Experimental investigation on effect of Automated internal process of a low cost 3D printer

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Abstract— The growing consensus of 3D printing technology will be one of the next major technological revolution. A lot of work already been carried out as to what there technologies will bring interm of product and process innovation, little has been done on their impact on business models and business model innovation. This research paper focus on investigation on the effect of automated internal process of a 3D printer by reducing the cycle time enhance productivity and decrease the cost of the product than conventional injection molding and machining and also assembly and integration of system interface to build the working model of 3D printer.
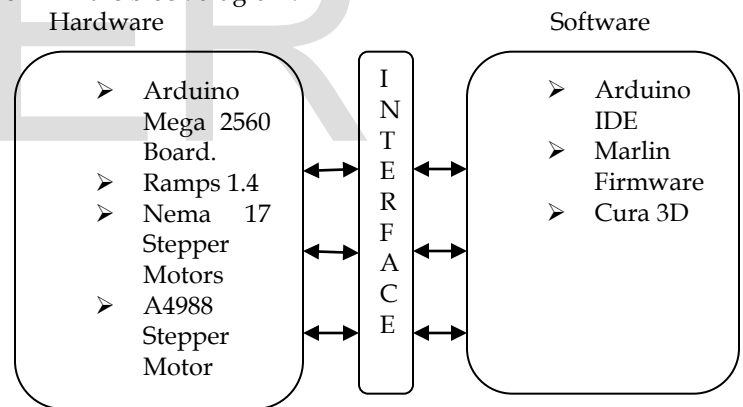
Index Terms— Assembly, Automated, build, enhance, 3D Printing, Investigation, system,

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1 INTRODUCTION

3D printing is a form of additive manufacturing technology where a three dimensional object is creatred by laying down successive layers of material. It is also known a Rapid proto-typing, is a mechanized method where by 3D objects are quickly made on a reasonable sized machined connected to a computer containing blue prints for the object.Two major mo-tivational categories for examining additive manufacturing costs. The first is to compare additive manufacturing process to other traditional process such as injection moding and ma-chining. The purpose of there types of examination is to de-termine under circumstances additive manufacturing is cost effective. Second is identifying resource use in additive manu-facturing to identify when and where resources are being con-sumed and these can be reduction in resources use by reduc-ing the scrap. [1] allen has worked on comparative costs of additive manufacturing vs machine from solid for aero engine parts.[2] Alexander has worked on part orientation and build cost determination in layer manufacutirng. [3] Byuns optimal build direction in rapid prototyping with variable slicing and its effects on part quality, build time and part cost [4] Camp-bells build time estimate based on volumetric calculations with in the error limits.[5] Gibson presented a paper in Addi-tive Manufacturing (AM) is an automated technique for direct conversion of 3D CAD data into physical objects using a varie-ty of approaches. Manufacturers have been using these tech-nologies in order to reduce development cycle times and get their products to the market quicker, more cost effectively, and with added value due to the incorporation of customiza-ble features. In this research paper main objective is with the use of low cost Automated 3D printer saves time and cost by eliminating the need to design, print and glue together sepa-rate model parts.   A 3D model can be created in a single process using 3D printer. The basic principle include mate-rials, cartridges, flexibility of output and translation of code into a visible pattern.
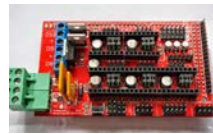
2 EMBEDDING HARDWARE, SOFTWARE .VIA INTERFACE AND PRINTING PROCESS

The integration of hardware components and software used for the low cost automated 3D printer via interface is shown in the block diagram.

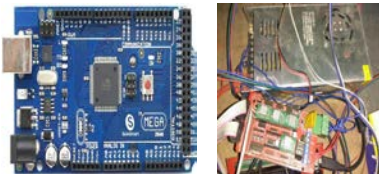| Hardware	INTERFACE	Software
➢ Arduino Mega 2560 Board. ➢ Ramps 1.4 ➢ Nema 17 Stepper Motors ➢ A4988 Stepper Motor	I N T E R F A C E	➢ Arduino IDE ➢ Marlin Firmware ➢ Cura 3D

Connect the hardware components via interface. Arduino Mega 2560 board with Ramps 1.4 are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating stepper motors of x,y,z,axis as shown in figures 2,3,4 , turning on an LED, pub-lishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. IDE contains text editor for writing codes, a message area, text console, tool bar, and menus. It connects to the Arduino and hardware to upload programmes and communicate with them. Marlin firm ware resides on 3D printer main board and runs when the machine is on and manages all the activities of the machine and coordinates heater, stepper motors, sensors, light, LCD display buttons connections are shown in figure 5
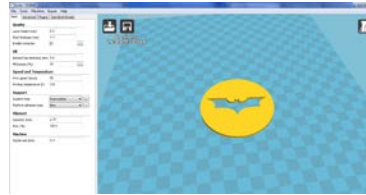
while printing. It reads the file from the SD card and execute in the form of commands generally G codes step by step and build the 3D model after configuring Marlin firm ware and Arduino Mega 2560 with in IDE software.   A 3D model is build using 3D software with a file extension .stl is exported to cura 3D where the slicing of the 3D model is done as shown in figures 6,7 Cura 3D translates .stl file into a format the printer can understand and instruct the printer how to place layer by layer to build the 3D model and the instructions are save on with the file extension .Gcode which is to SD card .
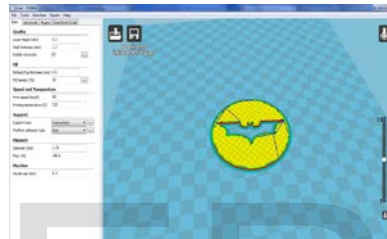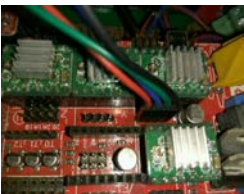

Power connections fig 1

X axis connection with Stepper Motor fig 2

Y axis connections with Stepper Motor fig 3

Z axis. Axis connections with Stepper Motor fig 4

Extruder stepper motor and thermistor

 connections fig 5

RepRAp Arduino MegaPololu Shield 1.4

3D Model imported in CURA fig 6

3D Model Sliced in CURA fig7

BATMAN LOGO fig 8

3. RESULTS

➢ 3D Models were build on low cost 3D printer as shown in fig 8.

➢ Enhancing the productivity, low cost, decrease in cycle time by automation of internal process of low cost 3D Printer than the conventional injection molding and machining.

➢ Less waste of Material

4. CONCLUSIONS

➢ The main aim of this research paper is to implement and encouse the manufacturer to adopt this low cost 3D printer.

➢ Connecting the hardware and software components of 3D printer.

➢ Automatic flow of data from hardware to software via interface.

➢ Automatic generation G-codes.

➢ Effective utilization Aurduino mother board, cura 3Dsoftware, Aurduino softwares.

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