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Online monitoring and mapping of water quality of wells in rural areas of Sri Lanka

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Water quality testing and monitoring is essential in North Central Province of Sri Lanka due to the prevailing health problem of Chronic Kidney Disease of unknown aetiology (CKDu). In addition mapping of fluctuation of water quality of wells is required to identify the prevalence and aetiology for monitoring environmental factors of this multi-factorial disease. Examining a well water sample is costly and time consuming due to transportation to the laboratories and manual procedures, which could be replaced using portable instruments or fixed sensors with online monitoring. However, portable instruments need technical assistance while fixed sensors require fixed separate sensors for each water quality parameter at all locations which again is costly. Recent developments in internet of things (IoT) could be used to monitor water quality. However it requires accessibility to wireless network. Therefore, a portable automated instrument along with online monitoring and mapping can help minimize the stated issues. This research study focused on online monitoring and mapping of groundwater wells using in-situ colorimeter. In this study, well water quality was monitored in rural area of Medawachchiya and mapped to obtain special distribution of selected water quality parameters. A portable automated measuring instrument was developed to detect pH, conductivity, hardness and fluoride concentrations of water, interfaced to an online monitoring system, which helps to display spatial distribution of said parameters. A GSM module, arduino controller and raspberry pi processor were used to implement the system. Detected levels of test parameters and the location coordinates were sent via a SMS (Short Message Service) to a central location. Remote access data acquisition system was improved by applying an error control coding method. In the central monitoring station, information received was processed using MySQL database and the risk levels of the tested water were indicated with colour variation with its location in the google map. The in-situ colorimeter provides water quality parameters with 90% accuracy, and latency of the communication system depends on the GSM network where data analysis and mapping takes less than 2 minutes. Highly accurate data was obtained without failures such as transmission errors. The spatial distribution map shows groundwater wells under risk in red while the others are in green. Invented in-situ system online monitoring and mapping helps to identify wells and households that need immediate attention, and effectively reduces the time taken for operation and decision making.