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Small Scale Automatic Jaggery Production(AJP) System

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Abstract— Jaggery or pug is the one of the main agricultural products which is widely used in individual households, eateries, restaurants, hotels and clubs and industrial applications. In this paper an automatic system to improve the production rate, increase the quality of product and to address the labor problems in the plant is presented. This proposed model is designed to control and monitor the processes of manufacturing jaggery product. The main controlling console of the automatic jaggery production system is microcontroller (Atmel). Which read the sensors (LM35) measure physical quantity temperature of the boiling sugarcane juice to monitor the temperature to get good quality molten jaggery. The movement of the pan is controlled by DC motor and switches through the programming the microcontroller, along with the opening of control valve for the easy flow of molten jaggery(pug) into the cooling pit to get the required shape of jaggery to reduce the labor work.

Keywords- Jiggery(pug), microcontroller, sensor, Arduino board, dc motor and ADC

I. INTRODUCTION

Jaggery(pug) is a traditional uncentrifuged sugar. It is a concentrated product of date, cane juice, or palm sap without separation of the molasses and crystals, and can vary from golden brown to dark brown in color. jaggery is the one of the main agricultural products which is widely used in individual households, eateries, restaurants, hotels and clubs and industrial applications[1]. There are few steps involved in preparing jaggery as cutting sugar cane from fields, feeding the grinder to extract juice. boiling the juice, adding ingredients, tray Feeding, solid jaggery in required shape[2].

Fresh sugarcanes are cut, cleaned and carefully brought to the plant to get juice. To extract juice from the sugarcane, using a small power run machine, extracted sugar cane juice is directly feed to the vessel. Next step involved is boiling the extracted juice; juice is feed to a large big iron vessel. Heating unit of the vessel .The juice is boiled in the vessel for at least three hours until the liquid juice becomes a semisolid paste, small quantity of sodium carbonate is added as a reducing agent, which helps in making jaggery balls. After stirring well until the juice becomes a semisolid paste, the paste is feed to an iron tray, until more thickening comes. With help of a wet cloth, hot jaggery paste are made as balls precautions are taken, to prepare the balls as fast as possible, as the paste gets to the solid state within a short span of time as shown in figure.1 for a single feed of vessel, they get approximately around 100 kg of Jaggery, they get around fifty Jaggery balls, and jaggery are stored and sold as a complete bulk cart[5][6].

This type of conventional jaggery making is done manually which is more time consuming, need more human monitoring throughout the manufacturing process . This manual manufacturing mechanism may leads decreases the production rate, quality and increases man power requirement.

The main monitoring and controlling of temperature and motors is by arduino board which is embedded with the high-performance Atmel 8-bit is a AVR RISC-based microcontroller, temperature Measurement of 6-channel 10-bit ADC, 23 Programmable I/O Lines in PDIP Package. Simply power it with an AC-to-DC adapter or battery to get started. The 5 volt regulated power supply used to power the microcontroller and other components on the board[3].

The material in this paper are organized as follows in section II brief on procedure to make jaggary production is discussed. Automation of production plant is discussed in section III. Observation and results are discussed in section IV at the end conclusion is given in section V.

II. METHODOLOGY

The juice is extracted from fresh sugarcane. Then it is filtered and boiled in wide, shallow iron pans with continuous stirring and, simultaneously soda or Lady's finger juice is added in required quantity. While boiling, brownish foams come at the top which are continuously removed to get golden yellow color of jaggery. The specific quantity of sugarcane juice is poured into pan and it is heated up to few ^{0}C which is considered as reference temperature for good quality jaggery. The temperature sensor senses temperature continuously and produces the output in terms of voltage[1].

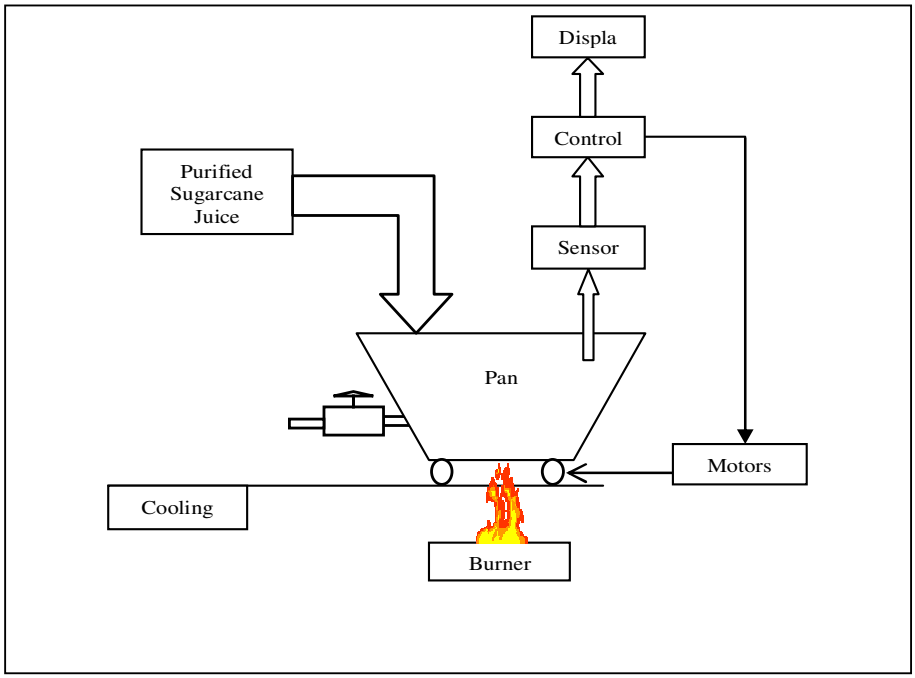

Figure.1 Block diagram of AJP system

This temperature is continuously monitored and displayed by the microcontroller on LCD for reference. Once the temperature reaches the specified temperature, the microcontroller activates the motor to move the pan towards the cooling pit. When the pan reaches at the cooling pit, the motor stops rotating, which intern stops the moving pan. The flow control valve is opened to take out the pug. After certain time the valve is closed and the pan is moved back to the initial position to repeat the process all over again as shown in figure.1.

III. WORKING OF AJP SYSTEM

The central consoler microcontroller operates with 5v supply and also other interface components. LM 35 is used as temperatures sensor which is connected to analog channel A0 of microcontroller. When the cane juice is poured into the pan and the sensor is immersed in the juice before turning on the AJP system. Once it is ON initially it display the plan name as project title is on the LCD (16X2) interface with controller board. The sensor outputs single is in analog voltage which corresponding to the temperature. The voltage value is continuously read through Analog channel A0 with help of sensor and converted to temperature in degree Celsius for monitoring and to display on LCD[7].

Continues reading the sensor output upon reaching 1120C a signal to motor driving circuit is given from pin 7 of Arduino board, a message saying "PUG IS PRODUCED" is displayed. With the help of motor

driver circuit and DC motor pan is moved to cooling pit[6]. When pan reaches at the cooling pit area, the soon after control valve is opened for collection of jaggery in the cooling pit, The valve is kept open for few seconds based on content of sugarcane juice . controller will be programmed. Once the jaggery is taken out and the polarity of the motor is reversed to get the pan to original place for next production. Mean while a message saying "PROCESS COMPLETE" is displayed for 4 seconds. During the process of system reset the message, "INPUT NEXT BATCH" is displayed, as procedure is show in figure.2

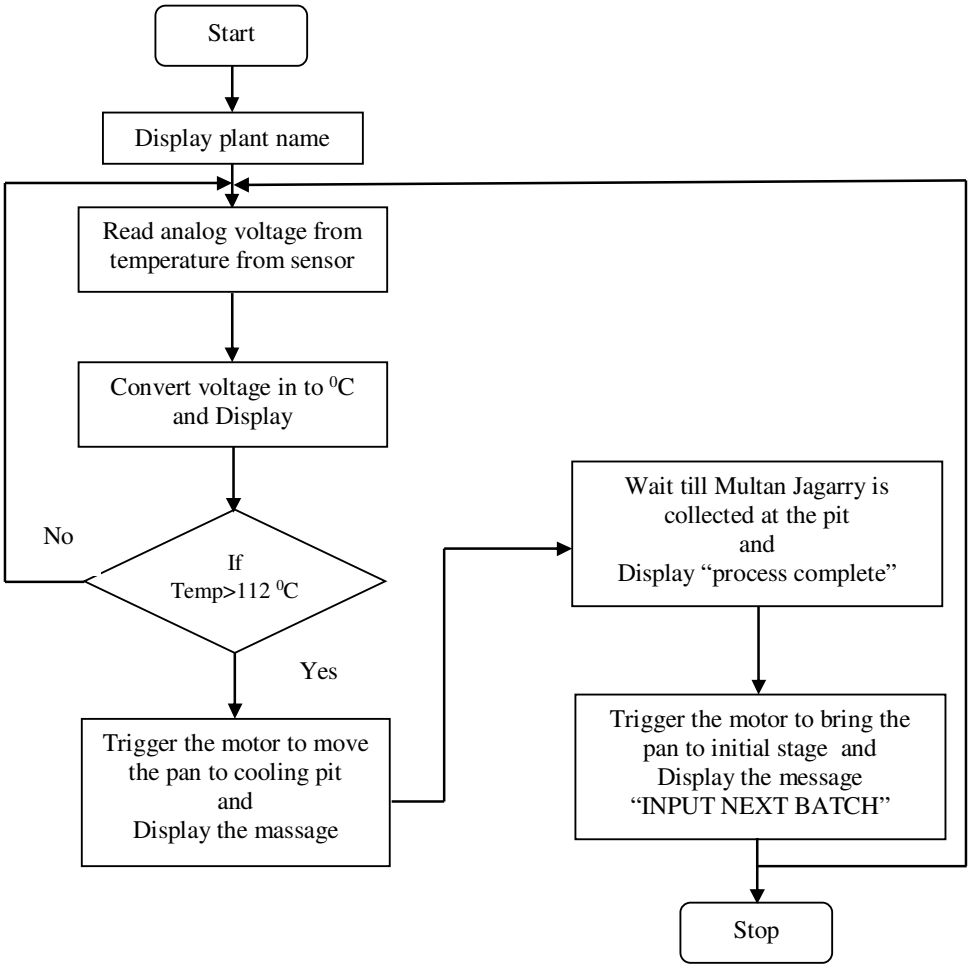

Figure.2 Flow chart of production process

IV. RESULTS

When cane juice of 1 liter is poured into the pan and sensor is immersed in the pan is at initial position as shown in figure.3. The voltage value is continuously read through Analog channel A0 and converted to temperature is displayed on LCD as in figure.4. The juice is boiled continuously and upon reaching 112 ^{0}C, a signal to motor driving circuit is given from pin 7 to rotate the motor to reach cooling pit. Controller board display the message saying "PUG IS PRODUCED" is displayed as shown in figure .5 and 6.

Figure.3 System's Initial Position

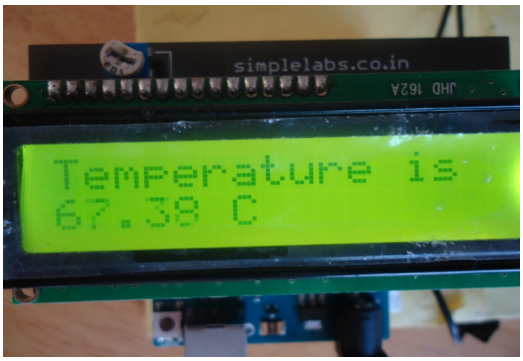

Figure.4 Monitoring of Temperature

Figure .5 Cane juice boiling

Figure .6 Display after temperature is reached

When system reaches at the cooling pit area, the control valve is opened for collection of jaggery in the cooling pit as shown in figure.7.

Figure.7 Pan at cooling pit

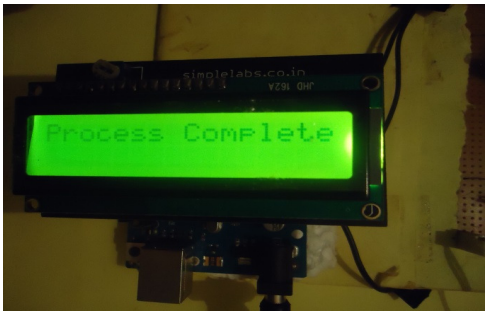

Figure.8 Display after valve closing

Figure.9 Pan initial place

Figure.10 Display after pan at initial place

The valve is kept open for few seconds. Once jaggery is taken out a message saying "PROCESS COMPLETE" is displayed for 4 seconds as shown in figure.8 and approximately 450 gm of Jaggery was obtained. Mean while pan will come back to its initial place. During the process of system reset the message, "INPUT NEXT BATCH" is displayed as shown in figure.9 The system now reaches initial position as seen in figure.10. There are two observation are made with respect to type of sugarcane juice as show in table1.

Table 1 : Quantity of jaggray observed

	Quantity of juice used	Yield temperature point	Quantity of jaggery obtained (approx.)
Type-1 juice	1 lt.	112 ^{0}C	460 gm
Type-2 juice	1 lt.	111 ^{0}C	490gm

IV. CONCLUSION

This system automates the manufacturing of the Jaggery production against the traditional manufacturing method to benefit the rural economy. It provides organic and hygienic and quality Jaggery by increasing the rate of production utilizing very less man power and thus using all the resources efficiently. The system uses low cost machinery and fewer infrastructures.

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