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A Survey on GPS clock module based different timing outputs for time synchronization system

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Abstract – *Presently days, Time synchronization is basic to current electrical power systems.SCADA system, slave display device, data loggers, protective relay, sequence of event recording (SER), digital fault recorder,remote terminal units (RTUs) and other intelligent Electronics Devices (IDEs) all are the different types of microprocessor based power systems instrumentswhich require precise timing for their proper working.IN this survey low cost GPS (Global positioning system) clock based different timing outputs like NMEA(National marineelectronics associations), Inter range instrumentation group – B(I.R.I.G-B), Network time protocol (N.T.P) for time synchronized system.*

Keywords *–GPS, NTP, NMEA, IRIG*

I.INTRODUCTION

In electronics system we need accurate time for any of the month details for relationship of data with respect to time. They are Communication, Data handling, and missile and spacecraft tracker systems. It can measure the duration and interval between the two particular events. Estimation of time should be done by two principal elements, the unit Second, with the help of this we determine the time period of occasion and the standard point – GMT. It is required that all devices connected which are applicable to some part of feature applications for example telecommunications, space applications centre, power industries, automotive applications, internet networks and servers, railway and airports and different various fields have their equipments time synchronized to global time with better accuracy as possible.
The cruel surrounding of the electrical power amenity such as GPS which have good precision proportion with respect to timing signals which are presently open for cost effective devices thatcan be used for basic and determined attachment. The UTCtiming has been turn into effective local timingwhich can be used for various purposes, with additional to many of the electrical commercial purposes. Current timetakes the quality as a result having its overall opportunity and comparatively industrial approach over GPS receiver.Now days, outcome will be execute to minimize cost and size. Thus, whenGPS Clock module communicates with satellites at a time we use minimizecost and size GPS receiver.
GPS clock module gainslocal time from GPS receivers and replace the current time on different local timing outputs like serial NMEAtiming output, IRIG-Btime code output, NTPoutput.

II.GPS RECEIVER

In GPS receiver entire satellitewill be work at same frequency signals likeL1 1.5 GHzto L2 1.2 GHz regularly. At the time when the message gets transferred, the satellite messenger holds the data of position and time of the satellite. GPS receiver utilized this message to calculate the accurate timeand decode the data based on decides the transmit time of each message and utilizing speed of lighteach satellite distance.
For most part, GPS receivers to calculate its position and time at that time it require minimum three satellites, but in that case it will be less accurate and if there will minimum four satellites needed to give accurate time and position. The operational GPS objective contain minimum 24satellites, each in its own orbit, just about 20,200 km.For appropriate perfection of the time-position GPS receivers are capable to track at whenever time of the day maximal 12 satellites are recognizable[1].
A part fromfirst requirement to receive a fixation to 4 satellites, GPS have various things which can be affected the production that given precise timeand more important, The position of GPS antenna operates a critical part in getting precise time data[2].Therefore, ideal execution, the antenna need a clear view of the skyline in every area. It gets approved the GPS receiver to notice the most digit satellites at the same time, and give a much fixed GPS lock [2].

III.TIME SIGNAL OUTPUTS

The different timing outputs are key element utilizing the master clock device for synchronizing the internal clock of slave devices. There are different timing outputs like Serial time NMEA frame output, IRIG-B time format, Network Time Protocol (NTP).

A. Serial Time NMEA frame output.

The time information is in UTCformat. The National Marine Electronics Associations (NMEA) has built up a detail that characterizes integrating cross differentsections of marine tools. Fundamentally all things considered GPS receiver communication is characterize inside this detail. The dominant PC code which gives ongoing time-position dataexpect and comprehendthat information is received in NMEA format. The NMEA serial time string output which contains velocity, time and position(PVT) solution calculatewith the help of GPS receiver. The possibility of serial frame holds the series of information called sentence which is autonomous from alternate sentences. The vast majority of the standard sentences have a two letter prefix that characterizes for GPS receiver number placed before another is "GP" and its gets trailed by a three letter progression (eg.RMC) that portrays the sentences content. Each line "$" will be starting point and CR/LF will be endingmessage line.The data items separated by commas [3]. The overall message of this is TABLE-1 shows the RMC Format which is given below.

TABLE-1 RMC FORMAT

Field	Example	Comments
String id	$GPRMC,	
UTC time	100525.00,	HHMMSS.SS,
Status	A,	A=Valid/V=Invalid,
Latitude	2314.9163,	DDMM.MMMM,
N/S indicator	S,	N=North/S=South,
Longitude	07237.8025,	DDDMM.MMMM,
E/W indicator	E,	E=East/W=West,
Speed over ground	000.1,	Knots,
Course over ground	245.0,	Degrees,
UTC date	290817,	DDMMYY,
Magnetic variation	,	Degrees,
Magnetic variation	,	E=East/W=West,
Checksum	*25	*CC
Terminator	<CR>,<LF>	Non-displayable characters

B. IRIG-B time format

IRIG time codegenerally known as Inter range instrumentation group, are standard formats for transferring timing information. The different types of time codes are characterize as A, B, D, E, G and H[4]. The main difference between time codes is pulse in each word commonly known as bit rate. In TABLE-2 all-time codes are different time frame and bit rate given below.

Time code A and time code B gives information regarding time of year in binary-coded decimal formats, and seconds-of-day in straight binary second formats. While the time code D, time code E, time code G, time code H give time-of-year information in binary coded decimal formats.

TABLE -2 TIME FRAME AND BIT RATE OF THE TIME CODE

IRIG Code	Time Frame	Bit Rate
A	0.1 Seconds	1 kpps
B	1 Second	100 pps
D	1Hour	1 ppm
E	10 Seconds	10 pps
G	0.01 Seconds	10 kpps
H	1 Minute	1 pps

IRIG time allotment demonstrate the time term in which the code frame is transmitted, Index count is the length of single pulse in time period where a bit is defined as each pulse in the time code word and the rate at which the bit repeats is the bit rare.

IRIG time code B is widely used in the electrical power industry and IRIG-B has a 100 pps bit rate with an index count interval 10 milliseconds over its 1 second time frame. There are three types of pulse format. To start with is the position markers and reference identifier which have term equivalent to 8.0ms out of 10ms length beat, Second is bit "1" (stamp) which appears by span of 5.0ms out of 10ms pulse and third is bit "0" (space) which appears by term of 2.0ms out of 10ms pulse.

IRIG-B is in most case assign as a unmodulated signal like DC level shift(DCLS),pulse width coded signal or as an modulated signal amplitude modulation based sine wave carrier with a frequency of 1 kHz. I.R.I.G.-B time code consists of 100 bits produced every 1 second out of 74 bit used for time, date and control functions. The 74 time code bits divided in which 30bits information regarding days, hours, minutes, seconds in BCD(Binary Coded Decimal) format, 9 bit for year information, 17 bit for binary value of current day seconds, 18 bits for control function also unused bits are filled with logical zero. Mark indicates the bit value of 1 whereas space indicates bit value of 0 [5].
IRIG outputs are synchronized with 1PPS signal so that time allotment of IRIG output starts with 1PPS signal and finishes precisely towards the end of 1PPS signal.

C. N.T.P. Output

Network time protocol is related to Ethernet protocol further it gets transmits under application layer of Internet protocol (IP) frame on User datagram protocol (UDP) packet.In UDP protocol there is no acknowledgment with respect to the successful transmission of the packet because UDP is connectionless protocol[6].GPS device act as NTP server which synchronizes the clock of NTP enabled network devices.After its origination with SNTP the later versions of NTP were in the order of 1 to 4.NTP protocol is able to give microseconds or milliseconds information and furthermore give timing outputs in second since 1900 in UTC format. The NTP customer synchronizes its clock loweras indicated by milliseconds/microseconds resolve in NTP server packet. GPS clock module gives NTP output on the basis of client/server error model or transmit model. NTP holds differentframework like Leap warning indicator, Version number (VN),protocol mode, stratums, poll intervals, precision timing, root delay, root dispersion, reference identifier, reference timestamp, originated timestamp, received timestamp, and transmit timestamp as shown in Figure1[7]. As GPS Clock modules follow like NTP server, the mode of NTP output of GPS is always server mode. NTP Versions number might be 1 to 4 based on various users. Since GPS clock device is an accurate time source, it provides precise time output. At stratum 1, GPS clock module is used. Atomic clock belongs to Stratum 0 and secondary time servers occupy stratum levels from 2 to 255.GPS is the reference identifier of GPS clock module. Precision of GPS Clock module depends on its internal clock precision which is mentioned in terms of seconds. Generally, GPS clock devices are of very high precision. Dissemination is the greatestmistake in clock as for its source. As GPS clock module is exceptionally precise time source as it gets time from satellite information, scattering is in microseconds. Most extreme permissible scattering of any solid time source is approximately 1.5 seconds. The scattering additionally relies upon the deferral in time transmission to the customer module and is for the most part checked in NTP customer calculation.Real time clock data with microseconds or milliseconds resolution is transmitted in transmits timestamp parameter.The 64-bit timestamp used by NTP consist of anupper (32) bits part for fractional second and lower(32) bits part for seconds which have a theoretical resolution in picoseconds. If each time information coming from GPS receiver at that time GPS clock module updates its clock time each second. In every second reference timestamp (64) of GPS receiver is updated.

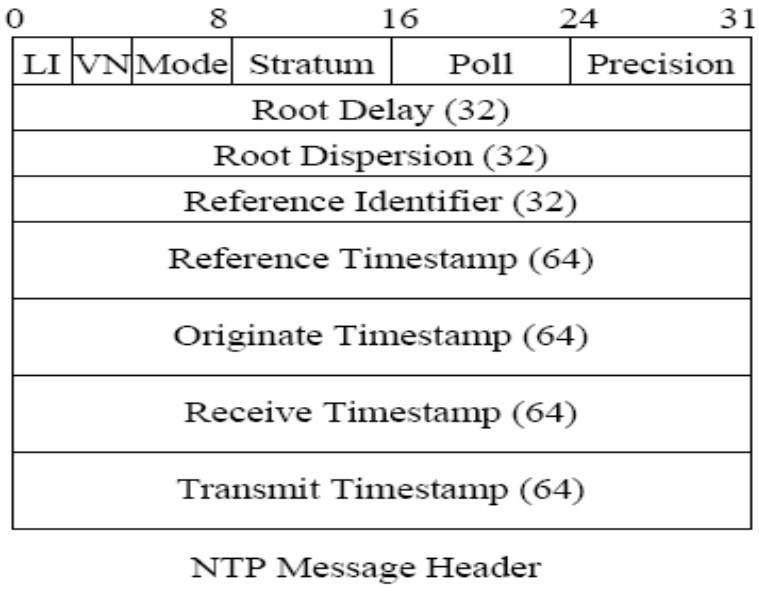

Figure1. NTP Data Formats

IV.CONCLUSION

GPS clock module is a low cost effective design,play an important role which provides time synchronization for many types of equipmentwith the help of various time electric formats and they are listed outputsas serial NMEA,I.R.I.G-B and N.T.P output.The time accuracy in serial output can be differed from 1second to 1minute and in N.T.P and I.R.I.G –B algorithm,we can get the time accuracy in the form of milliseconds.

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