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Automatic Wax Injector Machine (AWI Machine)

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Abstract: ***In this modern world machine plays a vital role in making the human life as easy as possible by reducing the work load. The financially sounded people easily update their machineries to be automated but the small-scale industry people find it difficult. The fact is that, the cost of setting up automated machineries are very high when the situation falls critical the small-scale industry owners quit their business and work for these financially sounded people. Then industrialists possess the high human resource support and they become the monopoly in that sector and so they play a major role in determining the cost of the goods, as a result the cost of the consumer goods become very high.***
To address this problem, we have designed and automated the wax injector machine used by rold gold industry people using hydraulics and Arduino UNO board.
Keywords: Arduino Uno, Wax injection, Rold Gold.

I. INTRODUCTION

In our project we identified the problem regarding the accuracy level in the production of rold gold jewels. From the detailed survey given by the labors, we found that they are not able to cope with the large scale industries in the automation sector. We also found that the cost of production device is very high. To give a better and simple solution to the above stated problems and to reduce the plight of the labors in the small scale rold gold industries, we programmed the Arduino board using "C" language, and constructed the Arduino controlled automatic wax injector (AWI) machine setup for reducing the overage load of the industry labors for the better finishing accuracy of the rold gold in the short time.



Fig.1.manual wax injector machine

A. Components Used

Arduino micro processing board
ESC (Electronic Speed Controller)
BLDC (Brush Less DC motor) motor
LI-PO battery.

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B. Arduino

Arduino is a software and hardware company that designs and manufactures microcontrollers. We have used Arduino microcontroller in our project because it is easy to program and it is an open source software and it can be connected with a number of digital and analogue sensors. One more reason for us to use it is because it is based on c language, which is a basic and simple programming language which is very easy to understand. We have used the Arduino uno microcontroller which is based on Microchip ATmega328P in this machine.

C. Arduino Technical Specifications

1) *Microcontroller:* Microchip ATmega328P
2) *Operating Voltage:* 5 Volts
3) *Input Voltage:* 7 to 20 Volts
4) *Digital I/O Pins:* 14 (of which 6 provide PWM output)
5) *Analog Input Pins:* 6
6) *DC Current per I/O Pin:* 20 mA
7) *DC Current for 3.3V Pin:* 50 mA
8) *Flash Memory:* 32 KB of which 0.5 KB used by bootloader
9) *SRAM:* 2 KB
10) *EEPROM:* 1 KB
11) *Clock Speed:* 16 MHz
12) *Length:* 68.6 mm
13) *Width:* 53.4 mm
14) *Weight:* 25 g

D. ESC (Electronic Speed Controller)

ESC is an electronic circuit which controls the motor. It sends s the current in pulses and the motor spins according to it, so it is the component which controls the motor speed. It is generally rated by the maximum current it can withstand Eg.25A A is ampere. Bigger the rating better the esc will be able to withstand the current flowing through it. If more current than the prescribed amount is passed to the Esc it may burn. So it is not advised

E. Bldc Motor

Bldc motor means it is a brushless dc motor .it usually consists of a controller which send the current in pulses to this motor. The motor rotates based on this current. The motor's speed is totally controlled in this way.

The bldc motor is usually rated in kv. The maximum RPM produced by the motor can be calculated with a simple formula MAX RPM = kv rating*battery output

F. Working Of The AWI Setup

We took two syringes (substitution for piston) one bigger sized and one smaller sized and we connected them together with tubes. We filled them with water so as a result due to Pascal's law when we pull the syringe outwards the other syringe gets pulled inside, we attached the smaller syringe to the plywood.

We placed two BLDC (Brushless DC motors) motors on either side of the smaller syringes. we connect them such that one motor spins clockwise and the other one spines anticlockwise so when one motor spins the smaller syringe gets pulled outside as a result the bigger one gets pulled inside after certain amount prefixed time the other motor spins and the syringe gets pulled inside so the bigger one gets pulled outside.

When the bigger own gets pulled inside it pushes a arrangement where the die is placed when it pushed the die presses the nob so the wax gets injected into it. When the bigger syringe comes outside the die releases the nob so the wax injection gets stopped. The working of the motors is controlled by Arduino and motors.

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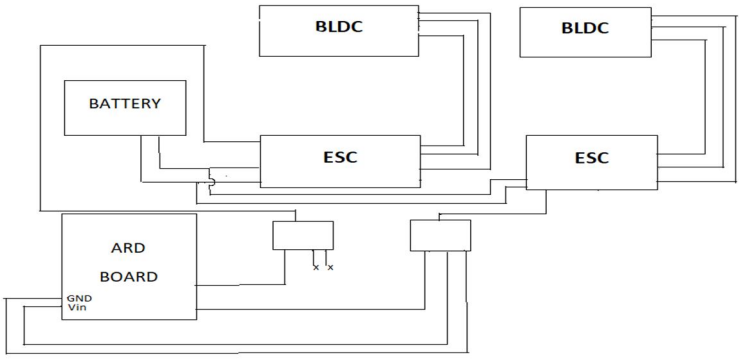


Fig.2. Block diagram of AWI Setup

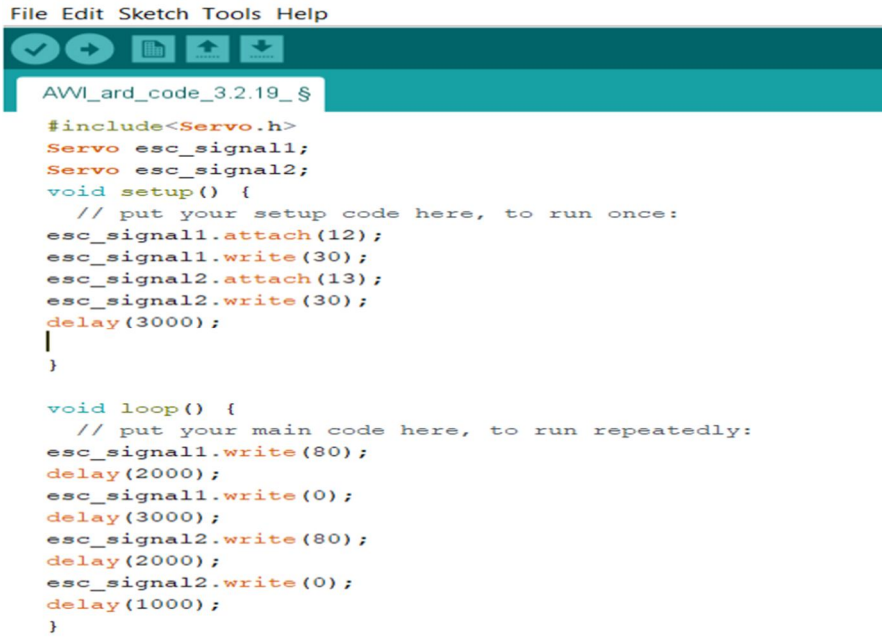


Fig.3. Arduino source code

G. Outcome

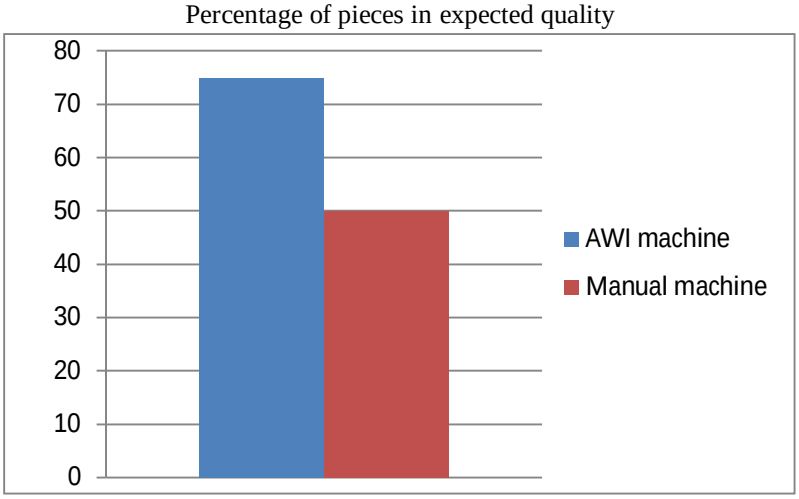


Chart 1: Variation in Rold Gold finishing

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The accuracy level increased when we used the AWI machine in the place of the manual machine, we calculated the accuracy for 10 pieces. When we used manual machine only 5 in 10 pieces were accurate but when we used the AWI machine 7 to 8 pieces were accurate

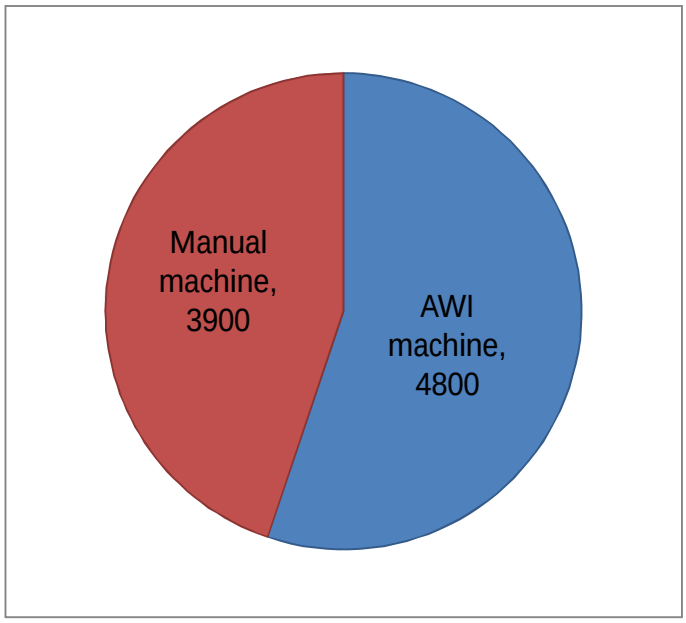


Chart 2: Variation of injection capacity of wax per day

No of injections done by manual machine in one day is 3900,but in our AWI machine it is 4800. Our AWI does 900 injections more than the manual machine because a man will take breaks but a machine does not.

Automatic machine cost: 50000
Manual machine cost: 22000
Cost of AWI setup: 7050

Approximately there are 600 wax injection industries in and around Coimbatore but only 5-6 of them have automatic machine others all use manual machine. If they want to move to automatic machines they have to shed 50000 rupees, but it is not economical for them instead they can just spend around 7000 and make their machines automated.

II. CONCLUSION

A. In manual machines only 5 in 10 pieces were up to the expected quality but in our AWI machine 7 to 8 in 10 pieces were up to the mark.

B. In a wax injection industry there will be at least two machines which will require two operators but when they use our AWI machine one operator is enough to operate two machine, so we can save the salary of that one operator ,if the operator is being paid 10000 we will save that 10000.

C. The cost of this machine is low when compared with other large-scale industry machines.

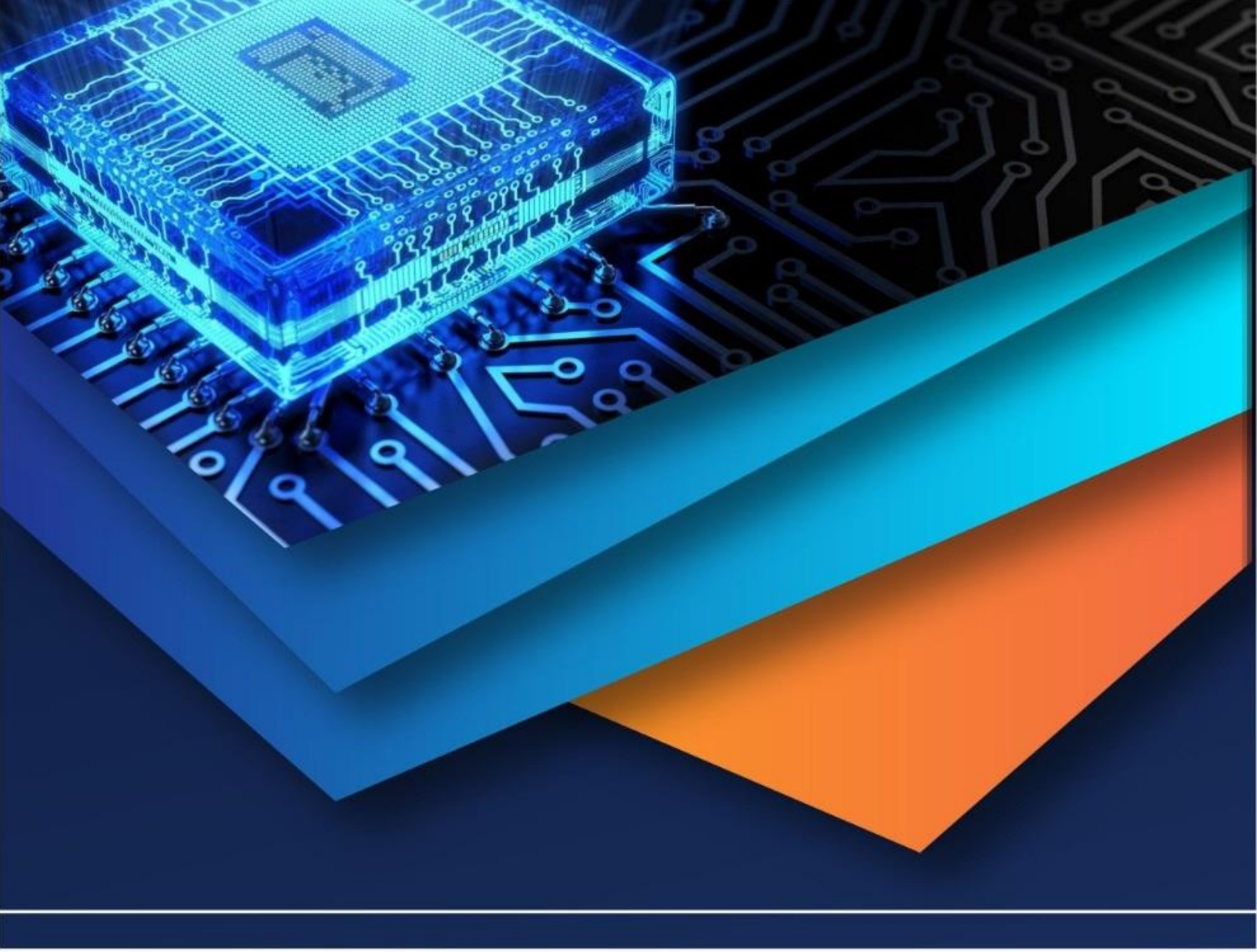
D. Considering the work load of the labour, no of pieces produced in a day, labor cost and the cost involved in setting up the automated machines our AWI machine is very much better than the other machines present in the mark

III. FUTURE SCOPE

A. We want to further develop it by making it fully automated. Now a worker needs to be present in order to change the die. In future, we can develop it such that it automatically changes the die. In simple words, we want to develop a machine that operates with zero human intervention.

B. Now we are using a battery operated machine, we want to further develop it such that it works on AC current.

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