Abstract: axis. i. introduction this project will serve

Business, Management

Abstract: Inertial measuring Unit (IMU) is anintegrated chip that has an on-board accelerometer and gyroscope. Theapplication using this chip is infinite and vivid, this paper dives into theautomation paradigm of the IMU and we intend to develop a system that enablesan automobile to drive through a bumpy road with ease and smoothness. Thevalues provided by the IMU gives a steady reference with respect to the groundfor the microprocessor to process the information and adjust the position ofwheels. Keywords: IMU, Accelerometer, Gyroscope, DoF, Yaw, Pitch, Roll, Axis.

I. Introduction This project will serve as aprototype which can be further implemented in large scale with help of thisunit we are able to track position an object to which this unit is attached in real-timeThis project can be related to handgesture project, but this project has a capability to track as well as logposition parameters as well Power management has been one of the mostdiscussed topic in the past decade because of the decrease in the energyreserves. Power shutdown is a major problem now-a-days and it occurs because alot of power is wasted in industries. 1. 1 Importanceof the project and its background: ? Real time tracking? Accurate results? Data recording? EnergySaving II. Methodology Realtime motion tracking technology is the upcoming high end technology. Wirelesstransmission of the coordinates after processing various parameters like linearacceleration, angular momentum, magnetic flux after its integration into aprocessor, which provides the position of the object to which the IMU isattached.

We have designed this project withminimum external modules and peripherals making it cost effectiveA. Typesof IMUIMU available in market now are invarious types and shape. So, user can select what type, size and shape. The IMUcan be selected from its degrees of freedom (DOF) that being developed bymanufacturer. User can select from three DOF, five DOF and six DOF. For threeDOF, the sensors configurations are two accelerometers and a gyroscope thatmeasures yaw. For five DOF, the sensors configurations are three accelerometersand two gyroscopes that measure pitch and roll. For six DOF, all axes foraccelerometer and gyroscope for measurement are available.

A. AboutMPU-6050 Six-Axis (Gyro + Accelerometer)The MPU-6050 devices combine a3-axis gyroscope and a 3-axis accelerometer on the same silicon die, togetherwith an on board Digital Motion Processor™ (DMP™), which processes complex6-axis Motion Fusion algorithms. The device can access external magnetometersor other sensors through an auxiliary master I²C bus, allowing the devices togather a full set of sensor data without intervention from the systemprocessor. The devices are offered in a 4 mm x 4 mm x 0. 9 mm QFN package. Fig.

1 MPU 6050 B. MPU 6050 features:· I2C Interface.· Supply voltage: 3 to 5 V.· I/O voltage: 2. 3 to 3.

4 V.· Triple axis gyro (angular rate sensor) with selectablescale (from ±250 to ±2000 dps)· Triple axis accelerometer with selectable scale (from ±2gto ±16g)· Temperature sensor with digital output.· Digital Motion Processing™· Size: 20 mm x 15 mm.

Fig2. Block Diagram of MPU 6050For precision tracking of both fastand slow motions, the parts feature a user-programmable gyro full-scale rangeof ±250, ±500, ±1000, and ±2000 °/sec (dps), and a user-programmableaccelerometer full-scale range of ±2g, ±4g, ±8g, and ±16g. Additional featuresinclude an embedded temperature sensor and an on-chip oscillator with ±1%variation over the operating temperature range. Formula: Required_value= (1)C.

Scopeof the project. This project has a very wide scopein visual reality where ever minute motion is tracked and analysed to producean amazing life-like experience. The air bags in vehicles needs to be deployedon a specific degree of Impact, it should not malfunction and deploy on minorjerk or on applying brakes. If it happens so then the safety system mightitself result into a mishap. Hence in order to sense the impact IMU can be usedwhich can be calibrated to trigger on a specific intensity of impact.

As thetechnology is advancing the is much more research activity in domain of Realtime motion tracking. D. Currentscenario Currently in order to track anyobject in 3- dimension we need complex wiring and grid of sensors for its realtime tracking or we can track it using GPS but there are some limitations toit, like the position is not accurate and may vary due to environmentalconditions and other physical parameters. E.

Theproposed systemThe system which we have proposed isvery compact is size and hence it can be attached to any moving object likevehicles or on humans. The proposed change makes our system wearable as well asthe components used in it makes the complete device cost effective and rugged.

The inertial measurement unit works by detecting linear acceleration using oneor more accelerometers and rotational rate using one or more gyroscopes. Amagnetometer is utilized, which is commonly used as a heading reference. Typical configurations contain one accelerometer, gyro, and magnetometer peraxis for each of the three vehicle axes: pitch, roll and yaw.

Due to thepresence of on board accelerometer, gyroscope and magnetometer on a single chipand with a central processor too the values are obtained in a systematic mannerand these sensors provide our project with the ability to have nine degrees offreedom for motion tracking.
F. 3Dorientation of MPU 6050 Fig3. Orientation of Axes of Sensitivity and polarity ofrotation G. Block diagram Fig4. Block Diagram2. 9 Design Phase: Circuit Diagram Fig5. Interfacing IMU with Arduino2.

10 Interfacing the Arduino MPU6050The MPU 6050 communicates with theArduino through the I2C protocol. The MPU 6050 is connected to Arduino as shownin the following diagram. If your MPU 6050 module has a 5V pin, then you canconnect it to your Arduino's 5V pin. If not, you will have to connect it to the3. 3V pin. Next, the GND of the Arduino is connected to the GND of the MPU 6050. The program we will be running here, also takes advantage of the Arduino's interrupt pin.

Connect your Arduino'sdigital pin 2 (interrupt pin 0) to the pin labelled as INT on the MPU 6050. Next, we need to set up the I2C lines. To do this, connect the pin labelled SDAon the MPU 6050 to the Arduino's analog pin 4 (SDA) and the pin labelled as SCLon the MPU 6050 to the Arduino's analog pin 5

(SCL). That's it, you havefinished wiring up the Arduino MPU 6050! III. Literature Survey A. How does accelerometer works: Basic workingof Accelerometer Operation: According to newtons second law ofmotion that the acceleration (m/s2) of body is directly proportionalto the net force acting on that body, and inversely to its massAcceleration= Force(Newton)(m/s2)*Mass (gram) A micro Gimbal likemechanism which is used to detect the force in a particular direction. Itbasically measures acceleration through the force applied to one of theaccelerometers axes. An accelerometer is anelectromechanical device, including holes, cavities, springs, and channel, thatis fabricated using microfabrication technology.

Accelerometers are fabricatedusing a multi – layer wafer process, i. Piezoelectric Effect A accelerometer works on piezoelectriceffect. Let us imagine a cuboidal box with a small ball inside it, like shownin the diagram below. The walls of this box are made with piezoelectriccrystals, if the box tilt on any of its side, the makes the box inclined andthe gravity forces it to collide with the wall on that particular side, thisresults into production of piezoelectric current. Six walls in pair of threecorresponds to 3 axis in 3D space. X, Y and Z Axes. Depending on the currentproduced from piezoelectric walls, we can determine the direction ofinclination and its magnitude.

Fig6. Piezoelectric Accelerometerii. Capacitive Effect In case of accelerometer that works oncapacitive sensing, outputs a voltage dependent on the distance between twoplanar capacitive surfaces. Both these plates are charged with an electricalcurrent. As the gap between the plates changes the electrical capacity of thesystem, which can be measured as voltage output. This method of sensing resultsin high accuracy and stability.

As capacitors are less affected by noise andother electromagnetic interference, the same goes with this type ofaccelerometer hence they are less prone to noise and variation with temperatureand the typically dissipate less power, and can have large bandwidths, due tointernal frequency circuits. Fig7 Acceleration associated with a single moving massFig8. Acceleration associated with multiple massesFig9. Mechanical model of 2-axis accelerometerBasicworking of GyroscopeGyroscopes work on the principle of Coriolis acceleration. Imagine that there is a fork-like structure that is in a constant back andforth motion. It is held in place using piezoelectric crystals.

Whenever youtry to tilt this arrangement, the crystals experience a force in the directionof inclination. This is caused as a result of the inertia of the moving fork. The crystals thus produce a current in consensus with the piezoelectric effect, and this current is amplified. The values are then refined by the hostmicrocontroller.

Tuning ForkGyroscope: This type of Gyroscope contains a pair of masses that are driven to oscillatewith equal amplitude but in opposite directions. While rotating the Coriolisforce creates an orthogonal vibrationwhich can be sensed by many types of mechanism. The figure below (Figure: 9)uses comb type structure to drive the tuning force into resonanceFig10. Comb type Tuning Fork Gyroscope StructureTherotation caused the mass to vibrate which in turn vibrate out of the plane, this type of motion is sensed by the structure IV. Result and Discussion Fig11.

Result of 3D simulation 1. Raw data of accelerometer Table 1. X-axis Readings Ax Range Sensitivity X-Axis -15608 2g 16384 0. 95g -945 4g 8192 0. 11g 256 8g 4096 0. 06g 2655 16g 2048 0. 8g Table 2. Y-axis Readings Ay Range Sensitivity Y-axis 5065 2g 16384 0.

31 -4856 4g 8192 0. 59g -255 8g 4096 0. 06g -589 16g 2048 0.

28g Table 3. Z-axis Readings Az Range Sensitivity Z-axis 450 2g 16384 0. 027g 8159 4g 8192 0. 99g -3698 8g 4096 0. 9g 898 16g 2048 0. 43g
2. Rawdata of gyroscope: Table 4.

X-axis Readings Gx Range Sensitivity X-Axis -349 250 131 -2. 66 65497 500 65. 5 499. 977 894 1000 32. 8 27.

25 2655 2000 16. 4 161 Table 5. Y-axis Readings Gy Range Sensitivity Y-axis -204 250 131 -1. 355 31 500 65.

5 0. 756 6512 1000 32. 8 198. 53 -589 2000 16. 4 -35. 91 Table 6. Z-axis Readings Gz Range Sensitivity Z-axis -247 250 131 -1.

88 41 500 65. 5 0. 311 23645 1000 32. 8 720.

88 898 2000 16. 4 54. 75 V. Conclusion By the realization of the above proposed system we cannot only track real-time position of an object in 3-Dimension but also use thedata for many other applications after processing it using various algorithmdepending on theVI. Reference 1 Webpagefor

interfacing IMU with Arduino: http://hotresistor. blogspot.
in/2015/09/interfacing-arduino-with-gy-87.

html. Accessed: October, 2017