INTERNSHIP PROJECT REPORT

HALL-MASTER 3D

BY:

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PROBLEM STATEMENT:

If a fault or an uncertainty of working of the motor is reported from the customer side, the service agent requires complex hardware and software in-order to drive down and detect the cause. This approach is time-consuming, resource-intensive, and impractical for on-site analysis, leading to delays in identifying and resolving issues. There is a need for a portable, efficient, and user-friendly diagnostic device that enables service engineers to conduct initial analysis on-site, reducing downtime and improving customer satisfaction. This portable device was proposed to support the service engineers for initial analysis.

SOLUTION

HALL-MASTER 3D

It is a field capturing device, that is used to check the proper working condition of the three hall effect sensors that are soldered on a PCB board which is mounted on the stator of the IN-HUB Motor. The stator is fed with 3-phase supply, which helps in energising the windings in a particular sequence.

This device is a circuit that consists of a breadboard with 3 LEDs and 3 resistors (one for each led) which are assembled and connected to an Arduino UNO board externally which is programmed using an Arduino Software. It is programmed in a way that whenever the Hall-effect sensor senses or detects a magnetic field close to it, it energises the LED assigned to it and the LED glows. From this, the working of the hall effect sensors and the sequence in which the windings are energised can be visualised and hence an easy and reliable way to find out if the motor is functioning or has malfunctioned.

The PCB consists of 5 output ports:

- The 3 signal ports of the Hall-effect sensors

- One signal port for the temperature sensor

- And one port for ground (GND)

The functionality of this device is that the stator of the IN-HUB motor is energized with a 3-phase supply, activating the windings in sequence. The Hall-effect sensors detect magnetic fields and send signals to the Arduino. When a sensor detects a magnetic field, it activates the corresponding LED, which glows to indicate proper functionality.

The benefits of using this device include portability as it is light weight, compact and suitable for field applications, ease of use as it provides a simple visual indication of sensor functionality and reliability as it ensures quick and effective initial analysis of motor and sensor performance.

COMPONENTS USED IN THE DEVICE

1. **Arduino Board:**
   The Arduino board used here is an Arduino UNO, which is a microcontroller board based on the **ATmega328P**. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

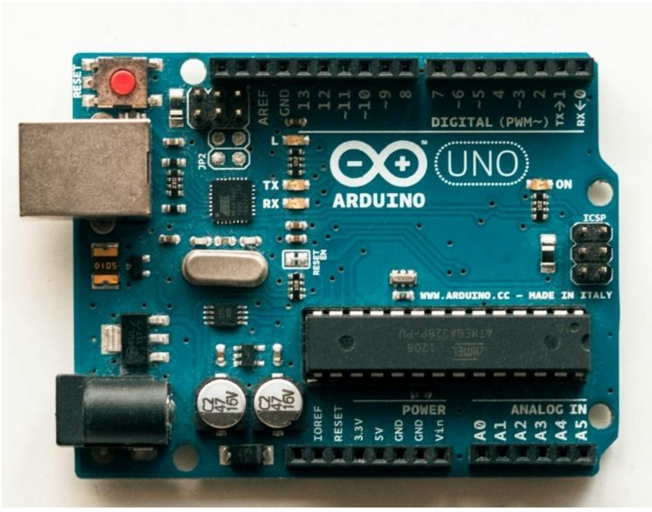

Fig 1.1

2. **LEDs:**

   White LEDs are used to indicate the hall signals whenever a magnetic field was present near the Hall-effect sensor.

   (3 LEDs are used in this device)


Fig 1.2

3. **Resistors:**

The resistors were used with the LEDs to limit the current through the LEDs. The rating of the resistors used are of 10K ohm.
(3 resistors are connect in series with the 3 LEDs)

Fig 1.3

4. **Jumper Wire:**

Male to Male Jumper wires is used to establish a path of flow of current between the components in the circuit.

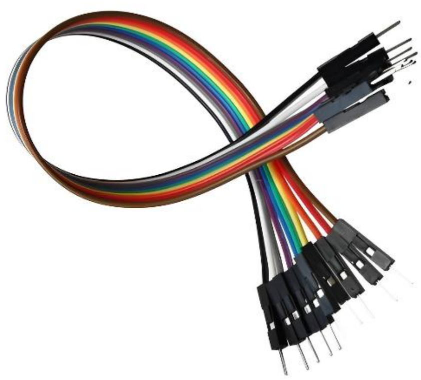

Fig 1.4

This circuit was constructed by connecting the U(blue), V(yellow), W(green) terminals of the PCB board to the digital pin 2, digital pin 3, digital pin 4 respectively on the Arduino board and the 3 LEDs to the digital pin 5, digital pin 8, digital pin 7 respectively on Arduino board. The Arduino UNO was programmed in a way that whenever the signal of the Hall-effect A goes high, the LED 1 glow and whenever the signal of the Hall-effect B goes high, the LED 2 glows and whenever the signal of Hall-effect C goes high, LED 3 glows. A common ground connection was also provided to the PCB on the breadboard.

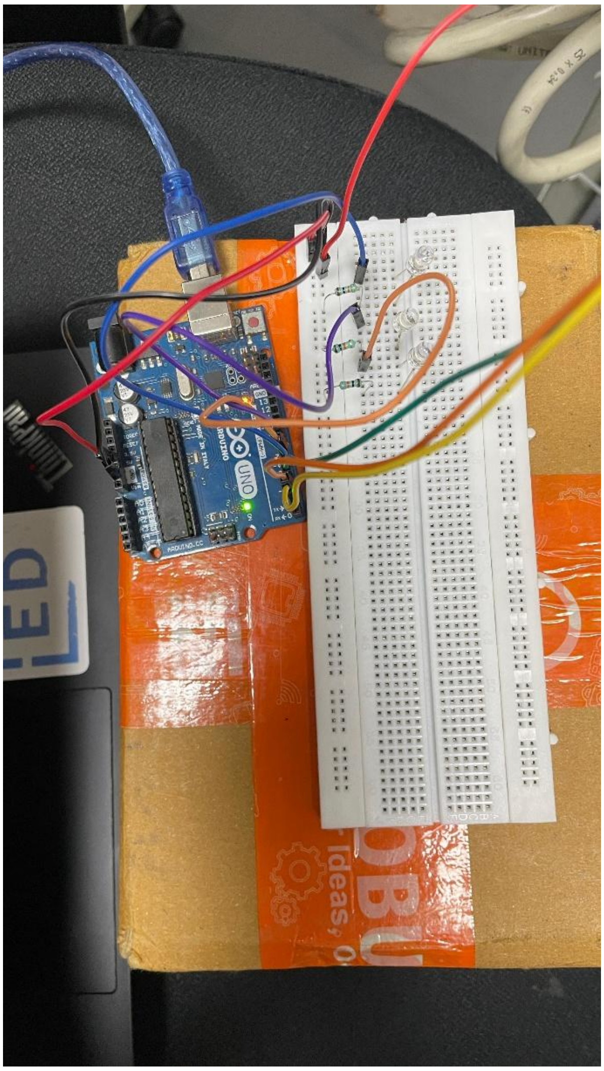

Fig 1.5

CODE

```
const int hall_A = 2;
const int hall_B = 3;
const int hall_C = 4;
const int led1 = 5;
const int led2 = 8;
const int led3 = 7;
int hallA;
int hallB;
int hallC;
void setup() {
pinMode(hall_A,INPUT);
pinMode(hall_B,INPUT);
pinMode(hall_C,INPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(led3,OUTPUT);
Serial.begin(9600);
}
void loop() {
hallA=digitalRead(hall_A);
Serial.print(&quot;A: &quot;);
Serial.println(hallA);
if(hallA==HIGH)
{
digitalWrite(led1,HIGH);
}
```

```
else
{
digitalWrite(led1,LOW);
}
hallB=digitalRead(hall_B);
Serial.print(&quot;B: &quot;);
Serial.println(hallB);
if(hallB==HIGH)
{
digitalWrite(led2,HIGH);
}
else
{
digitalWrite(led2,LOW);
}
hallC=digitalRead(hall_C);
Serial.print(&quot;C: &quot;);
Serial.println(hallC);
if(hallC==HIGH)
{
digitalWrite(led3,HIGH);
}
else
{
digitalWrite(led3,LOW);
}
delay(100);    }
```

INTERFACING THE DEVICE WITH THE IN-HUB MOTOR

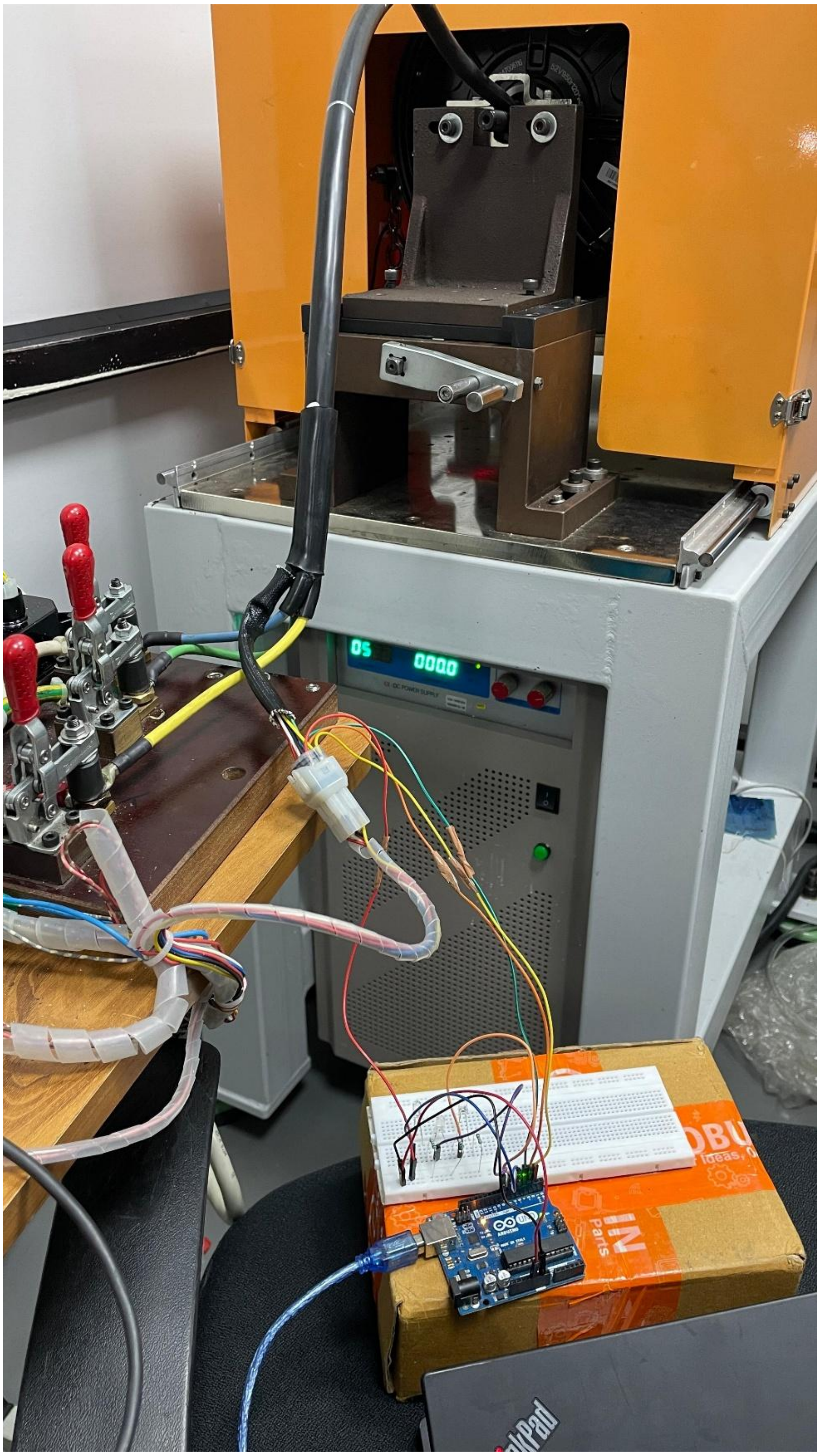

Fig 2

CONCLUSION

The HALL-MASTER 3D can be used by service engineers or by any service agents. If a customer reports a fault in the working of the motor, stator being one of the most important parts for the working of the motor, it is essential to check the working condition of the sensors used in it. This device can be used to check the proper working of the Hall effect sensors and to check whether the 3 phase windings are getting energised properly in a sequence for the continuous operation of the IN-HUB Motor. Its simplicity, portability, and reliability make it an indispensable tool for ensuring the continuous operation and longevity of IN-HUB motors, ultimately improving customer satisfaction and reducing maintenance costs.