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Self Balancing Floating Platform

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ABSTRACT:

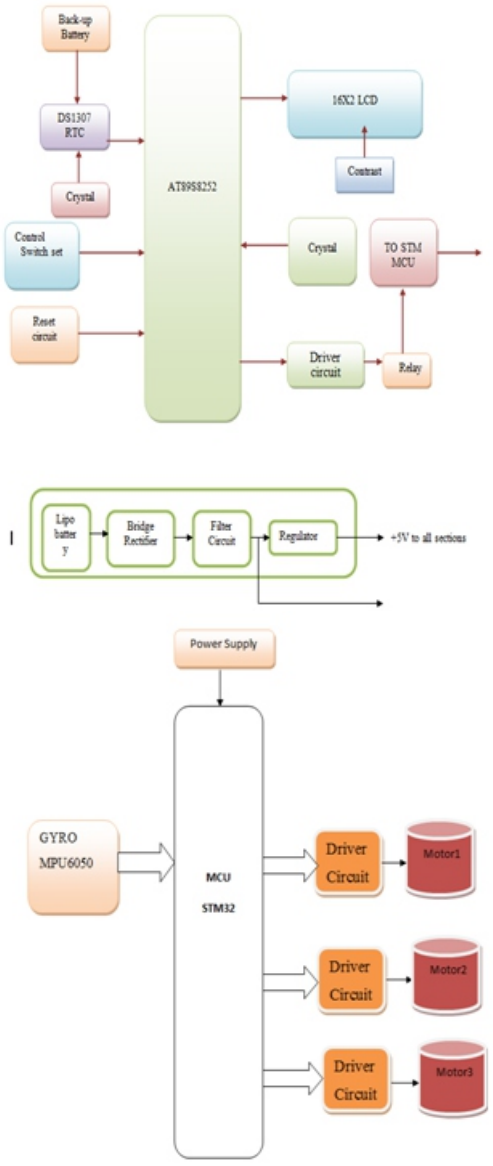
The balancing is necessary for n number of applications. It is suitable for working in outdoor environment especially where the ground is not flat. The platform provides agile movements of thebut itself is an unstable system. Hence, a self-balancing controller is implemented by considering the motion. The incline angle is obtained by fusing a gyroscope. Under the balancing control, the forward motion is achieved by giving a desired tilt angle profile. Self balancing platform is the basic concept use in auto pilot mode in aero plane.

In this airplane balances itself in air without help of pilot and try to remain parallel with respect to ground level. In self balancing platform the main components are GYRO MPU6050, microcontroller and dc motor. Depending upon change in platform movement controlling action is performed. Considering change in platform position due to some artifacts this change is sensed and signal is send to microcontroller.

Depending upon the amount of change in position of Platform and direction controller energies respective motor to bring platform back to is originally/ stable position. Three dc motors are attached to platform with help of driver circuit such that it is parallel with respect to ground level. Even on the uneven surfaces the products (item) on that platform will remain in the perpendicular position to the surface.

Here we are using STM32 as our controller. Here we are using a proto type model and this is not applicable on water. This project uses regulated 3.3V, 500mA & 12V, 500mA power supply. 7805 and 7812 three terminal voltage regulators are used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/12V step down transformer.

BLOCK DIAGRAM



Hardware modules

I.RTC DS1307

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The real time clock (RTC) is a widely used device that provides accurate time and date for many applications. The RTC chip present in the PC provides time components of hour, minute and second in addition to the date/ calendar components of year, month and day.The RTC chip uses an internal battery that keeps the time and date even when the power is off.One of the most widely used RTC chips is the DS1307 from Dallas semiconductor.

Description:

The DS1307 serial real-time clock (RTC) is a low power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially through an I2C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator.

II.AT89S52 FEATURES

• Compatible with MCS-51® Products
• 8K Bytes of In-System Programmable (ISP) Flash Memory
– Endurance: 1000 Write/Erase Cycles
• 4.0V to 5.5V Operating Range
• Fully Static Operation: 0 Hz to 33 MHz
• Three-level Program Memory Lock
• 256 x 8-bit Internal RAM
• 32 Programmable I/O Lines
• Three 16-bit Timer/Counters
• Eight Interrupt Sources
• Full Duplex UART Serial Channel
• Low-power Idle and Power-down Modes
• Interrupt Recovery from Power-down Mode
• Watchdog Timer
• Dual Data Pointer
• Power-off Flag

III.GYRO FEATURES:

» The triple-axis mems gyroscope in the mpu-60x0 includes a wide range of features:
» digital-output x-, y-, and z-axis angular rate sensors (gyroscopes) with a user-programmable fullscale range of ±250, ±500, ±1000, and ±2000°/sec
» external sync signal connected to the fsync pin supports image, video and gps synchronization
» integrated 16-bit adcs enable simultaneous sampling of gyros
» enhanced bias and sensitivity temperature stability reduces the need for user calibration
» improved low-frequency noise performance
» digitally-programmable low-pass filter
» gyroscope operating current: 3.6ma
» standby current: 5µa
» factory calibrated sensitivity scale factor
» user self-test

IV.Accelerometer Features:

» The triple-axis MEMS accelerometer in MPU-60X0 includes a wide range of features:
» Digital-output triple-axis accelerometer with a programmable full scale range of ±2g, ±4g, ±8g and ±16g
» Integrated 16-bit ADCs enable simultaneous sampling of accelerometers while requiring no external multiplexer
» Accelerometer normal operating current: 500µA
» Low power accelerometer mode current: 10µA at 1.25Hz, 20µA at 5Hz, 60µA at 20Hz, 110µA at 40Hz
» Orientation detection and signaling
» Tap detection
» User-programmable interrupts
» High-G interrupt
» User self-test

V.MOTION PROCESSING:

Internal Digital Motion Processing™ (DMP™) engine supports 3D MotionProcessing and gesture recognition algorithms.

The MPU-60X0 collects gyroscope and accelerometer data while synchronizing data sampling at a user defined rate. The total dataset obtained by the MPU-60X0 includes 3-Axis gyroscope data, 3- Axis accelerometer data, and temperature data. The MPU's calculated output to the system processor can also include heading data from a digital 3-axis third party magnetometer. The FIFO buffers the complete data set, reducing timing requirements on the system processor by allowing the processor burst read the FIFO data. After burst reading the FIFO data, the system processor can save power by entering a low-power sleep mode while the MPU collects more data.

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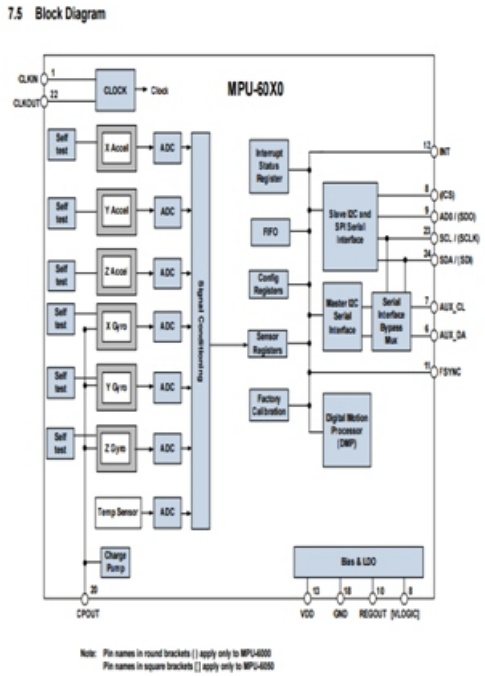
Programmable interrupt supports features such as gesture recognition, panning, zooming, scrolling, tap detection, and shake detection. Digitally-programmable low-pass filters.



Three-Axis MEMS Gyroscope with 16-bit ADCs and Signal ConditioningThe MPU-60X0 consists of three independent vibratory MEMS rate gyroscopes, which detect rotation about the X-, Y-, and Z- Axes. When the gyros are rotated about any of the sense axes, the Coriolis Effect causes a vibration that is detected by a capacitive pickoff. The resulting signal is amplified, demodulated, and filtered to produce a voltage that is proportional to the angular rate. This voltage is digitized using individual on-chip 16-bit Analog-to-Digital Converters (ADCs) to sample each axis. The full-scale range of the gyro sensors may be digitally programmed to ±250, ±500, ±1000, or ±2000 degrees per second (dps). The ADC sample rate is programmable from 8,000 samples per second, down to 3.9 samples per second, and user-selectable low-pass filters enable a wide range of cut-off frequencies.

VI.LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1.The declining prices of LCDs.

2.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.

3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

4.Ease of programming for characters and graphics.

These components are “specialized” for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed writing different messages on a miniature LCD.

VII.SOFTWARE DETAILS

A.Keil compiler:

Keil compiler is a software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

B.Proload:

Proload is a software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it. Hence we have implemented successfully self balancing floating platform using STM32.

Conclusion:

Hence we have implemented successfully self balancing floating platform using STM32.

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