DEVELOPMENT OF IOT BASED EMBEDDED BRUSHLESS DC MOTOR CONTROL SYSTEM

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Abstract: Brushless DC motor is changing into more and more widespread in sectors like automotive,white product and industrial as a result of it will away with the mechanical switch utilized in ancient motors, commutation it with associate degree device that improves the dependableness and sturdiness of the unit.motor management system control motor per application specific logic.If you drive a contemporary automobile, you need to have detected however swish the ability steering,power window and seat adjustment etc has become.all this has been attainable with advanced control system that not solely drive a motor in several speed associate degreed directions however additionally in an economical and swish manner.motor management system is associate degree electronic control unit includes of small controller ported with motor drive logic and integrated with another control peripherals.BLDCM additionally known as static magnet BLDCM area unit used for shopper and industrial applications attributable to their compact size,controllability and easy frame. during this variety of motors the mechanical switch utilized in brushed dc motors is replaced with electronic switches fitly driven by associate degree electronic circuit this feature permit to get associate degree rising of dependableness and potency of the motor itself and an extended in operation life because of the absence of brushes erosion. Another advantage of BLDCM is that at constant power and so for equal motor torsion and provide voltage values,since there are not any brushes ,they can be factory-made with reduced dimensions ensuing thus additional appropriate for applications that need smaller volumes and weights.

Index Terms - **BLDC,motor control,speed management,IoT,PWM**

I. INTRODUCTION

The brushless DC (BLDC) motor is changing into more and more widespread in sectors like automotive (particularly electrical vehicles (EV)), white product and industrial as a result of it will away with the mechanical switch utilized in ancient motors, commutation it with associate degree device that improves the dependableness and sturdiness of the unit. Another advantage of a BLDC motor is that it are often created smaller and lighter than a brush sort with constant power output, creating the previous appropriate for applications wherever area is tight. The brushes of a standard motor transmit power to the rotor windings that, once energized, flip during a mounted magnetic flux. Friction between the stationary brushes and a rotating metal contact on the spinning rotor causes wear. additionally, power are often lost because of poor brush to metal contact and arcing.Because a BLDC motor dispenses with the brushes – instead using associate degree "electronic commutator" – the motor's dependableness and potency is improved by eliminating this supply of damage and power loss. additionally, BLDC motors boast variety of alternative blessings over brush DC motors and induction motors, as well as higher speed versus torsion characteristics; quicker dynamic response; quiet operation; and better speed ranges.Electric motors area unit the backbone of business drives. DC motors area unit extremely governable however incur higher operations prices than AC motors, partly because of part maintenance for the switch and brush.

Brushless DC (BLDC) motors would like no such maintenance, making them widespread among the appliance, automotive, and part industries. BLDCs offer a period exceptional 10 thousand hours, and also are extremely economical because of the dearth of copper loss within the rotor, and supply reduced noise, higher speed vary and a better torsion to weight magnitude relation . Precise management is achieved through Pulse breadth Modulation (PWM) BLDC control will be achieved with and while not sensors . to manage the rotor, the current position is measured by the sensors. subsequent management action is then determined by the PWM or DC bus voltage management. The stator coil winding is energized on the alignment of rotor poles. Hall sensors area unit used for position measuring additional ofttimes than older varieties like optical encoders and potentiometer sort sensors as a result of they supply additional reliable operations in environments characterised by high vibration, dirt and wetness – environments well-suited to BLDC motors

A BLDC motor is thought as a "synchronous" sort as a result of the magnetic flux generated by the stator coil and also the rotor revolve at constant frequency. One advantage of this arrangement is that BLDC motors don't expertise the "slip" typical of induction motors.

This thesis is organized as follows, Chapter one consists of Introductory half, Chapter two discusses the connected researches during this field, Chapter three consists of style, Chapter four consists of the look methodology ,chapter five discuss concerning tools used,Chapter six consists of benefits and chapter seven tells concerning results and discussion,Chapter eight consists of future scope and also the last chapter points the conclusions.

2. Related Works

Design of speed control and reduction of torque ripple factor in BLDC motor using spider based controller [1] . In this work, the quick stabilization with torque ripple reduction is presented using a bio-inspired algorithm-based technique in a Brushless DC (BLDC) motor drive.Brushless DC Motor Controlled by using Internet of Things[2] . This paper presents the study and control of the Brushless DC (BLDC) motor by using IoT. . The Internet of Things (IoT) refers to the ever growing network of physical objects that feature an Internet protocol (IP) address for internet connectivity and the communication that occurs between these objects and other internet enabled devices and systems. Embedded speed control of BLDC motors using LPC1549 microcontroller [3] This paper presents a speed controller of a Brushless DC motor using root locus method. The control algorithm of the Brushless DC motor is implemented on LPC1549 microcontroller, using a hardware event driven state machine. This algorithm runs on a state configurable timer peripheral, without any intervention of the processor. The Hall sensors of the low cost motor are software calibrated in order reduce the output speed noise from the Brushless DC motor. Design of a Brushless DC (BLDC) Motor Controller [4] . Growing need for high productivity is placing new demands on mechanisms connected with electrical motors. The demand for low cost Brushless DC (BLDC) motor has increased in industrial applications.Sensor-less Brushless DC Motor Control System Design for Electric Vehicle [5] This paper, based on the performance characteristics of electric vehicles, provides a rather integrated set of control strategies of sensor-less brushless DC motor for electric vehicles.

3. METHODOLOGY

The proposed system focuses on controlling speed and direction of BLDC motor.Here a cortex M-series microcontroller is used,which is STM32L475 discovery IOT kit board.Comparing with existing systems this system has low power consumption and low cost,also we can integrate several arms to this microcontroller board since,board is integrated with Mbed OS .

From the PWM output pin of microcontroller the PWM are given to the motor driver circuit.Motor driver circuit used is actually a electronic speed controller circuit(ESC).ESC is used to change the speed of an electric motor and also acts as dynamic brake.ESCs are frequently used on radio controlled models which are electrically powered, with the change most frequently used for BLDC motors basically providing an electronically produced 3-phase electric power low voltage source of energy for the motor.According to motor speed we can generate PWMs with different Duty Cycle and make motor to rotate in different speed.
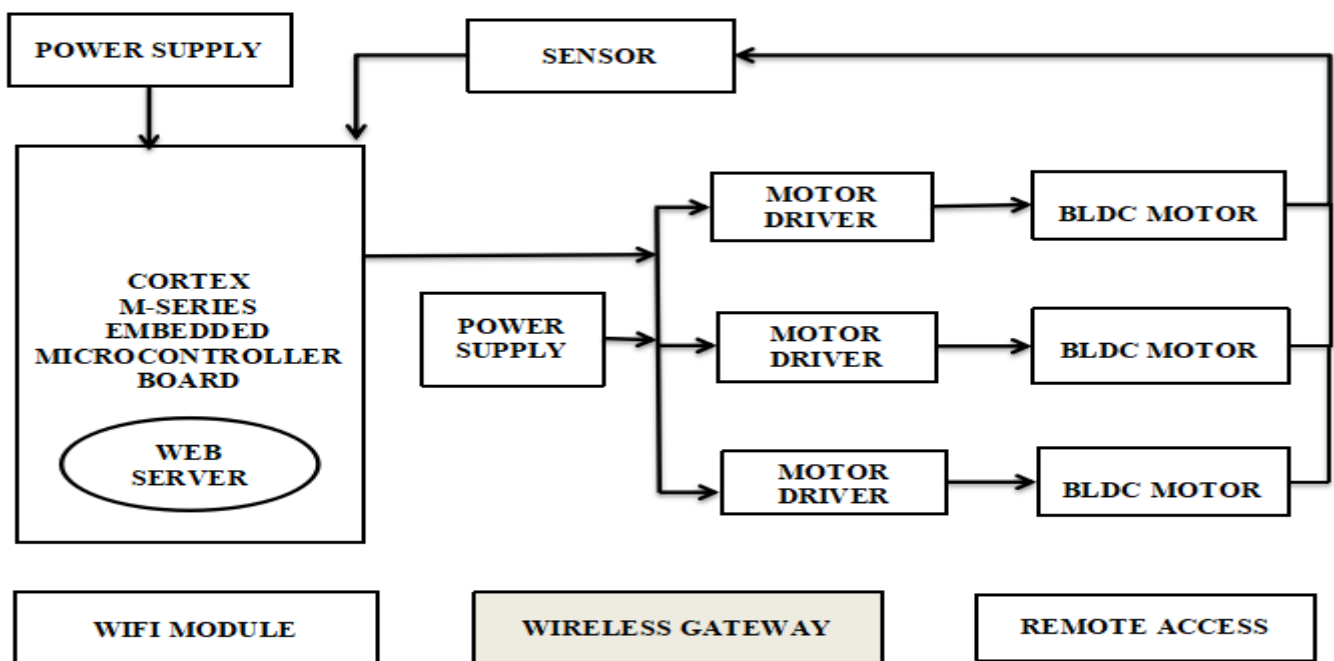

Fig 1: Block diagram

Arm Mbed OS integrated microcontroller is used here DISCO-L475VG-IOT01A which includes the controlling algorithm for 3 motors used and this can be used typically in multimotor robots.Arm Mbed OS is a free, open-source embedded operating system designed specifically for the "things" in the Internet Of Things.It includes all the features you need to develop a connected product based on an Arm Cortex-M microcontroller, including security ,connectivity, an RTOS,and drivers for sensors and I/O devices.After web server creation different clients can access this system.We can work motor in different speeds by creating PWM with varying frequency and duty cycle.

3.1 DISCO-L475-IOT01A

The B-L475E-IOT01A Discovery kit for IoT node allows users to develop applications with direct connection to cloud servers. The Discovery kit enables a wide diversity of applications by exploiting low-power communication, multiway sensing and ARM Cortex -M4 core-based STM32L4 Series features. The support for Arduino Uno V3 and PMOD connectivity provides unlimited expansion capabilities with a large choice of specialized add-on boards. Ultra-low-power STM32L4 Series MCUs based on Arm Cortex -M4 core with 1 Mbyte of Flash memory and 128 Kbytes of SRAM, in LQFP100 package

4. EXPERIMENTAL RESULTS

Controlling algorithm is written in Mbed OS and we created 3 PWM for different motors.According to different duty cycles of PWM the speed is controlled.For driving the motor MOSFET driver is used.PWM with different duty cycle is created and given to this drivers and drive the motor in different speed.The microcontroller is integrated with Mbed OS and WiFi is enabled.The figure below shows the serial monitor display which indicates the initialization of WiFi.The system is then connected with access point for network connectivity.

For obtaining different speed of motor that we desired,we want to give PWM with different duty cycles.If the maximum speed of motor is 1400rpm then the 50% duty cycle means 700rpm speed.Similarly we can vary speed according to our will.
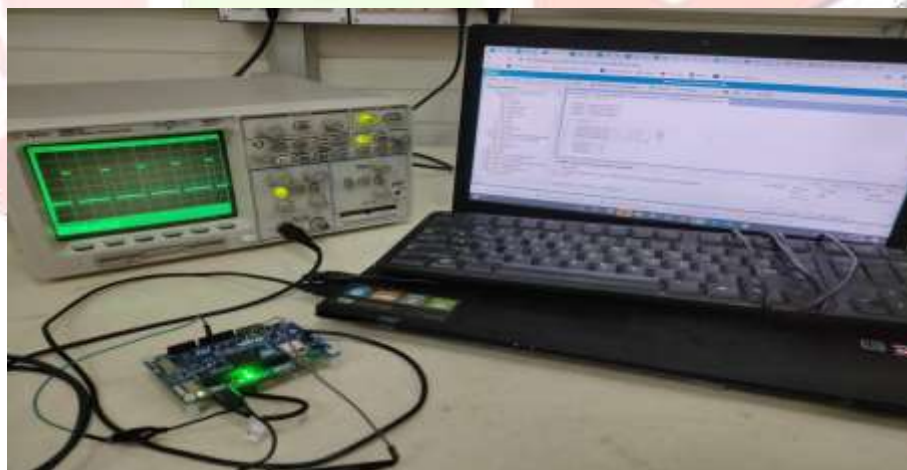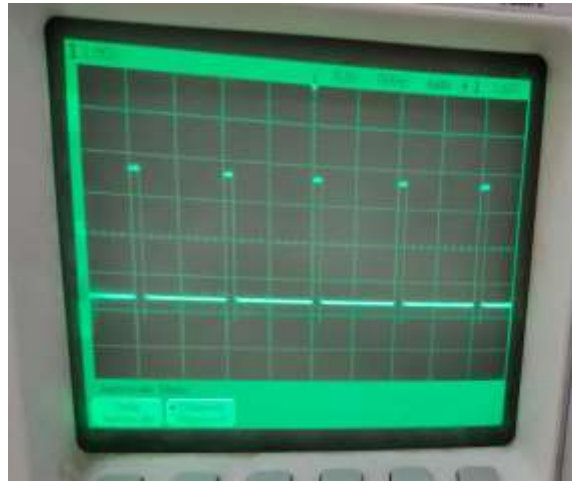

Fig 2: .Experimental Setup

Fig.3.Case 1:10%Duty Cycle

Here we are considering different cases with different duty cycles.In program we written modify with different time period.Speed and direction is controlled,according to motor 3s here used we get maximum of 12800rpm and it can vary with varying width and frequency of PWM giving to motor driver. Here we use ESC motor driver.

Fig.4.Case 2: 25%Duty Cycle

Fig.5.Case 3:40%Duty Cycle

5. CONCLUSION

BLDC motors offer a number of advantages over conventional motors. The removal of brushes from a motor eliminates a mechanical part that otherwise reduces efficiency, wears out, or can fail catastrophically. In addition, the development of powerful rare earth magnets has allowed the production of BLDC motors that can produce the same power as brush type motors while fitting into a smaller space.One perceived disadvantage is that BLDC motors, unlike the brush type, require an electronic system to supervise the energizing sequence of the coils and provide other control functions. Without the electronics, the motors cannot operate.However, the proliferation of inexpensive, robust electronic devices specially designed for motor control means that designing a circuit is relatively simple and inexpensive. In fact, a BLDC motor can be set up to run in a basic configuration without even using a microcontroller by employing a modest three-phase sine- or square-wave generator.Here an embedded brushless DC motor controlling is done based on internet of things. The device can be used to control a three-phase or four-phase BLDC motor.However, employing an 8-bit microcontroller (programmed with factory-supplied code or the developer's own software) adds very little cost to the control system, yet offers the user much greater control over the motor to ensure it runs with optimum efficiency, in addition to offering more precise positional-, speed-, or torque-output.

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BIOGRAPHY

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