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Automatic Conveyor With Black and White Color Sensor for Vessel Cargo Selection

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ABSTRACT

Electronic components were developed in modern life to help alleviate human work. One application is in sorting goods using conveyors. A conveyor is a device used to move an object from one place to another by a mechanical system. In the industrial world, to transport goods, many use conveyors because of the large and sustainable number of goods. In industries involving large and heavy goods, it is needed to apply conveyors. Various tools that use control systems can reduce human roles even without human assistance. Such a control system is applied to a conveyor so that the conveyor can operate auto-run. The method used in this research is to make a prototype, the manufacturer; this prototype is developing a new product or perfecting an existing product, be it hardware or software. The automatic conveyor proto e utilizes the project board for the control system assembly, arduino nano as an Arduinontroller, and some sensors as a supporting automation component. Researchers use this method to research and develop arduino nano software starting from analysis, design, code, and testing. The data collected in this study uses an observation checklist, then the data is processed to move the conveyor with the software that has been created. Microcontrollers are programmed using the Arduino IDE programming application. Through this research, it is expected that sorting of goods can be done 24 hours, has high efficiency, reduces electricity costs and reduces human power for vessel cargo selection..

1. Introduction.

Moving goods can be done in a variety of ways. The era of globalization supports science and technology in all areas of life. Various forms of technological facilities in science, industry, offices, and even in everyday life, especially on ships. The development of technology significantly affects human life, both from lifestyle and work. (Díaz-García et al., 2017). Creating tools that can sort shiploads into the best alternative to facilitate human work.

Many professions make people work hard by relying on physical strength. (Salam et al., 2011), Human work is getting lighter by utilizing technology because tools help many. This makes the industrial world take advantage of technological developments, which used to work manually now. No, watching auxiliary aircraft that work automatically will undoubtedly save energy. One of the tools that humans have made is a conveyor; it has many types, one of which is a conveyor that uses a belt or often called a belt conveyor. Bela t conveyor is an auxiliary aircraft whose function is to move objects above the belt (Selvan et al., 2019).

The conveyor is one of the devices that can facilitate the transfer of goods/cargo such as factories/industries, ports, airports, and others. (Selvan et al., 2019). The conveyor is generally a conveyor that operates manually; this tool uses continuously since the system is turned on, there are objects detected, or nothing are seen on it. With the conveyor constantly working

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without depending on the existence of the Object, there are disadvantages, especially the use of electrical energy that is less effective. In addition, undeveloped conveyors have not been able to sort the color of the Object automatically, so if the conveyor transports the color of the different thing, it still requires additional power to sort it out.

However, manual conveyors are still widely used in all wasteful electrical energy fields because they work continuously. (Sun & Böhringer, 2020). Existing manual conveyors can be modified/ added to reduce the use of electrical energy that costs more expensive. Furthermore, the proper sensor for this conveyor can help put humans at work because it can sort, distinguish colors and manage the conveyor's working time.

A conveyor is a device used to move an object from one place to another by a mechanical system. In the world of industrial, to transport goods many use conveyors, because of the large and sustainable number of goods. In industries involving many large and heavy goods, it is needed to apply conveyors. There are several types of conveyors that are created (belt conveyor, roller conveyor, chain conveyor, bucket conveyor, screw conveyors, pneumatic conveyor) and used according to the needs of various different industries. Under certain conditions, the use of conveyors is more efficient compared to other conveyors; conveyors can mobilize large quantities of goods continuously from one place to another. (Jin et al., 2018).

In this study, researchers chose the belt conveyor as a tool used as a research object because of the simple conveyor work system. (Jin et al., 2018). A belt conveyor is a means of transportation that utilizes tires or rubber as a moving belt to carry the material that is on it.

The working principle of the belt conveyor is to carry the material or object that is above the belt, where the belt is moved because the head pulley is rotated by the motor through the gear reducer.(Pham et al., 2006)

This research utilizes electronic components; some of the essential elements of electronics in this study are microcontrollers and sensors. A microcontroller is an IC chip (Integrated Circuit) that is able to receive input signals, process them and send output signals in accordance with the program filled into them. The input signal comes from a sensor that is information from the environment to be processed microcontroller. In contrast, the output signal is addressed to the actuator that can affect the environment. A microcontroller is the brain of a device capable of interacting with the environment with the help of supporting components. Basically, a microcontroller is a computer in one chip, which contains a microprocessor, memory, Input / Output (I / O), and other supporting components. The speed of data processing in microcontrollers is lower when compared to personal computers (PCs). The rate of microprocessors on PCs has reached the GHz order, while the operating speed of microcontrollers generally ranges from 1 - 16 MHz. So is the capacity of RAM and ROM on PCs that can reach the Gbyte / Tbyte order, in contrast to microcontrollers that only range bytes / Kbyte. (Crepaldi et al., 2021).

The microcontroller used in Arduino nano.(Yaseen et al., 2021). Arduino Nano is one of the small microcontroller development boards. (Pan & Pan, 2019), It can be used on project boards. This microcontroller was created using the atmega328 base. (Aghenta & Iqbal, 2019) for version 3.x and Atmega 168 for version 2.x (Ramos-cosi & Vargas-cuentas, 2021). Because the Arduino Nano is mini-sized, it is only equipped with USB pins and plugs that are used to connect to the computer and are not equipped with direct electric current plugs. To provide power to the microcontroller, this can be done by connecting the power supply with the pin on the Arduino board (Kelechi et al., 2021).

This research aims to develop conveyors by incorporating electronic elements, namely microcontrollers, motion sensors, and color sensors, to work effectively and efficiently. Utilizing this is expected to create a belt conveyor that can operate automatically. This research is necessary because it can help facilitate human work by utilizing project boards to put electronic components as props. Using these sensors, the conveyor will only work when the Object is exposed and will automatically sort the Object's color. In addition, this study can reduce the use of electricity because the conveyor will work if there are objects above the belt.

2. Methodology.

The development of conveyors is carried out by combining electronic science. (Jin et al., 2018), This is done by using the Arduino nano project board as a microcontroller and some sensors as support devices. The method used by researchers is the creation of prototypes (Ramos-cosi & Vargas-cuentas, 2021). Researchers used this method to research and develop Arduino nano Software. (Amirah et al., 2020) Starting from analysis, design, design, software coding, and testing. The data collected in this study uses an observation checklist, then the data is processed to move the conveyor with the software that has been created. This research develops a product and will produce a new product or perfect an existing product. (Taques et al., 2021). In this case, it was designed with software, operating systems, and applications.

3. Results.

3.1. Assembly.

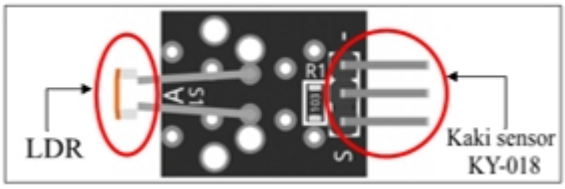
This study will combine the mechanical design of the conveyor (Selvan et al., 2019) with electronic components. To drive rollers and sorters, the designer automatically utilizes sensors and microcontrollers and uses the project board as the basis for designing electronic schemes. The two primary sensors used are ky-018 and TCRT-5000.

The main component of this KY-018 sensor module is the LDR (Light Dependent Resistor), so this component works depending on the intensity of the light. (Moeys et al., 2018) exposed. The working principle of this component is that if the light is exposed to high intensity, the LDR resistance will decrease; conversely, if the light is dim, the LDR resistance will rise. The LDR will be a poor conductor or a great resistance when the light is dimmed.(Leeuw & Boss, 2018), And the LDR will be a good conductor or small resistance when exposed to

high-intensity light. This study used the LDR sensor as an object detection sensor by combining lasers as light-spreaders. (Jeong et al., 2019).

The ky-018 sensor will operate well when it gets a voltage of 3.5V to 5V; this sensor can provide digital and analog input signals to connected microcontrollers.

Figure 1: KY-018 sensor.



Source: Authors.

There are three legs on this sensor module, the coded foot (-) is for VDC(-), the middle foot is for VDC(+), and the coded foot (S) for the input signal to be forwarded to the microcontroller (Tahir et al., 2022).

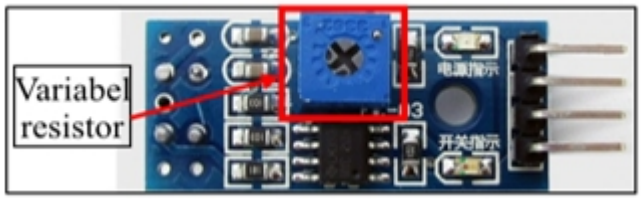
The following sensor used in this study is the TCRT-5000 Type Black and White sensor has two essential parts: the infrared transmitter as a transmitter and the receiver as a reflection receiver. The working principle is that the transmitter emits infrared. If it is blocked by a white or reflective object, then the infrared will be reflected and detected by the receiver, then this sensor can be used as an object detector between black and white.

Figure 2: Front view of the TCRT-5000 sensor.

Source: Authors.

The TCRT-5000 sensor operates well when it gets a voltage source of 5Volt to 7Volt. These sensors only provide digital input signals. There are four legs on the TCRT-5000 sensor module, the coded foot (VCC) is the foot that serves to get the voltage VDC (+), the coded foot (GND) is the foot for the ground or VDC (-), the foot that has code (D0) and (A0) for the input signal to be forwarded to the microcontroller.

Figure 3: Rearview of the TCRT-5000 sensor.



Source: Authors.

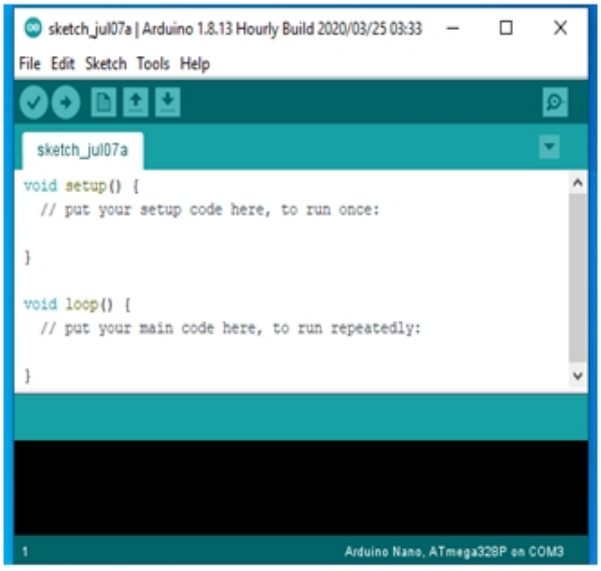
On the back of the sensor module, TCRT-5000 equipped with variable resistors serves to regulate the sensitivity of the receiver (Bian et al., 2021) in capturing infrared reflections emitted by the transmitter so that the effective detection distance can be adjusted.

3.2. Creation of Software Automatic Conveyor Control System Detection of Object Presence and Color objects (Black and White).

Programming processor using a computer (Borys et al., 2020) means. This study used Arduino nano as a microcontroller (Khanna et al., 2021). Arduino has a particular application for programming, namely Arduino Integrated Development Environment or often called Arduino IDE (Kumar et al., 2022).

To program, Arduino must be installed Arduino IDE application (Kumar et al., 2022) the computer to be used to program. This application can be downloaded from various sources on the internet, including on the official Arduino page (Selvaraj & Anusha, 2021).

Figure 4: The initial view of Arduino IDE.



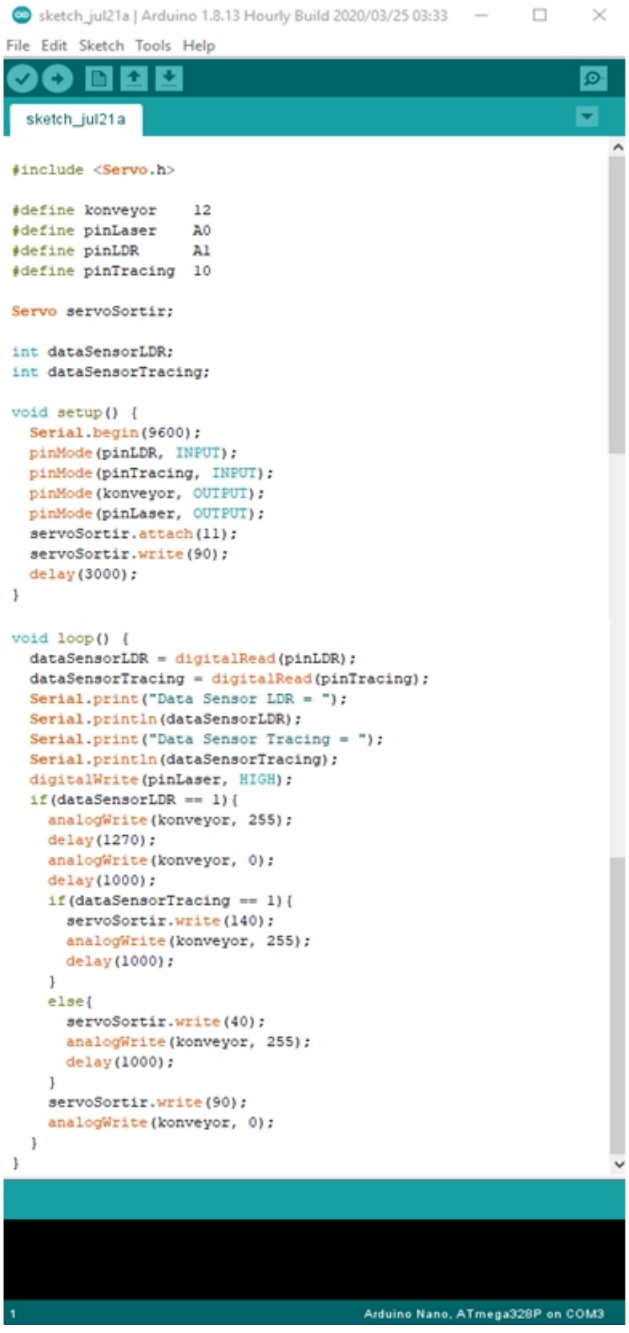
Source: Authors.

If the microcontroller is connected, it is ready to be programmed according to the designer's expectations. For example, here is the program or coding used in automatic conveyor drilling with black and white and object detection sensors (Kelechi et al., 2021).

3.3. Prototype Trials.

The research results on the development of automatic conveyors with some of these sensors, test the sensors used and get mixed results. Researchers tested the sensor by giving the sensor's criteria and observing the reactions that occurred due to the action. The result of creating this automatic conveyor development model is that the conveyor belt drive machine can operate automatically when placed objects on it, and servo motors can sort mechanical things based on the Object's color.

Figure 5: Coding Arduino IDE.



Source: Authors.

Design of automated conveyor development model props (Jin et al., 2018) This is done in sequence in each manufacturing process and adjusted to the problem formulation. The manufacturing process is done well and in detail to get the designer's expected results.

Automatic Conveyor Development Model Show Making (Jin et al., 2018) With Color Sensor and Object Presence Detection Sensor. The initial part of making a prop is to prepare the tools and materials to be used because the completeness of tools and materials will affect the smooth manufacture of braces.

This stage of making props further makes the conveyor design first, to make it easier for the designer to make conveyor material parts. In the manufacture of conveyor design, the designer creates a sket in a manual image.

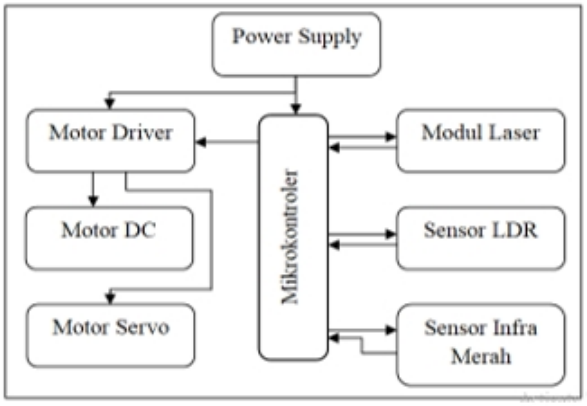
The materials to be used should also be considered based on their advantages and disadvantages, function, durability, and aesthetic value. Designers use clear acrylic as the most widely used material.

The parts of the props are made manually, so it requires thoroughness to get results in line with expectations. The details are designed into an amount in a mechanical form that will be combined with electronic elements, and corrections and repairs are made if there are parts that are not perfect. Design of Automatic Conveyor Control System Detection of Object Presence and Color

The electronic control system is converting a signal into another signal to give the desired system response; the simple electronic system is input, process, output.

Electronic components cannot operate on their own. (Aghenta & Iqbal, 2019), Between components must be interconnected to operate properly because between components with other components have their respective functions; for that, the designer must create a scheme before assembling these components.

Figure 6: Control system schema.



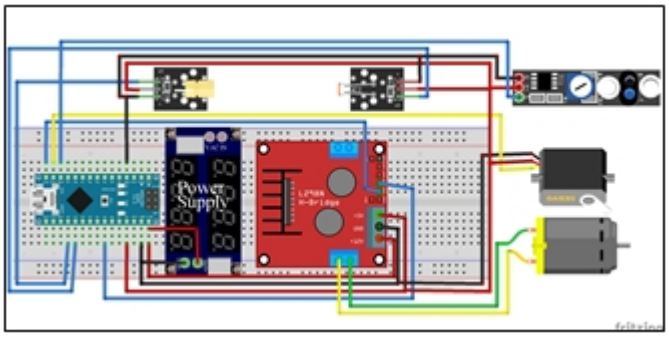
Source: Authors.

This assembly utilizes the project board as the primary assembly board. Arduino Nano as a microcontroller, motor driver as dc motor rotation controller, KY-018 as object detection LDR sensor assisted by KY-008 laser module, TCRT-5000 as black and white detection sensor, DC motor as roller drive, servo motor as a black and white sorter, and some supporting components.

4. Discussion.

The Creation of the Automatic Conveyor Development Model Show With Color Sensor and Object Presence Detection Sensor proved to help alleviate human work (Management et al., 2020). It can be applied in the industrial world. Its existence is better than a manual conveyor that works continuously despite no charge/workpiece. This research can save the

Figure 7: Wire control system diagram.



Source: Authors.

burden of electricity costs and reduce machine working hours so that it is expected that the machine can work longer and be more durable. For industries that already have conveyors, manual conveyors that already exist today can be added using this software, so there is no need to buy new tools.

Design of automatic conveyor control system (Selvan et al., 2019) It uses two sensors, the TCRT-5000 black and white sensor and the KY-018 type object detection sensor connected to the Arduino Nano microcontroller, both of these sensors can provide input signals in digital form that are passed to the microcontroller. What distinguishes these two sensors is the working principle; the TCRT sensor works because the receiver receives the reflection of infrared light emitted by the transmitter, while the KY-018 sensor works based on the intensity of the morning (Moeys et al., 2018).

Ky-018 and TCRT-5000 sensors have the disadvantage of not functioning correctly if both sensors detect objects and colors together. Because in one programmatic microcontroller, each sensor must provide a sequence input signal according to coding (Borys et al., 2020).

The next drawback is that the black and white sensor will experience dysfunction if it operates after the object detection sensor. For example, if the KY-018 sensor has detected the presence of an object and after that, the TCRT-5000 sensor detects black and white, then the TCRT-5000 sensor will experience dysfunction and will not be able to scatter between black and white.

KY-018 sensors, TCRT-5000 sensors, and Arduino microcontrollers are commonly used components in robotics; in addition to being easy to obtain, such details are easy to design and program because KY-018, TCRT-5000, and Arduino microcontrollers are complex modules. (Borys et al., 2020).

Automatic Conveyor Control System Programming Detection of Object Presence and Color.

A pre-programmed microcontroller controls this object and color detection system (Kelechi et al., 2021). Programming applications using Arduino IDE (Murad et al., 2021). The designer chose the application because it has the most straightforward programming language compared to other programming applications, so it is easy to use and easy to understand.

In a coding is written microcontroller functions process input signals to produce output signals(Taques et al., 2021), For example, the input signal from the KY-018 sensor will have an output signal in the form of a DC motor rotation. (Moeys et al., 2018). Coding on microcontrollers will run sequentially as written, which has been explained in the results of the study. So the microcontroller will not respond to the input signals of all sensors before completing the previous function. This is the disadvantage of programming an automatic conveyor control system.

Microcontrollers have been programmed in sequence (TCRT-5000 sensor detects color, KY-018 sensor detects object DC motor conveyor drive operates, Motor servo operates Object carried by conveyor belt, object split by servo motor Object falls pointed or left according to color). If the Object has not been lost and has been given the next thing, then the conveyor will not respond to the presence of the item. So one process can only be given one thing.

In the application of use, the selection of the suitable sensor can be adjusted for a wide variety of conveyors; in advanced industries, sensors can be developed and can read more color code, code, or motion more efficacy. But this study is limited to using only object detection sensors to move the conveyor only and black and white detection sensors only.

Conclusions

The creation of this automatic conveyor development model demonstrates a mechanical conveyor prototype to detect the presence of objects and colors. Use Arduino microcontroller, black and white TCRT-5000 sensor, and KY-018 object detection sensor. Aiming for both sensors to operate correctly then the TCRT-5000 sensor is placed front before the KY-018 sensor.

Creating the Automatic Conveyor Development Model demonstrates proven to increase efficiency and can be applied real with size and dimensions suitable for industry needs. Its existence is better than a manual conveyor that works continuously even though there is no workpiece. With this research, it can save the burden of electricity costs and reduce machine working hours so that it is expected that the machine can work longer and be more durable. These automatic conveyor props can be further developed by adding more color sensors such as red, yellow, and green color sensors or barcodes to be made in the form of real conveyors and utilized in the industrial maritime.

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