An Automated ThingSpeak System representing MPU6050 Sensor data using Raspberry Pi

M. Ravi Kumar¹, Dr. S.A.K. Jilani², Mr. S. Javeed Hussain³, Mr. P.R. Ratna Raju. K⁴

Student (M.Tech in Micro and Nano Electronics), Madanapalle, India¹
Professor, Department of Electronics & Communication Engineering, MITS, Madanapalle, India²
Associate Professor, Department of Electronics & Communication Engineering, MITS, Madanapalle, India³
Assistant Professor, Department of Electronics & Communication Engineering, MITS, Madanapalle, India⁴

Abstract: In this paper, we are exhibiting the MPU/6050 sensor data that is obtained by varying the sensor and this data is represented graphically which records the variations using ThingSpeak. Here, in his obtaining the stable data using mpu6050 is a challenging task which is done by using python programming language and interface the obtained data on IOT. By successfully performing this system, it can be used in many applications such as InstantGesture, Motion enabled game and application frame works, BlurFree, AirSign, TouchAnywhere, Motion Command technologies. This system is implemented using Raspberry Pi B+ and mpu6050 sensor. The system provides a break through utilize the sensor data on any applications as it is represented using ThingSpeak which is an emerging area of research. The system is preprogrammed as such it will work as standalone system mode.

Index terms: Raspberry Pi, Raspbian OS, Wi-Fi adapter, Gyro sensor, Python, ThingSpeak.

1. INTRODUCTION

The engineers with a down to business methodology are the greatest aid to a general public. The utilization of thoughts, speculations, and new advancements is the thing that drives them. For quite a long time the work was done on Arduino loads up, however with the dispatch of the exceptionally low-cost Raspberry Pi everything changed. The Raspberry Pi platform has gained wide popularity in the last few years thanks to its wide availability, ease of use and excellent support and documentation, combined with its low cost. The Raspberry Pi has proved particularly useful in the development of educational projects, with applications spanning over a wide range of fields. Each network device is formed by a Raspberry Pi Model B+, equipped with a Wi-Fi USB dongle for Wi-Fi access.

For MPU-6050 Motion Tracking devices have additional information about designing and electrical specialization, collectively called as MPU family. By using design, analysis and simulation results only, we can analyze electrical characteristics. Without prior notice specifications will change. Depends upon the characterization of silicon production final specifications will update. Refer MPU6000/MPU6050 register map and register descriptions documented as a control interface for reference of registered map and description of individual registers.

In Mechatronic designs, many are using motion sensors as a valuable component, especially high tech systems are using these motion sensors for designing and applications means cost enormous of money. Here we have another issue, It is to develop a software to communicate protocol between the data acquisition card and motion sensor.

In most of the applications it is identified that the data obtained by MPU6050 is tried to represented in real time systems and to obtain results at different locations. To perform such thing Iot is utilized to act accordingly. This can be done by using python and discussed below.

1.1 How to Talk To ThingSpeak with Python (A Memory/CPU Monitor):

Here we have some instructions about the communication between Python and ThingSpeak data logging web service. Uploading data from devices, sensors, computers can be allowed by ThingSpeak by web services. It can visualize that data in the form beautiful charts and having some API key, which features real-time updates. Using the ThingSpeak Charts API we can send our computer’s available memory and CPU usage with the help of python code.

2. LITERATURE SURVEY

Reading the sensor data has been widely used in many fields. We have observed about to reading the data of the sensor’s on arduino as well as in raspberry pi. M. Soga and K. Yamada proposed a visual motion sensor of integrated version for ITS applications[Intelligent Transportation Systems][1]. Andrew Burkett had proposed a system to interface raspberry Pi to a Six-Axis Gyro + Accelerometer sensor and the one settled on was based on a MPU6050 chip. And also shown commands to detect the I2C and install the smbus module with some simple Python code to read the data it offers[2]. G.Z. jinn & X.Y. Chen
had completed their research on key technology and its applications for Internet of Things[3]. The code I present here is very basic and should be extended to handle errors and allow the sensor to be configured with different sensitivity levels. I've done this in my application and embedded it into a web server. This allows me to make a simple http request to the Raspberry Pi and get a gesture reading from the sensor.

3. SYSTEM DESIGN

3.1 Hardware System Design:

3.1.1 Raspberry Pi board:

Raspberry Pi board is a scaled down wonder, having considerable computing power into a foot shaped impression no bigger than a credit card. It’s able to do some amazing things, however there are a couple of things you're going to need to know before you dive head-first into the thorn patch.

Figure 1: Raspberry Pi computer Model B+

The aim was to rekindle the microcomputer revolution from the 1980s, which produced a whole generation of skilled programmers. The name, Raspberry Pi, was the combination of the desire to create an alternative fruit-based computer (such as Apple, BlackBerry, and Apricot) and a nod to the original concept of a simple computer that can be programmed using Python (shortened to Pi).

The Model B is far and away the most popular version of the Pi, with a lot more functionality and a tiny bit more power for only marginally more money. The Model B already received a stealthy update shortly after it was released by giving it some more RAM but the Raspberry Pi Foundation has seen it fit to release a third iteration of the Model B called the B+. The main difference is the rearranged components on the board itself. Along with the removal of the Video out port, changing the SD card port to MicroSD and adding on two more USB ports. The new arrangement also has all the inputs and outputs along two sides of the Raspberry Pi, allowing for a tidier workspace or project. There are also 14 extra GPIO pins to bring the count up to 40, with the first 26 having the exact same functions as the original layout. This means your old projects will still work on the new Pi model with the same pin configuration. They are two more clock signal pulses on pins 29 and 31, along with three extra serial peripheral.

Interfacing Bus pins on 36, 38 and 40. There’s some Ground pins and a few hybrids on the rest of the pins but it’s basically more of the same so that you can have a few more options. One of the important changes not well advertised is that the Model B+ also draws a lot less power than the Model B this efficiency has a number of benefits such as being powered easier from a computer’s USB port to just saving a little bit of money on the electric bill. If you have the original Model B it’s definitely not an essential upgrade but it is a very logical one, it’s also supposed to be the last version of the Model B.

3.1.2 Power Supply:

The power supply framework on the Raspberry Pi is very straightforward. It utilizes a Micro USB association with power itself. The power source utilized for the device is a 5200mAh outside battery for advanced mobile phones and tablets.

3.1.3 Gyro Sensor – MPU6050:

The MPU6050 is a veritable bit of motion by handling MEMS 3-axis gyrometer and a 3-axis accelerometer on the single silicon and adding together with Digital Motion Processor (DMP) to form a 9 hub motion sensing calculations.

Figure 2: MPU6050 gyro sensor

Figure 3: sensors data of hand gesture
Generally we know about two methods of gesture recognition techniques, one by seeing and other is MEMS (using gyroscope or/and accelerometer). Most of present systems are following vision based gesture recognition approach.

3.1.4 Additional Hardware utilized Compatible to Raspberry Pi:

For the project use of Raspberry Pi is not enough. For input and connectivity some other devices are required.

I. Wi-Fi Adapter

Wireless USB connectors are required for associating raspberry Pi and wireless desktop and web. For the task EDUP-EP-n85317 remote 802-11n nano usb -adapter is utilized. It is World's smallest, has green force sparing mode and backings WPS, WPA2, 802.11b/g/n with information rates up to 150 Mbps.

II. SD card

The SD card is installed with Raspberry Pi’s operating system “Raspbian wheezy”. Here SANDISK SD 8GB CLASS 10 MEMORY CARD (the class indicates how fast the card is) is used.

III. Monitor

For visual display, here we are connecting to a monitor or a TV with raspberry pi. The raspberry pi has a HDMI port which you can plug directly into a monitor or TV with an HDMI cable.

IV. HDMI to VGA converter

For monitors with VGA only, you can use an HDMI to VGA adapter. We suggest using only powered HDMI to VGA adapters (with an external power source). Using an unpowered adapter may damage your Pi and therefore is not advised.

V. Mouse and Keyboard

Wireless keyboard or USB keyboard and mouse are used as raspberry pi inputs. After pairing these to raspberry pi only it will work.

3.2 Software System Design:

3.2.1 Raspbian OS:

Raspbian is the first distro every new Raspberry Pi owner should ideally use. It’s based on Debian Linux and, as we mentioned, is fully optimised for the raspberry Pi’s hardware. It’s also an excellent starting point as it contains a plethora of pre-installed programs that will help get you up and running, and into the wonderful world of the Raspberry Pi. The Raspbian operating system itself is very well constructed and developed. Running LXDE (Lightweight X11 Desktop Environment) as the desktop environment, and Open box as the window manager, makes this a considerably streamlined operating system ideally suited to the limited system resources of the Raspberry Pi.

Procedure to Install Raspbian OS:

1. To start with step is to download Raspberry pi Supported Raspbian OS.
2. Introduce “Win32Disk Imager” application on your windows framework.
3. Insert SD card connector into your framework.
4. Burn OS into SD card utilizing Win32 Disk Imager.

Figure 4: Installed Raspbian OS

A. Installation of RPi.GPIO: To do this enters the following command into LX Terminal:
   “sudo apt-get install python-rpi.gpio”

B. Installation of I2C-tools: Then enter the following command in LX terminal:
   “sudo apt-get install i2c-tools” The figure 5 shows the installation of I2C tools

Figure 5: I2C tools installed

C. Installation of python-smbus module: Then enter the following command in LX terminal
   “sudo apt-get install python-smbus”
D. connecting MPU6050 gyro sensor: After detecting the sensor, the screen will show the following page.

![Python smbus installed](image)

**Figure 6**: Python smbus installed

After interfacing with MPU6050 sensor

3.2.2 **ThingSpeak**:

ThingSpeak is an IoT platform designed to enable meaningful connections between people and things. Features of ThingSpeak include real-time data collection, data analysis, data processing of the position information, data visualization, message transmission, etc., using a connected SNS, via an open-source API to support various platforms. It helps you easily transfer data from embedded devices such as Arduino, Raspberry Pi, and Python.

2.3 **Python Programming**:

Python is used all around the world, because of code comprehensibility, sentence structure, it shows a route to developers to express their views in less lines of code than other languages like C++, or Java. Python has a clear and easy-to-grasp syntax. It’s a very concise language. Useful tasks are executed in just a few statements, and complete apps can be created with relatively few lines of code. With Python’s interactive mode, you enter statements and see the results immediately. IDLE, a simple Python editor, is already included. Other Python-friendly editors, such as Geany, are easy to install. Python’s built-in functionality is supplemented by hundreds of specialized modules. Developers use these modules to create tools, games, websites, Smartphone apps, hardware controllers, and much more. Google developers, astronomers, robotics engineers, space scientists, nuclear physicists, and bioinformatics researchers all use Python. As the language is free to use and distribute, Python is popular with software companies, research laboratories, and academic institutions across the world. And the programming skills you’ll acquire can be applied to other languages, such as PHP, Java, and C.

**IV. PROPOSED SYSTEM**

We heard about many sensors like pressure, light, humidity which can sense related parameters and send that data to raspberry pi. By using ARM present in the Raspberry Pi and LAN or ETHERNET connection, we can prepare the data and send to the preferred web services.

The proposed system is reading, and sending the sensor gesture information utilizing ThingSpeak and Raspberry Pi. The objective is to design and implement the system to visualize the sensor information as charts. This will be a straightforward undertaking to associate the IOT in the structure ThingSpeak. In this device, the MPU 6050 sensor is used to sense the motion. MPU6050 comprises of 3-axis accelerometer and 3-axis gyroscope. When a standardized perusing of information is finished, the Raspberry Pi sends that information to the client by utilizing Wi-Fi connector according to the program written in python environment in software implementation.

![Block diagram](image)

**Figure 8**: Block Diagram of the proposed system
Hence, they can deal with the crisis quickly. The sensor 6-axis real time gesture data is visualized as graphs in ThingSpeak. The proposed work is done in two stages, which are in hardware implementation and software implementation as we discussed earlier.

Flow chart of proposed system:

![Flow chart of proposed system](image)

**V. RESULTS**

After the execution of the code the results can be seen through the software python and web service ThingSpeak. In ThingSpeak we can see sensor gesture data in the graphical representation. Here the data of mpu 6050 is shown graphically and connected to IOT. This will help us to analyze the variation in the acquisition of data and to act accordingly. The data obtained can be seen globally. By this mechanism, we can utilize the system for various applications such as in medical, automotive, sensitive alarming areas etc.

**VI. CONCLUSION AND FUTURE USE**

In this mechanism of real time system, we designed and implemented saving and sending the sensor data to web services using ThingSpeak and raspberry pi. Like this we can send any sensor data without the direct access with the websites. It helps control and online supervision not only public but also private network which means LAN. The overall system is easily upgradable and maintain, and also portable and cheap in price. By using different types of sensors with these modules, we can make many applications. With the successful communication implementation, it can be further developed by adding sensors to develop smart applications such as smart alarm system. This project is a stepping stone to introduce the various features and possibilities available in Raspberry Pi and opens up an avenue for researchers who wish to embark into this new embedded invention. By increasing the number of parameters and sensor nodes with the wireless sensor networks this work can be extended further.

**ACKNOWLEDGEMENT**

I extended my earnest on account of professor Dr.S.A.K. Jilani, Associate Professor Mr.S. Javeed Hussain, Assistant professor Mr.P.R. Ratna Raju.K, Department of ECE furthermore my sincere thanks to Dr.A.R.REDDY, Head of the Department of ECE for their backing to complete this exploration work effectively.
REFERENCES


AUTHORS DESCRIPTION

1. M. Ravi Kumar is pursuing his M.Tech in the stream of Micro & Nano electronics from Madanapalle Institute of Technology and Sciences, Madanapalle. He completed his B.Tech in the stream of Electronics and communication, from Jayaprakash Narayan College of Engineering, Mahaboobnagar. His areas of interest are embedded systems, IC fabrication, and Micro & Nano electronics

2. Dr. S A K Jilani is working as the Professor and project coordinator in the department of ECE, Madanapalle Institute of Technology and Sciences, Madanapalle. He has the teaching experience of over twelve years. He also worked as an R&D Profession- onal earlier in Electronics Industry. He obtained his PhD In the year 2002 and also published more than 35 papers in different national and international Journals. He has also guided more than 50 M.Tech, M.Sc, MCA, B.Tech Projects. His areas of interest are Artificial Intelligence, Computer Visions, Digital Signal Processing and Embedded Systems.

3. S. Javeed Hussain received B.Tech from JNTU University & M.Tech degree in electronics & communication Engg., Hyderabad, India. He is currently working towards PhD Degree in Digital Image Processing at J.N.T University Hyderabad, India. At present He is with Madanapalle Institute of Technology and Sciences Angallu A.P., India, working as a Associate Professor in Dept. of ECE., He presented many research papers in National & International conference. He is a member of professional societies like IE (India), ISTE (India), BMESI (India).his research interests include Signal Processing, Time Series Analysis and Image processing.

4. M.P. Ratna Raju,K received B.E from SIR C.R Reddy college of Engg. Eluru, AP & M.Tech from SVNIT, Surat, Gujarat, India. He is currently working towards PhD Degree in Communication Systems. At present He is with Madanapalle Institute of Technology and Sciences, Angallu, Madanapalle, working as a Assistant Professor in Dept. Of ECE., He guided more than 20 B.Tech projects. He presented many research papers in National & International conference.