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Design and Development Modish Smart Key Box using RFID based on Arduino WEMOS Mega

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Abstract - *The Modish Smart Key Box (MSKB) is a key storage that developed with the safety features and modish appearance. MSKB has been designed in line with 4.0 industrial revolution by using internet of thing (IoT). MSKB employed IoT in order to update the key utilization via mobile phone. Besides, MSKB also engaged with lean manufacturing tools which is adaptation of visual factory tool. The term "visual factory" refers to an approach of lean manufacturing processes based on visual information throughout the workplace. A visual factory uses a system of communication tools to share information at the time and place. The design of MSKB was complete with LCD monitoring board and using Arduino mechanism in order to send the information pertaining the key usage through mobile phone. Radio Frequency Identification (RFID) system also a part of this this project for the purposed of security which is user must scan a staff card whereby those cards already installed with RFID code. Consequently, outsider could not access that MSKB for security purposes. Aforementioned, the keys can easily be traced while those who take the key can be identified by appearing the name on LCD and simultaneously signal will send to application through mobile phone in order to update key taker's name and list of room/lab. MSKB has been created due to key lost problem and also cannot identify the key taker in Mechanical Engineering Department, Politeknik Tuanku Syed Sirajuddin (PTSS), Malaysia. As a result, MSKB has been developed with mechanism of Arduino system, RFID and LCD monitor.*

Key Words*: *IoT, RFID, Arduino, LCD and Relay

1. INTRODUCTION

The main objective of key box at Mechanical Engineering Department, PTSS is to ensure the keys of workshop, labs and classes are safely stored. These keys are only accessible to staff who have been granted consent only. Therefore, this key box should have a high level of security to make sure the outsider cannot access this key box and the keys will not be missing.

Unfortunately, the main problems that always encountered with this conventional key box are the security vulnerabilities when accessing the key box, no usage data such as retrieval time and returns time of the keys and cannot identify the key user at that time. This conventional key box can't give the need data instantly.

Aggressive estimates says there are 50 billion devices connected with IoT which is a smart network that can detect, control and program the device by itself automatically [1]. IoT allows its surrounding devices to communicate and contact directly and indirectly. IoT generally works by connecting objects to the internet and using the connection to provide remote monitoring or control over the object. By 2020, [2] estimates people life will surroundings by trillion of devices connected to the IoT.

Therefore, MSKB has been designed as a key box that implements internet of thing (IoT) in line with the goal of the industrial revolution 4.0 which is the data available instanly or in real time. The main IoT components that will apply in this product development are RFID and Arduino WEMOS Mega + Wifi R3.

2. LITERATURE REVIEW

Radio Frequency Identification (RFID) is generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies [3]. Refering to [4], there are many innovative uses in domain application of RFID technology such as asset tracking, manufacturing, supply chain management, retailing, payment systems security and access control.

According to [5], the automatic unlocking system that uses identification knocking pattern consists sensor, microcontroller ATTiny85, solenoid lock and Arduino IDE. The developed system can identify knocking pattern based on number of knocks, time between knocks and soft or loud of knocks.

Meanwhile in another study [6], the safety lock on the locker door is designed by using a dual system which uses microcontroller ATMega16, RFID, LCD 16x4, keypad 4x4, push button, LED, servo motor, relay and solenoid. The doors of locker only can be opened by using RFID card and password where the RFID card locker serves as the identity and password as the electronic lock.

3. METHODOLOGY

The system was conducted using Software Development Life Cycle (SDLC) as a methodology for planning, creating, testing, and deploying an information system. Every phase is important in order to make sure the product development being more systematic and well arranged.

3.1 Tools Design

In the design of a hardware and software, block diagram is needed as a guide to design or create a tool in the way of work and the desired work system. The block diagram of the planning system has been shown in Fig – 1.

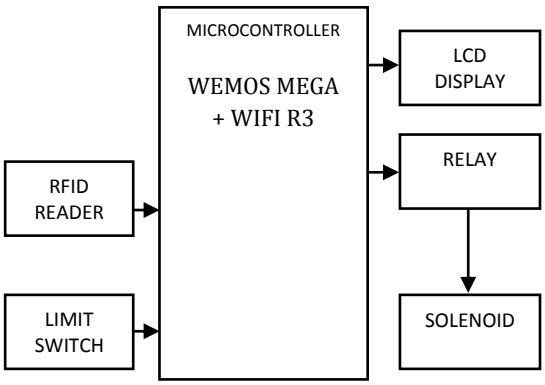

Fig – 1: Block diagram

The function of each block diagram is shown in Table - 1:

Table – 1: Component function

Component	Function
Microcontroller WEMOS MEGA + WIFI R3	It is a major component of the minimum working system. Functioning to process the input and give the commands to output.
RFID Reader	To gather information from an RFID tag which is used to track individual objects.
Limit Switch	To make or break an electrical connection.
LCD Display 7.0 Inch HMI USART UART	To display the information and status of staff that taking and returning keys.
Relay	To stream current/voltage on solenoid.
Solenoid	Works as an automatic lock.

3.2 Design Phase of MSKB

The dimension of MSKB are 380mm x 80mm x 550mm. Meanwhile Fig – 2 shows three view of MSKB that are top view, front view and side view.

Fig – 3 shows full assembly parts of MSKB that designed using AUTOCAD 2018 and several parts that can be seen in Fig – 3 are listed in Table – 2.

Table – 2: List parts

Item	Part
1 & 2	Body & cover frame of key box
3	LCD display
3	RFID reader
6	Key lock

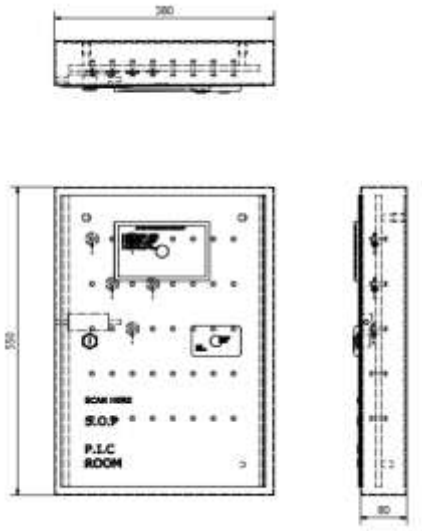

Fig – 2: Front, top and side view of MSKB

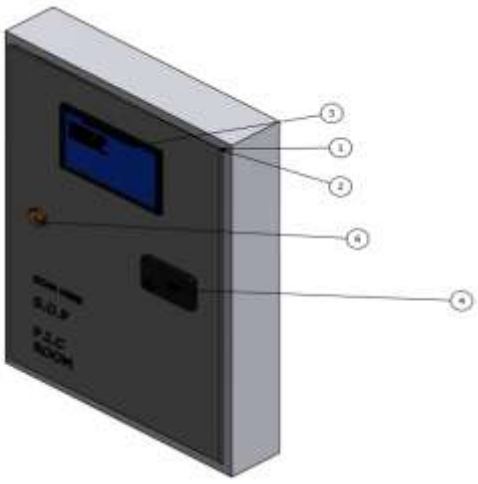

Fig – 3: Full assembly of MSKB

3.3 Flow chart using RFID based on Arduino WEMOS Mega + Wifi R3

In software development, the flowchart is needed to facilitate designing tools. The designed flowchart is shown in Fig – 4.

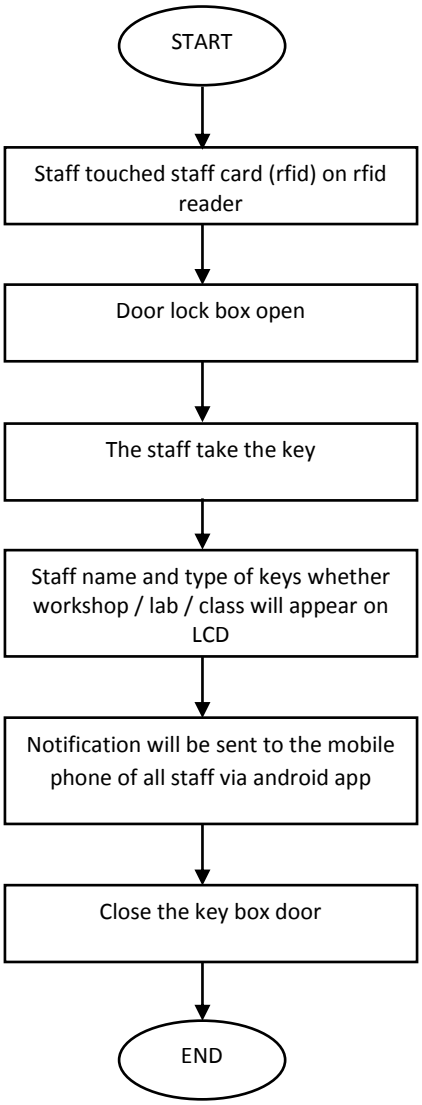

Fig – 4: Flowchart of MSKB

3.4 Testing the MSKB

The MSKB system has been tested to know either the whole system can function properly as desired or not. This finished product as shown in Fig – 5 has been tested twice to make sure the RFID module and WEMOS Mega + Wifi R3 can work well.

Fig – 5: Testing the MSKB

4. CONCLUSIONS

RFID gave a lot of benefits that cannot be denied. In this study, RFID and Arduino WEMOS Mega + Wifi R3 was used to improved the security, shorter process to take and trace keys also solution to recovery the lost or stolen keys.

Due to its speed, range and durability, RFID has made a place for itself in high-end technologies compared with conventional safety box. In this study, combination of RFID and Arduino WEMOS Mega + Wifi R3 has been proved can greatly reduce the loss of keys and provide additional security for display the important information of use of keys.

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