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DEVELOPMENT OF HANDY HONEY COLLECTOR TO OVERCOME THE DRAWBACKS IN TRADITIONAL HONEY COLLECTING SYSTEM

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Abstract: Honeybees are social insects which collects nectar from flower. These insects are known for their incredible capacity of storing honey in a complex hexagonal structure. On average, a comb will produce about 29 kilogram of honey per year. In 2020 honey production has increased 57.58%. Honeybees store this viscous liquid during winter, and it is harvested in summer. The methods adapted for extracting honey affects both the quality and the nutritive value. The apiculturist harvests the honey using traditional method, which is a tedious, and risky process. Traditionally honey harvesting is done by destroying the entire comb, which involves bare hands to squeeze and smoking that interrupt the honeybees. Thus, this project aimed to design a honey extractor to overcome all difficulties faced in traditional method.

Index Terms - — Honey, honeybee collector, Traditional method, Moisture sensor

I. INTRODUCTION

Honey is a mixture of sugars comprising of glucose and fructose, in addition to water (usually 17- 20%). It also contains very small number of other substances like minerals, vitamins, proteins, and amino acids. Bee is a winged, flower-feeding insect which have branched body hairs. They are dependent on pollen as a protein source and on flower nectar or oils as an energy source. Bees are the most important pollinating insects where they are the only rich sources of honey.

Presently, honey is extracted from honeycomb using tradition method. As shown in fig 1, the traditional method often involves squeezing of honeycomb leading to reduction in both nutritional value and quality; the unripe and capped honeycomb are collected at night, and the extraction is achieved by squeezing manually with the hand. It involves the use of bare hands with a knife to cut open the comb of the honey before extracting it into a container thereby damaging the honeycomb. The local procedures of using bare hands include the use of buckets or containers, match, dry leaves or palm kernel shaft, torch light, because the operation is done at night. After sitting the bee comb, put the dry leaves or palm kernel chaff on the caped comb and heat for few minutes to kill both the queen and the drones. Thereafter, an extracting knife is used to pull of the uncapped comb and then put inside the bucket or container. After the extraction, the honey is then taken home and pressed with the hands to separate the honey from the residue. The raw honey is filtered with a sieve to remove the remaining particles after this the honey is ready and fit for consumption [12].

Fig. 1 Traditional method of Honey Harvesting

The developed portable and handy device aims to collect honey through non-invasive manner. Hence this is a easy way of collecting and storing honey directly from trees. Collection of pure honey with the help of this device prevents the honey from contamination and other accidental adulterations. This extractor targets to help the rural and tribal people to gain knowledge on honey collection without any ecological disturbance.

II. MATERIALS AND METHODS

The entire equipment involves the assembly of various components which turns out to be the major parts of the transformed equipment. These components includes a Microcontroller unit, LCD Module, Sensor, Suction pump, Foldable frame, Container, Capillary tubes and a 6-point bolt-nut combination for assembling purposes. These parts are eventually arranged to give out a single unit. The components that make up a single unit are defined below:

2.1 Microcontroller unit

The Microcontroller unit is attached to the equipment to govern a set of specific operations.

2.2 LCD module

The LCD displays the various phases of operations which enables easy handling of the device.

2.3 Sensor

The Sensor enables the conversion of analog signals to digital signals for easy readability of results.

2.4 Suction pump

The Pump enhances the flow of various fluids with a suction cup which gets attached to the surface easily.

2.5 Stand

A portable stand is responsible for holding up all the parts above the ground level.

2.6 Foldable Frame

The entire setup operates on a foldable stainless-steel frame which is built with the help of a 6 point-bolt nut combination.

2.7 Container

A Stainless-steel detachable container is placed in the socket for storage purposes.

2.8 Capillary tubes

Capillary tubes are attached for the easy transport of liquid.

2.9 H-bridge

The use of H-bridge is to control the speed of the suction pump.

2.10 Nozzle

An insulated stainless-steel nozzle is used for penetrating the honeycomb.

III. DEVICE DESCRIPTION

The dimensioning of the stainless-steel frame is of 10 feet (305 cm x 5 cm), Stainless steel container (30 cm x 10 cm) and Capillary tubes (30 cm x 1.5 cm) respectively. The dimensions of the frame can be varied based upon the needs and requirements. The device makes use of a moisture sensor to detect the presence of honey in the comb. On detecting the presence of moisture, the Arduino instructs the suction pump to operate. This enables the rapid operation only when the comb is filled with honey. The pump consists of a suction cup which makes has a very firm grip to the surface. The extraction involves the non-invasive harvesting where no damage occurs to the comb or the honeybees. The harvested honey is stored directly in the container.

IV. DESIGN SPECIFICATION AND CONSIDERATION

- ATMEGA 328 is a well-rounded peripheral set with Q touch capability. This can run even at lower voltages such as 5V. This microcontroller operates up to 10 times faster than the conventional CISC microcontrollers. The pins present in ATMEGA 328P can detect signal from an analog sensor such as moisture sensor and can change them into digital values
- the liquid crystal display (lcd) is an electrically operated thin, flat panel which consists of any number of monochrome or coloured pixels filled with liquid crystals arrayed in the front of a backlight, which is a light source or even a reflector.
- The YL69 moisture sensor [4]is designed with dual probes which is efficiently used to measure the volumetric content of water. The YL69 sensor can be connected in either analog or digital mode. Initially analog connection is made which is gradually switched to digital mode.
- The R385 DC diaphragm based mini water pump is used here for the suction. This pump is preferred over other module just because of their ideal non-submersible character which enhances the flow behaviour of variety of liquids. It also consists of a suction cup which makes it adhesive to the surface.

V. CONSTRUCTION DETAILS

The entire components were fixed together/assembled for the perfect operation of a single unit. Assembling procedure includes welding, bolting, fitting of the containers, embedding the major operating systems and fixing the capillary tubes at appropriate positions. The established unit aims to collect honey from the place of extraction and stores the product simultaneously. The non-invasive technique makes the harvest easy and ecofriendly without the usage of any external heat source.

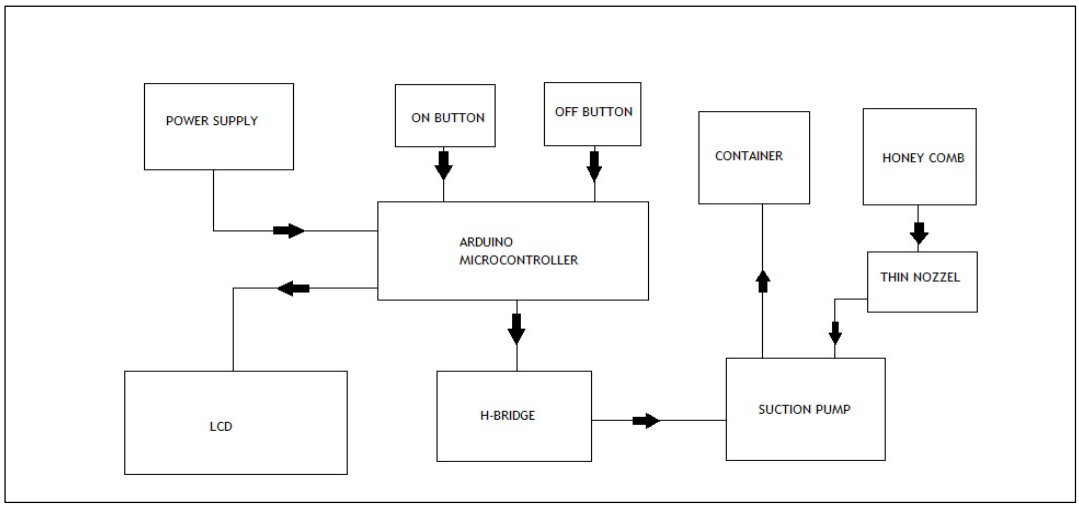

Fig.2 The system consists of Arduino as a main microcontroller, and it waits for the button command to start the device. the device gets started if moisture is detected. The device status is displayed in the LCD module. The speed of the suction pump can be controlled by the H-bridge.

VI. FINISHING OPERATION

The assembly of the unit will be followed by a cleansing procedure. This procedure will be done with a nylon cloth followed by greasing at essential parts such as the point bolt nut combination. The constructed stand will be holding up the entire unit from the ground level without any occasional dismantle.

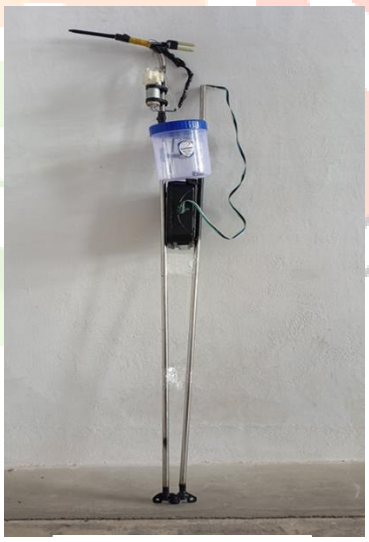

FIG 3

VII. RESULTS AND DISCUSSIONS

Trails were carried out to determine the performance if this non-invasive device. To start with the trail, all the major components are monitored for faults. When the faults are not found and turns out to be in a good condition the trails are started. The equipment is switched ON is lifted to the required altitude where the comb is located. The LCD display is checked for the welcome message to begin the procedure. Once the equipment runs, the LCD display gives out the message “NO HONEY”. In this condition, the pump remains switched off. Once the YL69 moisture sensor detects the presence of honey from the comb, the microcontroller performs the operation where the motor is instructed to operate. The suction pump adheres to the honeycomb and enhanced the velocity of honey collection.

An approximate mass of 3Kg of honeycomb was used for the trails of the equipment. This produced about 1.94 Kg of honey with a harvesting period of 2 minutes. Equation (1) and (2) were used to calculate the capacity and efficiency of the device.

$$MTC = \frac{M}{T} \qquad (1)$$

$$\text{Efficiency} = \frac{m}{M} \qquad (2)$$

The device was found to have an efficiency of 54.63% and this proves that the device is efficient. Also, the performance of the device turns out to be 33.8 Kg/hrs. which is an excellent capacity.

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