

IoT-ENABLED SMART FIELD LIGHT AUTOMATION WITH MONITORING FOR FUTSAL

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Abstract: Lighting is one of the important aspects in supporting the comfort of public facilities, especially for futsal fields that rely on lighting for better user visibility at night. This study focuses on finding lighting solutions for futsal fields that are still running manually by providing alternative solutions in the form of implementing the concept of a smart automation system based on the Internet of Things (IoT) by combining the working systems of LDR sensors, ultrasonic sensors, and microcontrollers, this aims to provide convenience while creating innovation for existing problems. Using observation and implementation methods produces a system that is designed in such a way that the results will later be displayed on the Kodular android application for remote monitoring. It is hoped that the system in this study can work effectively and efficiently in managing field lighting that can answer the problems raised.

Keywords: automation; IoT; kodular; lighting; monitoring.

Abstrak: Pencahayaan merupakan salah satu aspek penting dalam hal yang mendukung kenyamanan fasilitas publik terutama untuk lapangan futsal yang mengandalkan pencahayaan untuk visibilitas pengguna lebih baik pada malam hari. Penelitian ini berfokus pada pencarian solusi pencahayaan pada lapangan futsal yang masih berjalan secara manual dengan diberikannya solusi alternatif berupa penerapan konsep sistem otomatisasi pintar berbasis Internet of Things (IoT) dengan memadukan sistem kerja sensor LDR, sensor ultrasonik, dan mikrokontroler, hal tersebut bertujuan memberikan kemudahan sekaligus menciptakan inovasi bagi permasalahan yang ada. Menggunakan metode observasi dan implementasi menghasilkan sistem yang dirancang sedemikian rupa dengan hasil yang nantinya akan ditampilkan pada aplikasi android Kodular untuk pemantauan jarak jauh. Diharapkan sistem dalam penelitian ini dapat bekerja secara efektif dan efisien dalam pengelolaan pencahayaan lapangan yang dapat menjawab permasalahan yang diangkat.

Kata kunci: IoT; pencahayaan; otomatis; pemantauan; kodular

INTRODUCTION

Smart automation system is a concept where integrated devices is set to automatically runs manually work systems coded to a chip of microcontroller that also linked to Internet of Things (IoT) Internet of Things or also known as IoT, is a concept that aims to expand the benefits of continuously connected internet connectivity that allows us to connect machines, equipment and other physical objects with network sensors and actuators for obtain data and manage its own performance.

This study take place at Smart Futsal located at Murai street, Karang Anyer, Kisaran Timur where there is an issue where the lighting management is still running manually that cause user sometimes need to tell the court keeper to turn it on makes it ineffective and inefficient which will cause inconvenience services.

This study aims to assist the futsal court manager to solve the problem he has about lack of facility management in lighting where the initiation is to design a smart system using sensors and microcontroller based on IoT. This study created a smart field light automation with monitoring system that refer to previous studies by (Azim Ben) he design prototypes and create mobile and python application programs using the Raspberry Pi 3 as a remote light controller with an internet network that can be applied to electronic equipment such as lamps, so that the level of energy efficiency and working hours of officers and in terms of saving electrical energy used [1].

And also by (Rizky Prasetyo Tulodo) that he created a Smart Light system that can be controlled using voice commands from Google Assistant and

the Blynk application connected to an IoT device [2]. Similarly as (Aldi Burhanuddin) his study aims to create a modern light control system with internet of things and Bluetooth media. The NodeMCU microcontroller was chosen as the brain of the control system. The input of the control system uses the HC-05 bluetooth module, while for the output it uses the relay module [3].

Also inspired by these studies such as (Julianti Habibuddin) this study aims to design and develop an Arduino IoT Cloud based light intensity monitoring system for broiler chicken coops. The result is displayed on a 16x2 LCD screen and uploaded in real time to the Arduino IoT Cloud platform for remote monitoring [4].

The concept of smart field itself is refer to some of similar studies but only the object is different like from (Achmad Hamdan) that choosing office as its object, with definition that smart office is the implementation of a concept aimed at supporting human productivity. Smart office should be designed to assist workers in the office according to their needs because too much interaction among colleagues or with surrounding objects will disrupt office workers' productivity. Meanwhile smart field itself has the same goal in which to boost effectiveness of work in futsal court environment as the quality of futsal courts is another crucial factor, as many owners fail to provide complete facilities [5].

This study backed up by some studies from (Yuda Prasetya) that design, create, and evaluate a hydroponic automation system by monitoring the quality of plant growth that uses LED grown lights and natural light conditions on hydroponics [6]. From (Hakan Aydin) that also define smart home automation

concept using Light Fidelity (Li-Fi) technology that has the potential to enable remote control of devices such as lighting, air conditioning, music systems, security cameras, and door locks within SHAs [7] and others same concept addition like from (Yurike Aditya Eka Putri) that a temperature tele controlling system and smoke detection in the archive warehouse were made using hybrid visible light communication technology to improve data transmission performance [8].

Overall data result will be displayed on an application android platform Kodular, (Cahyo Hasanuddin) a website application based on the Android operating system using block programming so that users do not need to do coding [9]. And also inspired by others previous study that speaks about IoT monitoring system also like from (Stevan Togar Pasaribu) that monitoring energy use, especially electricity, is an alternative step to improve energy efficiency by develops and implement Narrowband-IoT (NB-IoT)-based electrical energy monitoring [10].

From (Utari) to design an IoT-based home light monitoring system using Wemos D1 Mini. This tool is designed to control the current and voltage contained in house lights automatically [11]. And lastly by (Uvlansisco Lumbantobing) that in his study uses sound sensor to automatically monitoring light [12]. This study also initiate novelty in expand of smart automation system concept by develops it into more advance structure of the system and its scale of research object with choosing a bigger one to implements.

As for better understanding this study observes a problem occurs on Smart Futsal where the place is lack of lighting management that the work sys-

tem still running manually which caused user dissatisfaction. So based on the study observation, it is given an alternative solution where an automatic system is implies to give a better update on previous way of doing things relying on advance Internet of Things (IoT) technology.

So, The goals in this study to give an alternative solution that fits the problem found on the spot where there is a lack of facility management in lighting that need to be settle in which given a solution to design a smart field system where the concept to automatically controlling the light based on IoT that can be monitored.

METHOD

The research methodology includes literature study obtained by previous study on journal reference, collecting data from every aspects of module using observation method that is to perform direct observes on the object, system analysis that identifies working module system, system design that combining every module, system test which in this step is to perform several test on system, and implementation that applies settled overall tool.

Table 1. Data Analysis

INPUT			
Device	Type	Quantity	Function
Sensor 1	LDR	1	Capture light intensity
Sensor 2	Ultrasonic	1	Detects object in range
Microcontroller	ESP32	1	Controlling system device

OUTPUT			
Device	Type	Quantity	Function
Relay	4 channel	1	Flows electric current automatically
Hannoch's Light Bulb	LED	1	As an output to system
Kodular	APK	1	Mobile remote display monitor

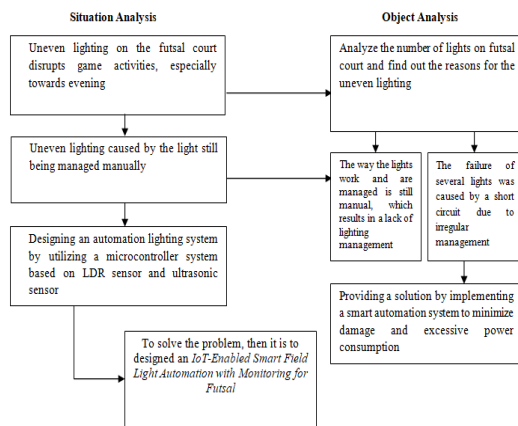


Image 1. Research Process Analysis

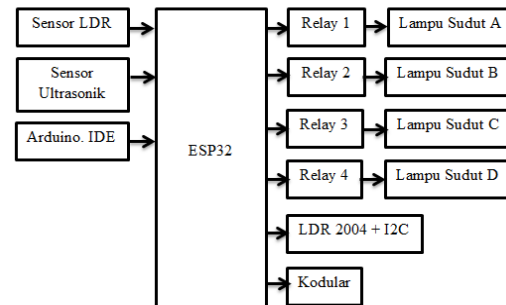


Image 2. System Design Flow

After having analysis and design flow, then it is start to the design phase where every module is being combined on another and next step to do a system test, it is to perform several trials before the system was implemented based on the available analysis and integrated into the final tool.

RESULTS AND DISCUSSION

Testing was conducted directly using hardware modules to enable automatic lighting control for futsal courts. Several testing stages were performed to obtain accurate data. The results are presented in Table 2

Table 2. Test Result

Conditions	Sensor		Description
	LDR	Ultrasonic	
Entering nighttime without people on the court	Active	Passive	The system enters ON mode and is ready to detect objects.
Entering nighttime with people on the court	Active	Active	All lights turn on for the court.
Entering daytime with or without people on the court	Passive	Passive	All lights remain off, indicate entering daytime, and the system is inactive.

The explanation of the table which in first condition it is set on nighttime mode that signaling the system is on and sensors ready to detect object where the LDR sensor is active signaling it works on detecting the time scheme and ultrasonic sensor is passive because the first condition is to test without people on the court. Second condition, the ultrasonic is working due to it's detect objects. Third condition, it is entering daytime signaling even the system is off because the system is unnecessary in daytime.



Image 3. Test Condition 1

Condition 1, it's shown that the system worked on point, only LDR sensor catch the time scheme displayed on Kodular right at the bottom space, it's written "malam".



Image 4. Test Condition 2

Condition 2, now the ultrasonic also worked result of there's object pass the device. Make the kodular to update the display shows the amount of objects passing by and display the light's on or off status.

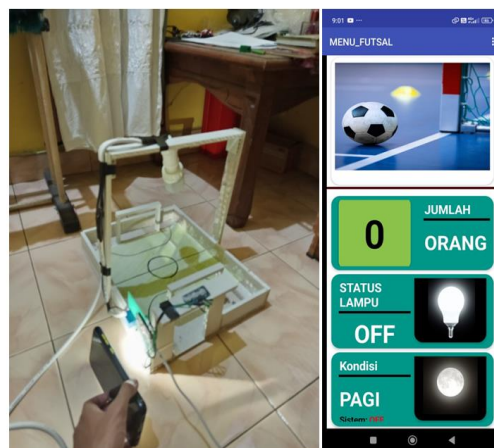


Image 5. Test Condition 3

Condition 3, as shown in Kodular, the bottom space that displays the time scheme on this system is written "morning" which means the system is off and will not work during the day because it is programmed only for the night.

The advantages of this system are quite effective and efficient for work that should no longer depend on human power, and the disadvantages of this system are because this kind of technology is still man-made, external maintenance is needed so that the system continues to work smoothly. So as a precaution, an alarm or some kind of reminder is needed so that the guard can regularly maintain the system properly. after successfully applied, then this study tries to find out the level of effectiveness of the system. The results obtained several aspects that increased after the implementation of this system.

The following table is a presentation of the results before and after the system was implemented, including:

Table 3. Before The System Applies and After The System Applies Comparison

Aspects	Before	After
Work System	Works manually by needing the futsal court keeper to turn the lights on	Works automatically by just entering the court
Effectiveness	Taken too much resource and often feels off point when it comes to effectiveness of work system	Ease every aspects of work system and also given ease of use
Efficiency	Time and energy were often wasted	It requires short time to use, and the energy is more save

In the table above it gives us a better view of how the system helps so much in giving the better solution for this kind of issue, which before the system applies the work system is far inferior in terms of how genuine the system works compare to how the system works after the system applies, it gives much pleasant of how the system works where it does not depends on the keeper's affliction to turn it on but now it just happen naturally and regularly.

The effectiveness also takes effect on its benefit where as of now it gives many good things that now the keeper does not need to bother himself turning on or off the light every time there is a user that wants to use the court. Efficiency is just as much as affected which now the stability and save of the energy is better than ever because there will be no wasted energy thanks to the system that gives a solution where the energy can be preserved properly.

CONCLUSION

This research is to be made not just as an alternative solution for unnecessary manual work system that needs an update to nowadays more practical ways to do

things and that is utilizing Internet of Things (IoT) technology, but also as a new innovation to address the issue that often happens on public facilities management. Especially where the study picks specific issue and that is lighting management which the system made settle the issue quite good on every aspect including work system effectiveness and energy efficiency relying on its automatic work system and sensors to make it even on preserving the system.

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