# The Grizzly Badgers,
# Singapore Management University

# Ang Mo Kio - Thye Hua Kwan Hospital

# IS480 Solutions Proposal
# Stepwise
### v1.1

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# Contents

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## Objective

Team Grizzly Badgers (Team GB) from Singapore Management University (SMU) and Management Information System (MIS) from Ang Mo Kio – Thye Hua Kwan Hospital (AMKTHKH) are collaborating to redevelop the "Triage System". This document aims to present the possible implementations to the management of AMKTHKH.

## Background

Team Grizzly Badgers

Team GB is made up of a group of 6 students in their third year of studies in SMU and are embarking on their capstone project (IS480). They aim to design, develop and implement the new Triage System for AMKTHKH.

Triage System

Mr Damien Tong, HR Director and Mr Edy Chandra, Systems Analyst from MIS recommended Team GB to undertake the challenge of redeveloping the Triage System.

The Triage System is a visitor logging system which plays a role in the hospital's Pandemic Preparedness and will be deployed as part of the hospital's response in a pandemic.
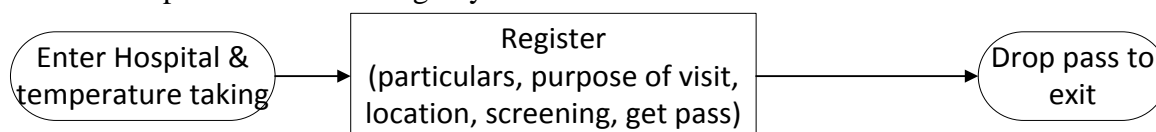The system will also consist of a contact tracing module which facilitates the contact tracing of visitors who have come into close contact with a patient diagnosed with the disease.

## Problem Description

Based on the MOH guidelines, the Infection Control Team has implemented the following processes have to be carried out for visitor logging.
- Visitor's particulars have to be recorded. The required information is those as stated on the NRIC, including contact number, purpose of visit and location of visit.
- Visitor's temperature has to be recorded before entry into the hospital.
- Visitor has to be asked screening questions before entry into the hospital.

The current process for the Triage System is as follows

```
Enter Hospital &          Register                      Drop pass to
temperature taking   →    (particulars, purpose of     →   exit
                          visit, location, screening,
                          get pass)
```

The first version of the Triage System is able to meet the guidelines set out by MOH. However, it is limited in its ability to accurately track a visitor's actual locations of visit within the hospital, time of arrival at the location, dwell time and time of departure from the hospital.

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The redeveloped system aims to reduce the amount of manual tasks required by the staff, facilitate the visitor logging process and log a visitor's movements within the hospital as accurately as possible.

The contact tracing module will utilise the information collected from the visitor logging module to generate a list of visitors who have come into close contact with a patient diagnosed with the disease. This list is to be submitted to the Ministry of Health (MOH) within 24 hours.

## Considerations

The team has determined three possible implementations of this system based on the complexity. Each implementation will vary the
- Level of tracking of visitors' movement within the hospital,
- Visitor access restrictions within the hospital and the
- Budget required.

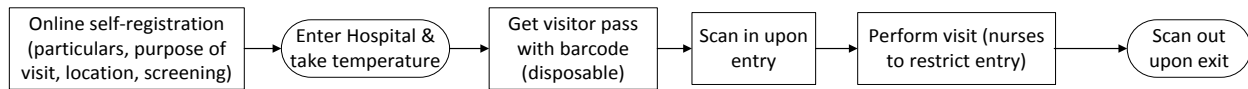| Solution | | | |
|---|---|---|---|
| | **Low complexity of implementation** | **Medium complexity of implementation** | **High complexity of implementation** |
| **Level of tracking** | Main entrance / exit | 'Checkpoint' based | Fully automated, live tracking |
| **Visitor access restrictions within hospital** | Minimal restrictions | | Possible gantry / access cards |
| **Budget** | Current available hardware such as scanners, computers, tablets, printers | Resources at each 'checkpoint', such as a scanner and computer at each wing or ward | RFID scanners, beacons and receivers |

## Solutions

All three solutions will feature an online self-registration where the visitor will be able provide his particulars and visit details even before his arrival at the hospital.

The team is also exploring a temperature taking process which can record a visitor's temperature automatically into the system after he takes his temperature. This aims to reduce the number of staff required at the temperature taking station who are required to manually key in visitors' temperatures. The feasibility is yet to be confirmed.
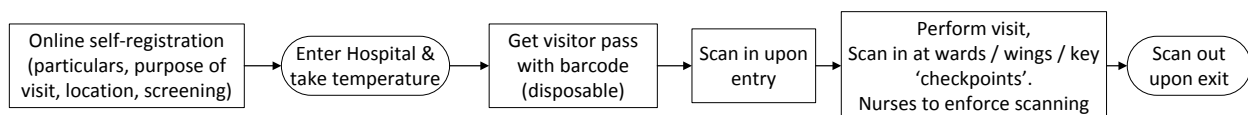
The three possible solutions will be as follows

### Low-complexity Solution

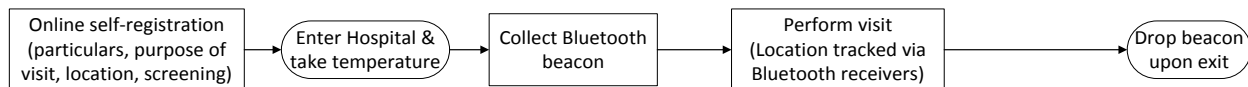| Online self-registration (particulars, purpose of visit, location, screening) | → | Enter Hospital & take temperature | → | Get visitor pass with barcode (disposable) | → | Scan in upon entry | → | Perform visit (nurses to restrict entry) | → | Scan out upon exit |

This solution will be limited in its ability to register the visitor's actual visit locations. However, it will be able to track the time the visitor leaves the hospital. There is minimal visitor access restriction.

### Medium- complexity Solution

| Online self-registration (particulars, purpose of visit, location, screening) | → | Enter Hospital & take temperature | → | Get visitor pass with barcode (disposable) | → | Scan in upon entry | → | Perform visit, Scan in at wards / wings / key 'checkpoints'. Nurses to enforce scanning | → | Scan out upon exit |

This solution is able to register the visitor's actual visit locations. However, it is based on trust that the visitors will 'check-in' and will need to be enforced by the nurses. There is minimal visitor access restriction.

### High- complexity Solution

| Online self-registration (particulars, purpose of visit, location, screening) | → | Enter Hospital & take temperature | → | Collect Bluetooth beacon | → | Perform visit (Location tracked via Bluetooth receivers) | → | Drop beacon upon exit |

This solution is able to register the visitor's actual visit locations without any human intervention. The receivers around the hospital automatically detects the Bluetooth beacon and registers the locations he visited. However, some investment is required to set up the infrastructure needed. Separately, visitor access restriction can only take place if further enhancements such as key card entry are implemented. There will also be the challenge of enforcing the return of the Bluetooth beacons or key cards, which can be troublesome and costly to replace.

## Assumptions

In considerations for budget, the following assumptions will be made
- There will be two assisted self-registration counters and two temperature-taking counters which will be the point of entry into the hospital.
- There is no equipment set aside for Triage System. If there are items are available, the quantity required to purchase, reflected on the table below, can be reduced accordingly.

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## Budget

| Process | Equipment | Low complexity of implementation | Solution Medium complexity of implementation | | High complexity of implementation | Equipment |
|---|---|---|---|---|---|---|
| | | | Option A | Option B | | |
| Self-registration, temperature taking and entry into hospital | Barcode Scanners + Laptop Thermometer (connected to computer) | 2 x $60 = $120 (for entry to hospital) 4 x $1,500 = $6,000 (2 for entry to hospital, 2 for registration) 2 x $400 = $800 (actual thermometer model to be confirmed) | | | | |
| Visitor Tracking at checkpoints (Hospital's hardware) | Barcode Scanners + Laptops | NA | 12 x $60 = $720 (Barcode Scanners) 12 x $1,500 = $18,000 (Laptops) | 12 x $398 = $4,776 (Smartphone / Tablet) | 16 x $100 = $1,600 | Raspberry Pi |
| Visitor Tracking at checkpoints (to be held by visitor) | Visitor Pass | $100 (Printer ink and Paper) | | | 300 x $15 = $4,500 | Bluetooth Beacon |
| | Total Estimated Cost | $7,020 | $25,740 | $11,796 | $13,020 | |

Xiaomi Mipad - http://www.mi.com/sg/mipad/

Tablets and smart phones - http://www.harveynorman.com.sg/computers-tablets-and-gaming/ipads-and-tablets/android-tablets/

Raspberry Pi - http://www.sgbotic.com/index.php?dispatch=products.view&product_id=2098

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## Support Required

Team GB is thankful for the support and mentorship which the management and staff from AMKTHKH are providing and are glad for the opportunity to propose solutions for the hospital to adopt.

Mr Damien Tong, Human Resource, HR Director
Mr Edy Chandra, MIS, Systems Analyst
Mr Wayne Lee, MIS, Systems Analyst

Dr Jocelyn Koh, Infection Control Team Lead
Mrs Quah Kim Moi, Infection Control Team
Ms Sarah Lim, Infection Control Team

## Potential Risks and Challenges

| Possible Risks & Challenges | Mitigations |
| --- | --- |
| Inability to complete the project due to lack of time or unfamiliarity with the development of the system. | The team will be updating Mr Edy fortnightly on the progress of the system development. They will be following the development timeline as stated in the proposal to their school. |
| Unfamiliarity with the technology used. | The team is new to using Bluetooth beacons and receivers as part of the solution. However, the team will consult Prof Tan Hwee Pink from SMU who is currently embarking on a project using similar IOT technology. |
| Requirements gathered might not be clear. | A functional specification document will be produced to document the process requirements. The team will clarify with Mr Edy, who will coordinate with the Infection Control Team to determine the requirements. |

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## Conclusion

The three solutions of varying complexity will impact the redeveloped Triage System's ability to accurately track the visitor's location within the hospital and register his dwell time.
Team GB wishes to adopt the medium-complexity implementation as it will be able to meet the hospital's needs of generating a contact list for contact tracing.

The high-complexity implementation will be able to fulfil the requirements better. Should the hospital be looking to track dementia patients or key staff within the hospital in future, this solution will provide a good foundation to doing so. However, the team recognises that the technology is uncommon and has not proven itself yet. The management might also want to consider the need to have hardware dedicated to visitor tracking in a pandemic period, unless other forms of tracking during normal times are required.

The team is aware of possible budget considerations for the medium-complexity solution. However, should the hospital already have such equipment readily available, the estimated budget amount would be greatly reduced. The major component of the estimated cost, laptops, are also able to be used by staff when the Triage System is not operational.

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