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**Web-Based Integrated Precise Positioning System
Design and Testing for Moving Platforms in Offshore
Surveying**



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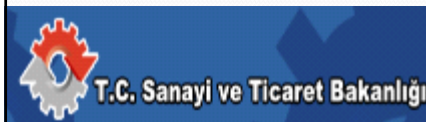
TS 31 - Positioning Techniques for Hydrography
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Scope of the study

- The aim of this study is to develop a tool, equipment and a web-based software system that provides integration of positioning systems and prevents production of erroneous or inadequate real-time/DGNSS positioning data in order to navigate a petroleum platform while it transports between two locations and to track it dynamically where they are precisely positioned.
- Moreover, web-based implementation of the system design will provide online remotely monitoring availability for the moving platform activities in offshore.

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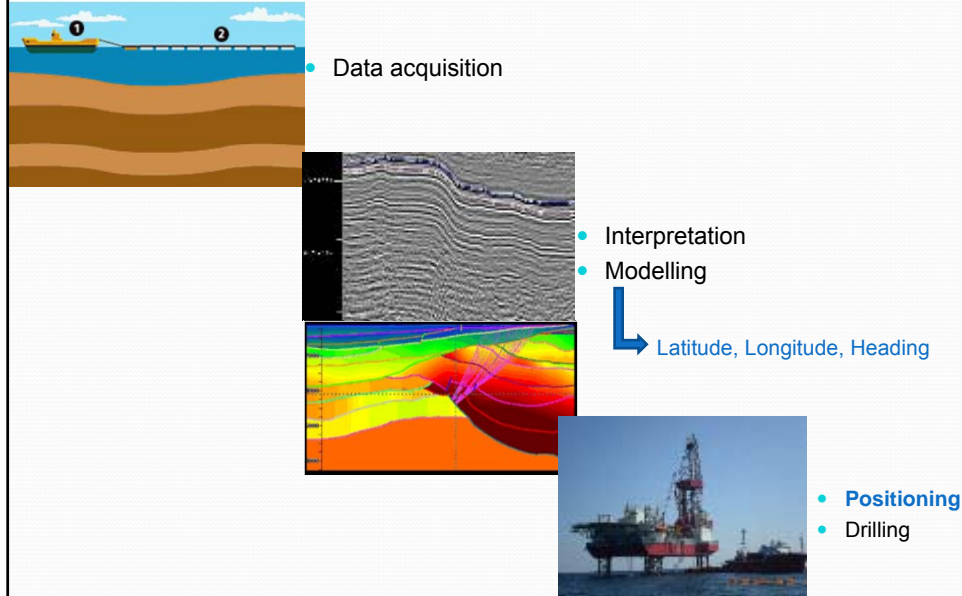
The subject of this study is a PhD. thesis that is being supervised in the Department of Geomatic Engineering at the Institute of Science and Technology, Istanbul Technical University, Turkey and supported by both
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Leica – System Computer and Technical Services Inc.



Off-shore exploration/development activities-1

- Positions of points on which it is decided to drill exploration wells are defined after some feasibility studies in petroleum exploration activities carried out in offshore sea areas:
 - Obtaining exploration rights of a block
 - Understanding geology and hydrocarbon systems
 - Gravity-magnetic data acquisition
 - 2D-3D seismic surveys
- Development may also be necessary for some wells which were positioned and drilled before. In such cases, re-positioning is required.

Off-shore exploration/development activities-2



Real-time Positioning

- Moving platforms to a desired location **by its own engine** or **by trailer vehicles** and locating the axis direction of the drilling rig of the platform to predefined well place inside of limits precisely are very important parts of whole study
- Equipments used in offshore exploration activities are very expensive. Thus, even a small deviation from the planned route of the platform may delay whole study and cause extra costs.
 - Shallow offshore well costs a number of ten million dollars
 - Deep/ultra deep offshore well costs a number of hundred million dollars
- Also, if the axis of the drilling rig passes over the security circle limits, because of the movements of semi-submersible or drillship platform, drilling equipment may be injured/broken and this situation may prevent whole study proceed.
- So, correct real-time positioning data is necessary in order to control whole movement and to limit these movements in defined limits.

Platform Types – Jack-up

Jack-Up (< 100 m)



- 3 or 4 legs – moved up – down by hydraulic or electrical system
- After legs sit seafloor, platform moves above the sea surface
- Transported by tugs or boats
- In comparison with the other types, even it provides a stable environment, it can operate in shallow waters

Platform Types – Semisubmersible

Semisub (100 - 3000 m)



- Consists of two hulls. One includes drilling rig and facilities for crew, another hull is similar to the outer surface of a submarine and takes air inside and this makes the semisub float.
- When the semisub positioned a location, the air is released and the platform becomes semisubmersible. When drilling is carried out, the down hull is filled with water to provide stability.
- Also, anchors are used to make the semisub more stable.
- Dynamic positioning is used to monitor the platform whether it maintains the desired position or not.

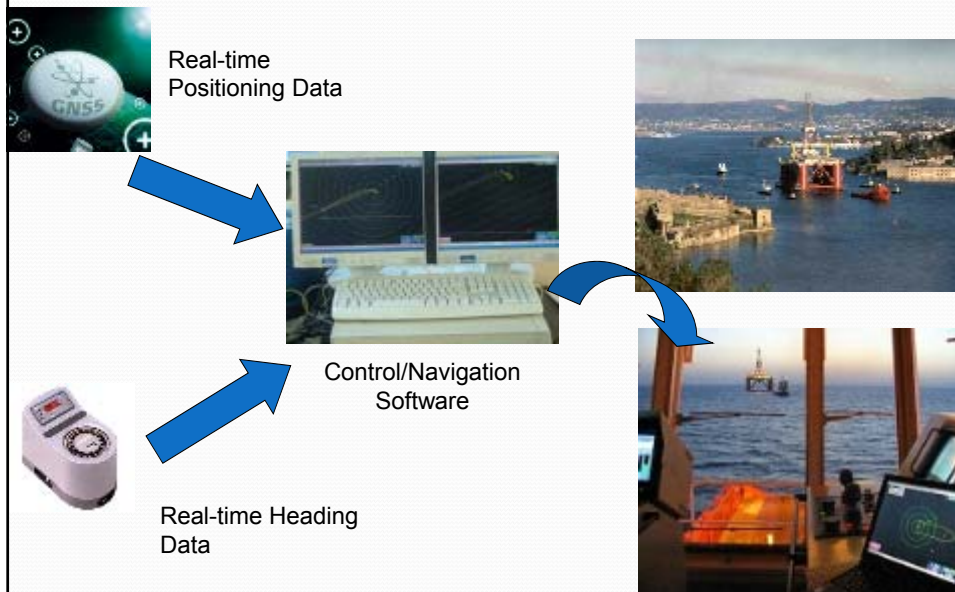
Platform Types – Drillship

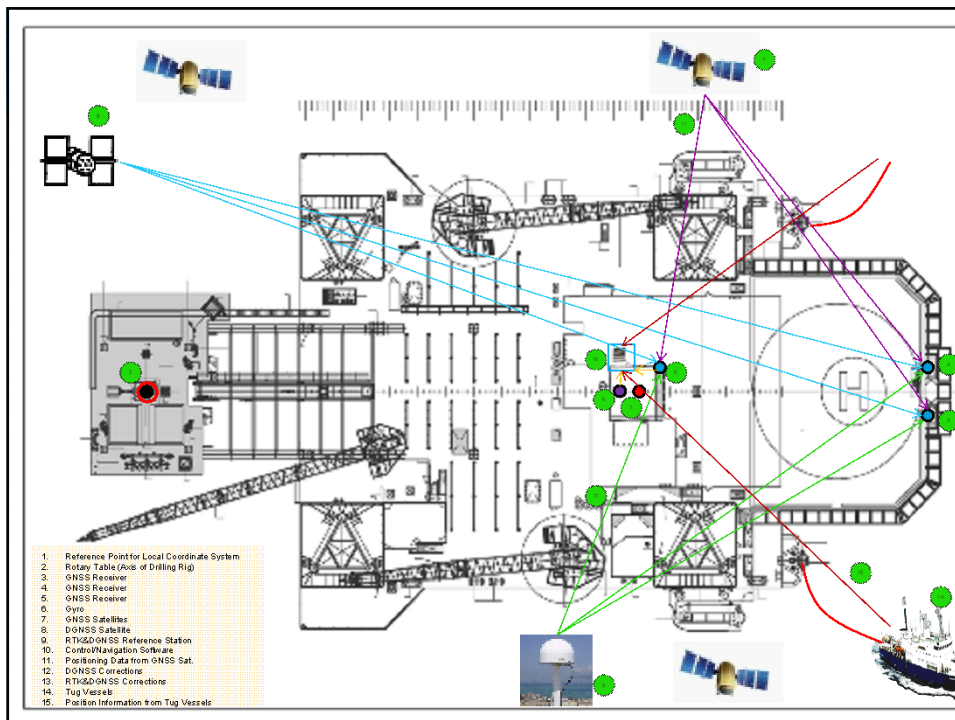
Drillship (600 - 3000 m)

- Drilling equipment added vessels
- Used for scientific purposes besides petroleum/natural gas exploration activities
- Uses Dynamic Positioning System



Rig Positioning





Design Alternatives

- There are 3 GNSS receivers and one gyro. This design provides followings:
 - If any of the sensors fails, its measurements are going to be taken into account as outliers and positions are computed with remaining measurements
 - Increasing the redundancy and reliability
 - More accurate, reliable and better quality positioning results of the rotary of the platform.
- Heading measurements and calculations derived from GPS/GNSS positioning also provide redundancy.
- If GPS/GNSS system is in differential mode:
 - A third party differential data provider
 - GPS/GNSS reference station
 - National Continuously Operating Reference Stations (CORS) network
- If GPS/GNSS system is in real-time mode:
 - Data from onshore Reference station
 - CORS network
- In any case GPS/GNSS positioning data and gyro data of individual sensors are transferred in NMEA format to processing unit for further process and analysis.
- When semi-sub platform is concerned, platform needs at least three outside transport vessel for moving towards and anchoring at drilling location. Thus, their spatial information must be known in real-time. In order to solve this problem SISNav, is considered. Therefore, outside transport vessels' positions are determined by SISNav. Then, positions are transferred by SISNav to platform processing unit for the information of the tow master for easy conducting of platform navigation and anchoring.

Web Application

- Web based applications in marine circle are also very hot and popular and hence very beneficial since it allows people/users reaching and monitoring even dynamic information online. This provides very efficient and helpful advantages in any offshore applications.
- All navigation data are displayed in the processing unit at the platform for precise navigation, positioning and efficient conducting. However thanks to internet technology a new demand is come out to remotely monitor the platform and vessel positions during navigation and anchoring by the contractor or business owner.
- In that case new positioning system should also provide online access via internet to platform operation.
- This is also a good advantage for taking care of emergency cases and security.
- The system designed and developed is also providing this facility for the users, since it has been developed server based technology.

Tests and Real World Applications

- Test of the system is considered as in both laboratory and real petrol platform.
- Developed components of the system have been successfully tested in the laboratory environment. For instance positioning data are successfully received from the receiver and post it to the internet environment. Thereafter posted positioning data listened and captured via internet and remotely displayed in several different computer connected to the internet.
- However, real case testing stage has not been achieved yet. Real case testing is in the stage of agreement with one of the platform user. When agreement is done, it is expected to be realized next October.
- Experience gained from the real case testing will be shared on the following paper about the project.

Conclusion

- Turkey is encircled from three sides by three seas and it also has an inner sea.
- Recently, there has been increasing activities in petroleum and natural gas exploration. Especially in last ten years, in Black Sea, there have been intensive studies carried out in order to explore hydrocarbon which is estimated to be under the sea bottom.
- In the next future, it is easily predicted that these studies will continue incrementally. Accordingly, platforms will be used to drill shallow or deep/ultra deep sea wells and these platforms will be positioned via positioning systems.
- In this study, we tried to design, implement and test an alternative positioning system.
- Currently there is no such service in the country for positioning petrol platforms or checking position of a platform already positioned. When this project is completed it is going to be the national alternative for solving such positioning, monitoring, inspection and etc problems.

