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**THE DEVELOPMENT OF ONLINE MONITORING SYSTEM PROTOTYPE FOR  
TIGRIS CONSERVATION CENTER**

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**A report submitted in partial fulfillment  
of the requirements for the degree in  
Bachelor of Electrical Engineering (Control, Instrumentation & Automation)**

**Faculty of Electrical Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**JUNE 2016**

“I declare that this report entitles “The Development of Online Monitoring System Prototype for Tigris Conservation Center” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree”

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To my beloved mother and father

## ACKNOWLEDGMENT

I take this opportunity to present my votes of thanks to all those guideposts who really acted as lightening pillars to enlighten our way throughout this report to successful and satisfactory completion of this project. I am really grateful to my lecturer for providing me with an opportunity to undertake this project in this university and providing us with all the facilities. We are highly thankful to Mr. Mohamad Riduwan Bin Md. Nawawi for his active support, valuable time and advice, whole-hearted guidance, sincere cooperation and pains-taking involvement during the study and in completing the project of preparing the said report within the time stipulated. Lastly, I am thankful to all those, particularly the various friends, who have been instrumental in creating proper, healthy and conducive environment and including new and fresh innovative ideas for us during the project, their help, it would have been extremely difficult for us to prepare the project in a time bound framework.

## ABSTRACT

The Wildlife Conservation Society (WCS) has the mission to save the inevitably wildlife animal especially tigers and the landscape through which they roam at Endau Rompin, Pahang. In conjunction with this effort, the development of online monitoring system prototype for Tigris Conservation is proposed. The presented system includes RF (Radio Frequency) and wireless technology for communication systems with very low power consumption, which can receive small signals at very long distances. The user can identify the tiger's mobility in the specified area and monitor the updated total number of tigers' population at that area using a PC-based software and networked base station located at the same area. The transmitter emits a unique RF signal that represents each number of tiger tagged to the receiver. The assigned authority will determine the suitable range setting for the receiver, based on the frequency that is typically placed in the tiger's tagged collar. The system will transfer the data to PCs without any cable connection. The processor will identify the tiger's movement based on locked-frequency. Then the tiger's location information will be sent to the PC-based monitoring system in control room station. User will enable to remark the updated tiger's location and get notified alert for any mishaps. Furthermore, the indication of the tiger's location will be available on the field.

## ABSTRAK

Wildlife Conservation Society (WCS) mempunyai misi untuk menyelamatkan hidupan liar terutama harimau dan landskap di mana mereka berhabitat di Endau Rompin, Pahang. Demi usaha ini, pembangunan sistem pemantauan dalam talian untuk Tigris Pemuliharaan dicadangkan. Sistem ini merangkumi RF (Radio Frequency) dan teknologi tanpa wayar untuk sistem komunikasi dengan penggunaan kuasa yang rendah, yang boleh menerima isyarat kecil pada jarak yang sangat lama. Pengguna boleh mengenal pasti pergerakan harimau di kawasan yang ditetapkan dan memantau bilangan jumlah terkini harimau di kawasan itu menggunakan perisian berasaskan komputer peribadi dan stesen pangkalan rangkaian yang terletak di kawasan yang sama. Pemancar mengeluarkan isyarat RF unik yang mewakili setiap nombor harimau yang telah dilengkapi kepada penerima. Pihak berkuasa yang bertugas akan menentukan tetapan julat sesuai untuk penerima, berdasarkan kekerapan yang biasanya diletakkan di kolar harimau. Sistem ini akan memindahkan data kepada komputer peribadi tanpa apa-apa sambungan kabel. Pemproses akan mengenal pasti pergerakan harimau berdasarkan frekuensi yang ditetapkan. Kemudian maklumat lokasi harimau akan dihantar kepada sistem pemantauan berasaskan komputer di stesen bilik kawalan. Pengguna akan membolehkan untuk peka terhadap lokasi harimau yang dikemaskini dan menyedari untuk sebarang kejadian yang tidak diingini. Tambahan pula, petunjuk tentang lokasi harimau akan disediakan di kawasan yang telah ditetapkan.

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## CHAPTER 1

### INTRODUCTION

#### 1.1 Project Background

Wild tigers are found in three main landscapes in Peninsular Malaysia: Belum-Temenggor, Taman Negara and Endau-Rompin [1]. However, due to poaching of tigers and tiger prey, in addition to habitat degradation, the integer of tigers in each of these landscapes is below the resonant size. Less than 500 Malayan tigers are supposed to remain in the empty space. The WCS-Malaysia's inclusive tiger conservation program in the Endau-Rompin landscape for the past four years. WCS-Malaysia has been occupied strictly with the State Governments of Johor and Pahang (in Peninsular Malaysia) to recruit a rescue program of the tigers and other wildlife in the Endau-Rompin landscape. WCS-Malaysia is dedicated working in this landscape over the many years to achieve a repossession of the tiger residents. There are three main direct intimidations to tigers in the Endau-Rompin landscape: habitat loss in key corridor areas, direct killing of tigers by poachers and, killing of tiger prey by poachers [1].

To address these serious issues, WCS-Malaysia works with the state and federal governments of Malaysia to simplify the following involvements: tiger-friendly land-use planning in the key corridor areas; a robust, continuous, on-the-ground anti-poaching effort across the whole Endau-Rompin landscape, outreach programs with local societies living in and around the Endau-Rompin landscape to rise consciousness on protecting the tiger and its prey and regular monitoring of tiger and prey population numbers around the conservation area. Online monitoring system is a good supportive project management for the wildlife conservation project. It implicates the systematic and continuous collection of data useful for auxiliary analysis (review and evaluation) and for understanding decision-

making. Online monitoring mainly to ensure the population of tiger in The WCS-Malaysia tiger conservation program focuses on two major activities to control poaching in the Endau Rompin landscape. The first is catalyzing and supporting effective on-the-ground ranger patrolling across the Endau-Rompin landscape. Some patrols are on foot in the backcountry while others use vehicles and boats. Mobile spot checks and static checkpoints are also conducted at the entry points to the landscape, as a further means of deterring the high number of relatively less committed, minor poachers and the smaller number of more committed poachers. WCS Malaysia's engagement with the enforcement units of the state governments has led to a dramatic increase in the effectiveness of the on-the-ground anti-poaching activities by develop the online monitoring PC based for rangers. A second major anti-poaching activity of WCS-Malaysia is to strengthen the laws that impact poaching in the landscape. The efforts will enable a vital and constant on-the ground being there of strong surveillance that will protect and allow for the recovery of wild tigers across the Endau-Rompin landscape.

One of greatest needs is the ability to monitor key 'scorching spots' of the forest as close to real-time as possible so fast action in reporting illegal activity that could threaten tigers or their prey. Basically the monitoring required is visual, and would be of specific sites within the forest approximately 10m<sup>2</sup> in area. Monitoring is important for keeping track of the tigers' movement patterns, habitat utilization, poaching incidents and breakout. This valuable information has potential advantages to management applications, especially in planning successful strategies to control the population of tigers in Malaysia [3],[4].

From the background studies, one of the method implemented to track animals is through cellular technology. The advantages of cellular technology are steadily increasing, especially in the coverage of the network around the world and the continuity advanced speed in data transfer through cellular networks. However, the cellular technology drawbacks are the technological challenge of reducing the size space, the users' demand of reducing power consumption, and the complexity usage of different cellular architectures in different landscape [5].

Together with this effort, a development of monitoring system prototype for wildlife animal is proposed. The presented system includes RF (Radio Frequency) and wireless technology for communication systems with very low power consumption, which can receive small signals at very long distances. The user can identify the tiger's mobility in the specified area and monitor the updated total number of tigers' population at that area using a PC-based software and networked base station located at the same area. The transmitter emits a unique RF signal that represents each number of tiger tagged to the receiver. The assigned authority will determine the suitable range setting for the receiver, based on the frequency that is typically placed in the tiger's tagged collar. The system will transfer the data to PCs through wireless system.

The tiger's location information will be sent to the PC-based monitoring system in control room station. In conjunction with this project, a programming language and environment developed by Microsoft. Based on the BASIC language, Visual Basic was providing a graphical programming environment and a paint metaphor for developing user interfaces. Instead of worrying about syntax details, the Visual Basic programmer can add a substantial amount of code simply by dragging and dropping controls, such as buttons and dialog boxes, and then defining their appearance and behavior. User will enable to remark the updated tiger's location and get notified alert for any mishaps. Furthermore, the indication of the tiger's location will be available on the field.

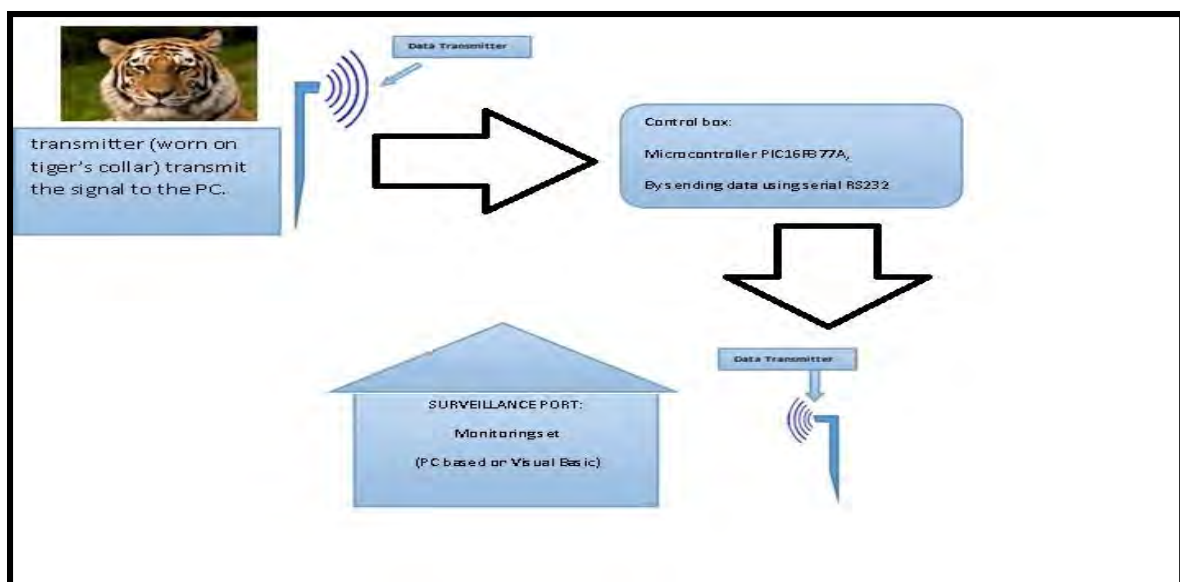


Figure 1.1: Block Diagram for Online Monitoring System Prototype for Tiger Conservation Centre.

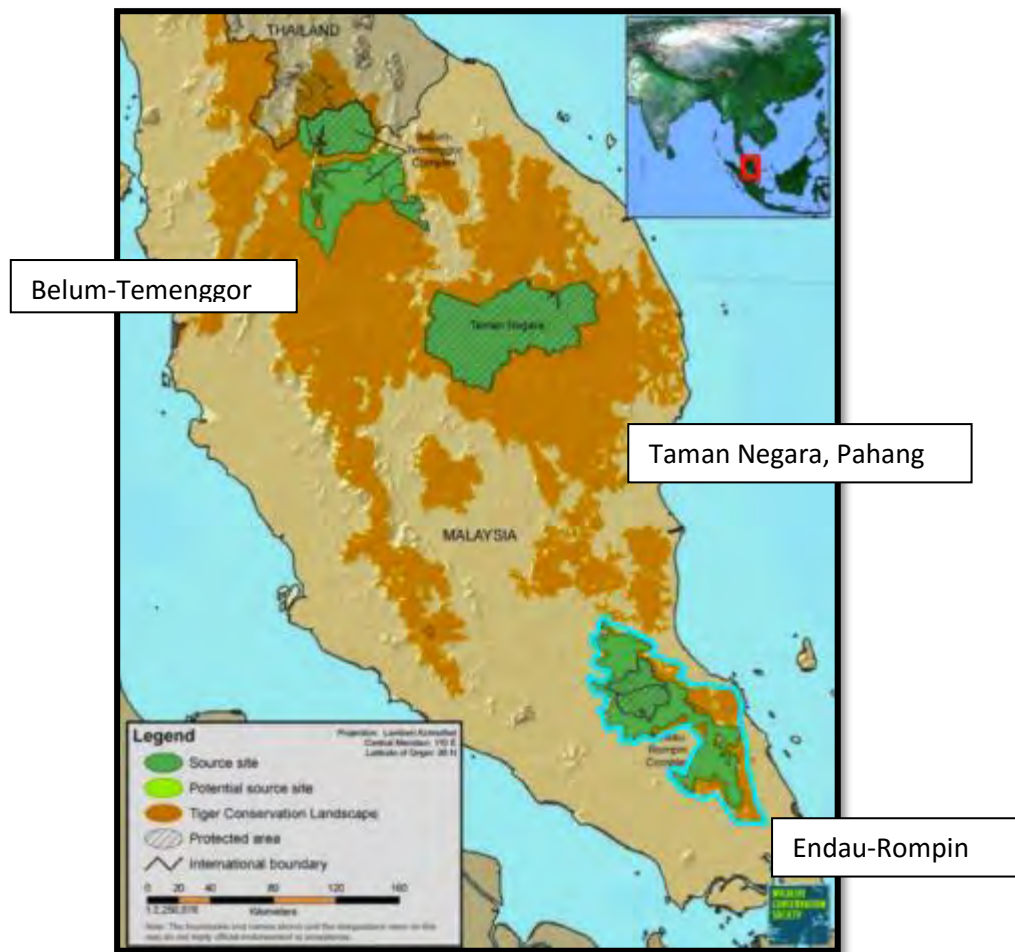


Figure 1.2: Location of Three Main Tiger Conservation Landscape in Peninsular Malaysia

## 1.2 Objective

The purpose of this study as listed below:

- To monitor the number of tiger in National Park
- To design online monitoring scheme in Visual Basic.
- To develop online PC- based monitoring system prototype for the population of tiger at National Park Endau Rompin through wireless application.

### 1.3 Motivation of Project

The proposed of monitoring system prototype for wildlife aim's is to have real-time monitoring system to indicates the mobility of tigers at Endau Rompin National Park. The online monitoring system prototype enables rangers to identify the total number of tigers' population at all times as well as to get notified if any mishap occurs in the tigers' conservation wildlife area. The system further allows effective wildlife enforcement patrol to be taken among all community rangers, park managers, any groups, agencies or individuals directly engaged in, supporting, or responsible for the wildlife conservation, especially the tigers' population. This project can be used across a broad range of conservation contexts, from strictly protected areas to multiple-use zones, ranging from terrestrial to ecosystem. This product can motivate wildlife park rangers in their daily work by carrying the task of collecting data regarding the tigers' population during their daily site patrol. In addition, the usage of this product may empower conservation manager to gather and monitor timely and accurate information on what and where the treats are occurring to the tigers' population and how the enforcement teams are responding to that situation.

### 1.4 Problem Statement

Nowadays, the number of tigers' population in the world has been declined. This situation has led to the need effort to protect the endangered animals, in this case the tigers. In Malaysia, the Endau Rompin National Park in particular, is the chosen suitable wildlife reserve to conserve the tigers' population. Currently, there is no effort to carry out the real time surveillance monitoring for tiger conservation in Malaysia. It is difficult for the authorities at Endau Rompin National Park to track and monitor the tigers' population at the wildlife reserve. The Wildlife Conservation Society (WCS) Malaysia needs an effective solution that can visually monitor illegal activities regarding to tigers' mobility. The main component of this system is an Arduino, by sending data via wireless networking, using radio frequency system. Microsoft Visual Basic as interfacing system in server. The purpose construction of these system, it is expected that the number of tiger



shows in detail of mobility of the animals in real time. If the surveillance monitor shows the illegal incidents do occur, the WCS staff need to be informed quickly so that the relevant Endau Rompin National Park authority can be assigned to stop the illegal activities regarding the endangerment of tigers' population. Therefore, to overcome this problem, a monitoring system is proposed.

### **1.5 Scope and Limitation**

In this pre-development prototype, the range distance from the transmitter and the receiver need to be defined according to the tiger's territory's in Endau Rompin National Park. Frequency booster and repeater are implemented to intensify the radio frequency for transmitting and receiving process. The system designed to implement hardware with an interface to the computer where the circuit system may interact with the computer through the interface. Write a program using Visual Basic language to computer and show the number of the tiger in the certain area.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Project Overview

The surveillance system for tiger conservation is developed to monitor the mobility for the tiger in the area and the overall total numbers for tigers. This system prototype applies communication protocol, and uses the RF transceiver. It has the characteristic of low power consumption, low cost, flexible structure and accurate counter scheme. Furthermore, it also can achieve long monitoring for tiger's condition in real time [1]. Serial communication has some advantages over the parallel communication. One of the advantages is transmission distance where serial link can send data to a remote device more far than parallel link [2].

#### 2.2 Project Overview at Conservation Centre, Endau-Rompin

For the past four years, WCS-Malaysia has been working closely with the State Governments of Johor and Pahang (in Peninsular Malaysia) to initiate a recovery of the tiger population and other wildlife in the Endau-Rompin landscape. WCS-Malaysia is committed to working in this landscape over the many years it will take to achieve a recovery for the number of tiger. For these reasons, a system is needed to be in place for continuously monitoring the number of tigers to surveillance and prevent the decrease of population tigers at large scale by implement the online monitoring system. Online monitoring system is an automated communications process by which measurements are made and other data collected at remote and transmitted to receiving equipment for monitoring. This work has considered the problem of tracking and monitoring wild animals and their interaction and dependency on their environment. An adaptable solution

has been proposed, that allows the mobility of tigers to be monitored using the online monitoring system and which automatically sends data through the network to the end user. Thus, this work has the potential to greatly enhance the understanding of animal behaviour, by providing large amounts of inter-related data with minimal human input. Furthermore, online monitoring allows for real-time location of an animal as locations are determined automatically.

Online monitoring is thus specified such that some parameter (such as lifetime) is maximized, at the cost of a decrease in some other desirable feature (such as sampling frequency). Obtaining data from tracking tags deployed in the field can be a time consuming and laborious affair. The WCS-Malaysia tiger conservation program focuses on activities to control the number of tigers in the Endau-Rompin landscape. It catalyzing and supporting effective on-the-ground ranger patrolling across the Endau-Rompin landscape. Some patrols are on foot while others use vehicles and boats. Mobile spot checks and static checkpoints are also conducted at the entry points to the landscape. Since year 2009, Camera-trap study to estimate the density of tigers are also underway in the area Endau-Rompin. During the study population, the camera-trap and social-economic survey will produce a baseline and to identify the environmental factors that affect the ecology of tigers and prey species. The preliminary results of this ongoing study has become a guide for environmentally friendly infrastructure design Endau-Rompin in Johor and land use planning in that area. ecologically friendly. Preliminary results of the camera-trap study under conservation centre in 350 km<sup>2</sup> in Endau-Rompin had recorded at least seven tigers [3].

Moreover, for some of these systems (in particular manual monitoring), the presence of the rangers in the field tracking the animals causes disturbance to their natural behaviour. This disturbance is likely to introduce bias into the obtained data. In addition, the network should adapt to node insertions and removals with zero configuration required from the user – the network should be a transparent method of information delivery, not a system which requires technical skill to operate and configure. Somehow, the workload of traditional artificial monitoring is big, `trapping technique, is higher and environmental impact is big. They can only monitor generally. Thus, traditional wildlife monitoring methods are far cannot meet the needs of the current. The current surveillance system in general is the use of long distance wireless communication technology is by using PC-

based monitoring via visual basic development, which is relatively easy while its portability is very low besides it is a kind of low cost, multiple technology fusion of online monitoring is designed and realized in this study.



Figure 2.1: camera-trap images of tigers in Endau-Rompin taken in 2007. These photos and others from 2007 inspired senior Malaysian government officials to fully endorse the tiger conservation efforts and to allocate increased Government funding and other resources to tiger protection.



Figure 2.2: WCS-Malaysia staff setting up a camera trap in Endau-Rompin

### 2.3 Research Background

The accurate estimation of wildlife population density is difficult and requires considerable investment of resources and time. Population indices are difficult to obtain and being influenced by many unknowns and the relationships to actual population densities are usually unclear as recorded in Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Therefore, a method to monitor a wildlife population may need to be tested or validated, to surveillance the population of endangered wildlife animal such as tigers.

A large number of methods have been used to monitor the threaten wildlife animal. The population may be a valued species such as deer, bear, elephant and tiger that is being managed on a sustained-yield basis may need more rigorous method to monitor their mobility for density estimation or a known population size

Technological developments have provided several methods for monitoring populations such as the use of remote camera application. Remote cameras in [4], can assist estimating population numbers, and understanding animal activity patterns. As example, [4] demonstrates the ability of remote cameras by identify the Canadian Rockies multi-species occupancy. The main findings of the Canadian Rockies Multi-Species Occupancy Monitoring Project is a collaboration between Parks Canada and the University of Montana focus the research is 270 remote cameras that placed throughout 5 Canadian national parks. These data are used to help Parks Canada inform its remote camera monitoring as efforts for surveillance large mammal populations in Canada.



Figure 2.3: Data from Camera Trap for Online Monitoring System



On the other hand, the developments in [5] have delivered other methods for monitoring the mobility of wildlife animal by using Mobile monitoring, that is widely used nowadays. In order to determine the real-time animal mobility, [5] proposed the monitoring to avoid such problems in the finding exact geographical location of animal in the jungle, national park or in wildlife reserves, wildlife animal mobile monitoring is used. This system utilizes technologies such as Global Positioning System and Global System for Mobile Communication. In [5], modem has SIM card, which is used to send SMS to the forest authority or to any government authority.

Furthermore, PC-based monitoring system has developed as one of the methods for monitoring populations. Tele monitoring system in [6], consists of sensing unit and receiving unit with PC-based for monitoring. As the technology is already part of modern farming, [6] implement a system to be in place for continuously monitoring the animal health as to control and prevent the eruption of diseases at large scale. This project is development has been used in electronic livestock farming and focused on the development of animal health tele monitoring systems via PC-based method.

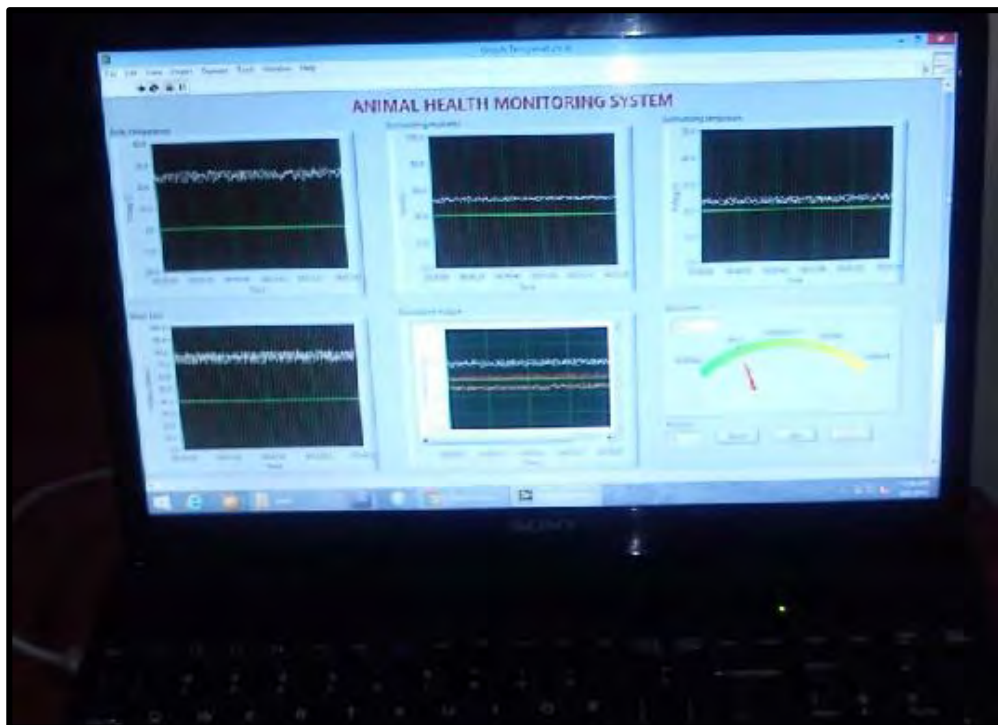


Figure 2.4: The front panel of the PC based monitoring system

## 2.4 Application for Online Monitoring Display

A computer-based monitoring system, also known as an electronic monitoring system is an automated communications process by which measurements are made and other data collected at remote and transmitted to receiving equipment. Technological developments for PC-based online monitoring have provided several methods for monitoring populations such as the use of web-based application and window-based application.

A web-based application is any application that uses a website as the interface (the 'front-end'). Users access the application from any computer connected to the Internet using a standard browser, instead of using an application that has been installed on their local computer. Web-based application platform likes MySQL, Apache and JSP has been used in [7], as an integrated method for reporting and recording of livestock health records. This web-based livestock monitoring systems is used to help farmers and livestock veterinary to share information for the purpose of early prevention of dangerous diseases from infected their livestock via monitoring the health status of a livestock.

In addition, web-based monitoring system has offered several advantages for Cost effective development. With web-based applications, users access the system via a uniform environment—the web browser besides it also easier to install and develop.

On the other hand, online monitoring development is also providing another convenient module for communication that is by using window-based application. Compared to web-based application module, window based application delivered advantages of window based. As in [8], applied a mechanism for ubiquitous monitoring and smart alert generation systems. In [8], the system updates the central database whenever necessary and will be able to generate views and reports whenever necessary. This project depicting these activities and overall work flow using some screen shots. Online monitoring system provide some of the Apps likes Patient Monitoring, ICU Direct Monitoring, Vitals Chart Lab Wizard, are monitored and are discussed in detail.

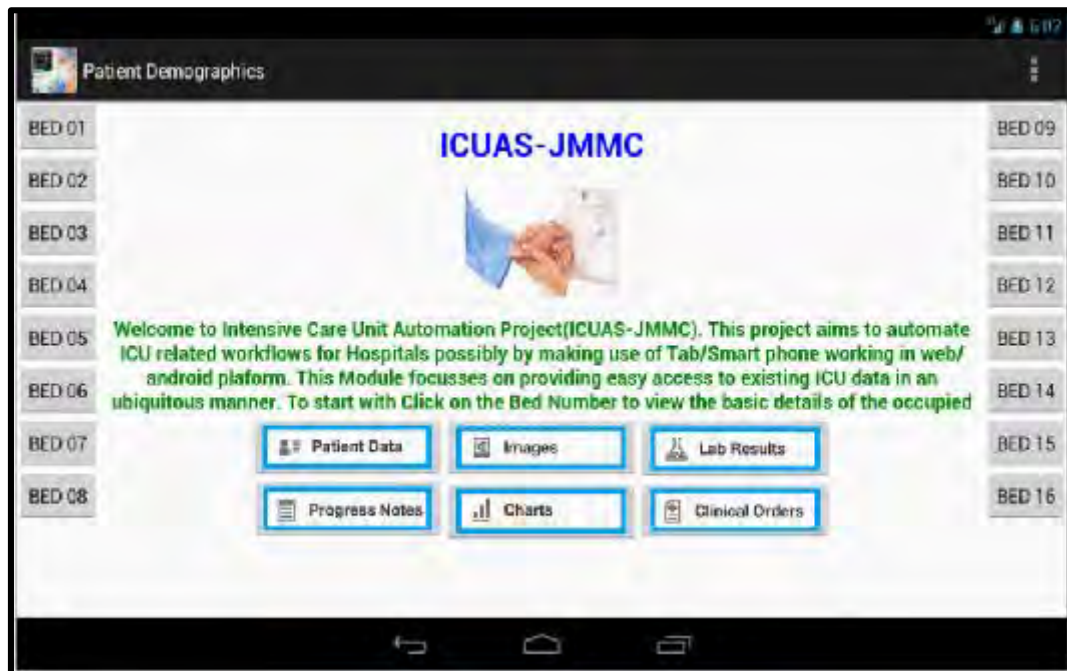


Figure 2.5 A View of Patient Data Application

This window-based application offers a set of advantages for the clinical staff, since they can move around and perform various tasks and at the same time use the device at their point of service. It will reduce the effort involved in clinical data entry, thereby allowing them to provide better patient care. The system will automatically provide more accuracy, swiftness and flexibility to their work flow.

The development of online monitoring system will be use a window based application which is more precisely a computer based application, that run through, because web based application runs from a web, through a browser may not be relevant implemented in Endau-Rompin landscape area which has difficulty with coverage communication system. Windows based application has to accessed by the particular computer and particular ranger is more suitably used in conservation centre compared to web based application as can be used by different user accessing the same program, hence mobility is more. Speed is comparatively faster for windows based application that may contribute to involvement of ranger instantly compared to speed that is slow for web based application. Therefore, window based application by using visual basic is developing in online monitoring system for monitor the mobility and the number of tigers in Endau-Rompin landscape.