fig.3 (a) (b) and (c) shows the Proteus results of the microcontroller circuit. In this the LCD display and keypad is interfaced to Port D and Port C of the controller. The Relay is connected to pin RB0 of the Port B to control the Solenoid Valve. Temporarily LED has been connected in the circuit.

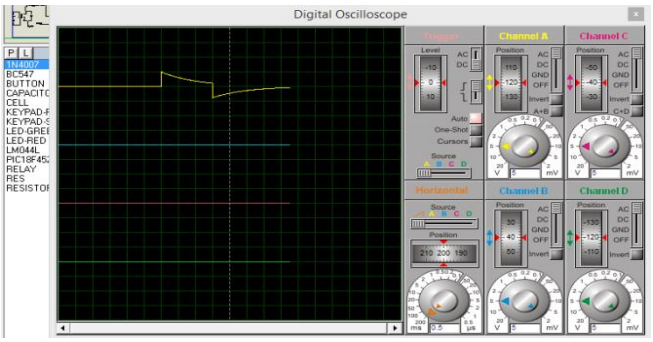


(a)

In Fig.3 (a) of the proteus simulation shows the signal at the output of microcontroller port when the single quantity is provided from the keypad. Fig.3 (b) shows the signal at the output of microcontroller port when the two quantities is provided from the keypad and so on for the third quantity the signal is shown in Fig.3 (c)



(b)



(c)

Fig. 3 (a) (b) and (c) Proteus Simulation Results

V. CONCLUSIONS

Automatic Bhel Vending Machine has been fabricated and tested successfully. The Microcontroller has been used to automate the series of sequences in the machine. Bhel is served quickly and saves time of customers. The taste and hygiene is maintained. Authors have filed Indian Patent on this work along with other co-project partners.

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REFERENCES

[1] Kwangsoo Kim, Dong-Hwan Park et.al, “Smart Coffee Vending Machine Using Sensor and Actuator Networks”, IEEE International Conference on Consumer Electronics, 2014

[2] Kamalanathan.P et.al, "Automatic Paper Vending Machine", International Journal of Science, Engineering and Technology Research, Vol.4, Issue-4, 2015

[3] Zhang Wen and Zhang Xin Long, "Design and Implementation of automatic vending machine Based on the short massage payment", IEEE, 2010

[4] Yavuz Ege, Osman Kalender, and Sedat Nazlibilek, "electromagnetic stirrer operating in double axis", IEEE Transactions on Industrial Electronics, Vol. 57, No. 7, 2010

[5] S.A.M. Matiur Rahmani, Md. Abdullah Al Mamun et.al, "Design of Automatic Controlling System for Tap Water Using Floatless Level Sensor", IEEE International Symposium on Robotics and Manufacturing Automation, 2014

[6] Benoît Huard, Mathieu Grossard, Sandrine Moreau, and Thierry Poinot, "Sensorless Force/Position Control of a Single-Acting Actuator Applied to Compliant Object Interaction", IEEE Transactions on Industrial Electronics, Vol. 62, No. 6, 2015

[7] S.Tsai, S. C. Mukhopadhyay et.al, "Microcontroller-based Sensors and Instrumentation For Roll-to-Roll application", IEEE Sixth International Conference on Sensing Technology, 2012

[8] Cui Wenshan, Huang Yanqun, Liu Minyang, "Influential factors of vending machine interface to enhance the interaction performance", 8th International Conference on Intelligent Computation Technology and Automation, 2015onference on Intelligent Computation Technology and Automation8th International Conference on Intelligent Comp

[9] http://www.sciencedirect.com

[10] Muhammad Ali Mazidi et.al, "PIC Microcontroller and Embedded system Using Assembly and C for PIC18"