MALAYSIA

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"WATER MANAGEMENT / MONITORING AND AUTOMATION SYSTEM - FOCUS – KRIAN IRRIGATION SCHEMES"

by

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Introduction

Malaysia, which comprises Peninsular Malaysia, Sabah and Sarawak, is located between latitudes 1 degree and 7 degrees North and longitudes 100 degrees and 119 degrees East. It covers a total land area of over 330,000 sq km. The population is approximately 23 million with an estimated growth rate of 2.6 % per annum. The climate is equatorial with an average annual rainfall of 2000 - 2500 mm. The average temperature and relative humidity are around 26 degrees C and 80% respectively.

Approximately 80% of Malaysia is covered by tropical rainforest. About 22% of the land in Malaysia is utilized for agriculture. Townships, mining activities and other uses take up another 10%. Approximately 50% of the agricultural lands are cultivated with perennial crops such as rubber and oil palm. The other 50% is taken up for annual crops, mixed horticulture, shifting cultivation and fish ponds.

Presently, the agriculture sector contributes more than a quarter of the country's total export earnings, 20% of the Gross Domestic Product and nearly 33% of the total employment. However, value added earnings per worker in the agriculture sector is half that of the manufacturing sector.

1. Water Resources – Agriculture Sector

From a study conducted by the FAO it was found that the agricultural sector is presently the largest water consumer accounting for 85% of the country's water demand of irrigation purposes. This sector is also considered a comparatively low-economic-value, low efficiency and highly subsidized water user. It was found that most of the irrigation schemes have system efficiencies of less than 50% and water productivity index of less than 0.2 kg/m3. As the country is now having a fast economic growth and development towards industrialization in line

with Vision 2020, there will definitely be an increase in water demand for other sectors such as industries and household consumers and coupled with the country's limited water resources, there is a need for a more efficient and responsive water allocation and distribution management system to be implemented. In line with the government's policy of having an electronic government, it is imperative that the department has to move towards paperless bureaucracy and also real time data access through computers and networking. For management to obtain accurate information timely and make good decisions, an integrated operations, control and management system that allows easy and rapid access of data for diverse purposes needs to be implemented.

2.0 Government Policy

2.1 Irrigation in Malaysia has been directly linked to the national rice industry. In the late 1980s, the rice industry in the country faced a number of problems arising from labour shortage and escalating production costs. The smaller irrigation schemes were quite severely effected with many left idle. The priority of irrigation development added a new dimension with the need to rationalize rice production costs and profit considerations. A policy was developed to confine irrigation development to eight large irrigated areas, which were designated as Granary Areas where economy of scaled could be practiced. The main thrust is to increase the productivity in these areas totaling some 220,000 ha. Currently, Malaysia produces 1.5 million tonnes of rice annually and imports 0.340 million tones. Granary areas contribute 72% of the total production.

2.2 The small irrigation schemes (in the Non-Granary Areas) were designated to be gradually changed from rice to diversified land use such as more remunerative cash crops. Existing rice irrigation schemes totaling 54,000 ha have been identified for conversion. An additional 70,000 ha of rain-fed rise areas have been also been targeted for conversion. Provision and management of suitable irrigation systems and related infrastructure will be required to maximize production. Modern irrigations methods such as micro-irrigation systems (drip and trickle) and overhead sprayers will be introduced.

3.0 Background – Kerian Irrigation Scheme

The Kerian Irrigation Scheme which covers an area of 23,359 hectares is located in the North West Corner of The State of Perak. It is the third largest granary area in Malaysia. The scheme I divided into eight compartments, i.e. A to H. The coastal compartments A to D are called Kerian Laut whereas the inland compartments E to H are referred to as Kerian Darat. Kerian Darat are supplied from the Bukit Merah Reservoir whereas Kerian Laut gets the supply from the same reservoir but are supplemented by Sungai Samagagah, a tributary of Sungai Kerian through the Bogak Pumping Station. Two primary canals namely Main Canal and Selinsing Canal convey water from the

Bukit Merah Reservoir to compartment A to F and compartments G and H respectively. A network of secondary and tertiary canals also serves the project area. The scheme has a network of primary, secondary and tertiary drains, which eventually drain either into Sungai Kurau in the South, or Sungai Kerian in the North or directly into the straits of Malacca in the West through tidal gates.

The Study On Modernization of Irrigation Water Management System In the Granary Areas of Peninsular Malaysia by JICA from February 97 to July 98, proposals were made to modernize the irrigation and drainage facilities as well as the current irrigation water , for the granary areas concerned.

4.0 Current Issues In Water Management

4.1 Low irrigation efficiency

Overall irrigated efficiency estimated to be below 50%, due to cultivating practices and related loss of water that flows over the field batases.

4.2 Inadequate Field Water Management due to:

i) Oversupply of water with the use of field siphon
ii) Cost saving for O & M (US100/ha/year)
iii) Continuous irrigation
iv) leaking of concrete irrigation canals
v) field leveling
vi) cropping intensity from 170%to 190%.

4.3 Head losses in main canal due to building of structures that need to be controlled water productivity index from 0.3 to 0.5 kg/m3.

4.4 Lack of beneficiary participation as distribution cannot be considered in solution.

4.5 Real time assessment and telemetry not available.

4.6 Government policy to increase yield from 4 ton/hectare to 10 ton /hectare by 2005. Rice production to increase from 1.5 million metric ton to 2.3 million metric ton.

5.0 Irrigation Objectives

5.1 To have an efficient water management system through real time and accurate data and information transfer using the latest information and automation technology.

5.2 To improve water use efficiency and productivity in the provision of irrigation for Kerian Irrigation Scheme.

5.3 To facilitate the provision of adequate, timely and equitable water supply for intensive paddy cultivation (double cropping).

5.4 To optimize water resource utilization and also implement flood monitoring/warning system by monitoring real time rainfall and water level data in the catchments area.

5.5 To provide telecontrol/automation for important structures in the schemes so as to improve the time lines and effectiveness of operation and to reduce O & M costs.

5.6 A saving of 15% in irrigated water can meet 15% of water demand for domestic and industrial sector.

6.0 Irrigation Modernization

Key areas for improvement :

* System infrastructure improvement
* Infield infrastructure improvement
* Water management improvement
* Land consolidation
* Acceleration of mechanized farming
* Improvement of agriculture (farming practices)
* Strengthening of farmers' organizations
* Environmental management.

The Proposed Telecontrol / Automation system of Kerian Irrigation Scheme :

6.1 Conversion of manually operated gate systems into motorized gate systems for main gated structures, and provision of battery backup system to enable automatic operation of diesel pump, if any. Damaged or old gates unsuitable for automation purpose should be replaced or upgraded.

6.2 Installation of remote control/automation system for selected gated structures and pump stations. The locations of structures and pump stations to be provided with telecontrol/automation system shall be as guided by JICA's proposal. However, additional structures that are found to be crucial in the operation of the scheme will be added. The existing automated system for Kerian Barrage is to be integrated into the new proposed automation system.

6.3 The supervisory control system to be installed at The Control Centre at JPS Bagan Serai should be able to provide both manual and automatic control capabilities for the water conveyance and delivery system. The primary objective is to met the delivery needs of the water users with a high efficiency. To achieve this purpose, the supervisory control system should be able to carry out regulation of the structures in the main canals (either automatic or supervisory) manual mode) so as to achieve target discharges and water levels within reasonable limits. The key structures as described in part (b) above should be able to be operated in three different control modes. In local control mode, the structures are operated from its individual control panel on site, independent of the supervisory control system. In supervisory manual mode, an operator at the master control station initiates remote control actions for gates or pumps. In supervisory automatic control mode, computer-generated control actions are initiated from the master control station. Setpoints and schedules are computed at the master station and transmitted to RTUs at check structure or pumps that execute local closed-loop position controls. The primary functions of the RTUs are a monitor system status and to telemeter these data to the master control station, to perform remote manual open-loop control on command from the master station, and to perform closed-loop functions (e.g. local auto automatic gate control). The software installed at each RTU provides interfacing between the master control station, the RTU, and the control equipment at each site. The software should incorporate suitable control algorithms (controllers) using local feedback data for dynamic automatic regulation and control of gate or pump.

6.4 Remote video monitoring of structures selected for automations at the central control station.

6.5 Upgraded/new telemetric rainfall, water level, and evaporation and gate opening gauging stations at the necessary remoter locations and the telemetric equipment at the control centre.

6.6 For monitoring of water levels and discharges at intake, diversion and regulation structures, the monitoring points should be guided by the points proposed by JICA. However, additional points can be added if found to be strategic and important.

6.7 For monitoring water resource and flood status of the Kerian Scheme, adequate and strategic rainfall and water level stations should be selected to cover the basins of Kerian Reiver and Kurau River, Bukit Merah Reservoir catchments as well the scheme area itself. The proposed telemetric stations for the Kerian River and Kurau River basins and Bukit Merah catchments area which are also required for The Proposed Flood Monitoring and Warning System as described under 4.3 below. The proposed system should be able to allow for safety control and early countermeasures for extraordinary conditions through warning system for

flooding or critical low water levels at pumping/diversion points in rivers or at Bukit Merah Reservoir during drought periods.

6.8 Development of SCADA software to cater for scheduling of automatic polling of remote stations for data, data logging, database and file management

6.9 A computer network system is to be provided to handle, process and communicate data/information between the remote terminal units, central control station and workstations at the branch offices. The workstations/printers should be provided at branch offices at Farmers' Development Centers (FDC), pump houses and Bukit Merah site office. Communication of input/output data and information as well as video conferencing should be possible between the branch/site offices and the central control station.

7.0 DEMONSTRATION PROJECT

7.1 This primary objective of the Demonstration Project is to demonstrate the benefits of telemetry and automation. The experience gained in the demonstration projects can be used to fine – tune the design for the Kerian Water Management / monitoring and Automation System.

7.2 The objective of the system is to :

i) Remotely monitor the reservoir water level, gate position and canal water level.
ii) Remotely control the gate movement.

7.3 The works involved:

i) Installing and testing actuators on the two existing slide gates.
ii) Installing electronic water level sensors on the reservoir and canal.
iii) Installing and programming the RTU at the reservoir.
iv) Installing a pc with (SCADA) software at the JPS Kerian Office.

7.4 a) The demonstration Projects consists of two sites, the first being the reservoir located at Bukit Merah, and the control station located at master station in JPS Bagan Serai. The

two sites were connected remotely via the GSM network. The major components used are :

i) Mantacom MC – 1000 Remote Terminal Unit RTU
ii) IBM Deskop PC
iii) Mantacom Scada software
iv) Rotork Gate Controller
v) Ultrasonic water level sensors
vi) Axis network camera
vii) Wavecom GSM modem
viii) Lighting protection system.

b) Issues with Demonstration projects :

i) Gates closes when power supply resumes after stoppage.
ii) Lighting strikes – ELCB trips.
iii) Variation in ultrasonic after level sensor.

iii) Sudden change in water level measuring reading.
iv) High cost of telephone bill for GSM link.

8.0 CONCLUSION

8.1 Information technology is one of the key success factors of an organization. In this department many systems which have been discussed above with the aim to improve operation and maintenance and also provide real-time accurate information for management decision making. It is now timely to expand such deployment into the various areas and also to integrate these systems into the department IT system to that rapid access to data from anywhere on the corporate network by a range of personnel for diverse purposes can be realized. An integrated SCADA system proposed shall be able to perform such task.

8.2 To implement such integrated system so that existing systems that have already been developed by the various divisions can be readily integrated without much hassle needs the careful and committed planning, co-ordination, implementing and monitoring by a special Steering Committee on IT and SCADA. Co-operation and help from the various divisions is needed.

8.3 To implement such a system allocation and funding is necessary and the unit that is entrusted with the implementation should be provided with the necessary funds to ensure successful implementation. Funds shall be channeled to the division that is most suited for the log-term development.

8.4 Implementation of the system requires the support and effort of all levels of personnel in the department especially the commitment of top level management in making a clear decision.

9.0 RECOMMENDATION

9.1 The provision of a modern computerized water management system coupled with a real time supervisory control and data acquisition system can ensure optimal distribution of irrigation water to the various areas in the scheme. The modern water management will be needed to be implemented to enhancing the irrigation efficiency of the scheme and minimizing inefficient use of water. Data requirement should cover :

i) Rainfall
ii) Evaporation
iii) Actual planting schedule and crop variety
iv) Infiltration rate
v) Other losses
iv) Irrigation supply
vi) Field water depth.

9.2 Research and development of appropriate technologies such as simple irrigation facility and the utilization of local content are needed for water management system.

9.3 It is vital for promoting research activities and methods used in other countries be used locally.

9.4 There is need for research into the applicability of technologies available internationally to suit Malaysia soil and water conditions assessment of low efficiency and water productivity, economic viability, effectiveness of the technology and its sustainable in case of poor maintenance standard .

9.5. Need to research adept local condition on integrated water management system.

9.6. Japan experience should come useful especially in trying to increase:

a) Low system efficiencies
b) Water productivity index
c) 4 ton/hectare to 10 tan/hectare.
d) ICT program
e) Infrastructure rehabilitation
f) maintenance strategy required sustain the system effectiveness.
g) Infrastructure and technology development that contribute to water conservation.

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6. Application of SCADA System in Support of the Main Functions of JPS by Ir Khor Kong Kee

APPENDIX

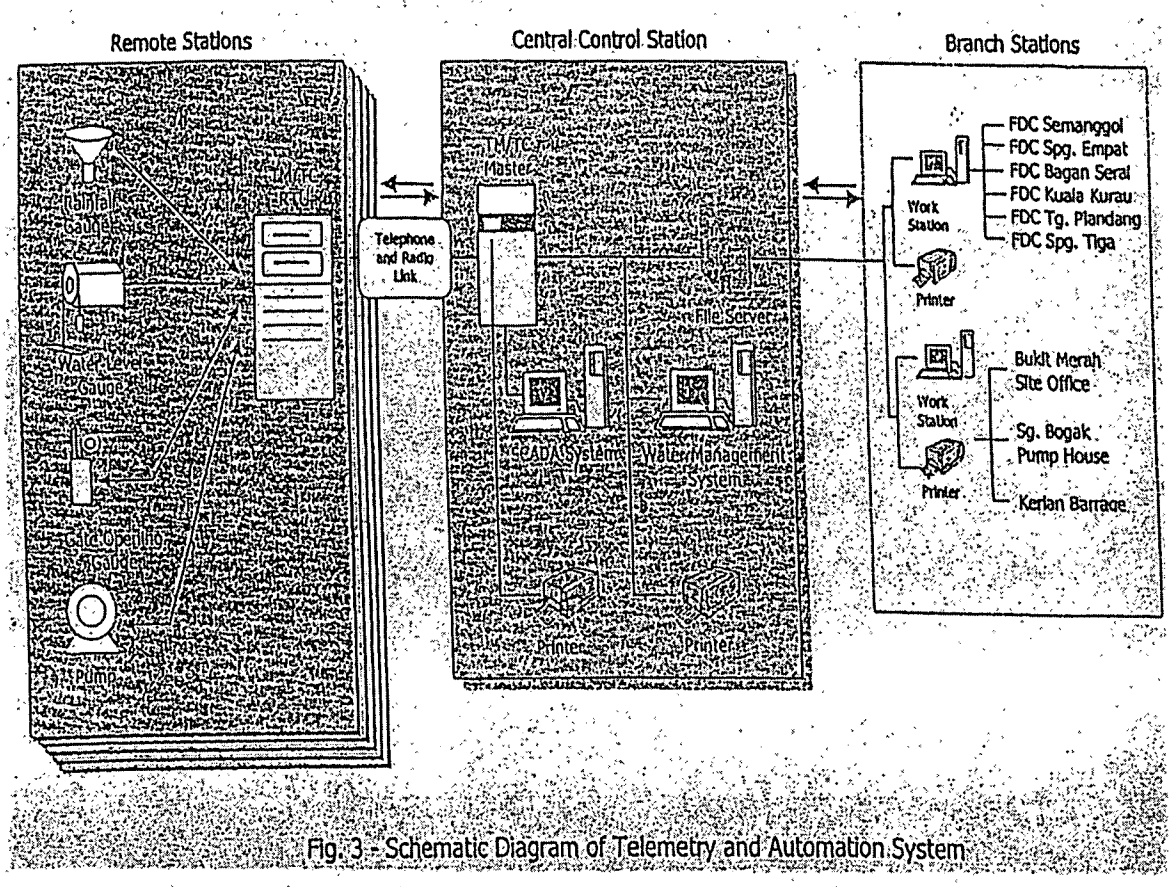
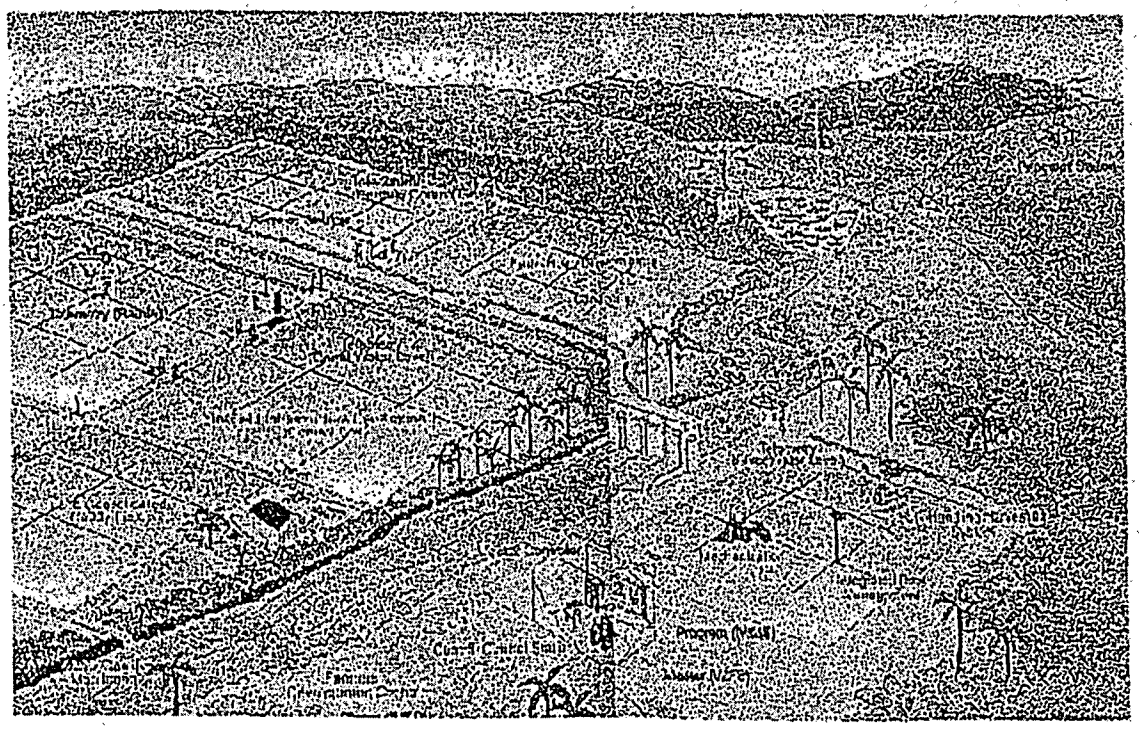


Fig. 3 - Schematic Diagram of Telemetry and Automation System



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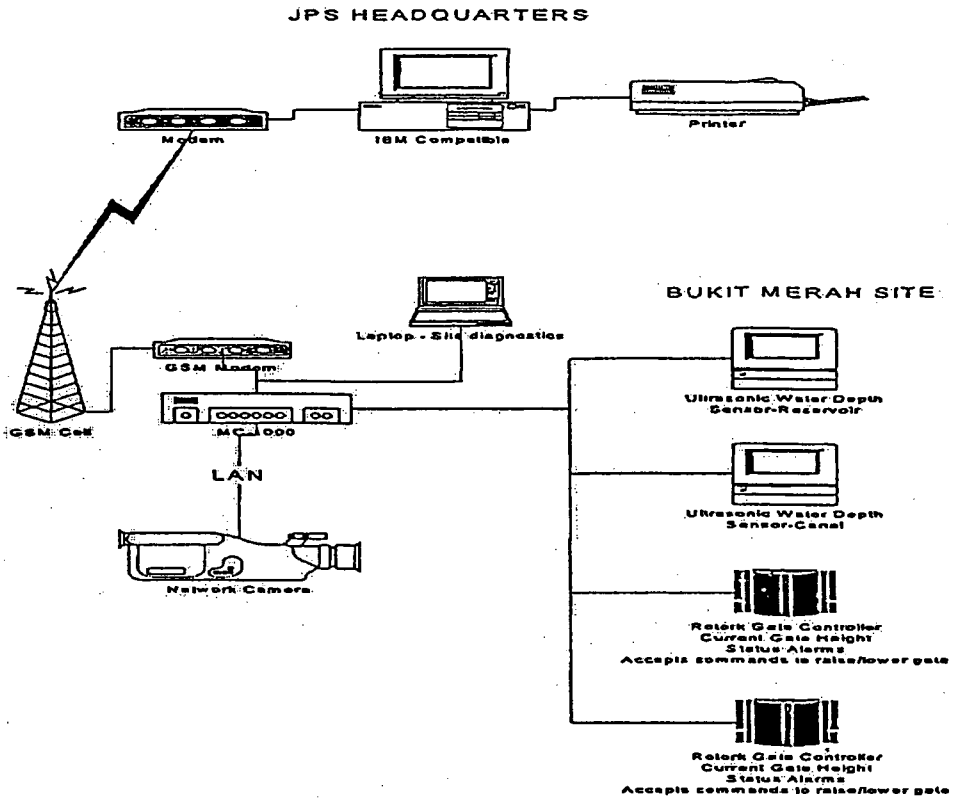
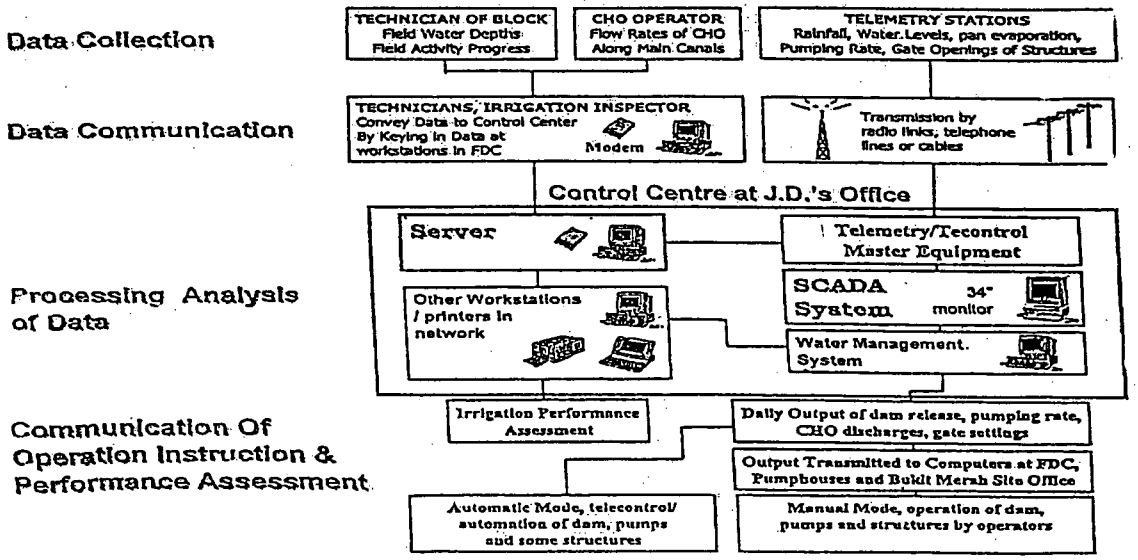


Demonstration Project System Overview



Proposed Irrigation Water Management and Automaton System